ACEH TRADITIONAL HOUSE: ADVANTAGE OF THE BUILDING DESIGN IN RESPONDING TO THE TROPICAL CLIMATE

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ABSTRACT

Tropical architecture is a building design concept that adapts to the tropical climate, which must be able to overcome climate problems. Aceh traditional house commonly called Rumoh Aceh, is the traditional house that is still inhabited by the Acehnese community nowadays. The building design of Aceh traditional houses is proven to have many advantages compared to modern houses nowadays, in terms of structure, construction, and also thermal comfort. The purpose of this paper is to investigate the tropical wisdom in Aceh traditional houses by learning the implementation of the design, to know how it provides comfort for the users. Qualitative research is a method used to identify the effectiveness of the building design strategy of the houses in adapting to tropical climates. The data collection is done through observation, interview, and documentation. The result shows that the Aceh traditional house apply tropical wisdom in its building design. The wisdom of tropical design elements in the houses is seen from the north-south orientation of building mass, the use of stage-form in the building to optimize air circulation, the appropriate placement of air ventilation, the open space for the interior concept, the use of environmentally friendly local material, and the use of sloping roof with a wide overhang to quickly channel rainwater, prevent rain splashes, and prevent strong winds from damaging the roof structure.

Keyword: green material, rumoh aceh, sustainable structure, tropical climate, tropical wisdom

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1. INTRODUCTION

A house is a shelter that can accommodate all the activities of its users safely and comfortably. A house is not only a building (structural) but also a place of residence that fulfills the conditions of life that are worthy of being viewed from various aspects of people's lives. Home is a sanctuary, a place to enjoy life, rest, and have fun with family [1].

To create a safe and comfortable dwelling, several factors must be considered during the design process, one of which is the climate factor [2]. The climate is very influential in the design of a building because the building must be able to adapt to the local climate. By knowing the problems and potentialsof the climate, appropriate design solutions can be applied to buildings, so that the building's function as a shelter can be realized optimally.

Indonesia has a tropical climate, that tropical climates usually cause high air temperatures because solar radiation falls on the surface almost perpendicularly at noon each year [3]. Moreover, Indonesia specifically is included in the humid tropical climate, it can be categorized as follows: Strong solar radiation, high rainfall, relatively low wind speed, relatively high humidity, and high air temperature [3].

The character of a humid tropical climate is characterized by precipitation (rain) and high humidity withalmost always high temperatures, which have annual temperatures ranging from 26° C in the wetseason to 38° C in the dry season, light wind, moderate to strong solar radiation, and high rainfall, heavy rain [4]. Adapt the tropical climate, buildings must be able to respond to every element of the tropical climate, namely sunlight, humidity, rainfall, and air circulation [5]. Tropical climate buildings must be able to reduce energy use, by utilizing natural lighting and ventilation, to minimize electricity usage. Inaddition to energy-efficient buildings, tropical buildings are also synonymous with environmentallyfriendly buildings, one of which is through the use of local materials. This local material is a naturalmaterial that is easily found in the surrounding environment. There are several characteristics of tropical architectural buildings, those are the use of sloping roofs (usually > 30°), wide windows for naturallighting, lots of air ventilation for circulation, and building orientation facing north-south. using bright colors in buildings, using natural materials or local materials that are easy to find around.

One of the house-owners in Lubok Sukon, the Acehnese traditional house, or what is commonly referred to as Rumoh Aceh, is a typical house of the Acehnese people [6]. Acehnese traditional house designs are related to the beliefs of the Acehnese people in ancient times. This traditional Aceh house is also inseparable from the religious side, where this house is a representation of people's belief in God and the universe. Acehnese traditionalhouses use building materials that are all obtained from nature, such as wood and thatch, so the use of these natural materials is a form of gratitude from the community for God's grace, and for the availability of abundant natural wealth. The influence of the Acehnese belief in buildings can also be seen from the orientation of traditional Acehnese house buildings that extend from east to west, where the west direction is an attempt by the community to build an imaginary line with the Kaaba in Mecca, which make it easier for home users to determine the Qibla direction to perform prayer. This Aceh traditional house is also in the form of a stage, where the shape of this stage is based on considerations to avoid wild beasts in ancient times and also as an effort to avoid flooding [7].

