EXTERNAL SHADING DEVICES AS PASSIVE DAYLIGHTING STRATEGY FOR RESTING CORRIDOR IN TROPICS

MUHAMAD FAIZ BIN ZAKARIA

UNIVERSITI TEKNOLOGI MALAYSIA

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MUHAMAD FAIZ BIN ZAKARIA

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DEDICATION

This thesis is dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time.

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ABSTRACT

The use of external shading devices as a passive daylighting approach aims to enhance the comfortability of the rest and relaxation space of the resting corridor in tropical climates. The purpose of this research is to determine the most convenient types of external shading devices that are intended to improve passive daylighting performance in tropical climate resting corridors. However, the primary challenge in harvesting natural daylight for visual discomfort owing to glare and heat gain concerns from direct daylighting for resting corridors in tropical climates is the lack of shade in resting corridor. For example, in tropical states like Kuala Lumpur and Penang, there is no specific study that can justify the response of external shade devices specifically designed to be installed in resting corridors in tropical climates. Furthermore, a literature study analysis was utilised to gather data, which was then incorporated into the experimental pre-test and post-test data collections using the digital simulation approach conducted by Velux Daylight Visualizer and SketchUp, which was then analysed using a chosen literature research for resting space, elements of corridors, external shading devices, and daylighting performance in a tropical climate. Data from the literature is obtained prior to the research in order to offer independent variables for the experiment. Quantifiable data is created as a result of the computer simulation study. Based on the method, the performance of egg-crates with shaded panels with a pitch angle adds to the improvement in daylighting performance in illuminating the inside of the resting corridor than conventional egg-crate shading devices when used as a passive daylighting approach for resting corridors in the tropics. This study definitely answers the question of whether the use of egg-crate external shading devices is effective to obtain excellent illuminance levels and daylight factors at resting corridors in the tropical climate. As the intention of resting corridors is to provide a sense of rest and relaxation with the mechanism of the corridor.

ABSTRAK

Penggunaan peranti teduhan luaran sebagai pendekatan pencahayaan siang hari yang pasif bertujuan untuk meningkatkan keselesaan ruang rehat dan santai yang terdapat pada ruang koridor rehat pada iklim tropika. Tujuan penyelidikan ini adalah untuk menentukan jenis peranti teduhan luaran yang paling berkesan bertujuan meningkatkan prestasi pencahayaan siang hari yang pasif pada ruang koridor rehat dalam iklim tropika. Walau bagaimanapun, pencahayaan siang semula jadi boleh menyebabkan ketidakselesaan visual disebabkan silau dan panas menjadi kebimbangan dan merupakan cabaran utama kajian ini. Hal ini kerana, pencahayaan siang yang terlalu terdedah di ruangan rehat koridor pada iklim tropika merupakan satu kekurangan. Sebagai contoh, di negara beriklim tropika seperti Malaysia dan Singapura, tiada sebarang kajian khusus yang dapat menjelaskan tindak balas peranti teduhan luaran yang dirancang khusus untuk dipasang di koridor rehat pada iklim tropika. Oleh itu, analisis kajian literatur digunakan untuk mengumpulkan data, yang kemudian dimasukkan ke dalam eksperimen pra-ujian dan pasca-ujian dalam pengumpulan data dari ujian tersebut menggunakan pendekatan simulasi digital dengan mengunakan perisian *Velux Daylight Visualizer* dan *SketchUp*, seterusnya dianalisis menggunakan penelitian literatur terpilih untuk ruang istirehat, elemen koridor, peranti teduhan luaran, dan prestasi siang hari di iklim tropika. Data daripada literatur diperoleh sebelum penyelidikan untuk menyediakan pemboleh ubah bebas untuk eksperimentasi. Data yang dapat diukur dijadikan sebagai hasil kajian simulasi komputer. Berdasarkan kaedah itu, prestasi pengunaan *egg-crate* serta peneduh bersudut condong menambah peningkatan prestasi pencahayaan siang dalam menerangi bahagian dalam koridor rehat. Selain daripada ciri peranti teduhan *egg-crate* yang lebih ke arah konvensional apabila digunakan sebagai pendekatan pencahayaan siang hari yang pasif untuk ruang rehat koridor di kawasan tropika. Kajian ini menjawab persoalan sama ada penggunaan peranti peneduhan luaran *egg-crate* berkesan untuk mendapatkan tahap pencahayaan yang terbaik dan antara faktor pencahayaan siang hari pada koridor rehat pada iklim tropika. Seterusnya, menjawab tujuan utama iaitu berehat di koridor dapat memberikan kesan rehat yang santai dan tenang dengan adanya kepelbagaian mekanisme yang terdapat pada koridor.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Daylighting is seen as a key component of space identity and, as a result, a key component of space quality. It can have a significant impact on resource conservation, occupant productivity, health, and comfort.(Hafiz and Transport, 2020). Daylighting will help lower the amount of CO2 in the atmosphere while boosting consumer health. (Muhamad *et al.*, 2022). When the body's equilibrium is achieved by natural illumination, symptoms of sleepiness, lethargy, and exhaustion are decreased. (Muhamad *et al.*, 2022) In Addition, The utilization of natural light has proven equally essential in enhancing the environmental quality and energy efficiency of buildings. (Ku Adzman *et al.*, 2020). In response to natural daylighting, a passive daylighting system is an ideal technique for space quality. According to the study conducted by (Nihmiya, 2021) by collecting natural light and reflecting it into darker areas of the building, passive daylighting techniques increase the quantity and equitable distribution of daylight across a building.

