engineering proceedings

MDPI

Proceeding Paper

Performance Analysis of Batik Solo Trans Corridor-6 Services †

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† Presented at the 7th Mechanical Engineering, Science and Technology International Conference, Surakarta, Indonesia, 21–22 December 2023.

Abstract: The development of public transport in Surakarta City can be seen from the existence of Batik Solo Trans Corridor-6. This route passes through several types of land uses so that the passengers are very diverse. This article is focused on analyzing the user characteristics and their assessment of the service performance and operations. The data required consist of: bus arrival/departure time, number of passengers getting on/off, distance between stops, number of passengers, and occupancy rate. Data were collected by distributing questionnaires offline on the bus to obtain respondents. The performance analysis refers to the Minister of Transportation Regulation, and the World Bank. The analysis results show that the majority of respondents were female, aged 15–25 years, and students. Other results show that most BST users change modes once, using private vehicles and walking, and come from the Timuran to the Al Islam High School Bus Stop. Operational parameters that meet the standards are headway, travel speed, and stopping time, while those that do not meet the standards are the load factor and travel time. However, the respondent satisfaction level obtained was 76.78%. This value states that the service is still in the good category according to what is felt when using the service.

Keywords: performance analysis; public transport; services

Citation: Hidayati, N.; Damarjati, I.; Mulyono, G.S.; Magfirona, A. Performance Analysis of Batik Solo Trans Corridor-6 Services. *Eng. Proc.* **2024**, *63*, 9. https://doi.org/10.3390/engproc2024063009

Published: 27 February 2024

1. Introduction

Transportation is the process of physically moving people/goods from one place to another, either using or without transport mode [1]. The development of transportation has made it easier for human mobility for various reasons including social economic activities [2,3]. This development is influenced by several factors such as environmental, historical, technological, and political economic factors, and society's demands for global transportation [4–6]. Massive developments and with changing times have made means of transportation increasingly modern and sophisticated, one of which is public transportation [7].

Based on Law No. 22 of 2009 [8], public motorized vehicles are defined as any vehicle used to transport goods and people for a fee. Its existence needs to be implemented in order to provide good and appropriate transportation services for the community [9]. Public transportation is one of the factors that plays an important role in the movement of traffic flows in a place and the social and economic development of a region [10]. One of the regions in Indonesia that has rapid economic growth is Surakarta. In 2022, this city recorded economic growth of 6.25%, which was higher than the Indonesian average of 5.31% [11].

Surakarta/Solo is the most populous city in Central Java. This is proven by the population of 522,728 people in 2021 within an area of 46 km^2. Population density in this city reaches 11,363.65 people/km^2, compared to a density of 4431.92 people/km^2 in Semarang [12,13]. This development cannot be understood separately from the support of

the transportation sector which facilitates connections between regions. This city is among those developing integrated public transportation, namely the BST route with Balapan Station and Adisumarmo Airport. It is hoped that the procurement of BST can improve the quality of services to the people in this city [14].

The performance of a transportation system can be considered from many perspectives, including those of engineers, economists, managers, planners, and definitely from those of travelers or users [15]. Regarding public transportation, the differences in perception are grouped into three, i.e., users, operators, and government [16]. The performance in question is the ability of public transportation to operate or serve users. Minimum service standards on routes constitute the requirements for the implementation of public transportation regarding the type and quality of service received by each user of transportation services [17]. The optimal service is generally the hope desired by the community. Some of the desired performance parameters are comfort, security, and speed [18].

PT. Batik Solo Trans is the party responsible for BST Bus operations. Bus Friends is an online application from the Ministry of Transportation which was launched in June 2020. This application, TEMAN BUS, was created to provide economical, easy, reliable, and comfortable transportation for the Indonesian people [19,20]. Currently, PT BST operates six main corridors with a fleet of buses. Based on observations of land use around Corridor-6 in the form of hospitals, schools, markets, universities, hotels, and so on, the number of passengers is varied [7]. Based on the description above, this research needs to be carried out to identify user characteristics and their assessment of the corridor's service performance, as well as its operational performance. It is hoped that this research can be used as material for consideration by related agencies and as reference material for similar research.

