

Inter Island Port Passenger Terminal Design as A Support Area in Coastal Zone Area at the Merak Coastal Banten

M. Firhan Adriansyah¹, Syaifuddin Zuhri²

^{1,2}UPN "Veteran" Jawa Timur, Indonesia

creativetjojo@gmail.com, syaifuddin.zuhri@upnjatim.ac.id

Abstract

As a center point for the distribution of people and products, the port area's built environment development faces a major challenge that will have a significant impact on environmental sustainability. The intention to create a port terminal in the Merak Banten area into an inter-island port passenger terminal strongly affects the existence of the intended location area in the coastal area of Merak Banten. Coastal regions are important strategic places for the conservation of natural resources since they are located at the boundary between the land and the sea. It is possible that the development of natural resources in connection with port dock planning would disrupt the balance of the natural environment. This is because the place in question will be transformed into one that is dominated by the built environment and thus require a sufficient amount of space. This study attempts to show that port terminal planning requires more consideration so as not to disturb the balance of space and the existence of nature. It is expected that the approach used to investigate the needs of the object while taking into account a number of fundamental spatial criteria, including functional features, infrastructural connections, technical requirements, and environmental requirements, will reveal the fundamental requirements of port terminal planning among the research subjects. For the sake of preserving the setting's potential and enhancing the image and value of the proposed concept.

Keywords

environment; functional; infrastructure; passenger terminal; technical



I. Introduction

According to the Institute for Economic and Community Research, Faculty of Economics and Business, University of Indonesia (LPEM FEB UI) that Indonesia's economic growth is in the range of 3.5-4% which has experienced a lot of decline due to the Implementation of Restrictions on Community Activities (PPKM) since 2020, so there is a lot of distribution back and forth people and community needs are decreasing (Kristianus, 2022). This causes the means of transportation of seaports, airports and transportation to experience a decrease in the number of passenger flows. With the opening of the emergency PPKM, there has been a drastic spike in the flow of ship passengers and the end or no validity of the homecoming period which originally ended on May 24, 2021, was extended to May 31, 2021 according to the Circular Letter of the National Covid-19 Task Force Number 13 of 2021. Because sea transportation plays an important role as a means of distributing goods and services between regions. Besides that, transportation facilities are also required to be more efficient in providing services to the public, passengers, vehicles and goods in a larger capacity and in a relatively short time.

According to a source from the Directorate of the Ministry of Land Transportation (2017) that the Merak Port Passenger Terminal is an entrance located next to the Merak Integrated Terminal which is different from the usual terminal, it is a sea crossing port located in Pulomerak, Cilegon City, Banten which connects Java Island and Sumatra Island separated by (Sunda Strait/Krakatau) with an estimated development area of 42.505 square meters. Pulomerak sub-district, which is located in this district, 10 km from the city center, is of interest to us because it has the potential as a transportation route between 2 islands, namely Java and Sumatra. Another problem is that the existing port is no longer able to accommodate the activities of the port users. This port also has the potential to increase local revenue in Serang district.



Figure 1. Seaport development area in Merak Banten (Source: (Bantennews, 2021))

The natural conditions that support the area to become a port in principle must be considered and maintained, such as the existence of the Great Merak Island which can be used as break water and the existence of a bank that juts out into the open sea. However, there are also natural conditions that must be watched out for so as not to interfere with port activities such as muddy seabed which is sediment from wadas river which can interfere with ship movement and in certain months (September - December) the waves reach ± 2 m which can interfere with activities at Merak Port.

As we know that the small islands of the Banten waters have potential for fish resources, maritime archeology that contains historical value, potential for important habitats (coral reefs, seagrass beds and mangroves) in coastal areas and other marine and coastal resources that have not been revealed much and well-informed and structured (Black et al., 2018). The development of the built environment in marine and coastal areas should pay attention to the potential of natural resources and their diversity (Isputranto, 2003).

