THE EFFECTIVENESS OF PASSIVE DESIGN STRATEGIES FOR A MOSQUE IN MALAYSIA: CASE STUDIES OF PUTRA MOSQUE AND TUANKU MIZAN ZAINAL ABIDIN MOSQUE

BY

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ABSTRACT

Malaysia has a tropical climate with warm and humid weather all year round. It is usually very hot and humid, especially in the major cities. Malaysia is the best country to study on the passive design strategies in tropical climates. Since the time of our ancestors, buildings had been built characterized by passive design where it focused on a balance between local climate, surrounding areas, functions, appearances and design of the buildings. Passive design strategies can defined as the measures that had been taken to ensure the comfort of the occupant achieved. It must have a closer relationship with its surroundings to achieve a comfortable internal environment with a minimum of resource used. However, in this modern age, most of the building neglected the beauty of passive design strategies and end up relying on active design strategies such as air conditioning systems and others. This research will discuss the importance of passive design strategies and knowing its effectiveness against the user's comfort, energy efficiency and the visual impact on the user's point of view. Characteristic of passive design strategies taken from the Malaysian Standard: MS1525. MS1525 is the Code of Practice on Energy Efficiency and use of Renewable Energy for Non-Residential Buildings, which was developed to provide the best practice in energy efficiency for buildings. Two case studies involved are Putra Mosque and Sultan Mizan Zainal Abidin Mosque. Both federal mosques have a different approach to passive design techniques that comparative studies between both cases studies, help to evaluate the effectiveness of passive design strategies and the perception of user's preferences. Other than that, questionnaires, interviews, field works and data collections conducted as primary data to justify the results. This research will help designers to determine the characteristic of the passive design strategies that effective in giving comfort to people, reducing energy consumption and add beauty to a building as a whole.

ملخص البحث

تتميز ماليزيا بمناخ إستوائي مع طقس دافئ ورطب طوال السنة. فمناخها عادة جد حار ورطب، وخاصة في المدن الكبيرة. تعتبر ماليزيا البلد المتميز في دراسة استراتيجيات التصميم السلبي في المناطق ذات المناخ الإستوائي. لقد تميزت البنايات التي بنيت من طرف أجدادنا بالتصميم السلبي، حيث وازنت بين المناخ المحلي، والمناطق المحيطة، ووظائف، ومظاهر، وتصميم البنايات. يمكن تعريف استراتيجيات التصميم السلبي بأنها تلك الإجراءات التي أخذت بعين الإعتبار للتأكد من تحقق ارتياح الساكن. يجب أن يكون لهذا التصميم علاقة متقاربة بالمحيط لأجل تحقيق بيئة داخلية مريحة باستعمال أقل للموارد. لكن نلاحظ أن أغلب البنايات في العصر الحديث أهملت جمال وقيمة استراتيجيات التصميم السلبي، وبدلا من ذلك فقد أخذت تعتمد على استراتيجيات التصميم الإيجابي مثل أنظمة التكييف وغيرها. سيقوم هذا البحث بدراسة أهمية استراتيجيات التصميم السلبي، ومعرفة فعاليتها في تحقيق راحة مستعملها، وفعالية الطاقة، والتأثير البصري على وجهة نظر المستعمل. لقد تم أخذ خصائص استراتيجيات التصميم السلبي من المقياس الماليزي: MS1525. ويعتبر هذا المعيار دليلا لقواعد الممارسة فيما يخص فعالية الطاقة واستعمال الطاقة المتجددة للبنايات اللاسكنية، وقد تم إنشاؤه لتقديم أحسن ممارسة لفعالية الطاقة للبنايات. وقد تم دراسة حالتين وهما مسجد بوترا، ومسجد السلطان ميزان زين العابدين. ولكلا المسجدين الفيدراليين مقاربات مختلفة تجاه تقنيات التصميم السلبي، وإجراء دراسات مقارنة بين الحالتين سيساعد في تقييم فعالية استراتيجيات التصميم السلبي وتصور تفضيلات المستخدم. إلى جانب ذلك؛ فقد تم الإعتماد على الاستبيانات، والمقابلات، والأعمال الميدانية، وجمع البيانات، وقد تم استعمالها كبيانات أولية لتبرير النتائج. سيساعد هذا البحث المصممين في تحديد خاصية استراتيجيات التصميم السلبي التي تعتبر فعالية في تحقيق راحة الناس، والإنقاص من استهلاك الطاقة، وإضافة لمسة جمالية على البناية ككل.

