Technological Structure of the Coastal Area For Constructing the Future of Vernacular Settlements in Makassar

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Abstract

Coastal regions Makassar can not be separated from the Settlement Vernacular. But the didaster-prone coastel conditions led to the settlement does not have a future. This research aims to develop technology design structure of the coastal area of Makassar. Based on this basic issue and local knowledge, to maintain vernacular settlements. Technology research concerns the design of structures used in anticipation of the settlement of abrasion, high winds and of abrasion, high winds and other climatic changes.

The methode used in this research is descriptive-evaluative using two approaches (1) morphological approach (2)Behavior and Architectural Approach. Analysis od the data in this study was done by using spatial analysis and descriptive analysis.

The result in this research is the design of the structure of the region that can be applied directly to the area around the Vernacular Settlements in the coastal area of Makassar.

Keywords: Structure Technology, Vernacular Settlement

I. Introduction

I.1. Back Ground

Damage to coastal areas can result in widespread impact when disaster strikes. Call it a transition function of mangrove land into embankment land and sea sand excavation brutally which resulted in widespread coverage to the ocean surf beach. Everything will culminate in damage to coastal areas. Recent years, the natural phenomenon of the tide that hit coastal settlements and the water that flooded rob another region frequently occur. If you want to realize, these events is the impact of wrong action in treating coastal areas. The disaster became an annual routine in line with climate change significantly. At least, the sequence of events had been giving the red line to be tackled. One way to minimize the impact of damage caused by the disaster by setting up disaster mitigation in coastal areas (Sukmawati, 2010). Mitigation of damage in coastal areas can be implemented in various forms and actions that lead to prevention and efforts to minimize the impact caused by the disaster. The effort it can be done in several ways, among others attempts shaped structure.

One of the prevention and mitigation of this is through the development of settlements Vernacular models for disaster management (Bakornas, 2002). In addition, mitigation measures are applied to the housing sector and the settlement may affect risk reduction. The largest losses due to disasters generally present in the area of settlements. Thus the identification of the characteristics of settlements needs to be done to be able to recognize the level of risk of disaster that may occur (Pratiwi, et al., 2008).

The coastal area of Makassar degraded environmental capacity are quite significant. This is caused by the use of space that is less controlled than with development and geomorphological conditions of coastal areas prone to disaster risks. The coastal area condition if not addressed / corrected and mitigated will result in damage to the coastal environment will also impact on the surrounding area. Planning coastal areas need to be addressed by developing the concept of disaster mitigation through technology approach coastal area structure and construction technology approach Vernakuar homes in coastal areas.

Naing research results (2015) show that slums fishermen contained in Makassar coastal areas showed different characteristics, so that strategies and patterns of regional management and house construction is also different. In the study area, which is often experienced catastrophic coastal settlements are tornados, sea water intrusion, abrasion / erosion and fires. It is highly influenced by the typology of settlements with a linear pattern, berbanjar and irregular. Conditions settlement density is very high. It is necessary for disaster relief efforts with a structural approach coastal areas and home construction approach to the concept of Vernacular.

I.2. Formulation of The Problem

From the background of the above problems can be formulated problems in this study is not the model of regional structures and construction technology Vernacular settlements to cope with disasters in coastal areas of Makassar

I.3. Objectives and Benefits Research

The purpose of this study is Finding structural technology system of coastal residential areas, as well as house construction system with the concept of the vernacular in menggulangi disaster on the coast of Makassar. The benefits of this research is to improve disaster resilience against high winds and tidal waves, as well as the danger of fire in the coastal slums in Makassar, so as to improve the quality and comfort of living for coastal communities.

II. Literature Review

II.1. Structural Mitigation Coastal Area of Makassar

Based on Natural Disaster Mitigation Guidelines on Coastal Areas and Small islands Directorate General of Coastal and Small Islands Ministry of Marine Affairs and Fisheries (2004), that mitigation efforts include:

II.1.1. Coastal Erosion Mitigation Structural

Structural efforts in dealing with catastrophic erosion is a technical effort that aims to maintain the balance of sediment transport processes along the coastlines, strengthen the geological structure of the coastline, as well as adding sediment supply. Structural mitigation measures can be grouped into 2 (two) groups : 1) Naturally, like planting a green belt (coastal forests or mangroves), strengthening of the sand dunes with vegetation and others. 2) In artificial, like a wave building retaining walls, construction of groins and others.

Structural mitigation efforts by artificial means need to be planned carefully because it may result in changes in the patterns and characteristics of the wave in the long run may lead to erosion elsewhere.

