Understanding the Relationship between Urban Morphology and Crime in South Krembangan, Surabaya

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DOI: 10.29322/IJSRP.8.6.2018.p7929
http://dx.doi.org/10.29322/IJSRP.8.6.2018.p7929

Abstract **-** Crime has a diverse understanding and conception of various disciplines related to spatial and social aspects. In the architecture and and urban design itself, the concept of crime is concerned with the spatial aspects, in this case is urban morphology and functional attributes of a city. In Surabaya, the highest crime rate is located in South Krembangan. South Krembangan is a area with high historical value but has a criminal problem. Therefore, the purpose of this study is to identify and analyze the morphology of the area to see how it relates to the crime. Based on field observations and typological-morphological analysis results, it is known that there is a tendency for the relationship of each typology to be found with the number of crimes that occurred, that the more public and accessible the area, the higher crime occurs.

Index Terms- Crime, Urban Design, Urban Morphology.

I. Introduction

Crime or criminality is a phenomenon that is very close to people's lives, especially in a big cities in Indonesia. It has a diverse understanding and conception of various disciplines such as sociology, environmental psychology, criminology, as well as design. This shows that the crime have a broad articulation in relation to the form or shape of the built environment of the city. In sociology, psychology, and criminology, an understanding of crime is closely related to the social aspect or sociality. While in the field of architecture and urban design, the concept of crime is more associated with the spatial aspect or space within a city. The spatial aspects including design patterns and spatial configurations including urban morphology and functional attributes of a city [1].

As the second largest city in Indonesia, Surabaya has criminal problems like big cities in general. Based on data from the Surabaya 2015-2016 police report, the crimes committed in Surabaya are spread out but tend to concentrate on Krembangan District. In this study the types of crime focused on crimes related to urban environments such as theft, theft with violence and violence in public places. The distribution of the crime scene map in Krembangan Sub-District is shown in Figure 1. From the map, it can be seen that the distribution of crime in Krembangan Sub-District tends to be centered in the southern part (South Krembangan). Therefore, in this study the authors choose South Krembangan Sub-District as a focus area of research.

Figure 1. Crime Distribution of Krembangan District

South Krembangan has grid-shaped street pattern where the area can be reached from various sides. This area which was once the center of activities and settlements of Dutch citizens, is now a cultural heritage area that has lost its vitality[2]. Colonial buildings that used to have functions as settlements and government buildings have now turned function as trade and services, warehouses, and neglected buildings. As a result, the area is only active during the day and becomes quiet at night. Areas that have easy access but are not supported with sufficient activity can increase the potential for crime [3].

Based on empirical facts above, the phenomenon of a crime /criminality in Surabaya centered at a specific point, shows that criminals are more likely to "choose" a location where it can be easily and safely perform the action. Based on the theories and facts described above, it is necessary to identify what kind of environment / location the criminals prefer and facilitate their action.

II. Research Elaborations

To obtain actual knowledge about the physical setting and crime relationships, in general, this research focuses on the theories of urban morphology and crime. Aspects of the research are associated with elements of urban morphology (land uses, plot pattern, street pattern and building structure) [4], and

analyzed it using typological-morphological analysis. The main objectives of this process of analysis are [5]:

1. To find the stability and/or slow changes of the things that form one type of object architecture studied.
2. To create a description of the typology shown by various city artifacts such as roads, buildings, public space, and others.
3. To identify the structure of linkages and/relationships between parts of the city.
4. To study the formation and dynamics of the type and structure of architectural objects studied.

Data collection in the study is divided into two parts, among them are:

Table 1 Data Collection Techniques

Observation (as main data)	Visits to the location intensively to observe the physical form of the environment and conduct survey institutions in Surabaya Police Headquarters to obtain crime rate data in Surabaya.
Interviews (as supporting data)	Interviews for residents and strangers to find out where the location that crime often occurs and cause fear of crime.

III. Results and Findings

A. *Administrative Boundary of the Study Area*

Administratively, Krembangan Selatan Sub-district is included in Krembangan District, Development Unit (UP) V Tanjung Perak. In RTRW Surabaya 2015 UP V has the main functions as a port, military area, strategic industrial area, and trade and services.

