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Environmental Impact Assessment on the Development and Operation of Type B Terminal in Bontang City

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ABSTRACT

Purpose: The Type B Terminal is critical for improving the area's connectivity and accessibility, particularly in Bontang City and its surroundings. The principles of equality, ecological balance, resilience, sustainable development, viability, and connectivity will guide the terminal's construction and operation. The effects on environmental components must be evaluated, and appropriate countermeasures must be implemented to ensure the project's long-term viability.

Design/methodology/approach: The impacts and countermeasures of the terminal in Gunung Telihan Village, West Bontang District, Bontang City, East Kalimantan Province were determined using a qualitative descriptive method. The matrix method was used to determine the significant impacts during the pre-construction, construction, and operational stages. The structure and operation are expected to have seven effects on the physical environment components, including a reduction in air quality, an increase in noise intensity, a decrease in surface water quality, a disruption in smooth and safe traffic, damage to existing roads, specific waste handling (unloading), and the generation of domestic solid and liquid waste.

Findings: At the same time, three components must be evaluated when implementing countermeasures: disruption of smooth and safe traffic, generation of domestic solid and liquid waste, and handling of specific waste (building demolition) to mitigate the impacts.

Paper type: Research paper

Keyword: *Environment, Evaluation Impact, Management, Monitoring, Transportations*

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I. INTRODUCTION

A. Background

According to Minister of Transportation Regulation No. 132 of 2015, Type B Terminals play an important role in providing public transportation for inter-city travel within a province and urban and rural transportation services. The Bontang Type B bus terminal's current condition requires renovation, as its roof has begun to peel, posing a risk to passengers. It also lacks a proper garden layout, greening, and lighting, particularly for parking for 4-wheeled and 2-wheeled vehicles. Water storage and distribution systems are disorganized, and new support facilities are required.

The Bontang Type B Terminal, which requires renovation, is located next to the semi-modern Telihan Market, which meets the basic needs of the locals. The renovation is expected to improve the flow of goods and people, stimulating economic activity in the surrounding area. As a result, the East Kalimantan Province Transportation Service intends to renovate the terminal, with a proposed development area of 10,000 square meters and a building area of 1,248 square meters.

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Table 1. Land use details

No.	*Land Use*	*Area (m2)*	*Percentage (%)*
1.	*Main Building*	*763.76*	*7.64*
2.	*bus shelter*	*360.00*	*3.60*
3.	*Office*	*473.60*	*4.74*
4.	*Generator and Pannel Room*	*84.00*	*0.84*
5.	*Canteen Building and Driver Rest*	*82.00*	*0.82*
6.	*Garbage Disposal Site*	*24.00*	*0.24*
7.	*Gate*	*47.56*	*0.48*
8.	*Retribution Post*	*22.14*	*0.22*
9.	*Environmental Road*	*637.50*	*6.38*
10.	*Parking Area*	*1,820.0*	*18.20*
11.	*Bus Parking Area*	*325.20*	*3.25*
12.	*Public Vehicle Parking*	*185.04*	*1.85*
13.	*Circulation Area, Fence, Channel, Green Area, etc*	*5,175.00*	*51.75*
	Total	*10,000.00*	*100.00*

Source: Transportation Department of East Kalimantan Province 2022

Gunung Telihan Village, West Bontang District, Bontang City, East Kalimantan Province, is the proposed construction site. The site coordinates 0° 9'5.39" North Latitude and 117°29'24.12" East Longitude. Figure 1 depicts the Site Plan for the Development and Operational Plan of Bontang Type B Terminal, which includes a map of the activity location.