Uneven development between regions and between sectors will be impacted by a lack of understanding of the potential and features (Li et al., 2019), as well as concerns and problems related to resources. Inequality in regional development has consequences for social well-being. Consequently, development implementation must be carried out in an integrated, harmonious, positive, and balanced manner, and coordinated, so that development in each region is in accordance with the priorities and potential of the region

(Hein et al., 2013). Implementation of the priority and potential scales really requires data and information related to the existing potential and issues, so that there is no imbalance between utilization and conservation (Irannezhad, 2020).

From what has been described, it is clear that the Merak Port needs to be structured and developed according to the potential and natural resources so that the difficulties in the Merak port region can be resolved and the local revenue of Serang Regency can be increased (Hisom, 1997). Hence, how to create the Inter Island Port Passenger Terminal, which also serves as a buffer zone, in an effort to safeguard the Merak coastal area in a manner that is more suitable so that it can become an environmentally responsible and sustainable port (Hein et al., 2013).

II. Research Method

This study employs an exploratory descriptive methodology, which is geared toward looking up descriptive technical and non-technical data. The relationship between the technical elements that emerge as a result of the geographical conditions that are analyzed descriptively to determine the relationship between the technical and non-technical aspects that arise is then examined using an exploratory analysis once the data has been collected (Zuhri, 2020). This study evaluates the technical aspects of the location in light of the design requirements of an inter-island port passenger terminal (Cui, 2020).

The development of the Inter-Island Port Passenger Terminal must meet several basic criteria for space that accommodate factors such as functional factors, infrastructure connections, technical requirements, and environmental requirements (Momirski, 2017). With an analytical assessment highlighting the key elements of a marine terminal's spatial transformation in four defining phases with key elements (Spence, 2020), namely:

- Function: uses and activities intended for the wharf platform and building on the platform;
- Shape: the physical shape of the pier, as well as the outlines and edges;
- Construction: features of the wharf structure;
- Traffic network: highways, railroads and other highways;
- Environmental conditions: configuration and changes in the natural environment.

III. Result and Discussion

The operational development of the coastal plan must be directed to Merak Harbor which is the development and expansion of the pier area, the first pier needs to be extended to the west, with a length of 350 meters and a width of 475 meters. Meanwhile, the second pier must extend westward from the operating beach at the end of the pier with a length of 400 meters and a width of 500 meters. Similarly, a third pier with a length of 700 to 1.000 meters and a width of 250 to 350 meters needs to be built along the operating coast area. In smaller port developments, smaller ship and ferry docks, and disembarking passengers typically use docks located in designated passenger areas of the port, which are specially designed for this purpose. In medium and large sized ports with a growing number of passengers, passenger traffic is separated from cargo traffic and, for that, a special passenger terminal is built with all the necessary facilities that can provide complete and modern services to all port users (Dundovic, 2002). Merak Port can be carried out by means of partial reconstruction, and supporting facilities are built (Jugović et.al. 2007).

3.1 Port Function Development

In the future development of port functions, ports have transformed from maritime functions, cargo handling, stacking, and distribution to become multimodal transportation nodes in the global logistics distribution chain. In modern ports, shipments flow from one mode to another, they all converge and then spread. Therefore, port planning needs to focus on smooth flow management and efficient and economical transportation. As stated by Notteboom & Rodrigue (2009), the physical reality of a port's transport infrastructure must coincide with its anticipated future expansion in port traffic. It is not enough to provide capacity, and future development of the passenger terminal and its infrastructure will focus more on service output than capacity. Thus, less emphasis should be placed on the land side function of the port, although thorough design from the standpoint of the transportation function is essential. Ports are also being segmented into large 'load centers' and 'feeders' and are becoming bringing new demands on port performance as supply chain management has been.

