Journal of Architectural Research and Education

Journal homepage:
https://ejournal.upi.edu/index.php/JARE/index

Study of The Concept of Modern Tropical Architecture in a Villa in The Panbil Area, Batam

Susanto [1], Yoseph Seno Prakoso [2]

[1, 2] Department of Architecture Universitas Internasional Batam, Kota Batam, Indonesia
*Correspondence: E-mail: susanto1912005@gmail.com

ABSTRACT

The concept of Tropical Modern Architecture is a combination of building ideas that solve tropical climate issues and a more contemporary building style. The Panbil area in Batam, which is located near a protected forest, applies the Tropical Modern Architecture concept to its buildings, including the Villa Forest House. This research aims to identify, understand, and explain the principles of Tropical Modern Architecture design in residential villas in the Panbil area, particularly in Villa Forest House. The research method used is descriptive qualitative, with an inductive approach to studying the object as primary data and relevant literature as secondary data. After collecting all the data, an empirical analysis is conducted to conclude that the relationship between the tropical climate and modern style affects the overall facade of the building, including the type of roof and building materials used.

ARTICLE INFO

Article History:
Submitted/Received 24 Feb 2023
First Revised 20 September 2023
Accepted 15 January 2024
First Available online 1 April 2024
Publication Date 1 April 2024

Keyword:
Tropical Modern Architecture,
Tropical,
Modern,
Villa, Panbil

1. INTRODUCTION

Indonesian architects have many architectural design references used as a guide, such as references from regions with moderate climates (European countries, Canada, North America, etc.) and regions with dry tropical climates (some countries in the Middle East, etc.). However, if building planners do not reconsider the suitability of these design references with the humid tropical climate, inappropriate design concepts will occur. This is a mistake that can have a serious negative impact. Therefore, in adopting design concepts from the "West" or "Middle East", architects must still consider factors related to the local climate in Indonesia, which is the humid tropical climate. Even though the building may have various design styles such as Hi-Tech, Deconstruction, Postmodern, Minimalist, etc (Mutmainnah et al., 2016)

Indonesia, as one of the tropical countries in the world, experiences two types of seasons, which are rainy and dry seasons. The intensity of rainfall is higher than that of the dry season, which classifies Indonesia as a wet tropical climate or Af climate (Saliim & Satwikasari, 2022). Batam is the largest city in the Riau Islands province of Indonesia and is also a tropical island.

According to the map of the Batam City Spatial Plan for 2021-2041, as stipulated in Regional Regulation No. 3 of 2021 (Peraturan Daerah Kota Batam Nomor 3 Tahun 2021 Tentang Rencana Tata Ruang Wilayah Kota Batam Tahun 2021-2041, 2021), the Panbil area is adjacent to a protected forest area in Batam. The Panbil area is officially designated as a National Vital Object (Obvinas) in Batam, which pertains to matters related to the livelihoods of many people, national interests, or strategically important sources of national revenue.

Panbil has an integrated business that includes villa housing, specifically designed to meet the high demand in the market, especially for Villa Forest House (Panbil Group, 2020). This new product from Panbil is located in a lush green forest in a tropical area. The building design takes into account the available potential while also considering architectural aspects.

1.1. The Materials

1.1.1. Tropical Architecture

Tropical originates from Greek, "tropikos" which refers to the tropics, covering about 40% of the earth's surface. The Tropic of Cancer and the Tropic of Capricorn, which are located at 23°27' North and South latitude respectively, form these lines. The tropical region is defined as the area between the 20° isotherm lines in the Northern and Southern hemispheres (Ardiansyah et al., 2022). Therefore, tropical architecture is architecture that exists in tropical regions and has adapted to tropical climate conditions.

In Wirawan's article (Putra, 2018), there are several distinctive features of tropical architecture in Indonesia. Firstly, the use of natural materials such as wood and other natural materials as the main building materials. Secondly, the utilization of natural ventilation and lighting to maintain a cool microclimate and save costs, compared to using mechanical air ventilation or electric lighting. Thirdly, the utilization of a spacious courtyard or terrace as a place for plants or relaxation for the occupants of the house. Finally, the use of a sloping roof with wide eaves to accelerate the falling of rainwater and its absorption into the ground. The wide eaves on the roof also serve to protect the house from rain splashes and keep it dry.

