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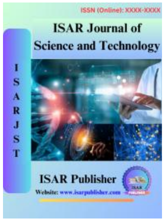

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Simulation Model of Feeder Public Transportation Requirement in Palembang City

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Abstract: The feeder public transportation system in Palembang serves as a connecting mode between residential areas and the main public transport network, namely the Light Rail Transit (LRT). Its existence improves accessibility, expands the coverage area of public transport services, and reduces the community's reliance on private vehicles. This study aims to analyze the operational characteristics and fleet requirements of feeder public transportation operating along Corridor 4 in Palembang City. Two analytical approaches were employed to determine the required fleet size. The first is a passenger-based calculation method, referring to the Regulation of the Directorate General of Land Transportation (2002), which uses parameters such as load factor, circulation time, vehicle headway, number of vehicles per cycle, and fleet requirements during peak hours. The second method adopts the Faulks R.W. distance-based approach, using headway and the number of required vehicles as comparative parameters. The results from both methods were simulated using Microsoft Visual Studio Basic 2010. Based on the passenger-to-capacity ratio, the average daily load factor was 157.03%, with a headway of 11 minutes and a one-cycle travel time of 62.1 minutes. These findings indicate that the existing fleet of feeder minibuses operating along Corridor 4—currently consisting of five units—is insufficient to meet optimal service standards. The analysis and simulation results suggest that an additional four feeder units are required to enhance service performance, improve operational efficiency, increase service frequency, and provide greater passenger comfort.

Keywords: Feeder Public Transportation, Palembang City, Corridor 4, Passenger-Based Calculation Method, Distance-Based Calculation Method, Microsoft Visual Studio Basic 2010 Simulation, Fleet Requirement.

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1. Introduction

Palembang City, as one of the metropolitan areas in Indonesia, also faces significant challenges related to public transportation. The public transport modes currently operating in the city consist of urban buses with a capacity of approximately 55–60 passengers and the Light Rail Transit (LRT) system, which accommodates around 630 passengers per train. In addition to these modes, the presence of pedicabs, private vehicles, and motorcycles further contributes to roadway congestion. With a high population density, improving the public transportation system in Palembang is crucial to minimising traffic congestion and enhancing overall road safety. Transportation represents a *derived requirement*, as it arises from human needs for goods and services that cannot be fulfilled in a single location (Winaya et al., 2017).

The rapid development of Palembang City has led to increased population mobility, which in turn necessitates an effective and efficient public transportation system. The continuous enhancement of facilities and passenger comfort must be considered to ensure that public transportation services in Palembang become more attractive than private vehicle use (Limaryantomarico et al., 2015). In an effort to support an integrated transportation system, the local government has introduced several modes of transport, including the Light Rail Transit (LRT) and intermodal feeder services. The reduction in private vehicle use, either directly or indirectly, contributes to the mitigation of traffic congestion (Nopianti et al., 2022). However, the increasing requirement for these services, particularly along Corridor 4, has not been matched by an adequate number of operating fleet units. The requirement for transportation services does not arise without the presence of underlying driving factors (Amahoru et al., 2022). A mismatch between transport capacity and actual field requirement not only reduces the efficiency of the transportation system but also risks decreasing public interest in the sustainable use of public transport. In this case, the number of sustainable use of public transport. In this case, the number of operating fleets must be adjusted to the actual passenger requirement to achieve optimal service performance (Putra et al., 2013). Therefore, analysing the required number of feeder fleet units is essential for developing service improvement strategies that are data-driven and aligned with users' actual needs. Effective and efficient public transport planning is thus crucial, particularly in the context of feeder transportation systems.

In 2002, the Directorate General of Land Transportation under the Ministry of Transportation of the Republic of Indonesia issued a decree providing guidelines on various operational characteristics to consider in the planning and development of public transportation systems. These guidelines include aspects such as operational time, travel distance, and vehicle capacity, which collectively ensure adequate accessibility for users. In addition to the Ministry's regulations, the calculation methodology developed by Faulks R.W. serves as a valuable analytical tool for assessing public transport fleet requirements. This method enables an appropriate estimation of vehicle needs based on travel requirement and the desired level of service, which can be translated into operational fleet requirements. By adapting this model within the context of feeder transportation, more accurate and responsive planning can be achieved, ensuring that public transport services are better aligned with community mobility needs.

