Journal of Technology and Social Science

Trans Semarang Bus Service Analysis for Monitoring and Passenger Information System

Mudjiastuti Handajani[1, a]

[1]Civil Engineering Department, Faculty of Engineering, Semarang University, Indonesia

[a]<hmudjiastuti@yahoo.co.id>

Keywords: Monitoring System, Passenger Information System, Smart Transportation, Trans Semarang Bus

Abstract. Semarang Smart Transportation Program is creating the city transportation system which are reliable, environmentally sound, safe, comfortable, well-organized and modern management. Nowadays, Trans Semarang Bus always came in uncertain times. The purpose of this study was analyzing Trans Semarang Bus performance which able to increase the better city transportation system in the future especially developed country like Indonesia. Monitoring and Passenger Information System were able to inform buses depart and arrival in the real time. Research methodology in this study used qualitative and quantitative technique. The result for this study was long route 26.75 km; average speed 14 km/ hour; time calculation 2.1 hours; waiting time 10 minutes, headway 20 minutes, bus stop distance 300 meters. Many people in Semarang are expected the on time city buses. Data will be entered into Monitoring System (MS) and Passenger Information System (PIS). MS and PIS will give accurate information and go to better city transportation system.

1. Introduction

Currently, Trans Semarang Bus public transportation has not been optimal because it is only able to serve 7% of total population [1]. The majority of Semarang residents often use private vehicles (motorcycles and cars) in performing daily travel / activities as they are easier and faster. The strategy to improve the Urban Transportation System is by improving mass public transportation services. In order that Trans Semarang Bus is demanded by the people, the arrival and departure information in real time should be provided so that users can plan when to leave and to arrive at their destination [2].

The program of City Smart Transportation makes the city transportation system reliable and environmentally sound, safe, convenient, cheap, well organized, scheduled and makes management arrangement more modern [3]. Up to now City Transportation System in Semarang has not used Passenger Information System, so that there is not information of arrival / departure at the bus stop. The schedule / the departure time are provided only in terminal. Trans bus in Semarang is on the roads alongside with other vehicles (traffic mix), so that traffic jams often happen on the roads. Therefore it is necessary to conduct analysis on the service / performance of Trans Semarang Bus (route, speed, travel time, waiting time, headway and the distance between bus stops / shelters.

The purpose of this study is to analyze the system of Trans Semarang Bus Coridor I and Coridor II, where the data will be used for monitoring system at Semarang Department of Transportation and passenger information system at bus stop shelter. Besides beneficial to provide information on bus arrival / departure in real time, it also helps developing countries plan the better city transportation system, especially in Indonesia. This certainly will attract the people of Semarang city to use Trans Semarang Bus public transportation, so it can reduce traffic jams on the roads and reduce the volume of vehicle / traffic on roads as well as reduce the consumption of fuel oil [4], which comes from the unrenewable fossils, towards Semarang Smart Transportation which eventually leads to Semarang Smart City.

2. Literature Review

States of the art of this study were taken from several previous studies, national journals and international journals. According to [5], headway of Public Passenger Car (PPC) on Pandanaran street Semarang was just 30 seconds at peak hour, indicated that the number of PPC was too many, whereas at off peak hour, headway was 10 minutes. The overlap routes between Trans Semarang Bus and PPC happened. This led to chaos and increased air pollution. Reducing air pollution can be done by transferring the use of private vehicles into mass public transportation [6]. The growing number of people served by mass Public Transportation in a city, means fuel oil consumption / capita is lower; it supports Smart Transportation [7].

Semarang Metropolitan City had 1.5 million inhabitants in 2016. If the population density is high, the city transportation had better use mass public transportation. Population density and city transportation are the main keys to control fuel oil consumption [1]. Mangkang Terminal Type A Semarang until now has not been used optimally; this terminal should be able to serve an integrated urban transportation system (Interconnection Mode) [8]. The use of Public Bus in the cities of Indonesia is still very little, it is seen on the model of the relationship between transportation system and fuel oil using Partial Least Square (PLS) which shows that the use of city fuel oil gives little effect on the number of bus (0.213), due to the number of public bus that serves public is still very little [9].