According to the Ciwandan Banten Port Master Plan, it is explained that the planning of the functions of the Merak Port Passenger Terminal in the short term development is focused on several physical ports as follows:

Table 1. Short-term development of Merak Terminal

I	Public	Area
1	Reclamation	300.000 m ²
2	Terminal Facilities, Food Dry Bulk Stacking Field, Food Dry Bulk Warehouse, General Cargo Stacking Field	50.856 m ² 21.600 m ² 14.500 m ²
3	Reception Facilities	1.500 m ²
4	Path	800 m ²
5	Clean Water Installation	1 LS
II	Food Dry Bulk Dock	
1	Port Construction	10.086 m ²
2	Pond Dredging	1 LS
III	Non Food Dry Bulk Dock	
1	Extension of Port Length	5.700 m ²

(Source: Ciwandan Banten Port Master Plan, 2020)

Spatial plans for ports based on land reclamation, existing land, or a combination of both should be designed according to reliable data for the existing situation and appropriate objectives based on a reasoned vision by the port authorities. The integrated multifunctional planning of ports required for environmental sustainability deserves to be taken into account and considered in planning (Kovačić et al., 2016).

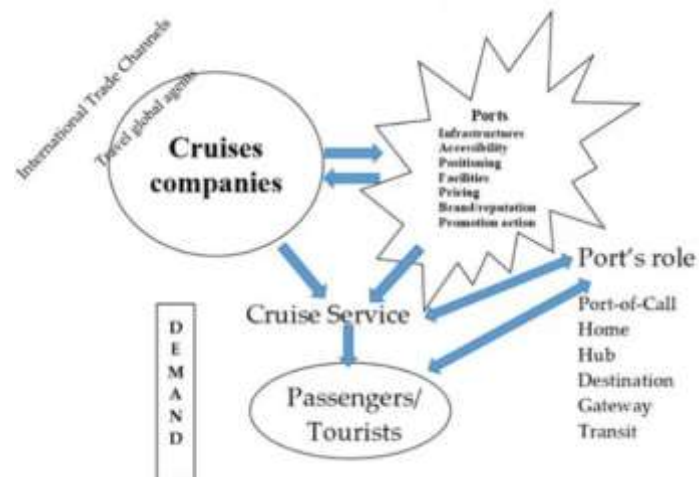


Figure 2. Process mechanism at the port passenger terminal
(Source: Maria Santos at/al, 2019)

The rapid development of the shipping sector demands different port functions and shows a clear imitation process. In accordance with its scope as a passenger terminal, it is necessary to enrich the supply with local identity content and experiences that are able to overcome the relatively flat passenger flow. As well as ports to be able to display their natural, cultural and technical characteristics, as well as promote local potential and have attractiveness capabilities.

3.2 Overview of the Physical Form of the Pier

In accordance with the Indonesian National Standard (refer to SNI) for Facilities and Equipment at International Shipping and Passenger Service Ports, the layout and circulation blocks of passengers and escorts/pick-ups at the international terminal are as follows (see Figure 3).

