

THE OPERATIONAL PERFORMANCE OF THE JAKARTA BUS RAPID TRANSIT (BRT), LINE EIGHT

Leksmono Suryo Putranto

Senior Lecturer

Civil Engineering Department, Tarumanagara University

Jl. Let. Jen S. Parman No. 1, Jakarta 11440

Tel.: +62 21 5672548, Fax.: +62 21 5663277

ls.putranto@ftuntar-id.com, lexy@tarumanagara.ac.id

Abstract

This paper discusses the performance of the recently operated Jakarta Bus Rapid Transit (BRT), line eight (Lebak Bulus-Grogol). The on bus observation was made on Friday, 13 March 2009 from 5a.m. to 8 p.m. At the beginning of each observation hour, a group of surveyors consist of 2 to 3 persons waited the bus on the Mal Taman Anggrek stop (at Grogol) and took the first available bus. During the travel, the surveyors observed the arrival and departure time of the bus on each stop and number of passengers boarding and alighting on each stop. From these data several performance indicators can be calculated, e.g. total travel time, travel speed between pairs of stops, stop time on each stop, passenger boarding and alighting rates, number of bus passengers between pairs of stops, etc.

Keywords: bus rapid transit, on bus observation, speed, stop time, boarding and alighting ratea, bus passenger

INTRODUCTION

Jakarta Bus Rapid Transit (BRT) system has been operated since the beginning of 2004. At the time of the preparation of this paper eight corridors (lines) have been in operation and an additional of several new corridors was planned to start the services. According to the Decree of the Governor of Jakarta No.84/2004 which contains of Jakarta Macro Transport Pattern, there will be 15 lines of BRT services at the end of 2010. Recently, the operation of the Jakarta BRT, line eight (Lebak Bulus-Grogol) was started. This line was originally planned to connect Lebak Bulus on the Southern part of Jakarta to Harmoni, the busiest BRT transfer point in Central Jakarta (Figure 1). Please note that the term “koridor” in the map means “line”. However for operational efficiency reason, passenger travelling to or from Harmoni should make a transfer to or from line three (Kalideres-Harmoni) on any of three overlapped stations with line three, i.e. Indosiar, Jelambar or Grogol/ Grogol 2. Buses of line eight travelling from Grogol 2 to Lebak Bulus need to make U-turn in Tomang intersection and can start boarding passengers from the next available stop at Mal Taman Anggrek (not shown in Figure 1) before reaching Grogol 2 stop again from the opposite direction. Line eight has been faced a lot of controversy. Starting from public rejection (especially those who live in Pondok Indah, a luxurious residential area) for this line to pass through their area, a tough negotiation with Pondok Indah community ended up with some agreements. Firstly, instead of using a curb as busway separator, more easily passed separator was installed along Metro Pondok Indah road and therefore the exclusivity of the busway could not be maintained. Secondly, the construction of additional lane (to maintain the original road capacity for the general traffic) should maintain the number of the palm trees originally grew along the median and road sides of the Metro Pondok Indah road. Thirdly, large trees in Metro Pondok Indah roundabout should be preserved and therefore smaller size of Metro Pondok Indah roundabout (to increase traffic flow performance) could not be established. Another problem was the relatively low passenger demand. The survey was conducted just few weeks after the opening of this line. But this was not justify the very low passenger demand if this was compared with the passenger demand history of the other lines. This line has also many at grade intersections without signal priority. In most of the underpasses, busway is not exclusive. The bus should

share the two-lanes two-ways underpasses with the general traffic. Lastly the use of busway by general traffic was wide-spread. The violation was not enforced seriously. This paper discusses the operational performance of the Jakarta BRT, Line Eight (Lebak Bulus-Grogol).

