Building Roof Model Influenced by Environmental Climate

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ABSTRACT

The roof is the main thing in a building that functions to protect the building and occupants. Indonesia has gable and trapezium roof models. Both have advantages and disadvantages. The advantages and disadvantages are managed to become a strength that complements the building. The roof consists of three parts, first the roof frame, second the roof covering frame and the covering material. The roof frame is often called the truss and is made of wood, iron, concrete or mild steel. The covering frame is often called a batten made of bamboo wood or mild steel. The roof is often called tiles made from clay, concrete or metal. Each roof construction has different slope requirements. The slope angle will affect the maintenance, durability and beauty of the building. Determining the angle must be careful and adjusted to the characteristics of the roof covering. The characteristics of the roof angle are influenced by the impermeability of the covering material. The more impermeable it is, the slower the angle will be. The climate also affects the existing roof model. The angle of the roof will be influenced by the environmental climate. The climate affects the use of roof angles.

KEYWORDS

Roof, roof angle, climate affect the roof.

1. INTRODUCTION

Many houses have good designs but have problems during the rainy season. Luxury homes have high walls, high ceilings but still use air conditioners for comfort. This phenomenon is all around us and it is the designer's job to solve it.

Research Gap. Some researchers have taken up the topic of models, the effect of materials on heat, and traditional roofs. This manuscript examines roofs in terms of climate adjustment. It is very interesting to study and few researchers have studied this topic. Choosing the wrong roof model and building height will make the building vulnerable to rainwater. We all know that many residential houses use roof models that do not pay attention to the environmental climate. Designers only pursue the latest house style but do not pay attention to the climate so that residents are less comfortable in the rainy season. Building designs that pay attention to the surrounding climate will result in comfort and ease of cleaning and maintenance.

Objective. Many residential buildings are built to extreme heights. The height of the building does not take into account the climate and the direction of the sun, so there will be problems when the sun shines on the house and when it rains. The house needs cool air. Air conditioning does not have to use high walls but can use proper ventilation according to the air flow in the environment(Badan Standarisasi Nasional, 2020; Zameeruddin & Sangle, 2021; Zięba & Skrzypczak, 2021). Building design needs to consider lighting, airflow, door and window direction(Kałuża, 2020; Kementerian PUPR, 2023),

Novelty. The manuscript has a novelty roof design that pays attention to the surrounding climate will produce a comfortable building, easy to clean and maintain as in table 1. This manuscript shows the things that should be considered when designing a roof. Many residential buildings only pursue the current model but are not climate-friendly. Buildings that do not pay attention to the climate and materials result in difficulties in maintenance and cleaning (Afrina et al., 2023; Ichwan Prastowo, 2023; Kementerian PUPR, 2023).

Significance. This manuscript is useful in guiding the design of residential houses. Homeowners can use this manuscript as a basis for designing houses. In addition, the manuscript has environmental studies that make the house sustainable. Sustainable home design is the dream of all homeowners.

2. METHODOLOGY

This research uses the literature analysis method. Literature analysis is used to process the field data obtained. Whether the roof design used has met the requirements for the angle, distance of the rafter and truss. Whether the use of materials is in accordance with the environmental climate. Validation of the literature with design data in housing and village houses is a guideline in producing conclusions.

Research Design. The study used an action research model. The action research in question is to observe the sample and then analyze it with existing guidelines and then conclude (Kartikawati, 2024; Kementerian PUPR, 2023; Parekh, 2024) Eden, Colin and Huxham, Christine; Clegg, S and Hardy, C and Nord, W, eds. (1996) Action research for the study of organizations. In: Handbook of organization studies. Sage, Beverly Hills, pp. 526-542.

Population and sample used. The population uses two groups, namely the residential roof model group and the roof model in the village. The sample takes several existing designs. Some images can be taken from the internet and analyzed and validated with guidelines summarized by several researchers.

Data Collection Techniques. The research data was collected using observation, analysis and confirmation. These three methods are needed to determine the climate around the house. The climate includes wind direction, rain direction, openings facing where and comfort (Hadi, 2020; Zameeruddin & Sangle, 2021)). This data is used as a parameter in validation and drawing conclusions. Validation uses PUPR regulations (Barkanov, 1978; Kartikawati, 2024; Kementerian PUPR, 2023; Parekh, 2024).

Tools or Instruments Used. The tools used were stationery in launching the question and answer media. Questions include some data on wind direction, rain direction, openings facing where and comfort. This question is equivalent with PUPR regulations.

Data Analysis Methods. The method used is observation and validation between field data and resume from PUPR regulations and journal articles. From the field data then validated with the results of several studies and existing regulations. Then recommendations are written for a building roof design. The above activities resulted in three recommendations, namely: meets; needs alignment; does not meet

3. RESULTS AND DISCUSSION

The results of the validation of regulations and scientific articles are as follows.

