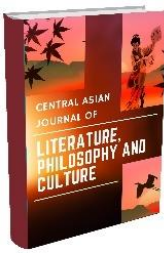

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Minangkabau Traditional Rumah Gadang as an Alternative for Earthquake Disaster Response (An Effort for Cultural Sustainability in Padang, West Sumatra)

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Abstract: Wooden Rumah Gadangs as an alternative to earthquake Rumah Gadangs in West Sumatra are based more on traditional community Rumah Gadangs. The limited cement material and the high price of wood are problems in building "traditional Rumah Gadangs". However, this can be overcome by finding alternative wood solutions such as coconut wood and others. Japan has been using wood as traditional earthquake-resistant Rumah Gadangs for hundreds of years. As a cultural heritage, the Rumah Gadang is a response to the earthquake disaster for the West Sumatra region. In addition, this Rumah Gadang is full of people's cultural philosophies.

Keywords: arthquake resistant, traditional Rumah Gadang, minangkabau, model.

INTRODUCTION

Indonesian territory has the potential to experience earthquakes and tsunamis. This condition is based on the geological and geographical position of the Indonesian archipelago which is located between three plates, namely the Eurasian Plate, the Pacific Ocean, and the Indo-Australian Plate which moves relative to the West and North towards Eurasia and can often cause earthquakes and sometimes cause tsunamis. In addition, Indonesia also has a series of "The Pacific Ring of Fire" or a series of volcanoes starting from Kanchatta Alaska, Japan, Sumatra, Java, Bali, Lombok, Flores, Sulawesi and ending in the Philippines. The stretch of this series is the longest volcanic area in the world, so this area is known as the most active continental margin on earth. When compared with earthquakes in the United States, Indonesia has 10 times the frequency of earthquakes. The logical consequence is that Indonesia is a tectonic and volcanically unstable region in the world [1-5].

Data from The International Institute of Seismology and Earthquake Engineering states that from 1970 to 1984 there were 6,148 earthquakes in Indonesia. Meanwhile, data from the Meteorology, Climatology and Geophysics Agency (BMKG) states that 75

tsunamis have occurred in a period of 100 years (1901-2000) [6]. With the above data, it is enough for Indonesia to put it in a position of "earthquake alert". An earthquake with that much frequency should be enough to apply the teachings that are often echoed by Mr. Pendidikan Ki Hajar Dewantoro with the names in Javanese: *niteni, niroake* dan *Â nambahake* [7].

[8] explains unfriendly natural phenomena make people always have to be ready to face all possibilities that occur. the tsunami in Aceh, the earthquake in Yogyakarta and Tasikmalaya, as well as the recent earthquake in West Sumatra. The earthquake this time again took its toll. Earthquakes often occur in Indonesia. Moreover, in recent years, earthquakes occur frequently. The phenomenon of consecutive earthquakes in the country has made people start to look at earthquake-resistant *Rumah Gadang*s.

For ethnic groups in Indonesia, if you look further, you already know the existence of earthquakes and tsunamis. This is evident from the earthquake-resistant traditional *Rumah Gadang* designs. They have learned to read the language of nature against the coming disaster. In the culture of the people of Simeulue, Aceh, for example, natural behavior in the form of a sudden drop in sea level and then a big wave comes, has been known since time immemorial. They knew it was very dangerous, and so they fled to high ground in an attempt to save themselves. This is a form of *niteni* (rescue mitigation). This is one of the efforts to minimize damage to buildings and disaster victims, namely to return to the choice of traditional earthquake-resistant *Rumah Gadang*s. Earthquakes that often occur are lessons for us from the cases of Aceh, Tasikmalaya, and West Sumatra which were hit by large earthquakes. The condition of buildings located in the earthquake area generally suffered severe damage and many victims were crushed by concrete buildings. When compared to people living in traditional buildings, there were no victims and little damage. Padang is one of the cities that was hit by a disaster last October in 2009 which will be discussed in this research [9].

