Passenger Ticket Service Time of The Jakarta Bus Rapid Transit, Line 1

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***Abstract*-The Jakarta Bus Rapid Transit has already been operated in 8 lines at the time of preparation of this paper. Line 1 between Blok M and Kota is well-operated due to the exclusiveness of the busway and therefore provides relatively acceptable level of bus operation services in terms of time headway between successive buses, travel time, travel speed, etc. However, other aspects of passenger services have not been improved. Passenger ticketing service for example is still very basic. The ticket card is not a smart card and its only function is to open the gate. Passenger ticket purchase is carried out in one or more manually served ticket boxes. This paper is intended to evaluate the passenger ticket service time in Blok M and Kota bus stations during morning and afternoon peak hours . Limited observation of effect of denomination of money used for ticket purchase on service time was also carried out.**

I. INTRODUCTION

The Jakarta Bus Rapid Transit (BRT) has already been operated in 8 lines at the time of preparation of this paper (circeled in Figure 1). Line 1 between Blok M and Kota was the first line operated in the system. This line is well-operated due to the exclusiveness of the busway. This is maintained by tight monitoring and enforcement of the busway carried out by police officers and BRT staffs. The nature of the line 1 also supports its exclusiveness. This line has only few at grade intersections. Therefore line 1 provides relatively acceptable level of bus operation services in terms of time headway between successive buses, travel time, travel speed, etc.

However, other aspects of passenger services have not been improved. On stations and stops services are from satisfactory. Passenger ticketing service for example is still very basic. The ticket card is not a smart card and its only function is to open the passengers entrance gate. Although free line transfers are available in some stops and stations, these were maintained only by stops or stations design allowing free line transfers. There is no ticket system integration with other transport modes such as feeder buses and trains.

Passenger ticket purchase is carried out in one or more manually served ticket boxes. This paper is intended to evaluate the passenger ticket service time in Blok M and Kota bus stations during morning and afternoon peak hours in a normal working day. Limited observation of the effect of denomination of money used for ticket purchase on service time was also carried out.

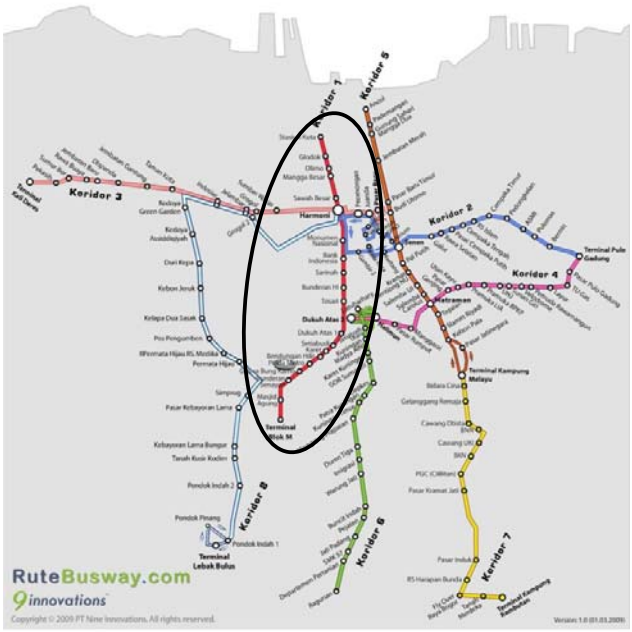

Figure 1. The Jakarta BRT network

II. PREVIOUS STUDIES

Despite large media coverage on the Jakarta BRT operation, academic research on this topic in Indonesia is still rare. Research on the Jakarta BRT has been done in earlier opened lines, such as in line one by [1] on its operational characteristics such as headways, boarding/ alighting rates and travel speeds and by [2] on factors affecting the use of this line. Previous study by Melissa et al [3] was on line two, regarding environmental impact of the opening of this line. Previous study by [4] was on line 4, regarding the predicted mode shift to the BRT due to the opening of line 4. Reference [5] discusses the possibility to increase operational performance of line one by providing more fly-overs. As far as the knowledge of the author, no publiction has been made on pasenger ticketing services of the BRT.

III. METHODOLOGY

The observation was made on a normal working day on October 2009. The morning peak hours observation was made between 7.30 a.m. and 9.30 a.m in Blok M station and between 7.00 a.m. and 9.00 a.m in Kota station. The afternoon peak hours observation in Blok M station was made between 4 p.m. and 5 p.m. and between 5.15 pm and 6 p.m. The afternoon peak hours observation in Kota station was made between 4 p.m. and 6 p.m. No observation was made on the stops. Both Blok M and Kota stations are not exclusive stations for BRT, because other buses also depart and arrive from this stations. However ticket boxes for BRT were exclusive.

