The Effectiveness Analysis of Bus Rapid Transit Services (A Case Trans Semarang, Indonesia)

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Abstract

The population density in the city of Semarang, which is the impact of the flow of urbanization, is in line with the high demand for transportation. This situation also creates a new problem for the city: traffic jams. Traffic jam occurs because the available road capacity needs to be balanced with the number of vehicles used. In addition, the people of Semarang City tend to use private Transportation rather than public Transportation provided by the city government, namely Bus Rapid Transit (BRT). This research was conducted to analyze the effectiveness of Semarang BRT in meeting the high transportation needs in the city of Semarang. The research results will show aspects of BRT that need to be developed or improved, thereby increasing public interest in choosing to use the public transportation provided. Several indicators of Semarang BRT service quality have been assessed as good, with the highest tariff parameter. This condition illustrates that BRT tariff determination can still provide good service for road users. Meanwhile, the parameters that were considered bad service were disabled facilities and pregnant women.

Keywords: Transportation demand, Effectiveness, Supply

1. Introduction

Transportation is an activity that cannot be separated from people's lives because, in the story of its development, humans permanently moved from one place to another to make ends meet (Dwiatmoko, Mudjanarko, Setiawan, & Muhammad, 2021) . Based on its development, there are three types of transportation, that air transportation, land transportation, and sea transportation. Then, based on their services, transportation is divided into two, namely public and private transportation. Meanwhile, transportation in Seoul is dominated by public transportation, namely public buses at 28 percent, subway at 37 percent, taxis at 7 percent, bicycles and other means of transportation at 4.4 percent, and private vehicles at only 23.5 percent (Sulistyowati & Muazansyah, 2019).

Along with the increasing population growth in Indonesia, the need for transportation will also increase. The development of the amount of production and the number of motorized vehicles not only provides benefits for the fulfillment of road transportation facilities but can cause harmful excesses. This occurs because road growth and the increase in the number of vehicles need to be balanced. On the other hand, along the road, illegal parking is everywhere with itself, closing the space for traffic flow. Suppose it needs to be carried out as a form of supervision and regulation, as well as intensive guidance on the existence of these motorized vehicles. In that case, it will result in congestion, accidents, environmental pollution, irregularities, and so on (Apriyono & Rumpus, 2021) . The increasing rapid growth in the movement of people and goods makes the demand for the provision of a road network from the quality and quantity aspects need to be increased to accommodate all this growth in the movement (Wijanarko & Ridlo,

2017) . Activation of an efficient public transportation system characterized by minimal environmental impact involving residents avoiding the use of private vehicles with the consequence of reducing the phenomenon of congestion (Severino, Pappalardo, Olayode, Canale, & Campisi, 2022).

The severe impact of population growth is on the country's transportation system (Jha, 2021). The transportation system is an essential element of infrastructure that influences urban development patterns (Aminah, 2018) . Rapid urban development impacts the quality and quantity of urban space (Dermawan, Johannes, Isradi, & Rifai, 2022). In urban areas, urban transportation is beneficial for people's mobility to carry out their daily activities (Dwiatmoko, Mudjanarko, Setiawan, & Muhammad, 2021). One of them is what happened in the city of Semarang, the largest city in Central Java with a high population density because of the impact of urbanization. This will certainly align with the increasing need for transportation to carry out various aspects of life. Several major cities in Indonesia have Bus Rapid Transit (BRT) services to support mobility communities (Safitri, Mediana, & Septiani, 2019). One of the efforts to provide public transport services in the city of Semarang is the provision of BRT, which has been developed since 2010 (Kurnianingtyas, Mardliyah, & Fauzizah, 2020).

BRT in Semarang officially started operating in 2010. Many developments and improvisations have been made, such as adding corridors, improving infrastructure, and improving services. As a result, a growing city should have a reliable public transit system (Sulistyono, Djakfar, & Wicaksono, 2017) . In transportation, there are two most essential elements, namely the transfer or movement and the physical changing of the place of goods or commodities and passengers to another place (Kurniawan, Handayan, & Astutik, 2022). This research on the use of BRT aims to analyze the effectiveness of BRT in meeting the demand for transportation use and reducing the impact that will arise due to high demand for transportation use. The results of this study can be used as a reference for people to prefer public transportation as a means of transportation in everyday life. Moreover, as a reference for stakeholders to further develop various aspects of the public transportation system.