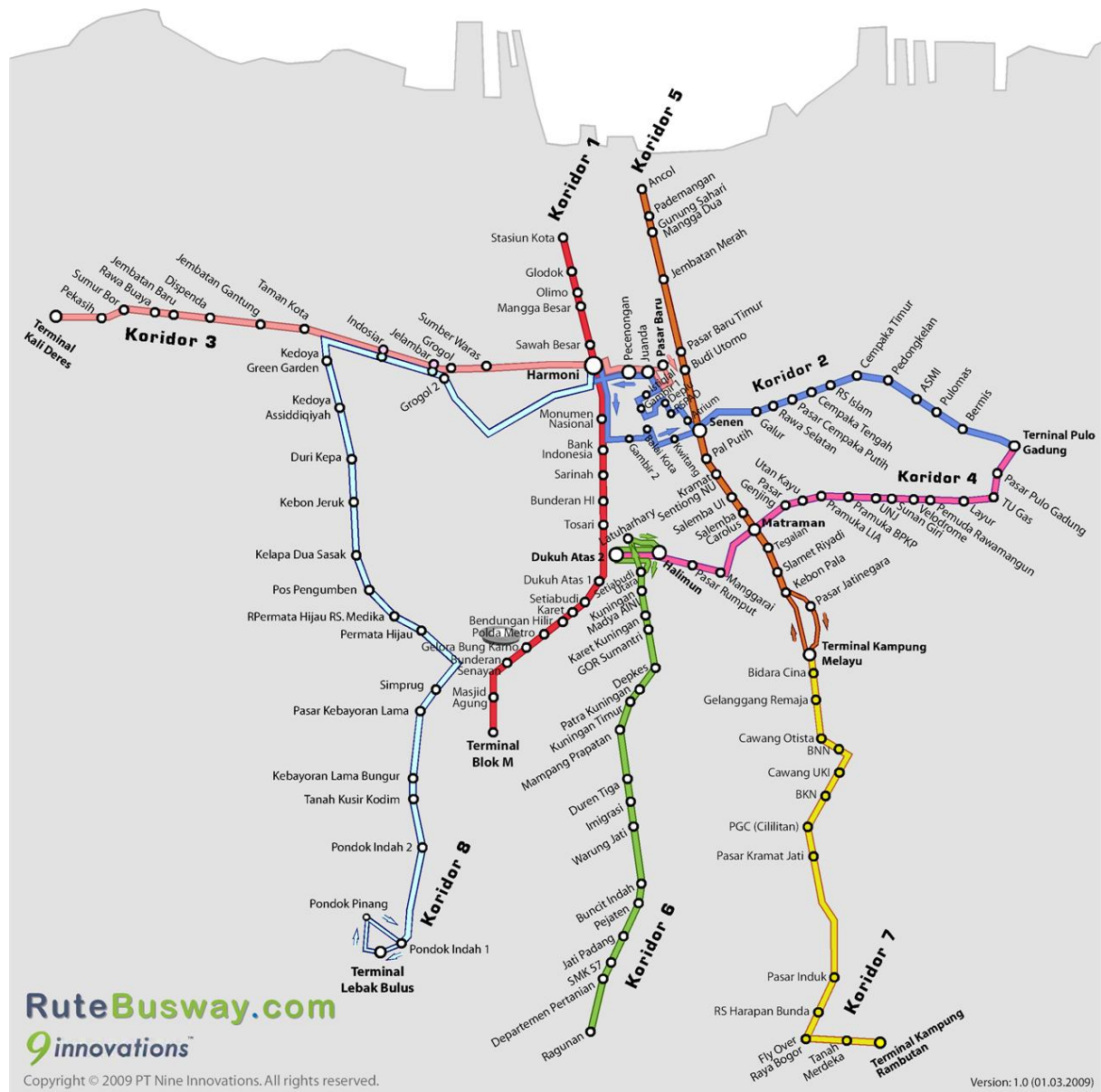


Figure 1. The Jakarta BRT Network

LITERATURE REVIEW

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 Putranto (2007) on its operational characteristics such as headways, boarding/ alighting rates and travel speeds and by Suharso and Priyanto (2007) on factors affecting the use of this line. Previous study by Melissa et al (2007) was on line two, regarding environmental impact of the opening of this line. Previous study by Manurung et al (2007) was on line 4, regarding the predicted mode shift to the BRT due to the opening of line 4. These lines were having relatively small number of at grade intersections. However Sunggiardi and Najid (2007) discuss the possibility to increase operational performance of line one by providing more fly-overs. In terms of at grade intersections conflicts, line eight has different characteristics with earlier opened lines ore this paper discusses. Therefore this paper will deal with this particular topic.