DR. Ir. RM. Sugiyatmo presents several properties of buildings that can be considered to apply the principles of tropical architecture. Some of these characteristics include (Kadafi et al., 2022):

a. Building Orientation

Building orientation refers to the facing direction of a building in a particular area, which is divided into eight directions, namely North, West, East, South, Southeast, Northeast, Northwest, and Southwest. In passive design, the pattern of building

DOI: https://doi.org/10.17509/jare.v6i1.55840
p- ISSN 2776-9909 e- ISSN 2580-1279

orientation has both positive and negative impacts. This is because passive buildings tend to utilize their natural potential to achieve thermal comfort, and therefore need to consider the orientation of the sun and wind (Iqbal, 2019).

b. Shielding against the sun's rays and intense rainfall

When dealing with the direction of the sun facing towards the north or south, the intensity of solar radiation can be reduced by means such as using double facades, sun shading (canopies), and placing plants. Meanwhile, to deal with heavy rainfall, a sloping roof and wide overhangs can be used (Arisal & Sari, 2020).

c. Airflow Through Buildings

The occurrence of air flow is based on several principles, including the difference in air pressure and temperature between the indoor and outdoor air. Additionally, the location of ventilation openings and the architectural design can also affect the pattern of air movement. These factors, along with differences in elevation, contribute to the movement of air within a space (Prianto et al., 2018).

d. The illumination that originates from the sun's light during daytime

The characteristic of a tropical climate is the presence of strong sunlight. Natural light that enters a room will affect the visual comfort during activities and the psychological atmosphere that supports activities inside the room. Therefore, the architectural design should not completely avoid the entry of sunlight into the room (Thiodore, 2018).

e. Providing open green space

External factors affecting thermal comfort are closely related to microclimate elements (Santi et al., 2019).

f. Using local materials that have high durability

Studies on the thermal impact in humid tropical climate regions show that building envelopes are a crucial factor in controlling building thermal passively. One of the methods that can be implemented is by reducing the rate of heat transfer into the building by selecting materials with high heat resistance (Munir, 2017).

1.1.2. Modern Architecture

The concept of modern architecture emphasizes form over function (form follows function). Modern architecture was first defined by Rayner Banham in his work. One of the main goals of modern architecture is to simplify the layout of complex buildings. The characteristic of contemporary architecture is its simple appearance, often in the form of a box, without ornamentation, and repetitive (Arya & Wahadamaputera, 2022).

The Modern Architecture embodies the principles of functionality and efficiency. Functionality emphasizes that buildings should be able to accommodate the activities of their inhabitants, while efficiency should be applied to various aspects such as cost, time, and maintenance of the building. The characteristics of Modern Architecture include rejecting traditional styles, avoiding excessive ornamentation and carvings, simplifying building details, and emphasizing that materials and function are crucial to the final outcome of the building. Modern Architecture also views buildings as machines (Pratama et al., 2018).

1.1.3. Tropical Modern Architecture

Tropical modern architecture is a form of development of modern architecture that adapts to modern society's lifestyle. This architectural style combines the aesthetic value of tropical buildings with efficient and functional design, while taking into account the needs of the climate and surrounding environment. Each room is designed to optimize the circulation of natural light throughout the day through wide doors, window ventilation around the building, and skylights in some roof corners, creating a fresh and comfortable atmosphere.

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p- ISSN 2776-9909 e- ISSN 2580-1279

Thus, modern buildings with tropical architecture design provide a more lively and warm atmosphere while minimizing the use of fans or air conditioning (Sofi et al., 2017).

Modern tropical architecture is a type of architectural design that is specifically designed and adapted to meet the needs and climatic conditions in tropical regions. Tropical regions are typically located around the equator and have specific characteristics caused by high intensity sunlight, high humidity and rainfall, as well as the influence of wind and other factors. Therefore, modern tropical architecture focuses on ways to optimize these climatic conditions, by considering aspects such as ventilation, air circulation, appropriate building materials, and so on (Zaeny et al., 2021).

1.2. Villa

Several definitions explain that a villa can be interpreted as follows:Villa is a temporary accommodation used for tourism or recreation purposes, whether it is permanent or portable like a tent. This place provides various complete facilities and is only intended for guests who will stay for a certain period of time. (Suwita et al., 2022). Several definitions explain that a villa can be interpreted as follows:

1. Gunawan et al. see Villa as a temporary residence that is owned for vacation and recreation purposes. In addition, Villa is often utilized as a place to rest (Rahman, 2022).
2. Villa is one type of tourist accommodation that is usually located near tourist areas. Villas are intended for tourists who want to vacation, have fun, and spend leisure time away from monotonous work routines (Anisyah Imran, 2021).

