

Functional Changes of Under Stilt Houses as an Effort of Adaptation and Adjustment in Settlement

Bambang Wicaksono, Ari Siswanto, Susilo Kusdiwanggo, Widya Fransiska Febriati Anwar

Abstract: *The development and change of stilt house on the Musi riverside are influenced by river geography. Model houses on the banks of the river Musi in the form of houses on stilts. The effort to build a stilts house is inseparable from the condition of the Musi river, which is generally in the form of wetlands, so that housing is needed that can adapt to the water environment. In the initial conditions of settlements, under the riverfront house stage functioned as allowing air to move so as to minimize the humidity that is under the stage. With the current settlement conditions, people make adjustments or change the settlement environment as a form of adaptation to the tidal Musi river. Stilt houses are an alternative place to stay that continues in the Palembang river community in dealing with climate and weather. This study aims to determine the tendency of morphological changes in the development of space under the stilt house. In achieving the objectives of the study carried out to identify architectural models, explore the activities of community settlements on the banks of the Musi river. Data collection is done through field observations, literature studies, and in-depth interviews. Data analysis was carried out qualitatively on the variable elements of the building, with identification of riverfront stilt house models. The results show that the house on the river bank has experienced physical changes in the model house on stilts, both in terms of function and building materials. Changes in the physical elements of houses from wood to fabrication occurred in some of the stilt houses on the banks of the river Musi, resulting in river bank settlements dominated by brick or terrestrial houses.*

Keywords: *Settlements; Adaptation; Adjustment; Stilt House; Riverside*

I. INTRODUCTION

Since the beginning of the development of the city of Palembang has been influenced by the important role of the Musi River and its population settlements. The form of a house on the banks of the Musi River consists of houses on the banks of the river above the Musi River in the form of rafts called Rumah Rakit and stilt houses on poles which are stuck on the banks of the Musi River with *limasan* roofs

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which are then called *Limasan* Houses and *Gudang Limasan* Houses.

History records reveal that the traditional houses developed from vernacular communities and the growth of early settlements in Palembang that hung on the banks of the Musi River. The model of settlement development that occurs linearly along the Musi River flow, namely on the left and right sides of the Musi river which is now called Seberang Ulu and Seberang Ilir in Palembang.

The houses with their adaptive houses were erected on the banks of the river, bearing in mind the landscapes of the Palembang region, which were almost entirely flooded so that shelter was needed higher than the ground so that it was always dry and clean. In its development which continues to experience changes due to several factors, such as the geography of the river, technological developments, making the community change the function of the stilt house into a land-based house. It is marked at the bottom / under the house experiencing a change in function that affects the material and layout of the room.

In the initial settlements, the community only used the upper part of the house as a shelter and the lower part as a place for water activities, starting from the bathing, washing and toilet and place to place the boat.

Rapoport (1969) revealed the influence of physical changes influenced by social forces such as climatological factors or environmental ecological conditions, material procurement, technical knowledge and local cultural rules to the forms of diversity of local architecture. Every community has their own ways about the stage of building a house which is seen not only as a place to live or a physical building, but the house is also the work of a local community culture.

II. LITERATURE REVIEW

Stilt House in the Musi River

Settlements on the banks of the Musi river and its constituent elements can be viewed as vernacular architectural works. The vernacular settlement is a collection of home activities and livelihoods related to local environmental conditions. Likewise, the form of vernacular architecture is not an architectural model that is issued and easily patented such as classical architecture, popular architecture, or modern architecture, (Rapoport, 1990).

