

Enhancement Force and Artistic Local Wisdom Earthquakes Residential Houses

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Abstract— Houses in mountainous areas are very vulnerable to the dangers of seismic waves from quakes. Recognizing seismic activity in this study, it aims to find out how our predecessors survived or prepared themselves from the sudden danger of earthquakes. The unpreparedness of this building or house which resulted in a lot of human casualties and damage to houses and environmental fields surrounding the earthquake. Therefore, our ancestors' habits and patterns of life must be observed in building a house of human salvation. This habit is called local wisdom. Local wisdom like what people in the mountains have in the case of earthquake resistant houses. The method recited in this study is qualitative analysis with a local wisdom approach. The conclusion of this study is to apply the lifestyle of noble values in everyday life and apply natural materials as building materials for houses in anticipation of earthquakes.

Keywords— Residential Houses, Local Wisdom, and Earthquakes.

I. INTRODUCTION

Residential house are places where people carry out daily activities ranging from waking up, doing activities to doing housework, to finally sleeping again. Houses must also be able to protect from rain, heat, animal disturbances and natural disasters; earthquakes that cannot be predicted when they arrive [1]. In the past, the tendency of people to build houses was because of the need and shelter, but now people build houses besides their needs as well as someone's prestige in showing establishment. However, we forget that the land or earth as the place where the house or building is built has the power to move, vibrate, called an earthquake, so that we consciously stand afraid of being in our own house. The fear is based on anxiety about the collapse of the roof or collapse of the house we inhabit [8].

A. Local Wisdom

Local wisdom is local wisdom in the community. In terms of making a house, this is related to local wisdom in terms of making a house [2]. People who live around the mountains build their houses using wood, and bamboo. This shows that wood or bamboo are more environmentally friendly than reinforced concrete. The use of foundation (umpak), in the form of a stilt house (column) is found in traditional houses in Brastagi, Karo Regency. Permana, R, said [6] that if nature is angry then natural disasters arise in the form of floods, landslides, volcanic eruptions. Traditional communities generally also have local knowledge and ecological wisdom in predicting and reducing natural disasters in their area [3].

Siswanto [7] said, that in hilly or highland areas there are types of traditional houses that have poles above stone pillars or above a few stone grains. The traditional houses include the Besemah house, Semendo's house and the Ulu Berundak house [5]. The tool has a function to reduce vibration due to earthquakes and reduce moisture on wooden poles. Traditional houses in South Sumatra are known as houses of unloading, can be dismantled from somewhere and put back in another

place. This is possible because the technique of making traditional houses in a clamp, pile, press and pull. The manufacturing technique by unloading until now is still done and produced in the villages of Tanjung Batu Seberang, Tanjung Batu and Tanjung Atap in Ogan Ilir district.



Fig. 1. Tanjung Batu Knock-down House

B. Earthquake

Large earthquakes occur related to the tectonic activity of the Earth's layers which occur mainly on the continental plate. According to Idham [4]. accumulation of movements, collisions, shifts and partitions that are the cause of earthquakes Disasters resulting from earthquakes can be either direct or indirect events. Impacts can directly affect land and buildings. Direct effects on the soil in the form rupture of the soil structure, broken soil, liquefaction (changes in soil structure will be separated by water content so that the soil becomes loose and runny so it loses its carrying capacity), the ground collapses and the rocks slide. While the direct impact on buildings can be in the form of vibrations in buildings, the fall of building elements and collapsing buildings.

Meanwhile, the indirect impacts of earthquakes can cause fires, damage to infrastructure: such as gas and oil pipes, and damage to clean water sources and networks. Apart from land, earthquakes can cause floods, landslides and tsunamis. Lippsmeier adds that the main cause of earthquakes is

erosion, sedimentation, and debris to change the skin of the earth, through the decomposition of radioactive material on the outside of the earth's crust. shrinkage occurs.

