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The Role of Building Pathology to Realize Eco-Housing

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Abstract:

The application of eco-housing should pay attention to the things about green building, which green building is divided into environmental and spatial aspects, in accordance with the requirements of the physics building. These aspects (environment and interior) can be measured by greenship scoring. At low values of scoring was indicator of any weaknesses in the building design which is lack of attention to the aspect of green building. Knowledge to help early detection of those aspects which do not support green building in design or any part of the building components are suspected can decrease construction function more faster than its properly is the building pathology.
The science of building diseases (building pathology) is needed for architect in designing a building, so the design criteria for realizing eco-housing have to consider building pathology aspects. In this research an observation is performed directly on the Bugis traditional house, as well as on the basis of records researched report from management of maintenance building; and also to search data that is available through the internet, papers and books.

Keywords: building design, building pathology, eco-housing

1. INTRODUCTION

The building is generally planned works during its life (service) period. However, during its service period, building susceptible to damage in variety things, including natural and human behavior factors. This is supported also by a decision of the Minister of Settlement and RI Regional Infrastructure [1] which states that the age of buildings is the building period can still fulfill the functions and reliability of buildings, in accordance with the requirements that have been set. Meanwhile, the concept of ecological architecture with or referred as eco-architecture, was dedicated to management of land, water, and air for ecosystem sustainability. In eco-architecture, the chosen material is the energy-saving should be considered with the utilization of natural resources, for use in the building and recycling permits (sustained), and waste produced can in accordance with the cycle of nature.

Building pathology science can be defined as the systematic knowledge of "building diseases", with the aim to understand the causes, symptoms, and improvements treatment need to be given to solve the problem. In the context of medical, someone be the subject of testing and investigation of which detailed considering of life period, healthy and the manner of its treatment; likewise with buildings that need to be taken care of his health so it meets the service (life) period that has been designed. The building pathology concept as overall needs a holistic approach from condition of a building anatomical. Some element details required in this approach were building design, material selection, how to build, use, alteration and other mechanisms relating to the local environment conditions [13].

2. LITERATURE REVIEW

2.1. Building Design

Frick and Suskiyatno [3] explained that planning eco-architecture guided by nature as the pattern, so that a planning should meet the requirement follows:

- an adjustment on the natural environment
- save a source of energy that cannot be renewed and thrift of energy usage
- protecting the environment (air, ground, and water)
- maintain and improve the natural cyclic
- reduce dependence on central of energy system (electricity, water) and waste (waste-water, garbage)
- residents participated actively in development planning and housing maintenance
- place of work and settlement near
- the possibility to produces their (residents) own needs daily
- using simple technology

This is emphasized by global awareness of the environment and climate change, in particular in the field of architecture and the environment, in recent years it has increased sharply. The green movement which grew rapidly when it not only aims to protect the natural resources, but also implemented in an effort to minimize the use of energy efficiency as well as damage to the surrounding environment. Rating system of "greenship" is a tool for the construction industry, entrepreneur, engineer, and other agents in implementing best practices and reaches measurable standards that can be understood by the general public, especially tenants and users of the building [2]. To be achieved in the implementation of standards greenship is the occurrence of a *green building* that environmentally friendly since planning, development, until the operation and maintenance of daily. One of the criteria of assessment is the *material resources and cycle*/MRC associated with the pathology building.

An alignment of planning or design, materials using (natural or artificial), building system, utility system and innovative construction method to realize the green building. Elements referred to façade, floor, walls, cladding; while the component referred to building materials, machinery, equipment and utilities; system referred to innovative construction methods of and the result is green building [2]. A material

that are chosen to be considered as energy efficient ranging from the utilization of natural resources up on the use in building and enables recycling (sustained), and waste that can be suitable with the cycle in nature. Conservation of natural resources and sustainability of ecosystem cycles in nature, the selection and utilization of building material by emphasis on recycling, health of inhabitant and the impact to its environmental, energy efficient, and maintain the potential of region. The harmony of architectural design with nature should also be able to maintain the sustainability of nature, both of local vegetation or other living beings, by expanding green areas are expected to increase the absorption of CO2 produced by human activity, and preserving habitats for other living beings [11].

2.2. Building Pathology and Eco-Housing

Harris [4] explains that the treatment building done in a planned and professional will provide benefits such as:

- provide cost savings in a long time;
- provide protection of investments that have been implanted;
- provide comfort environment that can support the environmental conditions of a clean, healthy, comfortable and passionate;
- increase work productivity of users building with a convenience given by the building.