2. Research Methods

The object of this research is the bus of Batik Solo Trans Corridor-6 in Surakarta City, which has a capacity of 20 seats. Currently, the fare applied to the general public is IDR 3700, while for students and people with disabilities, the fare is IDR 2000. This corridor starts from Tirtonadi Bus Station and goes to Solo-Baru, the route of which can be seen in Figure 1.

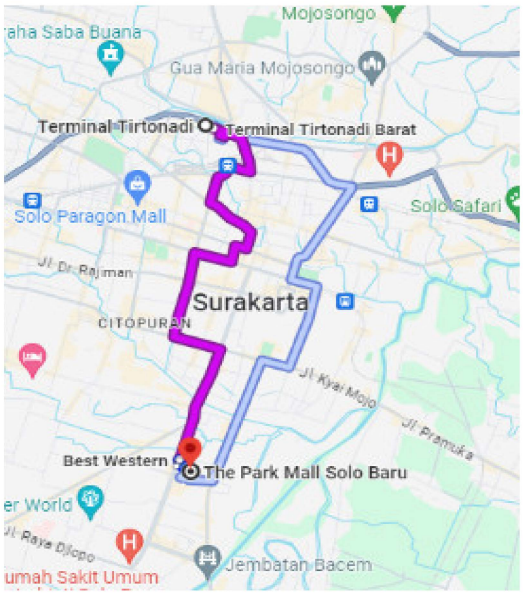

Figure 1. Corridor-6 of Batik Solo Trans [21].

The primary data obtained comprise the vehicle user and operational characteristics, as well as answers to questions regarding the transportation service. The questionnaire used

to search for respondent assessment data was previously tested for validity and reliability, the results of which can be seen in Table 1. Data obtained from other related agencies are: the average number of passengers per day and the monthly occupancy rate from the Surakarta City Transportation Service and PT. Bengawan Solo Trans, Surakarta, Indonesia.

Table 1. Instrument validity and reliability test results.

Question Number	$r_{calculate}$	r_{table}	Mark
1	0.701	0.355	Valid
2	0.845	0.355	Valid
3	0.543	0.355	Valid
4	0.670	0.355	Valid
5	0.527	0.355	Valid
6	0.725	0.355	Valid
7	0.594	0.355	Valid
8	0.584	0.355	Valid
9	0.724	0.355	Valid
10	0.483	0.355	Valid

Performance analysis is based on Minister of Transportation Decree SK.687 [22], Minister of Transportation Regulation PM 10 [23], and the World Bank [24]. Data collection was carried out offline on the bus with the respondents being passengers in the corridor. The characteristics of the respondents reviewed were: age, gender, occupation, origin and destination of passengers, number of mode changes, and modes used before and after.

Based on Table 1, it can be seen that all calculated r-calculated values are greater than r-table. This shows that all question items are valid and can be used as research instruments. The results of the reliability test for the variables used have a Cronbach's Alpha value of 0.841 or greater than 0.6, so they are said to be reliable to use.

2.1. Operational Performance

The operational performance parameters of public transport used consist of load factor, headway, speed, travel time, and delay. Load factor (LF) is a comparison between the number of passengers and the number of available seats expressed in percentage. The standardized value to obtain balanced operational conditions is 70%.

Headway (H) is the time interval between two consecutive buses which is usually determined at terminal gates and bus stops. The standard value is 5–10 min for ideal conditions and 2–3 min for peak hours. This value can be calculated from the difference between the arrival times of the second fleet (T_2) and the first (T_1), as shown in Equation (1).

$$H = T_2 - T_1 \quad (1)$$

Speed is the rate of movement of a vehicle expressed in kilometers per hour. The standard value during peak hours is 30 km/h, while the standard value during off-peak hours is 60 km/h. Travel time (TT) is the time required for each transport fleet to complete the journey from the terminal of origin to the destination with an average value of 1–1.5 h and a maximum of 2–3 h. Stopping time (ST) is the time for which the bus stops at each shelter or bus stop. The standard value is 45 s during peak hours and 60 s at during off-peak hours.

2.2. Satisfaction Level Assessment

The level of passenger satisfaction is a measure of the satisfaction of each passenger when using public transportation. This was obtained from a direct survey of Corridor-6

BST users. The data obtained are the result of a questionnaire that was given to users. All the data are then processed by multiplying each answer weight by the predetermined points. The total respondent achievement value from the assessment results is adjusted based on the respondent achievement level (RAL) value. Adopted from Sahlan in [25], the classification of the achievement levels in this case can be seen in Table 2.