At the beginning of its development, the Palembang settlement not only had a *Limasan* traditional house, but there

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were also other houses such as rafts and warehouses. *Gudang* house is a model of merging between home space and storage. Because the community used to make a house as a storage place such as rice, corn and livestock. Meanwhile, some types of traditional houses have the form of houses on stilts, each of which has a different type of stage system and is adaptive to the surrounding environment, this model is referred to as a *limas* house. Likewise, raft houses stand along river banks and take on environments along large rivers. (Siswanto, 1999)

In a study of typology models of a riverside house, Dwinasari 1997 in Hidayat 2014, divided traditional house models into three categories: First, Houses that are always floating on the water and standing on the banks of the river, are called raft houses. Second, riverside houses whose

location depends on the tides and are traditional Palembang houses are called stilt houses (*limas* houses). Third, a house that is located in a relatively dry area with soft / watery and watery conditions when there is seasonal flooding, is called a row house / stilt house which has changed its function to become a land house. Similar discussion was also reviewed by Angkasa (2016), regarding the architecture of vernacular houses in southern Sumatra, namely the type of *limas*, warehouse houses and raft houses.

The study discusses the typology of vernacular houses from relatively has a catchment infrastructure networks at the local level. Material limitations affect the improvement of spatial to spatial functions that occur in some models of community dwellings that have a typology relatively consistent with the environment, Dovey (2014).



Fig. 1(a) Model of a stilt house when the river recedes

(b) Model of a stilt house on the riverside of the Musi when the volume of water rises / pairs

Source: rumametmet / Musi River Palembang

Functional Space of Stilt Houses

The Musi Riverside model house which is divided into three types of model houses, namely the raft house, the *limas* house and the land house are the houses of the Palembang traditional community, in its construction, the riverside houses were built by making a stage. The lower part (starting from digging the ground to erect a pillar, *blandar*), the middle part, and the top, then proceed with the

installation of the roof and most recently the ceiling construction.

In determining the function of the space on the stage house of the Palembang river Musi, the initial community determines by taking into account the number of families and relatives and other social aspects. This makes the physical stage on Palembang's house bigger and longer.

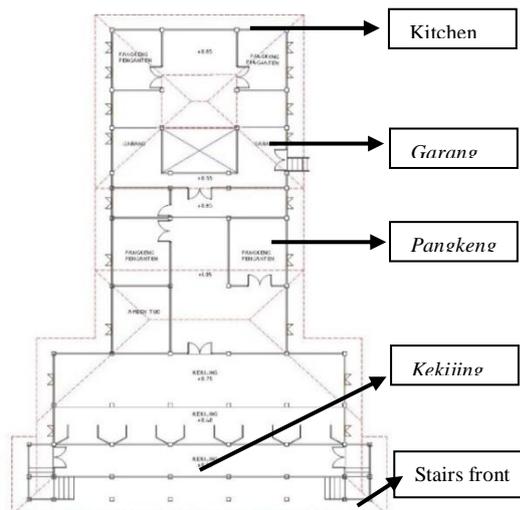


Fig. 2 Lay-out Space of stilt house (*Limas*) in Palembang

In the initial community, the front room of the house is used as a gathering place or deliberation, while the middle part functions as a bedroom (*Pangkeng*) and the rear functions as a kitchen, and generally directly leads to the river.

According to the height of the stage, there are 3 types of stilt houses on the riverside Musi Palembang, namely: a stilt house that has a height of more than 2 meters, a height of 1 to 2 meters and a stilt house with a height of less than 1 meter.

The function under the stage house is adjusted to its height. Altitudes less than 1 meter are usually used for storage or cages. Whereas a height of more than 2 meters is usually a stilt house in the first layer of riverside settlements and is used as a socializing common space.

Functional Under in the Stilt House

In general, a stilt house built on the waters, both on rivers, swamps, lakes, and rice fields, the purpose is adaptation to the water space. The function under the stilt house in the early community on the Musi River was used to store boats, pets and other objects. Under the stage which is left empty, function allows air to move so as to minimize the moisture under the stage. The ground under the stage becomes dry, so the damp air does not rise to the floor of the stilt house.

The floor of stilt house is made of bamboo or *unglin* wood, so that air circulation can still pass through it. In addition, air circulation up from the pond can exchange with openings on the walls of the house.

