

Pattern matching evaluation of spatial planning policies in Surabaya coastal area

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Abstract. Surabaya City has some spatial plannings of coastal area that overlap. There are RZBWP3K Surabaya, RTRKSE Lamong Gulf, RTRKSE KKJS-Kenjeran Beach, and RTRKSL East Coast Surabaya. There are indications of mismatch on each of the document. This study aims to determine the relationship between spatial planning documents and formulate recommendations. The method used is the content analysis and overlay analysis. The content of documents in general have been the same, but the spatial aspects are still not conformity. Need to do is complementing each other between the documents, detailing the substance of strategic area spatial plan related to specifications, dimensions, or delineation and equalizing spatial data (land use and blocks).

1. Introduction

The Indonesian archipelago has a total of 16.056 islands and a coastline of 99.093 km long [1] The population of Indonesia in the coastal area reaches 161 million people or 60% of the 250 million population of Indonesia. That number continues to grow at a growth rate of 1.2% per year. The increasing population requires the development of adequate infrastructure to facilitate increased need anyway. In addition, the sea area of Indonesia reached 5.8 million km² and Indonesia dominate total territorial area of 7.7 million km². The allocation of space in coastal areas, both land and sea in general have been arranged in coastal spatial planning documents in a hierarchical manner. Until this year, most macro plan contained in the scope of the province as a national coastal spatial plan has not been finalized, while the coastal areas spatial planning at the district/city is currently directed to be managed by the authorities at the provincial level.

Surabaya city which is the capital of East Java province is one of the waterfront city (city developed on the banks of the sea) in Indonesia. Surabaya has a long coastline of 40.4 km, stretching from the eastern side of the border point Sidoarjo regency (on the south) to the north from the border point Gresik [2]. The coastal area of Surabaya is equipped with some infrastructure such as the Port of Tanjung Perak, Suramadu Bridge, Ken Park in Kenjeran, and Ecotourism Mangrove. The existence of such infrastructure to spur growth in the region around the coastal area.

Surabaya City Government through Surabaya City Development Planning Agency has made some coastal spatial plan documents. Documents of spatial plans in the coastal city of Surabaya are Zoning Plan of Coastal Areas and Small Island (RZBWP3K) Surabaya, Environmental Strategic Area Spatial Plan (RTRKSL) East Coast Surabaya, Economic Strategic Area Spatial Plan (RTRKSE) Suramadu Bridge Area (KKJS) - Kenjeran Beach, and Economic Strategic Area Spatial Plan (RTRKSE) Lamong Gulf. The region scope of planning area in each document shown on the map below.



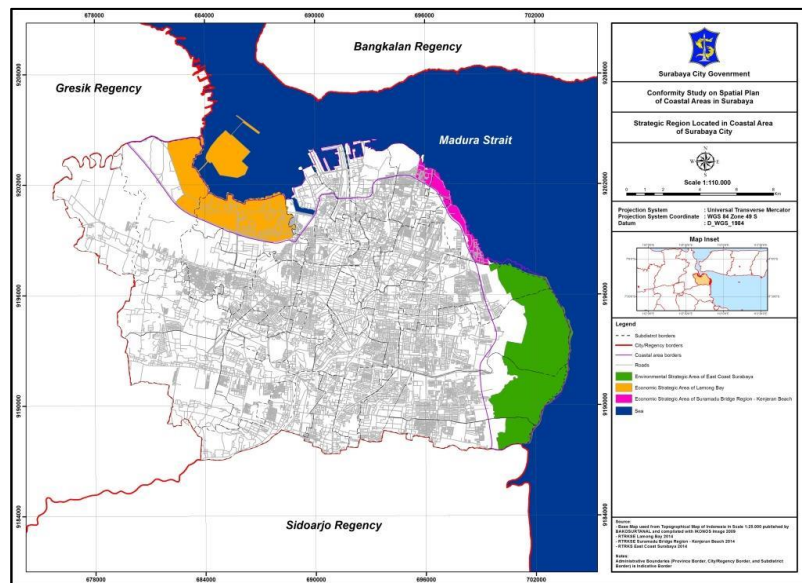


Figure 1. Strategic Region in Coastal Area of Surabaya.