Table 2. Respondent achievement level (RAL).

Information	RAL (%)
Extremely poor	0–20
Poor	21–40
Moderate	41–60
Good	61–80
Extremely good	81–100

3. Result and Discussion

3.1. Passenger Characteristics

The characteristics of BST passengers can be identified according to the results of the completed questionnaire. The proposed criteria are gender, age, occupation, passenger's origin and destination, and the mode used before using public transport as seen in Figures 2 and 3, and Table 3.

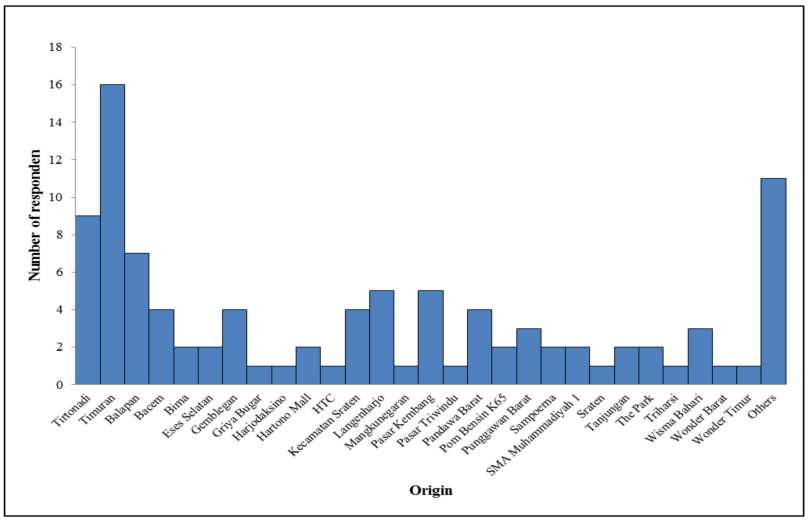

Figure 2. Distribution of passenger origin zones.

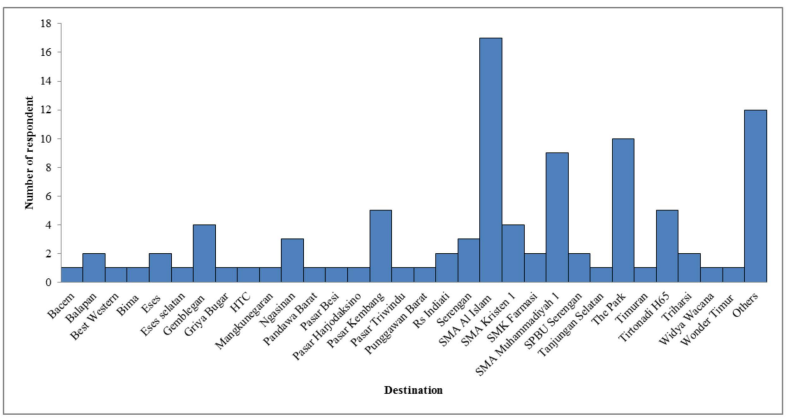

Figure 3. Distribution of passenger destination zones.

Table 3. Characteristics of passengers.

Characteristic	Respondents	
	Number	(%)
Gender		
Male	39	39
Female	61	61
Age		
15–25	44	44
26–36	23	23
37–47	16	16
48–58	12	12
59–70	5	5
Occupation		
Student	40	40
Merchant	19	19
Private employee	23	23
Government employee	6	6
Others	12	12
Frequent		
1	78	78
2	20	20
3	2	2
Previous mode used		
Walking	36	36
Private mode	36	36
Others	28	28

Based on Table 3 as well as Figures 2 and 3, it can be seen that the majority of respondents who use this transportation are female (61%), aged 15–25 years (44%), and are students (40%). Moreover, 78% only made one modal change, with walking and using private vehicles constituting 36% each. The majority of respondents' came from the Timuran Bus Stop (16%), and the most common destination was the Al Islam High School Bus Stop (17%).

3.2. Operational Performance

Based on the results of the performance evaluation, the values for the load factor, headway, travel time, travel speed, and stopping time are obtained. The recapitulation results can be seen in Table 4.

