

Site Processing Assessment at the Type A Bus Terminal in Surakarta based on Eco-Tech Architecture Theory

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Abstract - Problems that are often seen in bus terminals are identical to air pollution, noise pollution and excessive use of energy in their operations, so that the bus terminal has a negative impact on the surrounding environment. Solving these problems can be done by site processing that applies Eco-Tech architectural theory. Eco-Tech architecture encourages environmentally-based designs combined with smart building design technology, is energy efficient, environmentally friendly and provides a sense of comfort for users. The theory is closely related to the principle of Green Building, where building design now must refer to the concept of green buildings. Assessment can be through the GreenShip reference standard set by the Green Building Council Indonesia (GBCI). One of the principles used in this assessment is appropriate land use management at the type A bus terminal site in Surakarta. This principle aims to assess and determine the condition of the site and its surroundings, the efficiency of land management, and rainwater treatment in the site in the future. This research method uses a qualitative method and provides an index value based on secondary data through the problem identification stage, inputting theory and literacy which is then followed by data analysis, and produces a conclusion, namely the application of this principle has not been fully applied to the design of the bus terminal in Surakarta.

Keywords – Bus station, Surakarta City, Appropriate site, Eco-Tech

Introduction

Terminal is a major component in the transportation system as a place to start and end of the journey as well as a place for travel transitions, one of them is to move goods, people and information from one place to another (Akbaridin, 2019)(Pangalila et al., 2018). The Type A bus terminal is centered in the Gilingan village, Banjarsari district, Surakarta. This terminal is placed in the Gilingan area because the location is on a strategic route that directly connects bus transportation from East Java and West Java. The terminal is classified as a type A terminal which is functioned to serve inter-city transportation between provinces (AKAP), inter-city transportation within the province (AKDP), transportation within the city such as: public transportation, rural transportation, and minibuses (Akbaridin & Permana, 2020).

The rapid development of infrastructure and tourism sector development which has the potential to make Surakarta a developing area. In 2018 the Central Statistics Agency of Surakarta recorded an increase in visitors which occurred by 3.03% or as many as 534,249 in the Surakarta area. (BPS Surakarta 2019). Along with the increasing number of residents and tourists in Surakarta, it is necessary to build facilities that make it easier for users, especially in terms of transportation and daily needs. One form of transportation mode needed is a bus or public transportation. The increasing number of buses and public transportation

will require facilities in the form of terminalsto support the smooth movement of people or goods as well as intermodal and intramodal integration in certain places(Permana, 2012).

Type A bus terminal is a terminal that can accommodate a large number of modes of transportation and will serve passengers with proper facilities for a long period of time. In site processing, the design of a bus terminal is required to pay attention to the state of the surrounding environment, so as to optimize land use and not have an impact on the surroundings(Bahari, 2020)(Vidiyanti et al., 2020).

Eco-Tech architecture, this theory is used because it is suitable as a supporter of object activities in it which focuses on environmental conditions and sustainability. Eco-Tech Architecture is an environmentally friendly technology architecture. Having an environmentally-based design approach combined with technology that creates smart building designs, saves energy, or can even produce its own energy, and does not damage the environment and can integrate the natural environment with buildings and provide a sense of comfort for users (Agnes, Veronica, 2016). Eco- Tech Architecture Concept according to Catherine Slessor (1960) in her book Sustainable Architecture and High Tech has six important principles(Prima & Prayogi, 2020)(Anissa et al., 2020)(Syamsi et al., 2019), including:

- **Structure Expression**, Processing on the shape of the facade of the building that emphasizes the structure is used as an aesthetic in the building.
- **Sculpting with Light**, Processing of building skin through the use of transparent materialsto utilize sunlight as lighting and heating into the building.
- **Energy Matter**, the building is planned by utilizing the natural conditions of the local climate environment to meet the energy in the building.
- **Urban Responses** , The relationship of the building on the site to the urban area layout that is able to interact with the surrounding buildings.
- **Making Connections** , The relationship between the mass of site development (micro) and urban areas (macro) is able to make people comfortable in the building and there is interaction outside
- **Civil Symbol**, Processing on the shape of the building mass as a whole that describes the characteristics of the surrounding area, so as to create a landmark from that form.