Furthermore, building must be stout and safe against collapse (structural failure), danger of fire, thunderbolt, as well as the forces caused by wind and earthquakes, and also they are not result in damage to the environment by performing a suitable outdoor space. Building also needs to consider the economic aspects, easy in implementation of construction, and not complicate in the operation and maintenance [6]. According to Wordsworth [13], decrease in the building value happened because of building components life and maintenance factor. Meanwhile, Juwana [6] explained that the calculation of building life and the calculation of buildings value are affected by maintenance and depreciation factors.

The use of pathology building ever known in a few decades ago, but in the present was not indispensable; as happened with the building right now. If there was a building which has life time in hundred years is regarded as a factor of good maintenance, the construction was strong and good management. The building can have long life time working, because there are men to overcome all problems in the building by way of caring, loving and concerned to keep in maximal condition. Thus, since the design until after building woke up, the benefits of pathology is still needed, so the building has a long life time [10]. Watt [12] explained the definition scope of building pathology based on some of important stages to understand which is resulted in design, implementation (contrition management), and post implementation, namely:

- A knowledge of building functional (old/new)
- Performance of outdoor and indoor building
- Estimation (defect, damage, decay) of building material
- Survey and life time assessment of building

- Maintenance management of building

On the basis of the ecological basic knowledge, then architecture is developed to be suitable with nature and human interests as its inhabitants. It is also mentioned that eco-architecture is [4]:

- Holistic, related to the overall system, as a whole, which is more important than just a collection of parts.
- To take advantage of the human experience (traditions in development) and the experience of the natural environment for humans.
- Development as a process and not as a reality of static specific.
- Cooperation between man and its surrounding (nature) for the safety of both sides.

Understanding of nature by using ecological approach is expected to keep nature balance. Similarly in the building designs as architecture are needed to harmony with nature because in globally; building is expected to use 50 percents of natural resources, 40 percents of energy and 16 percents of water; release of CO_2 emissions by as much as 45 percents of emissions. The architectural design also changed the natural arrangement to be human arrangement with the systems and human cycles will never identical as to systems and natural cycles [3]. One way to achieve it by apply the concept of housing development environmentally sound or better known as the sustainable housing or eco-housing, green is a residential area built with attention to environmental conditions so as to prevent and reduce damage to the environment and energy saving. By applying the concept of eco-housing at a residential building or residential area we will be able to save of using electric energy, and the comfort it brings would be better. Energy saving by using eco-housing concept is by optimizing the openings in it aims to reduce the use of electricity for lighting and air circulation. In addition, the buildings tend to be open and blend with nature will gain a healthy residential quality [11].

3. METHOD

In this research an observation is performed directly on the Bugis traditional house, as well as on the basis of records researched report from management of maintenance building, includes:

- To conduct observations on the condition of building construction in the interior and exterior areas.
- Investigation of damage location of the building construction and identify the damage type, both due to the design, construction, maintenance system, and also due to the utilization of the building materials.

By reviewing the conditions and look for references that help the understanding of the research problem. In addition, to complement observation data, is also to search data that is available through the internet and the sites that is frequently visited and trustworthy the truth by discussion towards the writing of this paper.

4. RESULT AND DISCUSSION

4.1. Building Design

To get the result of capable design in harmony and suitable with nature behavior, then all decisions from design concept through analysis of scientific and technical. The consideration requires an interdisciplinary and holistic thinking because it is very complex and covers wide range of scientific knowledge. From the various opinions on the architecture design with ecological approach, is essentially to approach the issue of architecture design with emphasis on buildings harmony with natural behavior, starting from the establishment stage until the end building. Building as the third protector for human should be convenient for residents, harmony with nature, efficiency in utilization of natural resources, and eco-friendly. So its planning is needed to predict the possibilities of unsuitable with nature that will arise when the building has established, operating until not used, notably of energy use, waste disposal of the building systems. All the decisions must be through the holistic and interdisciplinary consideration of the technically and scientifically. The purpose of the architectural design through architectural approach was an effort to protect the harmony of building designs with nature for a long period of time. This harmony is achieved through the relationship and unity between the natural conditions, time, space and human activity demanding the development of technology that considers ecology values, and constituting an attempt to sustain.

Concerning the designing aspect of Bugis traditional housing and traditional house in general that storeyed stage (above the land) with the wood are as follow; pole(pillar) material/ columns of building up to sawhorse construction made from wood while roof cover material generally use of zinc metal. Construction of wood stage house it is a square four elongated backward, where construction was made in knock down so that can be moved from one place to another.