Source: RTRW Surabaya

RZBWP3K and RTRKS have different details. Such differences include the substance and scope of the territory. That difference led to indications - indications of non synchronization of spatial documents. To determine the relevance of the products of the plan, needed a study in order to materialize the planning area integrated coastal city of Surabaya. Study done by making a comparison between the documents, Comparison is is a descriptive investigation trying to find a solution through the analysis of the causal link, which is selecting certain factors related to the situation or phenomenon investigated and compared the factors [3]

2. Methods

Method of analysis used in the study is triangulation using content analysis and overlay. Research methods illustrated in diagram below. Content analysis is a technique to analyze and understand the text. This analysis is used to determine the appropriateness of referrals. To analyze the spatial data, analysis overlay used by overlapping land use map and also block map.

2.1. Triangulation of Sources: Conforming Pattern of Regulation

Study in conformity of regulation focused on land use regulation in each document. RZBWP3K Surabaya is used as the core document to be compared with strategic plan document. The purpose of this part of study is to compare the substance of land use regulation inter-document.

2.2. Triangulation of Sources: Conforming Pattern of Land Use

Conformity of Land Use is done by comparing land use type and its area in hectare. Spatial data of land use obtained from Surabaya City Development Planning Agency. The result can show the difference of land use in RTRKS and RZBWP3K Surabaya.

2.3. Triangulation of Sources: Conforming Pattern of Block

Block is another variable to be compared by overlapping the map. By overlapping the block map, we can find out how line of buildings and roads be made. If the difference is found, we will know where it is in the map and propose a recommendation.

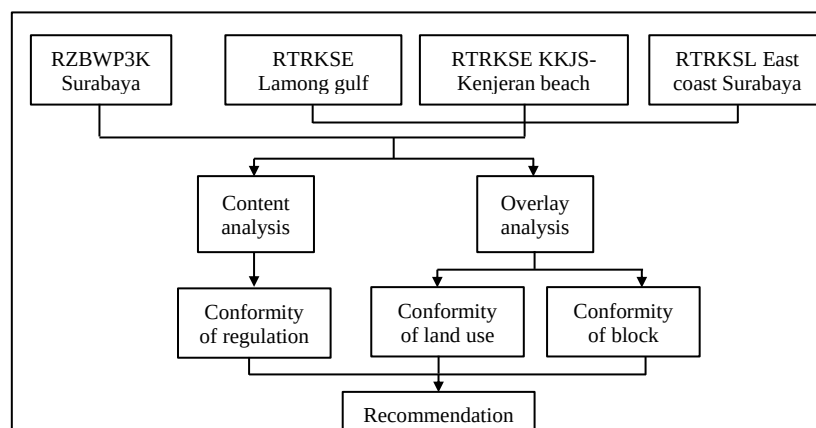


Figure 2. Study flowchart.

3. Discussion and Findings

Coastal Area in Surabaya city are divided into three part which are: Lamong Gulf that review from RTRKSE Lamong gulf [5], Kenjeran Beach and East Coast that review from RTRKSE KKJS [6]. The document that being used for pattern matching techniques is multi document that might be overlapping between each other or even didn't have connections between each other. Comparing the documents will give an insight if there any unmatching pattern between the documents to produce better policy in the future.

3.1. RTRKSE Lamong gulf

Table 1. Triangulation of regulation in RTRKSE Lamong gulf and RZBWP3K Surabaya.