(Prasetyo et al., 2019) said that the problems seen in the existence of a bus terminal were identical to pollution and excessive use of energy in its operations. The effect of transportation on the environment appears to be negative. This impact produces noise and air pollution from vehicle fumes, as well as dust from vehicle activities. Another problem that is often encountered in the terminal is the problem of cross circulation between vehicles and humans, as well as suitability in achieving space, it is necessary to have a bus terminal site processing that can increase effectiveness, safety and comfort for users(Pradharma et al., 2021).

Based on the problems described above, to meet the assessment on the processing of the bus terminal footprint, a reference standard from green ship is needed established by the Green BuildingCouncil Indonesia (GBCI) to provide solutions that can reduce the negative impacts caused. The design of the building now must emphasize the use of the green building concept in it. Eco-Tech architecture is closely related to the concept of green buildings. One of the principles that will be used is the principle of appropriate land use (Appropriate Site Development). The principle of appropriate land use contains 8 criteria that have been determined by the Green ship rating system as follows: Community Accessibility (1), Motor Vehicle Reduction (2), Bicycle (3), Site Landscaping (4), Heat Island Effect (5), Storm Water Management (6), Site Management (7), and Building Neighborhood (8). The results collected were an assessment of the location, circulation of achievements, accessibility of control, microclimate, landscape processing, and rainwatermanagement.

Research Method

This study is carried out using qualitative methods that will be used to examine the condition of natural objects (Sugiyono, 2005). This type of qualitative research is obtained from secondary data which is the result of a literature study in the form of: expert data and theories regarding the principles of Eco-Tech architecture or Green Building criteria through books, journals, articles, research reports that have been carried out and data on the internet. Understanding the design begins with looking at the phenomenon in the existing building which is then followed by a review ofsecondary data. The discussion will focus on land assessment of the type A bus terminal buildingin Surakarta according to Eco-tech principles with Green Building Appropriate Site Development criteria based on the Greenship rating system which contains 8 criteria. This rating is done by giving an index value of 1 - 5 for each criterion. If they do not meet the requirements, a score of 1 will be given, while those who meet the requirements will be given a maximum score of 5. Output from this literature study is the collection of references relevant to the formulation of the problem.

Results and Discussion

The type A bus terminal, also known as the Tirtonadi bus terminal, is located on Jalan Jendral A. Yani, Gilingan Village, Banjarsari District, Surakarta. The Tirtonadi bus terminal functions as a place for public transportation to drop and pick up passengers, as well as move from one place to another. Based on the


results of search data on the Internet, the existing site area is currently around 5.2 Ha, already meeting the standards of the Regulation of the Minister of Transportation of the Republic of Indonesia Number 132 of 2015 concerning the Implementation of Road Transport Passenger Terminals which must be fulfilled by 5 ha on the island of Java. according to local regulations, it has been designated as a public service area. Has KDB: 80%, KLB: 1,3, KDH: 10% And GSB is adjusted to road conditions.








Figure 1. Research Location of Surakarta Type A Bus Terminal.



(Source of Fig. Analysis, Author, 2021)


The process of literature review and exploration resulted in an assessment of the condition of site processing at the bus terminal type A in Surakarta with eco-tech architectural principles and taking into account the green ship standard reference, namely land use processing (appropriate site development). In land use management, there are 8 (eight) criteria in it and will be discussed in the following table:

Criteria	Existing	Discussion
<p>1.Green Base Area The Green Base Area is used to improve the quality of the microclimate, reduce CO2 and pollutant substances, prevent soil erosion, reduce the burden on the drainage system, maintain a balance in the balance of clean water and ground water systems (Green ship V1.2)</p>	 (Source of Fig. Analysis, Author, 2021)	<p>According to Surakarta City Regional Regulation Number 2 Year 2011- 2031 regarding the Regional Spatial Planning (RTRW), has zoning provisions in the form of a Basic Building Coefficient (KDB) in public service buildings of 80% and A Green Basic Coefficient (KDH) of 10% to provide rainwater catchment areas so that they remain in the initial function of the land which is a absorption area.</p> <p>This terminal has a land area about 5 ha consisting of 3.4 ha of building area and 1.6 ha of emplacement area. It has met the RTRW regulatory standards. The treatment system for clean water has been fulfilled in the terminal.</p>
		<p>Index 2 (Sufficiently Fulfilled)</p>

Criteria	Existing	Discussion
<p>2. Site selection</p> <p>Avoid development in greenfields and avoid clearing new land (Greensiip V1.2).</p>	 <p>(Source of Fig. Analysis, Author, 2021)</p>	<p>The location of the bus terminal is in the northern part of the city of Solo. Its location is very strategic because it is traversed by the main traffic route that connects West Java bus transportation and East Java buses. Classified as a type A terminal that can transport foam between provinces and within provinces, it requires large-scale land as a container for Dropping and transporting passengers. In the Minister of Transportation Regulation No. 132 of 2015 concerning Road Transport Terminal Operators, it has been determined that the type A terminal on the Java Island has a land area of 5 ha. In the Tirtanadi terminal land, it has met the requirements or regional regulations with a land area of 5.2 hectares.</p>
<p>3. Accessibility and Community</p> <p>Encourage development in places that already have network connectivity and increase the achievement of building use so as to make it easier for people to carry out daily activities and avoid the use of motorized vehicles (Greensiip V1.2).</p>	<p>A. Access to Terminal</p>  <p>B. Distance to the terminal</p> 	<p>Tirtanadi bus terminal is located on AhmadYani Street where this road is an arterial road that is always traversed by many vehicles, so that accessibility to the terminal is very easy to reach by motorists or pedestrians. There are many signs on each road that will direct you to the bus terminal location.</p> <p>The type A bus terminal building has a relationship and influence on the surrounding environment in carrying out its activities. The bus terminal building has been integrated with the train station which is connected by a 483 m sky bridge, making it easier for passengers to go to the stations or vice versa. However, road facilities in the form of sidewalks, road markings and other road complements still do not meet the requirements for safe and comfortable pedestrian safety.</p> <p>(Urban Responses)</p>

Criteria	Existing	Discussion									
	 <p>(Source. Analysis, Author, 2021)</p>	<p style="text-align: center;">Index 3 (Fulfil)</p>									
<p>4. Public Transportation Encourage development in places that already have network connectivity and increase the achievement of building use so as to make it easier for people to carry out daily activities and avoid the use of motorized vehicles (Greensiip V1.2).</p>	<table border="1" style="width: 100%;"> <tr> <td rowspan="8" style="text-align: center; vertical-align: middle;">Passing public transportation</td> <td>AKADP/AKAP BUS</td> </tr> <tr> <td>BST/BRT</td> </tr> <tr> <td>public transportation</td> </tr> <tr> <td>Taxi</td> </tr> <tr> <td>Ojek online</td> </tr> <tr> <td>Car</td> </tr> <tr> <td>Motorcycle</td> </tr> <tr> <td>Pedicab</td> </tr> </table> <p>(Source. Analysis, Author, 2021)</p>	Passing public transportation	AKADP/AKAP BUS	BST/BRT	public transportation	Taxi	Ojek online	Car	Motorcycle	Pedicab	<p>The distance from the terminal to the city of Solo is about 2 km, with this distance the terminal is also easy to reach by using city public transportation such as BRT/BST and Taxi/online. Meanwhile, those who are close from the terminal can be reached on foot or using public Transportation such as rickshaws or public transportation. However, in the terminal there is no clear waiting area for taxis, motorcycle taxis, and rickshaws where vehicles park randomly in the terminal so that it can endanger the passengers inside. For private car parking, it is placed on the second floor, but there is no clear direction that makes passengers who want to go to the car park confused and there is no canopy as a shade for pedestrians.</p> <p style="text-align: center;">(Making Connection)</p>
Passing public transportation	AKADP/AKAP BUS										
	BST/BRT										
	public transportation										
	Taxi										
	Ojek online										
	Car										
	Motorcycle										
	Pedicab										
<p>5. Bicycle User Facilities Encourage the use of bicycles for building users by providing adequate facilities so as to reduce the use of motorized vehicles (Greensiip V1.2).</p>	 <p>(Image Source. Google Photos, 2021)</p>	<p>Local residents can visit the site by bicycle. However, residents' interest in using bicycles is still not there because around the terminal there are no special lanes for bicycles and bicycle parking spaces, so residents still feel it is not safe to use bicycles.</p> <p style="text-align: center;">(Making connections)</p>									
		<p style="text-align: center;">Index 0 (Not Fulfilled)</p>									