II.1.2. Tornado Disaster Mitigation Structural

Structural efforts in dealing with hurricanes / storms are technical efforts aimed at achieving a more resilient environment hurricanes / typhoons. Physical prevention efforts that can be done include: low cost retrofitting roof, especially the structure of the roof is susceptible to damage from hurricanes / typhoon : a) Mitigation efforts of Sea Level Rise (sea level rise / SLR) Structural. Structural efforts in dealing with the disaster SLR is the technical effort that aims to protect the coastal environment prone to disaster SLR. Prevention efforts physically to do, among others: 1)• Creating a system of coastal protection whether they are static as the construction of dikes, sea wall, revetment, groin, and detached breakwater and dynamic as mangrove planting. 2) Lifting and elevating all forms of land facilities and the beach. 3) Move all forms of land facilities and the beach landward safe from the reach of the sea water. 4) Adjustment of drainage system ; b) Landslide Mitigation Structural. Structural efforts in dealing with the landslide is a technical effort that aims to protect the coastal environment that is prone to drought. Prevention efforts are physically very varied depending on the type of avalanches and the mechanism of occurrence, which includes: 1)

Construction of a dike in locations that are prone to landslides. 2) Structuring adequate drains 3) Reforestation in areas prone to landslides.

II.2. Home Construction Design for Coastal Disaster Mitigation

To determine the construction of houses in disaster mitigation in coastal areas, the construction of houses should also consider the location of the house and Standards disaster-friendly house (Directorate of coastal and marine, 2008).

II.2.1. The Location of The House

The home site of disaster mitigation in coastal areas should consider the following matters: 1) Not being in the coastal border area. 2) Located on the sun-zone settlements.3) Taking into account risks to reach rob runoff / flood / tidal waves.4)The soil texture. The house was built on the land or land that has the texture of ripe (not bog / software).

II.2.2. Standard house for Disaster Mitigation

In general, the construction of houses for disaster mitigation has a bottom construction which should be capable of supporting all loads are forwarded by the top structure without decreasing excessive. Under the structure of the house is planned such that when the decline will be uneven. In addition it should be given a safety factor that is greater than the top of the building to avoid premature failure of the structure, in particular as a result of an earthquake occurs. Building on should be capable of supporting all loads without excessive deflection. Building on must be planned such that in the event of the collapse will be detailed. The connection should be planned in a way to be able to transfer the forces from one part of the structure to the other elements. Failure place of connection should be avoided by giving a greater safety factor on the connection.

II.2.3. Prototype Selection

Selection is based on the home prototypes recent developments potency of locally available building materials, with a selection of alternative non-stage houses on stilts and risk-adjusted rob runoff / flood. Besides the selection of one of the prototypes of the house is based on the study of microzonation of building materials, geology and architecture, at the provincial / or district / city, with reference to the zoning Simple Healthy House National (Minister of Settlement and Regional Infrastructure No. 403 / KPTS / M / 2002 on Technical Guidelines Development Simple Healthy House).

II.2.4. Architecture Building Requirements

In general terms the architecture of the house includes three conditions, namely (1) Appearance of house building; (2) The spatial structure of the building; and (30 balance, harmony, and harmony house building with its surroundings. The appearance of houses in coastal areas should pay attention to the shape and the architectural characteristics of the coastal environment. These considerations are intended to create more environmental compatibility through the harmonization of value and style of architecture, use of materials and color of houses , The shape and orientation of the house.

Houses in coastal areas should have the appropriate facilities, adequate and safe for everyone. Completing the building to allow the occupants to evacuate people who have time to save themselves safely without feeling a pinch. Houses in coastal areas should allow the movement of people in a safe, comfortable and adequate. Provisions way out include stairs, ramps and passageways (gang) should be safe for traffic building users. Stairs, ramps, floors, balconies and a roof that can be achieved by the people must have the dividing wall, balustrade or other barriers to protect the buildings against the risk of falling. Each building must have at least one exit on each floor. Dimensions / size of the exit is to have a completely free height shall be not less than 2 meters, indoor doors should not open directly to the stairs, hallway.

III. Method

III.1. Approach of Research

In general, the research is descriptive-evaluative using two approaches, morphological approach, Approach and Behaviour Approach (Neer, 1999). They will also be conducted Architectural Appproach. The first approach deals with the study of the geographic setting and environmental aspects of the existence and characteristics of the settlement. The second approach deals with the study of the process of resettlement of residents, "survival strategy" that is owned by a resident that is manifested in the socio-economic conditions. The third approach deals with the study of the residential area and house construction. The third approach is operationalized with a comparative perspective, by comparing the existence of the settlements were filtered through mechanisms of regional structure technology system determination and house construction that both mitigation of disasters.