This study aims to analyse the required number of feeder public transport fleets serving LRT Corridor 4, which operates along the route from Palembang Police Station LRT Station to the OPI Complex in Palembang City. The analysis refers to key operational parameters such as load factor, headway, capacity, route length, travel time, and average speed. The calculation method is based on the technical guidelines outlined in the Directorate General of Land Transportation Decree No. 687 of 2002. It is complemented by a simulation approach to evaluate system performance under both existing conditions and alternative scenarios. The findings of this study are expected to provide recommendations for the optimal number of feeder fleet units and serve as a reference for planning and policymaking in developing a more responsive and sustainable public transportation system.

2. Literature Review

Public transportation is a mode of transport that serves community mobility along specific routes, functioning as a key instrument for reducing traffic congestion, improving energy efficiency, and ensuring equitable accessibility (Pojani et al., 2017). It represents an integral component of the urban transportation system that cannot be separated from the dynamics of city development. The existence of public transport supports community mobility and reduces dependency on private vehicles, thereby contributing to energy efficiency, lower emission levels, and decreased traffic accidents (Widayanti, 2014). When properly managed through the provision of roadworthy fleets and high-quality service, public transport can enhance the public's willingness to shift modes. Conversely, inadequate fleet conditions and poor management may lead to increased congestion and higher risks of traffic accidents.

Determination of Fleet Requirements

1. Calculation of Fleet Requirements Based on SK Dirjen Perhubungan Darat No. 687 Tahun 2002

a. Load Factor

The available capacity for a single trip is usually expressed as a percentage (%). To calculate the load factor, the following formula can be used:

$$Load\ Factor = \frac{\text{Number of Passengers}}{\text{Transport Capacity}}\ x\ 100\%$$

b. Time of Circulation

The circulation time refers to the duration required by a passenger transport vehicle to complete a whole route in one round trip (outbound and return), starting from the origin, travelling to the destination, and returning to the point of origin. Assuming an average operating speed of 20 km per hour with a travel time deviation of 5%, the equation used to calculate the circulation time is as follows:

$$CTABA = (TAB+TBA)+(\sigma AB+\sigma BA)+(TTA+TTB)$$

Notes :

CTABA : Time of Circulation from A to B and then back to A

TAB : Average Travel Time from A to B

TBA : Average Travel Time from B to A

σAB : Travel Time Deviation from A to B (5%)

σBA : Travel Time Deviation from B to A (5%)

TTA : Stopping Time Of Vehicle at A (set at 10%)

TTB : Stopping Time Of Vehicle at B (set at 10%)

c. Headway

The vehicle headway is calculated based on the maximum number of passengers per hour on the most congested section, using a load factor value of 70% under dynamic conditions, as expressed in the following equation:

$$H = \frac{60.C.LF}{P}$$

Keterangan:

H : Headway (minutes).

P : Peak Hour Passenger Requirement on the Most Crowded Section

C : Passenger Seating Capacity

LF : load factor, from 70%(Under Dynamic Conditions) .

Notes :

Headway (ideal) : 5 - 10 minutes.

Headway (peak requirement) : 2 – 5 minutes.

d. Number of Vehicles per Cycle Time

The number of fleets per circulation time refers to the total number of vehicles required within one operational cycle and during peak periods. The fleet requirement is calculated using the following equation:

$$K = \frac{CT}{HxfA}\text{he}$$

Notes :

K : Number of Vehicles

Ct : Time Cycle (minutes)

H : Headway (minutes)

fA : Vehicle Availability Factor (100%)

e. Fleet Requirement during Peak Period

The fleet requirement during the peak period is defined as follows:

$$K' = K X \frac{W}{CTABA}$$

Notes : W = Interval 06.00 - 10.00 = 4 hours = 240 minutes

2. Calculation of Fleet Requirements Using Faulks R.W. Method

The calculation using the Faulks R.W. method is employed to determine the required fleet size based on the number of vehicles needed, using the following calculation parameters:

$$H = \frac{60}{F}$$

$$KB = \frac{2\,(RT+TT)}{H}$$

Notes :