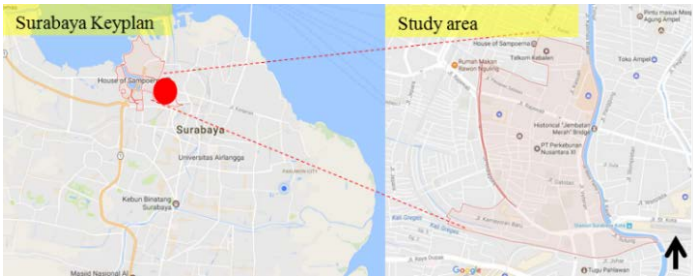


Figure 2. Administrative Boundary of Study Area

South Krembangan Sub-district has administrative boundaries as follows:

- North Boundary: Nelayan Street and Sampoerna Street
- South Boundary: Bubutan Sub-district
- East Boundary: Kalimas River
- West Boundary: Indrapura Street

B. *Crime Distribution in Study Area*

Figure 3. Crime Distribution map of South Krembangan

C. *Typological-Morphological Analysis*

Typological-morphological analysis (typology and morphology) is an analysis that focuses on urban tissue / urban fabric structure. Urban tissue can be described as a set of rules, which is described as a unique combination of existing morphological components of land use - plot patterns – street patterns - building structures [7].

1. *Land Uses*

Land use is a key component in the region's growth. This component is considered as an activity system generator (activity system) that determines the pattern and direction of growth of the region [6].

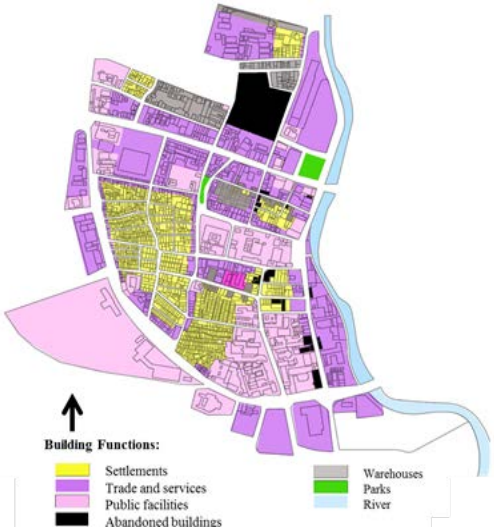


Figure 4. Land Uses of Study Area

Based on Figure 4 it can be seen that the study area has diverse land uses, but there are three dominant land use functions, that is trade and services, public facilities and settlements. Trade and services mostly located in the north (Rajawali and Veteran corridors) and perimeter segments of residential areas. Public facilities mostly in the south (Indrapura, Kepanjen and Sikatan corridors), and settlements located in the eastern part. While the use of land with small

portions in this area is the Park and warehousing located in the north.

In relation to the crime, the land use map and crime distribution are overlaid as follows:

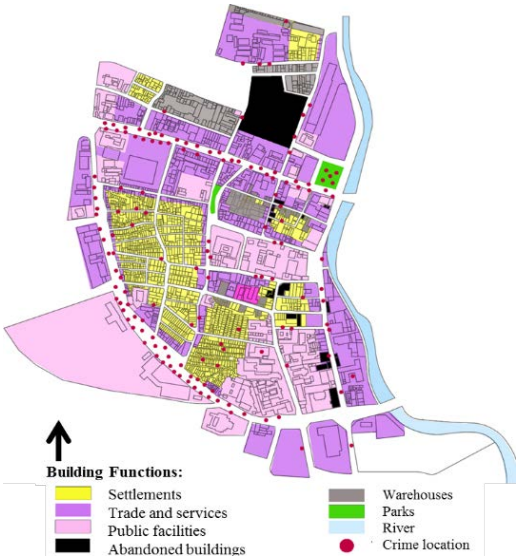


Figure 5. Overlaid map of Land Uses and Crime Distribution

From the map it is found that out of 144 reported crimes, most occured around public areas, that is service trade and public facilities 113 cases (78.5%) , while the rest in the settlements area 15 cases (10.4%), warehousing 11cases (7.6%) and Open spaces 5 cases (3.5%). Because the open space has a small area and is partly as a passive park, the crimes that occur in this area can not be used as a reference.

