Water Based Architecture In Kalimantan And Development Study Of Ark'a Modulam (Module Amphibious) Foundation

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Abstract: This paper aims to describe the water-based architecture in Kalimantan and describe the study of the development of Ark'a Modulam Foundation. The method used is description. the conclusions resulting from this paper are: 1). Historically, Indonesia has always been familiar with architecture amphibious, but it was not built on land but on the banks of river spaces, 2). In Kalimantan in particular and in Indonesia in general, naming amphibian houses in each region has different names and 3). The study of the development of the ark'a modulam foundation is still a preliminary study to formulate the basic form of amphibian foundations for simple dwellings that are expected to be industrialized. Therefore further research will be used in industrial product materials

Index Terms: Waterbased, Architecture, Kalimantan, Arka Modulam, Module Amphibious, Foundation, Development Study

1 Introduction

Kalimantan (Borneo) is an Island with many rivers. From its downstream to the center is a wetland and floodplain. In the drought season, the land remains wet. While in the rainy season, it turns a flooded. Because of a big number of rivers existing, the settlements is build by the river. To anticipate an overflow of water, houses are constructed based on the flood stage. These days, some settlements from downstream to upstream have turned into a city. The growth of settlement has developed in the wetland or floodplain of the city. Historically, there are four types of foundation construction techniques for the water based architecture in Kalimantan : 1) Static timber propped, 2) Floating statically, 3) Moving while floating, and 4) Amphibious. Nowadays, the architectures have been parts of the cities by the river. As a result of the city development, a number of low income dwellings spontaneously increase in the wetland or floodplain of the city. The type of the architecture is static timber propped. In the last five years, there has happened an extreme flood in the rainy season. Consequently, many of the static timber propped dwellings get flooded. For that, we need an innovation for the foundation construction design for the houses going to be built in the wetland or floodplain in Kalimantan. Besed on the ex-plaination above, the aim of this paper is to describe the techniques of the foundation construction for the water bases dwellings in Kalimantan and the impacts of the extreme flood toward the static timber propped dwellings in the wetland and floodplain. At the end of this study is foundation construction called Ark'a Modulam[1,2] introduced as an alternative design to created amphibious architecture

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2 Water Based Architecture In Kalimantan

Until now, when the water-based housing in Kalimantan can not be known with certainty. Some ancient literature was obtained, published in the 18th century (Thomas Salmon, 1744; Daniel Beeckman, 1718; Jonathan Carver, 1779) and published in the 19th century (JH Moor, 1837; William Channing Woodbridge, 1825; Freeman Hunt, 1848; Board, 1841) informed that some settlements that were part of a city at that time in Kalimantan, were once built on river waters. On the south side of Kalimantan, settlements above the waters are located around the mouth of the Chinese river or the Banjar river (now called the Barito river). On the north side, settlements on the water are located around the mouth of the Brunei river. On the east side, the settlement on the water is located in the village of Sumerindan (now Samarinda). While on the west side of Kalimantan, settlements on the water are located in an area now called Sangau. In addition, ancient sketches / paintings and photographs obtained, drawn or photographed in the 19th century and in the early 20th century, show Banjarmasin, Pontianak, Sambas, Sintang, Tenggarong, Pangkalanbun, mengkabong and Brunei Darusalam. is a settlement on river water. Based on ancient photographs in the early 20th century, Sandakan and Kota Baru were once coastal settlements that stood on sea water. Based on literature, sketches / paintings or ancient photographs, it can be seen that there are 4 (four) types of dwelling that are above the river water, namely: 1). Immovable Shelter Residential (static), 2). Floating Floating Shelter (static), 3) Amphibious Shelter and 4) Boat-Shaped Shelter.

3 Amphibious Architecture In Indonesia And Kalimantan

In Indonesia, houses that are like amphibious architecture, in its history, in the past there was in the flood plain of the space belonging to the Batanghari river (Sumatra), Barito (Central Kalimantan) and Kapuas (Kalbar). Similar to amphibious architecture, the houses can also float and can tread on the ground. The difference is that if amphibious architecture is built on a land or flood plain that is not a river property, in Indonesia in the past it was built in a river property. If amphibious architecture today cannot be moved, houses in ancient Indonesia can move when the house floats. Because they can move when they float, the houses in each region have names whose names are related to their floats. On the Batanghari

river and on the Kapuas river it is called the Raft House (Rumah Rakit), while on the Barito river it is called Lanting. On the Musi river in Palembang, on the Sambas river and on the Samarinda Mahakan river, in the past there was also a Raft House. In the Barito river Banjarmasin in the past there was also a Lanting. However, due to the characteristics of the river, the Raft houses in Palembang and Lanting in Banjarmasin generally can only float and are unable to hold land to tread on the ground. This is because the construction of the raft house foundation in Palembang and the lanting in Banjarmasin are made of bamboo assemblies, so that if this house steps on the ground, it is likely that the foundations made from bamboo assemblies will be damaged, being unable to withstand the weight of the house building. Rakit and Lanting houses that can tread on land that used to be in the Batanghari, Kapuas and Barito rivers, the foundations are bolted from solid logs, 60 cm in diameter and above.