METHODOLOGY

The on bus observation was made hourly on Friday, 13 March 2009 from 5a.m. to 8 p.m. At the beginning of each observation hour, a group of surveyors consist of 2 to 3 persons waited the bus on the Mal Taman Anggrek stop (at Grogol) and took the first available bus. During the travel, the surveyors observed the arrival and departure time of the bus on each stop and number of passengers boarding and alighting on each stop. After reaching Lebak Bulus, the surveyors took the first available bus travelling to Grogol. From these data several performance indicators can be calculated, e.g. total travel time, travel speed between pairs of stops, stop time on each stop, passenger boarding and alighting rates, number of bus passengers between pairs of stops, etc. For analysis purposes, four periods of observation were estabilishe, i.e. morning (05.00 a.m.-09.59 a.m.), noon (10.00 a.m.-1.59 p.m.), afternoon (02.00 p.m.-05.59 p.m.) and evening 06.00 p.m.-8.59 p.m.).

Statistical analysis was carried out to evaluate factors affecting the violation rate involving t-test and Pearson correlation analysis. Significant level was 0.05. There were several research questions, i.e.:

- a. Was there travel speed difference between Lebak Bulus to Grogol trip and Mal Taman Anggrek (Grogol) to Lebak Bulus trip?
- b. Was there travel speed difference between links with at grade intersections and links without at grade intersections.
- c. Were there travel speeds differences between morning, noon, afternoon and evening periods?
- d. Were there number of bus passengers differences between middle line stops and beginning/end line stops?
- e. Were there number of bus passengers differences between morning, noon, afternoon and evening periods?
- f. Were there number of boarding passengers differences between morning, noon, afternoon and evening periods?
- g. Was there number of alighting passengers differences between morning, noon, afternoon and evening periods?
- h. Were there boarding rate differences between morning, noon, afternoon and evening periods?

- i. Were there alighting rate differences between morning, noon, afternoon and evening periods?
- j. Was there correlation between stop time, number of boarding passengers and number of alighting passengers?

SUMMARY OF THE DATA

The total travel time from Mal Taman Anggrek to Lebak Bulus was between 36 minutes (5 a.m.) and 1 hour 30 minutes (5 p.m.), with mean travel time of 57 minutes. The total travel time from Lebak Bulus to Grogol was between 36 minutes (8 a.m.) and 1 hour 17 minutes (3 p.m.), with mean travel time of 58 minutes.

The travel speed between stops for Mal Taman Anggrek to Lebak Bulus direction was between 1,7 kph and 80,9 kph (3 data above 100 kph was ignored), with mean travel speed of 28,7 kph. The travel speed between stops for Lebak Bulus to Grogol direction was between 2,3 kph and 77,1 kph (3 data above 100 kph was ignored), with mean travel speed of 26,4 kph.

The number of passengers on the bus during the travel from Mal Taman Anggrek to Lebak Bulus was between 1 and 93, with mean number of passengers on the bus of 42. The number of passengers on the bus during the travel from Lebak Bulus to Grogol was between 0 and 80, with mean number of passengers on the bus of 33.

The number of boarding passengers on each stop during the travel from Mal Taman Anggrek to Lebak Bulus was between 0 and 45, with mean number of boarding passengers on each stop of 4. The number of boarding passengers on each stop during the travel from Lebak Bulus to Grogol was between 0 and 44, with mean number of boarding passengers on each stop of 3.

The number of alighting passengers on each stop during the travel from Mal Taman Anggrek to Lebak Bulus was between 0 and 17, with mean number of alighting passengers on each stop of 3. The number alighting of passengers on each stop during the travel from Lebak Bulus to Grogol was between 0 and 68, with mean number of alighting passengers on each stop of 5.

