

Study on urban spatial pattern of riverside settlement, case study: Musi riverside, Palembang

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Abstract. The riverside settlements in Palembang are located in wetlands in that form of tidal swamps. This natural condition affects the formation of the urban spatial pattern because all local people activities are carried out on swamp land. Studies on the urban spatial pattern of riverside settlements are intended to obtain the consideration in wetland urban spatial planning, especially in Zoning Regulations, as a tool in building permission. The research method is a case study method consisting of field research and questionnaires distribution to the local community. The location take place in three riverside settlements. The analysis uses descriptive analysis for field surveys result. The analysis shows that the riverside settlements have unique characteristics because most of the people activities are take place above the water. The boundaries of neighborhood units are formed by rivers and roads. The pattern of villages and buildings has two orientations, the road and to the river. The urban spatial patterns in riverside settlement consist of three patterns, they are linear patterns, grid patterns, cluster patterns and combinations, due to the natural conditions and the limitations of the material used to form the structure of the road. Buildings and roads in the area are made above the water (on stilts structure), and the height of the stilts considering the water level at the highest tide. The results of this study can be used as consideration in determining the design criteria of urban spatial planning in the riverside settlement.

Keywords: spatial patterns, settlements, river banks

1. Introduction

Palembang municipality is the capital of South Sumatera Province. Palembang divided into two area by Musi River, namely Seberang ulu and Seberang Ilir. There many heritage settlement along the riverside, since the river was a main transportation at the past. The riverside area growing and developing into big settlement with high population growth, both from indigenous people and immigrants. These riverside settlements cover a large area and the fast development settlement tend to be slum area. In Palembang there are about 59 urban kampung which categorized as slum areas (Fitriawijaya, 2016).

Two of the riverside settlements 3: 3-4 Ulu and 35 Ilir. Each areas represented settlements in Seberang Ulu and in Seberang Ilir, 3-4 Ulu represented Seberang Ulu riverside settlement and 35 Ilir represented Seberang Ilir riverside settlement. Those two riverside settlement have the similar physical characteristic, they are located on the Musi riverside and affected by tides. The two settlements are also included the old settlements. In 3-4 Ulu, many migrants built their houses leading

to the river banks connected with existing settlements. New settlements that were built by migrants tend to be irregular and bad condition. While in 35 Ilir, only a few migrants built their houses on this area, but the settlement also became irregular form due to the limited land.

The urban designing of the riverside settlements requires various considerations from various aspects. Riverside environment is one of the important aspects that important to be considered in urban designing and planning (1)(2)(3)(4). While Bayu(5), Qureshi(6) and Shams (7) argue that the socio-cultural aspects of society also influence the urban designing and planning. The consideration of physical aspects and non-physical aspects in determining urban design criteria will improve the structuring of performance. This research will be used to determine urban design criteria for riverside settlements on wetlands, especially on the riverbanks of Musi River. This urban design criteria then became one of elements for making urban spatial models. This criterion also can be used in determining special rules in Zoning Regulations as a tool in spatial patterns and building permits regulation. In zoning regulations there are several important elements to be regulated related to the sustainability that affected by tides. These elements include land use, building mass management, circulation and open space(8)(9)(10)(11).

1 Methods

The research method is a case study method consisting of field research and questionnaires distribution to the local community. The location take place in two riverside settlements, They are 3-4 Ulu and 35 Ilir. The analysis uses descriptive analysis for field surveys result.

3. Discussion

3.1. Physical and Natural Conditions of Riverside Settlements

Riverbank settlements in Palembang City have special characteristics, because most of the area is covered by tidal land. The tidal area found almost along the Musi riverbanks, especially in Seberang Ulu settlements. Two of the tidal settlements at Musi riverside are on 3-4 Ulu and 35 Ilir. The water from the rivers can reach more than half of the riverside settlement areas. The tides has a certain cycle, which the highest tide is every five years. The local people in tidal settlement have their own uniqueness because all activities adjust to the natural conditions.

