



Feasibility Analysis of The Construction of the Trans Metro Dewata Bus Stop Based on Technical Aspects and Accessibility

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Abstract. The problem of limited accessibility and uneven public transportation facilities requires the construction of proper bus stop houses at bus stop points. This study aims to analyze the feasibility of constructing the Trans Metro Dewata bus stop house by considering four main criteria: land use, passenger demand volume, location of travel generation (such as offices and schools), and road geometry. The research method employs the Analytical Hierarchy Process (AHP) approach, which is implemented using Expert Choice software. Data were obtained through a field survey at bus stops that did not have a bus stop shelter, and then analyzed to determine the priority of the construction site. The study's results showed that Politeknik Negeri Bali bus stop received the highest priority weight, ranging from 62.7% to 66.7% in most criteria, and was therefore determined to be the most feasible location for prioritizing the construction of bus stop houses. The Ngurah Rai GOR bus stop occupies a middle priority, with a weight of 15.1%–29.8%, while the Titi Banda bus stop tends to be at the lowest priority, with a weight of 9.4%–21.8%. An exception is shown in the geometric aspect of the road, where the Titi Banda bus stop received the highest weight of 37.9%. These findings are expected to serve as the basis for planning the construction of bus stop houses that are more efficient, safe, and sustainable.

Keywords: Accessibility, AHP, Bus Stop Shelter, Feasibility

1 Introduction

Trans Metro Dewata is a relatively new mass transportation system in Bali Province, serving several strategic areas, including Badung, Denpasar, Gianyar, and Tabanan (Bali Provincial Transportation Office, 2022). Although the bus fleet is still in excellent condition, having been operated since 2021, the level of community utilization is not optimal. One of the main obstacles faced is limited access to stopping points or bus stops. Many prospective passengers have difficulty reaching the bus stop because its location is not integrated with community activities and facilities that are not up to standard. The lack of information regarding locations and routes is also a significant obstacle. Therefore, in-depth research is needed to evaluate the feasibility of the location and design of the bus stop house (Utami, A. N. & Nugroho, 2023). This study

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aims to develop a comprehensive technical design and feasibility study for bus stop houses, enhancing the ease of access, comfort, and efficiency of public transportation in Bali (Kurniawan, 2022).

Trans Metro Dewata uses a medium-sized bus fleet that serves five major corridors in Bali. The first corridor connects the Kuta parking center in Badung Regency with Preparatory Terminal 2 in Tabanan, covering a round-trip distance of about 62.3 km and passing through 74 stopping points. The second corridor operates a route from Ubung terminal to Ngurah Rai international airport with a total travel length of 46.2 km and 68 stop points. The third corridor connects Ubung Terminal to the Matahari Terbit Beach area for 35.6 km through 46 stops. Furthermore, the fourth corridor connects the Ngurah Rai GOR with the Monkey Forest parking center, spanning a distance of approximately 58.3 km with 68 stops. Meanwhile, the fifth corridor serves the journey from the Kuta parking center to the Politeknik Negeri Bali campus, ending at the Titi Banda bus stop, with a distance of approximately 61 km and passing through 69 stops. Although in the second corridor, especially the Ubung terminal-airport route, there are around 69 stops available (West, 2022). Although in corridor 2 (Ubung terminal-airport) there are many bus stops, there are still stopping points, especially in corridor 5, which are not equipped with adequate facilities such as seats, shade, or route information, thus reducing comfort and ease of access for prospective passengers (Yuliani, D. & Siregar, 2021).