The stop time on each stop during the travel from Mal Taman Anggrek to Lebak Bulus was between 0 seconds (drivers made very short stops less than 10 seconds at 48% of stop locations during the observation) and 84 seconds (excluding extreme stop times in Mal Taman Anggrek and Grogol stops), with mean stop time of 15 seconds. The stop time on each stop during the travel from Lebak Bulus to Grogol was between 0 seconds (drivers made very short stops less than 10 seconds at 56% of stops location and no stop at 7% of stops location during the observation) and 123 seconds (excluding extreme stop times in Lebak Bulus Terminals, with mean stop time of 31 seconds.

The boarding rate on each stop during the travel from Mal Taman Anggrek to Lebak Bulus was between 0.03 passengers/second and 6.20 passengers/second, with mean boarding rate of 0.36 passengers/second. The boarding rate on each stop during the travel from Lebak Bulus to Grogol was between 0.01 passengers/second and 2.50 passengers/second, with mean boarding rate of 0.26 passengers/second.

The alighting rate on each stop during the travel from Mal Taman Anggrek to Lebak Bulus was between 0.03 passengers/second and 6.00 passengers/second, with mean alighting rate of 0.28 passengers/second. The alighting rate on each stop during the travel from Lebak Bulus to Grogol was between 0.01 passengers/second and 4.86 passengers/second, with mean alighting rate of 0.24 passengers/second.

ANALYSIS

Table 1 show the mean difference of travel speeds between stops between four pairs of observation periods (morning, noon, afternoon and evening) on Mal Taman Anggrek-Lebak Bulus direction. A 0.05 significant level was used. Therefore only pairs of morning-afternoon periods and morning-evening periods were significantly different in terms of mean travel speeds. This imply that in this direction morning mean travel speeds is significantly higher than afternoon and evening mean travel speeds and therefore in terms of mean travel speeds, the performance of this direction was the best during the morning period. Table 2 shows that there were no significant difference of travel speeds between stops between four pairs of observation periods Lebak Bulus-Grogol direction. The mean travel speeds in this direction were almost uniform in the four observation periods, i.e. between 28.2 kph to 30.9 kph

Table 1. The Mean Difference of Mal Taman Anggrek-Lebak Bulus between Stops Travel Speeds between Four Pairs of Observation Periods

Observation Period	Mean Travel Speed (kph)	Mean Difference with Travel Speed from Observation Period*		
		Noon	Afternoon	Evening
Morning	32.2	4.8 (0.083)	8.0 (0.008)	8.7 (0.007)
Noon	27.4	-	3.2 (0.190)	3.9 (0.104)
Afternoon	24.2	-	-	0.7 (0.817)
Evening	23.5	-	-	-

*Significant level is provided in the bracket

Table 2. The Mean Difference of Lebak Bulus-Grogol between Stops Travel Speeds between Four Pairs of Observation Periods

Observation Period	Mean Travel Speed (kph)	Mean Difference with Travel Speed from Observation Period*		
		Noon	Afternoon	Evening
Morning	28.2	-1.1 (0.737)	1.3 (0.639)	-2.7 (0.429)
Noon	29.3	-	2.4 (0.425)	-1.6 (0.645)
Afternoon	26.9	-	-	-4.0 (0.206)
Evening	30.9	-	-	-

*Significant level is provided in the bracket

Table 3 shows the mean difference of number of on bus passengers on Mal Taman Anggrek-Lebak Bulus direction between four pairs of observation periods. In general, in this direction number of on bus passengers in the afternoon and evening periods were significantly larger than the number of on bus passengers in the morning and noon periods. Table 4 shows that on the Lebak-Bulus-Grogol Direction number of on bus passengers in the evening periods was

significantly smaller than the number of on bus passenger in the other periods. This shows clear land use difference between Lebak Bulus and Grogol. Lebak Bulus is in general residential area in South of Jakarta, whilst Grogol is a busy multi-activity area in West of Jakarta (shopping malls, private universities, four stars hotels, government/ non-government offices, hospitals, etc)

Table 3. The Mean Difference of No. of on Bus Passengers on Mal Taman Anggrek-Lebak Bulus Direction between Four Pairs of Observation Periods