This natural condition affects the formation of the urban space. Urban rivers have a key ecological and social role in a wider urban system. This ecological function will be included as one of the urban design criteria. This natural condition also affects the shape of urban space. Population activities in public spaces have limitations, because there is few space that can be trampled on and limited spaces for circulation. This is in accordance with Doxiadis's Theory that the form of settlement patterns is usually the result of various factors that shape it(12)(13). In other words, the form of settlements consists of content, namely humans both individually and in society and containers, namely the physical environment of settlements.

Physically the riverside settlements in Palembang are boundaried main road and the Musi river on the other hand. Between the road and the river there are several small river which are also use as administrative boundaries (figure 1).

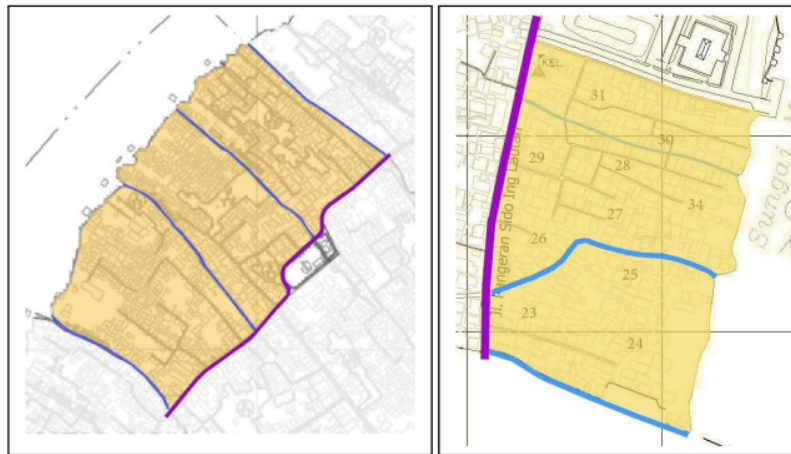


Figure 1. The boundaries of riverside settlement in 3-4 Ulu and 35 Ilir Palembang

In riverside settlements, the buildings that located on the main road are mostly landed houses, while the buildings on the setback are stilt houses, and the height of the stilts are adjusting the highest water tides level. The left and right side of the main road are mostly reclaimed and the buildings usually use as education facilities, health facilities, religious facilities, stalls and shops (figure 2).

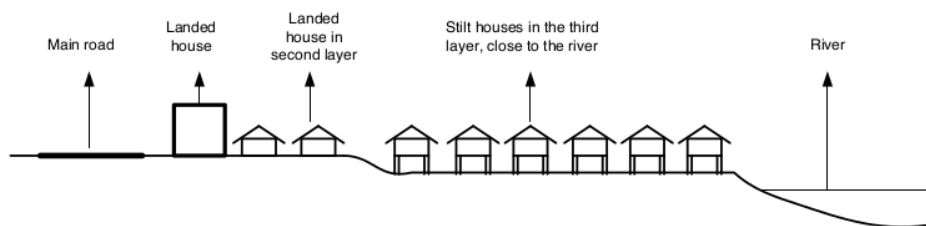


Figure 2. Physical condition of riverside settlement

In general, the physical conditions in riverside settlements are: (1) riverside settlements have physical borders, they are main roads and large rivers, and small rivers between them; (2) the distance between the main road and the river is around 200-400 meters; and (3) The area close to the road has been reclaimed while the area on the second layer is still a tidal swamp. These physical constraints will be a limitation in constructing the spatial pattern of urban design.

1.2. Social Aspects

Related the social aspect, there are significant differences between local people of the settlements in Seberang Ulu and Seberang Ilir. In the Seberang Ulu, there are many migrants from the area around the Palembang city, as well as the indigenous population. Most indigenous people occupied old houses from generation to generation, while migrants built their houses towards the riverbank by connecting pathways to the existing road environments. While in Seberang Ilir, the majority of the population of riverside settlement are indigenous people who have lived in the area for a long time.