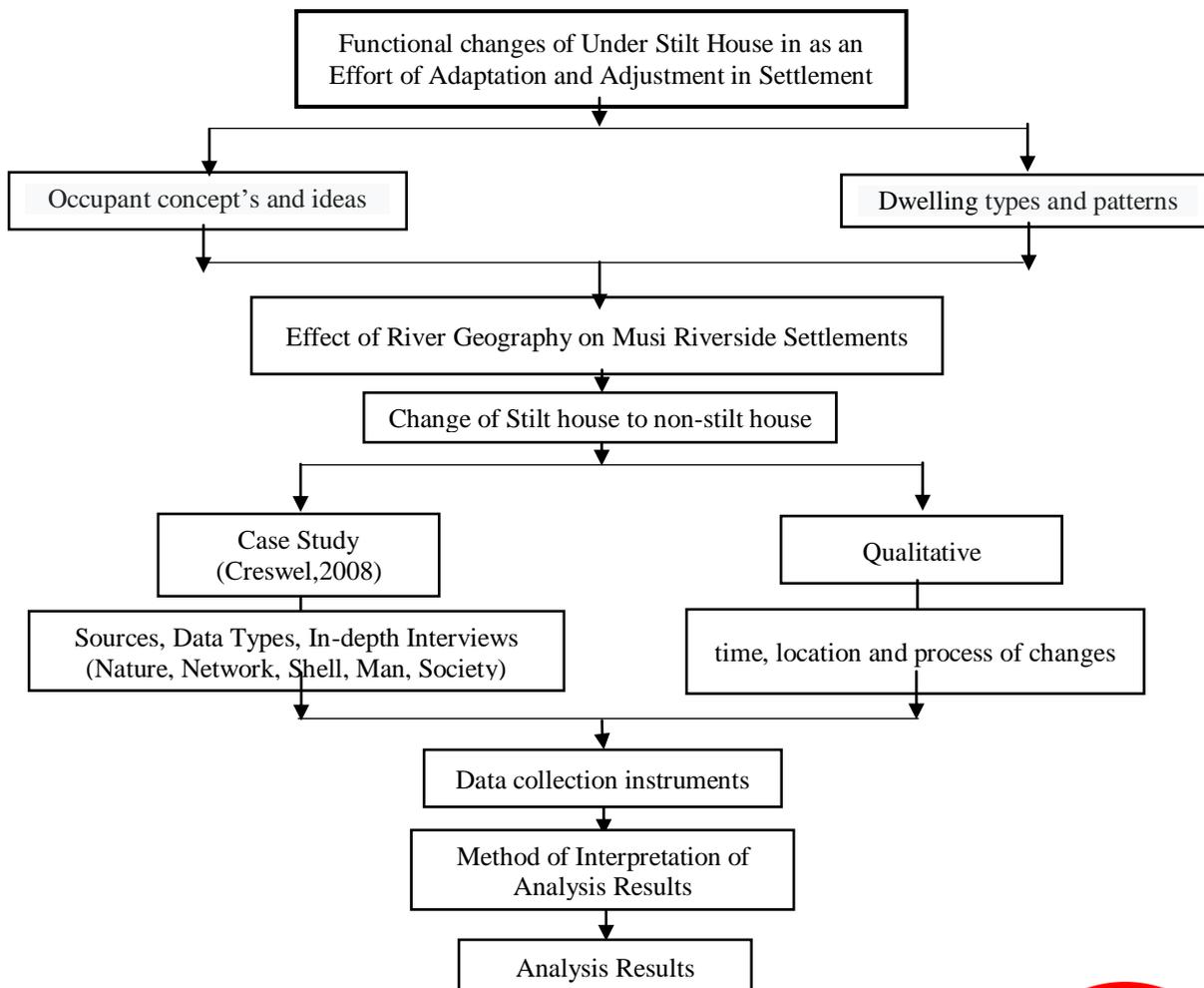
III. METHODOLOGY

Determination of the method used in this research is the case study method in Creswell, (2008). The case study method was then combined with qualitative exploration based on field data in the exploration of adaptation strategies that were completed in the Palembang riverbank settlement. A riverbank house is a form of an adapted sustainable house whose existence is regulated by nature (vernacular).