Observation Period	Mean No. of on Bus Passengers	Mean Difference with No. of on Bus Passengers from Observation Period*		
		Noon	Afternoon	Evening
Morning	31.2	-3.8 (0.238)	-21.4 (<0.001)	-23.6 (<0.001)
Noon	35.0	-	-17.6 (<0.001)	-19.8 (<0.001)
Afternoon	52.6	-	-	-2.2 (0.619)
Evening	54.8	-	-	-

*Significant level is provided in the bracket

Table 4. The Mean Difference of No. of on Bus Passengers on Lebak Bulus-Grogol Direction between Four Pairs of Observation Periods

Observation Period	Mean No. of on Bus Passengers	Mean Difference with No. of on Bus Passengers from Observation Period*		
		Noon	Afternoon	Evening
Morning	35.4	-3.1 (0.288)	-3.3 (0.008)	22.4 (<0.001)
Noon	38.5	-	-0.2 (0.932)	25.7 (<0.001)
Afternoon	38.7	-	-	25.9 (<0.001)
Evening	12.8	-	-	-

*Significant level is provided in the bracket

There was no significant mean difference of number of boarding passengers on stops along Mal Taman Anggrek-Lebak Bulus bus travel (Table 5). On Lebak-Bulus-Grogol direction, the mean number of boarding passengers in the evening periods was significantly smaller than the mean number of boarding passengers in the other periods (Table 6). This can also be explained by land use factor as stated before. In general, there were no significant mean differences of numbers of alighting passengers on stops along Mal Taman Anggrek-Lebak Bulus bus travel (Table 7) and along Lebak-Bulus-Grogol bus travel (Table 8).

Table 5. The Mean Difference of No. of Boarding Passengers on Mal Taman Anggrek-Lebak Bulus Direction between Four Pairs of Observation Periods

Observation Period	Mean No. of Boarding Passengers	Mean Difference with No. of Boarding Passengers from Observation Period*		
		Noon	Afternoon	Evening
Morning	3.4	0.2 (0.811)	-1.7 (0.092)	-2.0 (0.105)
Noon	3.2	-	-1.9 (0.108)	-2.2 (0.101)
Afternoon	5.1	-	-	-0.3 (0.798)
Evening	5.4	-	-	-

*Significant level is provided in the bracket

Table 6. The Mean Difference of No. of Boarding Passengers on Lebak Bulus-Grogol Direction between Four Pairs of Observation Periods

Observation Period	Mean No. of Boarding Passengers	Mean Difference with No. of Boarding Passengers from Observation Period*		
		Noon	Afternoon	Evening
Morning	3.8	0.1 (0.9530)	-0.3 (0.750)	2.0 (0.006)
Noon	3.7	-	-0.4 (0.739)	1.9 (0.032)
Afternoon	4.1	-	-	2.3 (0.015)
Evening	1.8	-	-	-

*Significant level is provided in the bracket

Table 7. The Mean Difference of No. of Alighting Passengers on Mal Taman Anggrek-Lebak Bulus Direction between Four Pairs of Observation Periods

Observation Period	Mean No. of Alighting Passengers	Mean Difference with No. of Alighting Passengers from Observation Period*		
		Noon	Afternoon	Evening
Morning	2.5	0.6 (0.195)	-0.3 (0.456)	-1.0 (0.066)
Noon	1.9	-	-0.8 (0.069)	-1.6 (0.010)
Afternoon	2.8	-	-	-0.7 (0.272)
Evening	3.5	-	-	-

*Significant level is provided in the bracket

Table 8. The Mean Difference of No. of Alighting Passengers on Lebak Bulus-Grogol Direction between Four Pairs of Observation Periods

Observation Period	Mean No. of Alighting Passengers	Mean Difference with No. of Alighting Passengers from Observation Period*		
		Noon	Afternoon	Noon
Morning	4.3	-0.5 (0.773)	-1.5 (0.364)	1.2 (0.415)
Noon	4.8	-	-1.0 (0.618)	1.7 (0.390)
Afternoon	5.8	-	-	2.7 (0.166)
Evening	3.1	-	-	-

*Significant level is provided in the bracket

Table 9 and Table 10 show the mean difference of boarding rate on Mal Taman Anggrek-Lebak Bulus direction and Lebak-Bulus-Grogol direction respectively. Table 11 and Table 12 show the mean difference of alighting rate on Mal Taman Anggrek-Lebak Bulus direction and Lebak-Bulus-Grogol direction respectively. In general mean boarding rates and mean alighting rates were almost uniform in four observation periods.