2 Methodology

This research is focused on the Trans Metro Dewata bus stop house as the object of study. The method employed is a qualitative approach with a field study design, utilizing direct surveys. Data collection is conducted through on-site observation to assess the extent to which the bus stop is accessible to users. The data collected included the total number of bus stops spread across five service corridors, as well as an assessment of the physical feasibility of the bus stops based on aspects such as mileage, travel duration, and estimated costs required to reach the bus stops from the user's point of origin. Direct observation methods in the field are combined with geospatial mapping to evaluate the relationship between the location of the bus stop and the activities of the surrounding community (Handayani & Pratama, 2021). Additionally, a survey method using quantitative instruments was employed to collect data on the public's perception of the function and feasibility of bus stop facilities (Putri et al., 2022). The analysis technique was conducted descriptively, utilizing spatial data processing software to identify priority points for constructing bus stop houses (Wijaya, 2023). Here is an overview of the location of the Trans Metro Dewata bus stop in Bali. As part of the data validation method, the researcher also examined the results of academic studies and transportation policies that highlighted the implementation of the Trans Metro Dewata BRT system in Bali. The analysis offers further insights into the effectiveness of the corridor, the distribution of bus stops, and the community's response to the service's existence (Arimbawa & Susila, 2022). In addition, this field study also adopts the principle of activity-based accessibility, which is increasingly

relevant in the urban context of Bali, where the tourism sector and daily mobility are key factors (Putra & Yuniartha, 2023).



Figure 1. Bus Stops and Trans Metro Dewata Bus Stops

The survey stage of this research began with the collection of data on all bus stops in the Trans Metro Dewata service corridor that are currently not equipped with bus stop houses. Each identified bus stop point is then observed directly in the field to obtain data related to physical conditions, the surrounding environment, and the potential for bus stop construction space. Furthermore, data collection was carried out in accordance with four main criteria that became the basis for the assessment, namely: (1) land use around the bus stop point which includes the function of the area and its suitability with the existence of the bus stop, (2) the density of demand obtained through the observation of the number of users during peak and non-peak hours, (3) the location of the largest travel generation such as offices, schools, shopping centers, and other public facilities around the bus stop point, as well as (4) the geometric condition of the road which includes the width of the road, safety for stopped vehicles, and the smooth flow of traffic. The survey data is then processed and analyzed to determine the bus stop points that are most feasible for prioritizing the construction of bus stop houses, so that their

existence can support accessibility, comfort, and the smooth operation of public transportation.

3 Result and Discussion

3.1 Results

Respondent Characteristics. The characterization of the respondents was made taking into account: gender, age, education level, and professional occupation. Of the valid questions, 47% were asked of men, and 53% were asked of women. Passenger revenue data illustrates quite significant variations in income levels among passengers. A total of 63 people, or most of the passengers, have an income of less than 4 million, reflecting the existence of a low-income sector of society that uses this transportation service. Meanwhile, the other 24 passengers had revenues ranging from \$4 to \$8 million. Based on the data obtained, it can be concluded that the vulnerable age group of Teman Bus transportation users in Corridor 3 is 16-30 years old, comprising 53% of the population. This suggests that Teman Bus is a highly sought-after transportation option among the younger generation. In addition to the 16-30 age group, the vulnerable age group of Teman Bus users is also dominated by those aged 31-45 years, with a percentage of 25%. This indicates that Teman Bus is also gaining popularity among the millennial generation. Meanwhile, the age of Teman Bus users is relatively older, with 6% of users being over 60 years old. The type of work of transportation users, Teman Bus, is dominated by students, with a percentage of 41%. In addition to students, the type of work of Teman Bus users is also dominated by students, with a percentage of 41%. Based on the number of family members who use Teman Bus in Corridor 3, it was found that people who have the number of family members 1 are 14 respondents, passengers who have the number of family members 2 are 36 respondents, passengers who have the number of family members 3 are 31 respondents, passengers who have the number of family members 4 are 12 respondents, passengers who have more than 5 family members are 7 respondents.

The survey results showed that the travel time of respondents to the bus stop was mostly less than 5 minutes, in 45% of cases. It can be concluded that most of the bus stops are close to the respondent's residence.