In Blok M station, two ticket boxes were serving a single passenger queue. However number of serving ticket boxes were determined by the demand. In Kota station, each of two ticket boxes were serving a seperate passenger queue. Number of serving ticket boxes were also determined by the demand. Sampling rate was calculated by dividing number of observed passengers with number of serviced passengers. The intended sampling rate was 50%. In Kota station this was carried out by purposively observe one of the operated ticket boxes. However in some cases especially in Blok M station, it was lower than 50% because obscured vision of the ticket box operation due to indiscipline passenger queue. As the result the overall sampling rate was 44,7%, Blok M station sampling rate was 40,4% and Kota station sampling rate was 49,4%. During the observation periods, number of passengers in Blok M station (2842) is higher than in Kota station (2535). However number of observations of passenger ticket service duration in Blok M station (1149) was less than in Kota station (1252). Total number of observations was 2401 passenger ticket transactions out of 5377 passengers in morning and afternoon peak hours in Blok M and Kota stations. Sampling rate in the morning was 42.4% (893 observations from 2105 passengers) and sampling rate in the afternoon was 46.1 % (1508 observations from 3272 passengers). The complete sampling rate data is presented in Table 1. Time spent by each observed passengers in the ticket box was recorded. Observation was grouped in 15 minutes observation periods. Limited observation of denomination of money used for ticket purchase was carried out (Table 2).

TABLE 1
SAMPLING RATE OF PASSENGER TICKET SERVICE TIME

	Time Period	Number of Observations	Number of Passengers	Sampling Rate (%)
Blok M Station	07.30-08.30 a..m.	214	533	40.3
	08.30-09.30 a..m.	260	734	35.4
	04.00-05.00 p.m.	282	748	37.7
	05.15-06.15 p.m.	393	827	47.5
Sub Total		***1149***	***2842***	***40,4***
Kota Station	07.00-08.00 a..m.	228	456	50.0
	08.00-09.00 a..m.	191	382	50.0
	04.00-05.00 p.m.	324	743	43.6
	05.00-06.00 p.m.	509	954	53.4
Sub Total		***1252***	***2535***	***49.4***
Total		***2401***	***5377***	***44.7***

TABLE 2
SAMPLING RATE OF DENOMINATION OF MONEY USED FOR TICKET PURCHASE

Station Name	Number of Observations	Number of Passengers	Sampling Rate (%)
Blok M	260	2842	9.1
Kota	324	2535	12.8

The collected data were then summarized. Service time distribution was presented in both histogram in, morning periods, afternoon periods and total morning and afternoon periods separately for Blok M station and Kota station. A t-test was carried out to compare the mean service time with the standard service time determined by the BRT company. Another t-test was also made to compare the difference between mean service time in different observation periods and to compare the difference between mean service time in different stations. A Pearson correlation analysis was made between service time, denomination of money used for ticket purchase and number of purchased tickets. All statistical analysis were evaluated based on 0.05 significant level. caption

IV. SERVICE TIME DISTRIBUTION

Fig. 1 shows the passenger ticket service time distribution of the overall sample (2401 observations), whilst Fig. 2 shows the same but classified into stations and observation periods. It can be seen that the mode of the sample of passenger ticket service time was between 2 seconds and 3 seconds. However the mean of passenger ticket service time was 5.4 seconds. The BRT company set up some minimum service standards for various operational aspects. For passenger ticket service time they put 3 seconds as a target. However there was no detailed values of targeted passenger ticket service times under different ticket purchase scenarios.