Table 9. The Mean Difference of Boarding Rate on Mal Taman Anggrek-Lebak Bulus Direction between Four Pairs of Observation Periods

Observation Period	Mean Boarding Rate	Mean Difference of with Boarding Rate from Observation Period*		
		Noon	Afternoon	Evening
Morning	0.249	-0.059 (0.410)	-0.238 (0.009)	-0.203 (0.1340)
Noon	0.308	-	-0.179 (0.072)	-0.144 (0.268)
Afternoon	0.487	-	-	0.035 (0.804)
Evening	0.452	-	-	-

*Significant level is provided in the bracket

Table 10. The Mean Difference of No. of Boarding Passengers on Lebak Bulus-Grogol Direction between Four Pairs of Observation Periods

Observation Period	Mean Boarding Rate	Mean Difference with Boarding Rate from Observation Period*		
		Noon	Afternoon	Noon
Morning	0.259	-0.003 (0.950)	-0.055 (0.350)	0.071 (0.245)
Noon	0.262	-	-0.052 (0.361)	0.074 (0.187)
Afternoon	0.314	-	-	0.126 (0.062)
Evening	0.188	-	-	-

*Significant level is provided in the bracket

Table 11. The Mean Difference of Alighting Rate on Mal Taman Anggrek-Lebak Bulus Direction between Four Pairs of Observation Periods

Observation Period	Mean Alighting Rate	Mean Difference of with Alighting Rate from Observation Period*		
		Noon	Afternoon	Evening
Morning	0.207	-0.030 (0.480)	-0.076 (0.108)	-0.256 (0.046)
Noon	0.237	-	-0.046 (0.380)	-0.226 (0.081)
Afternoon	0.283	-	-	-0.180 (0.121)
Evening	0.463	-	-	-

*Significant level is provided in the bracket

Table 12. The Mean Difference of No. of Alighting Passengers on Lebak Bulus-Grogol Direction between Four Pairs of Observation Periods

Observation Period	Mean Alighting Rate	Mean Difference with Alighting Rate from Observation Period*		
		Noon	Afternoon	Noon
Morning	0.213	-0.029 (0.714)	-0.061 (0.275)	-0.003 (0.973)
Noon	0.242	-	-0.032 (0.705)	0.026 (0.822)
Afternoon	0.274	-	-	0.058 (0.522)
Evening	0.216	-	-	-

*Significant level is provided in the bracket

Table 13 shows the mean difference of between stops travel speeds on Mal Taman Anggrek-Lebak Bulus direction. The travel speeds were grouped into with and without at grade

intersection between stops. The results show that except for morning observation period, the mean travel speed between stops with at grade intersection is significantly lower than mean travel speed between stops with at grade intersection. Different results were found on Lebak Bulus-Grogol direction (Table 14). The mean travel speed between stops with at grade intersection is significantly lower than mean travel speed between stops with at grade intersection only if data from all of four periods of observation were pooled together.

Table 13. The Mean Difference of with and without at Grade Intersection Mal Taman Anggrek-Lebak Bulus between Stops Travel Speed at Four Observation Periods

Observation Period	Between Stops Travel Speed (kph)		
	With at Grade Intersection	Without at Grade Intersection	Mean Difference*
All Day	25.1	33.2	-8.1 (<0.001)
Morning	30.1	37.6	-7.5 (0.118)
Noon	25.4	32.7	-7.3 (0.025)
Afternoon	21.7	30.6	-8.9 (0.037)
Evening	21.2	29.8	-8.6 (0.037)

*Significant level is provided in the bracket

Table 14. The Mean Difference of with and without at Grade Intersection Lebak Bulus-Grogol between Stops Travel Speed between at Four Observation Periods

