

Local Wisdom of Traditional House in Earthquake Risk Mitigation

(Comparison of Traditional House in Kampung Naga, West Java and Minka Gassho-Zukuri Architecture in Shirakawa Village, Gifu Prefecture, Japan)

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Abstract—This study investigated the architecture of traditional house in Kampung Naga in West Java, Indonesia and traditional house in Shirakawa Village, Gifu Prefecture, Japan and focusing on the traditional wisdoms to adapt to earthquake. In detail, the study intends to (1) describe the architecture of traditional house in Kampung Naga, West Java, Indonesia and architecture Gassho zukuri house in Shirakawa Village, Gifu Prefecture, Japan; (2) depict the traditional norms of Kampung Naga traditional house and Gassho zukuri house in Shirakawa Village; and (3) describe local wisdom values which can be found in both traditional houses. This study employed descriptive qualitative method. Data were collected from literature study, interview, and on-site observation in both places. The result of this study showed that although Indonesia and Japan are two different countries with different culture and tradition, but they have the same believe and wisdoms in living harmony with nature. This implies that local wisdoms living in ancient lives are still needed to be introduced to today's generation in their learning process.

Keywords—*local wisdom; Shirakawa; Kampung Naga; Mitigating; Earthquake Risk*

I. INTRODUCTION

Earthquake architecture or also called seismic architecture is not a familiar term since few architects devote themselves to the subject. It is an implementation of architectural designs using earthquake engineering issues as the main inspiration. Nowadays we are using this technology to build buildings and houses. Years ago, ancient people did not have this technology. However, they survived the earthquake because of their wisdoms of nature. In Indonesia, Kampung Naga, a traditional sundanese village, is one good example. On September 2, 2009, a 7.3 Richter scale earthquake shook Bandung area and caused 13 people died, 373 people injured, and 26,985 houses broken. However, traditional houses in Kampung Naga were not broken although the village is not too far from isoseismic. The unique architecture of those traditional houses made them survived on earthquake. It is confirmed by the chief of Indonesian Disaster Mitigation Agency.

Johar Maknun [1] in his research about Local Wisdom Based Disaster Mitigation found that Kampung Naga villagers views on their houses had a value of cosmology. That cosmology reflected three part of the world, top, middle, and bottom. All family activities should be done inside of the house which was believed situated in the middle, between top world (the roof) and bottom world (the ground). To separate the middle part from the bottom, pillars of the house was made not to touch the ground by putting stone pedestal called *tatapakan* to refute the pillars. Ismudiyanto [2] explained how orderly are the houses in Kampung Naga. They form several small group of houses. They had customary rules they always obeyed in terms of building a house. It was applied through their generations hereditary.

On the other part of the world, Japan, a country well known as an earthquake area also has a world heritage village named *shirakawa* that has traditional houses known for its *Gasso zukuri* or *hands in pray* architecture. Miyazawa [3] in his book said that Bruno Taut (1880-1938), a Germany architect, found that the architecture of the house had wisdoms of nature that delivered hereditary through generations. It was different from other Japanese traditional house, the shape of the roof was the same as the one in medieval european house. It did not have precise and accurate triangle binding, its great lumber made it resistant to earthquake and strong wind. Ochiai [4] in her research about Traditional Community-Based Disaster Management in World Heritage site of *shirakawa Village* found that it was not only the architecture that had wisdoms of disaster risk mitigation, but also in the community live system called *yui* (labor exchange). *Yui* is one of those systems seen particularly in agricultural communities where needs assisting one another through cooperative labor.

The shape of both traditional houses in Kampung Naga and *shirakawa* are very similar. Researchs findings above also showed that both of the houses had their architecture design based on wisdoms of nature to adapt earthquake. Research comparing both houses seemed has not yet been done. Since Arbi5 in his research found that the Grand shrines at Ise was came from the same family of Austronesian vernacular

architecture, one thought of the same idea of both traditional houses in Kampung Naga and Shirakawa.

II. METHODS

This study employed descriptive qualitative method. First data were collected from literature study to develop appropriate and reliable observation instrument. The literatures studied were about architectural aspects of traditional house, Sundanese and Japanese culture, tradition and norms, and Sundanese and Japanese views about nature. Based on those data, observation instrument were developed and used for collecting data on-site of both places, Shirakawa and Kampung Naga. On-site observation was also supported by interview on villagers met on site to get a better understanding on the data.

All collected data were compared to find the differences and similarity between both traditional houses architecture design to adapt earthquake and local wisdoms engrained in the houses.