KB : Number of vehicles required (bus),

RT : Travel time and dwell time on the segment (minutes),

TT : Waiting time at the terminal (minutes),

H : headway, time between vehicle arrivals/departures (minutes)

F : Vehicle frequency (buses/hour)

Fleet Requirement Simulation

Microsoft Visual Studio Basic 2010

The Microsoft Visual Studio Basic 2010 application serves as a tool to assist in analysing the calculated operational characteristics data. This study utilised the application to simulate the feeder fleet requirements by determining the load factor value. Visual Studio Basic 2010 (also known as VB .NET 2010) is generally recognised as a computer programming language consisting of commands or instructions that the computer understands to perform specific tasks (Rahmahdani et al., 2024).

Microsoft Visual Studio Basic 2010 has been widely applied in developing information systems and requirement simulation models due to its syntactic simplicity and support for object-oriented programming. According to Rahmahdani and Yahfizham (2024), programming with Visual Studio Basic .NET 2010, which is integrated with a MySQL database, is capable of producing an effective and efficient system design for data processing, particularly in the implementation of CRUD (Create, Read, Update, Delete) functions. Similarly, a study conducted by Ultariani, Putra, and Amroni (2020) demonstrated that the design of inventory and sales information systems using Visual Studio Basic 2010 with the Economic Order Quantity (EOQ) and Reorder Point (ROP) methods improved data processing accuracy and accelerated administrative procedures across various database systems. Therefore, the application of Microsoft Visual Studio Basic 2010proves to be highly relevant for developing requirement simulation models that require computational precision and process efficiency, owing to its flexibility and ease of implementation.

The flowchart of the programming process used as the standard framework for the fleet requirement simulation developed with

the *Microsoft Visual Studio Basic 2010* application illustrates the systematic stages of constructing the simulation, as presented in Figure 1.