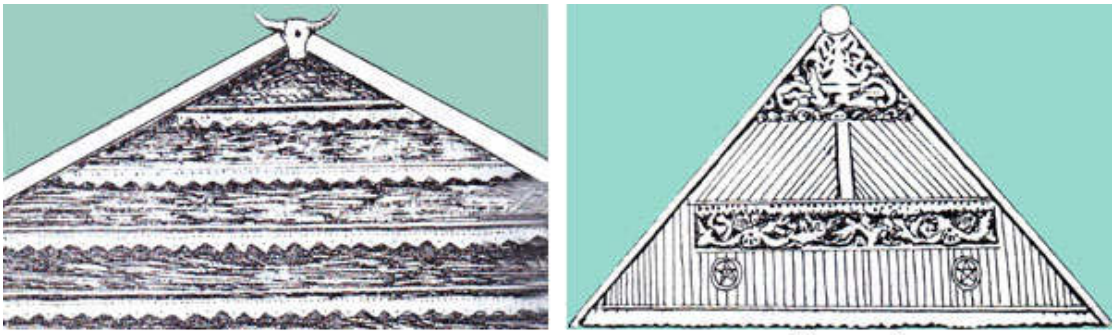

Figure 1. *Timpak laja* (prism-shaped ridge cap) *Soaraja* and *Timpak laja Bola Ogi*
Souce: Tradisi Membangun Rumah di Sulawesi Selatan (Robinson, 2005)

Bugis people also know the level of social system that can affect the form of their homes, characterized by means of special symbols. Based on the social level, then the form of Bugis traditional house known with the term *Soaraja* (*Sallasa*) and *Bola*.

Soaraja mean a large house, namely house occupied by a descendant of king or nobility, while *Bola* means the usual house, namely a dwelling house for common people. In terms of structure and construction of buildings, both types of homes did not have a difference of principle. The difference lays only in the size of the house and social status its inhabitants. In general, *Soaraja* more large and broad than *Bola*, this is usually marked by the number of pillars. *Soaraja* has 40 - 48 pillars, *Bola* only has 20 - 30 pillars. While the difference in social status of its inhabitants can be seen in the form of a lid ridgepole the eaves of house which is called by *timpak laja* (prism-shaped ridge cap). *Soaraja* building has a timpak laja stratified is between 3-5 level, while the *timpak laja* on *Bola* has no stratified or unadorned (Figure 1). The number of *timpak laja* stratified on *soaraja*, indicate social status its inhabitants [8].

In future, the pillars material as module of building structure to strengthen the building structures has difficulties in the availability of raw material. Therefore, adjustment of determination of the module distance needs to be done to reduce the number of pillars which also has impact on a reduction in the use of wood. With using wood product innovations, or not solid-wood is an advantage because it could reach a distance of a pillars/columns to columns with widely expanse construction. But in the selection of wood products innovation should pay attention to the conditions of Indonesia territory, that is majority was the earthquake line, so design of traditional house should take into calculate the structure strength.

4.2. Building Pathology and Eco-Housing

According to Sebastian [10], building maintenance is effort and necessary actions in order to maintain the building condition include its facilities (infrastructure) still in appropriate condition of technical specifications and usage planning of building age. Building maintenance is a continuous process to compensate services and charges in an attempt to give their feeling of security comfortable and satisfying users of building.

The utilization of building material made from wood that is attached almost 90 percent in traditional house, this is a challenge to use of wood in traditional house in the future. Now the availability of wood construction was difficult met with a reduced production of woodland plant natural the people because it has been replaced with forest an industrial plant in harvest in an average life of 20 years. The age of trees relatively young (20 years) is the main problems as an ingredient of building construction for traditional house as standard before. Age of 20 years is still classified as young timber although including wood species are Strong Class I (one). The condition is relatively less durable, because is easy attacked by organism of destroyer wood like fungi, bacteria, beetles and termites. Meanwhile, the habitat of wood organism is getting narrower by the logging industry as well as for the development of urban areas causing wood organism makes building material consisted of wood as their house or source of their food. Thus, the maintenance of the pillars structure on Bugis traditional house must be done in order for longer life to prevent damage.