Some areas of the earthquake area are in Indonesia from the east to the west of the islands in Indonesia. There are 3 classes of earthquakes that exist, namely 1. Shallow Earthquake (red) 2. Middle Earthquake (yellow) 3. Deep Earthquake (green). Following the earthquake area as shown below:

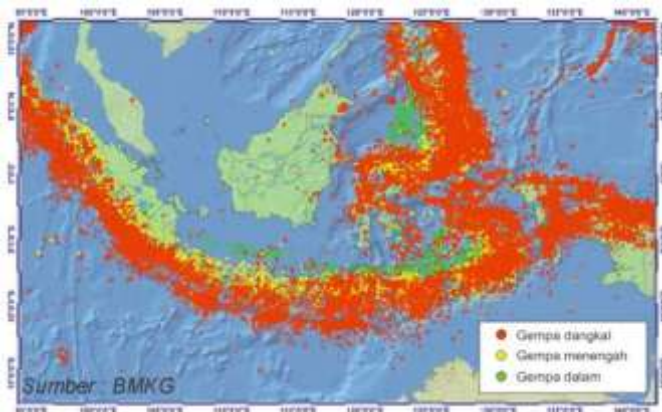


Fig. 2. Maps of Earthquake, Indonesian

The tendency of earthquakes can be carried out by monitoring, recording and routine calculation of seismic activity in an area. But the exact prediction of when earthquakes occur is still not possible until now (Idham, 2014). The most widely used supervision is the recording of seismographs to estimate the period of time the earthquake occurred. In theory, all changes that suddenly come out of normal conditions can be said to be a sign of an earthquake due to the large accumulation of energy before the earthquake.

II. LITERATURE REVIEW

Analysis is done by describing, explaining the patterns of daily life and habits of mountain people, maintaining cleanliness of the environment, obeying the rules of cutting down trees, and how to build without damaging the environment.

The massive earthquake that occurred in Mexico in 2017, brought down buildings and killed at least 149 people. Mexico City was once a former site of an ancient lake bottom filled with soft wet clay deposits. Experts equate the geological structure of the land with a "bowl" that will vibrate violently in a large earthquake. According to [5], one source of strength in many structures is the procedure of building design itself. The structure must be analyzed using strength which is reduced by the load. So, in building a house, the design takes into account the weight of the structure, material that must be lightweight from concrete like plastic that has high elasticity in resisting earthquake loads.

The foundation (umpak) is located above the ground. This is a way that local people do in anticipating the vibrations produced by earthquakes. Creating a foundation on the ground will minimize the collapse or destruction of the structure of the house. The structure of the home connection is very

simple, namely the system associated with the angles called knock-down. The traditional wall part of the house (figure 3), that is by the design of the sloping wall at an angle. This is done in order to accommodate the load from the roof structure above it. The roof is designed with a triangle and a trapezoid at the top. The roof material is palm fiber, this is done so that the roof load is lighter in carrying loads [4].



Fig. 3. Fondation (Umpak), traditional house Karo

TABLE I. A Ten year earthquake in Indonesia

Date,Month Year	Magnitudo	Place	Victims (person)
November,17, 2008	7,7	Pulau Sumatera	4
January,4,2009	7,2	Manokwari	2
September,2,2009	7,3	Tasikmalaya dan Cianjur	>87
September,30,2009	7,7	Pariaman, Padang Aqam	1115
Oktober,25,2009	7,7	Sumatera Barat	408
April,11,2012	8,5	Pulau Sumatera	1
July,2,2013	6,2	Aceh	39
Maret,2,2013	6,2	Kepulauan Mentawai	-
December,7,2016	8,3	Pidie Jaya	104
July,29,2018	6,4	Lombok	16
August,5,2018	7,0	Lombok	>390
September,28,2018	7,4	Sulawesi	>2073
Oktober,11,2018	6,3	Situbondo	3

Earthquakes that occur throughout the year in Indonesia really need to be research of architect experts in designing earthquake-resistant buildings. Many victims over the past 10 years (table I) due to earthquakes that occur every year. Looking at the data in table I above, that the strong weak magnitude that occurs does not guarantee that the earthquake can take a lot of casualties or little. In January 2009 an earthquake with magnitude 7.2 in Manokwari claimed as many as 2 lives, while in August 2018 in Lombok the smaller magnitude of Manokwari namely 7.0 could have claimed more than 390 lives. From the data, it can be analyzed that the conditions and types of local soil are taken into consideration, the soil structure in Lombok is more unstable than the soil structure in Manokwari [7].