The monitoring system and passenger information system are designed stand alone to display the bus location in real time, equipped with GPS tracking to get the bus location information to central control unit. Monitoring method used web server to monitor the bus in real time and mobile application for bus users [2]. Mass transportation can work well if the land use is compact. Reducing fuel oil consumption is by transferring the use of private vehicles to reliable mass public transportation (environmentally sound, safe, comfortable, affordable, well organized and scheduled along with the modern management arrangement) [10]. Likewise, route needs to be evaluated in order to avoid overlap [11].

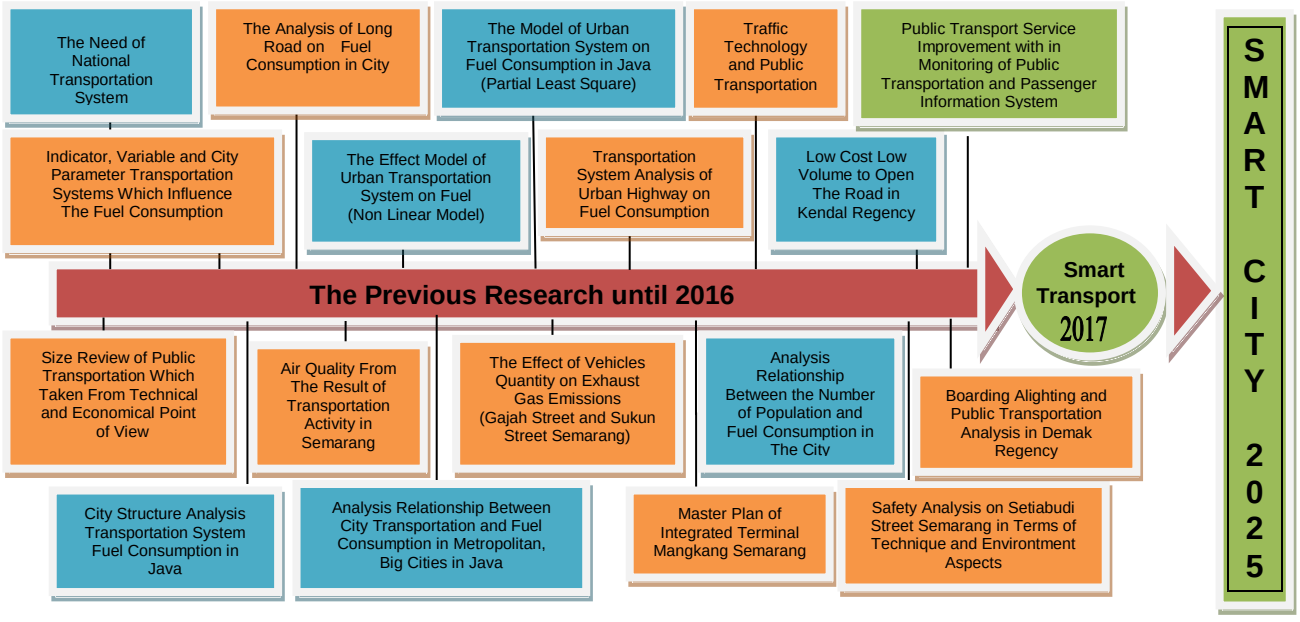

Fig.1. Fish bone diagram in the previous study

This study will analyze the available Trans Bus work system recently, where data will be used for monitoring system and passenger information system in Semarang city in the next research stage. The road map of this study will be showed by fish bone diagram which already available in the previous study can be seen in Fig 1.

3. Research Methodology

The first stage done was performing preparations, such as preparing the survey equipment. Field survey was conducted to obtain primary data (Trans Semarang Bus route, speed, boarding alighting, headway, the distance between bus stops, the bus stops condition and questionnaires) and secondary data were taken from the Transportation Department of Semarang City (number of vehicles, schedules, coordinates, bus route, number of stops, stops condition, and the type of bus). The next stage was compiling the data continued by analyzing Trans Semarang Bus service descriptively, qualitatively (Bus service questionnaire) and quantitatively (other data), so that later it can be used to design Monitoring System and Passenger Information System. The Research Flowchart can be seen in Fig. 2.

