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**ANALYSIS OF PLANNING RESIDENTIAL DEVELOPMENT IN URBAN AREAS USING
SPATIAL ANALYSIS METHODS
(CASE STUDY : WEST SURABAYA)**

**Teguh Hariyanto and Cherie Bhakti Pribadi
Indonesia**

Abstract

Surabaya is one of the major cities in Indonesia which has a very strategic position both regionally and nationally. According to Central Bureau of Statistics the city of Surabaya in 2011, the sprawling city of Surabaya entirely ± 326.36 km² divided into 31 districts and 163 villages. According to Law No. 4 of 1992, the housing serves as a housing area or residential environment equipped with infrastructure and facilities. While the settlement is part of the environment outside the protected area, either in the form of an urban area or a rural area that serves as a living environment or residential environment and the activities that support life and livelihood.

The dynamics and the city is very high activity spurred the development of the city is very fast and the population growth is increasingly crowded. With the rapid growth of the population, as a source of land supply for housing development into the needs of each individual becomes increasingly limited. According to the Spatial Plan (RTRW) in Surabaya, the pattern of settlements in the city of Surabaya leads to the suburbs, such as in the western, eastern, and south of the city in the form of residential real estate. Therefore, in this study will be to analyze the development planning of housing in urban areas, especially in West Surabaya to determine the feasibility and suitability of land and environmental conditions at the site that will do the construction of housing proficiency level.

The land suitability map results be overlaid with detail spatial planning city data (RDTRK) maps of West Surabaya to determine the appropriate area to be used as residential development in accordance with the government policy to produce land suitability maps against detail spatial planning city data (RDTRK) map of West Surabaya. The result of land suitability map against detail spatial planning city data (RDTRK) map of West Surabaya then be overlaid with Existing map of west Surabaya in 2012.

The result of this research indicate that determination the feasibility and suitability of land for planning the development of residential areas resulted in the level of suitability of land for residential area dominated by the West Surabaya appropriate level amount 9399.550 Ha (81.17%) of the total area amount 11580.13 Ha in West Surabaya. Furthermore, The spatial use that appropriate to use as residential development area in West Surabaya located in the use of pond amount 1204.95 Ha, land use of green open space amount 1037.20 Ha, land use of vacant land amount 370.85 Ha and the land use of public facilities by 2.24 Ha.

Key words: Residential Area, Spatial Analysis, Land Use

INTRODUCTION

Surabaya is one of the major cities in Indonesia which has a very strategic position both regionally and nationally. According to Central Bureau of Statistics the city of Surabaya in 2011, the sprawling city of Surabaya entirely ± 326.36 km² divided into 31 districts and 163 villages. According to Law No. 4 of 1992, the housing serves as a housing area or residential environment equipped with infrastructure and facilities. While the settlement is part of the environment outside the protected area, either in the form of an urban area or a rural area that serves as a living environment or residential environment and the activities that support life

and livelihood. As well as under Section 28H of the 1945 Constitution, the home is one of the basic rights of the people and therefore every citizen has the right to reside and got a good environment and healthy. Besides the house is also a basic human need to enhance the dignity, the dignity, quality of life and livelihood, as well as personal self-reflection in order to improve the standard of living, as well as the formation of character, character and personality of the nation.

The dynamics and the city is very high activity spurred the development of the city is very fast and the population growth is increasingly crowded. With the rapid growth of the

population, as a source of land supply for housing development into the needs of each individual becomes increasingly limited. The transformation of land use in urban areas is often carried out in order to meet the housing needs for people are increasing. But the construction of such housing should always take into consideration environmental aspects and development sites in accordance with the spatial plan in order to create a balanced environment and the provision of facilities and infrastructure necessary to develop an efficient and integrated way, directed, planned and ongoing / continuous. According to the Spatial Plan (RTRW) in Surabaya, the pattern of settlements in the city of Surabaya leads to the suburbs, such as in the western, eastern, and south of the city in the form of residential real estate. Therefore, in this study will be to analyze the development planning of housing in urban areas, especially in West Surabaya to determine the feasibility and suitability of land and environmental conditions at the site that will do the construction of housing proficiency level.

