



PERFORMANCE ANALYSIS OF PUBLIC TRANSPORT FEEDER LIGHT RAPID TRANSIT (LRT) PALEMBANG SOUTH SUMATRA

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Abstract. Feeder is transportation that serves parts of the city that are beyond the reach of the BRT/LRT/MRT transportation system or transportation above it and is not connected to the system. This study is intended to assess the performance of feeder public transportation. As for the performance assessment that will be calculated based on this public transportation performance survey, among others, travel time, headway, load factor, speed, and the number of LRT passenger growth when before and after the existence of this feeder public transportation. The LRT Station which is the object of research is the Haji Dormitory Station, so that the Corridor passing through the Asrama Haji Station is divided into 3 corridors, namely, Asrama Haji - Talang Betutu, Asrama Haji - Sematang Borang, and Talang Kelapa – Asrama Haji - Pundi Kayu. Based on the data obtained in the field shows that travel time, headway, load factor, and speed still meet the performance of public transportation so that this feeder is very useful for the people of Palembang.

Keywords: Performance, Load Factor, Headway, Travel Time, Feeder.

1 INTRODUCTION

1.1 Background

Palembang City, located in South Sumatra, is the second largest city in Sumatra with a population in 2021 of 1,686,073 people. This figure continues to grow from the previous year which was only 1. 668 164. (BPS Palembang city). With this high population, Palembang is ranked 11th as the most densely populated city of 98 other cities in Indonesia. As the number of people increases, the need for movement will also increase.

The increase in population certainly has a big influence on transportation movements. As in the city of Palembang, which since the last 20 years has continued to improve to become a big city with so many changes and destinations in it. Palembang has become a destination for job seekers and domestic tourists. With this large number

of residents and migrants, a city will become more crowded and dense. The need for transportation in this city also increases.

Movement in Palembang city uses private transportation and passenger transportation. Private transportation has several options such as private cars, motorized vehicles and bicycles. Passenger transportation has several options such as public transportation, Trans Musi Bus and Light Rail Transit with its own feeder. However, private transportation is still the main choice for people in Palembang city. This private transportation is the biggest contributor to congestion in Palembang city. This can be seen with the large volume of motorized vehicles on each side of the road which causes congestion. Congestion is clearly visible on arterial roads, especially during peak hours.

Congestion that often occurs due to the accumulation of private vehicles often causes various problems. Several steps have been implemented by the local government to overcome the congestion problem in Palembang city, by improving the service of public transportation modes, namely Light Right Transit.

Light Rapid Transit (LRT) is a mode of public transportation in the form of an urban train that has a lower speed and capacity than Mass Rail Transit (MRT). This sophisticated train also has a separate track from other vehicles so that it has no obstacles in its movement. Light Rapid Transit (LRT) should ideally be the choice of the people of Palembang city, especially for workers and students to choose the mode of transportation to get to their destination. In an effort to attract the interest of the Palembang city community in choosing this mode, the Palembang city Transportation office and KAI Light Rapid Transit (LRT) launched feeder transportation to encourage people to use this mode of transportation massively.

Feeder transportation is a small public transportation and is responsible for accommodating passengers on predetermined road routes and attracting generation to Light Rapid Transit (LRT) stations according to their respective corridors.

On Saturday, November 11, 2022, Minister of Transportation Budi Karya Sumadi, handed over 29 units of feeder transportation to the South Sumatra government and Palembang city government. Budi Karya said that with the existence of this feeder transportation, public transportation services in the city of Palembang will be improved.

2 RESEARCH METHODOLOGYS

2.1 Scope of Research

The location of this research is Asrama Haji Station, Palembang. The target of this research is LRT passengers who continue their journey by using LRT facilities. The study area is corridor 1 Asrama Haji - Talang Betutu, corridor 2 Asrama Haji - Sematang Borang, and corridor 3 Talang Kelapa - Asrama Haji - Pundi Kayu.

2.2 Data Collection

The data needed to support this research consists of primary and secondary data. Primary data is data taken directly in the field through direct surveys to the field such as travel time data, headway, load factor, and speed of the feeder public transportation

followed. Secondary data is obtained from several related agencies from several sources including: Research that has been done before, Palembang LRT passenger data, especially the Asrama Haji Station before and after the existence of Feeder Public transportation obtained from the Palembang Railway Implementation Center. Data issued by related agencies such as Feeder Public Transportation Network Map and Bus Rapid Transit (Musi Emas).

2.3 Data Analysis

The method for obtaining data in the field is to use the Following Car method. Two surveyors using two-wheeled vehicles followed the feeder transportation from behind while recording the time, up and down passengers, and the number of stops (mini stops) along the route. Primary data that has been obtained from the survey is processed to get the same load factor, travel time, headway, and speed. Then the data is analyzed again to get the percentage of passengers who use LRT to continue their journey with Feeder public transportation on the 3 corridors. This survey was conducted for four days, 2 days' weekday and 2 days' weekend with a range of peak hour times (morning and evening).

