

Optimization of Public Transport Service *Bus Rapid Transit (BRT) Trans Musi* in the City of Palembang

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ABSTRACT

The Palembang city government in 2018 made a policy regarding public transportation in the form of stopping city bus transportation by replacing it with a Bus Rapid Transit fleet. Rejuvenation of this transportation requires a comprehensive management and handling. This study aims to find out how to optimize BRT transportation in its services. So that it can be sustainable, given the relatively high cost of investment in facilities and infrastructure. The method used is direct traffic flow observation on the Plaju – PS.Mall corridor of the Trans Musi BRT and its transportation infrastructure. From the results of field data analysis obtained as follows: load factor mean vehicle = 0.83; mean corridor service time = 4 minutes 19 seconds. To get optimum leveling on the peak day is required: increasing the number of buses from 13 to 22 vehicles; headway = 10 minutes; 1 minute service time; travel time = 1.50 hours and average speed = 22 km/hours

Keywords: Public Transport, BRT, Trans Musi

1. INTRODUCTION

The Palembang City Government made a policy regarding public transportation in the form of stopping City Bus Transportation and replacing it with a Trans Musi Bus Rapid Transit (BRT) fleet. The purpose of BRT is to improve better transportation services to the community by creating an efficient, quality and sustainable public transportation system, so as to support the implementation of safe, fast, smooth and reliable road traffic and transportation. The city government of Palembang has been implementing modern public transportation Trans Musi Bus Rapid Transit (BRT) since 2010. Transport rejuvenation needs a comprehensive management and treatment, so as to sustainability. From the description above, a study is needed on whether the Trans Musi BRT service has been optimal in supporting its reliability?

1.1. Problem Solving

Is the Trans Musi BRT transportation service optimal? in supporting the sustainability of public transport operations in the city of Palembang.

1.2. Research Purpose

The purpose of this research:

1. Get the BRT vehicle Load Factor.

2. Determine the average service time of each BRT vehicle on the corridor.
3. Set the time between vehicle departures.
4. Simulates optimal service on the corridor that the BRT passes.

1.3. Research Benefit

This research is expected to be a reference for transportation practitioners and the development of transportation knowledge, especially public transportation.

1.4. Research roadmap

Some previous studies (Santuri, Riccky, Doddy, 2008) stated that "the number of passengers who need public transportation varies for certain times.

Research that the author has done on Trans Musi Bus Rapid Transit on Corridor PS - Plaju with Gabriela Isnaini and Venny Rizki in 2010. From the research results obtained Load Factor (LF) is still small than the maximum LF. Research topic on BRT in 2017 by A. Fuad Z and Yusri concluded that the load factor (LF) of each bus is smaller than required by LF = 0.7

In 2018, the authors also conducted a study on the Trans Musi BRT, to find out how much BRT Trans Musi contributed to the service of the road sections in the corridor passed and how the solution to make this public transport operational and sustainable. This study was

conducted in the Sako-PIM BRT corridor. From the results of the study, it was found that the contribution of the Trans Musi BRT Public transport to the total traffic on the corridor that was passed was relatively small.

1.5. External Research

The outputs that will be generated from this research are:

- The main outputs is the Final Report of the 2020 research results.
- Additional outputs in the form of scientific publications / proceedings in journals.

2. LITERATURE REVIEW

2.1. Transportation

Transportation is the effort to move, move, transport an object from one place to another, wherein another place it is more useful for a certain purpose (Miro:2004).

2.2. Public transportation

2.2.1. The meaning of public transportation.

The definition of public transportation in the Decree of the Minister of Transportation No. KM.35 of 2003 concerning the Implementation of People Transportation on the road by Public Vehicle is the transfer of people/goods from one place to another using a vehicle.

2.2.2. The purpose of public transportation.

The purpose of public transport services is to provide safe, fast, comfortable, inexpensive services to people whose mobility is increasing, especially for workers in carrying out their activities.

2.3. Bus rapid transit

BRT is a bus system that is fast, convenient, safe, and on-time from infrastructure, vehicles and schedules. Use the bus to serve service of better quality than other bus services. The BRT system certainly uses a different improvised system, although the improvised sharing with other BRT systems. The result of the system was to approach rail transit if it still enjoyed the safety of bus fares.

2.4. Load factor

Based on Government Regulations, according to the Decree of the Minister of Transportation number Km.35 of 2003 dated August 23, 2003 in article 6 paragraph (1), verse (20), verse (3) concerning the operation of public transportation on the road by public transportation, that the addition of the transport fleet

(open tray) in a route is possible if the average Load Factor (LF) exceeds 0.70 or 70%.