APPROVAL PAGE

I certify that I have supervised and read this study and that in my opinion; it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Science in Building Services Engineering.

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Maisarah Ali
Supervisor

I certify that I have read this dissertation and that in my opinion; it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Master of Science in Building Services Engineering.

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This dissertation was submitted to the Kulliyyah of Architecture and Environmental Design and is accepted as a fulfillment of the requirement for the degree of Master of Science in Building Services Engineering.

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Alias Abdullah
Dean, Kulliyyah of Architecture and Environmental Design

DECLARATION

Ihereby declare that this dissertation is the result of my investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted as a whole for any other degrees at IIUM or other institutions.

Tengku Anis Qarihah bt Raja Abdul Kadir

Signature: …….. Date: ……..

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Affirmed by Tengku Anis Qarihah bt Raja Abdul Kadir

_____ _____

Signature Date

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"In the name of Allah, the most compassionate, the most merciful, Praise to The Allah, Lord of Universe, and peace and prayers be upon His final Prophet and last Messenger." Praise be upon Him, to Allah the Almighty, with His most grateful and merciful attribute for the living in this world. Peace be upon the beloved Rasulullah (p.b.u.h) his family, his companions and all Muslim in the whole wide world.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

Malaysia located in the southeast of the Asian continent; therefore this region is often referred to as Southeast Asia. Malaysia consists out two parts: Peninsular Malaysia, situated between Thailand in the north and Singapore in the south, and the two provinces Sabah and Sarawak, located on Borneo. Malaysia has a tropical climate with warm and humid weather all year round. It is usually very hot and humid, especially in the major cities.Malaysia is the best country to study on the passive design strategies in tropical climates.

What are passive design strategies? Since the time of our ancestors, buildings had been built characterized by passive design where it focused on a balance between local climate, surrounding areas, functions, appearances and design of the buildings. Passive design strategies can defined as the measures that had been taken to ensure the comfort of the occupant achieved. It must have a closer relationship with its surroundings to achieve a comfortable internal environment with a minimum of resources used as researched by Aziz (2007)

However, in this modern age, most of the building neglected the beauty of passive design strategies and end up relying on active design strategies such as air conditioning systems and others. In this research, we are going to discuss the importance of passive design strategies and knowing its effectiveness against the user's comfort, energy efficiency and the visual impact on the user point of view.

In the research, we will focus more on the passive design strategies that had stated in the Malaysian Standard: MS1525. MS1525 is the Code of Practice on Energy

Efficiency and use of Renewable Energy for Non-ResidentialBuildings,which was developed to provide the best practice in energy efficiency for buildings. This standard is very useful as it provides minimum standards for the design of new, existing buildings as well as methods of determining their compliance (Aziz, 2007: 423-430). Effective passive design strategies may contribute to minimizing the energy consumption in a building in relation to this standard and also helps to reduce wastage in line with Islamic principle (Qur'an, *al-Isra'*:27).

1.2 STATEMENT OF PROBLEM

There is no thorough research that had been conducted to determine the effectiveness of passive design strategies for a mosque in Malaysia based on three aspects that are human comfort, energy savings, and visual impressions.

1.3 RESEARCH QUESTIONS

Passive design strategies had applied in most of our buildings in Malaysia including in a mosque. However, how can we determine whether the strategies are effective and give benefits to the users? The effectiveness of the strategies carried different functioned to the users. Some may work very well in other building typologies such as offices or houses but not suitable implemented in a religious building like a mosque. Some may give impact to the visual impression but doesn't work in reducing energy for a building.