2. *Plot Pattern*

The plot pattern or typology is a solid void configuration within an area [6]. Plot pattern in South Krembangan is currently dominated by grid pattern in the middle of the region, while in the south and east areas bordering the Kalimas River is curvilinear. Here is a figure-ground map development of South Krembangan Sub-district:

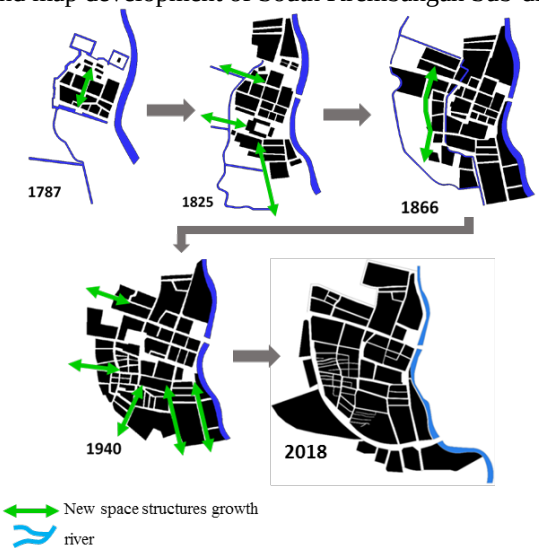


Figure 6. The Development of Plot Pattern in Study Area

The pattern of the plot was formed based on the development of the area that started since the Dutch East Indies government, where the initial form of the plot is grid. As the area widened, the grid shape adjusted to existing land with small rivers, thus creating a clipped grid shape that resembled a square and trapezoidal blend [8]. In addition, the development of the area that is right on the Kalimas River creates a curvilinear pattern. The solid void configuration in this region will affect the shape of the street pattern.

3. *Street Pattern*

The street pattern is a liaison system within the area. Based on the previously described solid void configuration, the road network formed within the grid-shaped region. Road network pattern in the form of grid, creating many intersections of roads within the area and causing the Village of South Krembangan has an "open" characteristic. It provides enough access options that can be taken by pedestrians or other road users to enter the area.

From the survey results, it found that the study area has 4 levels of hierarchy of streets namely, secondary artery street, secondary collector street, secondary local street, and neighborhood street. A street hierarchy is a grouping of roads based on: road function, government administration and axis loads involving vehicle dimensions and weight.

The street hierarchy within the study area marks a different level of privacy: public – semi-public – semi-private - private. Privacy in an urban environment is the process of arranging interactions with others aimed at increasing or decreasing interactions [9]. The level of privacy within the study area is affected by physical boundaries such as road hierarchy, road width, road material, and fences. Here is a map showing the street privacy within the study area:

Figure 7. Street Privacy Level Map of Study Area

Table 2 Street Privacy Typologies of Study Area

Typology	Characteristics
Public street	Public street is a secondary arterial road that has a high vehicle intensity with a width of road between 9-15 m with asphalt material. This road is a liaison within the city with easy access.
Semi-	Semi - public street are collector street and

Typology	Characteristics
Public Street	local street that exist in areas with road widths between 5-8m and using asphalt materials. The intensity of the vehicles and activities that occur is lower than the public street.
Semi-Private street	Semi-private street is a 3-6 m wide road with paving material. This street can be passed by the general public but because it uses paving material, vehicles users cannot pass this road at high speed.
Private street	Private street are 2-3.5 m wide roads whose access is limited only by locals by adding a fence to the entry area. This is done to minimize the entry of stranger into the area.

In relation to the crime, the street privacy map and crime distribution are overlaid as follows:

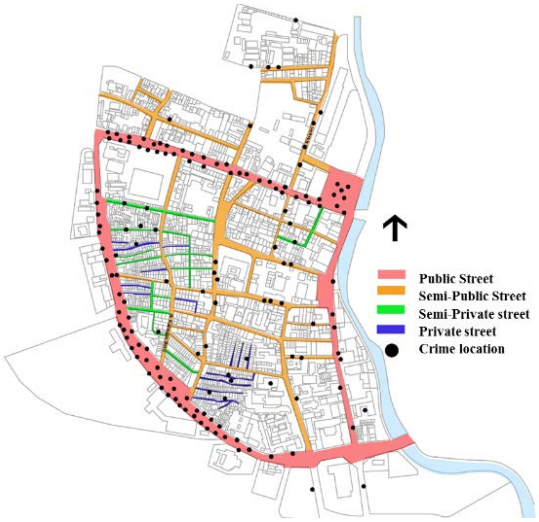


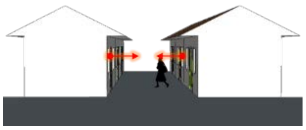
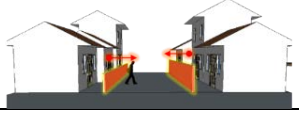
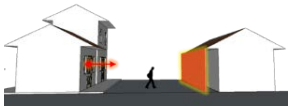
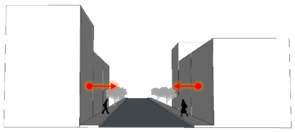
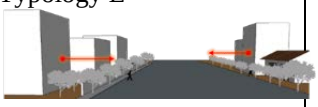
Figure 8. Overlaid map of Street Privacy Level and Crime Distribution

When viewed from overlay map of street privacy with the number of crimes that occurred (Figure 8) it was found that the most frequent crimes occurred on public roads were 95 cases (69.4%) , semi-public roads 31 cases (21.5%), semi private road 7 cases (4.9%) and private road 6 cases (4.2%).

4. Building Structures

Building Structure is discussed through two aspects: mass building arrangement and architecture of the building. Here is the typology of building structures in the area of study:

Table 3 Building Structure Typologies of Study Area

Typology	Descriptions
Typology A 	This typology is mostly located in residential areas. Comparison between height and width of the road creates a narrow and intimate atmosphere.
Typology B 	In this typology the balance is achieved between the building and the distance between them. Sense of enclosure can still be felt.
	There is a fence that can limit both public and private areas.
Typology C 	In this typology, the impression of the space that is formed is still balanced, but the road space is not well supervised due to the high wall that limits the building by road.
Typology D 	This typology has a wide path. With the availability of pedestrian way, then this typology becomes a room that is comfortable enough to walk, thus allowing a lot of pedestrian activity in it.
Typology E 	With a path that is too wide, the typology of this sense of enclosure is reduced so that supervision in the street space becomes increasingly decreased.

Here a building structure and crime distribution map of study area:

Figure 9. Overlaid map of Building Structure tipologies and Crime Distribution

Furthermore, in discussing the structure of buildings is important to assess the character of the region through the physical condition of the buildings that make up the area. The area of study that developed since the colonial era led to the many Dutch heritage buildings. The buildings there are still functioning and maintained, but there are also less well maintained even been abandoned or turned into a warehouse. Abandoned buildings are likely to cause fear of crime is a fear created by situations and circumstances that make people feel vulnerable to crime. Here is a map of the fear of crime depicted by local residents as well as foreigners within the study area:

Figure 10. Fear of Crime Map Drawn by Residents and Strangers

IV. Conclusions

Based on the typo-morphological analysis that has been done, it found that there are relationship between morphological elements and the number of crimes available. Here is a table of land use, street typologies and building structures typologies in relation to the number of crimes that occurred.

Table 4. Grouping of typologies in relation to the intensity of crime that occurred

Physical Aspects	**Safe** (Crime Rate <10%)	**Less Secure** (10-30% Crime Rate)	**Unsafe** (Crime Rate> 30%)
Land Use	Warehousing	Settlements	Trade services and public facilities
Typology Level of Privacy	Semi Privat and Privat Streets	Semi Public Streets	Public Street
Building Structure Typology	Typology B	Tipology A and Tipology C	Tipology D and Tipology E

- The more public areas (trade in services and public facilities areas) the higher the crime. While in the warehouse area, although not have a high crime rate, but cause fear of crime (based on observation and interview).
- The lower the privacy of the road the higher the crime.
- While the pattern of relationship typology of building structures with crime can be influenced by several factors related to the level of supervision on the road and access control on buildings. Where the lower level of supervision on the road and access control on the building then the crime will be higher.

Acknowledgment

This publication based on Master Program Thesis which conducted in 2018, entitled “Designing the Area of South Krembangan Surabaya in Efforts to Solve Crime Issues.”

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