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Green Open Space Design, Based on Disaster Mitigation Approach in Bulak Coastal Settlements

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Abstrac

Residential areas that directly border their coastline have a significant risk of natural disaster. One of them is the tidal flood disaster that threatens throughout the year, so that it greatly affects the activities of residents who mostly work as traditional fisherman. Based on the result of previous research, it was recorded that several tidal floods occurred within a period of one year which resulted in seawater inundation in residential areas, a significant decrease in the elevation of the sea wall and damage to traditional fishing boats, the impact of tidal floods was exacerbated by the phenomenon of significant increase in the number of houses that exceeded the land boundaries according to the designation of space. The Kejawen Lor area, Bulak District, is the coast of Surabaya City, which is prone to tidal floods. According to Presidential Regulation No. 51 of 2016, the safe distance between the shoreline and residents houses and also the arrangement of open spaces for evacuation and circulation are currently considered not to meet safety and feasibility standards. Through qualitative research, we want to find effort to prevent and reduce the negative impacts after the tidal disaster in the Kejawan Lor area to provide design proposals for improving the sea wall infrastructure and arranging green open spaces to beautify the area. Through field observations, general identification, sectoral area mapping and technical studies are carried out which are expected to produce a safe and habitable artificial environment.

Keywords: Resilience, Architecture, Disaster Mitigation

Introduction

Settlements that directly border coastlines often face a high risk of natural disasters, one of which is tidal flooding. This phenomenon occurs due to rising sea levels combined with the natural ebb and flow of tides, resulting in increased water accumulation in coastal areas. Tidal floods have a significant impact on community activities, particularly for traditional fishermen who rely on the sea for their livelihoods. In the Kejawen Lor area of Bulak District, Surabaya City, tidal flooding is a recurring threat that damages infrastructure, fishermen's equipment, and disrupts the daily lives of residents. As the population grows, urbanization in coastal areas frequently overlooks environmental carrying capacity.

Image 01 : High tidal floods,
Source detik.com (2020)

Image 02 :Peta Rawan Genangan Banjir Rob Surabaya
Source RPJMD Kota Surabaya 2016-2021

According to *Presidential Regulation Number 51 of 2016*, a safe distance is required between the coastline and settlements to minimize the negative impacts of disasters. Furthermore, the current spatial planning in Kejawen Lor does not align with these regulations, particularly concerning the lack of green spaces meant for emergency evacuation. This is in contrast to *Surabaya City Regional Regulation Number 12 of 2014*, which outlines necessary steps for disaster management based on mitigation and adaptation as priorities, as *stipulated in Law Number 24 of 2007* concerning disaster management.

This study aims to provide solutions for infrastructure improvement, particularly regarding seawalls, and to propose a design for green open spaces that not only enhances the area aesthetically but also increases disaster resilience. The primary methods employed in this case include field observation, sectoral mapping, and technical studies to produce recommendations for safe, habitable, and sustainable designs.

Methodology

This Study uses a qualitative method approach to explore and design tidal flood mitigation solutions based on infrastructure and spatial planning improvements in the coastal area of Kejawen Lor, Surabaya City. The methodology used includes four main steps: literature review, expert interviews, analytical surveys, and data analysis. Further explanations of each method and related regulatory references are described as follows:

- *Literature Review*
  In this case study, the approach take based on laws and regulations that regulate technical guidelines that can be adapted in theoretical studies or field aplications. The following are some of the regulations that we use as technical references:
  - Presidential Regulation Number 51 of 2016 concerning Coastal Boundaries, which regulate the safe distance for development around the coastline.
  - Law Number 24 of 2007 concerning disaster management, wich emphasizes the importance of mitigation and adaptation as the main strategies for risk reduction.
  - Surabaya City Regulation Number 12 of 2014 concerning the Surabaya City RTRW 2014-2034, especially related to coastal area spatial planning.