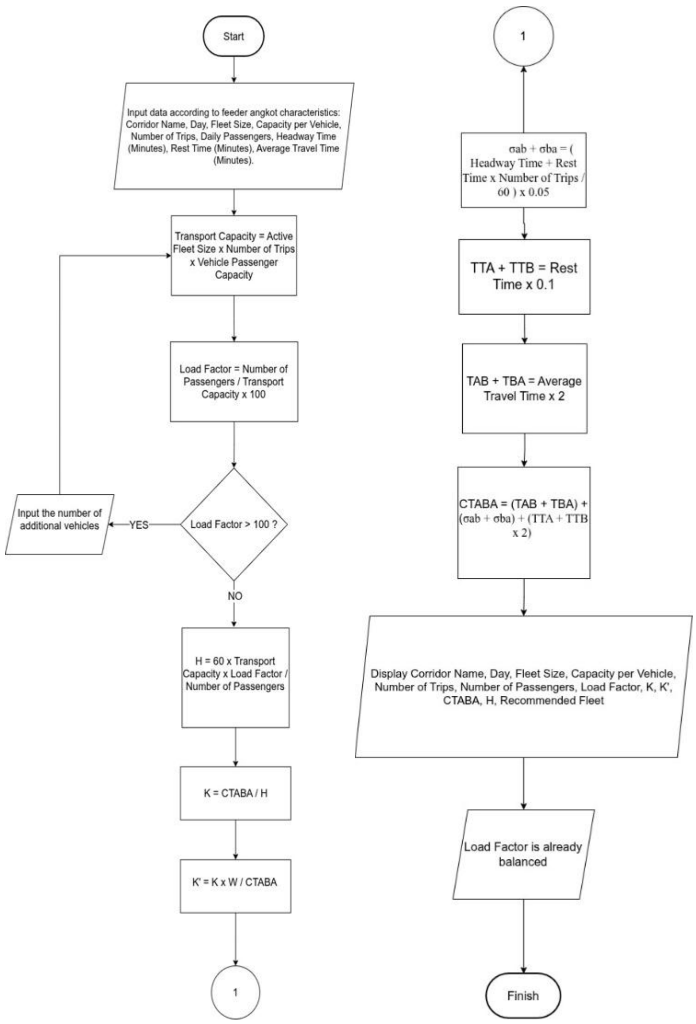

Figure 1. Programming Flowchart

3. Methodology

Location

The research was conducted on Corridor 4 of the feeder public transportation system in Palembang City. This location was selected based on its strategic role in Corridor 4 as the main feeder route supporting Palembang's Light Rail Transit (LRT). The route for Corridor 4 connects the Palembang Police Station LRT Station to the OPI Complex. An illustration of the route is presented in Figure 2. Corridor 4: Station Route of LRT Polresta Palembang – Kompleks OPI.

Data Collection Method

The data collection methods in this study consist of two types: primary data and secondary data, which are described as follows:

A. Primary Data

Primary data were obtained through direct field surveys on both feeder public transportation corridors. These surveys aimed to identify the operational conditions in the field and analyze the characteristics of feeder transport users.

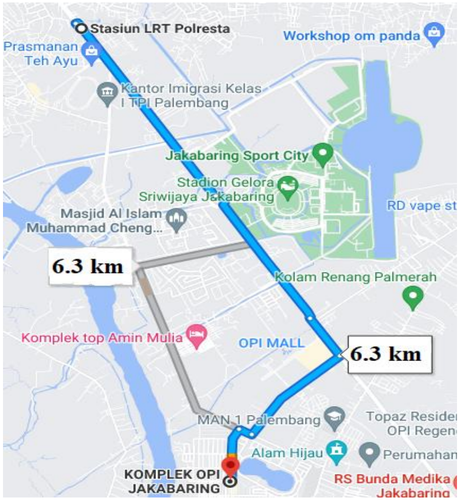

Figure 2. Station route of LRT Polresta Palembang – Kompleks OPI

Description : Corridor 4 LRT Feeder Public Transportation Route

The types of primary data collected include the following:

1. Arrival and departure times of feeder minibuses at each stop
2. Travel time of feeder minibuses per corridor
3. Walking time and distance from stations to stops
4. Passenger waiting time at stops
5. Dwell time of feeder minibuses at each stop
6. Number of boarding and alighting passengers
7. Number of passengers inside the feeder minibuses and those who were not accommodated

The data collection was carried out through field surveys aimed at assessing the efficiency and service capacity of the feeder public transportation system.

B. Secondary data

Secondary data were obtained from government agencies or related institutions, including:

1. The route network map of the Musi Emas LRT feeder minibuses
2. The number of fleets in operation
3. Passenger volume data and load factor since the beginning of operations
4. Minimum Service Standards (SPM) for public transportation operations

Data Collection Period

Data collection was conducted over six days in February 2025. The selection of this period considered operational conditions from both the operator's and passengers' perspectives, ensuring that the analysis results reflect the actual needs of both parties in a balanced and unbiased manner.

Data Processing Method

The collected data were processed using public transport performance evaluation parameters, in accordance with the Regulation of the Minister of Transportation No. 98 of 2013 and the Decree of the Directorate General of Land Transportation of 2020. The analyzed parameters included fleet size, load factor, travel time, trip duration, circulation time, travel speed, and headway.

Analysis of Operational Characteristics, Feeder Minibus Requirement Simulation, and Faulks R.W. Calculation

Based on the operational characteristics obtained from the processed data, a simulation was conducted to determine the fleet requirements for feeder public transportation operating on Corridor 4. The analysis was performed on the existing conditions, including the operational constraints encountered, to identify the optimal number of fleets for future operations. This simulation also serves as the foundation for developing policy recommendations regarding the management of the LRT feeder transportation system in Palembang City.

4. Results and Discussion

Results of Primary Data: Passenger Count and Operational Characteristics of Feeder Public Transportation

The survey was conducted in February 2025 using a direct observation method and on-site operational data recording. The observed parameters included travel time, headway, the number of boarding and alighting passengers, and the occupancy rate (*load factor*). The following table presents data from PT Trans Global Mandiri (TGM) and the static data collected from field observations.