MATERIALS AND METHOD

In order to achieve the aims of this research, the following tasks were performed : study area definition, data acquisition, Data processing, spatial analysis.

Study Area

Study area for this study is located in West Surabaya, Surabaya city, East Java, Indonesia with geographical location being on 7°13'22",238 south latitude - 7°14'44",476 south latitude and 112°35'29",605 east longitude - 112°43'3",973 east longitude.

Administratively, it is located in the district of Benowo, Pakal, Asemrowo, Sukomanunggal, Tandes, Sambikerep, Lakarsantri. It is bordered on the north by madura strait, on the south and west by district of Gresik, on the east by district of Wiyung, Sawahan, Dukuh Pakis, and Bubutan.

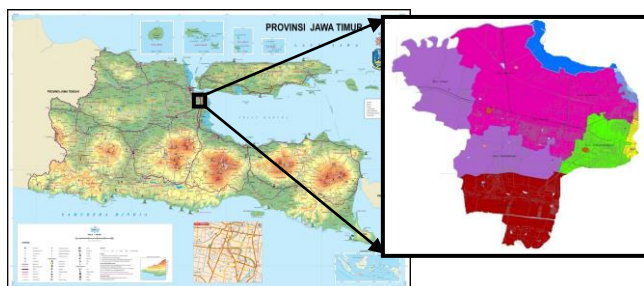


Fig. 1.Study area.

Data Acquisition

Parameter of land suitability for residential development in urban area such as detail spatial planning city data (RDTRK) in 2008 was obtained from Department of Public Works – Human Settlement and Spatial planning of Surabaya City, and some types of map Surabaya in 1992 as soil erosion map, land gradient map, inundation map, soil type map, soil texture map, soil effective depth map were obtained from Development Planning Agency at Sub-National Level.

Data Processing

Some maps that be used as parameter of land suitability for residential development in urban must be georeferencing before these few map use to next process. In this research, from some parameter was processed using overlay methods by using weighing according to scores and weights specified for residential development, the overlay process include:

- a. Overlay 1
Overlay of land slope map with soil erosion maps were processed to determines whether or not an area and soil erosion was used to produce map of land sensitivity
- b. Overlay 2
Result of overlay 1 was processed produce map of land sensitivity will be overlaid with soil type map where soil conditions become the basic foundation to be able to withstand the building
- c. Overlay 3
Result of overlay 2 was processed produce soil resistance map will be overlaid with soil texture map in which soil texture is closely related to the binding of water for plants
- d. Overlay 4
Result of overlay 3 was processed produce binding on groundwater map will be overlaid with a soil effective depth map which determines the penetration of plant roots that affect the amount of soil erosion by water
- e. Overlay 5
Result of overlay 4 will be overlaid with inundation map where inundation area is very influential on the surface of the water runoff can cause flood.

So from these process, land suitability maps have class results of four types of suitability land classes such as very appropriate, reasonably appropriate, appropriate, and very inappropriate.

Spatial Analysis

The land suitability map results be overlaid with detail spatial planning city data (RDTRK) maps of West Surabaya to determine the appropriate area to be used as residential development in accordance with the government policy to produce land suitability maps against detail spatial planning city data (RDTRK) map of West Surabaya.

The result of land suitability map against detail spatial planning city data (RDTRK) map of West Surabaya then be overlaid with Existing map of west Surabaya in 2012 to be used to adjust the land suitability of physical parameters and government policy with existing land use maps in 2012, it produce the settlement land suitability map of West Surabaya.

RESULTS AND DISCUSSION

Land Use

Land use at West Surabaya describe existing land condition in 2012. Distribution of each type of land use can be seen in the following table.

Table 1. Distribution od Each Type of Land Use

Land Use	Areas (Ha)	Areas (%)
Residential	4781.28	49.28
Public Facility	15.77	0.14
Vacant Land	1360.72	11.75
Pond	3185.84	27.51
Green Open Space	2087.79	18.03
Road	113.40	0.98
River	35.33	0.31
Total	11580.13	100

Table 1 describe land use in West Surabaya was dominated by residential area amount 4781.28 Ha (49.28 %), pond amount 3185.84 Ha (27.51%), Green Open Space amount 2087.79 Ha (18.03%), and vacant land amount 1360.72 Ha (11.75%).