- *Expert Interview*
  Conducted interviews with several experts, suck as academics, planning consultans, and local goverments. From this interview it is expected to get some clues such as:
  - Theoretical studies related to the case
  - Similar experiences that have been done
  - Previous data at the location being observed
  - Regulatory limits that allow and prohibit them

- *Survey Analysis*
  Conducted a survey to collect data on the latest exixting conditions in the research area. Some things tha can be done include:
  - Land measurement
  - Soil condition testing
  - Infrastructure damage data collection
  - Technical and statistical data collection

- Data Analysis
  From survey activities and data collectin is expected tobe used for planning the built environment, and regression analysis to identify patterns and trends. This is done to understand:
  - Synergy between environmental, social, and technical study variables on tidal floods risk.
  - How severe the impact of infrastructure on the environment is.
  - Be able to provide resilient design proposal.

Findings and Discussion

1, Area Overview

The Coastal area of Kejawan Lor, located in Bulak District, Surabya City is one of the coastal area directly adjacent to the Madura Strait. This location is a densely populated area, dominated by people who work as traditional fishermen. This area has typical coastal environmental conditions, characterized by fishermen's settlement, and other maritime economic activities.

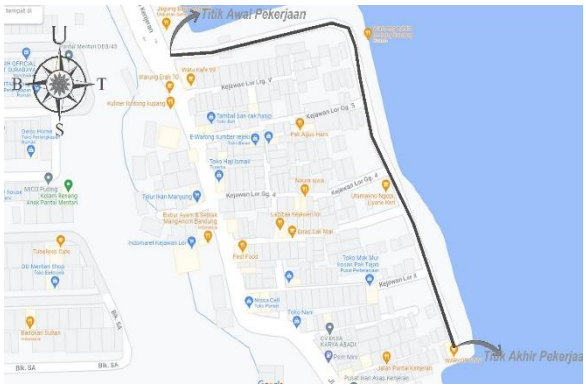

Image 03 : Location Maps
Source Google Maps, accesed in 2020

Bordered by

South : Madura Strait

North : THP Kenjeran

East : Madura Strait

West : Pantai Lama Road

2. Measurement Result and Location Observation

Based on the result of observations and measurements carried out in this study, following result have been obtained below :

- The coastline from the northern tip to the southern tip of this location is 376 meters long, and has an average distance between settlements and the beach of 20 meters.
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Image 04,05 : measurement result
Source, researcher data measurement in 2020

3. Data and Statistics Analysis

After collecting previous measurement data and the lates measurement result, an analysis and comparasion of general area conditions and the latest infrastructure condition especially.

3.1 From the result of the analysis and comparasion, it was found the there was a change in the height of the sea wall infrastructure building.

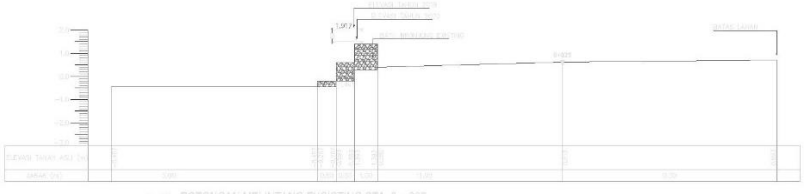

Image 06 : measurement result
Source, researcher data measurement in 2020

The latest sea wall elevation is currently 52 centimeters lower than previous sea wall elevation, meaning that there has been a decrease in the elevation of the sea wall infrastructure.

3.2 From the statistical data obtained, the Kejawan Lor area includes the Kenjeran coastal fishing village which experiences seasonal tidal flooding trhoghout the year and recurs.

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Tabel 1. Daftar kejadian banjir rob wilayah Surabaya tahun 2021-2022

No.	Tanggal kejadian	Tempat kejadian	Sumber
1	27 Mei 2021	Jalan Kalimas Baru dan perkampungan nelayan Pantai Kenjeran	(Belarminus & Faizal, 2021)
2	17-20 Mei 2022	Jalan Kalimas Baru	(Widiyana, 2022)
3	13 Juni 2022	Kalimas Surabaya	(Cable News Network Indonesia, 2022)
4	14 Juli 2022	Kawasan kalianak, Kecamatan Asem Rowo	(Patoppoi, 2022)

Image 07 : Table of tidal flood in Surabaya
Source, https://regional.kompas.com accesed in 2024

4. Theoritical Review

Some architectural theories and technical regulation about disaster mitigation and green open space planning that we use for a sustainable design approach are below :

4.1 Mittigation according to *Coppola,2007* defines mitigation as an effort carried sign out sustainably to reduce the risk of danger by reducing the possibility or components of the consequences of disaster risk.