RTRKSE Lamong gulf	RZBWP3K Surabaya	Explanation
Green space consists of several types. - City green space - Coastal park - Urban farming - Mangrove breeding and cultivation land. - Mangrove forest conservation - Critical areas mangrove	Green space consists of several types. - Median green space - Crossroads park - Monuments and the city gate - City park - Railroad, high-voltage wires, and rivers safety area, and other buffer zone	Matching Pattern Both documents have determined the allocation of green space, but still needed combination.
There is a coastal border zone which has several functions. - Maintenance of tidal marsh - Utilization for coastal border building flood control, road inspection, shipping flow, evacuation paths	Coastal border region of west bay area set 30-170 meters from the highest tide.	Matching Pattern RTRKSE Lamong gulf need to include a detailed explanation of coastal border minimum.
River border area adjusted in accordance with PP No. 38 Year 2011.	River border area minimum (meters) is different in each river of rayon Tandes. There are several rivers which is Kali Lamong (30-50), Kali Kandangan (15), Kali Sememi (15), Kali Balong (20),	Matching Pattern Need a detailed explanation of river border area in RTRKSE Lamong gulf.

RTRKSE Lamong gulf	RZBWP3K Surabaya	Explanation
Bozem border area is 50-100 meters around.	Kali Anak (6-10 for settlement and 30 for non settlement), and Kali Greges (6 for fishermen settlement and 20 for non settlement) No explanation specifically about bozem in Lamong gulf	Unmatching Pattern Need additional regulation on bozem border area of RZBWP3K Surabaya
Residential areas set in two zones, namely Zone I of Residential and Commercial (vertical housing) and Zone VI of Residential (special residential area).	Residential zone in Lamong gulf is divided into Fishing Village sub-zone, Non Fishing Village sub-zone, and Formal Housing sub zone.	Matching Pattern Residential zones already allocated and intertwined as indicated by the designation of zones for fishermen and non-fishermen workers.
Public facilities have been set in supporting facilities and infrastructure sub-zone.	The public facilities are in service center zone is composed of the existence of a collection of various types of public facilities.	Matching Pattern Both documents have determined the allocation of space for public facilities.
Commercial use is arranged in two zones, namely Zone I of Residential and Commercial and Zone II Industrial Assembly and Commercial.	Commercial use located in Asemrowo and Benowo subdistrict as waterfront city in local scale.	Matching Pattern Both documents have determined the allocation of space for commercial use.
Industrial and warehousing activities are set in some zones. • Assembly Industry and Trade Services • Industry Assembly • Industrial and Warehousing • Warehousing and Consolidation Depo	Establish Warehousing and Industrial Zone Margomulyo in Asemrowo and Benowo subdistrict.	Matching Pattern Both documents have been appropriate and support the development of macro objectives in Lamong gulf, which is to support the functions of the port area, industrial warehousing and integrated waterfront city.
Mitigation plan of disaster-prone areas includes flood and sea water intrusion.	Mitigation plan of disaster-prone areas includes floods, fires, and changes in physical, chemical, biological of water	Matching Pattern Both documents have determined mitigation plan, but still need combination of data.

Table 2. Conformity of land use in RTRKSE Lamong gulf

RTRKSE Lamong gulf		RZBWP3K Surabaya	
Land use	Area (Ha)	Land use	Area (Ha)
Bozem	9,03	Bozem	3,09
Industrial	527,54	Industrial	681,97
Public cemetery	0,62	Public cemetery	1,12
Commercial use	129,12	Commercial use	47,35

RTRKSE Lamong gulf		RZBWP3K Surabaya	
Land use	Area (Ha)	Land use	Area (Ha)
Residential	131,84	Residential	137,3
Green space	212,97	Green space	128,53
Public facilities	425,68	Public facilities	386,76
Total	1.436,8	Total	1.385,94