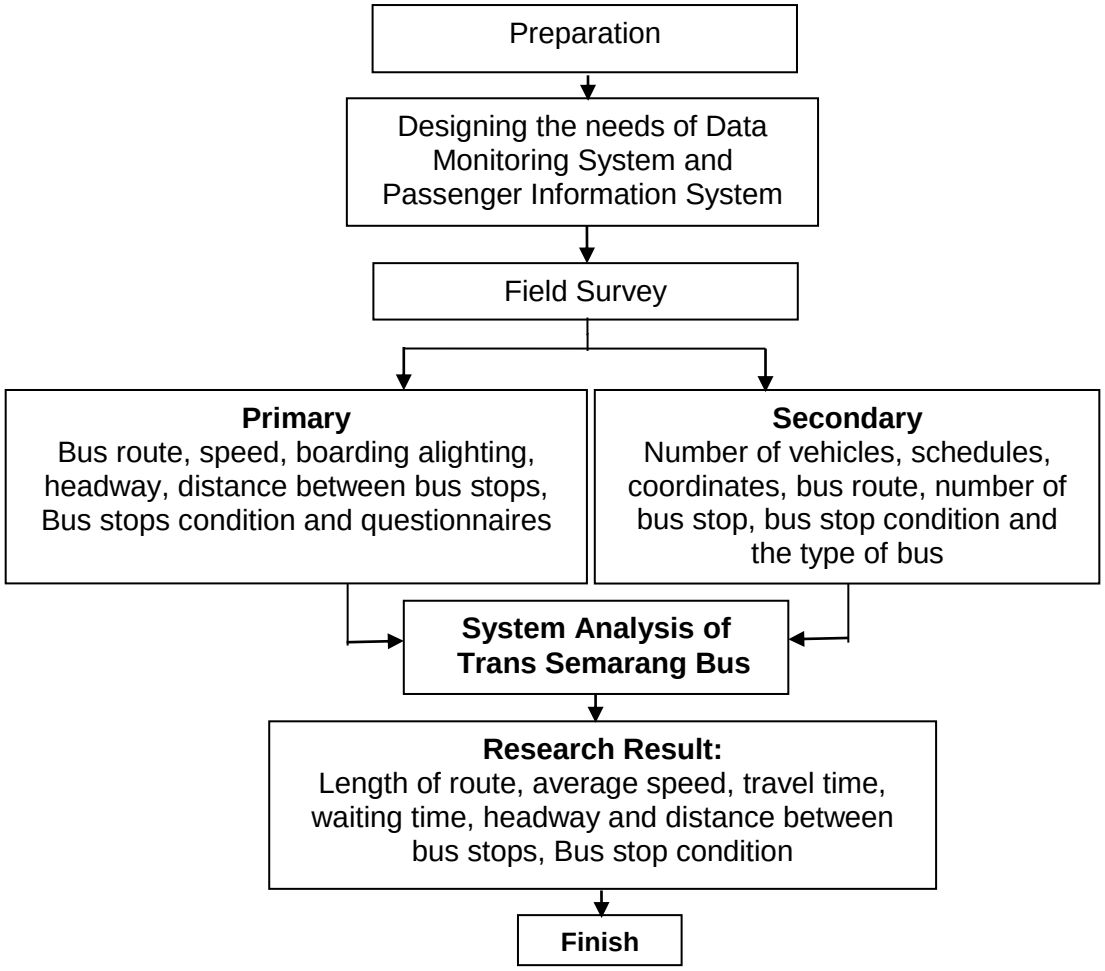

Fig. 2 Research flowchart

4. Research Result

At the time this study was being conducted, Bus Rapid Transit (BRT), which had operated in Semarang had 4 corridors. Corridor I (Mangkang-Penggaron) had a route of 26.75 km, so the whole route (round trip) reached 53.5 km, corridor II (Terboyo Terminal - Cisemut Terminal, Ungaran) had

whole route length of 49 km, corridor III (Tanjung Mas Port – Sisingamangaraja street) had 55.8 km, Corridor IV (Tanjung Mas-anyumanik via Bubakan) had 46 kilometers. Research Location in Corridor I and Corridor II of Bus Rapid Trans Semarang can be seen on Figure 3.