Spatial Utilization

Spatial Utilization in this research as function of land based on detail spatial planning city data (RDTRK) West Surabaya. Pembagian fungsi lahan pada RDTRK Surabaya Barat dapat dilihat pada tabel berikut :

Table 2. Land Use Based on Detail Spatial Planning City Data (RDTRK) West Surabaya

Land Use	Areas (Ha)	Areas (%)
Residential	5828.68	50.33
Public Facility	265.57	2.29
Trade and Service	950.99	8.21
Factory	1844.46	15.93
Green Open Space	1418.74	12.25
Bozem	52.67	0.45
Road	942.70	8.14
River	210.36	1.82
Landfill	65.96	0.57
Total	11580.13	100

Table 2 tell us about pemanfaatan ruang dengan cakupan luas wilayah paling besar terdapat on function of residential area amount 5828.68 Ha (50.33%) from total area of Detail Spatial Planning City Data (RDTRK) West Surabaya amount 11580.13 Ha. Then, being located on funtion of factory area amount 1844.46 Ha (15.93%) and function of Green Open Space amount 1418.74 Ha (12.25%). Function of residential area dominate on district of Pakal, Benowo, Tandes, Sambikerep, Lakarsantri, and Sukomanunggal. Whereas on district of Asemrowo is dominated by function of factory area.

Land Suitability for Residential Development Area Using Weigthing and Scoring Methods

Residential land suitability was determined by using weighting and scoring methods on each of the physical parameters (degree of slope steepness, erosion rates, soil type, soil texture, soil effective depth, and drainage) and an overlay between the parameters for determining the suitability of land settlements. The weight were given to each variable depend on degree of influence to residential land use, while score were given to each sub variable depend on roleplay of residential land use. In this methods, it is determined by the size of the interest rate on residential land use.

From these overlay process generated a total score for each area which classified into four types of residential land suitability level where the highest total score describes the most appropriate of residential land suitability, and the lowest total score describes the most inappropriate of residential land suitability. The interval on each total score of each level land suitability is shown in the following table.

Table 3. Interval Grade Level Each Land Suitability

Level of Land Suitability	Score Total	Area (Ha)
Most Appropriate	66.75 – 72	4147.769
Appropriate	61.5 – 66.75	5251.78

Inappropriate	56.25 – 61.25	546.571
Most Inappropriate	51 – 56.25	1634.01

Table 3 shows that level most inappropriate of land suitability currently on the total score of 51 - 56.25 amount 1634.01 Ha, inappropriate of land suitability currently on the total score of 56.25 - 61.25 amount 546 571 Ha, appropriate of land suitability currently on the total score of 61.5 - 66.75 amount 5251.78 ha, and most appropriate of land suitability currently on the total score of 66.75 - 72 amount of 4147,769 ha. Thus, the level of residential land suitability in West Surabaya is dominated by the level of the most appropriate and appropriate in the amount of 9399.550 Ha (81.17%) from total area of amount 11580.13 Ha, Whereas levels inappropriate of land suitability amount of 2180,581 Ha (18.83%).

Land Suitability against Detail Spatial Planning City Data (RDTRK)

Determining the location of residential areas in West Surabaya was derived after the process of residential land suitability analysis by using weighting and scoring methods on the parameters were used. Analysis for determination of residential area in West Surabaya was derived by the overlay and buffer on a map land suitability that describe land suitability based on the physical parameters used (slope steepness, erosion rates, soil type, soil texture, effective depth of the soil, and drainage), availability of facilities and infrastructure, as well as government policy with maps of Detail Spatial Planning City Data (RDTRK) West Surabaya in 2008 to determine the location of planning residential development based on government policy. The results of analysis of land suitability of the Detail Spatial Planning City (RDTRK) West Surabaya is shown in the following table.