Generally, the 'traditional buildings' in the disaster-stricken Padang suffered little damage and loss of life. The most important thing in dealing with earthquakes is the foundation of the *Rumah Gadang*. My experience in Padang during the earthquake in October 2009 was that my cousin fell victim to the collapse of a 4-story building that completely collapsed and killed hundreds of people in the building. The building is a GAMA tutoring site in Padang for middle and high school students. All 50 students and teachers died in the building and 13 died at the Ambacang Padang hotel [10]. Based on this experience, I think that construction buildings in Indonesia must choose the right model, to minimize casualties and damage in our society. Alternative efforts to choose traditional *Rumah Gadang*s are one way of sustainability in the future. Similarly, Japan has preserved its traditional *Rumah Gadang*s to this day.

FINDINGS

2.1 Earthquake and Traditional *Rumah Gadang*

After an earthquake, humans usually only realize the construction of buildings. An earthquake is not only a disaster but also a “wake-up call”, a wake-up call. A reminder of danger, a reminder of death, care, and also a reminder of God's existence and greatness. In recognizing various potential natural disasters, it is proper for the community with the knowledge and ability to adapt to the natural environment. It is human nature to survive. [11] adds since the first, traditional *Rumah Gadang*s in Indonesia which we categorize as buildings with traditional architecture have intrinsically taken into account the potential for natural disasters as the basis for their construction. The foundation of sand, wood, and rope for traditional *Rumah Gadang*s in the Bedouin community, Banten, is one example. This type of *Rumah Gadang* with such material or construction is generally earthquake resistant because it is flexible to lateral and vertical movements, such as earthquake vibrations.

Along with the progress of the times where cost, strength, and beauty became the three determining elements, the basic materials for building *Rumah Gadang*s shifted to cement, stone, and iron which

made buildings build fast, but stiff or not flexible. This makes the building very vulnerable to vibrations and earthquakes. Meanwhile, the design of a *Rumah Gadang* with a modern and flexible form at the foundation and connection points as well as a safety net right under the light roof is the best choice to meet human needs. This is what came to be known as an earthquake-resistant building structure. To deal with the earthquake disaster, the people of Padang since last October have chosen to build traditional *Rumah Gadang*s that are earthquake-resistant. Although the shape is designed in such a way, and the buildings vary. The characteristics of traditional buildings that developed in the city of Padang are as follows; rectangular, has many pillars, has a roof of *ilang* or zinc, is made of wood, a structure without nails, the foundation is not planted on the ground but sticks and can shift during an earthquake.

The traditional *Rumah Gadang* of the Padang people is different from the traditional Minangkabau *Rumah Gadang*. The main thing in choosing materials is that they are made of wood, the shape of the *Rumah Gadang* on stilts has a lot of pillars, the foundation of the *Rumah Gadang* is attached to the wooden foundation and the building slope so that when an earthquake occurs, the wooden foundation only moves from the floor of the building and causes little damage. The following is the difference between the Minangkabau traditional *Rumah Gadang* and the Padang traditional *Rumah Gadang* (Fig 1 and Fig 2):