Villas are available in three different classes, namely standard, intermediate, and luxury. The difference between these villa classes lies in the building size, facilities provided, and the number of rooms available inside. The higher the class of the villa, the more complete the facilities provided inside. Typically, villas are intended for the middle to upper class. Currently, there are many luxurious villas available with various complete facilities. These luxurious villas come in various sizes and different numbers of rooms. The price of luxurious villas increases in accordance with the number of rooms and facilities provided inside (Devi Astrini et al., 2022) .

2. RESEARCH METHOD

The research method utilized was qualitative inductive, which involved conducting a survey in the Panbil villa area and collecting data on villa buildings from the Villa Panbil Developer as primary data. In addition to the primary data obtained, various scholarly articles were also reviewed as a point of comparison.

3. RESULTS AND DISCUSSION

3.1. Building Orientation

Based on data from Google Maps and information provided by the Panbil area developers, The **Figure 2** is displaying the location and orientation of Villa Forest House towards sunlight can be identified and analyzed. The building's facade is oriented towards the east and west to enhance the villa's view and market value. However, this orientation also has consequences as it can result in excessive sunlight exposure, which needs to be considered in the building's facade design.

DOI: https://doi.org/10.17509/jare.v6i1.55840
p- ISSN 2776-9909 e- ISSN 2580-1279

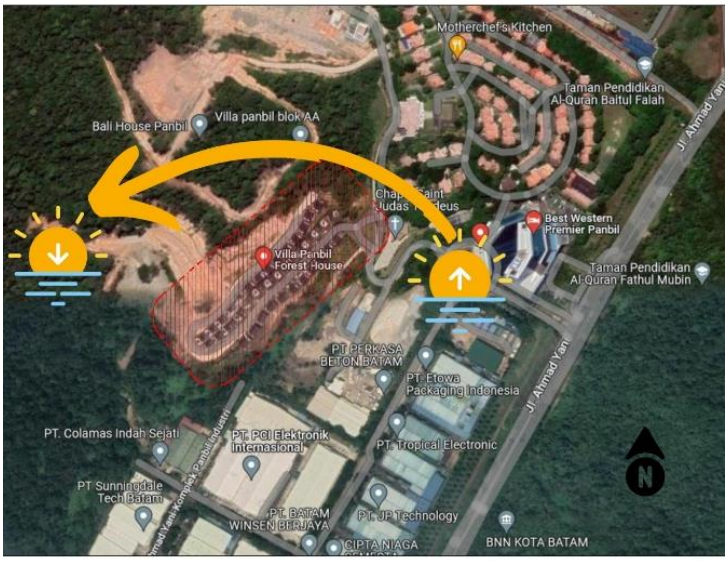

Figure 1 : Site location and Orientation analysis
Source : Google Map, 2023 with modification, 2023

Besides the cool breeze generated by the wind direction from the surrounding forest, the uneven terrain topography affects the selection of the type of building to be constructed, which is divided into two types, namely upslope (figure 2) and downslope (figure 3). Despite having different levels, the villa building is designed with a uniform theme so that it still appears as a unified whole.

Figure 2 : Front view of Upslope type
Source : Writer, 2019

Figure 3 : Front view of Downslope type
Source : Writer, 2023

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3.2. Building Materials

Villa Forest House was designed taking into account the weather conditions in tropical areas by using suitable materials. The walls are made of red brick press that is resistant to tropical weather, while the finishing material used is conwood, and the roof tiles are made of concrete.

Figure 4 : Walls material : Red brick press
Source : Writer, 2017

Figure 5 : Roof material : Concrete Tile
Source : Writer, 2017

The material utilized effectively reduces heat, ensuring a comfortable room temperature, and is resistant to water during rainy seasons. Furthermore, considering the erratic weather, conwood material is also acknowledged for its eco-friendliness and its resistance to termites and fire. As a result of using this material, Villa Forest House has a contemporary vibe.

3.3. Rainfall

Villa Forest House features a combination of gable roof design with a slope of ±30° and a flat roof in the carport area. The gable roof design has been tailored to meet the standard design requirements for tropical climates, as it effectively allows rainwater to flow off the roof without putting a burden on the building's structure.