To explore what is mentioned above, this research will discuss the tropical wisdom in Acehnese traditional houses and identify the adaptive efforts and design strategies that are applied to Acehnese traditional house buildings as a response to tropical climate conditions.

2. METHODS

The authors went to Lubok Sukon village, where the houses are located. Together with the villagers and the owners of the houses, the authors observed the houses structure, construction, and materials. It is the best way to understand the tropical wisdom of the traditional house.

During the investigation of the building design of Aceh traditional houses, the authors use qualitative methods. The qualitative method is research to describe and analyse phenomena, events, social activities, attitudes beliefs, views, and thoughts of people both individually and in groups [8]. This research emphasizes the data collection from visual observation and people interviews. Observation is a data collection method where researchers record information as they witness it during the research. There are several forms of observation, namely participant observation, unstructured observation, and group observation. The form of observation carried out in this study is group observation, which is an observation carried out by a group of research teams on an issue raised as an object of research [9].

In making observations, the author also documented various things needed to support the data. The things documented are the appearance of the traditional Acehnese house as an exterior and the interior – from the roof to the foundation – as well as the structure and materials of traditional Acehnese houses. During the survey, the authors asked the villagers about the history, function of each room in the house, structure, and materials; including what they do to renew the materials and their durability. Furthermore, the authors stay in the house in the afternoon, when the tropical temperature is at its peak, to know about the thermal comfort of the house.

Besides that, a literature study was conducted to know and obtain more in-depth information regarding tropical architecture and Aceh traditional houses. The characteristic of tropical architecture is then compared to the design of Aceh's house, to understand how the house were built and how the design responds to tropical climate.

3. RESULTS AND DISCUSSION

The traditional Aceh house is a stilt-shaped house, which consists of three main parts: the front porch (*seuramoe keue*), the middle porch (*seuramoe teungoh*), and the back porch (seuramoe *likot*). The traditional Aceh house is designed based on the culture, customs, beliefs, and beliefs of the Acehnese people. It is rectangular, with a building orientation that extends from the east to the west. The house has many openings and air ventilation, and it also uses local materials from the surroundings area.

a. The Building Orientation of The Aceh Traditional House

Aceh traditional houses are elongated, stretching from east to west. The main entrance and stairs are located to the east, while the back of the building faces west. The orientation direction of this building is considered based on the beliefs of the Acehnese people. The people of Aceh,who are predominantly Muslim, have always been known to be very firm and always adhere toreligious teachings in every aspect of life. This can also be seen from the design, where the orientation of the building stretching from east to west is a community effort to build an imaginary line with the Kaaba in Mecca. This will make it easier for every occupant of the house, both homeowners and visiting guests to find the Qibla direction when they want to pray [10]. The orientation is also an attempt to adapt to tropical climate conditions. The west direction is the direction that gets excessive sunlight, so the area of the building facing the west will be hotter than the areas in other directions. In this Aceh traditional house building, the stairs and entrance are to the east, while the back of the house faces the west. Laying the entrance to the east is protected from excess heat and can provide coolness and comfort for the occupants of the house. The orientation of the Aceh traditional houses, which stretch from east to west, is also based on wind direction considerations. The facade of the traditional Acehnese house does not directly face the direction of strong winds. The wind is blowing from the west or east, so if the house is facing to the direction where the strong wind is blowing, it is feared that the house may collapse due to the brunt of the storm winds which can occur at any time.

b. The material, structure, and construction of the house

The roof of a traditional Acehnese house is triangular, commonly called *bubong*. This gable roof is under the rules of tropical architecture, where the roof shape that is most suitable for tropical climates is a ridge roof. The ridged roof itself is a roof with a slope of 30-35°, whose function is to facilitate the drainage of rainwater from the roof to the ground below. In tropical climates, high rainfall is a major problem in buildings. This high rainfall causes the load of rainwater that falls on the roof to be channelled immediately. The use of this gable roof, apart from being easier to drain rainwater, also has an overhang which can protect the building from rainwater ingress and also function as a sunshade.

