Operational performance analysis of trans mebidang bus (case study: Binjai terminal - Medan)

M S Surbakti* and M R Bakara
Department of Civil Engineering, Universitas Sumatra Utara, 20155, Medan, Indonesia
*Email: medissurbakti@yahoo.com

Abstract. The purpose of this study is to analyze the performance of parameters and the satisfaction of passengers of Trans Mebidang bus which serves from the Binjai terminal to Medan City Market Center. Based on SK.687/AJ.206/ DRJD /2002, the performance of parameters is comprised of: the travel time, the headway, the circulation time, the load factor, and the comfort of the passenger area on the bus. The method that is used to measure the satisfaction of the passengers is Importance Performance Analysis. Results of the analysis found that the parameters of headway, circulation time, and load factor should be corrected because do not meet the standard, whereas the results of the analysis of the satisfaction of passengers indicated that the parameters that need to get improvement are the physical condition of the bus stop also the comfort and the safety of the bus stop.

1. Introduction

The mass transportation system no longer simply accelerates someone's mobility to reach their destination, but also provides comfort, security, and safety for the community. Due to the transport urban areas should be constructed with reference to the needs of people who consider the aspects of efficiency and effectiveness [1].

Medan city as the capital of the Province of North Sumatra has grown into a city of the metropolitan, in line with the growth in the number of populations development of the economy, and increasingly growing mobility of society. By thus the city of Medan as the center of activities of the economy and education has the attraction for people who live in the area supporting the city of Medan as the Binjai city and Deliserdang district. Trans Mebidang Bus is one of the supporting facilities for improving services to the community. In the process of the journey, the operational Trans Mebidang have the passengers sitting and standing comfort factors, stop affordability, regularity of operations such as waiting time, bus arrival information, bypassed bus stops information, accuracy and certainty of bus departure time, bus trip disruption information are frequent neglected thus reducing the public interest in using these transportation.

This is what actually hinders the development of mass city transportation systems. It is demanding the existence of a system of transportation that supports the smooth movement of people in the Medan-Binjai city. For it needs the efforts of the operation of the Bus Trans Mebidang with as effectively and efficiently as possible. So, it is necessary to know how the performance and service quality of the Trans Mebidang Bus. In accordance with the General Director of Land Transportation No. 687 In 2002 reference, the performance in terms of load factor, number of passengers were transported, headway, passengers’ comfort, waiting time and survey of passengers satisfaction.
The research is aimed to add to the science of knowledge, especially in the calculation of the performance of operational Trans Mebidang that is effective and efficient to serve the community in the operation. In addition to the research this can be used by agencies associated in determining policies in the operation of transport public mass.

2. Literature review

2.1. Trans Mebidang bus
The bus is a vehicle wheeled rubber which is driven by a driver who has the characteristics of engineering and operasional were varied [2]. In the service, the bus operates on a route or route and has a fixed schedule. Bus capacity is generally 70 people, which varies between 15 people (minibuses) - 125 people (articulated buses).

Trans Mebidang unveiled its operations at the end of the year 2015. It is operated by Perum DAMRI, the bus is operated in Medan, Binjai and Deli Serdang City with a fleet of as many as 30 buses were spread on two routes, namely the route Medan- Binjai along 23 km and the Medan-Deli Serdang route is 32 km long. The Trans Mebidang Bus fare is IDR 6000 for a far or near distance. Trans Mebidang Binjai Terminal - Medan City Market Center began to operate on at 6:05 pm until at 18:30 pm. However, in the operation amount fleet operates not reach 30. For the Terminal Binjai - Market Center Medan number of fleet operation is as much 9 fleet.

2.2. Public transport performance
The performance of public transportation is the result of the work of public transportation that runs to serve all activities of the community in traveling and activities [3]. The amount of the performance of operations or level of service of a system of transport public can be seen from some of the parameters that can be used as a tool to look at the effectiveness and efficiency of the operation of the number of fleets [4] [5]. As for the parameters in question is the load factor, total passengers were transported, headway, passengers waiting time, travel speed, delays cause, transportation availability, and the level of consumption of material fuel.

2.3. Importance-performance analysis method
The method is intended to measure the relationship between perceptions of consumers and priority improvement of the quality of the product or service that is known as a quadrant analysis. Based on the results of the assessment of the level of importance and performance results, a calculation will be made to the level of compatibility between the interests and the level of implementation.