In tropical climates, passive daylighting is the ideal companion in resting corridors. The resting corridor is an element that provided space for hybridization with corridic element. For example, according to (ARUP, 2017) natural light flow in corridors or rest areas between galleries allows visitors to relax and rest their eyes before proceeding. As for that, external shading devices are capable to utilize natural light sources as passive daylighting strategies for enhancing environmental and spatial quality. External shading devices are used to block direct sunlight from entering the living space. (Ku Adzman *et al.*, 2020). Moreover, Shading devices in both ventilated and unventilated rooms have a major influence on enhancing interior temperature conditions. However, due to their arrangement (i.e., a combination of overhangs and fins devices), egg-crate devices are the best in reducing interior air temperature and minimizing the number of discomfort hours.(Al-Tamimi and Fadzil, 2011) In summary, this research will concentrate on the development of external shading devices as a passive daylighting strategy for resting corridors in the tropics.

1.2 Problem Statement

In tropical climates, such as tropical states like Kuala Lumpur and Penang, the fundamental issue in harvesting natural daylighting for the visual discomfort due to glare and heat gain problems from direct daylighting. According to the (. *et al.*, 2018) glare problem is caused by the exceedingly unequal distribution of daylighting in space. As a matter of effect, no study has been conducted specifically on the external shading devices' response to resting corridors in the tropical climate. The role of resting corridor in public buildings as a space with sense of rest and relaxation with the mechanism of the passageway and the 30% of the efficiency of building could be enhanced by optimizing the corridor as functional spaces. In order to enhance and value-adding the resting corridor, the adjustment and improvement of the corridor has to be done, especially via natural daylighting. Nevertheless, several studies showed the impact of external shading devices. According (Al-Tamimi and Fadzil, 2011) External shading devices such as overhangs, louvres, and egg crates should be encouraged as architectural components in Penang, which has the highest radiation level in Malaysia, to shield building envelopes and inhabitants from solar radiation. However, no specific study can be justified the response of external shading devices specifically to be implemented on resting corridors in the tropical climate.

1.3 Research Aim

The proposed research aims to determine to analyze the type of external shading devices designed to enhance passive daylighting performance in rest corridors in Malaysia.

1.4 Research Objectives

The objectives of the research are:

(a) To study the significance of external shading devices for rest corridors in the tropics

(b) To explore the best design typologies of external shading devices in achieving the best illuminance daylighting for a resting corridor in the tropics.

(c) To evaluate the effectiveness to design parameters to optimize the daylighting performance with external shading devices.

1.5 Research Question

The questions of the research are:

(a) What are the most essential exterior shading devices in Malaysia for resting corridors?

(b) What are the design configurations of external shading devices to achieve the optimum illuminance daylighting for resting corridors in the tropics?

(c) What are the effectiveness of design parameters to optimize the daylighting performance with external shading devices?

1.6 Scope of Thesis

This research will focus on the design and performance of external shading devices in passive daylighting in resting corridors as a sense of rest and relaxation space with the mechanism of the passage way. The design features of external shading devices will be established using the passive daylighting system and theory in the tropical environment.