Fig 1. Minangkabau Traditional *Rumah Gadang*

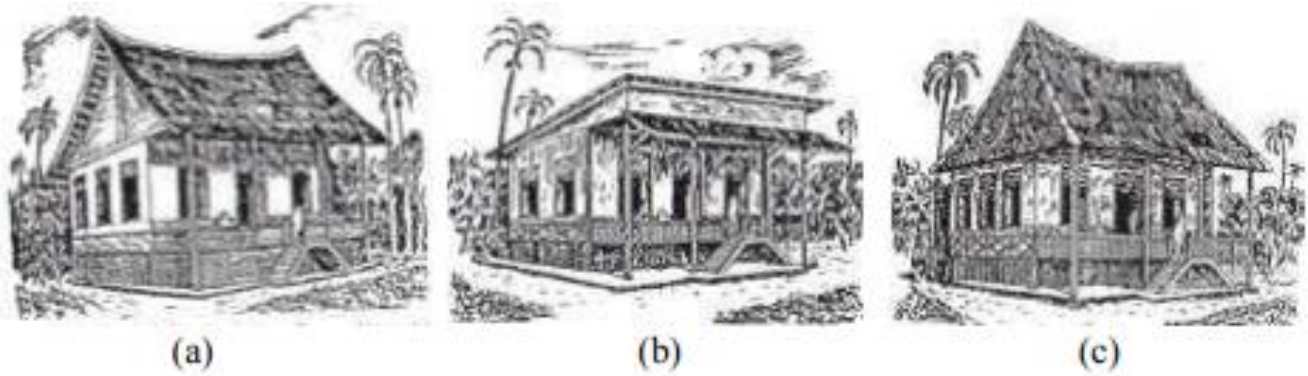


Fig 2. Some forms of traditional Padang *Rumah Gadang*s based on kinship (a). Kajang Padati; (b). Dangau Layang-Layang; and (c). Tungkuih Nasi (Source: *Rumah Gadang* di Pesisir Sumatera Barat, 2001)

The basic concept of this Padangnese building is earthquake resistant, which is intended as an effort to make all elements of the *Rumah Gadang* into a unified whole, which cannot be separated or collapsed due to the

earthquake. The concept of choosing building materials from stone, in the culture of the Padang people shows aspects of simplicity, and ease of materials as well as preserving cultural heritage. In addition, traditional buildings should have a building planning stage. According to the Ministry of Public Works, it is necessary to have a *Rumah Gadang* and building plan which is contained in this technical guideline as follows:

a. Natural conditions (including geological and geophysical conditions depicted by earthquake maps, technical conditions, and economic conditions in an area where these buildings and *Rumah Gadang*s will be built.

b. Indonesian National Standards (SNI) related to structural planning of *Rumah Gadang*s and buildings, such as the SNI-SNI listed in point 1.2 of the Normative Reference of this technical guideline.

c. Damages due to earthquakes that have occurred in *Rumah Gadang*s and buildings from the results of research that has been carried out in Indonesia.

d. Structural systems for buildings and residential *Rumah Gadang*s generally only use two kinds of structural systems, namely: 1) Bearing wall structure; and 2) Bearing frame structure consisting of a simple frame structure with infill walls to withstand lateral loads (earthquake loads) together, and a rigid beam and column frame structure to withstand lateral loads (infill walls are not considered to bear the load).

The following can be seen in the procession of the establishment of a *Rumah Gadang* in Minangkabau which is a habit of the local community.

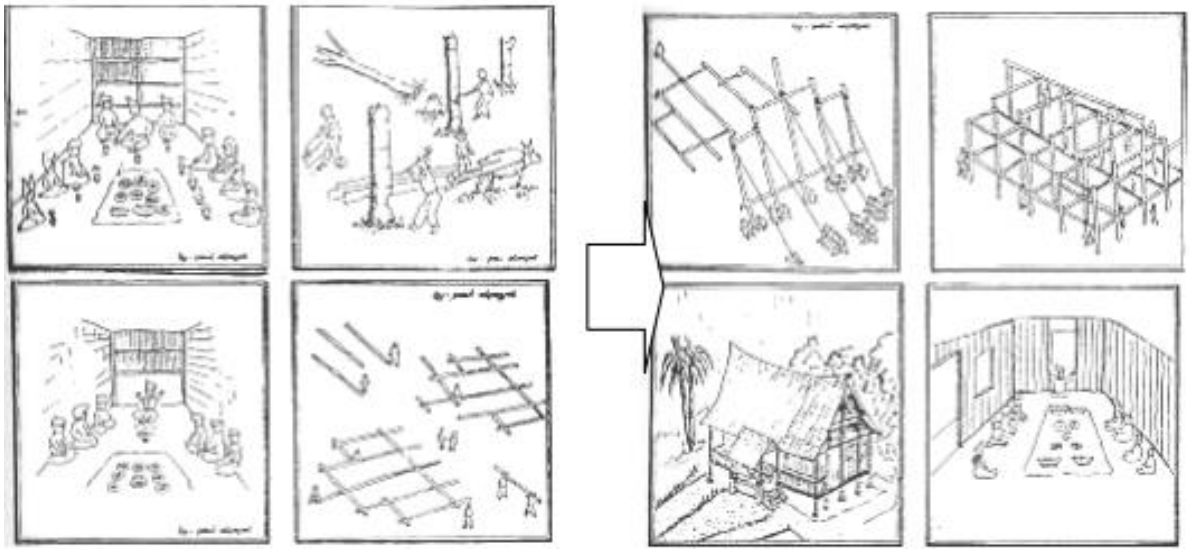
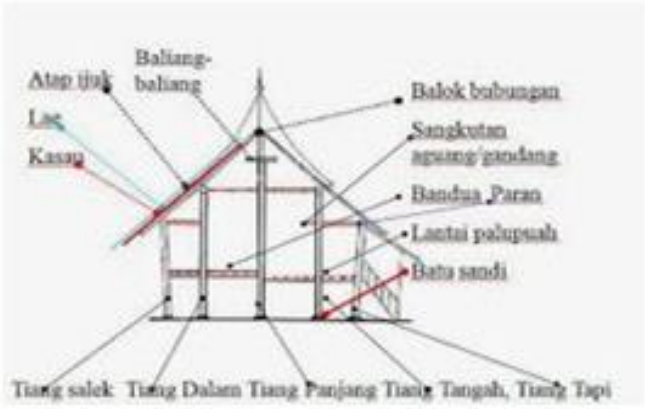