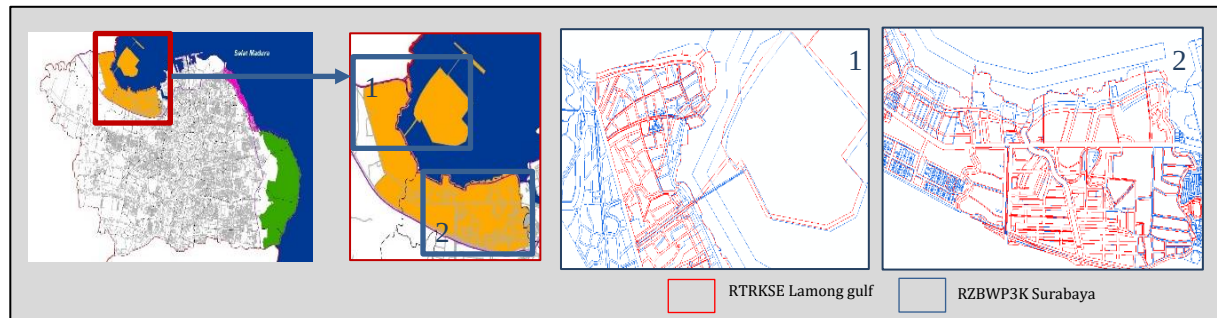


Figure 3. Conformity of block in RTRKSE Lamong gulf.

Based on the analysis above, there are several conclusions below.

- RZBWP3K Surabaya does not explain bozem border area in Lamong gulf.
- There is a significant difference in the area of bozem (5,94 Ha), industrial (154,43 Ha), commercial use (81,77), residential (5,46 Ha), green space (84,44 Ha), and public facilities (38,92 Ha).
- Differences in the total area of 50,86 Ha.
- Differences of block found in coastal border area.

3.2. RTRKSE KKJS - Kenjeran beach

Table 3. Conformity of regulation in RTRKSE KKJS - Kenjeran beach and RZBWP3K Surabaya.

RTRKSE KKJS - Kenjeran beach	RZBWP3K Surabaya	Explanation
Green space consists of several types. • City park • Public cemetery • Coastal park • Urban farming • Playground and field • Pump house area, high-voltage wires area, and fire extinguishers	Green space consists of several types. • Median green space • Crossroads park • Monuments and the city gate • City park • Field • Public cemetery • Railroad safety, high-voltage wires, rivers, and buffer zone	Matching Pattern Both documents have determined the allocation of green space, but still needed combination.
Coastal border zone set $\pm$ 200 meters drawn along the coastline.	No explanation specifically about the coastal border area.	Unmatching Pattern Need additional regulation on coastal border area of KKJS - Kenjeran beach in RZBWP3K Surabaya.
River border area set out in the Local Protection zone.	River border area minimum (meters) is different in each river of rayon Gubeng. There are several rivers which is Kali Jeblokan (30-50), Kali Larangan (15), Kali Kenjeran (15),	Matching Pattern Need a detailed explanation of river border area in RTRKSE

RTRKSE KKJS - Kenjeran beach	RZBWP3K Surabaya	Explanation
Bozem border area is 50-100 meters around.	Ria beach channel (10). No explanation specifically about bozem in KKJS - Kenjeran beach	Lamong gulf. Unmatching Pattern Need additional regulation on bozem border area of RZBWP3K Surabaya
Residential zone directed to develop vertical housing or landed house intended for fishermen and non-fishermen.	Residential zone for UPP. III is divided into Fishing Village sub zone, Non Fishing Village sub zone, and Formal Housing sub zone.	Matching Pattern Residential zones already allocated and intertwined as indicated by the designation of zones for fishermen and non-fishermen workers.
Public facilities are allowed in each zone generally are activities that have the scale of local services and/or the environment and is in a class of local roads.	The public facilities is composed of the existence of a collection of various types of public facilities with a central zone sub-regional scale service city, district to UP, and local/neighborhood	Matching Pattern Both documents have determined the allocation of space for public facilities
Commercial use that are allowed in each zone generally are activities that have the scale of local services and in a class of local roads.	Commercial use in KKJS - Kenjeran beach functions strategic areas for public service activities, trade and services to regional-scale.	Matching Pattern Both documents have determined the allocation of space for commercial use.
Industrial and warehousing activities are set in some zones. - Assembly industry and warehousing - Various industry - Warehousing - Depo	There are several sub zone contained within the zone Industrial and Warehousing. - Sub zone small industry - Sub zone secondary industry - Sub zone major industry	Matching Pattern Both documents have determined the allocation of space for industrial.
Mitigation plan of disaster-prone areas includes flood and sea water intrusion.	Mitigation plan of disaster-prone areas includes floods, fires, and changes in physical, chemical, biological of water	Matching Pattern Both documents have determined mitigation plan, but still need combination of data.