In terms of travel costs, it can be concluded that the transportation costs used to get to the bus stop are mostly less than 41% of Rp. 5,000.00. This is due to the distance traveled close to the bus stop. Furthermore, transportation costs are 22% with a cost range of Rp. 5,000.00 to Rp. 10,000.00.

3.2 Discussion

The placement of bus stops and their number play a crucial role in the effectiveness of using the Bus Rapid Transit (BRT) system. If the construction of bus stops is not carried out properly, this can actually worsen transportation problems because people who should be potential users are reluctant to take advantage of this mode. One of the main

reasons for the low use of bus stops is that the location of the bus stop is too far from the point of community activity, making it impractical to reach. Many passengers choose to get on or off in unofficial areas—such as near intersections, in front of shops, offices, or educational institutions—because it’s closer, safer, and less draining. Therefore, it is essential to strategically design the placement of bus stops and adjust them to meet demand points, thereby reaching a larger number of users in an optimal manner. The more stops available, the greater the level of ease of access to bus services becomes. However, it is also worth considering that the construction of a large number of bus stops will increase construction and operational costs. The conditions for the placement of the bus stop are as follows: Land use is a very dense center of activities such as markets and shops in urban locations with a distance of 200-300 meters; the use of dense land such as offices, schools, and services in urban locations with a distance of 300-400 meters from the bus stop; Land use in the form of settlements in urban areas with a distance of 300-400 meters and dense mixed land use in the form of housing, schools, services in suburban locations with a distance of 300-500 meters.

To determine the optimal location for the construction of the bus stop, a clear set of criteria is necessary to ensure that the facilities built can function effectively and efficiently. The Decree of the Directorate General of Land Transportation, Number 271/HK.105/DRJD/96, and the Draft Technical Guidelines for City Bus Transportation, issued by the Ministry of Transportation in 2006, stipulate four main criteria on which the assessment is based. These criteria include land use, demand density, the location of the largest travel generators, such as offices, schools, and other activity centers, as well as road geometry. The fulfillment of these four criteria is expected to ensure that the bus stop is located at a strategic point that is safe and easily accessible. It supports the smooth operation of public transportation.

Based on the results of observations and interviews, 3 alternative bus stops that need to be built were obtained. Among them are the Titi Banda bus stop, the Ngurah Rai GOR bus stop, and the Politeknik Negeri Bali bus stop. To determine the priority bus stop, the AHP method is used with the help of the Expert Choice program. The following is an overview of the Expert Choice program version 11. This is illustrated in Figure 2.

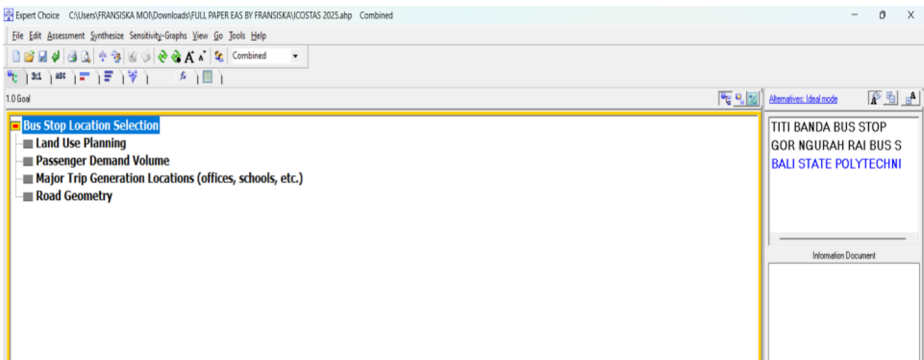


Figure 2. Use of the Expert Choice Program

The output of the Expert Choice program indicates that the criteria used for determining the priority of bus stop locations are Land Use Planning (Bus Stop Location Selection). The calculation results show the priority weight as follows: Titi Banda bus stop weights 0.094 (the lowest priority). GOR Ngurah Rai bus stop weighs 0.280 (medium priority). Politeknik Negeri Bali bus stop weights 0.627 (highest priority). An inconsistency value of 0.08 indicates that the level of consistency of the assessment is within acceptable limits (less than 0.1), so the weighting results can be considered valid. Thus, the most recommended bus stop location, based on Land Use Planning criteria, is the Politeknik Negeri Bali bus stop. (see Figure 3).