The travel time data and the number of unserved passengers obtained from the field survey of one active fleet over three consecutive days are presented in Tables 1 to 3. Based on the collected data, it was found that there were 17 trips per day, during which several trips recorded several unserved passengers. The average number of unserved passengers over the three days of observation was 70 persons. The highest number of unserved passengers on Monday and Wednesday, February 17 and 19, 2025, occurred during the third trip, within the time interval of 06:50–07:17, corresponding to the morning peak hour. Meanwhile, on Tuesday, February 18, 2025, the maximum number of unserved passengers was recorded within the time interval of 12:23–12:50, representing the midday peak period. The survey results indicate that during the morning and midday peak hours, the *load factor* reached 100%, resulting in several passengers being left unserved.

Table 1. The field survey data of feeder public transportation on Corridor 4 were collected on Monday, February 17, 2025, with five active fleets operating.

Trip Number	Time Interval	Travel Time (minutes)	Number Of Passengers	Unaccommodated Passengers	Headway (minutes)
2	05.55-06.25	31.12	35	9	10
3	06.50-07.20	31.45	39	15	10
4	07.46-08.16	30.01	39	12	10
5	08.41-09.11	31.56	30	6	10
6	09.37-10.07`	31.38	36	4	10
7	10.32-11.02	32.05	27	5	12
8	11.27-11.57	31.65	25	6	12
10	13.18-13.48	31.65	27	5	12
12	15.09-15.39	31.25	20	4	11
14	17.00-17.30	32.08	22	9	11
Total		-	300	74	-
Average		31.42	-	-	11.05

Table 2. The field survey data of feeder public transportation on Corridor 4 were collected on Monday, February 18, 2025, with five active fleets operating.

Trip Number	Time Interval	Travel Time (minutes)	Number Of Passengers	Unaccommodated Passengers	Headway (minutes)
3	06.50-07.20	30.36	38	7	10
5	08.41-09.11	31.78	33	4	10
6	09.37-10.07	31.38	27	6	11
7	10.32-11.02	32.21	20	7	10
8	11.27-11.57	31.9	27	7	10
9	12.23-12.53	32.23	37	8	12
10	13.18-13.48	31.81	34	6	10
11	14.14-14.44	31.7	33	6	12
12	15.09-15.39	31.13	33	4	12
13	16.05-16.35	30.7	32	6	10
Total		-	314	61	-
Average		31.52	-	-	11.05

Table 3. The field survey data of feeder public transportation on Corridor 4 were collected on Monday, February 19, 2025, with five active fleets operating.

Trip Number	Time Interval	Travel Time (minutes)	Number Of Passengers	Unaccommodated Passengers	Headway (minutes)
2	05.55-06.25	31.06	28	8	10
3	06.50-07.20	31.06	42	12	10
4	07.46-08.16	29.98	44	10	11
5	08.41-09.11	31.78	25	12	10
6	09.37-10.07	30.70	22	5	10
8	11.27-11.57	31.38	29	11	12
10	13.18-13.48	32.21	37	3	10
12	15.09-15.39	31.90	20	5	12
13	16.05-16.33	31.13	25	3	12
15	17.55-18.25	32.08	22	5	10
Total		-	294	74	-
Average		31.32	-	-	11.05

The description of the characteristics of unserved passengers at each trip and stop is presented in the following tables and figures. These tables and graphs provide a more detailed illustration of the specific time intervals during which unserved passengers were observed.

Table 4. Results of the Maximum Passenger Count Survey Conducted on Corridor 4 from February 17 to 19, 2025, with One Active Operating Fleet.