3. RESEARCH METHODOLOGY

3.1. Location/Place of Research

The research location is in Palembang City in corridor III Plaju-Palembang Square Mall (PS. Mall). While the observation points are at the bus stop and on the Trans Musi BRT bus (on board survey).

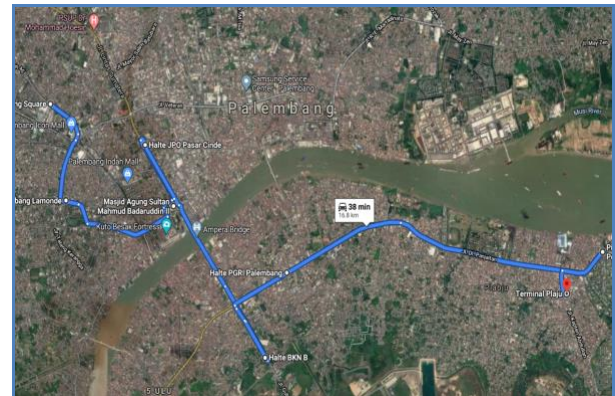


Figure 1. BRT Trans Musi Corridor III

3.2. Data Collection Techniques

Data collection methods in this study consisted of two types, namely field, and institutional surveys

3.2.1. Field surveys (primary data)

- Observing the characteristics and performance conditions of bus rapid transit services for passengers at the Trans Musi bus stop with the current conditions.
- Look at the patterns / characteristics of bus traffic at the Trans Musi bus rapid transit stop in carrying passengers.
- Take notes the number of vehicles and the time the vehicle arrives at the bus stop, the time it takes the vehicle to drop off and pick up passengers, and the time the vehicle leaves the bus stop at a certain time unit.

3.2.2. Institutional survey (secondary data)

- Data in the form of pictures of the Trans Musi route from the Department of transportation
- Data in the form of data on the total number of buses in the corridor and the number of buses operating from PT. SP2J.

3.3. Research Design

The stages of the research will be carried out as follows:

- Secondary Data Collection. This data is obtained from the City Transportation Agency, the central SP2J, and the SP2J Bus Rapid Transit Trans Musi unit.

- Study of literature. The literature study stage is intended to collect data sources of information / knowledge related to the research undertaken.
- Problem solving. At this stage, it will discuss the background why the research was carried out, the formulation of problems that will be raised in the research.
- Preliminary Survey (Field Review). The preliminary survey is used to determine the real conditions in the field, determine the location of a suitable observation point, determine the method to be used and preparation for direct traffic data observation / collection on the road and the time of the research.
- Preparation. At this stage, an explanation is made to the surveyors who will make observations about the form to be filled in, what to observe, and the times that must be filled in the form table.
- Primary Data Collection (Field Survey)
This activity is carried out after the field review is complete. Trans Musi data collection includes 3 surveys, namely:
 - a. Survey at bus stops
In this survey, data collection was carried out for one day during peak hours. The survey was conducted from 06.00 WIB to 17.00 WIB. That time is taken based on the starting time until the completion of the Trans Musi bus operating.
 - b. Survey on the bus
This survey was carried out on the bus during the first route (Plaju) to the final stop (PS Mall). The survey was conducted for 1 day. Survey time starts at 06.00 - 17.00 WIB until the bus stops at the final stop.
 - c. Geometric data collection survey
Data collection was carried out using a measuring instrument to measure the length, width, and height of the stop with the Run Tracker application to measure the distance between the next stop.
- Data Compilation. Data compilation is the grouping of data that has been obtained from the survey results that have been processed and are ready to be used for analysis.
- Data Analysis and Discussion. Here the data has been sorted according to need. The data obtained are in the form of travel time, arrival time, fill time of passengers, number of passengers who dropped off, the remaining number of passengers on the bus, the number of passengers who boarded, seating capacity and travel speed, as well as a price list to calculate direct and indirect costs. This data management uses excel software.