Fig 3. The meeting process, the search for materials, the process of building work, to completion

The selection of building materials and the use of local building materials, appropriate construction structural systems and building maintenance methods are the determining factors in the construction of traditional *Rumah Gadang*s such as in the city of Padang. This last factor is often neglected so that many traditional *Rumah Gadang*s are not so strong and reliable to face disasters such as earthquakes. We are known to be good at building, but poor in building maintenance culture.

Earthquake-responsive buildings tend to be in the form of simple plans or pieces, meaning they tend to use basic shapes, squares, circles, and so on. Even if there is additional space, it will be managed separately or as an integral part of the main building. Building proportions, both horizontal and vertical, are also considered balanced. The dimensions of buildings that tend to be large can be reduced by repeating modules to maintain

the stability of the building. For example, the room module uses a size of 3 x 3 meters, so that the building resembles boxes arranged. The following is one form based on the model and structure.



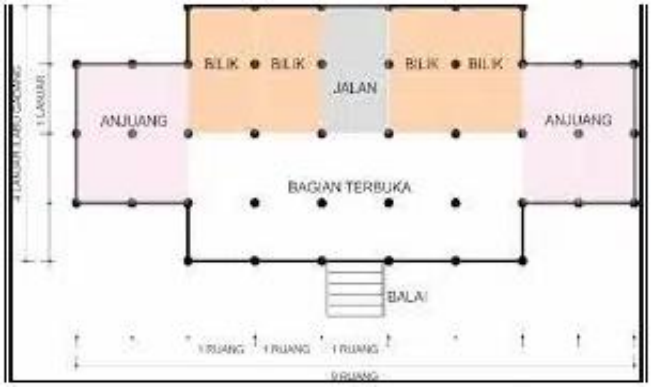


Fig 5. Structure in the *Rumah Gadang* building

These models will behave uniformly when exposed to earthquake forces, so that each module simultaneously moves in the same direction. As a result, the risk of building damage is small due to collision behavior of the module can be minimized. This is in accordance with the principle of traditional *Rumah Gadang*s, namely by placing building materials that are heavy in character, tend to be placed on the bottom and light building materials can be placed on top. This is the basic principle of balance. The use of lightweight materials in addition to reducing the burden of the building also when "forced" to collapse due to the earthquake does not seriously injure the occupants or building users.

The crucial thing is the connection between components between the foundation and the column, the column and the roof, and the unity between the columns with the sloof and ring balk. These connections must be strictly related to each other, to ensure the unity of the building, so that in the event of an earthquake it can be stable. Then the connection between the elements, whether using wood, bamboo, concrete or maybe steel, to make sure the connection is tightly and firmly connected.