Monday, 17 February 2025				Tuesday, 18 February 2025				Wednesday, 19 February 2025			
Time	Trip Number	Halte	Unaccommodated Passengers	Time	Trip Number	Halte	Unaccommodated Passengers	Time	Trip Number	Halte	Unaccommodated Passengers
05.55	2	23	5	06.50	3	7	3	05.55	2	2	4
06.50	3	3	5	08.41	5	12	2	06.50	3	4	5
07.46	4	10	4	09.37	6	10	4	07.46	4	2	5
08.41	5	12	4	10.32	7	2	7	08.41	5	3	5
09.37	6	12	2	11.27	8	29	4	09.37	6	13	5
10.32	7	10	5	12.23	9	3	4	11.27	8	2	6
11.27	8	8	6	13.18	10	11	4	13.18	10	13	3
13.18	10	13	5	14.14	11	2	3	15.09	12	8	3
15.09	12	2	5	15.09	12	2	3	16.05	13	11	3
17.00	14	13	5	16.05	13	2	3	17.55	15	15	2

Based on Table 4 and Figure 2, it can be observed that the number of unserved passengers varies across trips. The highest number of unserved passengers occurred during trips 7 and 8, with 6 and 7 passengers, respectively. In contrast, the lowest number of unserved passengers was recorded during trips 5, 6, and 15, with only 2 out of a total of 11 passengers. Overall, the total number of passengers remained relatively stable, ranging between 13 and 16 persons.

Therefore, given the passenger surges observed in specific trips, additional fleet units are required. According to Agustien et al. (2022), increasing the number of feeder fleet units whose total passengers exceed their carrying capacity is essential to ensure passenger safety, comfort, and service reliability, as well as to maintain smooth transportation operations.

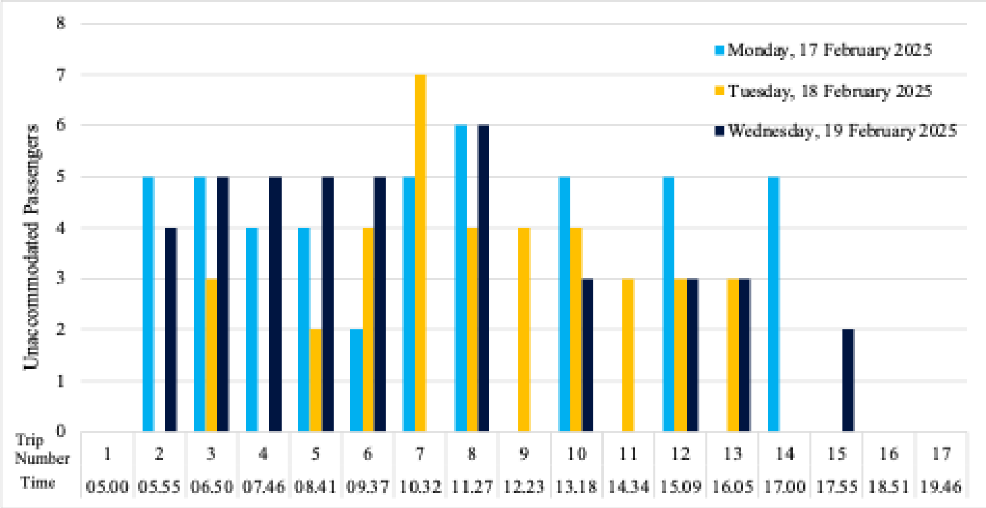

Figure 3. Results of the Maximum Passenger Count Survey on Corridor 4 from February 17 to 19, 2025

Results of Secondary Data Collection on Passenger Numbers and Operational Characteristics of Feeder Public Transportation

In addition to the primary data collected, secondary data were also obtained from *PT Trans Global Mandiri (TGM)*. During the research period in 2025, *PT TGM*, as the operator managing the LRT feeder public transportation system in Palembang City, provided daily passenger data for each fleet operating on every corridor. The feeder passengers of the LRT consist of two categories: passengers continuing their journey using the LRT, referred to as *LRT passengers*, and passengers who do not continue their trip by LRT, referred to as *general passengers*.

The daily passenger volume and load factor data for Corridor 4, obtained from *PT Trans Global Mandiri (TGM)* for the period of Monday to Wednesday, February 17–19, 2025, are presented in Table 5. The load factor value was calculated by dividing the total passenger count per day by the total available capacity. The daily capacity was derived from the product of the number of fleets, the number of trips, and the carrying capacity of a single vehicle unit. For the feeder public transportation operating on Corridor 4, which consists of five fleets, 17 trips, and a carrying capacity of nine passengers per unit, the total daily capacity amounted to 765 passengers. The daily load factor values exceeded 100%, with an average load factor of 157.03% over the three-day observation period.