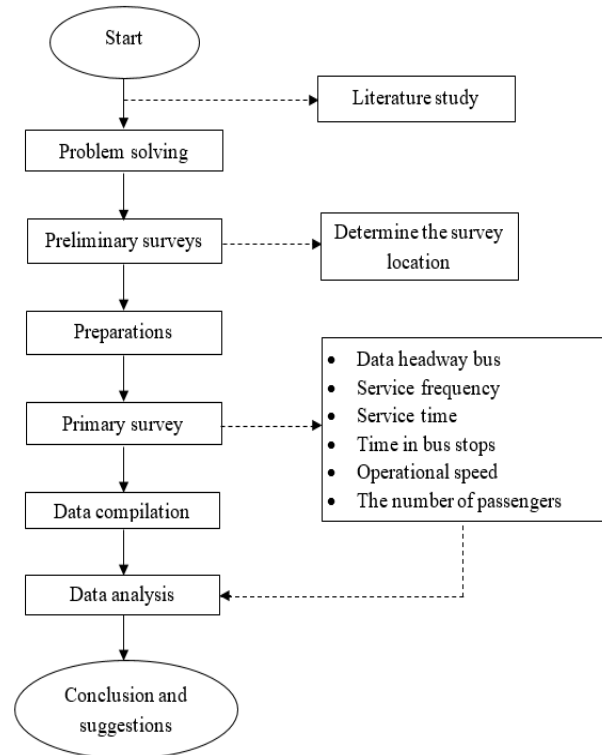


Figure 2. Research method flow chart

4. DISCUSSION

4.1. Traffic Volume

Observations were made on busy days, there is based on Secondary data from the Operational Management SP2J (Sarana Pembangunan Palembang Jaya), on Saturday. Traffic observations were carried out for one day from 07.00 - 17.00. This traffic observation was carried out before the implementation of PSPB in Palembang City.

Traffic observations are carried out on:

- a. Along the corridors be passed by BRT, its use is to knowing the performance of bus services on Corridor III Plaju –PS.Mall.
- b. The bus stop is in front of Pasar Cinde because this place has many activities for urban service and service center activities, including: Cinde market, shops, malls and LRT stations. This observation is used to find out how BRT bus services are at points prone to congestion.

4.2. Headway

Headway is the time difference between the arrival of a vehicle and the next vehicle at the same place, for example at bus stops, terminals and so on. The results of headway observations at the Cinde market stop are obtained as in the following table:

Table 1. Calculation of the headway for the Trans Musi Bus at the Cinde Stop (Morning Hours)

	Bus Number	Time arrived at bus stop	Headway
1	BG 7541 AO (K3.42)	07:27:55	00:14:22
2	BG 7542 AO (K3.43)	07:42:17	00:10:10
3	BG 7527 AO (K3.28)	07:52:27	00:01:43
4	BG 7529 AO (K3.30)	07:54:10	00:14:11
5	BG 7540 AO (K3.40)	08:08:21	00:10:11
6	BG 7538 AO (K3.39)	08:18:32	00:19:31
7	BG 7539 AO (K3.41)	08:38:03	00:14:49
8	BG 7532 AO (K3.33)	08:52:52	00:09:10
9	BG 7533 AO (K3.34)	09:02:02	00:09:07
10	BG 7525 AO (K3.26)	09:11:09	00:11:02
11	BG 7535 AO (K3.36)	09:22:11	00:09:54
12	BG 7541 AO (K3.42)	09:32:05	00:37:18
<i>Average</i>			00:13:27

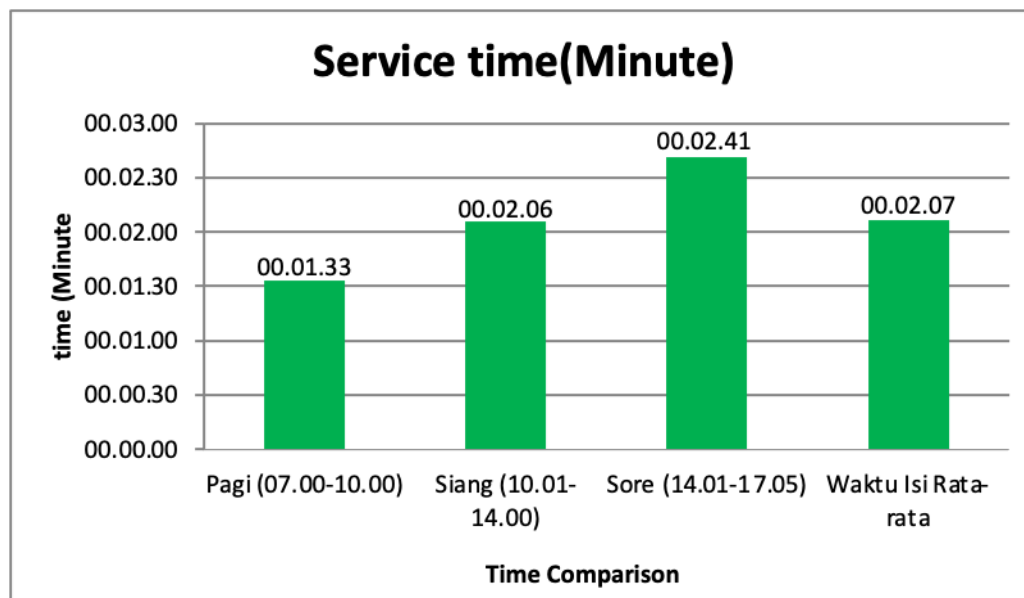
Table 2. Calculation of the headway for the Trans Musi Bus at the Cinde Stop (Afternoon Hours)