Observation is a way of collecting data, while observations of changes in the function of the house are carried out by direct field assessments to areas related to the stilt houses on the riverside Musi which change functions which are adaptations and adjustments of the community to the environment.

The realm of observation is more focused on the changing function factor under the stilt house. While the interviews were conducted more on things that affect the change of function under the stage house to become a permanent residence. Then, observations are made by looking at activities above and below the stage that are still original or that have changed functions. The observations are then used to analyze data in revealing research findings. Selected settlement data must meet integrated criteria, namely the relationship between the form and context are interrelated with the results of the observations.

Chart of the Methodology



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Overview of study areas

The research study location was in the settlement of the Palembang River Musi River, in the SeberangUlu and Ilir case studies, namely in 2 Ulu, 3-4 Ulu, 30 Ilir and KutoBatu. The focus is on the Musi Palembang Riverfront Riverfront research house that experiences a change in function underneath the stage house or changes from stage to non-stage.



Fig. 3 Research Map Locations (A) SeberangIlir and (B) SeberangUlu(Google earth, 2019)



Fig.4 Research Map incase study (1) 3-4 Ulu (2) 30 Ilir (3) 2 Ulu (4) KutoBatu(Google earth, 2019)

IV. RESULT AND DISSCUSION

Palembang traditional house is a dwelling category in the wetland area. The main reason for Palembang's traditional

settlement in the form of a stage is closely related in responding to the water space and as a water transportation route.

The Process of Changing the Stilt House into a Non-Stilt House (Characterized by Land Houses)

The decline in the existence of the Musi River has made extensive water spaces narrowed by the existence of land space. River houses and river banks are growing rapidly, their stilt houses are in the river stream, but with increasing population and kinship which causes an increase in housing density. The development of the wood industry has made rakit wood base material more expensive, houses that were originally stilts or rafts in response to the river, are now turning to land that is not patterned, along with the need for new space below for families and immigrants , economic needs under the stage are used to make rental rooms / dormitories and others. The river tends to be a back area. This makes residential houses and river banks begin to be characterized by land houses.

This state of change is one of the changes in the image of the city in Palembang. Palembang seems to lose its identity as a river city. This significant change causes public opinion to follow the development of changes that occur. Houses with a stage concept are considered old and old, so they are not adaptive to the current of globalization. Modern homes with hoarding swamps are a tradition in shaping urban planning. More simple, fast, interesting and easy to get material to build it. One of the main reasons people began to change their way of living was also because wood materials that are now difficult to obtain.

In addition, the community's efforts to adapt are efforts to regulate the condition of the natural environment (adjustment) as a way of dealing with environmental and network changes in the modern era and the development of residential areas.