Beside there is a different level of education and livelihoods. Most residents in Seberang Ulu have low education level and work in the informal sector. While in Seberang Ilir they have higher education level and people works in the formal sector. These two differences influence the settlements physical form. This is related to Doxiadis's theory that the urban pattern form is usually the result of various factors that forming it (14).

From time to time, in the process, the local population has begun to adjust the physical conditions of nature in the forming the riverside settlement. It is seen by the way they built their house. They built their houses on stilts, and because they have limited open space, they also add the veranda in each house. Aside from being a transitional space, this veranda also functions as a socialization space with neighbors. Some residents also use the veranda as a workspace.

3.3. People activities

Population activities in both research locations can generally be divided into three categories, namely daily activities, optional activities and social activities(15). The daily activities generally include three groups of main activities, they are: (1) Daily activities such as cooking, eating, sleeping, receiving guests, gathering with family, washing, drying, bathing; (2) Socializing with neighbors and community activities; and (3) Ceremonial activities such as weddings, circumcisions, marriage. Beside, in Seberang Ulu settlements local people also carry out economic activities around their homes, such as making crackers and crafts from nipah leaves. This activity is take place in public spaces, such as drying crackers on the roadside or in spaces between buildings. Beside those activities, local people also carry out activities in their neighborhood to earn income, such as selling, fishing, making boats and others. These activities shows that there is a strong connection between the daily people activities and the settlement, especially on the riverbanks.

The settlement environment is the most widely used for women for social interaction. Therefore urban spaces in residential areas must be comfortable to fulfill those needs. In the riverside settlement, urban spaces are also needed to set up the space for social interaction activities, especially by women, who spend most of their daily time around their homes. The design of the urban space must consider these requirements.

3.4. Settlement pattern

The physical boundary of each residential unit is bordered by the main road, a large river and two small rivers which lead to a large river. This is what distinguishes riverside settlements from other settlements in Palembang. Riverside settlements have begun to change the orientation from river to land(16). This also influence the settlement pattern. However, in two case studies, there was still a strong connection between the settlement area and the river.

From the results of the field survey it shows that the spatial pattern in 3-4 Ulu and 35 Ilir have almost the similar pattern. The spatial pattern in both settlements can be divided into three patterns, they are linear patterns, grid patterns and cluster patterns. The formation of three patterns shows that they are organic and unplanned. People built their houses in several layers, starting with the main transportation channel. These patterns are the same as the characteristics of traditional settlement patterns.

The linear, grid and cluster pattern can be found on 3-4 Ulu and 35 Ilir but in an irregular pattern, that influence by the wood material for the path of movement. This wooden walkway creates a straight pattern and interconnected that forming a linear pattern, grid pattern and cluster pattern or combination between them. The wooden walkway on stilt structure then turned into a reinforced concrete structure, also on stilts.

2.4.1. Linear pattern

The most common urban space patterns in riverside settlements are linear patterns. This pattern is also commonly found in a number of traditional settlements(17)(18). The linear pattern follows the path of the roads and alleys. This pattern has actually been used for a long time in swamp settlements, because

the **growth** of settlements followed existing roads or connected to existing roads. The houses orientation is to the circulation path. But sometimes the pathway passes next to a house.

The linear pattern is divided in two patterns, they are a one side linear pattern and a two-sided linear pattern. In a linear pattern one side of the building is on one side of the road, while in a two-sided linear pattern, the building is on both sides of the road. This linear pattern is widely used in riverside settlements where the straight pathway connect one to another and also connect to the river.