III. RESULT AND DISCUSSION

A. The traditional houses architecture

Although the shape of both traditional houses are alike, the details of both architectures can be said to be different. However, on earthquake resistant point, there are several similarities on the objectives of protecting human lives and limiting building damage.



Fig. 1. Kampung Naga Tradisional House



Fig. 2. Shirakawa Tradisional House

Kampung Naga traditional house is house on stilts. Installation of the foundation is done in two different ways. First way by using stone that chiselled in elongated rectangular shape about 50cm height. It is rised vertically to refute the wooden poles. Second way by using wooden pole with a single stone as its base. The stone has a purpose to avoid wood to be moisten and eaten by termites so it can sustain longer. Wooden pole is the main structural element of the house. The wood used as material are Albasiah tree (*Albizia Falcataria*) which is easy to find around Kampung Naga. To maintain its durability and strength, woods are soaked in mud for at least 40 days, and then cleaned and dried.



Fig. 3. Foundation of Kampung Naga Tradisional House

Materials used are only bamboo and wood. Villagers consider using materials other than natural materials such as nails are taboo. Using tiles is also considered taboo, therefore they use palm fiber from the sugar palm for the roof. Tepus leaves are laced up one another and stretched forming a large sheet then fstacked with palm fibers. This material allows air flows out and flows into the house through the roof.



Fig. 4. Roof of Kampung Naga Tradisional House

The main characteristic of the house is its rectangular shape in relatively small size, and the stone pedestals as the main structure of the building. The house's walls are made of bamboo instead of bricks. Bamboo are dried before used to make it more durable.



Fig. 5. Wall of Kampung Naga Tradisional House

Gassho zukuri house in shirakawa is also house on stilts. Giant pillars are rised on top of the cornerstones and beams are layed across. The bottom side of the giant round wood poles are carved resembles the curve of the cornerstone that will be its base, so it can be rised strightly not inclined. The wood used as material are commonly timber wood.of cypress. Its big size represent villagers view of beauty. It is durable and strong. It can remain for 30-40 years. However it is considered shorter then it used to when the irori (hearth) was commonly used in everyday life. The existance of irori has big influence on durability of all material of the house. Its smoke keeps the wood and the roof dried and prevents them eaten by termites.



Fig. 7. Roof of Shirakawa Tradisional House

The size of Gassho zukuri house is relatively large. Twice larger than Kampung Nagas. It has two parts, the bottom part and triangular attic on top. The tall attic being developed to provide two or three tiers of lofts for rearing silkworms. The living area is in the lowest floor. It has rooms with different name and different function. All the houses are facing on the same direction where the river flows. This can reduce wind gusts, and also makes the house warm in winter and cool in summer. The walls and floor are made of wood plank, but todays Gassho zukuri house also use tatami as its floor.



Fig. 6. Foundation of Shirakawa Tradisional House

Nails are not used in the construction of the house. However, two kinds of nails, Japanese nails (wakugi) and western nails (yokugi) are used only for wall and floor plank. The thatched roof itself are tied together with straw rope. The steep thatched roof (45-60 degrees) resembles two hands together as if in prayer (gassho). This is very useful when a great snow falls. It helps the snow to slide off the roof and prevents the house from being crushed. The roof are thatched with miscantus reed or called kaya in Japanese.

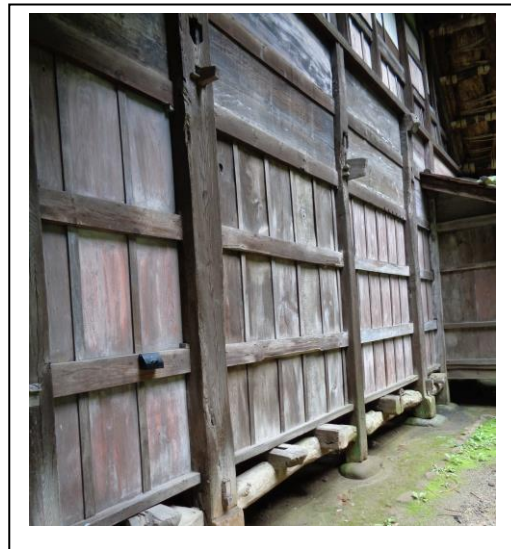


Fig. 8. Wall of Shirakawa Tradisional House

Seismic resistance on both traditional houses have similarites on the foundation and materials used. House on stilts like in Kampung Naga and shirakawa have no rigid installment among the foundation, the structure of the floor, and the body of the house. According to Nuryadin7 implementation of this method made the houses only shift their position following seismic horizontal force. Inertial style of the body of the houses made their columns move free and able to return back to their original position. Both traditional

houses only uses natural materials for all part of the houses. The difference is that house in Kampung Naga uses only lightweight materials, so that it is not burdened by heavy load. However house in shirakawa must adapt to the climate, where great snow are falling in the winter. So it has quite heavy materials to be able to hold the snow. What important is that cross beams are tied together with very elastic rope made of plant, so they are only shaking when the house is blown by strong wind or when the earthquake happen the house do not collapse. Security key of Kampung Naga house is also in the connections between the wood frame and the wall frame. They are connected with pen and pegs.