4.2 Looking at the characteristics of the area, according to the city architecture expert *Hamid Shirvani,1985* on his book "*The Urban Design Proses*", there are 8 elements that from the physical city ;

- Land use
- Building form and mass building
- Circulation and Parking
- Open space
- Pedestrian ways
- Supporting activities
- Preservation

4.3 Open space is defined as land with specific use whose function or quality is visible from its composition, *Rapuano,1964*.

5. Design Proposal and Gallery

Based on the adoption and adjustment to the conditions of the object, the regulations that govern it and the mitigation approach, the researcher provide the following design recommendations.

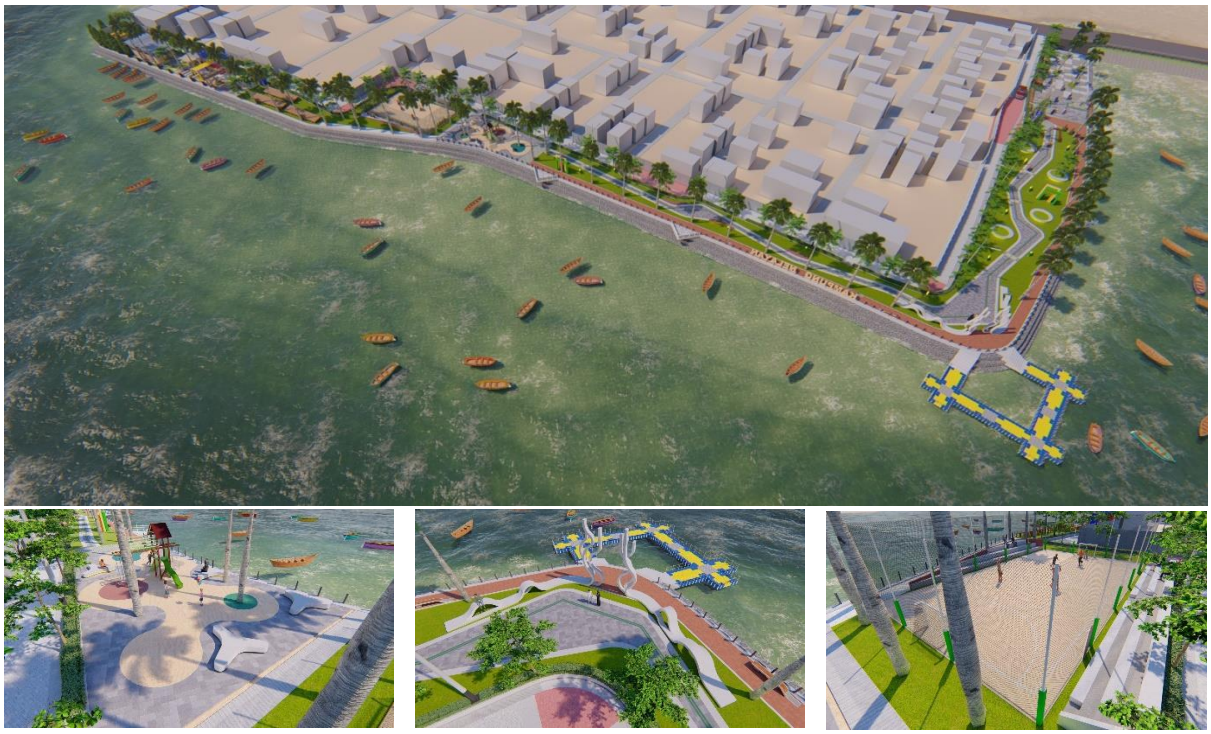

Image 08,09,10 : Recpmendation Design
Source, researcher Design

Conclusion

By knowing the condition of research area object by conducting identification, measurement, data collection and matching with the regulation that govern it, this research produce a design recommendation that synergizes between government regulation, the condition of the research object and social community, of course by emphasizing the disaster prevention approach in the design process in order to produce a functional, comfortable and resilience design.

Thank you note

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Reference

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