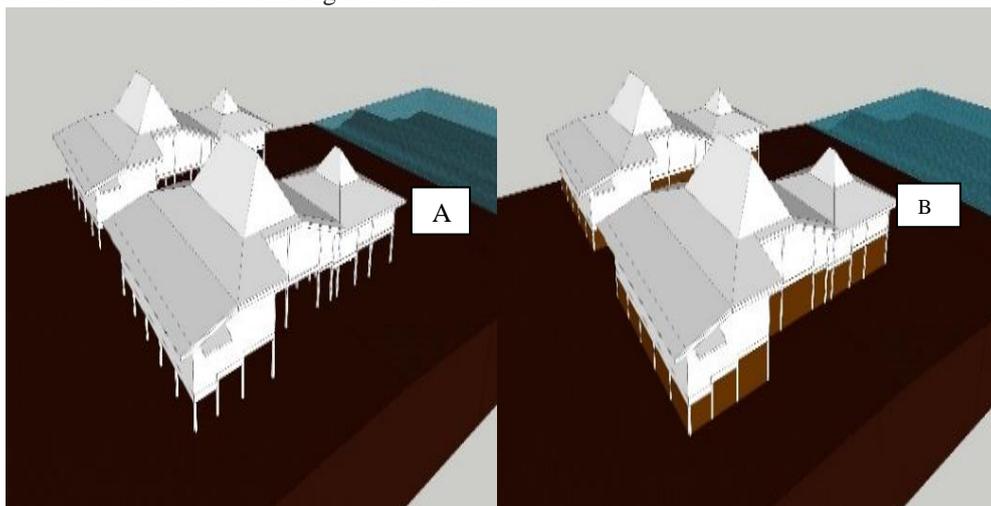


Fig. 5 (A) Type of Limas House before changing or stilt house Function (B) Type of Limas House after changing or additionof occupancy functions

Table.1 Physical aspects of the stilt house

NO	PHYSICAL ASPECT	Research Location Study							
		3-4 Ulu		30 Ilir		Kuto batu		2 Ulu	
		n	%	n	%	n	%	n	%
1.	STILT HOUSE								
	• More than 2 m	5	38	3	30	6	33.3	3	37.5
	• 1 – 2 m	6	46	6	60	10	55.5	4	50
	• Less than 1 m	2	16	1	10	2	11.2	1	12.5
	TOTAL	13	100	10	100	18	100	8	100
2.	Orientation of House								
	• To the River	89	18	12	7	59	69.5	27	21
	• To the Land	400	82	153	93	26	30.5	102	79
	TOTAL	489	100	165	100	85	100	129	100
3.	Roof								
	• Genteng	13	48	69	84	70	82.4	114	88.4
	• Zinc	14	52	13	16	15	17.6	15	11.6
	TOTAL	27	100	82	100	85	100	129	100
4.	Door of House								
	• The front & rear doors are in line and lead to the river	6	46.15	3	30	7	38.8	1	12.5
	• The front & rear door position is not in line and leads to the river	6	46.15	5	50	8	44.4	4	50
	• Front, rear and side doors to the river	1	7.7	2	20	3	16.5	3	37.5
	TOTAL	13	100	10	100	18	100	8	100
5.	Floor of Stilt House								
	• The floor has kekijing and still has under the stage	0	0	0	0	0	0	3	37.5
	• The floor has kekijing and switch non stage	10	76.9	1	10	7	38	1	12.5
	• There is no possession of kekijing and switch non-stage	3	23.1	9	90	11	62	4	50
	TOTAL	13	100	10	100	18	100	8	100

Changes in settlement orientation affect the development of the life of the riverbank community. Adaptation to the water environment is an effort by the community in responding to the existence of rivers governed by nature. Forms of adaptation of houses on stilts to the geographical conditions of the river, characterized by several physical aspects of the houses on the river banks, namely from each of the elements forming other houses such as the stage floor, walls, doors and roof.

Morphology of Development of Functional Under Stilt Houses

The morphology of the development of under floor functions is characteristic of the physical aspects of a stilt house, the function under the house of a stage is influenced by the height of the pillars or pillars of the house, which then functioned as space.

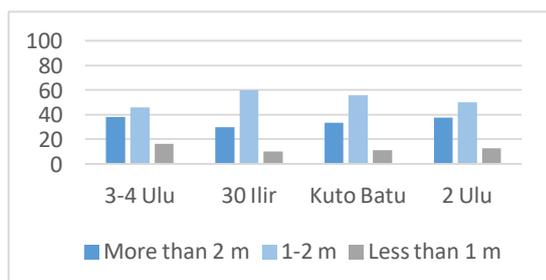


Fig.6 The Hight of pile of the stilt house

In Figure 6, a sample of the height of the house from the ground level in each case study location is described, the average height of the supporting pillar under the house that can be used as a space is around 1-2 meters or more than 2 meters, while under the house less than 1 meter is left empty or functioned as a warehouse or a place to store pets.