Hypothesis:

a) HUMAN COMFORT

   – The passive design strategies applied didn't provide comfort to the users

b) ENERGY SAVINGS

– The passive design strategies did not help much in reducing the energy consumptions

c) VISUAL IMPRESSION

– The passive design strategies do not carry meanings and impact to the users.

The studies on passive design strategies of a mosque in relation to these three elements are yet not being established and should be further discuss with detail analysis and studies in this research.

1.4 RESEARCH AIM

The central aim is to determine the characteristic of the passive design strategies that effective in giving comfort to people, reducing energy consumption and add beauty to a building as a whole.

1.5 RESEARCH OBJECTIVES

The following goals have identifiedto achieve the study. The research objectives are:-

a) To characterized the relevant and applicable passive design strategies that suitable for a mosque in Malaysia

b) To find out the effectiveness and impact of the strategies in a mosque based on human comfort, energy savings and visual impression

c) To evaluate and assess the perception of the user's preferences on the passive design strategies applied in the mosque buildings.

1.6 OVERVIEW OF RESEARCH METHODOLOGY

Literatures including books, articles, journals, master thesis and doctoral dissertations on the subjects of mosque, passive design strategies, energy efficient and sustainable

buildings reviewed. Moreover, related data and statistic from governmental and organizational reports and websites were explored.

Two federal mosques selectedas case studies in order to examine the effectiveness of the current passive design strategies that installed. The accurate information obtained through semi-structured and qualitative interviews with the architects, building operators and users. Field studies and inspections are also being conducted to observe the issues on site, to monitor the human comfort at the praying area. All the questionnaires, interviews, and data collections were gathered to evaluate the effectiveness of the passive design strategies in the mosque in relevant to the case studies. Comparative studies between both cases studies help to evaluate the perception of user's preferences in term of passive design strategies. Refer to figure 1.1 Overview of Research Methodology.