The research results were: the average travel time in the morning (06:15 to 09:10) a.m. was 2.916 hours; in the daytime (10:45 a.m. to 12:10 p.m.) was 1,416 hours and in the afternoon (13:43 to 16:05) p.m. was 1,833 hours, so that the average travel time/day was 2.1 hours. The average speed was obtained by comparing the distance traveled and the time required to reach that distance. The distance traveled (Pedurungan-Mangkang) in the morning, daytime and afternoon was 26.75 km. The speed in morning, daytime and afternoon gave various results. In the morning, travel time was 2.916 hours, the average speed was very slow that was 9 km/hour; in the daytime, with travel time of 1,416 hours, the average speed was quite high that was 19 km/hour; in the afternoon, travel time was 1,833 hours, vehicles moved a little bit slow at 15 km/hour. The average speed of vehicles / day was 14 km/hour.

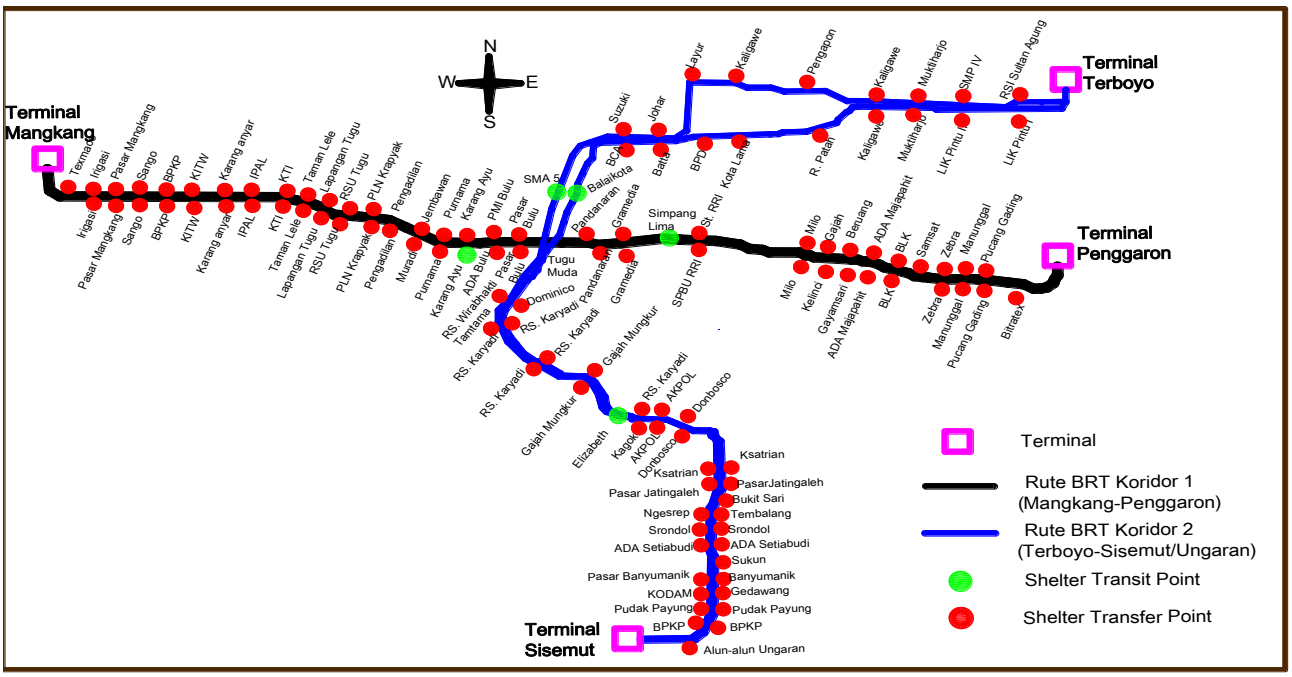

Fig.3. BRT route of Trans Semarang corridor I and II

Table1. BRT waiting time

NO.	Waiting Time [minute]	Respondents [person]	Percentage [%]
1	5	18	28
2	10	30	46
3	15	15	23
4	≥ 15	2	3
Total of Passengers		65	100

According to the Table 1, 46% of people perceived that BRT waiting time was approximately 10 minutes, whereas 28% of the passengers agreed that the waiting time was 5 minutes. 23% passengers agreed that waiting time around was 15 minutes and 3% passengers agreed that waiting timewas more than 15 minutes. That's why, the majority of BRT waiting time is 10 minutes. The average Headway of BRT public transportation was double times of waiting time. Therefore, waiting time in BRT Semarang was 20 minutes. The distance between bus stops was around 100 meters until 300 meters, distance from the bus stop selter of residence: 100-300 meters (Fig. 4) and 57% number of modal transfer from BRT to other places 2 times can be seen in Fig. 5.