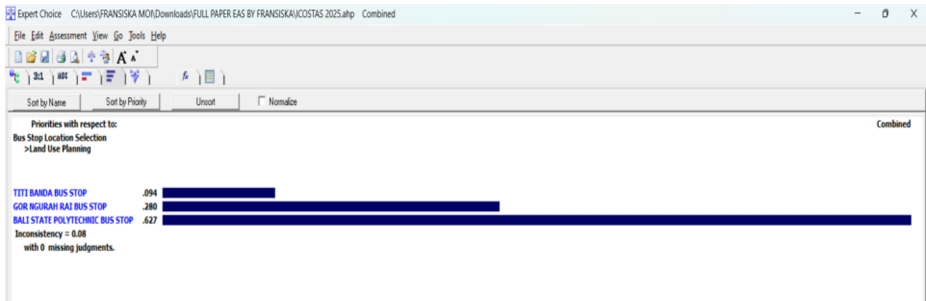


Figure 3. Selection of Bus Stop Locations Based on Land Use Criteria

The Passenger Demand Volume criterion is used to determine the priority of the bus stop location. The weighting results showed that Titi Banda bus stop had the lowest priority, with a weight of 0.111, followed by GOR Ngurah Rai bus stop, with a weight of 0.222, and Politeknik Negeri Bali bus stop, which had the highest priority, with a weight of 0.667. An inconsistency value of 0.00 indicates a very consistent assessment, so this result can be considered valid. This indicates that Politeknik Negeri Bali bus stop is the most suitable location choice based on the passenger demand volume criterion, as shown in Figure 4.

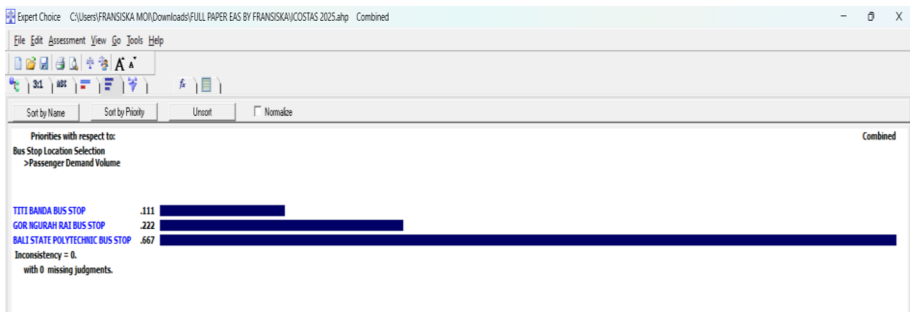


Figure 4. The Selection of the Location of the Bus Stop is Based on the Criteria of the Size of Passenger Demand

Major trip generation locations (such as offices, schools, and others) are used to determine the priority of bus stop locations. The weighting results showed that Titi

Banda bus stop was assigned a weight of 0.218, indicating a middle priority; GOR Ngurah Rai bus stop was assigned a weight of 0.151, indicating the lowest priority; and Politeknik Negeri Bali bus stop was assigned a weight of 0.630, indicating the highest priority. The Inconsistency value of 0.10 is still within the acceptable tolerance limit, so this result is considered valid. This indicates that the Bali State Polytechnic bus stop is the most suitable location, given its proximity to major travel generation centers, as illustrated in Figure 5.