Fig 1. Amphibious Village currently at the Edge of the Barito River Reservoir in Central Kalimantan

In its development, the old amphibious houses around Sintang and Muarateweh Kalimanatan, still exist today. Even though it is a newer building compared to the past, the amphibian houses in the vicinity of Sintang and Muarateweh still use solid round logs as their foundation construction. In Muarateweh, amphibious houses form a residential unit so that their presence floats during the rainy season and treads during the rainy season, making the collection of amphibious houses a tourist attraction. In addition to these two locations, on the Kahayan river Palangka Raya and on the Barito river Purukcahu in Central Kalimantan, amphibious house or lanting houses can be found on the edge of the river's property.

4 Development Study Of Arka Modulam Foundation

Ark'a Modulam is a module of construction and main poles of amphibious homes which when the wetlands are not watery, the foundation of the house will stand on the ground and when the wetlands are watery, the foundation of the house will float[3,4]. Arka Modulam consists of three compositional compositions namely[5,6]: 1) construction of vertical drive poles, 2). base construction and 3) Floating construction. Arka Modulam consists of three types (Figure 3, a), namely A (for 4 barrels), R (for 8 barrels) and K (for 16 barrels). In this study, the material used for constructions is wood. For base construction, the wood size is 8/8 for pole, 5/10 for beam and 5/5 for struts. For the floating construction, the wood size is 8/8 for main pole, 5/10 for frame beam and 5/7 for buoys of floating material. For the vertical drive pole construction, the wood size was 8/8 for main pole, 5/7 for supporting pole and 3/5 for struts. The wood used was Meranti and Kruing. The connected construction used bolt nuts, and nails for attaching struts. In this experiment, the floating material used was a 200 liter plastic barrel. The number of the plastic barrels were 4 pieces, arranged vertically. The barrel diameter was 58.5 cm and the height was 92.5 cm. Because the test did not have loading on the floating construction, the base construction pole and the vertical drive pole were plugged into the ground as deep as 50 cm.

Fig 2. The Trial Construction and the Assembling Process

The floating test was conducted at a certain village which was located in a floodplain in Palangka Raya, exactly at Mendawai. From the field observation, the water height in this city was around 2 meters, therefore, this village used stilt construction which has 2.5 – 3 meters height of foundation poles. Of that test, the weight of floating construction without four barrels was 157 kg. When the water level reached 98 cm where the length of base construction sank was 70 cm, the floating construction with wooden beam base 5/10 had not been floated yet. The floating construction began to float when the water level reached 115 cm height. When the floating construction released from the base construction, the plastic barrels sank were 12 cm height. By the availability of a connected beam to the main pole as a stability fastener of the floating construction to the vertical drive pole construction, the floating construction may step on the base when the water receded.

Fig 3. Arka Modulam Foundation when it is floating.

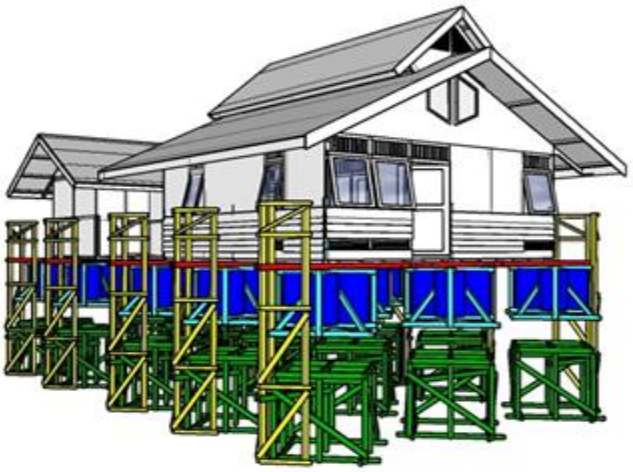

Fig 4. Ilustrasion of Arka Modulam Foundation application in a House Construction

In the second of the research would be formulated a trial model draft for the third year of research. According to the model of research result on the first year and the capability of buoyancy as well as supported floating materials as a component of amphibious foundation, it has been formulated a concept of Telapak Ark'a Modulam (TAM). The floating material used was EPS 60 cm x 150 cm x 150 cm. This EPS was covered by an armored concrete that fully in the form of foot plate. This concept will be assessed then will be drafted in the third year of trial project.

Fig 5. The illustration of Telapak Ark'a Modulam (TAM) Concept

Fig 6. The illustration of the application of the TAM foundation in house construction

5 Conclusions

Amphibious architecture is one of architecture water-based alternatives which are designed to adapt to flood and sea water level. In contrast, the Ark's Modulam is one of foundation alternatives to create amphibious architecture. It is possible to have another alternative in the future to make amphibious foundations since this Ark's Modulam is a proposed alternative as well. This paper is hopefully worthwhile to create other amphibious foundations which may adapt to flood and sea water level that urgently now attaching downstream urban areas. The conclusions resulting from this paper are: 1). Historically, Indonesia has always been familiar with amphibian architecture, but it was not built on land but on the banks of river spaces, 2). In Kalimantan in particular and in Indonesia in general, naming amphibian houses in each region has different names and 3). The study of the development of the ark'a modulam foundation is still a preliminary study to formulate the basic form of amphibian foundations for simple dwellings that are expected to be industrialized. Therefore further research will be used in industrial product materials.

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