Based on Table 4, it can be seen that several indicators have met the standards, namely headway, travel speed, and stopping time. Indicators that do not meet the standards are the load factor and travel time. This low load factor is because many people still choose private vehicles as their main mode of travel compared to public transportation. From observations in the field, it is found that there is currently a Trans Jateng Bus which has a Solo–Sukoharjo–Wonogiri route. This bus meets with the Corridor-6 of BST at Tirtonadi Terminal and Solo Baru, so it can be an alternative mode of transportation for passengers in these two areas. This is attractive because the route is simpler than Corridor-6 which passes through the city center.

Table 4. Corridor-6 of BST performance evaluation.

Indicator	Average	Standard			Marks of the Standard
		SK. 687 (2002)	PM 10 (2012)	World Bank	
Load factor (%)	19			>70	Did not meet
Headway (minutes)	5.78	Ideal 5–10 Peak 2–5		Average 5–10 Maximum 10–20	Meet
Travel time (hours)	36.85	Average 1.0–1.5, Maximum 2–3		Average 1.0–1.5 Maximum 2–3	Did not meet
Travel speed (km/hour)	25.47	Maximum 30	Peak 30 Off peak 60	High density 10–12, Low density 25	Meet
Stopped time (seconds)	6		Peak 45 Off peak 60		Meet

3.3. Passenger Satisfaction Level

The level of passenger satisfaction analyzed includes the physical condition of the bus and the service from the service provider. Based on the recapitulation results, the level of achievement of respondents was obtained, which can be seen in Table 5.

Table 5. Services assessment.

No	Criteria	Extremely Good	Good	Moderate	Poor	Extremely Poor	RAL (%)
1	Timeliness	16	64	14	6	0	78
2	Friendly officer	20	61	18	1	0	80
3	Comfortable seat	12	62	26	0	0	77.2
4	Bus stop information	17	43	38	1	1	74.8
5	Officer alertness	13	43	37	7	0	72.4
6	Quality of payment services	18	45	36	1	0	76
7	Air conditioning	17	58	25	0	0	78.4
8	Cleanliness and tidiness	15	64	20	1	0	78.6
9	Access for boarding and aligning	16	60	23	1	0	78.2
10	Interior and exterior appearance	10	60	21	9	0	74.2
		Average					76.78

Based on Table 5, it can be seen that the range of the respondent achievement level (RAL) values is 72.4–80%. The lowest score is related to the alertness of officers in handling problems on the bus. The highest score was obtained for the friendliness of the officers in the service. The table also shows the average RAL value, namely 76.78%, which refers to Table 2, which is included in the good category. Even though the results are good, operators and related parties are expected to continue to maintain this corridor service and listen to public complaints.

4. Conclusions

Based on the analysis, it can be concluded that the majority of Corridor-6 users are female (61%), aged 15–25 (44%), and are students (40%). The trip characteristics obtained were that mode changes were mostly only made once (78%), with private vehicle use or traveling on foot (36%), originating from the Timuran Bus Stop (16%) and going to the Al Islam High School (17%). The performance indicators for this mode of transportation that meet the standards are headway, travel speed, and stopping time, while those that

do not meet the standards are the load factor and travel time. However, the satisfaction level value is in the range of 72.4–80%, with an average of 76.78%. Based on the results of this assessment, the service performance is categorized as good. Even though it is good, there has been a lot of criticism and suggestions from the public. Therefore, operators and related parties are expected to continue to maintain their services and improve the necessary matters according to public complaints. The factors that cause the load factor to be small is the existence of an alternative mode that can be used, i.e., Trans Jateng Solo–Sukoharjo–Wonogiri, whose route is simpler than Corridor-6, which passes through the city center.

Author Contributions: Conceptualization and methodology N.H. and I.D.; validation, N.H.; G.S.M. and A.M.; formal analysis, N.H. and I.D.; investigation, I.D.; resources, N.H. and I.D.; data curation, I.D.; writing—original draft preparation, I.D.; writing—review and editing, N.H.; visualization, N.H. and I.D.; supervision, N.H.; project administration, A.M.; funding acquisition, N.H. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Universitas Muhammadiyah Surakarta through Research Contract of HIT-PT-FT-UMS Number: 092/A.3III/FT/III/2021.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data are contained within the article.

Acknowledgments: The authors would like to thank Universitas Muhammadiyah Surakarta, for their diverse forms of support, including facilities.

Conflicts of Interest: The authors declare no conflicts of interest.

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