3 RESULT AND DISCUSION

3.1 Survey Result of Following Car Method on Each Corridor

The research surveyed the load factor of each corridor studied. The average load factor of this feeder transportation is 50-100% because the capacity of this feeder transportation is only 9 benches. The following car method is also used because it takes into account the capacity of the feeder transportation, so that if the surveyor enters the feeder transportation, it will affect the level of occupancy greatly.

3.2 Identification of Load Factor For Each Road Section

Based on the survey results, the average level of occupancy of the Feeder Transport for the Asrama Haji - Talang Betutu Corridor is 5 passengers/trip for weekdays, and 3 passengers/trip for weekends. The Asrama Haji - Sematang Borang corridor is 7 passengers/trip for weekdays, and 5 passengers/trip for weekends. And the Talang Kelapa - Asrama Haji - Punti Kayu corridor is 6 passengers/trip for weekdays, and 5 passengers/trip for weekends. The following is a graph of the level of occupancy for the three sections that have been surveyed:

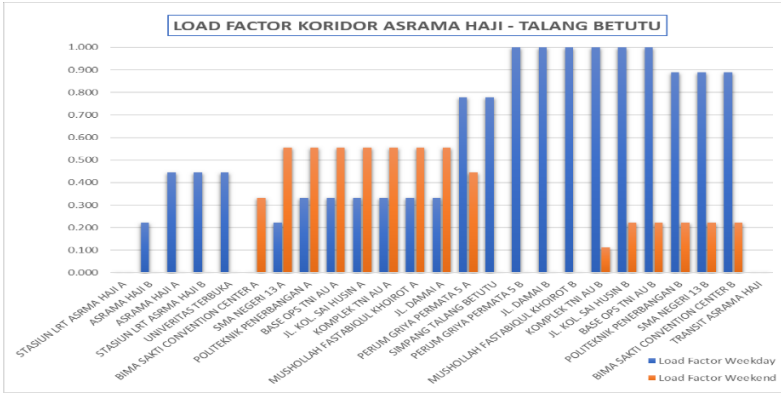


Fig. 1. Load Factor of Asrama Haji – Talang Betutu Corridor

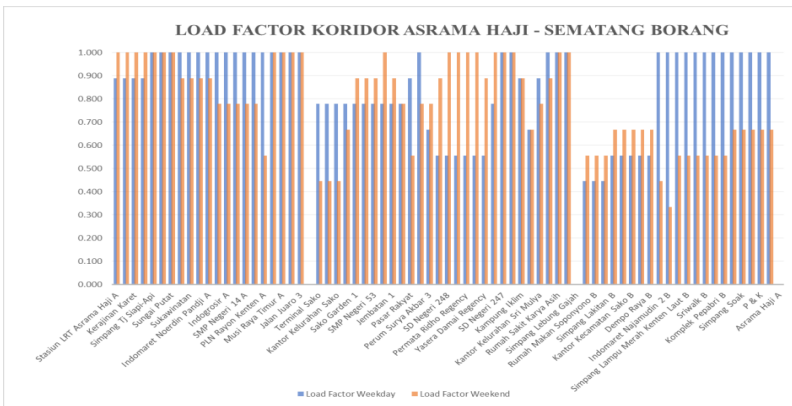


Fig. 2 Load Factor of Asrama Haji – Sematang Borang Corridor

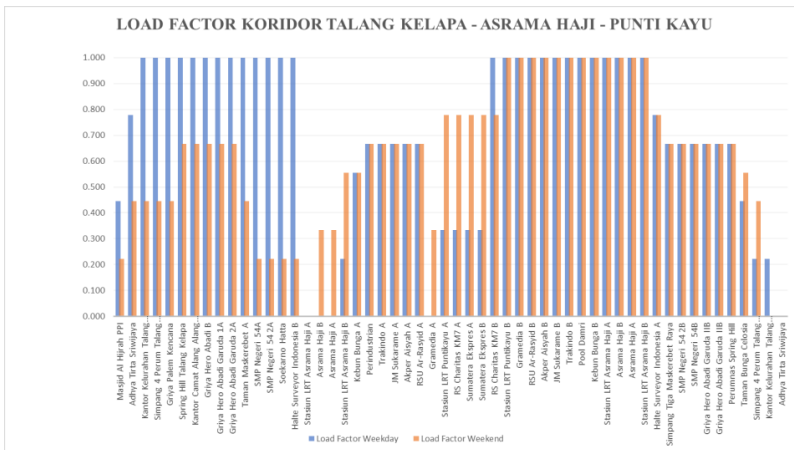


Fig 3 Load Factor of Talang Kelapa – Asrama Haji – Punt Kayu Corridor

Table 1. Table captions should be placed above the tables.