III. METHOD OF RESEARCH

In making a framework of thinking it is also necessary to pay attention to what is happening now like human behavior towards the environment.

If associate housing, local wisdom and earthquakes are relationships the principle that is by understanding nature, then alampan will give a good reaction to humans. In traditional society in Indonesia, it is actually seen from natural resources and resources human power. In traditional (local) society humans and nature are a unity because of both are created by the Almighty. Natural and humans are believed to have the same spirit. Natural can be friendly if humans treat them wise and vice versa will be angry if we damage it. If nature is angry, a natural disaster will occur floods, landslides, volcanic eruptions and others so on, then traditional society generally too have local knowledge and deep ecological wisdom predict and mitigate natural disasters in the area. Local people who live on the slopes. Mount Merapi, Central Java, for example, has the ability to predict possibilities eruption. This includes using indicator of various types of wild animals that descend the slopes at out of habit in normal environmental conditions.

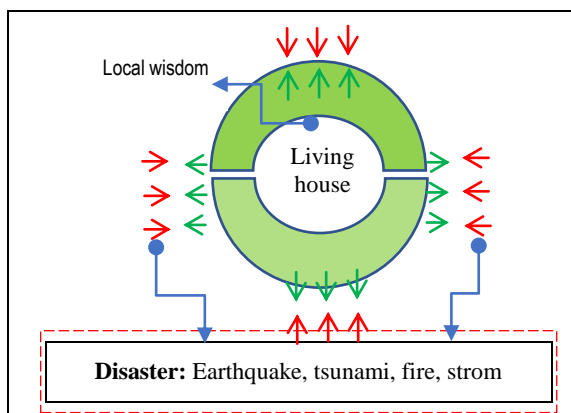


Fig. 4. Relationship between living house, local wisdom and disaster

Therefore, there is a need for self-awareness in living in the natural environment. An earthquake can happen, for that, we must pay attention and be responsive to nature and the environment. Natural material suitable for building a house is bamboo. Given that bamboo has strong strength which will be explained next. Bamboo as a structural element and building construction. Building a building that can withstand earthquake loads is not economical. Therefore, the main priority in building earthquake-resistant buildings is the creation of a building that can prevent casualties and minimize property losses.

In general, building construction must meet 5 conditions a. Strong and durable, in the sense that it is not easily damaged so that maintenance costs are relatively cheap. b. Functional, in the sense of the shape, size, and organization of the room has a need according to its function. c. Beautiful, in the sense that the shape is pleasing to the eye. d. Hygienic, in the sense that air circulation and light are sufficient so that residents feel comfortable and healthy. e. Economical, in the sense that there is no waste so that financing becomes relatively efficient and effective.

IV. ANALYZE AND DESIGN AND TECHNOLOGY

The most important thing in a house plan is a plan. The house plan is not only related to space functions in buildings, but also related to the structural system used in the house. Structural systems that are relatively safe against earthquakes can be seen from the distance of the column or wall of the bearer which has the same column grid pattern. And the distance between columns is the same. The distance between columns can increase building stiffness relatively. Conversely the distance between columns that are too far away can cause the carrying capacity of the column to the side force to be increasingly minimal. Structurally this can be anticipated with a large column size, but the large column size will increase its strength, causing the structural load to be large. This causes the building to become large which causes greater potential for rolling, which in turn will increase the risk of earthquakes.

However, the configuration of the bearer wall or wall is not the only consideration of the safety of the earthquake but can be seen from the plan. Plaque shape is very important to see from the horizontal sway. In buildings, earthquakes will shake parts of buildings and buildings to maintain as much as possible from shocks that occur. Plans in a simple form will have a high level of compactness in parts of the structure points. While the plan is not simple it will have a high degree of difference in the parts of the structure. This is because there is a horizontal torsion effect of the building on its center of gravity.