Forms of Changes in the Function Under the Stage Houses into Space and Materials Used

The presence of land space, making the development of the stage house became land oriented. In addition to the development and growth of family and kinship structures, as well as the economy, the community of the Musi River edge settlements requires a wider and more diverse space than before. For house expansion (additional space) the community conducts fencing or functions in the area under the house as space. Functional changes of under the house into various functions, such as residential, boarding houses, commercial or other functions. The description on the research location can be seen in the following pictures:



Table. 2 Physical Changes of Stilt House

NO	Stilt House in Study Area	Change of Stilt House in Study Area
1.	Area 3-4 Ulu 	Type of Addition functional space under stilt house as a residence of relatives and relatives and become material perenenen / characterized by land houses.
2	Area 2 Ulu 	Addition of function space at the bottom of the stilt house as dwelling and family dwelling and home orientation to land
3	Area KutoBatu 	Addition of function space at the bottom of the stilt house as dwelling and commercial and house orientation to land
4	Area 30 Ilir 	Addition of function space at the bottom of the stilt house as a dwelling.

4.3. Morphological Changes in the Development of the Space under the Stilt Houses

In several case study locations, changes in the morphology of the space under the stilt house on the riverside Musi generally functioned as a residence, but there were also those that combined it to become a place for producing goods, commercial or rental homes. The following is an illustration that shows the morphological layout of the development of a space under several space functions.

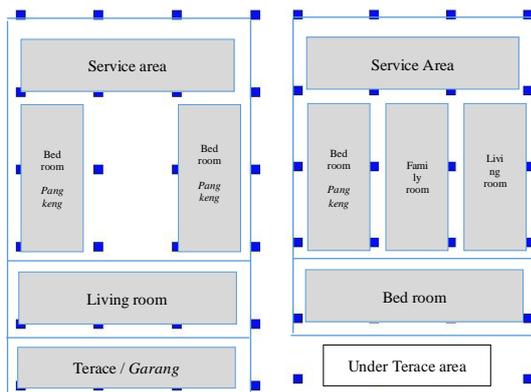


Fig.7 Functional lay-out of under stilt house, (Type 1)

Development of type 1, Functioning under the middle section into a new dwelling for family or relatives

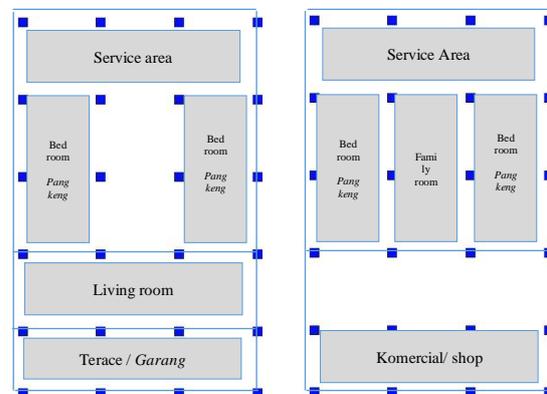


Fig.8 Functional lay-out of under stilt house, (Type 2)

Development of type 2, Functioning under the house into a residence combined



with commercial and other service activities.

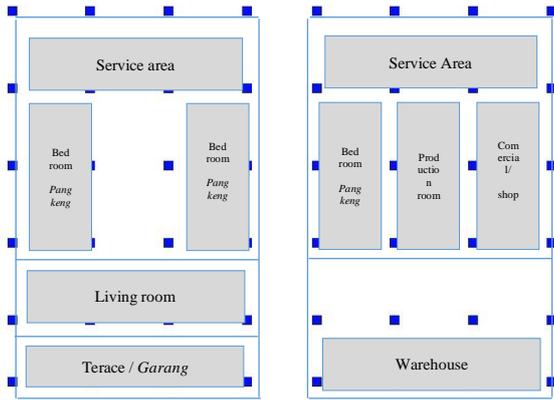


Fig. 9 Functional lay-out of under stilt house, (Type 3)

Development of type 3, Closing all parts under the house into a service function, which is to become a commercial place and production site.