| Time | Corridor | Load Factor Average |
|---------|--|---------------------|
| Weekday | Asrama Haji – Talang Betutu | 57.64 % |
| Weekend | Asrama Haji – Talang Betutu | 42.44 % |
| Weekday | Asrama Haji – Sematang Borang | 63.32 % |
| Weekend | Asrama Haji – Sematang Borang | 61.30 % |
| Weekday | Talang Kelapa – Asrama Haji – Pundi Kayu | 65.94 % |
| Weekend | Talang Kelapa – Asrama Haji – Pundi Kayu | 67.38 % |

Forecasting with the linear pattern, we get:

$$Y = 111322x + 40999 \quad \text{with } R^2 = 0.6653 \quad (1)$$

The following is a graph that can be seen to predict or forecast the number of LRT passengers in 2023 (see Fig. 4)

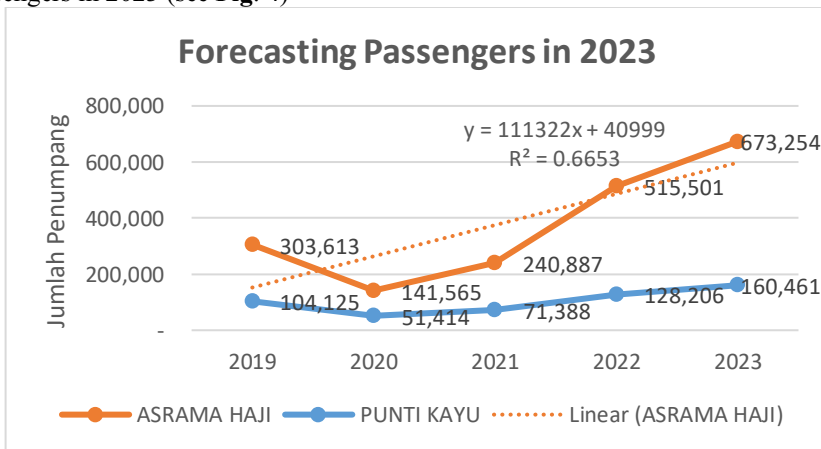


Fig. 4 Forecasting graph of the number of LRT passengers 2019 – 2023

3.3 Feeder Transportation Performance Analysis

Feeder Transportation Performance Analysis is an analysis of the results of travel time and headway surveys which are part of the performance assessment criteria of the feeder transportation. Based on the survey results that can be seen in the table below, the average travel time of the Asrama Haji - Talang Betutu corridor is 49 minutes, with a distance of 12,279 km. The Asrama Haji - Sematang Borang corridor is 125 minutes, with a distance of 40,443 km. and the Talang Kelapa - Asrama Haji - Pundi Kayu corridor is 82 minutes, with a distance of 21.39 km. The following are the recapitulation results of the travel time survey:

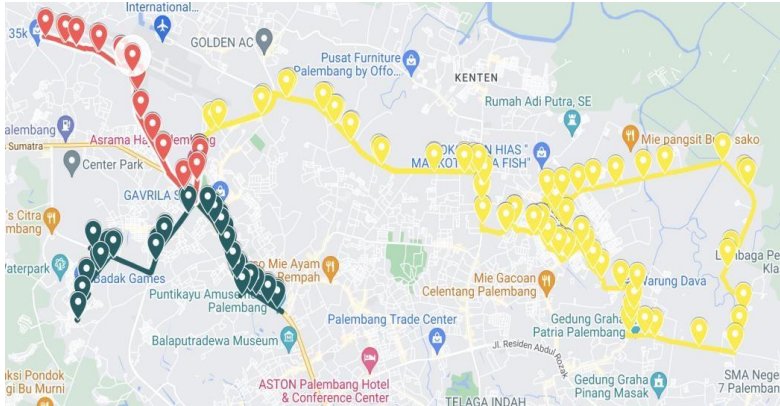


Fig. 5 Map of Each Corridors and Stop Location

Next is to conduct a headway survey which is carried out for 1 hour of observation. One team observed at the Asrama Haji Station and Talang Betutu intersection to observe the movement of feeders with the Talang Kelapa – Asrama Haji - Punti Kayu corridor, and the Asrama Haji - Talang Betutu corridor. For the Asrama Haji - Sematang Borang corridor, the team observed the headway at the Sako Terminal location. The survey was conducted for one hour of observation by recording the vehicle number and frequency of feeder operation during one hour of observation. The following table shows the results of headway observations for the three corridors observed by the survey team below:

Table 2. Headway Observation Survey for Each Corridor.

| Corridor | Place Observation | Headway |
|--|------------------------|-----------|
| Asrama Haji – Talang Betutu | Sako Terminal | 10 minute |
| Asrama Haji – Sematang Borang | Talang Betutu Junction | 10 minute |
| Talang Kelapa – Asrama Haji – Punti Kayu | Asrama Haji | 10 minute |

Based on the value of Travel Time Headway, and Speed that occurs in the corridor observation, will then be compared with the parameters of public transport performance of the Directorate General of Land Transportation in 2002 which can be seen in table 3 below:

Table 3. Standard Comparison Criteria With Actual Field Data of Feeder

| Aspect | Standard | Field Actual |
|------------------|-----------------------------|--------------------|
| Waiting Time | Average : 5 – 10 minutes | F-I = 15 minutes |
| | Maximum : 10 – 20 minutes | F-II = 20 minutes |
| | | F-III = 20 minutes |
| Walking Distance | Average : 300 – 500 meters | 250 meters |
| | Maximum : 500 – 1000 meters | |
| Change of Route | Average : 0 – 1 times | 2 times |
| | Maximum : 2 times | |

| | | |
|-------------|--|--------------------|
| Travel Time | Average : 1,0 – 1,5 hours | F-I = 82 minutes |
| | Maximum : 2 – 5 hours | F-II = 115 minutes |
| Headway | Ideal Headway : 5 – 10 minutes | F-III = 52 minutes |
| | Maximum Headway : 2 – 5 minutes | F-I = 10 minutes |
| | | F-II = 10 minutes |
| Speed | Class I : 30 km/h | |
| | Class II : 30 km/h | |
| | Class III A : 20 – 40 km/h | |
| | Class III B : 20 km/h | F-I = 30 km/hour |
| | Class III C : 10 – 20 km/h | F-II = 30 km/hour |
| | Main : 30 km/h | F-III = 30 km/hour |
| | Branch : 20 km/h | |
| Load Factor | Branch : 10 km/h | |
| | Direct : 30 km/h | |
| | One Trim : 70% | F-I = 74.07 % |
| | | F-II = 81.58 % |
| | | F-III = 66.80 % |
| Exp | F-I : The Corridor of Talang Kelapa – Asrama Haji – Pundi Kayu | |
| | F-II : The Corridor of Asrama Haji – Sematang Borang | |
| | F-III : The Corridor of Asrama Haji – Talang Betutu | |

3.4 Identifying the Number of LRT Passengers who Continue to Travel by Feeder Transportation

In addition to evaluating the performance of this feeder public transportation, analysis is also carried out on the percentage of how many LRT passengers have the potential to continue their journey using this feeder transportation. By analyzing the percentage, it is expected to illustrate the need for this feeder transportation in the future. This percentage is taken based on the frequency of departure with an average load factor at a time. So that the percentage of the total number of passengers using LRT, with the total number of passengers who continue their journey with this feeder transportation. The following is a calculation table of the comparison of the total number of Palembang LRT passengers with the number of passengers of the Musi Emas Feeder Transportation below:

Table 4. Calculation of Percentage of LRT Passengers Who Continuing to Travel by Using Feeder Transportation.

| Corridor | Frequency | Total Annual Passengers | Recapitulate | LRT Passengers 2023 | Percentage (%) |
|--|-----------|-------------------------|--------------|---------------------|----------------|
| Asrama Haji – Talang Betutu | 3 | 115.200 | | | |
| Asrama Haji – Sematang Borang | 12 | 108.000 | 223.200 | 673.254 | 33,15 |
| Talang Kelapa – Asrama Haji – Pundi Kayu | 5 | 117.818 | 117.818 | 160.461 | 73,42 |

Based on the analysis of the data above, that the percentage of LRT passenger movements with passengers who continue their journey using Feeder Transportation is 33.15% for Asrama Haji station passengers, and around 73.42% for Punti Kayu station passengers. With the number of passengers who continue the journey, forecasting can be calculated for the 5th year, namely 2028 as a prediction of the need for feeder transportation that can be prepared

4 CONCLUSION

From this research, the following conclusions were obtained:

- A. The results of the performance evaluation associated with this LRT feeder public transport research have met the performance of public transport required by the Directorate General of Land Transportation in 2002. Each parameter that is juxtaposed with the actual situation in the field has met the requirements of public transportation standards so that this feeder transportation is a good prospect to serve the movement of Palembang LRT passengers at Asrama Haji and Punti Kayu Stations.
- B. The percentage of displacement of LRT passengers continuing their journey using Feeder transportation for Asrama Haji station is 33.15%, and Punti Kayu station is 73.42%. This calculation is based on the average load factor of this feeder public transportation.

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