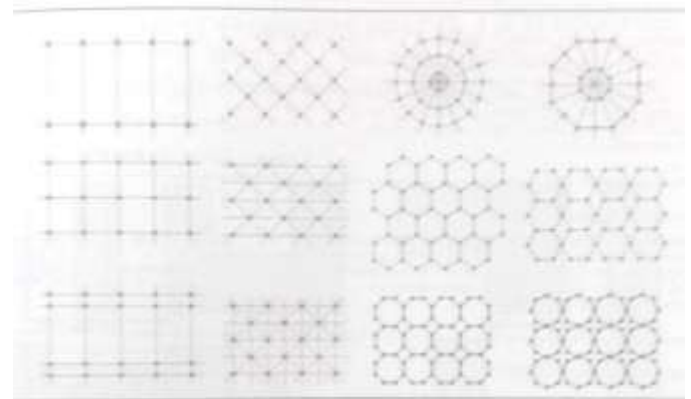


Fig. 5. Types of Grids Forming Building Plans

According buildings that have an asymmetrical shape will experience the greatest sway and have the biggest damaged tendency. The form of a plan that is not simply that has a large earthquake risk is the form H, T, + and also form I which has a ratio of side lengths more than 1: 2. In earthquake-safe buildings that must be taken into account are the locations of evacuation access, namely the lobby and emergency stairs. Stairs and emergency stairs must be calculated on the floor plan with a distance of no more than 10 meters from the hallway, and emergency stairs are placed every 20 meters.

In most of the countries and islands of South-East Asia, the main structure of the building and house and built with timber, wood and palm stems, and bamboo is only used in the construction of roofs particularly as rafters. Board of woven bamboo is used in the construction of interior and exterior

walls.

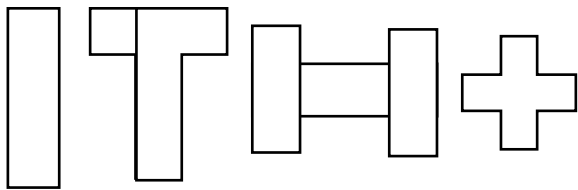


Fig. 6. Forms of complicated plans to avoid

In its most directly from this influence range from the reuse of old the timber, producing unusual curves in the roofs of buildings, to the utilization of complete boats, or copies of them, as shelters on land.

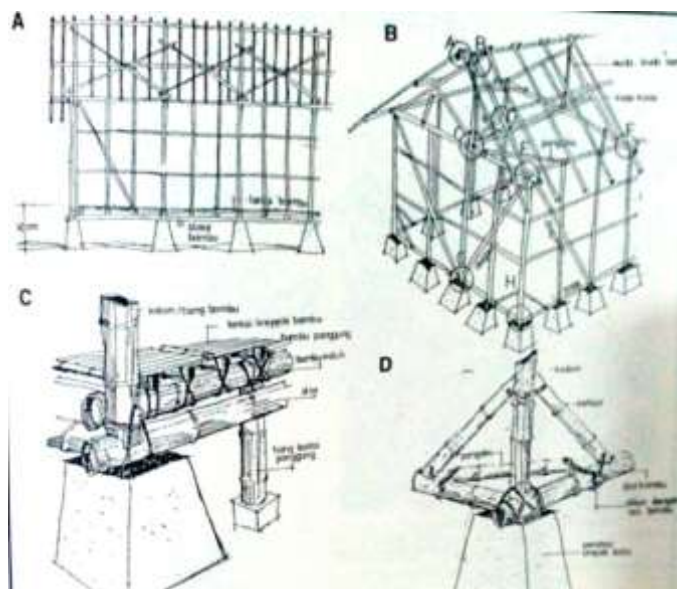


Fig. 7. Construction (The Toradja House)

In a technologically developed culture the influence of boats on building conflicts with the development of houses or communal buildings as integrated structured; in the latter demands of use and construction at a more sophisticated level take precedence over the secondary use of old boat timber, producing unusual curves in the roofs of buildings, to the utilization of complete boats, or copies of them, as shelters on land.