3.4.2. Grid Pattern

Grid patterns are an extension of linear patterns. The formation of this pattern is a combination of several road lines (main road and alleys) that form a grid pattern. This pattern is more efficient in land use and circulation. In riverside settlements, this grid pattern connects the main road to the river. At the meeting point between the road and the river there is a boat dock. The connection between the land and river circulation paths gives a unique pattern of riverside settlements. The existence of boat dock at each end of the meeting point reflects the people of the riverside settlements still utilizing the river as one of the transportation moda.

3.4.3. Cluster Patterns

This pattern is usually used in small environmental units. This culter pattern is made by a large family group who want their family to live not far from each other. In the middle of a houses group there will usually be open spaces that become communal spaces. This open space has many functions, it can be a space for socialization and ceremonial space. Houses in this pattern surround open spaces and face open spaces as the front. This grouping pattern usually tends to be closed and access to other residential units is limited.

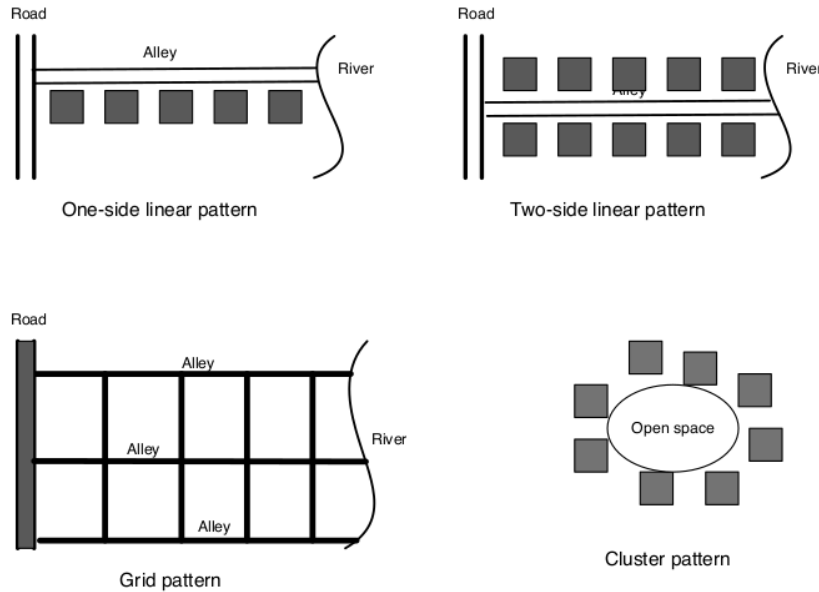


Figure 3. Spatial pattern of riverside settlement

3.5. *The Settlement Orientation*

Both in 3-4 Ulu and 35 Ilir, have two orientations, landed orientation and river orientation. Settlements with landed (road) orientation are usually on the edge of a large road with several characteristics: (1) the main road is the main orientation of all walkways and buildings; (2) the buildings on the back layer connected to the road with a path that formed by wood which was later renovated into a concrete bridge while still using the stilt structure; (3) The settlement pattern use a combination of grid patterns and linear patterns; and (4) only few dependance to the river, especially in terms of transportation.

While settlements that orientation to the river are the beginning orientation settlement in Palembang, because once the river was the main transportation moda. In this type, the building orientation is to the river and usually in each environmental unit has a small dock at the meeting point between alleys and river, a place for boat.

3.6. *Element Urban Spatial Pattern*

Elements of urban spatial in riverside settlements include land use, building masst, circulation and open space. These elements are different from Lisa(19) and Qomarun (9), but in line with the theory of Shirvani(8) who called it a physical element of the city.

5 3.6.1. *Land use*

Land use is the basic element for urban design, because space allocations for activities will be based on land use arrangements. Land use regulation cause more efficiency and effectiveness of land use, considering that urban land is an increase in value every year. To achieve effective land use, it is necessary to apply land use diversification. Of course the dominance of land use still refers to urban planning of Palembang City.