	Bus Number	Time arrived at bus stop	Headway
1	BG 7511 AO (K2.31)	10:09:23	00:08:23
2	BG 7527 AO (K3.28)	10:17:46	00:08:25
3	BG 7529 AO (K3.30)	10:26:11	00:16:11
4	BG 7540 AO (K3.40)	10:42:22	00:08:03
5	BG 7538 AO (K3.39)	10:50:25	00:26:48
6	BG 7539 AO (K3.41)	11:17:13	00:16:02
7	BG 7532 AO (K3.33)	11:33:15	00:04:34
8	BG 7533 AO (K3.34)	11:37:49	00:16:12
9	BG 7535 AO (K3.36)	11:54:01	00:09:55
10	BG 7525 AO (K3.26)	12:03:56	00:28:36
11	BG 7541 AO (K3.42)	12:32:32	00:12:48
12	BG 7509 AO (K2.29)	12:45:20	00:17:10
13	BG 7542 AO (K3.43)	13:02:30	00:08:41
14	BG 7527 AO (K3.28)	13:11:11	00:11:30
15	BG 7529 AO (K3.30)	13:22:41	00:12:44
16	BG 7540 AO (K3.40)	13:35:25	00:47:16
<i>Average</i>			00:14:54

Table 3.Calculation of the headway for the Trans Musi Bus at the Cinde Stop (Evening Hours)

	Bus Number	Time arrived at bus stop	Headway
1	BG 7539 AO (K3.41)	14:22:41	00:10:33
2	BG 7532 AO (K3.33)	14:33:14	00:21:48
3	BG 7533 AO (K3.34)	14:55:02	00:16:33
4	BG 7535 AO (K3.36)	15:11:35	00:09:19
5	BG 7525 AO (K3.26)	15:20:54	00:19:45
6	BG 7541 AO (K3.42)	15:40:39	00:07:20
7	BG 7511 AO (K2.31)	15:47:59	00:16:28
8	BG 7509 AO (K2.29)	16:04:27	00:08:13
9	BG 7542 AO (K3.43)	16:12:40	00:13:40
10	BG 7527 AO (K3.28)	16:26:20	00:13:55
11	BG 7529 AO (K3.30)	16:40:15	00:11:15
12	BG 7540 AO (K3.40)	16:51:30	00:13:37
13	BG 7539 AO (K3.41)	17:05:07	00:00:00
	<i>Average</i>		00:13:32

Figure 3. Graph Headway Average Busy Hour Bus at Cinde Stop



From the graph above, the highest average headway occurs during the afternoon rush hour, while the lowest average headway occurs during the morning and evening peak hours. The average headway for all peak hours is 13 minutes 58 seconds.

From the graph above, the average headway at the Cinde stop = 00: 13: 58 means that it is greater than the required SP2J = 10 minutes, so it needs to be reviewed.

4.3. Service Time

Service time is the time needed to serve passengers to raise and drop off passengers at the bus stop. This service time is often also called fill time, which means the time it takes to fill passengers. This table displays the average service times / contents of the buses at the bus stops.

Table 4. Calculation of the Average Service Time of Trans Musi Buses at Cinde Stops (Morning Hours)

No. (1)	Bus Number (2)	Arrived time (3)	Departured time (4)	Service time (4)-(3) = (5)
1	BG 7541 AO (K3.42)	07:27:55	07:29:20	00:01:25
2	BG 7542 AO (K3.43)	07:42:17	07:42:23	00:00:06
3	BG 7527 AO (K3.28)	07:52:27	07:54:07	00:01:40
4	BG 7529 AO (K3.30)	07:54:10	07:56:48	00:02:38
5	BG 7540 AO (K3.40)	08:08:21	08:09:06	00:00:45
6	BG 7538 AO (K3.39)	08:18:32	08:20:06	00:01:34
7	BG 7539 AO (K3.41)	08:38:03	08:41:03	00:03:00
8	BG 7532 AO (K3.33)	08:52:52	08:55:08	00:02:16
10	BG 7525 AO (K3.26)	09:22:11	09:23:03	00:00:52
11	BG 7535 AO (K3.36)	09:11:09	09:12:40	00:01:31
12	BG 7541 AO (K3.42)	09:32:05	09:34:05	00:02:00
average				00:01:33