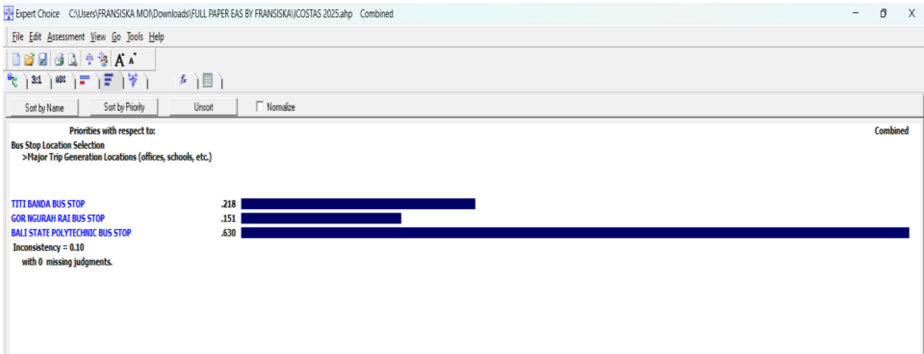


Figure 5. Selection of Bus Stop Locations Based on the Criteria for the Largest Travel Generation Location

The last criterion used is Road Geometry to determine the priority of the bus stop location. The weighting results showed that Titi Banda bus stop had the highest priority, with a weight of 0.379, followed by Politeknik Negeri Bali bus stop with a weight of 0.331, and GOR Ngurah Rai bus stop with the lowest priority, a weight of 0.289. An inconsistency value of 0.69 indicates a sufficiently high level of inconsistency, suggesting that this result requires review to ensure accuracy. Nonetheless, the order of priority can still be identified, as shown in Figure 6.

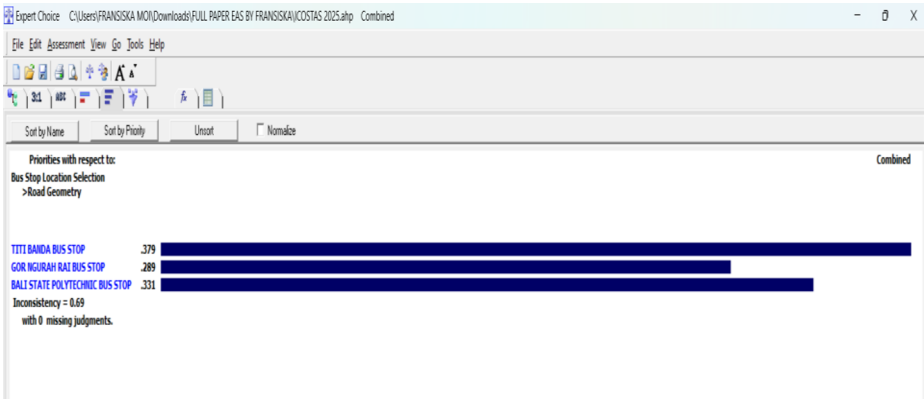


Figure 6. Selection of Bus Stop Locations Based on Road Geometric Criteria

Based on the results of the analysis using the Expert Choice program, the priority bus stop location for the construction of the bus stop is the Politeknik Negeri Bali Bus Stop, as it has the highest priority weight among the alternative locations.

4 Conclusion

This study emphasizes the importance of strategic planning in the development of bus stops for the Trans Metro Dewata system. By applying the Analytical Hierarchy Process (AHP) method, four main criteria—land utilization, passenger demand volume, location of major travel activity centers, and road geometric conditions—are systematically evaluated to determine the most feasible locations. The research findings consistently show that the Bali State Polytechnic Bus Stop holds the highest priority for development due to its strategic location and strong alignment with most of the criteria. Meanwhile, the Ngurah Rai Sports Hall Bus Stop ranks at a medium priority level, while the Titi Banda Bus Stop generally falls into the lowest priority category, except in terms of road geometry. These findings highlight that improving accessibility, safety, and comfort through well-planned bus stops will not only enhance the user experience but also increase the effectiveness and sustainability of the public transportation system in Bali.

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