TABLE I. COMPARISON OF BOTH TRADITIONAL HOUSE

No	Comparison of Both Traditional House		
	Component	Kampung Naga	Shirakawa
1	Shape of the house	Stilts house with triangle roof	Stilts house with triangle roof
2	Size	Around 5 m wide, 8 m long	Around 10m wide, 20m long
3	Direction	From south to north	Facing on the same direction where the river flows
4	House frame	Rectangular	Rectangular
5	Roof shape	Julang ngapak (soar up to the sky)	Gassho (hands praying)
6	Materials	Bamboo & woods	Woods
7	Roof materials	“Ijuk” (palm fiber)	“kaya” (hay)
8	Foundation	Pedestal	Pedestal
9	Wall	Woven bamboo	Woods plank

B. The traditional norms and The local wisdoms.

Building a house in Kampung Naga called *ngadegkeun imah*. It derived from the word *ngadeg* means stand and *imah* means house. The term *ngadegkeun imah* has a technical meaning, physical and non-physical techniques. *Ngadegkeun imah* according to the villagers traditional leader is *mernahkeun eusi kana cangkangna* which means putting the human spirit in their habitual. It is a hope that the owner of the house will feel at home living in the house. There are three step in building a house in Kampung Naga, they are called *ancer-ancer* (asking permission), *migawean* (work), and *slametan* (thanksgiving). *Ancer-ancer* is a ritual requesting permission to anchestor to build a house. *Migawean* is ceremonial of installing roof, floor, and wall. *Slametan* is a thanksgiving to set the house free from bad spirits.

Building a house in shirakawa also consists of three steps. Preparing the foundation, building house’s frame, walls, and floor, and the last is thatching the roof. Although there are not much ritual held in these three steps like in Kampung Naga, a Buddhist ritual for asking permission to the God is held after preparing the foundation. Cornerstones in a certain size are buried into the ground by hitting them with a wooden beam that lifted up and down by villagers in mutual cooperation

way. The second step is done by carpenters called Daiku and sawyers called Kobiki no shokunin. Carpenters and sawyers are a team working together measuring, sawing, connecting and set up the pillars of the house. The third step is thatching the roof. It is traditionally done by villagers in mutual cooperation system called yui. Shirakawa is an isolated village area. That is why they very dependent on nature and entrust their life to the God. In every Gassho zukuri house in shirakawa has praying room called Butsum. The name Gassho is also represent their closeness to the God.

C. Local wisdom in traditional house as a learning resource

Local wisdoms found in both traditional houses should be informed to the next generation through a process of formal education. There are at least two benefits for them to know this information. First it will foster their pride of their ancestor’s culture and tradition and second it can be a source of inspiration to develop architecture that fit to the environmental condition.

How these findings be applied in school? There are several ways to apply research findings as learning material resource. It is integrated in learning subjects or extracurricular activities, develop it as accessible reading material, or use it as an introduction in school’s earthquake mitigation and evacuation drill8.

Local wisdom engrained in both traditional house are considered relevant to be teaching materials such as architecture, social and cultural studies, history of a nation, and as an entry point for character education. The architecture of a house is an artefact that represent an era of life. It is also a reflection of technology, culture, social interaction, and economic life at the time9. On the other hand, learning about local wisdoms in disaster mitigation is also very useful to develop disaster mitigation system itself. As Kusumasari et. Al10 emphasized in their research that successful implementation of disaster management requires a high degree of adaptability to the local conditions. The success or failure of disaster management depends on the involvement of culture, traditions and customs. In other words, it is pivotal to take into account the cultural context of affected localities and regions.

IV. CONCLUSION

Humans have had a long way to overcome the difficulties that come from nature. Every culture has been traditionally successful in building a relationship with nature. Our anchestors who lived in a very limited technology era tried to protect themselves by maintaining a harmonious relationship with nature. Although todays modern man has mastered technology, harmonious relationship with nature seems need to be maintained. To a certain limit, nature will probably be more virulent and threatening if the balance of the ecosystem is disrupted. Knowledge of local wisdoms engrained in traditional houses should be our reference to re-establish a harmonious relationship with nature.

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