2. Literature Review

2.1. Transportation Demand

Urban development also increases the demand for transportation, so congestion cannot be avoided (Riawan, 2018) . The number of vehicles has been steadily growing worldwide in the last twenty years (Nesmachnow et al., 2018) . Congestion is a condition where there is a buildup of vehicles on the road (Haryono, Darunanto, & Wahyuni, 2018) . Traffic congestion certainly harms the physical and psychological aspects of road users. The physical impact is in the form of fatigue, while the psychological impact can be in the form of stress, irritation, and discomfort due to being surrounded by pollution, decreasing environmental quality due to pollution, and so on (Tamara & Sasana, 2017) . In congested conditions, drivers tend to become impatient, leading to undisciplined actions, exacerbating the congested conditions even further (Ali & Abidin, 2018).

Appropriate policies need to be carried out by synchronizing changing the mindset of the people, making them aware and gradually changing the habits of using private vehicles to public transportation according to the program being promoted by the Regional Government of Central Java Province (Sukarmi & Suwondo, 2019) . Furthermore, improving the quality of urban transportation services, especially mass transportation such as BRT, is a central issue currently (Riawan, 2018).

2.2. Bus Rapid Trans (BRT)

To overcome congestion on Semarang City roads, the Semarang City Government has developed a cheap, safe, and comfortable mass transportation, namely the BRT (Kurnianingtyas, Mardliyah, & Fauzizah, 2020). BRT has advantages because ticket prices are affordable, able to open jobs, and security is maintained when traveling (Chengula, 2017). In addition, BRT can help reduce health problems due to air pollution. Rapid transit BRT is a different type of transport infrastructure investment than road and rail investment. They add value not by creating additional lanes but by revising the use of installed right-of-way (Akbulut, Bezgin, & Aydin, 2018). BRT is intended as a public transportation that provides easy access and

promotes equality for marginalized people, such as the poor and other low-income residents, to reduce travel time and benefit health (Kusumawardani, Saintika, & Romadlon, 2021).

BRT is an integrated system of bus facilities, services, and convenience that collectively increases speed and reliability and is integrated with a substantial transit identity through high service quality (Riawan, 2018). Services offered on BRT transport consist of general service characteristics, including a) service frequency; b) timely performance; c) hours of service; d) network coverage; e) availability of information; f) ticket prices; g) behavior of personnel; h) existence of bus lanes; and i) efforts to realize environmentally friendly BRT transportation; and j) facilities as facilities and infrastructure needed in BRT services, including a) bus stops and bus stops in the form of walking distance for passengers to travel, provision of information, physical conditions (shelter, visibility, seating capacity, etc.), safety and safety while waiting; b) the vehicle in the form of the condition inside the vehicle (whether it is crowded or not and the condition of the facilities available such as seats, air conditioning, handles, windows, doors, floors, etc.), cleanliness, driving behavior, provision of information, provision of facilities for easy accessibility for the elderly and disabled people; and c) transfer points, in the form of distances between transfer points, waiting times, providing information for passengers about the combination of various lines and methods including time schedules (Riawan, 2018).

The BRT procurement has operational objectives, which are divided into several aspects: environmental, social, and economical. The environmental aspect aims to reduce highway emission pollution and noise levels. The economic aspect includes creating jobs, improving services, and shortening travel time. Meanwhile, the social aspect emphasizes increasing driving safety, facilitating access to cities, and reducing social inequalities (Romadlon & Saintika, 2020). However, the implementation of BRT facilities still needs to be improved. For example, the time between (headway) buses is unstable, and passengers jostle each other. When the bus is full, causing discomfort on the bus, and there is no information about the position of the bus or the scheduled arrival of the bus at the bus stop, most of the bus stops do not have good access. They do not have a particular bus lane (Purnomo & Herijanto, 2021). These conditions make people prefer to use private transportation rather than using BRT. Therefore, it is necessary to evaluate and improvise according to what is happening in the field to attract people's interest in preferring public transportation as a means of daily mobility.

The integrated transportation system creates orderly, safe, secure, comfortable, fast, regular, smooth, affordable transportation, sustainable transportation management (sustainable development), accessibility, equity, and environmental impact. Accessibility is pursued by planning an integrated transportation network (Siregar, Wardaya, & Tas'an, 2017). The implementation of transportation services must be based on safe, comfortable, ease, economical, smoothness, and eco-friendly (Kusumawardani, Saintika, & Romadlon, 2019).

3. Methodology

This research was conducted to analyze the effectiveness of BRT in meeting the demand for transportation use in the city of Semarang. However, there is still a low public interest in using the Semarang BRT, so it is necessary to study the level of user satisfaction with the performance of services and facilities so that improvements can be made to increase public interest. The systematic scientific research process must begin with identifying the right problem (Rifai, Hadiwardoyo, Correia, Pereira, & Cortez, 2015). The correspondents in the research to be conducted are BRT passengers in the city of Semarang. Passengers are grouped by gender, occupation, and age (Rifai, Hadiwardoyo, Correia, & Pereira, 2016).