3.4. Shading

To prevent dullness and rain splash, Villa Forest House is designed with a concrete canopy that is finished with conwood to maintain a natural-looking facade.

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Figure 6: Canopy with conwood
Source : Writer, 2017

3.5. Lightning

Villa Forest House utilizes a combination of natural and artificial lighting. Natural lighting comes from the sun shining through windows and glass walls, while artificial lighting is used when natural light is insufficient. In its design, Villa Forest House considers the orientation of the building to maximize the view of the sunrise and sunset. This provides an opportunity for occupants to enjoy the beauty of nature directly.

Figure 7 : Staircase (outside view)
Source : Writer, 2018

Figure 8 : Staircase area (Inside view)
Source : Google Map, Writer, 2018

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The staircase of Villa Forest House is designed to be transparent, with the aim of allowing sunlight to enter through the glass walls. Good lighting can offer various benefits, such as enhancing comfort, improving mood, aiding in visual tasks, and boosting productivity. In order to prevent glare from the sun during the afternoon, frosted glass is used on the inside of the glass, and an alternative option is to use curtains.

3.6. Ventilation and Air Circulation

Villa Forest House utilizes a cross ventilation mechanism that enables horizontal airflow through opposing apertures, promoting optimal air circulation and ventilation. As a result, this system efficiently lowers the indoor temperature. Apart from providing adequate air circulation, the openings in the building also serve as direct entry points to the house's garden and corridor area.

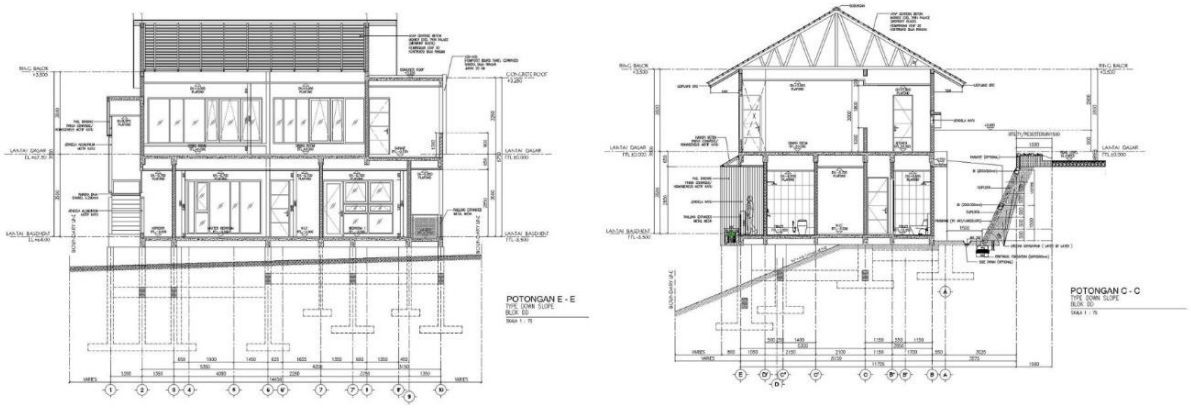

Figure 9 : Building Sections
Source : Writer, 2023

Villa Forest House also utilizes natural methods to cool the building by implementing a window system that can be opened and closed. The windows are placed on the interior and exterior walls of the building to allow air to flow smoothly throughout all the rooms.

Figure 10 : Opening : Window with balau wood frames
Source : Writer, 2017

4. CONCLUSION

From the above discussion, it can be concluded that modern tropical architecture is a building design concept that takes into account the tropical climate conditions. This concept requires buildings, especially homes, to adapt to the surrounding environment in order to

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p- ISSN 2776-9909 e- ISSN 2580-1279

create optimal thermal comfort indoors. The use of composite materials also makes Villa Forest House look modern and environmentally friendly.

Most of the concepts of modern tropical architecture applied to Villa Forest House Panbil have successfully responded to the tropical climate conditions, allowing the building to adapt to its surroundings. Some of the design requirements that should be considered to create optimal thermal comfort within residential buildings include: orienting the building to face east and west, while also considering the amount of sunlight entering the building, using building materials that can withstand hot and rainy weather, especially for residential units, providing shading to protect from excessive rain and sunlight, creating airflow with cross-ventilation systems to maximize air circulation, and designing a sloping roof with a ± 30° angle so that rainwater can easily flow without burdening the building's roof.

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