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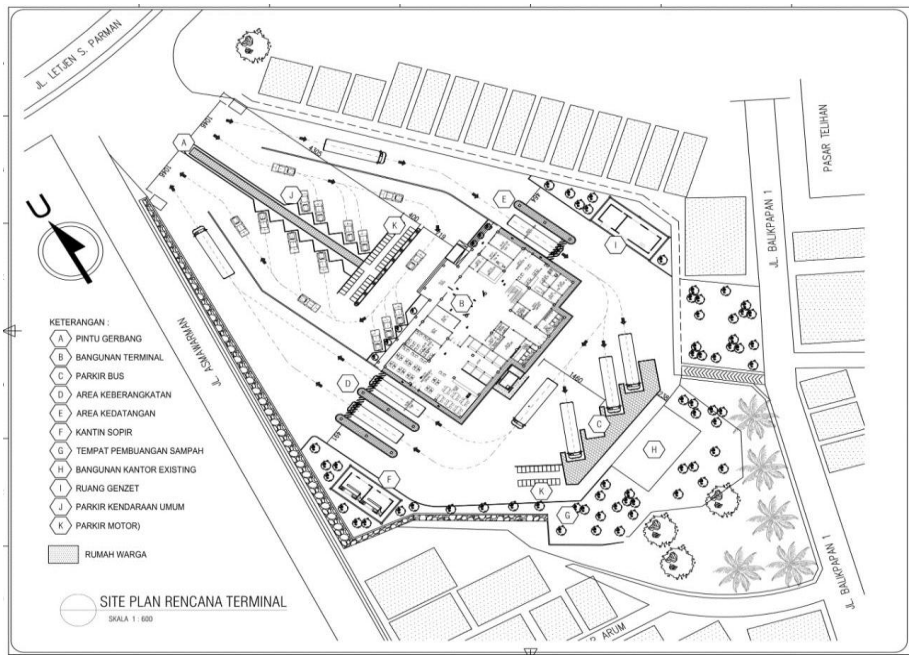

Figure 1. Site Plan for the Development and Operational Plan of Bontang Type B Terminal

B. Objectives and Benefits

The Passenger Terminal's construction aims to increase its significance in improving the region's connectivity and accessibility (Padmayasa et al., 2022). The advantage is that it increases the movement of goods and people. It will boost economic activity near the terminal. Land transportation is one of the most appropriate exercise modes in Bontang City, which has very complex geographical conditions.

II. METHODS

This research was based on the activities in the Detail Engineering Design, which will be completed in 2021. A qualitative descriptive research method assesses the environmental impact of the Bontang Type B Terminal's construction and operation. This method aims to describe the value of the independent variables, whether singular or multiple, without comparing or connecting them to other variables.

The environmental elements impacted by the construction and operation were evaluated using a matrix method in a comparative analysis. This evaluation considered the impact of each construction and operation stage, the efforts made to address the RKL (Environmental Impact Management Guidelines) and RPL (Environmental Impact Analysis) recommendations, and the actual conditions on the ground.

III. RESULTS AND DISCUSSION

The findings and discussion center on the effects of construction activities, such as increased noise, lower air quality, disruptions in traffic flow and safety, deterioration of existing roads, specific waste handling (construction waste), increased risks of workplace accidents (based on occupational safety and health), production of domestic solid and liquid waste, growth in employment and business opportunities, and an increase in people's income. The overall impact at the construction stage can be seen in Table 2, Development Impact Due to Construction Stages.

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Table 2. Development Impact Due to Construction Stages

Project Stages	*Impact Activities*	*Affected Environmental Components*		
		Physical Chemistry	*Biology*	*Social, Economic, Cultural, And Public Health*
Construction	*Recruitment of Construction Workers*			*Increased Job and Business Opportunities (+)*
				Increase in Resident Income (+)
	Construction and Operation of Basecamp and Office	*Domestic solid and liquid waste generation (-)*		
		Decrease in Air Quality (-)		
		Increased Noise Intensity (-)		
	Mobilization/Demobilization of Equipment and Materials	*Traffic smoothness and safety disturbance (-)*		
		Existing road damage (-)		
		Decrease in Air Quality (-)		
	Land preparation/demolition of the existing building	*Increased Noise Intensity (-)*		
		Handling of specific waste (construction waste)		
		Decrease in Air Quality (-)		*Job and business opportunities (+)*
	Construction of the Main Building and Supporting Facilities	*Increased Noise Intensity (-)*		*Increase in population income (+)*
		Increased risk of work accidents (K3) (-)		