1.7 Significant of the study

Differentiate external shading devices that are possibly implemented in resting corridor design in Malaysia. The various type of external shading devices and each capability to accomplish the significant space quality in the resting corridor as optimum illuminance daylighting for resting corridors in the tropics

1.8 Research Methodology

This study is using the mixing method which is a combination of the quantitative framework, where the research will be analyzed using computer simulation for daylighting performance in indoor space and the qualitative framework analyzed the selected literature review. The research framework is to evaluate the passive daylighting performance of external shading devices in resting corridors in tropical climates. As for the research conducted with the quantitative framework. A literature review is used to gather information and knowledge of the external shading device's response to the passive daylight system used in a tropical environment.

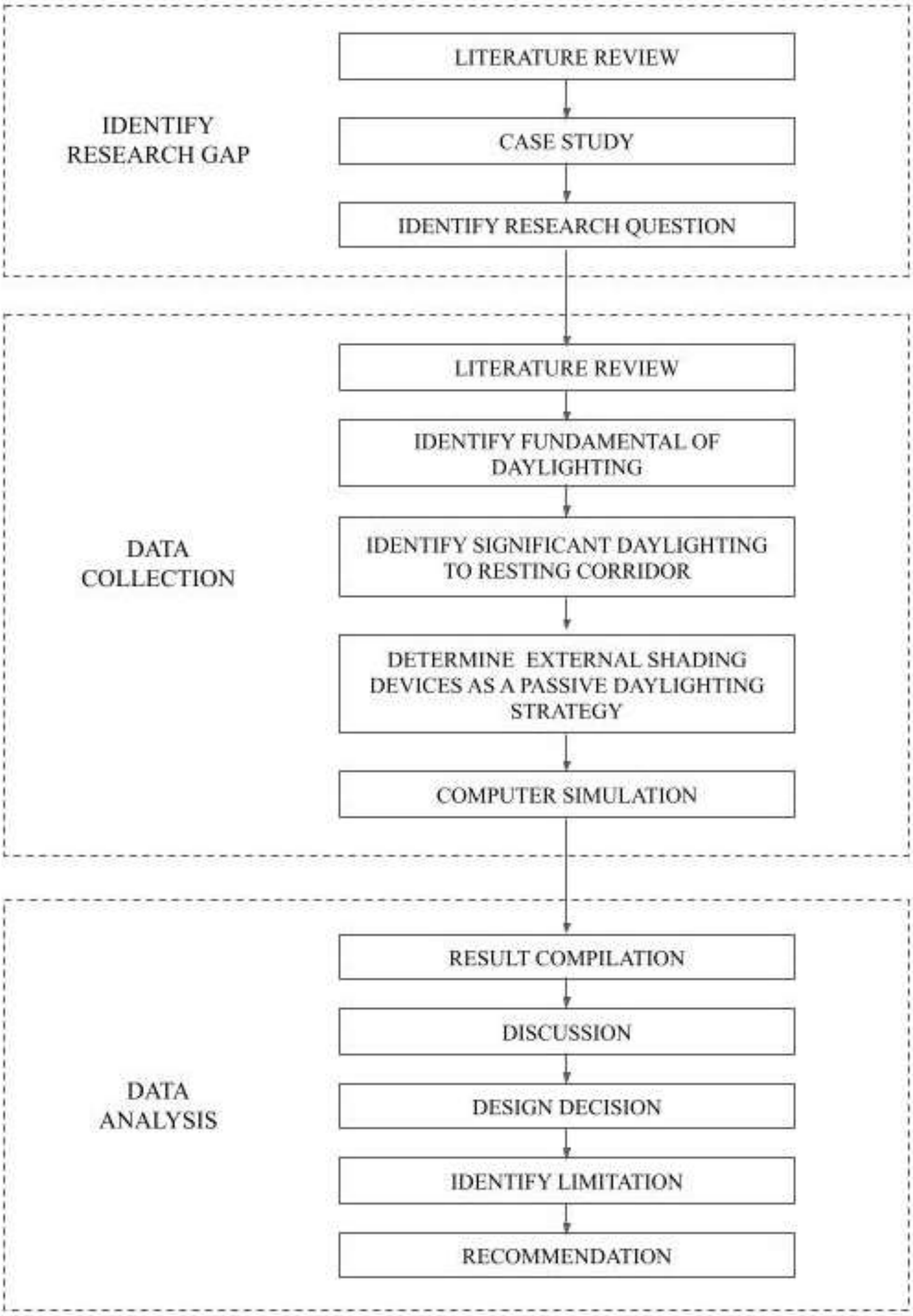

Figure 1.1 Research Methodology Flow Chart

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