III.2. Located of The Research

The location of this research is in the Village Tallo that has two typologies of settlements, ie settlements on water and settlements on the mainland. The second typology is considered to represent a typology of existing homes in the coastal area of Makassar.

III.3. Data Collection Technique

The data used in this study was obtained from observation, interpretation of satellite images (google earth), thematic maps, and interviews with respondents in depth interview. Untuk penentuan responden di dalam kegiatan indepth interview digunakan teknik quota sampling. Respondents were drawn as many as 15-20% of the sample of the total population in coastal slums. The selection of respondents is done by simple random sampling, which is taking a sample members conducted randomly without regard to strata that exist in this population (Sugiyono, 2007). This is done because the populations in coastal slums are considered homogeneous. Both in terms of housing conditions (material), economic and socio-cultural conditions. In each of the slums, the respondents to the head of the family.

III.4. Data Analysis Method

Analysis of the data in this study was done by using spatial analysis and qualitative descriptive analysis. In this study, used the unit of analysis of coastal slums. Objects that were examined are: (1) Design Technology of the structure of the settlement area, which consists of; (A) breakwater (b) prevention of coastal erosion (c) the coastal vegetation (d) facilities and infrastructure; (2) Design of home construction for disaster mitigation, consisting of: (a) the under structure (b) the structure of the house (c) structure of the roof (d) material of home (e) a structure frame (f) and parts of the house (floor, roof wall / ceiling). The research result is technology design of a residential area and construction of houses for disaster.

IV. Result and Discussion

IV.1. Structural Analysis of The Beach in the Coastal Area of Makassar

IV.1.1. Conditions structural characteristics of coastal village Tallo

Tallo coastal area, located in estuaries Tallo. The pattern of settlements in villages Tallo generally linear and spread following the road network, and irregular. The pattern of home in the Village Tallo using a system wide road series with the environment ± 1.2 to 2.5 meters. The house is located on the outskirts of the sea have a very close distance to the shoreline. If the note between the distance of the beach and settlements, it seems people in the Village Tallo not sustain coastal border. Even still there are homes that settled over the water. Under these conditions the region is very vulnerable to strong winds disaster, fire and rob

Conditions structural characteristics of artificial villages Tallo, showing the density of the building were as shown in the figure below. The physical condition of the buildings in the Tallo village are very diverse. Consisting of permanent homes and semi-permanent. In addition to building on the land, there is also a settlement on the water. Settlement can be categorized Vernakuler settlement, because it was built based on natural conditions.

Figure 2. The nature of coastal settlements village Tallo
Source: Personal Documentation, 2016

Generally, those who live on the water or floating homes are those who make their livelihood as fishermen. The structure of the house on the water using wood, roofing materials and walls using Seng. Those who live on the water do not have toilets and bathrooms were decent, they dispose of household waste directly into the sea.

Figure 3. Settlement Conditions on the water
Source: Personal Documentation, 2016

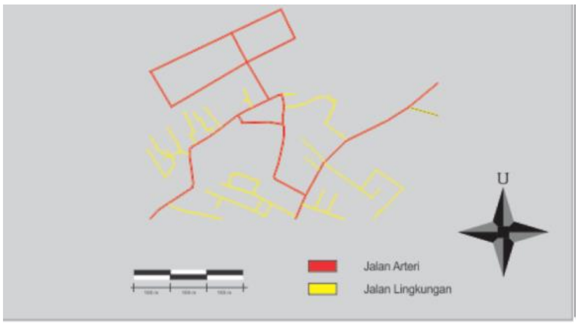

Figure 4. Map Circulation Paths.
Source: Personal Documentation, 2016

Figure 5. Map of the density of non-permanent buildings.
Source: Personal Documentation, 2015

Forms of prevention efforts undertaken in this region for disaster mitigation strong winds and sea level rise is the manufacture of a retaining wall of waves, and the utilization of mangrove plants in the surrounding settlements. It is also expected to minimize the disaster. But in fact, the shape and development of these plants do not grow properly, so it takes replanting and management of mangroves in order to get more leverage in preventing the occurrence of catastrophic winds.