An important feature of this type of building is that that huge overhanging gables at front and rear are not usually supported by poles direct to the ground (even though the prow and stern of the stored boat frequently are) as though to emphasize that a superstructure is a complete form supported only in the platform at its base, the gables are often braced in a series of kingpost trusses, linked by one diagonal member in each gable.

Bamboo earthquake resistant building standards are more flexible than wood, so the construction of bamboo does not pose a risk to the threat of human life if an earthquake occurs. Bamboo has the strength that can be competed with steel. Due to its high flexibility and strength, the bamboo structure is also an earthquake resistant building. Unfortunately, so far the strength of bamboo has not been matched by strong

connection techniques.

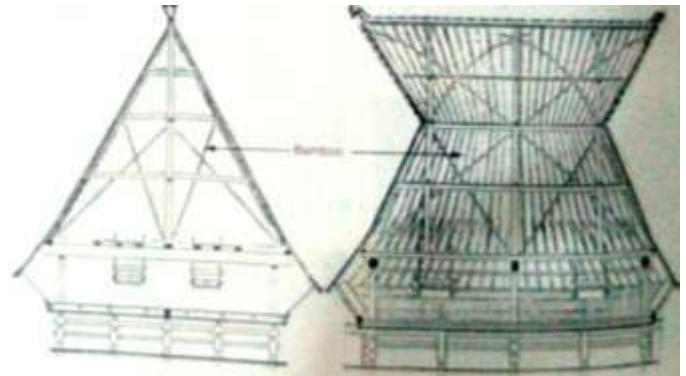


Fig. 8. Construction (The Toradja House)

Bamboo can be applied in the form of building construction with connection techniques that have been tested for strength in the laboratory and in the field. Various school buildings, residences, gazebos, and warehouses have been erected. The combination of strength, the foresight of the architect, and the efficacy of preservatives produce strong, earthquake-resistant, beautiful and durable construction for decades.



Fig. 9. Easy bamboo workmanship.

Bamboo is easy to grow and does not require special maintenance. To do bamboo cultivation, there is no need for a large investment, after the plants are established, the results can be obtained continuously without planting again. Bamboo cultivation can be done by anyone, with simple equipment and does not require high knowledge. During growth, certain bamboo can grow vertically 5 cm per hour or 120 cm per day. Bamboo can be used in many ways. In contrast to forest wood trees that are only ready to be cut with good quality after 40-50 years old, then good quality bamboo can be obtained at the age of 3-5 years.

Bamboo plants have extraordinary resistance. Bamboo clumps that have been burned, can still grow again. Bamboo has a fairly high strength, its tensile strength can be aligned with steel. However, this high strength of bamboo has not been utilized properly because usually the trunks of a bamboo structure are coupled with a peg or rope with low strength.

Bamboo is pipe-shaped so that the moment of moisture is high, therefore bamboo is good enough to bear the bending moment. Coupled with the elastic nature of bamboo, bamboo structures have high resistance to both wind and earthquake. Study of local wisdom and disaster mitigation on traditional society in Indonesia is actually seen in consideration of natural resources and resources human power. In traditional (local) society humans and nature are a unity because of together with the creation of the Almighty. Natural and humans agree to have the same spirit. Natural can be friendly if done by humans wise and vice versa will be angry if we damage it.

V. CONCLUSIONS

From the study above, conclusions can be drawn, namely;

1. A Good design is a design designed to minimize damage due to earthquake shocks, and future risks taking into account the shape and configuration of structures and columns
2. Maintaining the balance of the environment and humans as the embodiment of local wisdom must be obeyed, such as not cutting down trees carelessly because trees provide good air circulation for humans.

3. The pattern of everyday life is a manifestation of local wisdom the noble values need to be preserved such as the use of natural bamboo materials in house buildings as building construction is better to withstand earthquakes.

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