Fig. 10 Activities from Occupancy of the house that functions as a house production

Changes in the space under the stage house into several other functions, making the loss of identity as a riverside settlement because both the physical house and the activities of the dominant community are oriented to the road, and the river becomes the back area and does not provide benefits to the community.

Based on the explanation above, it gives an overview of the steps of developing an area under the house which shows the organization of the space under the following:

Table. 3 Space organization of under stilt house

N o.	Name of Space	of Activities	Location	Character of the space
1	Under Space	Ruang Sosialisasi	The front right side of the house	Semi Public
2		Rest/ Sleep	The Middle side	Private
3		Family Room	The Middle side	Private
4		Commercial	The front side / side of house	Public
5		Goods Production	The middle side and back side	Service
6		Cook, eat	The back side	Service
7		Toilet	The back side	Service

The change in morphology of development on the Musi riverside houses on stilts is evident in changes in the shape of houses characterized by land houses, this is influenced by social and economic factors of the community, but good quality wood materials are difficult to obtain, making people choose to use permanent materials.

But on the other hand, there is also a change in the morphology of the house due to the factor of ownership of the house with residents who are not from the family.



Fig. 11 Physical changes of the Limas house into a modern house

In Figure 11 is a change in the physical elements of the house. The change in building material to fabrication or permanent in the Musi river bank community homes became dominant in the environment. This tendency has an impact on the loss of the identity of the house as a traditional house on the banks of the Palembang River, which was originally in the form of a stage to be characterized by land dwelling.



Fig. 12 Environment changes of the settlement to the land



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Environmental problems that will arise from the dominant residential land or permanent characteristics, namely the reduction of water catchment areas, so that when the tidal river water will inhibit the circulation of water space movement. This phenomenon causes the volume of water to rise close to the floor of a house. This problem will be affected by flooding at some point on the river bank. The

impact of climate change is also a threat to land dwelling and government policies that do not limit the use of permanent material rather than using material from nature that should prioritize sustainable housing which will have a reciprocal impact between buildings and the environment, humans and the environment on the banks of the Musiriver.

Table. 4Initial Conditions Morphological Formation of houses on stilts

ElemenVariabel	Elements of Stilt Houses at the Beginning of Establishment Conditions
Height of the support poles	- The condition of the soil surface on the banks of the Musiriver influences the height of the poles in the settlement layer.
	- Building structures using conventional systems using wood material
Environment	- The dwelling environment is connected via waterways / rivers and <i>jerambah</i>
Activity	- The residence on the upper part of the stage of the house and the bottom as a place to put the boat
	- Trade houses with the mode of water transportation.
Network	- Main route through river and creeks
	- Jerambah wood as a road between houses

Table. 5Conditions of Morphological Change on stilts on the banks of the Musi River

ElemenVariabel	Elements of a Stilt House in the Formation of Changing Conditions
Height of the support poles	- The height of the space under the house on stilts which is more than 1 meter is used as space.
	- Changing the material on the floor of the house and supporting poles into concrete because it is difficult to get good quality wood.
Environment	- The home environment is very tight and congested even some parts of the riverbank are buried.
Activity	- In some riverside houses in the settlement layer, the function of the basement is as a residence, commercial, production place and rental house
Network	- Main roads are land routes or environmental roads
	- Tributary pathways are no longer used as residential waterways.
	- Add concrete as a road between houses

V. CONCLUSION

Conclusions from the results and discussion based on research (1) in the early community, the house on the banks of the Musi River Palembang provided a natural air flow facility from the bottom / under the house so as to minimize the humidity under the stage. The soil under the stage becomes dry, so the moist air does not rise to the floor of the stage house and is a form of adaptation of the tidal water space. (2) Changes in the morphology of the development of the space under the stage house become a function of space

for the occupants, namely as the occupation of family and relatives, as a commercial place and place of production, as a rental / boarding house, and so on. (3) Changes in wood material into fabrication or concrete materials occur in some of the stilt houses on the banks of the river Musi, physical stilts. The stage of house development to function under the house morphology is adjusted to the needs and capabilities of the homeowner.