Cartesian Diagram is used to determine indicators of services that satisfy or not satisfy consumers. Furthermore, the level of the elements that will be elaborated and divided into the four sections in the diagram Cartesian as follows:

Figure 1. Importance-performance diagram.
Quadrant 1 (Attributes to Improve) is the region that contains the factors that are considered relevant by the respondents. However, in reality, it is not appropriate as the expected (satisfaction that is still very low). The attributes that are entered in the quadrant of this must be improved.

Quadrant 2 (Maintain performance) is a region that contains factors that are considered relevant by respondents who are already following the perceived so that the level of satisfaction is relatively much higher. Therefore attributes are entered in the quadrant is to be maintained.

Quadrant 3 (Attributes to Maintain) is a region that contains factors that are considered less important by respondents and the fact that its performance is not too exceptional.

Quadrant 4 (Attributes to de-emphasize) is a region that contains factors that are considered less important by respondents and felt too excessive.

3. Research method
In this study, data were obtained from primary and secondary surveys. In the primary survey, the required data relates to; the number of passengers, travel time, location of passengers who took the bus and get off bus headway, and data from questionnaires. Secondary data required regarding bus specifications and bus routes [6].

Figure 2. Flowchart of research activities.
This research was conducted on the Trans Mebidang Bus Binjai Terminal - Medan route. The road route that is traversed namely Soekarno Hatta St, Gatot Subroto St, Iskandar Muda St, Gajah Mada St, S. Parman St, Raden Saleh St, Balai Kota St, Stasiun St, MT. Haryono St.

While the route from the Medan to the Binjai Terminal via FL Tobing St, Merbabu St, Surakarta St, Pandu St, Jend. A. Yani St, Pemuda St, Balai Kota St, Guru Patimpus St, Gatot Subroto St, Soekarno Hatta St.

Research carried out for two days, namely on the Sunday to represent the days off and the day Monday to represent a day of work. Surveys conducted on the bus and at several stops certain.

Total passenger buses per day in the month October 2017 was 2817 people, the number of respondents who were taken in the study obtained by using the Slovin formula with the level of accuracy of 10 % is [7]:

\[ n = \frac{N}{1+N \times e^2} \]  

\[ n = \frac{2817}{1 + 2817 \times 0,10^2} \]

\[ n = 97 \text{ person} \]

4. Analysis and discussion
In chapter this will be discussed regarding the processing of data and analysis of the data from each of the parameters are reviewed, namely, time travel, time between, the time of circulation, factors and unloading passengers, the comfort of sitting and standing, as well as the level of satisfaction of passengers

4.1. Performance analysis
Data were analyzed the primary data and secondary are obtained beforehand, then discussed about the performance and service of Bus Trans Mebidang. The parameters analyzed are the parameters contained in the Decree of the Director General of DGLT SK.687 / AJ.206 / DrJD / 2002 " Guidelines for Technical Operation of Transport Passenger Works in the Region Urban In the Project Fixed and Organized " is time travel, headway, circulation time, load factor, and comfort standards.

| No | Indicator                     | Department of Land Transportation Standards | Analysis Results | Information                   |
|----|-------------------------------|---------------------------------------------|------------------|-------------------------------|
| 1  | Headline                      | 5-10 minutes                                | 24               | Does not meet the requirements |
| 2  | Waiting Time for Passengers   | 5-10 minutes                                | 20 minutes       | Does not meet the requirements |
| 3  | Load Factor                   | 70%                                         | <70%             | Does not meet the requirements |
| 4  | Bus Travel Time               | 60-90 minutes                               | 77 minutes       | Meets Requirements            |
| 5  | Service Time                  | 13-15 hours / day                           | 12 hours         | Does not meet the requirements |
| 6  | Comfort Standards             | Sit 0.3-0.55 m2                              | 0.315            | Meets Requirements            |
|    |                               | Stand up 0.10-0.25 m2                       | 0.174            | Meets Requirements            |
4.2. Analysis of passenger satisfaction and expectations

Table 2. Results assessment level of satisfaction and rate of interest.

| No | Item       | Performance Implementation | Level of Importance |
|----|------------|-----------------------------|---------------------|
| 1  | Question 1 | 425                         | 440                 |
| 2  | Question 2 | 397                         | 443                 |
| 3  | Question 3 | 323                         | 433                 |
| 4  | Question 4 | 323                         | 437                 |
| 5  | Question 5 | 335                         | 390                 |
| 6  | Question 6 | 350                         | 402                 |
| 7  | Question 7 | 356                         | 409                 |
| 8  | Question 8 | 380                         | 387                 |
| 9  | Question 9 | 358                         | 409                 |
| 10 | Question 10| 390                         | 402                 |
| 11 | Question 11| 381                         | 395                 |
| 12 | Question 12| 390                         | 398                 |
| 13 | Question 13| 395                         | 398                 |
| 14 | Question 14| 427                         | 459                 |
| 15 | Question 15| 434                         | 461                 |

The level of performance of Trans Mebidang Bus services that can provide service user satisfaction is represented by the letter X, while the level of importance of the performance of the service is represented by the letter Y.