Table 4. Land Use of Residential Area Against Detail Spatial Planning City (RDTRK)

Land Use	Land Use Area				Land Appropriation on RDTRK (Ha)
	Appropriate		Inappropriate		
	(Ha)	(%)	(Ha)	(%)	
Residential	4575.50	78.50	1253.18	21.50	5828.68
Factory	1593.82	86.41	250.64	13.59	1844.46
Green Open Space	1086.54	76.58	332.20	23.42	1418.74
River	184.59	87.75	25.77	12.25	210.36
Trade	825.35	86.79	125.64	13.21	950.99
Road	781.32	82.88	161.38	17.12	942.70
Public Facility	256.03	96.41	9.54	3.59	265.57
Bozem	42.83	81.32	9.84	18.68	52.67
Landfill	65.96	100.00	-	-	65.96
Total					11,580.13

Table 4 show that appropriate land uses for determining the location of residential development against Detail Spatial Planning City (RDTRK) West Surabaya is residential sector amount 4575.50 Ha (78.50%) of the total area of residential area 5828.68 Ha where located on districts of Pakal, Benowo, Lakarsantri, Sambikerep, Tandes, Sukomanunggal. While district of Asemrowo is located in industrial sector.

Land Suitability against Existing Map Surabaya 2012

Residential area in West Surabaya was derived by the overlay and buffer on residential land suitability against RDTRK

West Surabaya, the availability of facilities and infrastructure, with Existing Map West Surabaya in 2012 to determine the location of planning residential development based on conditions existng field, Existitng condition which was covered by land suitability in West Surabaya have several types of land use, such as ponds, green open space, residential, vacant lots, and public facilities. The resulth of this process in a map of determination location of residential areas and changes in existing land use patterns that correspond to the physical parameters of residential land suitability and Detail Spatial Planning City (RDTRK) West Surabaya. The area of each

land use on existing conditions can be seen in the following table.

Table 5. Land Use of Residential Area Against Existing Map

Land Use	Land Use Area				Land Appropriation on Existing Map (Ha)
	Appropriate		Inappropriate		
	(Ha)	(%)	(Ha)	(%)	
Pond	1204.95	94.17	74.66	5.83	1279.61
Open Green Space	1037.20	76.59	316.98	23.41	1354.18
Residential	1960.26	76.12	614.97	24.88	2575.23
Vacant Land	370.85	60.19	243.13	39.81	616.17
Public Facility	2.24	64.08	1.25	35.92	3.49
TOTAL	4575.50	78.50	1253.18	21.50	5828.68

Table 5 show that the use of existing condition on the pattern of land use have compatibility with the potential to be used as a residential area is the use of pond amount 1204.95 Ha (94.17%) of the total area of land use ponds amount 1279.61 Ha, land use green open space amount 1037.20 Ha (76.59%) of the total area of land use green space amount 1354.18 Ha, and vacant land that also has the potential to be used as a residential area amount 370.85 Ha (60.19%) of the total area of land use vacant amount 616.17 Ha and land-use of public facilities amount 2.24 Ha (64.08%) of the total area of land use of public facilities amount 3.49 Ha.

CONCLUSIONS

The result of this research indicate that determination the feasibility and suitability of land for planning the development of residential areas resulted in the level of suitability of land for residential area dominated by the West Surabaya appropriate level amount 9399.550 Ha (81.17%) of the total area amount 11580.13 Ha in West Surabaya. Furthermore, The spatial use that appropriate to use as residential development area in West Surabaya located in the use of pond amount 1204.95 Ha, land use of green open space amount 1037.20 Ha, land use of vacant

land amount 370.85 Ha and the land use of public facilities by 2.24 Ha.

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Certificate



This is to certify that

Teguh Hariyanto

Has Participated as Presenter

**The First International Conference
of Indonesian Society for Remote Sensing (ICOIRS 2015)**
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A handwritten signature in black ink, appearing to read "M. Nur Cahyadi", is written over a faint, light-colored rectangular stamp.

M. Nur Cahyadi, ST., M.Sc. PhD.
ICOIRS 2015 Committee