In this study, the data collection method was carried out online using Google Forms. In giving answers, respondents were given the choice of a rating scale from 1 to 5, which means one is very dissatisfied and five is very satisfied. The location used in this study is the Semarang Mangkang-Penggaron BRT route. The location map is in figure 1.
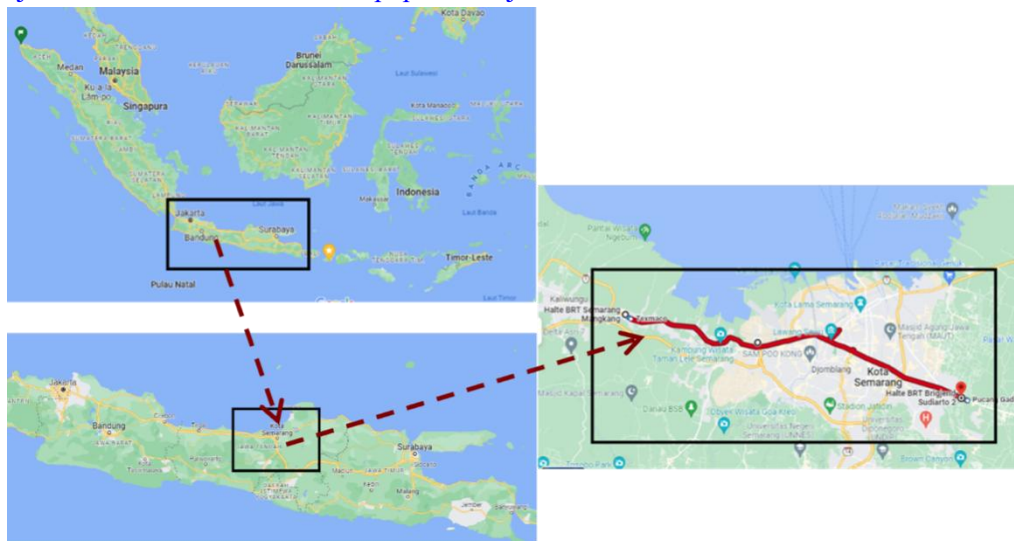
Figure 1. Research Locations

Parameters based on travel characteristics are frequency of use, the purpose of use, travel time to bus stops, and waiting time for arrival. In addition, there are parameters for calculating the quality of service, namely BRT fares, ease of ticket payment systems, providing information by staff about the stops to be skipped, accuracy and certainty of bus schedules, seating comfort, adequacy of space for standing passengers, convenience for persons with disabilities to access stops, and facilities for persons with disabilities.

Table 1. Service Quality Parameters

No	Parameters	Source				
		(Azali, 2018)	(Aidoo et al, 2013)	(Romadlon, Saintika 2020)	(Purnomo, Herijantom 2021)	(Sari, Afriandini, 2020)
1	Tariff	v	v	v	v	v
2	Easy ticket payment	-	-	-	v	-
3	Providing information	-	v	-	v	-
4	Schedule accuracy and certainty	-	v	v	v	-
5	Seat comfort	-	v	v	v	-
6	Properness of space to stand	-	v	v	v	-
7	Easy access to bus stops for disabilities	v	-	-		-
8	Facilities for persons with disabilities	v	v	-	v	-

After the data is collected, the data is processed quantitatively using the Importance Performance Analysis (IPA) method. The Importance Performance Analysis method is used to identify essential performance factors by an organization in meeting the satisfaction of service users. The results of the assessment of the level of importance, as well as the results of the work assessment, will calculate the level of conformity between the level of importance and the level of implementation by the service provider. The results of this study will also be described using the Radar Chart. From this Radar Chart, it will be seen which parameters need to be maintained or corrected so that the aims and objectives of the service procurement can be achieved.

4. Result and Analysis

BRT users who were randomly surveyed were 96 respondents who live in the city of Semarang. Demographic data of BRT users can be seen below. Trip characteristics include the purpose, frequency of use, and options if the BRT experiences delays.