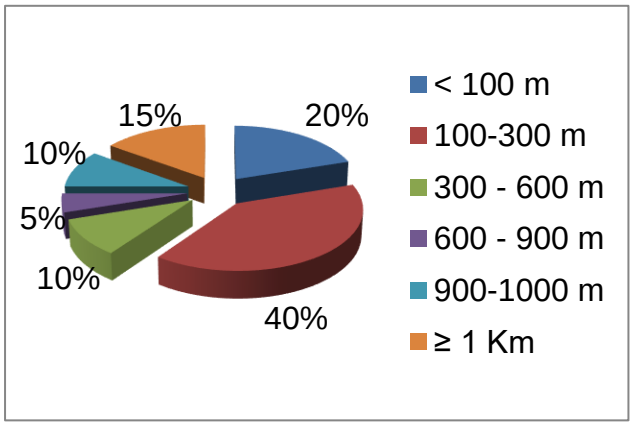

Fig. 4. Distance from the bus stop shelter of residence

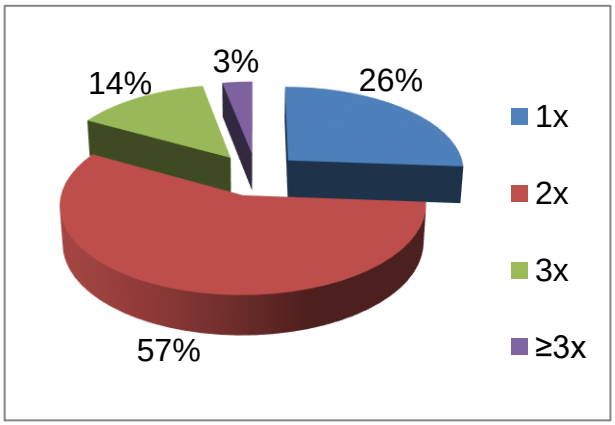

Fig. 5. Number of modal transfer from BRT to other places

The obtained data, such as distance between stops, vehicles headway, bus stop locations and bus locations; it will be used for Monitoring System and Passengers Information System on Bus Trans Semarang (Fig. 6). Work principle from monitoring system as follows: first, monitoring system conducted in Department of Transportation Semarang with put it inside the office. The monitoring system connected with satellite in space and it will be send the information of BRT's location, so the office will be know the position of the bus. Second, the bus position data will be reflected again to satellite through Passenger Information System which put on bus stop, so the bus passengers will be know the position of arrival and depart from bus stop. The system will be able to give the real bus arrival and depart information. The available of Monitoring System and Passenger Information System, it can help to design the better city transportation system for developing country especially in Indonesia.

5. Conclusion

1. According to the result analysis, the route of BRT (km), travel time (hours), average speed in a day (km/hour), waiting time, headway (minute), bus stop location, bus location, the obtained data will be put into Monitoring System (MS) and Passenger Information System (PIS).
2. MS and PIS will give accurate information and expect more passengers to use bus transportation. Besides, giving the real time of arrival/depart information, it also help to design the better city transportation in develop country especially Indonesia.