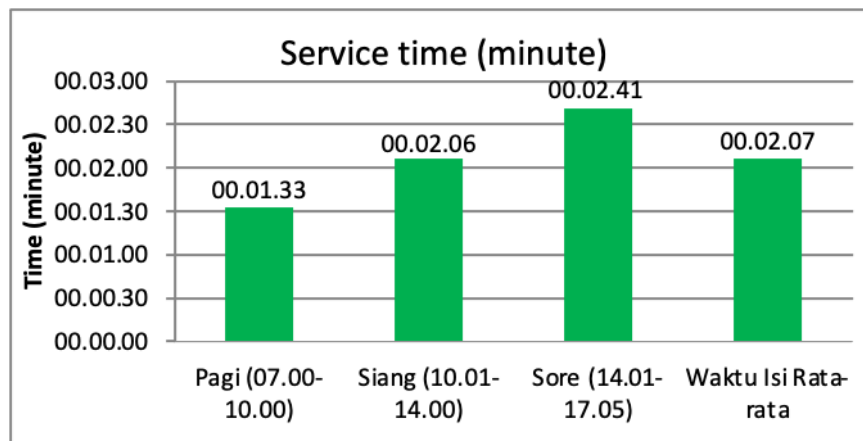
Table 5. Calculation of the Average Service Time of Trans Musi Buses at Cinde Bus Stops (Afternoon Hours)

No. (1)	Nomor Bus (2)	Waktu Kedatangan (3)	Waktu Keberangkatan (4)	Waktu Isi (4)-(3) = (5)
1	BG 7511 AO (K2.31)	10:09:23	10:11:27	00:02:04
2	BG 7527 AO (K3.28)	10:17:46	10:19:28	00:01:42
3	BG 7529 AO (K3.30)	10:26:11	10:27:20	00:01:09
4	BG 7540 AO (K3.40)	10:42:22	10:44:55	00:02:33
5	BG 7538 AO (K3.39)	10:50:25	10:53:59	00:03:34
6	BG 7539 AO (K3.41)	11:17:13	11:20:30	00:03:17
7	BG 7532 AO (K3.33)	11:33:15	11:34:48	00:01:33
8	BG 7533 AO (K3.34)	11:37:49	11:40:26	00:02:37
9	BG 7535 AO (K3.36)	11:54:01	11:55:38	00:01:37
10	BG 7525 AO (K3.26)	12:03:56	12:04:23	00:00:27
11	BG 7541 AO (K3.42)	12:32:32	12:35:40	00:03:08
12	BG 7509 AO (K2.29)	12:45:20	12:48:40	00:03:20
13	BG 7542 AO (K3.43)	13:02:30	13:06:01	00:03:31
14	BG 7527 AO (K3.28)	13:11:11	13:12:11	00:01:00
15	BG 7529 AO (K3.30)	13:22:41	13:23:25	00:00:44
16	BG 7540 AO (K3.40)	13:35:25	13:36:47	00:01:22
Average				00:02:06

Table 6. Calculation of the Average Fill Time of Trans Musi Buses in Cinde (Evening Hours)

No. (1)	Bus Number (2)	Time Arrived (3)	Time Departured (4)	Service Time (4)-(3) = (5)
1	BG 7539 AO (K3.41)	14:22:41	14:26:27	00:03:46
2	BG 7532 AO (K3.33)	14:33:14	14:35:57	00:02:43
3	BG 7533 AO (K3.34)	14:55:02	14:58:49	00:03:47
4	BG 7535 AO (K3.36)	15:11:35	15:13:58	00:02:23
5	BG 7525 AO (K3.26)	15:20:54	15:22:57	00:02:03
6	BG 7541 AO (K3.42)	15:40:39	15:43:56	00:03:17
7	BG 7511 AO (K2.31)	15:45:20	15:50:20	00:05:00
8	BG 7509 AO (K2.29)	16:04:27	16:06:53	00:02:26
9	BG 7542 AO (K3.43)	16:12:40	16:12:55	00:00:15
10	BG 7527 AO (K3.28)	16:26:20	16:28:45	00:02:25
11	BG 7529 AO (K3.30)	16:40:15	16:41:41	00:01:26
12	BG 7540 AO (K3.40)	16:51:30	16:52:17	00:00:47
13	BG 7539 AO (K3.41)	17:05:07	17:09:43	00:04:36
Average				00:02:41

Figure 4. Graph of Average Fill Time of Trans Musi Buses at Cinde Stop



From the graph of service time at the stop, the peak occurs in the evening. This is because when the workers / employees come home from the office and the students going back to home. The average service time is 00: 02: 07, exceeding the SP2J standard by 0.5 to 1.0 minutes, so it needs to be reviewed.

4.4. Travel Time

Travel time is the time the vehicle travels from the starting point to the end at a particular destination. In this observation, the travel time is calculated at the

time the vehicle departs from Plaju to PS Mall. And from PS. Mall headed to Plaju.

- Travel time is highly dependent on the traffic that the corridor passes, such as busy conditions, road width and traffic obstacles such as intersections.
- From the observations, it was found that the longest travel time during peak hours is 01:54:44. While the standard of PT.SP2J is less than 01:30:00. This indicates that the

travel time does not meet the maximum service time requirements.