IV.1.2. Structural Analysis for Disaster Mitigation Winds, Fires, Tidal Waves, and Floods

Structural mitigation in dealing with strong winds in the village Tallo is to achieve a more resilient environment hurricanes / typhoons. Structural mitigation measures can be grouped into 2 (two) groups:Naturally, that by planting a green belt (coastal forests or mangroves). In Tallo village is divided into three zones, namely the coastal zone, the zone greening and settlement zone above the water and on land. At the beach area immediately adjacent to the sea, placed a breakwater pier as a haven for boats. The wind speed in villages Tallo ranges from 40-60 km / h, so the planting of mangrove forests in the coastal border area can serve as a filter for high winds and flooding (sea level rise). So if there is a strong wind, indirectly leading to this settlement. In addition, mangrove forests can also function as a green open space area. By looking at the wind speed is in the village Tallo, the zone will be planted mangrove reforestation Rhizora apiculata types that have dense leaf shape with a height ranging from 8-10 M. These plants can serve to deflect the wind, so the wind which entered into settlement zone may be reduced.

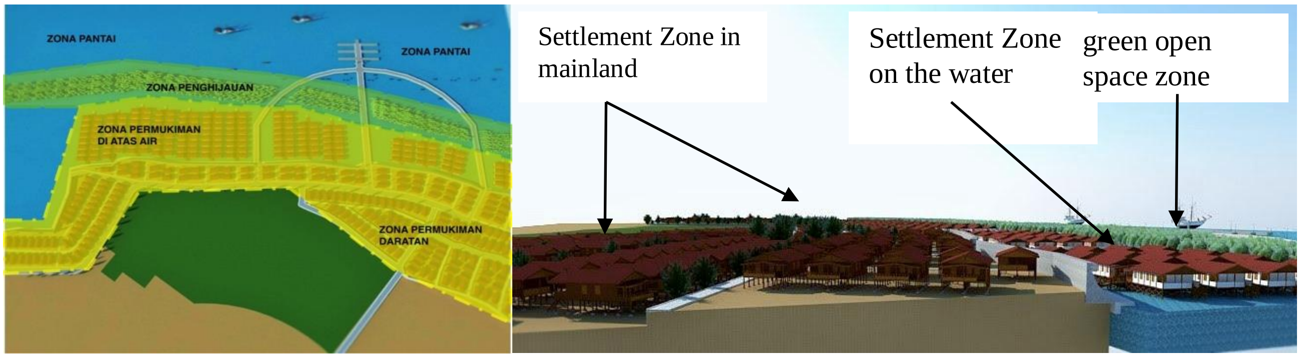

Figure 7. Zoning disaster mitigation village Tallo
Source: Analysis, 2016

Artificially, by performing the design manufacture coastal embankment structures that can withstand high winds, breaking wind and minimize wind speed coming into the settlements, with the Nose Cone System. This is done by raising the dikes up to 4.5 m above the arterial road. The elevation is intended as a barrier to high winds that would blow in a community settlement on the mainland. Nose cone system to function as a breaker of high winds which by its nature is adopted from a rocket head shape. Nose cone is a cone shape that is contained in the tip of the rocket. This conical shape serves as a wind breaker in order to move aerodynamically rocket. In general, the rocket could fly through the air as it refers to Newton's third law "every action there is a reaction equal and opposite". The rocket is generally divided into 4 parts:

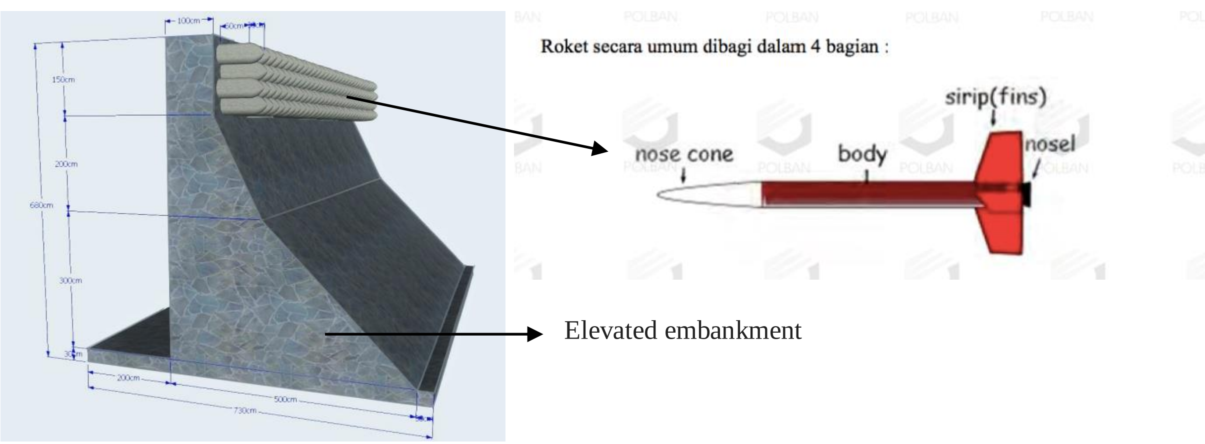

Figure 10. Forms Chart Rocket

Nose cone suitable for use in areas that have high levels of wind speed, especially in coastal areas Tallo village. Nose cone in place in front of the mainland settlement zone that serves as a wind breaker for existing homes in the mainland. Cone shape at the nose cone will break the strong winds come, so that reduced wind speed or wind scattered into all directions at speeds reduced. The advantages are the nose cone does not block the wind and do not change the wind circulation/air.