Source: Transportation Department of East Kalimantan Province 2022

A. Impact Assessment of Construction Stages

1. Increasing Job and Business Opportunities

   The development permits up to 80 construction workers to be employed during the construction stage, including 56 skilled and 24 unskilled laborers. Priority will be given to local workers, who are expected to make up 60% of the workforce (48 people). Integrating 48 construction workers is expected to increase local labor force participation (TPAK) and decrease open unemployment.

   Furthermore, recruiting construction workers in the West Bontang sub-district will benefit businesses capable of absorbing an 80-person daily workforce (Badan Pusat Statistik (BPS), 2022). The construction

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phase, set to begin in 2022, will create jobs during the early stages of construction and sustain them during the operational stage. During the active stage of the Bontang Type B Terminal, the construction workforce is expected to consist of up to 48 workers, mostly from the surrounding areas, with 56 workers expected to be local.

It is possible to increase labor force participation by absorbing a construction workforce of 56 people (TPAK). Increasing employment and business opportunities will have a knock-on effect by increasing the community's income surrounding the terminal.

2. Impact of Decreasing Air Quality

The calculations of the estimated impact of decreasing air quality on concurrent construction activities show that the Total Suspended Particles (TSP) concentration remains within the established quality standards.

Table 3. Overall Air Quality Measurement Results

No.	*Test Parameters*	*unit*	*Test results*		*Quality standards*	*Time Measurement*
			Terminal Areas	*Entrance Area*		
1	*Sulfur Dioxide (SO2)*	$\mu g/Nm^3$	*35.35*	*38,98*	*150*	*1 hour*
2	*Photochemical oxides (Ox), such as ozone (O3)*	$\mu g/Nm^3$	*47.32*	*51,65*	*150*	*2 x 30 minutes*
3	*Carbon Monoxide (CO)*	$\mu g/Nm^3$	*1.021*	*1.025*	*10.000*	*1 hour*
4	*Nitrogen Dioxide (NO2)*	$\mu g/Nm^3$	*22,70*	*29,58*	*200*	*1 hour*
5	*Dust particulates < 100 µm (TSP)*	$\mu g/Nm^3$	*61,62*	*57,39*	*230*	*24 hours*

Sources: PT. Global Environment Laboratory, 2022

The impact assessment shows that the concentration of Total Suspended Particles (TSP) generated by activities near the terminal is less than 230 g/Nm3, within the quality standards. In addition, other air quality parameters are kept within established limits (Prasetyotomo et al., 2015).

Decreasing ambient air quality will last one year during construction activities and will be cumulative, with the impact disappearing once construction is completed.

3. Impact of Increased Noise

Mobilizing equipment and materials, site preparation and demolition of existing buildings, and construction of the main building and auxiliary facilities all contribute to increased noise levels during the terminal's construction activities (Balirante et al., 2020). The impact of increased noise due to each activity which is estimated separately is as follows:

Table 4. Noise Measurement Results, 2022

No.	*Sampling Location*	*Coordinate*	*Test results*	*Unit*
1.	*Area Terminal*	*S: 00°° 08°° 18.16" E: 117°° 27°° 19,79"*	*53.36*	*dB (A)*
2.	*Terminal Entrance Area*	*S: 00°° 08°° 20.68" E: 117°° 27°° 19,08"*	*48.80*	*dB (A)*

Source: PT. Global Environment Laboratory, 2022

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Mobilizing equipment and materials, preparing the site and demolishing existing buildings, and constructing the main building and supporting facilities are all part of the construction activities. They are expected to raise noise levels above the standard for residential areas (55 dB). This impact will be felt primarily near the S. Parman access road, which the mobilization of equipment and materials will traverse. Because increased noise occurs at different locations and times, the effect is not cumulative. The impact will be temporary as long as the construction activity lasts a year. After the construction activity is completed, the result will vanish.