- It needs to be reviewed so that the travel time is within the permitted standards

- The travel time table for corridor III is shown in the following table.

Table 7. Travel Time of Trans Musi Corridor III: Plaju - PS Mall

	Bus Number	Operating hours at Plaju - PS Mall (WIB)		Operating hours at PS Mall - Plaju (WIB)		length of journey		
		departured	arrival	departured	arrival	Plaju - PS Mall	PS Mall - Plaju	Total time
(1)	(2)	(3)	(4)	(5)	(6)	(4)-(3)= (7)	(6)-(5)= (8)	(7)+(8)= (9)
[BG 7541 AO (K3.42)	06:21:55	06:56:00	07:14:35	07:55:21	00:34:05	00:40:46	01:14:51
2	BG 7542 AO (K3.43)	06:32:33	07:12:28	07:29:45	08:07:58	00:39:55	00:38:13	01:18:08
3	BG 7527 AO (K3.28)	06:40:40	07:14:56	07:37:02	08:23:56	00:34:16	00:46:54	01:21:10
4	BG 7529 AO (K3.30)	06:50:27	07:28:29	07:42:39	08:21:59	00:38:02	00:39:20	01:17:22
5	BG 7540 AO (K3.40)	07:01:42	07:39:24	07:54:30	08:32:16	00:37:42	00:37:46	01:15:28
6	BG 7538 AO (K3.39)	07:13:16	07:52:26	08:04:05	08:46:01	00:39:10	00:41:56	01:21:06
7	BG 7539 AO (K3.41)	07:23:14	08:05:11	08:22:45	09:09:10	00:41:57	00:46:25	01:28:22
8	BG 7532 AO (K3.33)	07:35:34	08:19:10	08:38:00	09:22:39	00:43:36	00:44:39	01:28:15
9	BG 7533 AO (K3.34)	07:45:41	08:23:56	08:48:30	09:29:04	00:38:15	00:40:34	01:18:49
10	BG 7535 AO (K3.36)	07:56:12	08:38:05	09:10:17	09:50:11	00:41:53	00:39:54	01:21:47
11	BG 7525 AO (K3.26)	08:05:04	08:43:48	08:58:20	09:37:30	00:38:44	00:39:10	01:17:54
12	BG 7541 AO (K3.42)	08:18:02	08:57:45	09:16:24	10:01:45	00:39:43	00:45:21	01:25:04
13	BG 7511 AO (K2.31)	08:41:28	09:31:21	09:53:37	10:38:44	00:49:53	00:45:07	01:35:00
14	BG 7542 AO (K3.43)	08:53:20	09:33:04	-	-	00:39:44	-	-
15	BG 7527 AO (K3.28)	09:08:10	09:52:15	10:01:52	10:47:08	00:44:05	00:45:16	01:29:21
16	BG 7529 AO (K3.30)	09:08:10	09:52:15	10:01:52	10:47:08	00:44:05	00:45:16	01:29:21
17	BG 7540 AO (K3.40)	09:33:40	10:17:48	10:26:56	11:13:37	00:44:08	00:46:41	01:30:49
18	BG 7538 AO (K3.39)	09:47:30	10:28:12	10:35:31	11:26:40	00:40:42	00:51:09	01:31:51
19	BG 7539 AO (K3.41)	10:09:20	10:53:28	10:59:38	11:53:10	00:44:08	00:53:32	01:37:40
20	BG 7532 AO (K3.33)	10:23:28	11:10:45	11:15:04	12:05:52	00:47:17	00:50:48	01:38:05
21	BG 7533 AO (K3.34)	10:35:39	11:20:07	11:21:53	12:17:15	00:44:28	00:55:22	01:39:50
22	BG 7535 AO (K3.36)	10:50:30	11:34:40	11:39:54	12:29:40	00:44:10	00:49:46	01:33:56
23	BG 7525 AO (K3.26)	11:04:11	11:48:03	11:48:37	12:37:12	00:43:52	00:48:35	01:32:27
24	BG 7541 AO (K3.42)	11:18:00	12:07:45	12:17:45	13:12:24	00:49:45	00:54:39	01:44:24
25	BG 7509 AO (K2.29)	11:31:02	12:14:30	12:30:30	13:22:13	00:43:28	00:51:43	01:35:11
26	BG 7542 AO (K3.43)	11:49:56	12:33:49	12:46:02	13:37:15	00:43:53	00:51:13	01:35:06
27	BG 7527 AO (K3.28)	12:05:13	12:53:03	12:55:20	13:40:51	00:47:50	00:45:31	01:33:21
28	BG 7529 AO (K3.30)	12:18:38	12:59:33	13:08:41	13:51:46	00:40:55	00:43:05	01:24:00
29	BG 7540 AO (K3.40)	12:31:20	13:17:01	13:20:20	14:05:03	00:45:41	00:44:43	01:30:24
30	BG 7538 AO (K3.39)	12:48:50	13:36:00	-	-	00:47:10	-	-
31	BG 7539 AO (K3.41)	13:04:15	13:58:46	14:02:47	15:03:00	00:54:31	01:00:13	01:54:44
32	BG 7532 AO (K3.33)	13:20:08	14:13:07	14:15:34	15:07:01	00:52:59	00:51:27	01:44:26
33	BG 7533 AO (K3.34)	13:39:02	14:27:50	14:39:34	15:25:03	00:48:48	00:45:29	01:34:17
34	BG 7535 AO (K3.36)	13:51:30	14:38:24	14:55:32	15:50:16	00:46:54	00:54:44	01:41:38
35	BG 7525 AO (K3.26)	13:59:26	14:43:01	15:05:44	15:49:06	00:43:35	00:43:22	01:26:57
36	BG 7541 AO (K3.42)	14:11:02	14:56:59	15:22:04	16:24:56	00:45:57	01:02:52	01:48:49
37	BG 7511 AO (K2.31)	14:20:46	15:07:00	15:31:45	16:17:55	00:46:14	00:46:10	01:32:24
38	BG 7509 AO (K2.29)	14:32:50	15:16:27	15:46:30	16:50:05	00:43:37	01:03:35	01:47:12
39	BG 7542 AO (K3.43)	14:47:15	15:26:25	15:56:07	16:43:44	00:39:10	00:47:37	01:26:47
40	BG 7527 AO (K3.28)	14:54:20	15:33:08	16:10:00	17:07:00	00:38:48	00:57:00	01:35:48
41	BG 7529 AO (K3.30)	15:05:30	15:46:19	16:23:45	17:24:25	00:40:49	01:00:40	01:41:29
42	BG 7540 AO (K3.40)	15:27:30	16:04:08	16:35:40	17:30:34	00:36:38	00:54:54	01:31:32
43	BG 7539 AO (K3.41)	15:36:11	16:20:15	16:46:15	17:46:23	00:44:04	01:00:08	01:44:12
TOTAL								14:39:17
Average								01:31:41