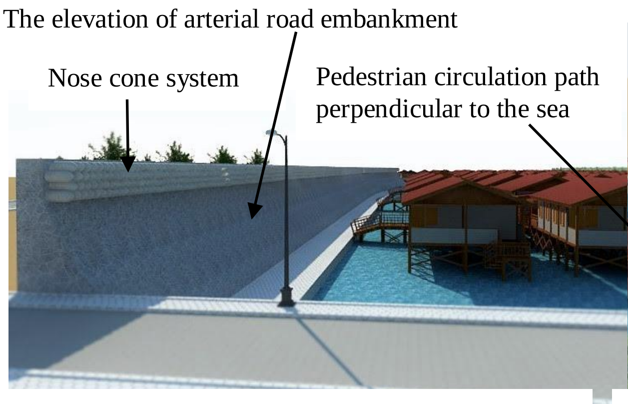

Figure 12. Structural Efforts to mitigate the Nose Cone System .
Sumber: Personal Documentation, 2016

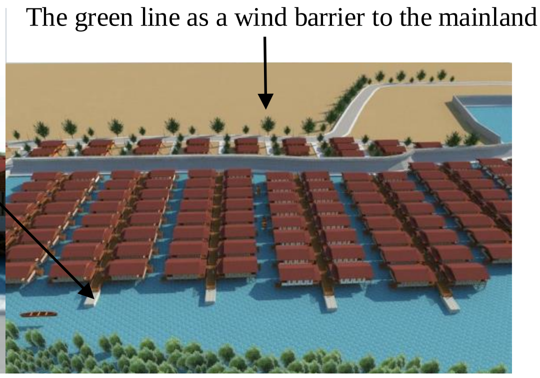

Figure 13. Position Settlement Region Disaster Mitigation in Urban Village Tallo .
Source : Analysis , 2016

Structural effort for disaster mitigation can be done by arranging the orientation of the building. In the Village of Tallo orientation of the house on a settlement on the water and on land laid out with the direction of home body parallel to the coastline. This direction allows the reception of information quickly about the dangers that threatened from the beach with a parallel position towards the coast so when the strong winds coming towards the settlements, houses wider surface allow to decipher the wind coming. In addition, pedestrian circulation, which is part of the integrative planning of paths to save themselves during a disaster. Path perpendicular from the sea towards existing settlements on land or at sea. Among the arterial roads and residential areas also serve as a green line wind barrier.

IV.2. Analysis of Home Construction for Disaster Mitigation Coast of Makassar

IV.2.1. Location Home Construction and Selection Prototype

Figure 13 shows the location of settlements in the village Tallo partly above water and partly on land. Settlement on the water is a coastal border area with the depth at high tide reaches a height of 1 M. As for the home on the mainland, there are houses located on the shoreline in the range of up to 10-15 M from the beach, so this area prone to various disasters such as strong winds and rob.

Figure 13. Vernacular Settlement on the water, Village Tallo
Source: Google Earth, 2016

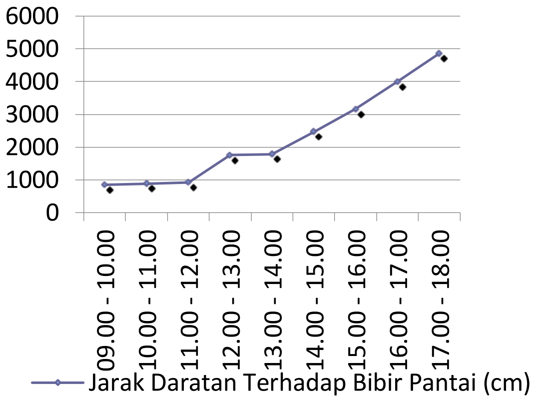

Figure 14. The Distance Inland on The Beach In The Village of Tallo.
Source: Observation, 2016