Table 2. Demographic Data and Travel Characteristics of Research Correspondents

User Variables	Description	Percentage
Gender	Female	49%
	Male	51%
Profession	Student	38%
	Employee (BUMN/Swasta)	52%
	PNS	1%
	Housewife	4%
	Lain-lain	5%
Age	>17 Years Old	11%
	17-20 Years Old	20%
	21-30 Years Old	38%
	31-40 Years Old	21%
	41-50 Years Old	10%
The intended use	Work	37%
	School	30%
	Holiday	28%
	Vacation	1%
	Etc	3%
Frequency of Use	Daily (5-7 days/week)	45%
	Once a week (2-5 days/week)	17%
	Once a month	38%
Alternative mode	It remains to wait for it to come	56%
	Change the option to another vehicle	17%
	Lain-lain	27%

Based on gender, male dominates with a percentage of 51%. Then, in terms of work, more than 38% are students, followed by employees (BUMN/Private) 52%, civil servants 1%, homemakers 4% and other jobs 5%. In addition, most BRT users are in the age range of 21 to 30 years (38%), followed by users aged 31-40 years (21%), users aged 17-20 years (20%), users 41-50 years (10%), and users under 17 years as much as 11%.

Most intended users use BRT for work, which gets a percentage of 37%, followed by the use of BRT for schools 30%, BRT for holidays 28%, BRT users for tourism 1%, and other purposes 3%. Most BRT users who travel using BRT every day or 5-7 days a week get a percentage of 45%, followed by those using BRT only once a month, 38%, and once a week, 17%. Most BRT users prefer to wait until they arrive if the

BRT is delayed, receiving a percentage of 56%, followed by changing other vehicle options by 17% and choosing other options by 27%. Then, the quality of Semarang BRT services can be seen from the radar chart can see in the figure 2.
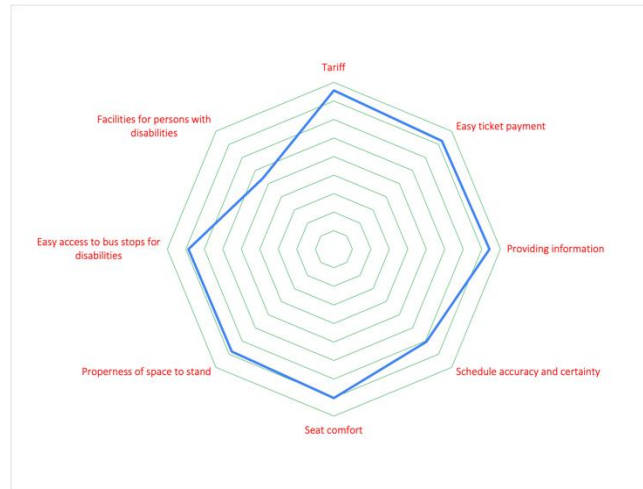

Figure 2. Perception of BRT Performance

The radar chart shows that the current BRT tariff points are the most off the radar. This shows that the Semarang BRT users feel that Semarang BRT tickets are still quite affordable. This affordable BRT tariff should always be considered with the conditions in the community to maintain public interest and interest in using the Semarang BRT. Furthermore, still in the same discussion, the ease of the ticket payment system is on the safe radar and must be maintained. The convenience of this ticket payment system is also supported by current technological developments, namely by creating a cashless payment system using an e-wallet.

Providing information by the staff regarding the stops passed is quite clear. Providing information about the stops that are passed is very important and makes it easy for all users, especially for new users and users who are going to try a new route. They are then followed by points of comfort where the seat is still on the safety radar. Convenience, in this case, shows that BRT users consider that the Semarang BRT already has comfortable and adequate facilities according to their needs. Therefore, the convenience of public transportation will be the main attraction for users.

Then on the comfort point of the BRT space for standing passengers, the community has considered it quite comfortable. The concept of BRT Semarang is mass transportation that can transport many people, but some get seats, and others stand with hanging handles. The community considers BRT facilities suitable for people with disabilities, the elderly, and pregnant women. Inside the Semarang BRT, two to four priority seats are located near the side entrance and designated for persons with disabilities, the elderly, and pregnant women.

On the point of accuracy and certainty, the schedule looks quite good, but it still needs to be improved. The more BRT users find bus schedules that are often late. This will affect the user's psychology to switch to another mode of transportation. This will reduce the function of BRT as mass transportation. For this reason, managers need to reschedule by paying attention to office hours and drivers' rest hours so that BRT needs can be met optimally. Meanwhile, at the bus stop, facilities for persons with disabilities, the elderly, and pregnant women are on the radar. This means that innovation is urgently needed to create friendly BRT shelters that can be used by persons with disabilities, the elderly, and pregnant women.

5. Conclusion

The research was conducted to determine the performance of the Trans Semarang BRT service, which is a user preference for the Semarang City BRT. This preference is based on the main factors, namely

demographic factors and user experience with BRT. As a result, several indicators of Semarang BRT service quality have been assessed as good, with the highest tariff parameter. This condition illustrates that BRT tariff determination can still provide good service for road users. Meanwhile, the parameters considered inadequate services were disabled facilities and pregnant women.

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