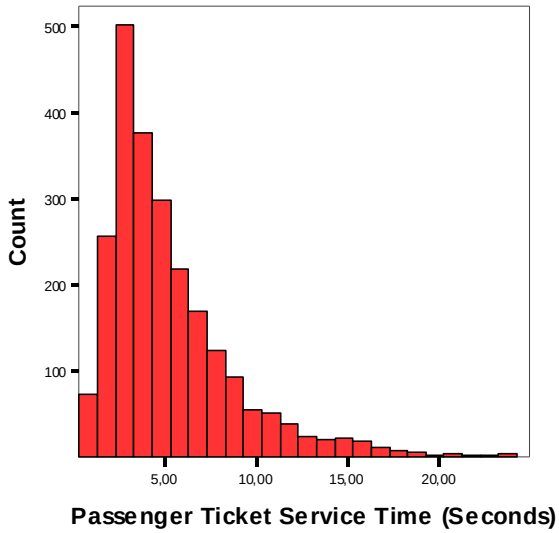

Figure 1. The Distribution of Passenger Ticket Service Time

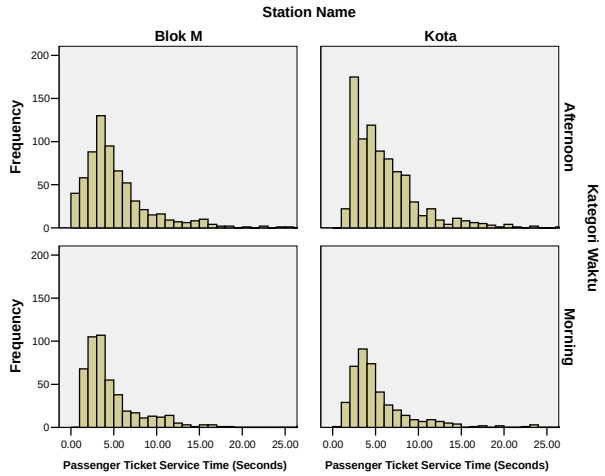

Figure 2. The Distribution of Passenger Ticket Service Time by Stations and Observation Periods

For example a passenger who was paying with exact fare might be having a relatively shorter service time compare to other passenger who was paying with non-exact fare especially the one using large denomination. It should be noted that during peak hours, the ticket fare was three thousands and five hundreds rupiahs and the largest money denomination in Indonesia was a hundred thousands rupiahs. There might also be an effect of number of tickets purchased by a passenger. 47 of 324 observations (14.5%) in Kota Station between 4 p.m. and 5 p.m. were multiple tickets purchase in which a passenger bought 2 to 4 tickets at once.

The shapes of passenger ticket service distributions in Fig 2 show that in general the distributions were almost the same for different time periods and different stations. The distributions were not symmetrical distributions. Longer tails were found in the right-hand sides. This means that shorter passenger ticket service times were more common compare to the longer one. However very short passenger ticket service times (less than a second) were very limited (about 2% of the sample).

Fig. 3 shows the distribution of denomination of money used to purchase passenger ticket.

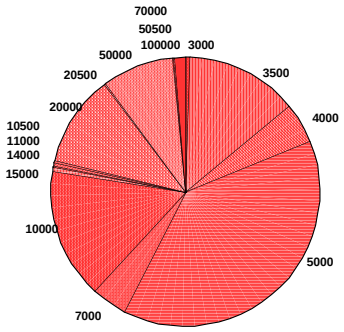

Figure 3. The Distribution of Denomination of Money Used to Buy Ticket

As the most ticket purchase was single ticket purchase, in Fig. 3, it can be seen that about 38% of the sample used five thousands rupiahs denomination. This was sensible because this denomination was the smallest single denomination higher than a single ticket fare during peak hour (three thousands and five hundreds rupiahs). About 16% of the sample used ten thousands rupiahs denomination. This denomination was the second smallest single denomination higher than a single ticket fare during peak hour. About 14% of the sample used exact fare of single peak-hour ticket purchase, i.e. three thousands and five hundreds rupiahs.

V. Service Time Differences

As mentioned before, the BRT company set up a passenger ticket service time of 3 seconds as a target. However a t-test to evaluate whether the mean passenger ticket service time was 3 seconds at significance level of <0.001 showed that mean passenger ticket service time was significantly higher than 3 seconds, i.e. 5.4 seconds. One might predict that the standard service time of the BRT company refers to a purchase of a single ticket using the smallest single denomination (five thousand rupiahs) higher than a single ticket fare during peak hour (three thousands and five hundreds rupiahs). However, this was not the case, as the mean passenger ticket service time for this category of purchase was also higher than 3 seconds (4,8 seconds).

Mean passenger ticket service time in Blok M station (5,1 seconds) was significantly shorter than mean passenger ticket service time in Kota station (5,4 seconds) at significance level of 0.001. This was unexpected since the queue system in Blok M station was very unclear.