Table 5. Passenger Load Factor on Corridor 4 Based on Dynamic Data from PT Trans Global Mandiri (TGM)

No	date	LRT passengers (persons)	General passengers (persons)	Total passengers (persons)	Load Factor (%)
1	17-02-2025	679	484	1163	152.03
2	18-02-2025	670	559	1229	160.65
3	19-02-2025	384	332	1212	158.43

Analysis of primary and secondary data indicates that during peak hours,the number of passengers exceeds the available transport capacity.Consequently,it is necessary to calculate the required number of feeder minibuses to ensure adequate service on Corridor 4.

Passenger-Based Calculation Method

The calculation of feeder minibus requirements was conducted using the Minimum Service Standard approach, based on Ministerial Regulation No. 98 of 2013 and the Decree of the Directorate General of Land Transportation of 2020. The parameters considered in the analysis include the number of passengers, round-trip travel time, waiting time, and headway.

1. Analysis of Operational Characteristics and Feeder Minibus Requirements for LRT Corridor 4 is presented as follows.

A. On Monday, 17 February 2025

a. Load factor

$$Load\ Faktor = \frac{\text{Number of Passengers}}{\text{Transport Capacity}} x\ 100\%$$

$$= \frac{1163}{765} x\ 100\%$$

$$Load\ Factor = 152\% = 1.52$$

b. Cycle time

CTABA = (TAB+TBA)+ (σAB + σBA) + (TTA+TTB)

= (32+32)+(1.6+1.6)+(3.2+3.2)

CTABA = 73.60 minutes

c. Headway

H $= \frac{60.C.LF}{P}$

$= \frac{60 \; x \; 1 \; x \; 9 \; x \; 17 \; x \; 1.52)}{(\frac{1163}{16})}$

H = 11.244 minutes

d. Fleet Size Cycle Time

K $= \frac{CTaba}{HxfA}$

$= \frac{73{,}60}{11{,}244 \; X100\%}$

K = 6.55 = 7 units

e. Fleet Requirement in Peak Periods

K' = K x $\frac{W}{CTaba}$

K' = 7 X $\frac{360}{73.60}$

Table 6. Recapitulation of survey results on the operational characteristics of feeder minibuses on Corridor 4 (All Passengers)

date	Load Factor (%)	Cycle time / CTABA (minutes)	Headway/H (minutes)	Fleet Size Cycle Time / K (units)	Fleet Size Per Cycle time/ K'(trip)
17-2-2025	1.52	73.60	11.24	7	35
18-2-2025	1.60	73.60	11.27	7	35
19-2-2025	1.58	73.60	11.25	7	35

Based on Table 6, the average load factor was 1.57, indicating that the average number of passengers exceeded the available capacity. The circulation travel time (CTABA) was approximately 73.60 minutes, while the average headway, or time interval between vehicles, was 11.25 minutes. This headway is relatively long compared to the ideal urban transport standard, which is typically below 10 minutes. Consequently, the required number of vehicles per circulation is two units, and the total number of trips needed during peak hours is 35.

Distance-Based Calculation Method

1. On Monday, 17 February 2025

H(Headway) = 60/9

= 6.67 minutes

F (Vehicle Frequency) = 60/6.67

= 9 minutes

Kb (Required Number of Vehicles) = 2(rt+tt)/h

= 2(27+11.05)/6.67

= 11.40 = 12 Units

Table 7. Faulks R.W. Calculation Recapitulation

H (minutes)	F (minutes)	Kb (units)
6.67	9	12
6.67	9	12
6.67	9	12

Based on Table 7, the calculation results using the Faulks Rule of Thumb (RW) method show a headway of 6.67 minutes, a frequency of 9 minutes, and a fleet requirement of 12 vehicles. These results indicate that a shorter headway requires a larger fleet to maintain consistent spacing between vehicles. This condition highlights the direct relationship between vehicle arrival intervals and fleet requirements in supporting smooth transport operations.