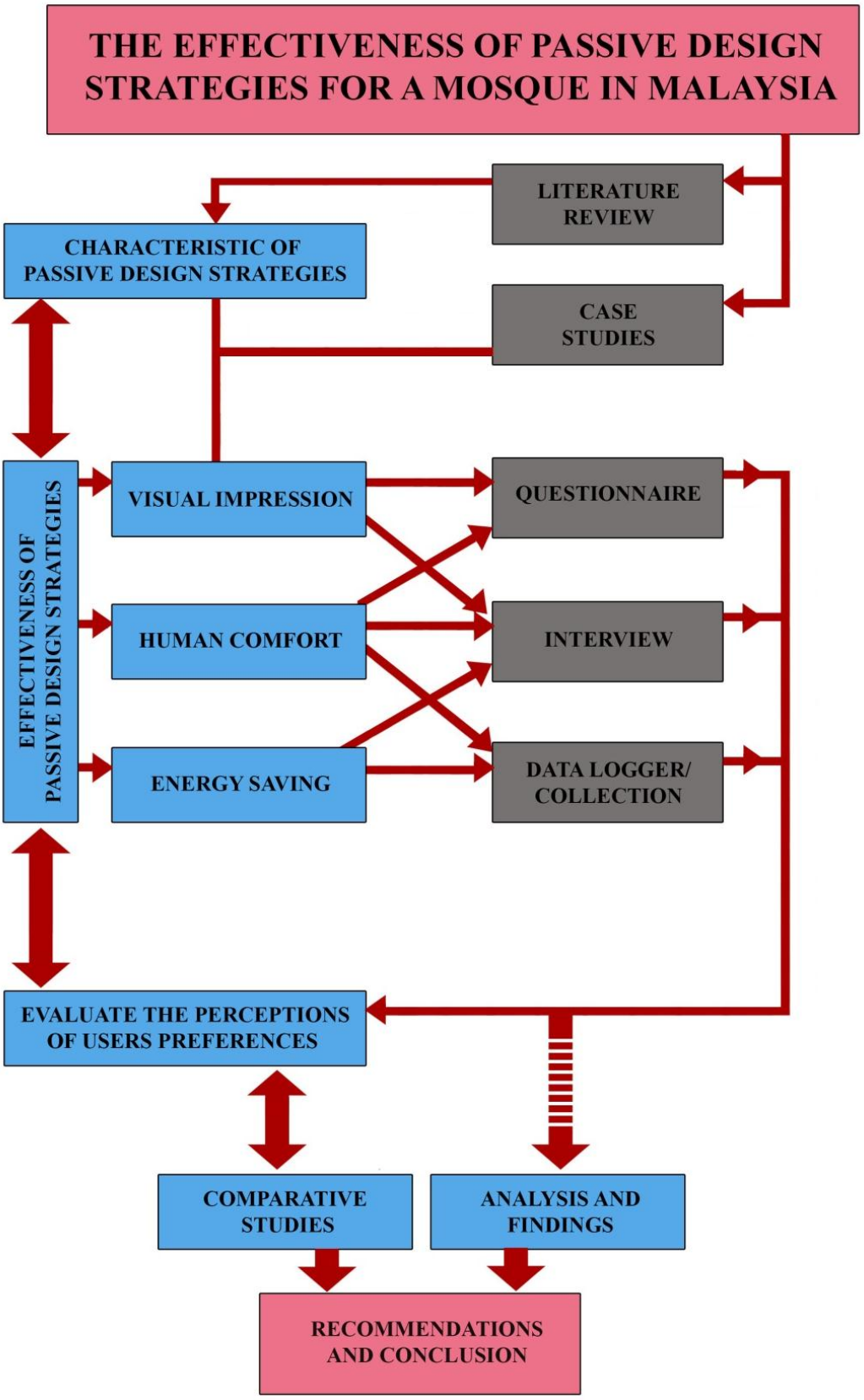

Figure 1.1 Overview of Research Methodology

1.7 SIGNIFICANCE OF STUDY

a) This study is to highlight the important aspect of finding, analyzing and synthesizing the effectiveness of passive design strategies for a mosque. Mosque is a type of building possesses high importance function and identifying the best alternatives to minimize the energy usage and give comforts to the users are highly beneficial to all parties.

b) The study is to increase the awareness on the importance of passive design strategies, environment conservation and energy saving issues to the designers, architects, engineers, and mosque's administrator and the users.

1.8 SCOPE AND LIMITATIONS

This research limited to studying 'Federal mosques in Putrajaya. The mosques are:-

- Putra Mosque, Dataran Putra, Putrajaya
- Tuanku Mizan Zainal Abidin Mosque, Putrajaya

The limitation is due time constrained of this study. The duration of the research limited while the process of collecting data is lengthy especially when permission required from governments and organizations.The researcher also needs to go through a few red tapes and procedures from the authority (government) and other relevant parties beforedocumentation; experiments and data can obtain. Some of the data collected also considered as private and confidential.

CHAPTER 2

LITERATURE REVIEW

2.1 MALAYSIA

Malaysiais located in Southeast Asia. It consists of thirteen states and three federal territories and has a total landmass of 329,847 square kilometers (127,350 sq mi). The South China Sea separates it into two similarly sized regions, Peninsular Malaysia and East Malaysia. Refer to figure 2.1 Malaysia Map. Malaysia is 329,758² km in size with the current population of Malaysia is roughly 28 million. Kuala Lumpur is the capital city of Malaysia, a metropolis with over 1.6 million inhabitants in the city center. Putrajaya serves as the federal administrative center of Malaysia,which located 25 km south of Kuala Lumpur. Putrajaya is a planned city due to overcrowding and congestion in the Kuala Lumpur had been looking to be well developed and expand further in the future. The capital city is Kuala Lumpur while Putrajaya is the seat of the federal government.

Figure 2.1 Malaysia Map