In general, mean passenger ticket service time in the morning (5,2 seconds) was significantly shorter than mean passenger ticket service time in the afternoon (5,6 seconds) at significance level of 0.019. In Blok M station, mean passenger ticket service time in the morning (5,0 seconds) was shorter than mean passenger ticket service time in the afternoon (5,2 seconds). However the difference was not statistically significant (α=0.344). In Kota station, mean passenger ticket service time in the morning (5,4 seconds) was significantly shorter than mean passenger ticket service time in the afternoon (5,9 seconds) at significance level of 0.003. There was no logical explanation of these results except that number of passengers in the afternoon peak hours (3272 passengers, i.e. 1697 passengers in Blok M station and 1575 passengers in Kota station) was significantly higher than number of passengers in the morning peak hours (2105 passengers, i.e. 1267 passengers in Blok M station and 838 passengers in Kota station). This might force the ticket box staffs to work harder and the work pressure might degrade their service speeds.

The Pearson correlations between service time, denomination of money used for ticket purchase and number of purchased tickets is reported in Table 3.

It can be seen in Table 3 that in general passenger ticket service time was significantly correlated with denomination of money used for ticket purchase. Service time was also significantly correlated with number of purchased tickets. However, the denomination of money was not significantly correlated with number of purchased tickets.

In Kota station, passenger ticket service time was significantly correlated with denomination of money used for ticket purchase. Service time was also significantly correlated with number of purchased tickets. However, the denomination of money was not significantly correlated with number of purchased tickets.

In Blok M station, passenger ticket service time was significantly correlated with denomination of money used for ticket purchase. There was no observation of number of purchased tickets in Blok M station.

Table 4 summarizes the results of t-tests of mean difference of passenger ticket service time by denomination of money used for ticket purchase. It can be seen that purchasing one ticket with the exact fare (3,500 rupiahs) had the lowest mean passenger ticket service time of 4.6 seconds. Purchasing one ticket with 4,000 rupiahs in ones hand also resulted in relatively short mean passenger ticket service time, because the BRT staff should only provide a coin of 500 rupiahs for the change.. Purchasing one ticket with 5,000 rupiahs denomination also resulted in relatively short mean passenger ticket service time, because the BRT staff should only provide a bank note of 1,000 rupiahs for the change. The mean passenger ticket service time of a payment using exact fare, 4,000 rupiahs or 5,000 rupiahs denomination had significantly shorter mean passenger ticket service time with large denomination such as 20,000, 50,000 and 100,000 rupiahs.

TABLE 3
CORRELATIONS BETWEEN PASSENGER TICKET SERVICE TIME, DENOMINATION OF MONEY USED FOR TICKET PURCHASE AND NUMBER OF PURCHASED TICKETS

Station Name	Correlation between	Pearson Correlation Coefficient	Significance Level (α)	Signi-ficant (Yes/No?)
Blok M	Service Time and Money Denomination	0.329	<0.001	Yes
Kota	Service Time and Money Denomination	0.543	<0.001	Yes
	Service Time and Number of Ticket	0.289	0.049	Yes
	Money Denomination And Number of Ticket	0.065	0.662	No
Blok M And Kota	Service Time and Money Denomination	0.392	<0.001	Yes
	Service Time and Number of Ticket	0.289	0.049	Yes
	Money Denomination And Number of Ticket	0.065	0.662	No

TABLE 4
THE MEAN DIFFERENCE OF PASSENGER TICKET SERVICE TIME BY DENOMINATION OF MONEY USED FOR TICKET PURCHASE

Denomination Of Money (Rupiahs)	Mean Passenger Ticket Service Time (Seconds)	Mean Difference with Passenger Ticket Service Time in Seconds with Denomination of Money Used for Ticket Purchase of[a]					
		4,000	5,000	7,000	10,000	10,500	14,000
3,500	4.6	0.3	0.1	3.4	1.7	6.9	13.9
		0.870	0.900	0.079	0.089	0.198	0.070
4,000	4.9		-0.2	3.1	1.4	6.6	11.6
			0.767	0.035	0.056	0.022	0.002
5,000	4.8			3.3	1.6	6.7	1.8
				0.013	0.001	0.155	0.351
7,000	8.1				-1.7	3.4	8.5
					0.054	0.363	0.080
10,000	6.3					5.1	10.2
						0.006	0.393
10,500	11.5						5.1
							0.502