Criteria	Existing	Discussion
<p>6. Landscaping on land Maintain or expand the greenery of the city to improve the quality of the microclimate, reduce CO2 and pollutant substances, prevent soil erosion, reduce the burden on the drainage system, maintain a balance in the balance of clean water and groundwater systems (Green ship V1.2).</p>	 <p>(Source of Fig. Analysis, Author, 2021)</p>	<p>For landscaping in the terminal area, there is already vegetation in the form of large trees, small trees and shrubs as roadblocks.</p> <p style="text-align: center;">Index 3 (Fulfilled)</p>
<p>7. Micro Climate Improving the quality of the microclimate around the building which includes human comfort and the habitat around the building (Greenship V1.2).</p>	 <p>(Image Source. Google Photos, 2021)</p> <p>(Image Source. Google photo ,2021)</p>	<p>Being in a tropical country which has two seasons, dry and rainy season, the design of the terminal site should be able to respond to these problems. At the Tirtonadi terminal, it was deemed sufficient to respond and the building was able to process sunlight into electrical energy using solar panels. (Urban Responses, Energy matters)</p> <p style="text-align: center;">Index 3 (Fulfilled)</p>

Criteria	Existing	Discussion
<p>8 Rainwater Runoff Reducing the burden of the Environmental drainage system from the quantity of rainwater runoff with an integrated rainwater management system. (Greenship V1.2).</p>	 <p>(Source of Fig. Analysis, Author, 2021)</p>	<p>The terminal has not been able to properly utilize rainwater runoff. There are no special rainwater reservoirs such as ponds or rainwater reservoirs so that the rain that falls will flow directly into the channel and be dumped directly into the river. For private vehicle parking lots, some have used conblocks so that runoff can be absorbed directly into the ground so it doesn't cause puddles. (Urban Responses)</p> <p style="text-align: center;">Index 1 (Still not fulfilled)</p>

Conclusion

Based on the results of the data above, it can be concluded that site processing at the Surakarta type A bus terminal is currently not fulfilled, all criteria and benchmarks are still not implemented. Based on the results of the assessment based on Greenship for terminal land management, which obtained 17 points out of 24 points for the standard provisions. After analyzed, the results obtained on the circulation of building achievements are easy to reach using public or private transportation and can be reached on foot. Landscape Processing needs to be considered again so that it looks neat, cool and beautiful. In terms of control accessibility, which is seen from the urban response, it is sufficient that the terminal building is connected to the Solo Balapan train station with a skybridge as a liaison between buildings, but on the pedestrian path they still do not see signs and special pedestrian markings that need to be added in the terminal. Based on the urban response and energy matter in rainwater management, the Surakarta type A bus terminal still has not processed it well and there is no rainwater storage area so the water is directly dumped into the river. The Type A Bus Terminal in Surakarta still needs to improve the land to make it better.

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