From the data above, it can be seen if the priority of



housing development towards the bottom is for the needs of family housing and service activities. This is done because it is related to security and ease of socialization and dominant activities on land.

AUTHORS' CONTRIBUTIONS

The author combines the design and implementation of research, including data collection techniques and data analysis. Furthermore, the writer reads, observes, edits, interviews and approves this manuscript related to the change of function under the stage of the Riverside Musi Palembang

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REFERENCES

1. Angkasa, Z. (2016). Tipologi Atap Pada Rumah Vernakular di Sumatera Selatan. Prosiding Seminar Nasional 2016. Kearifan lokal dalam perspektif global. Universitas Muhammadiyah Palembang
2. Asmal, Idawarni. (2015). Penambahan Fungsi Ruang Kolong dan Pengaruhnya pada Penggunaan Material Studi Kasus: Desa Nelayan Pantai Bahari, Kecamatan Bangkala, Jeneponto, Sulawesi Selatan. Prosiding Temu Ilmiah IPLBI. Fakultas Teknik Arsitektur. Unuversitas Hasannudin
3. Creswell, J. W. (2008). *Research Design: Qualitative, Quantitative and Mixed Approaches (3rd Edition)*. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. <https://doi.org/10.2307/1523157>
4. Dovey, K (2014). *Sustainable Informal Settlements?*. International Conference Green Architecture for Sustainable Living and Environment (GASLE). *Procedia-Social and Behavioral Sciences* 179 (2015) 5-13
5. Groat, L., & Wang, D. (2004). *Architectural Research Methods*. *Nexus Network Journal*. <https://doi.org/10.1007/s00004-004-0006-7>
6. Hidayat, Husnul (2014). *Konteks Ekologi Kota Tepian Sungai dalam Perspektif Lokalitas Bahan Bangunan*. Architecture Event 2014 (Membangun Karakter Kota dengan Lokalitas, Universitas Sriwijaya
7. Koentjaraningrat. (1981). *Pengantar Antropologi*. Jakarta: Rineka Cipta.
8. Mentayani, I., Nuryanti, W., Prayitno, B. dan Sarwadi, A. (2010). Aspek-aspek Tipomorfologi Permukiman Tepi Sungai : Kasus Permukiman Tepi Sungai Kota Banjarmasin, 1–9.
9. Mentayani, I. (2016). Identitas dan Eksistensi Permukiman Tepi Sungai di Banjarmasin. *Seminar Nasional 2016*.
10. Oliver, P. (1997). *Encyclopedia of vernacular architecture of the world*. (P. Oliver, Ed.) (3rd editio). Cambridge University Press.
11. Rapoport, A. (1969). *House Form and Culture*. Englewood Cliffs, N.J.: Prentice Hall
12. Rapoport, A. (1990). *The Meaning of the Built Environment : A Nonverbal Communication Approach*. The University of Arizona Press.
13. Siswanto, Ari. (1999). *Vernacular Settlement of South Sumatera as an Answer to Settlement Problem Arisen Today in Vernacular Settlement; The Role of Local Knowledge in Environment*. Seminar Proceeding. Depok; UI
14. Sari, I. K. (2013). *Perubahan Arsitektur Permukiman Kampung Beting, Kota Pontianak*. Universitas Gadjah Mada.
15. Taal, S. (2003). Change in Diversification in form and function of the Limas House of Palembang. In *Indonesian Houses Vol.1* (pp. 195–215). KITLV Press.