Denomination Of Money (Rupiahs)	Mean Passenger Ticket Service Time (Seconds)	Mean Difference with Passenger Ticket Service Time in Seconds with Denomination of Money Used for Ticket Purchase of[a]					
		15,000	20,000	50,000	50,500	100,000	
3,500	4.6	9.4	3.6	6.6	2.2	9.4	
		0.152	0.003	0.001	0.808	0.008	
4,000	4.9	9.1	3.3	6.3	1.9	9.1	
		0.013	0.001	0.001	0.669	0.001	
5,000	4.8	9.3	3.5	6.5	2.1	9.3	
		0.392	0.001	0.001	0.400	0.004	
7,000	8.1	5.9	0.2	3.2	-1.2	6.0	
		0.209	0.856	0.001	0.847	0.027	
10,000	6.3	7.7	1.9	4.9	0.5	7.7	
		0.045	0.001	0.001	0.871	0.010	
10,500	11.5	2.5	-3.2	-0.3	-4.6	2.6	
		0.714	0.090	0.909	0.522	0.514	
14,000	16.6	-2.6	-8.3	-5.3	-9.7	2.5	
		0.818	0.456	0.596	0.581	0.637	
15,000	14.0		-5.8	-2.8	-7.2	0.1	
			0.541	0.745	0.642	0.995	
20,000	8.2			3.0	1.4	5.8	
				0.001	0.659	0.031	
50,000	11.2				-4.4	2.8	
					0.251	0.086	
50,500	6.8					7.2	
						0.265	

[a]The number in the first row is mean difference and the number in the second row is significance level

It should be noted that people purchased multiple tickets were occupying more time in the ticket box even if they were paying with exact fare. For example purchasing 2 tickets using exact fare of 7,000 rupiahs took in average 8.1 seconds, purchasing 3 tickets with exact fare of 10,500 rupiahs took in average 11.5 seconds and purchasing 4 tickets with exact fare of 14,00 rupiahs took in average 16.6 seconds.

Fig. 4 shows the morning peak hour passenger ticket services in Blok M station. The upper part figure was the view from outside the queue area and the lower part of the figure was the activity of the BRT staffs inside the ticket box in Blok M station.

Figure 4. The Passenger Ticket Service in Blok M Station

VI. DISCUSSIONS

From the results of the observation and analysis it was found that the peak hour mean passenger ticket service time (5.4 seconds) was still significantly higher than the standard of passenger ticket service time set up by the BRT company. It was identified that passengers paying with non-exact fare, especially using large denominations had a considerable contribution in increasing the mean passenger ticket service time. Regarding this issue, a machine that can provide small change by inserting a large denomination bank note into the machine can be installed near the ticket box. However this might be used by non-passengers and to overcome this problem a ticket machine that can provide a change might be more appropriate. Latest practice in daily transactions requiring relatively small denominations of money is by using charge card. In Indonesia such cards are started to be more popular. BCA flash card can be used to pay parking fee, purchase gasoline, etc. Mandiri toll card can be used to pay toll fee and purchase gasoline. This can be extended to be used in paying public transport fee such as the use of touch and go card in London Tube (Fig. 5).

Figure 5. The Gates in London Tube Operated by Touch and Go Card

The use of charge card for public transport might lead to further benefit to the system and to the user. First of all, it is as flexible as the function of cash money. The charge card can be toped up easily in ATM's, convenience stores cashiers, ticket machines at stations or stops (Fig. 6) etc. with relatively low minimum top up value. Therefore it will be suitable even with people with limited income or non-fix income. Secondly, it can be used to provide incentives for certain groups of people. The card can separately issued for specific groups of people. Each group has different scheme of incentives. These groups include students, elderly people, jobless people, etc. Thirdly, it can be used to provide incentives for frequent user. The card can be issued in fix-term basis (Fig. 7), such as daily, weekly, monthly, quarterly or yearly. Fourthly, it can be used to provide incentives to longer trips by public transports by using zone system. Lastly it can be used to provide ticket integration with the other public transport modes.