The roof covering material on the Aceh traditional house uses *rumbia* leaves. The use of *rumbia* leaves is an option because it is naturally light and can also make buildings feel cooler and more comfortable. *Rumbia* leaves are a local material that in ancient times was very easy to obtain by the local community. The use of *rumbia* roofs is also one of the responses of the building to adapt to the tropical climate. The tropical climate has solar radiation ranging from moderate to strong so that buildings need materials that can reduce heat from sunlight so that the interior of the building feels cool and comfortable.

The construction of the house comes from natural materials such as wood and bamboo. The traditional houses are not built using nails or iron, but each wood and pillar is only held together by *bajoe* or pegs that interlock with one another [11]. The binding material for this building is a rope made of rattan, palm fiber, and waru tree bark. The structure is proven to be strong and earthquake resistant [12]. When an earthquake occurs, the building structure can follow the direction of the earthquake movement, and house construction will soon return to normal when the shaking stops. On the floor, there are supporting beams that are arranged tightly to each other, to minimize the risk of the building collapsing. The houses are supported by the construction of supporting pillars, which size ranges from 20 to 35 cm. At each lower end of the pillar, there is a foundation stone whose function is to prevent the entry of wood into the ground when a flood

occurs at any time. The use of the foundation stone at the bottom of the pillar is also a form of response from the building or the way the building adapts to tropical climate problems which can occur at any time due to the high rainfall factor.

Fig 1: Natural Materials Used in Aceh Traditional House

Natural materials used in traditional Aceh houses:

1. Wood
   Wood is used in the construction of roof trusses, walls, and floors, and is also used to make stairs and pegs.
2. Bamboo
   Besides using wood materials as walls and boards, traditional Aceh houses also use bamboo materials.
3. Palm fiber
   Palm fiber is used as a binder for roof construction and *rumbia* leaves, as well as a binder to join the bamboo halves on the floor of the building.
4. *Rumbia* leaves
   Rumbia leaves or commonly called coconut leaves, are used as a roof covering material in traditional Aceh houses. In ancient times, *rumbia* leaf was a natural material that was very easy to get because the trees thrived in the natural environment around them. It is the reason that causes *rumbia* leaves to be used as a roof covering material in house buildings.
5. Stone.
   The foundation of the traditional Aceh house uses river stone material. This foundation is also often referred to as *gaki tameh*.

The Aceh traditional house uses natural materials in all parts of the house. This shows tropical wisdom in traditional Acehnese house buildings, where the use of local materials in buildings is one of the characteristics of tropical architecture.

c. Natural Lighting and Ventilation in Traditional Aceh Houses

The Aceh traditional houses have lots of openings and air ventilation, so natural lighting and air circulation are easy to get. Its design is included in building designs that are energy efficient, environmentally friendly, and sustainable, which are following the characteristics of tropical architecture. One of the characteristics of a traditional Aceh house is that it has a *tulak angen*. *Tulak angen* is a triangular air circulation cavity located on the side wall of the house. *Tulak angen* has a hollow shape and also a variety of motifs, so apart from being an air ventilation, *tulak angen* also functions as an aesthetic for the building. In traditional Aceh house buildings, there are also vents surrounding the top of the house. This vent also functions to create healthy air circulation and optimize natural ventilation.

In addition to ventilation which functions as air circulation, the shape of the stage in Aceh traditional houses also plays a role in creating natural ventilation in the house. The shape of the

house on stilts has advantages, one of which is being able to circulate fresh air throughout the house. This circulation will make the air cooler and more comfortable. The floors of traditional Aceh houses, which are generally made of wood or bamboo, also contribute to creating healthy air circulation. It is made of boards that are not nailed, but only pinned; so that one day the boards can be easily removed for certain purposes, such as washing the corpse (in an Islamic way) so that the leftover water from bathing can fall directly to the ground [13]. The use of plank materials from wood and bamboo on the floor of this building can facilitate the flow of air in and out through the gaps in the plank cavities. With the process of air exchange and good air circulation, the house will be healthy because it obtains fresh air, and no air precipitation occurs.