4.5. Load factor

Load factor is the ratio between the number of passengers and the bus capacity that available for one trip expressed in percent. The calculation of the load factor for the Trans Musi bus can be shown in the following example.

Load Factor Plaju – PS Mall

$$\begin{aligned}
 &= \frac{\text{The number of passengers on the bus}}{\text{Bus Capacity}} \times 100 \% \\
 &= \frac{5}{36} \times 100 \% \\
 &= 13.9 \%
 \end{aligned}$$

Load Factor PS Mall - Plaju

$$= \frac{\text{The number of passengers on the bus}}{\text{Bus Capacity}} \times 100 \%$$

Load Factor Satu rute

$$\begin{aligned}
 &= \frac{35}{36} \times 100 \% \\
 &= 97.22 \% \\
 &= \frac{\text{Total Load Factor}}{\text{Amount of data}} \\
 &= \frac{111.1}{2} \\
 &= 55.6 \%
 \end{aligned}$$

Table 8. The Average Load Factor on Trans Musi Buses

	Bus Number	Load Factor (%)
1	BG 7541 AO (K3.42)	55,6
2	BG 7542 AO (K3.43)	32,4
3	BG 7527 AO (K3.28)	48,8
4	BG 7529 AO (K3.30)	31,4
5	BG 7540 AO (K3.40)	43,8
6	BG 7538 AO (K3.39)	58,8
7	BG 7539 AO (K3.41)	85,5
8	BG 7532 AO (K3.33)	81,6
9	BG 7533 AO (K3.34)	38,8
10	BG 7535 AO (K3.36)	38,5
11	BG 7525 AO (K3.26)	51,3
12	BG 7 541 AO (K3.42)	97,1
13	BG 7511 AO (K2.31)	96,2
14	BG 7542 AO (K3.43)	54,1
15	BG 7527 AO (K3.28)	101,3
16	BG 7529 AO (K3.30)	55,7
17	BG 7540 AO (K3.40)	87,5
18	BG 7538 AO (K3.39)	71,3
19	BG 7539 AO (K3.41)	127,6
20	BG 7532 AO (K3.33)	81,6
21	BG 7533 AO (K3.34)	97,5
22	BG 7535 AO (K3.36)	84,6
	Bus Number	Load Factor (%)
23	BG 7525 AO (K3.26)	60,0
24	BG 7541 AO (K3.42)	154,3
25	BG 7509 AO (K2.29)	111,3
26	BG 7542 AO (K3.43)	117,5
27	BG 7527 AO (K3.28)	73,8
28	BG 7529 AO (K3.30)	117,1
29	BG 7540 AO (K3.40)	72,5
30	BG 7538 AO (K3.39)	65,0
31	BG 7539 AO (K3.41)	156,6
32	BG 7532 AO (K3.33)	101,3
33	BG 7533 AO (K3.34)	108,3