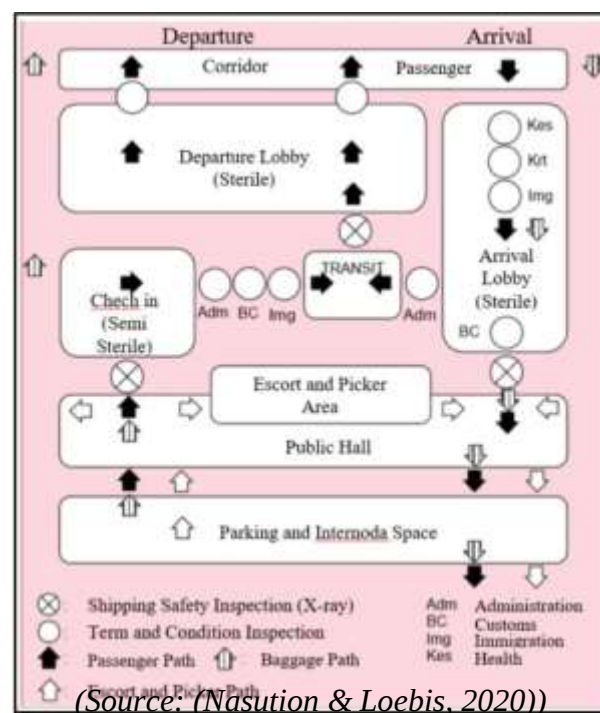
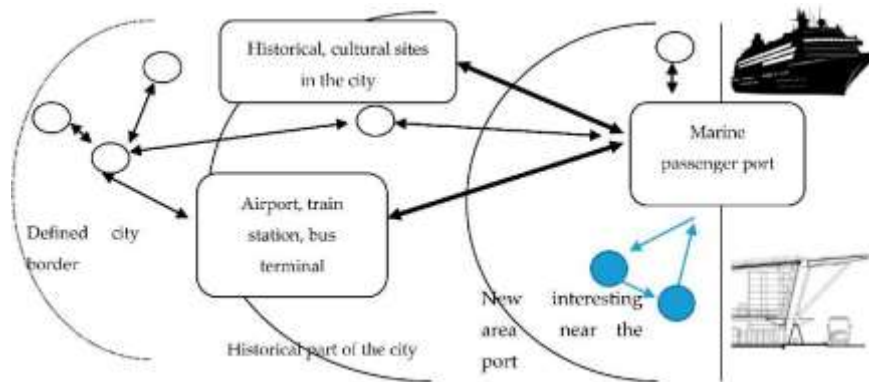


Figure 3. Layout and Passenger Circulation Block
(Source: (Nasution & Loebis, 2020))

Physical development of port passenger terminals should follow dynamic behavior or patterns, where dynamic mass and space will provide flexibility in spatial management that further enhances the role and sustainability of the environment.



(Source: (Santos et al., 2019))
Figure 4. *The relationship between the sustainability of the terminal and its potential environment*

This pattern is important in efforts to restore passenger traffic after the negative impact of Covid-19 on this facility, and it is hoped that changes will occur in both the route network and the passenger service process.

3.3 Pier Construction Overview

Various views on the environment in the development of coastal areas, especially in large-scale port facilities, are very important to note. Several factors are considered, including climatic factors, air quality, seawater, inland waters, groundwater, flora, fauna, habitat types, protected natural areas, cultural heritage, landscape features, soil, waste, and light pollution (Žerdin, 2009). Construction issues are a matter of concern in harbor design as construction will restrict mass flow of water, which can locally increase biomass (increased concentrations of algae and debris, slimy aggregations, and jellyfish), leading to accelerated decomposition (i.e., rotting) which causes oxygen deprivation in the lower layers (Momirski, 2017). From an environmental point of view,

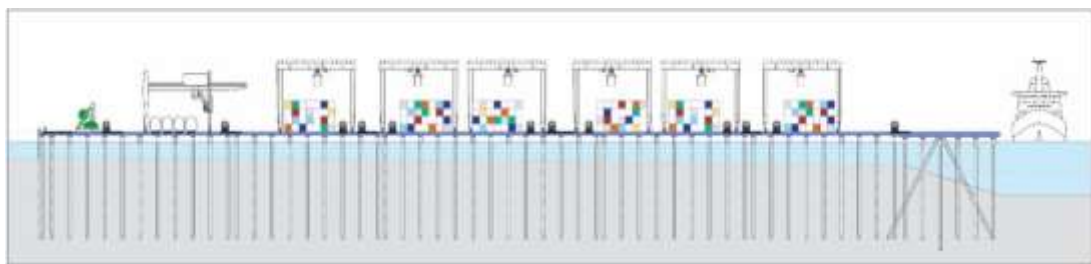


Figure 5. *Port construction form ((Momirski, 2017))*

In this way, the wharf platform will be based on vertical piers above sea level and will not extend into the sea area below the surface.