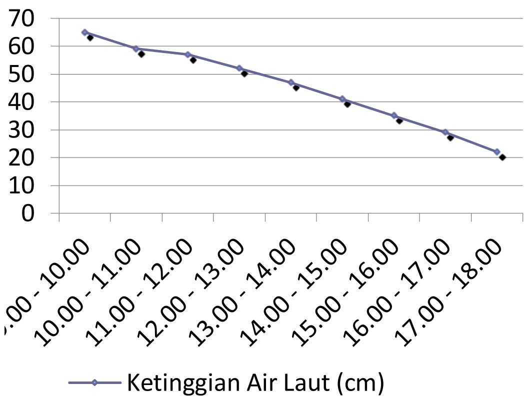

Figure 17. The Height Of The Tide In The Village Tallo.
Source: Observation, 2016

Because in the disaster-prone locations settled, so this settlement grew into the vernacular settlements, where people build a settlement based on the natural disaster-prone conditions. For the arrangement of settlement areas in the village Tallo maintained residential allotment zone, with a maximum height of the water will not reach to the floor of the house. It is intended that these settlements remain an icon in this area. In the settlements on the mainland will be directed to the settlement zone which is at a distance of 100 M from the beach, according to the standard arrangement of regional disaster mitigation, with due regard to the farthest distance of the sea level rise along the 25 M from the shore. With settlements like this, it is likely to face the risk of runoff water is not up to settlement in mainland again.

In the figure below illustrates a prototype house on the water and on land that is based on the study of microzonation of building materials, geology and architecture, at the provincial / or district / city, with reference to the zoning Simple Healthy House National (Minister of Settlement and Regional Infrastructure No. 403 / KPTS / M / 2002 on Technical Guidelines Development Simple Healthy House).

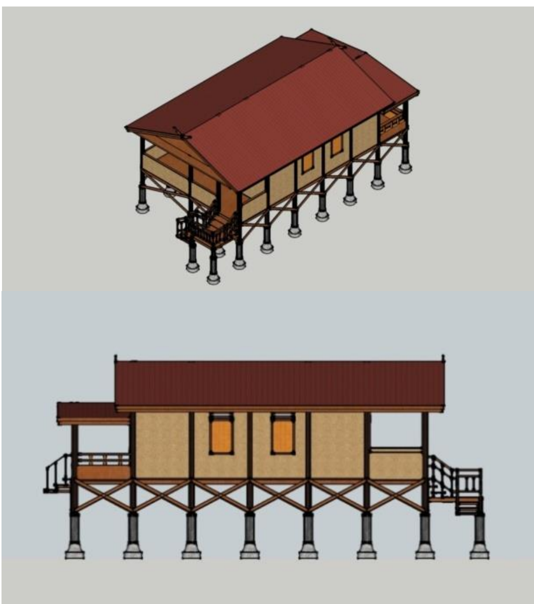

Figure 15. Design of Stilts Houses on The Water, in The Village Tallo. Source: Analysis, 2016

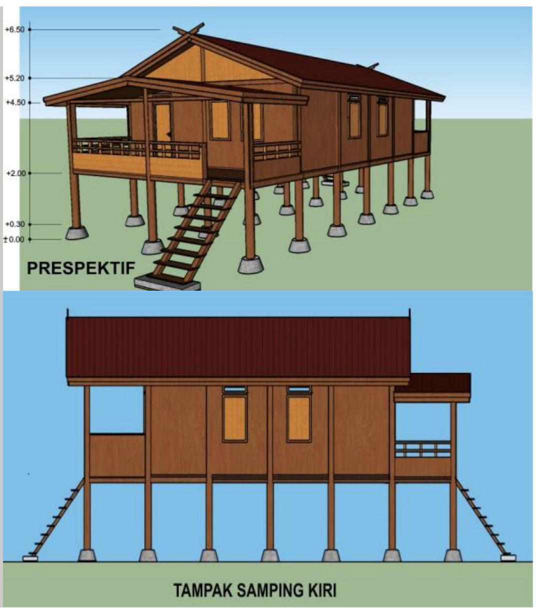

Figure 16. Design of Stilts Houses on the Mainland, in The Village Tallo.
Source: Analysis, 2016

Appearance prototype stage house in the village Tallo still adopts the form of local wisdom Makassar in which due regard to the rules Architecturally, the condition of the natural environment (risk of disaster in the area of the coastal village Tallo is catastrophic winds, sea level rise / runoff rob / floods), sedimentation natural and coast home building standards that have been set, so as to create Vernacular settlements. Differences protoip design stage house is above the water and on land situated in between the columns stiffener structure houses at the bottom of the home on the water.