34	BG 7535 AO (K3.36)	101,3
35	BG 7525 AO (K3.26)	62,5
36	BG 7541 AO (K3.42)	150,0
37	BG 7511 AO (K2.31)	89,7
38	BG 7509 AO (K2.29)	136,7
39	BG 7542 AO (K3.43)	45,0
40	BG 7527 AO (K3.28)	85,0
41	BG 7529 AO (K3.30)	111,4
42	BG 7540 AO (K3.40)	53,8
43	BG 7539 AO (K3.41)	56,6
Average		83

The average load factor (LF) was 83%. This exceeds the standard set at 50%. This means that there must be an increase / adjustment in the number of BRT buses in corridor III.

4.6. Operational Speed vehicles

- The average operational speed of the Trans Musi BRT vehicle is obtained by dividing the length of the corridor (PS Mall-Plaju and

Plaju-PS Mall) by the average travel time of buses in the corridor that is traversed. From the measurement results, the length of the track = 14,290 + 16,610 = 30.90 km. Travel time on the corridor of one route = 01:31:41 (1 hour 31 minutes 41 seconds) \approx 1, 53 hours.

- Obtained the average operating speed = $30.90 \text{ km} / 1.53 \text{ hours} = 20.196 \text{ km/hour} \approx 20, 2 \text{ km/hour}$. Speeds are still within the permitted standards, that is 20-40 km/hour.

4.7. Service Performance Characteristics

From the description above, the results are shown in the following table.

Table 9. Table of analysis results for several parameters of the Plaju - PS Mall Corridor

No	Item under review	Data result In the field	SP2J Operasional provisionns	Information
1	Headway	13,58	5 – 10 menit	Unqualified
2	Service time	0:02: 07	0,5 – 1 menit	Unqualified
3	Travel time	01:31:41	1-2 Jam	Qualified
4	Load Factor	82 %	50 %	Exceed the limit
5	BRT speed	20,2 km/jam	20-40 km/jam	Qualified
6	Long Coridor			
	a. Plaju – PS. Mall b. PS.Mall - Plaju	14.29 km + 16,61 km = 30,9 km	33 km	review

From the table above, there are parameters that do not match the operational criteria of SP2J, namely:

- a. Headway
- b. Service Time
- c. Load Factor

4.8. Management Solution / Service Optimization

- The SP2J (Sarana Pembangunan Palembang Jaya) Operational Management Standard uses a Load Factor (LF) < 0.5 .
- From the Load Factor (LF) value in the field = 0.83, it is necessary to increase the number of BRT fleets from 13 vehicles to 22 BRT buses. With the addition of BRT buses, of course there will also be changes in several variables such as: headway, filling time of passengers at bus stops, travel time and vehicle speed on the corridors that the BRT buses pass.

1. Headway
The maximum used headway is 10 minutes.
2. Service Time
Maximum use of service time is 1.0 minute
3. Travel Time
Travel time in the field is 01:31:41 or 1.43 hours, while the provision of 1-2 hours is used = 1.50 hours
4. Operational Speed
Average speed in corridor = $\frac{30.9 \text{ km}}{1.50 \text{ hour}} = 20.61 \text{ km/hour} \approx 21 \text{ km/hour}$

5. CLOSING

5.1 Conclusion

From the previous discussion on the Trans Musi BRT for the Plaju - PS Mall corridor, it can be concluded as follows:

1. Load Factor (LF) of average BRT bus = 0.83.
2. Service time (filling / dropping) the average passenger of the vehicle at the transit observation point is 00:02:07 (2 minutes 7 seconds), while the average service time in the corridor is 00:04:19 (4 minutes 19 seconds).
3. From the simulation to achieve optimum service is obtained:
 - a. additional BRT buses are required on peak days from 13 buses to 16 to 22 buses.
 - b. Headway = 10 minutes, service time = 1 minute, travel time = 1,43 \approx 1,50 hours.

5.2 Recommendation

1. The average travel time for BRT buses is obtained, one of the impact of the traffic around the bus stops, so that the Trans Musi buses can operate efficiently, it is necessary needs order around.
2. It is necessary to carry out further studies by taking concern to the load factor based on the Decree of the Minister of Transportation and Management of SP2J regarding the BRT transportation price.

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