2.2 Minangkabau traditional buildings as an alternative for earthquake disaster preparedness

The resistance of buildings to earthquakes that are happening is influenced by several factors: 1) Planning factors (precise and correct structural calculations); 2) Types and conditions of the soil where the building is erected; 3) Factors of building materials used (wood, steel, reinforced concrete, masonry); and 4) Implementation factors (fulfilling technical requirements). Of the four factors, the most dominant influence is

the planning factor and the implementation factor. It can be stated, although the building materials used are of high-quality materials, improper planning and implementation that does not meet the technical requirements will result in buildings that are fragile in their resistance to earthquakes.

On the other hand, even though the building materials used are of low quality, improper planning and implementation do not meet the technical requirements, it will result in buildings that are vulnerable to earthquakes. On the other hand, although the building materials used are of low quality, proper planning and implementation meet technical requirements, can produce buildings that have high resistance to earthquakes.

The form of traditional earthquake response buildings is not a dogma that must be the same and uniform. By empowering local materials, inviting community participation, as well as providing assistance to building techniques and methods, it is hoped that buildings that are home, local, and earthquake-responsive will be created.

In addition to these traditional building standards and efforts, in Padang, collaborations were also carried out with various institutions such as last October, the Padang City in collaboration with the Indonesian Heritage Preservation Agency (BPPI) launched a rapid assessment program of damage to cultural heritage buildings in the city of Padang. With the support of a team from Gadjah Mada University Yogyakarta who is experienced in post-earthquake rapid assessment in Yogyakarta and Central Java in 2006, this team has started coordinating in Padang since Saturday (10/10). The team from the Department of Architecture at Bung Hatta University (UBH), the Indonesian Architects Association (IAI) West Sumatra, the Archaeological Heritage Preservation Center (BP3) Batusangkar, the Bank Indonesia Padang Office, and the Prince Claus Fund jointly support this effort. This effort was initiated considering the concern that the initial post-earthquake recovery process would be able to completely eliminate damaged cultural heritage buildings. To prevent this, this process is carried out in coordination with the local city government.

Rumah Gadang as a traditional Minangkabau *Rumah Gadang* has several important aspects in preventing an impending earthquake, these include aspects; 1) Planning, through joint deliberation it is decided the place, time, size, type of wood, and the implementation of the *Rumah Gadang*; 2) Soil conditions: include red and black soils which can be grouped into the category of medium and soft soils and are suitable for using wood types as building materials that are more flexible and have resistance to sudden soil movements; 3) Foundations using a base or password; and 4) Between one wooden frame and the other do not use nails, but use wooden pegs and tie a rope. Here can be found the Fig 6 and Fig 7 below.

Fig 6. SiPlace the pillars on the stone pedestal directly (left) and the stone pedestal with added stones (right)

Fig 7. Coating system on the dam beam for the main beam to the pile is carried out on the piles

By making the traditional Minangkabau *Gadang* building from wood with an open structure and full of togetherness, the environment created is calm, cool, warm and comfortable, and full of kinship for the

community who live around it. Finally, this building is full of aesthetic value or the value of the beauty of the building for the eye that looks around it. Here you can see the conditions of comfort and beauty in a *Rumah Gadang* in West Sumatra (Fig 8 and Fig 9).

Fig 8. The atmosphere of the common room in the *Rumah Gadang* building after being renovated

Fig 9. The Perspective of the *Rumah Gadang*

CONCLUSION

Earthquake disasters will always come stalking the people of Indonesia because the territory of Indonesia is in an earthquake-prone area. Therefore, it is important to preserve traditional buildings that provide more benefits and security to the community. Traditional earthquake-resistant buildings can use a variety of building materials, according to the materials available in an area. The use of brick, wood, bamboo, or concrete has the same contribution to create earthquake-responsive buildings. Just as a guide, the use of materials is adjusted to the character of the material. In addition, traditional buildings meet building standards, which are appropriate for earthquakes, collaboration with various parties and experts, both in the field of earthquake mitigation training or self-rescue, and protection of valuable cultural assets from being destroyed and damaged by the earthquake disaster is also needed. Ensure that traditional building components meet building standards that are livable and safe against earthquake disasters. If it is analogous to a complete human being, then a building must have legs, a body, and ahead. The legs of the building are the foundation, the body is the walls, including the columns, and the head is the roof (frame and roof covering).

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