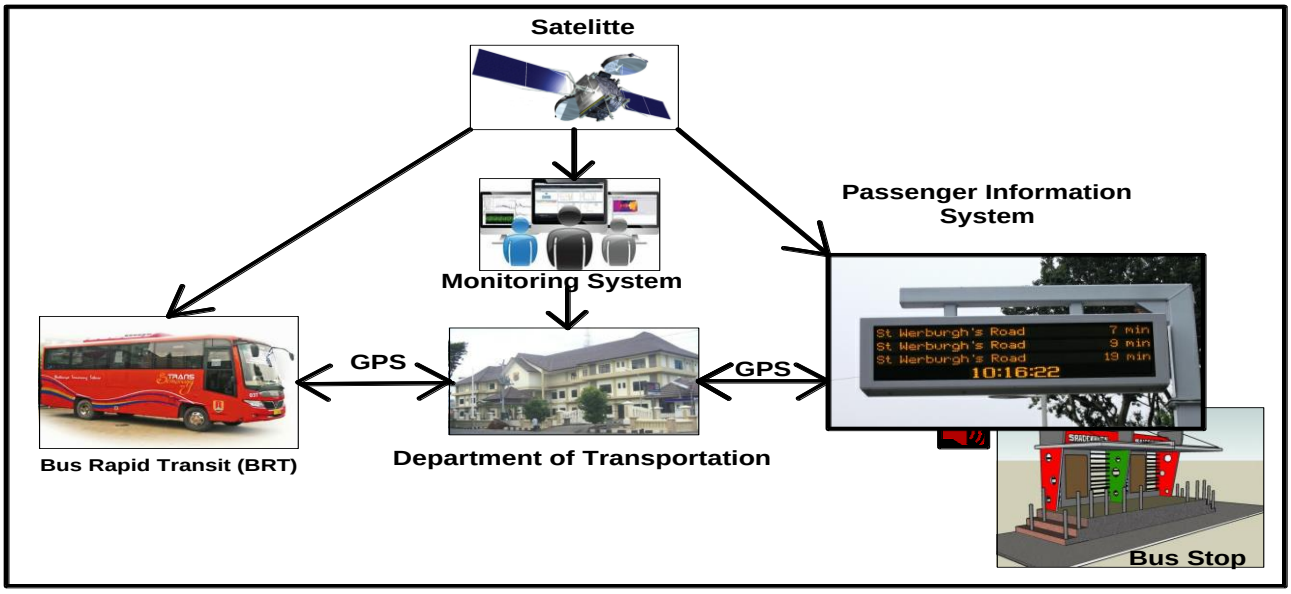

Fig.6. The work planning of monitoring system and passenger information system

Acknowledgements

Many thanks to The Ministry of Higher Education - Research and Technology, Department of Transportation in Semarang, Semarang University and Factory, I hope the continuity of this research will be done and applied in transportation system Bus Rapid Transit Trans Semarang. The last but not least, I would like to say my gratefulness to my colleague and students who work together, so this research can be done well.

References

[1] H. Mudjiastuti, "Analysis Relationship Between The Number of Population Density and City Transportation Fuel", ***Tataloka,*** Acredited National ISSN 0852-7458, Vol. 15, No. 4, pp. 235-316, 2013.

[2] Swati, "Implementation of Real Time Bus Monitoring and Passenger Information System", ***International Journal of Scientific and Research Publication,*** Vol. 3, Issue 5, ISSN pp. 2250 -315, 2013.

[3] H. Mudjiastuti, "Fuel (BBM) Efficient Solutions Towards Sustainable Transportation". ***Inauguration of Civil Engineering***, Civil Engineering Department, Faculty of Engineering, Semarang University, ISBN 978-602-9019-48-3, Semarang University Press, 2016.

[4] H. Mudjiastuti, "The Urban Transportation System and Fuel Consumption of Metropolitan and Large City", ***Proc. QiR 2013*** **(**Yogyakarta, Indonesia), June, 2013.

[5] H. Mudjiastuti, "Evaluation of Semarang Public Transport Reviewed From Technique and Environment's", ***Point of View***, Magister of System and Engineering Transportation, Gadjah Mada University,1998.

[6] H. Mudjiastuti and I. Iin, "The Influence of Vehicle Population with Vehicle Exhaust Emission". ***Proc. The 14th FSTPT International Symposium,*** (Pekanbaru, Indonesia), November, 2011.

[7] H. Mudjiastuti, "Fuel Consumption in Semarang and Surakarta Reviewed from Transportation System and City Typology", ***Transportation Journal FSTPT,*** Vol. 13, No. 3, 2013.

[8] H. Mudjiastuti, "The Master Plan of Integrated Terminal Mangkang Semarang". Semarang Transportation Department, 2013.

[9] H. Mudjiastuti, "The Urban Transportation System and Fuel Consumption of Metropolitan and Large City", ***Proc. QiR 2013*** **(**Yogyakarta, Indonesia) June 2013.

[10] H. Mudjiastuti, "A Study On The Relationship Between Land Use And Urban Transport With Fuel Consumption In Java", ***Proc. APTE 2016,*** **(**Perak, Malaysia), November, 2016.

[11] H. Mudjiastuti, "Boarding Alighting Survey and Analysis Public Transport in Demak", Demak Transportation Department, 2016.