Simulation Results of Feeder Minibus Requirements

The calculation of feeder minibus requirements was conducted using a standards-based approach, referring to the Decree of the Directorate General of Land Transportation (2002). The parameters considered in the analysis included the number of passengers, round-trip travel time, and waiting time. The simulation program indicated a shortage of active vehicles on Corridor 4, which resulted in increased load factors and passenger waiting times, thereby reducing service quality.

The results obtained from calculations based on the Decree of the Directorate General of Land Transportation (2002) for Corridor 4, with five active vehicles over 3 days, are presented in Figure 4. According to the simulation program, seven vehicles are required based on operational characteristics, while only five vehicles are currently active. Therefore, an additional two vehicles are needed for Corridor 4. However, the average load factor of 1.57 remains high, as it still exceeds the standard for public transport service levels, which should be below 100%. Moreover, the average waiting time of 11.25 minutes indicates that service is not yet optimal according to the public transport standard, which recommends a waiting time of less than 10 minutes.

Figure 4. Simulation Program Interface of Feeder Minibuses on Corridor 4

Subsequently, after adding two vehicles, the simulation results are shown in Figure 5. Based on the simulation program, after the addition of 2 vehicles, the average load factor remains above 100%, at 1.122. Although this value has decreased, it still does not meet the standard for public transport service levels. Meanwhile, the average waiting time of 8.042 minutes indicates that the service is now within the ideal range according to the public transport standard, which recommends a waiting time of less than 10 minutes.

Figure 5. Simulation Program Interface of Feeder Minibuses on Corridor 4 According to Operational Characteristics Calculations

The simulation results after adding two vehicles show that the average load factor remains above 100%. Therefore, according to the simulation program, an additional two vehicles are required to achieve a load factor below 100%, as shown in Figure 6. Based on the simulation, after increasing the fleet from 7 to 9 vehicles, the average load factor decreased to 0.944, which meets the public transport service standard of below 100%. Moreover, the average waiting time of 6.774 minutes is now within the recommended public transport standard, indicating satisfactory service levels.

Figure 6. Simulation Program Interface of Feeder Minibuses on Corridor 4 Based on Simulation Analysis

Conclusion

Based on the analysis and discussion of the Simulation Model of Feeder Public Transportation Requirement in Palembang City, the following conclusions can be drawn:

1. The operational performance of feeder minibuses remains suboptimal, particularly in terms of travel time and service reliability. Field observations indicate an average travel time of 32 minutes, which fluctuates due to traffic congestion and the absence of road priority for feeder vehicles. This condition directly affects passenger comfort and service reliability, leading to reduced user satisfaction. The average passenger waiting time along the corridor also exceeds the ideal public transport service standard of 5–10 minutes, with survey results showing an average of 11.25 minutes. Furthermore, 5–6 passengers remain unserved during peak hours.
2. The load factor (vehicle capacity utilization) on Corridor 4 consistently exceeds the ideal threshold of 100%. Dynamic operational data from PT Trans Global Mandiri (TGM) show an average load factor of 157.03%, while field surveys conducted over three consecutive days with one active vehicle recorded an average of 70 unserved passengers. This indicates a mismatch between feeder vehicle capacity and passenger demand. Overcapacity frequently occurs during peak hours, with an average of eight passengers unserved per trip, whereas underutilization is observed during off-peak periods. These findings highlight the need for route evaluation, schedule optimization, and adjustment of service frequency to achieve a more balanced and efficient operation.
3. Simulation results indicate that the current fleet size is insufficient to meet existing passenger demand, particularly during morning and evening peak hours. Fleet shortages contribute to increased waiting times, unserved passengers, and reduced operational efficiency. Simulation analysis suggests that four additional feeder vehicles are required to achieve an optimal load factor below 100% (0.944) and a headway of less than 10 minutes (6.744 minutes). Therefore, the addition of vehicles and adjustment of departure schedules are essential to improve service performance, operational efficiency, and passenger satisfaction.

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