Fig 2: The Contribution of Floor's Natural Material in Creating Natural Ventilation

Moreover, the shape of the stage also makes the house seems wider and there is space at the bottom of the house where its function can be optimized. In traditional Aceh house buildings, the lower part of the house is usually called *kolong*. *Kolong* has a height between 2.5-3 m from the ground to the floor of the house [14]. In ancient times, it functioned as a place to store crops or marine products, because most Acehnese people had livelihoods as farmers or fishermen. Nowadays, besides being used as a place to store crops, the *kolong* also functions as a place for socializing between communities. People use *kolong* as a gathering place and as a place for children to play. *Kolong* also often functions as a place to hang a swing to put the children to sleep, as it is an open and cool area due to the breeze flowing into it. The use of the *kolong* structure in Aceh traditional house can make the house above cooler because the air that moves through the *kolong* will enter the room at the top of the house through the gaps in the wooden plank floors.

Fig 3. The Stage-Form of Aceh Traditional House
Source: [15]

In addition to natural ventilation, natural lighting can also be created in traditional Aceh houses.This can be seen from the many windows found in traditional Aceh houses. The number of these windows can facilitate lighting in the house. Window placement in Aceh traditional house is

dominantly oriented to the east, north, and south. This is intended to increase the number of openings on the cool side and minimize openings on the west side so that excess sunlight does not enter the building which can disturb the user's comfort.

d. Interior Concept of Traditional Acehnese House

The traditional Aceh house has an open interior concept. The impression of spaciousness in the room is more visible because in Aceh traditional houses, there is no furniture such as chairs and tables. Based on the customs of the people of Aceh, everyone in the house, whether residents or guests who come to visit, sits cross-legged on a mat. The space of the front porch, the middle porch, and the back porch are shown by the difference in floor levels. The only room that is enclosed by a wall is the bedroom which is located in the central foyer. The open space area concept also facilitates air circulation and natural lighting in the building. The open inner space design is also a manifestation of tropical wisdom in Aceh traditional house, where the concept of open space without partitions to make it seem spacious and airy is also one of the characteristics of tropical architecture.

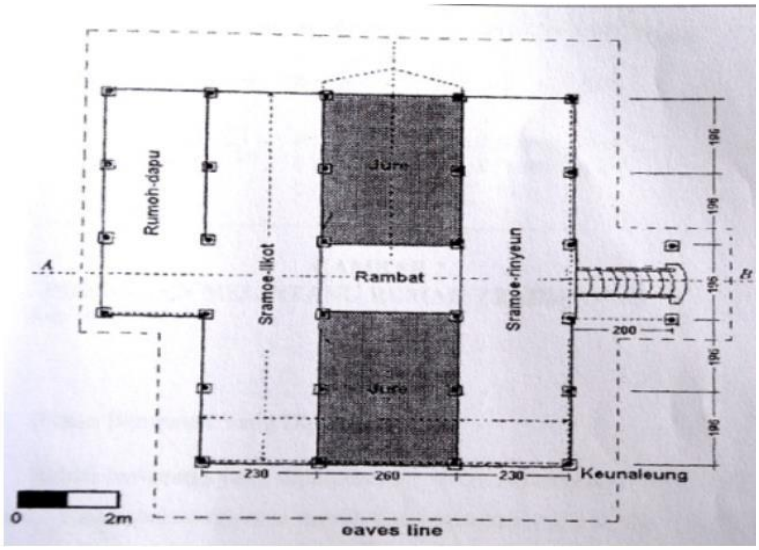

Fig 4. The Floor Plan of Aceh Traditional House
Source: [16]

4. CONCLUSION

Based on the results of observations on traditional Acehnese house buildings, it can be concluded that Aceh traditional house apply tropical wisdom to every element of the building. It reflects all the characteristics of tropical architecture, in which the design of the house is based on consideration of tropical climate conditions and the surrounding environment such as anticipation of high rainfall, humidity, and solar radiation. It has succeeded in creating buildings that can overcome climate problems and can also take advantage of the potential advantages of the tropical climate. The house uses natural and environmentally friendly materials.It uses structures and constructions that are lightweight but still strong and sturdy, maximizing natural lighting and natural ventilation into the building so that the house feels cool and comfortablefor the occupants. The uniqueness and ability of Aceh traditional house to adapt to the tropical climate should be used as a role model in designing residential buildings in the current era. Not only successful in adapting to the climate, but Aceh traditional house also able to make the biggest contribution in overcoming increasingly complex climate problems, namely the embodiment of energy-efficient buildings, and environmentally friendly and sustainable architecture.

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