Table 4. Conformity of land use in RTRKSE KKJS - Kenjeran beach.

RTRKSE KKJS - Kenjeran beach		RZBWP3K Surabaya	
Land use	Extents (Ha)	Land use	Extents (Ha)
Industrial	4,47	Industrial	0,28
Public cemetery	0,77	Public cemetery	0,73
Commercial use	85,68	Commercial use	125,64
Residential	98,95	Residential	115,77
Green space	23,36	Green space	19,31
Public facilities	37,29	Public facilities	19,02
Total	250,52	Total	280,75

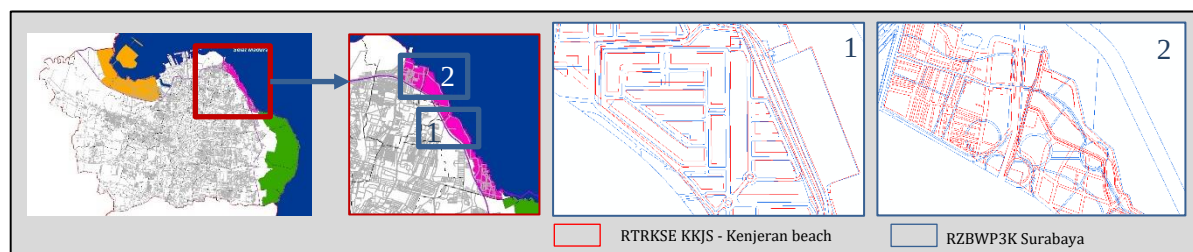


Figure 4. Conformity of block in RTRKSE KKJS - Kenjeran beach.

Based on the analysis above, there are several conclusions below.

- RZBWP3K Surabaya does not explain coastal border area in KKJS - Kenjeran beach.
- There is a significant difference in the area of industrial (4,19 Ha), commercial use (39,96 Ha), residential (16,82 Ha), green space (4,05 Ha), and public facilities (18,27 Ha).
- Differences in the total area of 30,23 Ha.
- Differences of block found in planned interchange road of Suramadu Bridge.

3.3. RTRKSL East coast Surabaya

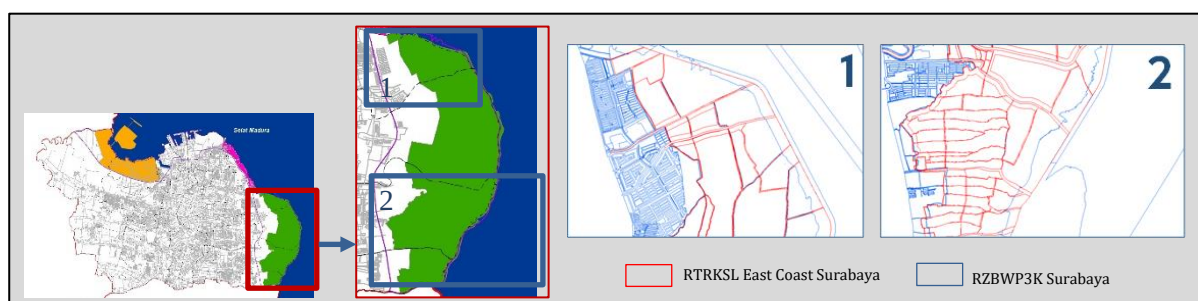
Table 5. Conformity of regulation in RTRKSL East coast Surabaya and RZBWP3K Surabaya.