Figure 6. Ticket Machine in London Bus System

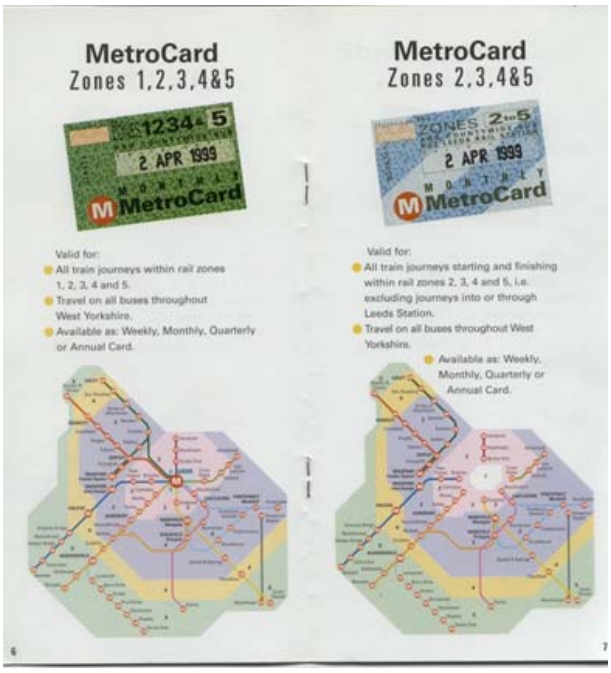

Figure 7. Monthly Metro Card in West Yorkshire, England

VII. Conclusions and Recommendations

From the analysis that has been done, some conclusions can be made as follows:

1. In manual observation of passenger ticket service time, target sampling rate of 50% was sensible.
2. The peak hour mean passenger ticket service time (5.4 seconds) was still significantly higher than the standard of passenger ticket service time set up by the BRT company (3 seconds).
3. Shorter passenger ticket service times were more common compare to the longer one. However very short passenger ticket service times (less than a second) were very limited (about 2% of the sample).
4. Mean passenger ticket service time in Blok M station (5,1 seconds) was significantly shorter than mean passenger ticket service time in Kota station (5,4 seconds).
5. In general, mean passenger ticket service time in the morning (5,2 seconds) was significantly shorter than mean passenger ticket service time in the afternoon (5,6 seconds).
6. About 15% of the ticket transactions were multiple tickets purchase in which a passenger bought 2 to 4 tickets at once.
7. About 38% the sample used 5,000 rupiahs, i.e. the smallest single denomination higher than a single ticket fare during peak hour (three thousands and five hundreds rupiahs) for ticket purchase. About 16% of the sample used ten thousands rupiahs denomination, i.e. the second smallest single denomination higher than a single ticket fare during peak hour. About 14% of the sample used exact fare of single peak-hour ticket purchase.
8. In general passenger ticket service time was significantly correlated with denomination of money used for ticket purchase. Service time was also significantly correlated with number of purchased tickets. However, the denomination of money was not significantly correlated with number of purchased tickets.
9. Passenger tickets bought using exact fare and small denominations require shorter service times than passenger tickets bought using large denominations.
10. Passengers purchased multiple tickets require longer service times even if they were paying with exact fare.

In order to improve the overall services of the Jakarta BRT, especially in terms of passenger ticket services, the followings are recommended:

1. Integrated public transport ticketing system must be developed and implemented. This will increase public transport mode share and support a sustainable urban transport system.
2. The ticketing system should include incentives for young people, students, elderly people, jobless people, people with special needs and other "potentially marginalized" groups in society
3. The ticketing system should provide incentives for frequent travelers and commuters.
4. The ticketing system should support free transfers between the BRT lines.
5. The ticketing system should use appropriate technology, whilst keeping the cost as low as possible to avoid cost burden to the passengers, i.e. by partnership with cash card publishers, smart card developer vendors, etc.

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References

[1] L.S. Putranto,, "The Operational Characteristics of the Jakarta Bus Rapid Transit Services.", *Proceeding of the 7th Eastern Asia Society for Transportation Studies*, Dalian, China, 2007.

[2] B. Suharso, S. Priyanto., "Analisis terhadap Beberapa Faktor yang Mempengaruhi Pengguna Transjakarta Busway." , *Proceeding of the 10th Symposium of FSTPT*. Jakarta, Indonesia, 2007.

[3] Melissa, H. Rahman, , Driejana, "Evaluasi Lingkungan Dampak Operasi Jalur Transjakarta Pulogadung-Harmoni Koridor II.", *Proceeding of the 10th Symposium of FSTPT*. Jakarta, Indonesia, 2007.

[4] E.C. Manurung,, I. Ilraswari, W. Santosa, A.C. Sutandi, "Prakiraan Perpindahan Moda pada Jalur Pelayanan Busway Koridor IV di Jakarta." *Proceeding of the 10th Symposium of FSTPT*.", Jakarta, Indonesia, 2007.

[5] R. Sunggiardi,, Najid., "Usaha Peningkatan Pelayanan Transjakarta dengan Pembangunan Fly Over pada Persimpangan, Sudi Kasus pada Koridor Blok M-Kota.", *Proceeding of the 10th Symposium of FSTPT*. Jakarta, Indonesia, 2007.