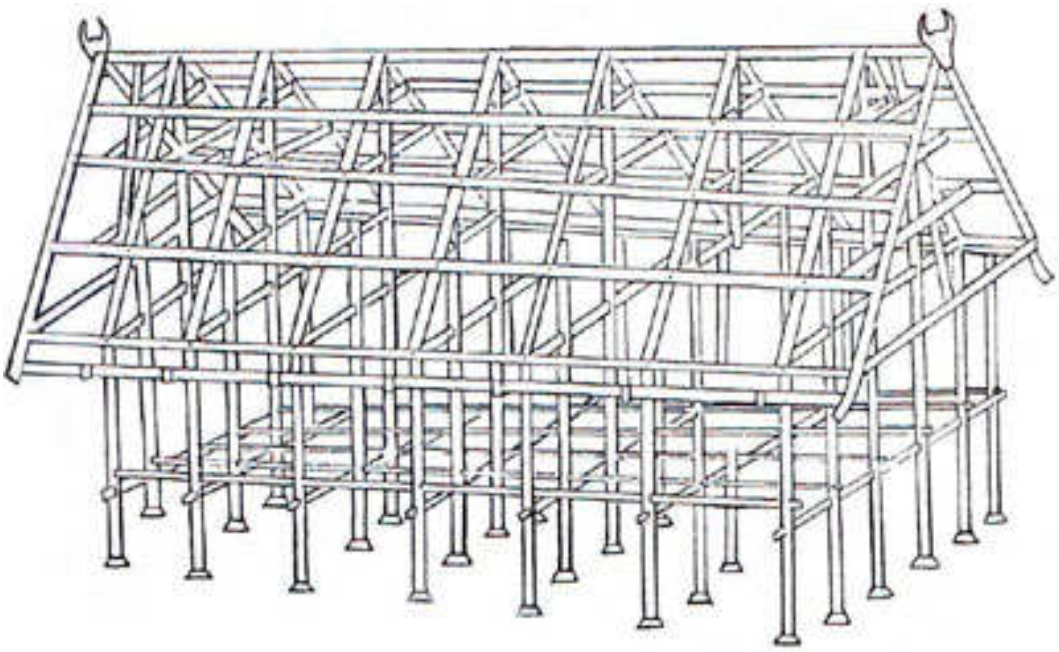

Figure 2. Framework of *Soaraja* look from the right
Souce: Tradisi Membangun Rumah di Sulawesi Selatan (Robinson, 2005)

An attempt to preserve of traditional houses that still exist with the same kinds of wood until the 19th century is impossible to be done, because the kind of wood with same age (of wood) that is not available in the natural forest and industrial plant forests now. The various parties with program by steps of repair and restoration have difficulty stock of raw material (wood). Technically, repairing and restoration of a building is on the exterior; such a distance as overstek eaves to the wall. The walls (made from wood) and the columns structure of floor supporting less noticed to aspects of natural environment of Indonesia is humid tropical climate. A moist environment impact on wood condition in building; namely decreasing function by growth of fungi and bacteria, the beetles and termites attack. Moist environment around the buildings compounded with poor sanitation become opportunities for fungi, bacteria, and termites.Generally in Bugis traditional house, the interior condition is less light (dark) due to the width distance of sawhorse construction making condition of the room more humid, so it can result in the of wood durability. On the portions of interior in buildings will be done cooking and washing activity on the face of wood-based flooring, that can make a wet zone and impact decreases force and durability (easily decayed and broken) of wood material itself. In the future, the availability of wood construction more complicated and necessary innovations use of other wood as wood lamination, wood composite, and so on.

The using of wood with a new innovation products or not solid wood constituting is an advantage because it could reach a distance of pillars/column to column with a wide expanse of construction. So the other thing that is wood innovation or wood

composite unfavorably even disliked by the insect wood destroyer, because pure cellulose elements are no longer as a staple food for organisms of wood destroyer.

The ecological conditioned of residence was began developed from start unit design of house (eco-housing). Eco-housing is a term created by two American Architects, Kathryn Mc Camant and Charles Durret [7] in order to describe a plan of housing developed in Denmark about 30 years ago, and are getting widely adopted throughout Europe and North America. Housing development and management is done by themselves which is a combination of anatomy of their private residence with the advantages of community life. The eco-housing concept which is initiated from west, this might be antithesis about technology developments of modern building which had been initiated (also) by themselves. And in Indonesia actually this has been laid down in our own ancestors based on their wisdoms to its environment.

The form of construction on the Bugis traditional house and traditional house in Indonesia since originally did not take into account availability of wood in the future getting less. Similarly with the climate condition in Indonesia which is tropical humid can be the cause of obstacles to the preservation of traditional house made of wood from solid wood. Moist or wet condition was caused damage to wood material at once can be known as a source of disease or damage to the building is continuously need treated and maintained for sustainability traditional house itself. Ecological approach from utilization of wood material can be done with wood-composite material. Innovation by using these products can reduce waste of a building made from wood, so that no material is wasted

CONCLUSION

A reciprocal relation between the environment or ecological aspects that results in destruction or disease in buildings is a strategic problems for the future can be solved by selection of wood material and selection of architecture completion and structures, so as to minimize damage or disease in the building. Thus an architect in design need to pay attention to aspect of building pathology to minimize damage detail of building construction or designation wet area on the interior design in the building. Technology of wood engineering can be a solution with the products of the wood composite material with other material as: cement, plastic, bamboo and other material.

With wood composite material, can use a wood construction with a modules distance of larger construction and more efficient compared to previous forms of wooden construction joints before. The installation of wood composite material needs to be done in the area of column, wall, floor, or roof of which often have wet during the rainy season. In aspect value of strong and durability, wood composite more enduring than the utilization of solid wood was younger-old (which is harvested from tree was 20 years).

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