4. Impact of generation of domestic solid and liquid waste
   The office and basecamp activities contribute to increased domestic solid and liquid waste generated during construction. The magnitude of this impact is cumulative and proportional to the extent to which land cover changes. The estimated amount of domestic solid waste generated per day is 24 kg. Meanwhile, 80 workers are expected to generate 12.10 m^3/day of domestic liquid waste (Firmawan, 2012). This effect is temporary and limited to the construction phase, but it will likely grow as the terminal opens and the number of visitors increases. As a result, proper management of domestic solid and liquid waste is critical.
5. Impact of Safety and Traffic Accidents
   The increased traffic volume during construction activities, caused by transport vehicles, is expected to cause highway vibrations. These vibrations, caused by an increase in the number of heavy vehicles and deterioration of road conditions, have the potential to damage buildings near the road. According to Sunandar & Mulyani (2017) research at the Research and Development Center for Roads and Bridges, vibrations 50 cm from the road were in Category B. (at a tool frequency of 31.5 Hz). It indicates the possibility of plaster cracking or detachment from load-bearing walls. Meanwhile, at a distance of 100 cm, the vibrations were in Category A (at a tool frequency of 31.5 Hz), indicating no structural damage. MENLH/II/1996, according to KEPMEN LH 49. However, as the number of passenger cars per hour increases, the damage to existing buildings may vary and even cause more damage.
6. Impact of Decreasing Surface Water Quality
   The erosion caused by site preparation activities for the main building and support facilities contributes to decreased river water quality. A TSS of 52 mg/l, which exceeded the quality standard, was the water quality parameter that increased (Brontowiyono et al., 2022). This impact grows in proportion to the amount of exposed land and will be amplified in times of maximum rainfall. The effect is only temporary during construction activities and will fade after management. The impact of reduced water quality due to erosion can be mitigated during the operational stage by constructing green open spaces throughout the terminal area. The concentration of TSS in surface runoff around the site reflects the effect of decreasing river water quality caused by land preparation work activities. Depending on the land area opened up due to land preparation activities, the impact of reducing river water quality accumulates in the flow body.
7. Impact of Increased Work Accidents
   During construction, more than 80 construction workers are at risk of injury. However, the impact is cumulative, and if the SOP for construction activities is not followed, work accidents will occur. The effect is only temporary as long as construction activities are carried out.

B. Directions for Environmental Management and Environmental Monitoring

1. Increasing Job Opportunities and Business Opportunities
   Environmental Management Efforts are as follows:
   a. Make room for informal business opportunities for the surrounding community.
   b. Create opportunities for the community to earn more money, particularly the stalls around the location, specifically in the study area, and especially for the people of West Bontang District.
   c. Assimilate and follow up on the community's aspirations and expectations in the study area regarding business opportunities that can support construction activities for the Bontang type B terminal and other supporting facilities.

2. Decreased Air Quality
   Environmental Management Efforts are as follows:
   Use operationally feasible project vehicles and project equipment.
   a. Install Complete barrier plates and covers/tarps on the body of the transport vehicle to reduce the spread of dust when transporting construction materials
   b. Clean the wheels (tires) on construction vehicles that enter and leave the activity site from dust, soil, and adhering mud by spraying water
   c. Carry out the transportation of the remaining material that has the potential to cause air pollution as soon as possible to a predetermined location using a closed cargo truck and transport according to the permitted capacity

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d. Clean up spilled soil material on the road (especially at project entrances and exits) by sweeping and sprinkling with water to reduce dust levels
e. Install a complaint contact number on each vehicle to make it easier for the public to report if an inappropriate situation occurs.
f. Install fences/walls around the construction site