Table 1. Requirement Guidelines

No	Units	Indicator
1	Tile roof angle	30^0 -35^0
2	Zinc roof angle	20^0 -35^0
3	Angle of asbestos roof	20^0 -35^0
4	Roof edge height of each floor	175 -300cm
5	Wooden truss	Maximum span 700 cm
6	Iron tuss	Maximum span 1500 cm
7	Light steel truss	Maximum span 1000 cm
8	Facing Openings	According to local wind direction
9	Air flow	diagonal
10	Opening ratio	5-15%
11	Terrace width	200-300 cm
Nb:	Tile roof angle Above indicators require separate calculations	

Source: research Source: penelitian (Badan Standardisasi Indonesia, 2020; Badan Standarisasi Nasional, 2010; Hadi, 2020; Islam et al., 2020; Marwahyudi, 2019, 2020; "Micro- and Macro-Structural Analysis," 1993; Miha Timocevic, 2006; Nurdiah & Hariyanto, 2013; PUPR, 1991, 2021, 2018; Tomaževič, 2009; Ullah et al., 2022; Wibowo, 2021).

Table 1 serves as a guideline in calibrating, validating the data obtained. The roof angle is based on the climate in Indonesia. Indonesia has a tropical climate consisting of dry and rainy seasons. The biggest problem is rainwater, so the angle is expected to be safe and comfortable. The roof height is also influenced by the climate in Indonesia. This height is expected to be safe against tempias. Many buildings with high roof designs cause problems with rainwater. This problem causes discomfort in the activities inside. The span of the truss is based on the strength and length of the material in the field. If made in excess of the existing table then a detailed calculation is required. The facing of the opening is based on the method of wind entry and exit. Buildings produce maximum wind movement must meet

several requirements; openings facing the wind direction; using diagonal opening circulation; opening ratio 5-15%. The effective slag distance is 2-3 m. This distance is adjusted to rainy conditions with normal winds so that it is protected from tempias. If the above provisions are violated, it is likely that the building will get problems during the rainy season (National Standardization Agency, 2010; Gambarotta & Lagomarsino, 1997; Marwahyudi, 2020; M. Marwahyudi, 2019b; Y. galuh and Marwahyudi, 2020; Miha Timocevic, 2006; Nurdiah & Hariyanto, 2013; PUPR, 2018, 1991; Tomaževič, 2009(DL, 2023; Ernawati et al., 2022; Kementerian PUPR, 2023; Rezaie et al., 2022; Ullah et al., 2022)).

Figure 1. House Design

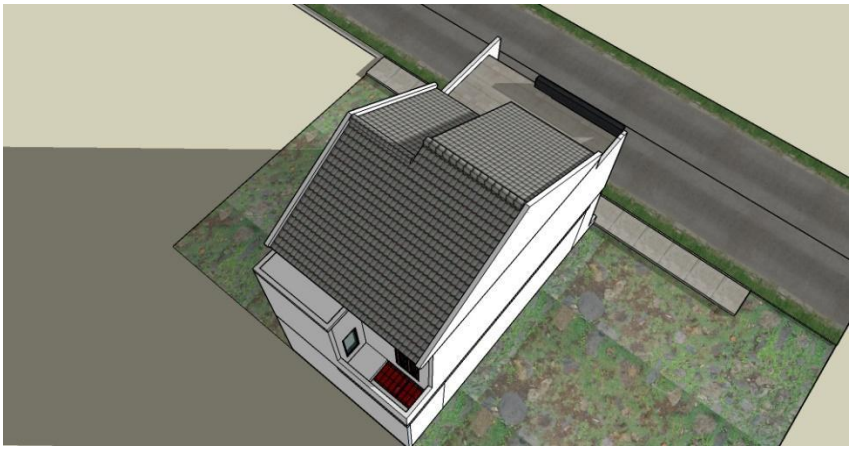

Figure 2. Top View of Window Location

Figure 3. Design Maximizes Wind and Sun Ventilation

The above design in figures 1, 2 and 3 shows a method that meets some of the provisions of table 1. So that in designing it needs some data that must be obtained.

Figure 4. Roof heights and terrace distances are not yet compliant

Figure 4 shows a design that does not meet Table 1 so that to get comfort it needs special treatment, namely additional canopy on the terrace. In addition, the balcony also requires a canopy.

4. CONCLUSION

The conclusion obtained is that the designed building must meet several regulations summarized in table 1. Table 1 describes some building criteria based on the climate in Indonesia. A comfortable building design must consider the climate. The data needed in

designing based on the surrounding climate are 1. Building facing anywhere, 2. Wind flow typology data, 3 wind during rain. In addition to climate-related data, of course, basic data in design must also be considered. Most homeowners don't pay attention to rainwater problems, they consider good, contemporary and cheap models. The results of this research provide guidelines for sizes that are safe for tropical climates. The table above can be used as a guide in designing a house so that the house has a good, contemporary, cheap and safe model for tropical climates.

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