In general, home construction vernacular for disaster mitigation has a bottom construction which should be capable of supporting all loads are forwarded by the top structure without decreasing excessive. Under the structure of the house will be designed using extolled foundation consisting of a mixture of concrete with a diameter of 20 cm and 30 cm high. At the bottom of the foundation added floorspace with a height of 20 cm, so that the load received indirectly channeled to the ground and the load evenly on each foundation. Such a structure also serves to strengthen the building when buffeted by strong winds. Bottom structure must be given in the form of system safety factor stiffener cross between columns. This is to avoid premature failure of the structure, particularly as a result of a disaster or an earthquake strong winds.

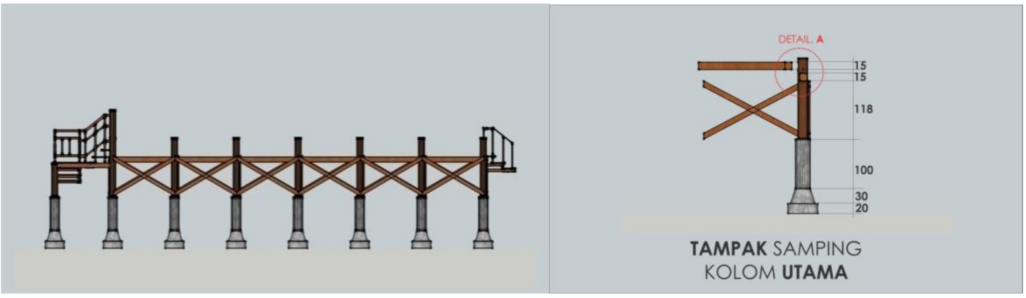

Figure 20. The Structure of The Lower Stilt House on The Water with a System of Stiffeners Between columns.
Source: Analysis, 2016

The structure of the center is the part that is above the bottom structure. In essence, the principle of the use of the substance / material walls and floor are light and "chewy", that use materials more lightweight material that is not harmful if it collapses and lighter so it will not burden the existing structure. Application of the stage house in the village Tallo would use the material walls and wooden floors, where the material is able to receive the displacement relationship between the scale timber moderate earthquake. Besides its density heavier than Seng thus more able to resist the arrival of strong winds. Therefore, the necessary connection structure that can support home construction, so as to support disaster mitigation strong winds and earthquakes are frequent in this region (Figure 23).

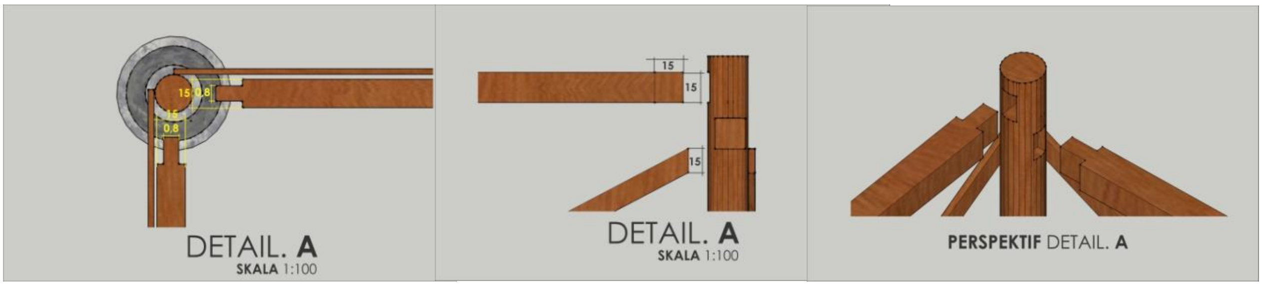

Figure 23. Connection details central structure of Stilts houses
Source: Analysis, 2016

For structures above must also be planned according to the standards that have been set, so that when disaster strikes high winds, earthquakes, sea level rise runoff / tidal / flood, or earthquake, the building is able to withstand such disasters. The structure above is also capable of supporting all loads without excessive deflection. Some problems due to high winds include: roofing airborne, gording apart, raised horses, and wood columns shifted or lifted. The roof is good is to accept the burden of the same wind from all directions. This form is very influential on the amount of wind pressure acting on the building. The higher the building the greater the pressure of the wind. Lighter wind pressure works when building height is smaller than half the width of the building. The slope of the roof that provides a low wind load that is between 10 ° -30 °. For angles greater than 30 °, need a better strength and that appropriate cover.