RTRKSL East coast Surabaya	RZBWP3K Surabaya	Explanation
Green space consists of several types. • City park • Median green space • Urban farming • Coastal park • Mangrove breeding and cultivation land. • Mangrove forest conservation	Green space consists of several types. • City park • Median green space • Crossroads park • Field • Public cemetery	Matching Pattern Both documents have determined the allocation of green space, but still needed combination.
Coastal border zone set out in the Main Protected Zone.	No explanation specifically about the coastal border area.	Unmatching Pattern Need additional regulation on coastal border area of east coast area in RZBWP3K Surabaya.
River border area adjusted in accordance with PP No. 38 Year 2011.	River border area minimum (meters) is different in each river. In rayon Gubeng there are Kali Bokor (10-15), Kali Dami (40-50), and Kali Kepiting (25). In rayon Jambangan there are Kali Wonokromo (40-100), Kali Wonorejo (10), Kali Kebon Agung (12-15), and Kali Perbatasan (40-50).	Matching Pattern Need a detailed explanation of river border area in RTRKSL East Coast Surabaya.
Bozem border area is 50-100 meters around.	Bozem border area in bozem Kali Dami 5 - 10 and bozem Wonorejo 200 meters around.	Unmatching Pattern Need a compliance between documents.
Mangrove forests are defined as sub zone in the Main Protected zone.	Mangrove Forests sub zone assigned to the coastal areas in the north and east	Matching Pattern Both documents have determined the allocation of space for mangrove forests.

RTRKSL East coast Surabaya	RZBWP3K Surabaya	Explanation
There are regulations about fishery development in Limited Use zone and Buffer zone.	Fishery development is allocated in Aquaculture sub zone and Capture Fisheries sub zone.	Matching Pattern Both documents have determined the allocation of space for fishery development.
Residential zone directed to develop vertical housing or landed house intended for fishermen and non-fishermen.	Residential zone for east coast of Surabaya is divided into Fishing Village sub zone, Non Fishing Village sub zone, and Formal Housing sub zone.	Matching Pattern Residential zones already allocated and intertwined as indicated by the designation of zones for fishermen and non-fishermen workers.
Public facilities are in each zone with Sub Zone Supporting Facilities & Infrastructure, Facilities and Public Utilities	The public facilities are in Zone Service Center	Matching Pattern Both documents have determined the allocation of space for public facilities
Mitigation plan of disaster-prone areas includes volcanic eruptions, sea water intrusion, earthquake, and erosion.	Mitigation plan of disaster-prone areas includes floods, fires, and changes in physical, chemical, biological of water	Matching Pattern Both documents have determined mitigation plan, but still need combination of data.

Table 6. Conformity of land use in RTRKSL East coast Surabaya.

RTRKSL East coast Surabaya		RZBWP3K Surabaya	
Land use	Area (Ha)	Land use	Area (Ha)
Boezem	29,85	Boezem	7,51
River	147,02	Drainage	94,88
Limited use zone	788,16	Housing and settlements	16,38
Main protection zone	1.323,08	Green space	2.361,19
Buffer zone	628,93	Public facilities	0,02
Total	2.917,04	Total	2.479,98

**Figure 5.** Conformity of block in RTRKSL East Coast Surabaya.

Based on the analysis above, there are several conclusions below.

- The substance of RZBWP3K Surabaya and RTRKSL East Coast Surabaya is generally similar.
- There is a significant difference in the extent in bozem (22,34 Ha).

- Zone at RTRKSL unspecified.
- Differences in the number of land-use area of 437,06 Ha.
- Differences of block is not significant.

4. Conclusion

From the study, we can conclude that spatial planning document of coastal areas in Surabaya has biggest deviation in Eaast Coast and Kenjeran Beach area, which are about 22% and the lowest in in the Lamong Gulf area which is about 11%. Generally the planning policies already have matching pattern in the substance of regulation. But on the other hand, there are many unmatching pattern and inconsistency between policies document in spatial data of land use and blocks. Some recommendations that suggested are complementing each other between the documents, detailing the substance of strategic area spatial plan related to specifications, dimensions, or delineation and equalizing of spatial data (land use and blocks).

5. References

- [1] Geospatial Information Agency in Forum of United Nations Conferences on the Standardization of Geographical Names and United Nation Group of Experts on Geographical Names in USA, 7-18 August 2017
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