3.4 Accessibility Network Overview

The design of this port also requires the arrangement and harmonization of the port's internal or external road network, and accessibility which is calculated will affect the frequency and mobility of the port such as the port railway line, which is integrated

with the city accessibility corridor (Taneja et al., 2012). Coordination of types and forms of cargo, spatial solutions, and environmental problems, further development of ports, and arrangement of areas around ports to reduce negative impacts on the environment are the main issues of port requirements.

3.4 Environmental Configuration Overview

The natural conditions that support the area to become a port in principle must be considered and maintained, such as the existence of the Great Merak Island which can be used as break water and the existence of a bank that juts out directly into the open sea. However, there are also natural conditions that must be watched out so as not to interfere with port activities, such as the muddy seabed which is sediment from wadas rivers which can interfere with ship movement and in certain months (September-December) the waves reach ± 2 m which can interfere with activities at Merak Harbor.

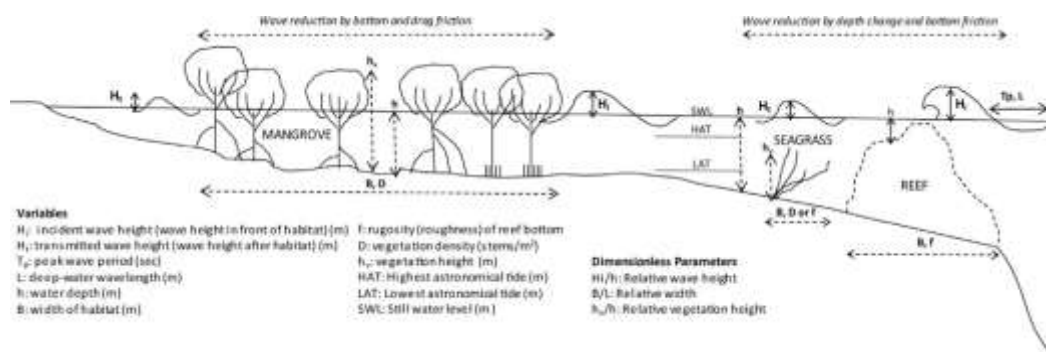


Figure 6. Heterogeneity of conserved coastal areas (Source: (Narayan et al., 2016))

Landscape protection is a legacy for future generations. Examples are the beaches of Navabag, Vengurla, Maharashtra where conservation of vegetation and extensive beaches facilitate fishing, recreation and tourism operations (Joubert & Pretorius, 2020). The revetment in Navabag is known as the "last line of defense". It was built deep inland and would only come into play if a series of very large and unusual storms eroded the coast. Below the existing water surface, the walls do not interfere with natural processes while the width of the beach is maintained. Although it was built as a flood protection measure, no leeway was made for higher water levels under climate change. Seawalls/revetments when placed farther out to sea have been shown to cause beach loss.

IV. Conclusion

At the port terminal, various human activities are concentrated in the limited space of the port area, and this condition is prone to threaten the balance of the environment. Integrated coastal area management that considers aspects, such as:

- 1) Uses and activities intended for the function of terminals and building docks in the Port area. This condition requires attention to design enrichment with local identity content;
- 2) Physical form of terminals and docks. The physical development of the port passenger terminal should follow a dynamic behavior or pattern, develop a relatively dynamic mass and space block design and provide flexibility in the management of space and land;
- 3) Features of the pier structure located on the beach. Strive to build buildings that are in contact with the sea by using vertical poles with materials that are not easily weathered;

- 4) Traffic network and other accessibility, which requires structuring and harmonization of internal or external port road network so that port mobility does not occur credit card; and
- 5) Considering environmental conditions, try to protect coastal areas consisting of a variety of vegetation and natural landscapes that are feasible to be maintained and protected due to the exploitation of buildings.

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