IV.2.3. Analysis of The Requirements of Ease of Building

For homes in the coastal area villages Tallo, has been equipped with evacuation facilities which will allow residents to have time to save themselves in the event of a disaster safely without feeling a pinch. Provisions way out include stairs, ramps and passageways (gang) should be safe for traffic building users. Stairs, ramps, floors, and roofs that can be achieved by a human being has a wall, balustrade or other barriers to protect the buildings against the risk of falling. Each building must have two ways out of each floor are located in front and behind. Dimensions / size of the exit is to have a completely free height is 2 M, doors and windows in every home is designed to be passed to the evacuation route. Given the houses on the water inhabited by fishermen, so every home is equipped with a boat mooring facilities each house can be accessed via the back door of the house.

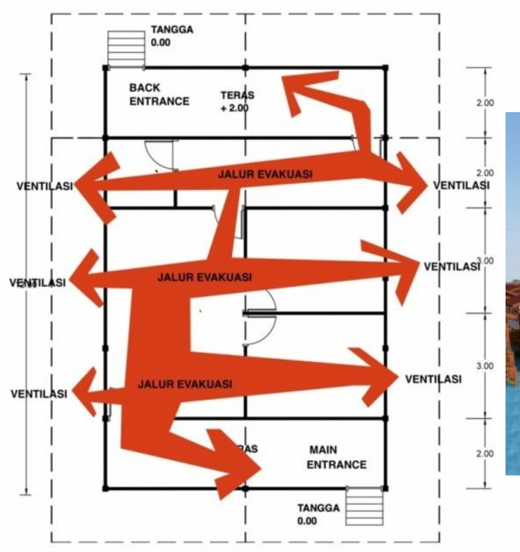

Figure 33. Strip Evacuation stilt house in the village Tallo.
Source: Analysis, 2016

Figure 34. The Fishing Jetty on stilts over the water.
Source: Analysis, 2016

V. CONCLUSION

From the analysis of regional structural design and construction house design, for disaster mitigation for the vernacular settlement in Cambaya Village, Tallo Village and Untia Village, it can be concluded as follows:

1. Design regional structures for disaster mitigation in coastal areas Cambaya, Tallo and Untia, based on the disaster that is often experienced , basically have a different design characteristic.
   a. Cambaya regional structure design, with high winds disasters, fires and flooding, created the structure of the region by opening some space for evacuation paths and places Gather/Muster Station and laid Fire Hydrant Extinguiser or environment. To prevent excessive winds, re-ordering the settlement area by considering the arrangement of the house and lane road in the

direction of the wind, so the wind is coming does not decompose, which can cause rapid spread of fire when the fire.

b. Tallo administrative district structure design , with high winds and tidal disaster / sea level rise , is the design manufacture coastal embankment structures that can withstand high winds and break into the settlements . Namely by raising the dikes up to 4.5 m above the arterial road . Also on the top of an embankment , made nose cone system. This system was adopted from the head shape of aircraft that can break wind. The advantages are the nose cone does not block the wind and do not change the wind circulation.

c. In the village Untia, region structure design for disaster mitigation, conducted by planting and management of mangroves and the use geobag on the waterfront to minimize the high winds and tidal disaster. Geobag usage in residential areas fisherman Untia serves to hold the tidal flood entered into settlements or against waves enter into the settlement .

2. Design house construction technology for disaster mitigation in coastal areas Cambaya, Tallo and Untia, based on the disaster that is often experienced, are as follows:
   a. In the village Cambaya, construction design house for disaster mitigation of fires and strong winds have the bottom of the construction should be capable of supporting all loads are forwarded by the top structure without decreasing excessive. The prototype house in the village Cambaya is keeping the traditional architectural style stilt houses Makassar, but in accordance with building standards coastal homes that have been set . The use of wood in combination with reinforced concrete on the sub - structure and midlle - structure, finishing Sodium Silicates home using ingredients that can slow or inhibit sparks in case of fire. Calcium Panel Board as a wall covering material is also resistant to fire.
   b. For the village of Tallo, construction design house based disaster high winds and flooding, has been designed on the house on the water and the house on the mainland. Selection of prototype houses on stilts, based on the consideration of sea level rise to a height of 1 meter, so that the pole height house up to 2 meters for homes located on the water. Differences protoip design stage house is above the water and on land located on the stiffener structure between the columns on the structure of the house.
   c. In the village Untia , system construction foundation and columns used in building disaster mitigation , is the foundation of poor plate 80x80 cm , column form circular with a diameter of 30 cm , because of the nature of the circle in the column will be flexible if the tidal flood and high winds , so it does not put a halt to the wind and flooding . The structure houses on stilts as a prototype implemented in rural areas Untia considered able to adapt to the phenomenon of tidal flood that occurs regularly in each year. Further lifting peil lower floors house about 100 cm , it anticipates rob that occur in each year up to the height of 50 cm , so people still can work under the house and can serve as a storage and transport goods safely.

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