3. Increased Noise Intensity
Environmental Management Efforts are as follows:
a. Use a roadworthy vehicle that meets the road class and has all the appropriate documents and permits. Make arrangements for the flow of cars transporting tools and materials in and out of the project site
b. Install stickers about SOP (Standard Operating Procedures) attached to each project vehicle (e.g., dashboard) intended for drivers to comply with the provisions written in the SOP, such as limiting the speed limit of project vehicles to a maximum of 30 km/hour
c. Strive to prevent project vehicles from operating side by side.
d. Ensure the load of vehicles transporting construction tools and materials according to their capacity.
e. Construction equipment and material mobility should be done an outside rush hour.
f. Install mufflers on vehicles that are used as needed and possibly to use.
g. Install a complaint contact number on each project vehicle used.
h. Coordinate with the local government and community leaders in implementing development activities during community breaks.

4. Decrease in River Water Quality
Environmental Management Efforts are as follows:
a. Construct drainage channels (according to SNI 03-3424-1994 regarding planning procedures for road surface drainage, SNI 03-2406-1991 concerning general planning procedures for urban drainage) before land preparation in the site area of the building plan. It is necessary so that the runoff that occurs allows it to be more controlled on the drainage channel.
b. Construct sediment traps in drainage channels before entering water bodies/rivers according to SNI 2851:2015 concerning the Design of sediment retaining structures.
c. The sediment trap building is dredged regularly to ensure good operation.
d. Implement scheduled land-clearing actions following work progress.

5. Increase in Domestic Solid and Liquid Waste
Environmental Management Efforts are as follows:
a. Provide two types of storage bins for organic and non-organic garbage.
b. Inform workers about how to dispose of waste based on the kind of waste.
c. Solid waste transportation in partnership with local stakeholders (RT/RW).
d. Transporting waste from the trash bins inside the basecamp to the final disposal site outside the Regional Government's terminal every day from 18.00 to 06.00 WITA.
e. Regarding B3 waste (used oil from heavy vehicles), the Contractor maintains cars outside the construction activity area.
f. Build biofilters for grey water, and use the water to hydrate the soil and plants around the site
g. For black water, a biofilm tank is created, and if it becomes full, desludging will be performed in partnership with a licensed third party.

6. Existing Road Damage
a. Implementing Law Number 22 of 2009 Article 19 and Article 162 to regulate loads according to road capacity

7. Increase in workplace Accident Risk
a. Workplace hazard control (elimination, reduction, engineering control, administrative control, and personal protective equipment).
b. Provide periodic guidance and socialization on occupational safety and health to all construction employees every time they work.
c. Providing insurance coverage for Construction Services Employment BPJS for all workers.
d. Provide and require each project worker to wear Personal Protective Equipment (PPE) following the type of hazard and safety for the workforce
e. Provide first aid kits for the first response in a work accident.

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f. make banners, flags, and general K3 signs in front of the project site as well as special OSH signs in every accident-prone work location

Submit a report to the Bontang City Manpower Office in case of a work accident.

IV. CONCLUSION

A. Conclusion

Based on the discussion and study objectives, the physical impact on the construction and operation of the terminal was evaluated, and mitigation steps were made. There are several conclusions:

1. An analysis of the terminal's construction and operation stages shows that 7 environmental components impact the most. It includes a decrease in air quality, increasing noise, reduction in surface water quality, damage to existing roads, rising accidents and occupational safety, increasing domestic solid and liquid waste, and handling special waste (demolition of construction materials).
2. In addition to countermeasures, three environmental components must be evaluated to maximize the results. These components include features for increasing the generation of domestic solid and liquid waste, damage to existing roads, and handling of special waste (disassembly of construction materials) in developing and operating the terminal.

B. Suggestions

This research only looks at the environmental impact of physical components during the construction stage. More research should be done to determine the effects of the construction and operation on other elements such as biology, socioeconomic culture, and public health.

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