The results of the calculation of the factors of satisfaction and importance are then broken down into four sections or Cartesian diagrams. It is intended to obtain the points on the diagram are based on the level of interest and satisfaction the performance of services which allows the administrator Bus Trans Mebidang prioritize efforts repairs to the factors that are considered important by the services of Bus Trans Mebidang. Table 3 calculate passenger satisfaction factor and mean of performance and importance cartesian line.

Table 3. Calculate passenger satisfaction factors.

| Item       | Performance Implementation | Level of Importance | X'   | Y'   |
|------------|-----------------------------|---------------------|------|------|
| Question 1 | 425                         | 440                 | 4.25 | 4.4  |
| Question 2 | 397                         | 443                 | 3.97 | 4.43 |
| Question 3 | 323                         | 433                 | 3.23 | 4.33 |
| Question 4 | 323                         | 437                 | 3.23 | 4.37 |
| Question 5 | 335                         | 390                 | 3.35 | 3.9  |
| Question 6 | 350                         | 402                 | 3.5  | 4.02 |
| Question 7 | 356                         | 409                 | 3.56 | 4.09 |
| Question 8 | 380                         | 387                 | 3.8  | 3.87 |
| Question 9 | 358                         | 409                 | 3.58 | 4.09 |
| Question 10| 390                         | 402                 | 3.9  | 4.02 |
| Question 11| 381                         | 395                 | 3.81 | 3.95 |
| Question 12| 390                         | 398                 | 3.9  | 3.98 |
| Question 13| 395                         | 398                 | 3.95 | 3.98 |
| Question 14| 427                         | 459                 | 4.27 | 4.59 |
| Question 15| 434                         | 461                 | 4.34 | 4.61 |
| Mean       |                             |                     | 3.78 | 4.18 |
Figure 3. Diagram cartesian to factors that affect satisfaction.

Image Caption:
1. Bus physical condition
2. Bus cleanliness conditions
3. The physical condition of the bus stop
4. Conditions of safety and comfort in stop bus
5. Information tool to provide travel route info
6. Ease of getting the bus during rush hour
7. Bus arrival time interval
8. The speed of the bus to stop the intended
9. Affordability of bus stops
10. The hospitality and courtesy of bus officers in serving passengers
11. The information that is obtained by passengers when the bus had arrived at the bus stop
12. The attitude of officers in helping passengers to get a seat
13. The attitude of the officer in the rescue of passengers for lifting goods innate
14. Safety level on the bus
15. Comfort level on the bus

Figure 3 describe the position of the factors of satisfaction in all four quadrants are bounded by axis horizontal (X’) and the axis of the vertical (Y’) are mutually intersecting.

5. Conclusion
1. Judging from the performance, factors that need to be corrected is the factor of headway, the waiting time for passengers, the load factor, and the time of service of Trans Mebidang for operating airport passengers
2. Based on the results of the answers of respondents (Passenger of Trans Mebidang Binjai Terminal - Medan), concluded that the factors that become a priority main performance of services Trans Mebidang are factors which are in quadrant by all, that is the physical condition factor of Trans Mebidang bus stop and the comfort and safety conditions factor at the Trans Mebidang bus stop.

6. Suggestion
If seen from the results of the analysis of the performance of operational Trans Mebidang, which serves the Binjai Terminal – Medan Market Center, the authors suggest to:
1. It is recommended to optimize the headway so that it does not take too long to use operational rest time. The operational rest time should finish for 5-10 minutes.
2. Optimize the accuracy of the time necessary to maximize the service of transporting Trans Mebidang Binjai Terminal - Medan City Market Center Bus.

3. Maximizing the load factor by limiting or diverting other public transport routes that have the same route as the Trans Mebidang and setting the right headway so that all passengers are transported.

4. Doing the regular maintenance for Trans Mebidang, so it does not happen the cancellation of a trip due to interference technical.

5. Supervise and maintain damaged and dirty bus stop facilities, and the community must have the awareness to maintain public facilities.

6. For the safety of passengers and the others, recommended getting on and off bus must be at the bus stop.

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