Diversification in land use allows for the flexibility of activities permitted in the area. As an area designated for settlements, other activities that are permitted there are those that support settlement activities. Structuring land use also considers the need for space for the activities of its population. For example, open space also needs to be allocated specifically to meet the needs of the population for social interaction. This open space can be placed on the meeting point the road and alleys or at several meeting nodes between the path and the riverside area.

From the results of questionare, there were differences in people opinions about land use. At 3-4 Ulu land use is in second rank after circulation, while at 35 Ilir land use is the most important thing in urban design. This is understandable because in 3-4 Ulu circulation is the most important problem for increasing settlement access. Whereas in 35 Ilir land use is considered important because it is the basis for the activities on it.

3.6.2. *Building Mass*

The intensity of the building analysis is the most important in building mass regulation, as well as the analysis of building structure, analysis of building distance and the building orientation pattern that is associated with the existence of roads and rivers. Calculation of building distance includes the distance between buildings with each other, the distance between buildings and roads, the distance between buildings and paths and the distance between buildings and rivers.

The distance between buildings is very tight and causes a lack of healthy living environment. This is because under the house becomes exposed to the sun well and becomes moist, so many mosquitoes inhabit the underwater area. This is also exacerbated by unhealthy ways of life, such as throwing garbage or household waste under the house.

In order to set up the building distance, there are number of things to be considered: (1) Safety against fire hazards, because most of the houses material use flammable wood; (2) The natural lighting from the sun needs to be calculate so that the underside the house remains exposed to sunlight and not

moist; (3) Building thickness arrangement, because it will affect the irradiated area and the area covered by shadows; and (4) Arrangement of the height of the building stilt structure, because it will affect the area under the sun. Setting this stilt height is also influenced by the height of the water level at the highest tide.

The distance between buildings and rivers follows the rules of river border boundaries for residential areas, about 15 metres from the river bank at the highest tide for large rivers. While for small river the distance buildings and the river banks is at least 3 metres from the edge of the embankment. The river is used as a waterfront and not the backyard of the building. Building arrangements will reduce interference with the river itself. Until to date the river which initially became the front of the building has turned into the back and tends to become slum. Expansion of the building also caused the river banks to become unclear.

3.6.3. Circulation

In riverbank settlements there are two main circulation paths, road and river paths. Between these two circulation paths are usually connected with small roads or alleys. At each meeting of alleys and river usually there is a boat dock and stairs to go down to the river. Local residents sometimes still often use the river as a toilet facility (bath, wash, toilet) on the stairs. There is strong connectivity between road and river path. Changes in modes of transportation from river transportation to road reduce the river functions as a circulation path. But in riverside settlements, rivers are still an alternative circulation path.

3.6.4. Open space

Open space in riverside settlements is different from on landed settlement. Open space includes movement paths (roads, bushes, rivers) and spaces between buildings. Open space which is a public space is mainly located in an area that can be 'trampled', meaning that there are limited spaces for open spaces. These open spaces in this settlement include main road and alleys on stilt structures. Other open spaces are spaces between buildings that tidal area which when the tidal season is flooded and when the dry season becomes 'land'. To fulfil the need of open space, sometimes local people try to 'widen' the land, by adding a platform from some wood on stilt. Beside, the veranda also be an important part of the house as a place to socialize with their neighbors.

4 Conclusion

The boundaries of neighborhood units are formed by rivers and roads. The pattern of villages and buildings has two orientations, to the road and the river. The urban spatial patterns in riverside settlement consist of several patterns, they are linear patterns, grid patterns, cluster patterns and combinations, due to the natural conditions and the limitations of the material used to the structure of the road. Buildings and roads in the area are made above the water (on stilts structure), and the height of the stilts considering the water level at the highest tide.

There are four elements of urban spatial pattern that necessary to be consider in urban designing, they are land use, building mass, circulation and open space. All of the spatial pattern elements have different characteristic compared with the other settlements. The results of this study can be used as consideration in determining the design criteria of urban spatial designing in the riverside settlement.

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