Observation Period	Between Stops Travel Speed (kph)		
	With at Grade Intersection	Without at Grade Intersection	Mean Difference*
All Day	26.6	34.0	-7.4 (0.002)
Morning	26.6	32.4	-5.8 (0.204)
Noon	27.5	33.9	-6.4 (0.215)
Afternoon	25.7	29.9	-4.2 (0.319)
Evening	26.5	42.3	-15.8 (0.055)

*Significant level is provided in the bracket

Table 15 shows the mean difference of number of on bus passengers between middle stops and other stops on Mal Anggrek-Lebak Bulus direction. It was clear that except for noon observation period, mean number of bus passengers on middle stops was significantly higher than mean number of bus passengers on the other stops. Table 16 shows the mean difference of number of on bus passengers between middle stops and other stops on Lebak Bulus-Grogol direction. It was clear that except for noon and evening observation periods, mean number of bus passengers on middle stops was significantly higher than mean number of bus passengers on the other stops.

Table 15. The Mean Difference of No. of on Bus Passengers between Middle Stops and Other Stops at Mal Taman Anggrek-Lebak Bulus Direction at Four Observation Periods

Observation Period	No. of on Bus Passengers		
	Middle Stops	Other Stops	Mean Difference*
All Day	47.6	34.9	12.7 (<0.001)
Morning	37.3	23.7	13.6 (<0.001)
Noon	38.8	30.2	8.6 (0.103)
Afternoon	58.5	45.3	13.2 (0.019)
Evening	61.9	46.0	15.9 (0.017)

*Significant level is provided in the bracket

Table 16. The Mean Difference of No. of on Bus Passengers between Middle Stops and Other Stops at Lebak Bulus-Grogol Direction at Four Observation Periods

Observation Period	No. of on Bus Passengers		
	Middle Stops	Other Stops	Mean Difference*
All Day	35.8	28.6	7.2 (0.001)
Morning	39.3	30.0	9.3 (0.004)
Noon	42.4	33.1	9.3 (0.059)
Afternoon	42.5	33.6	8.9 (0.018)
Evening	12.7	13.4	-0.7 (0.766)

*Significant level is provided in the bracket

Table 17 shows that stop time correlate significantly only with number of boarding passengers. Table 18 shows that stop time correlate significantly with number of boarding passengers, number of alighting passengers and total number of boarding & alighting passengers. This implies that in general stop times were determined by the driver based on demand. This was against the policy regarding uniform stop time of about 20 seconds.

Table 17. The Pearson Correlation between Stop Time, No. of Boarding Passengers, No. of Alighting and Total No. of Boarding & Alighting Passengers on Mal Taman Angrek-Lebak Bulus Direction

	Stop Time	No. of Boarding Passengers	No. of Alighting Passengers	Total No. of Boarding & Alighting Passengers
Stop Time	-	0.117 (0.024)	-0.059 (0.158)	0.089 (0.067)
No. of Boarding Passengers	-	-	-0.220 (<0.001)	0.893 (<0.001)
No. of Alighting Passengers	-	-	-	0.243 (<0.001)
No. of Boarding & Alighting Passengers	-	-	-	-

*Significant level is provided in the bracket

Table 18. The Pearson Correlation between Stop Time, No. of Boarding Passengers, No. of Alighting and Total No. of Boarding & Alighting Passengers on Lebak Bulus-Grogol Direction

	Stop Time	No. of Boarding Passengers	No. of Alighting Passengers	Total No. of Boarding & Alighting Passengers
Stop Time	-	0.496 (<0.001)	0.105 (0.037)	0.297 (<0.001)
No. of Boarding Passengers	-	-	0.564 (<0.001)	0.834 (<0.001)
No. of Alighting Passengers	-	-	-	0.926 (<0.001)
No. of Boarding & Alighting Passengers	-	-	-	-

*Significant level is provided in the bracket

CONCLUSIONS AND RECOMMENDATIONS

From the results, several conclusions can be made, i.e.:

- a. In terms of between stops mean travel speeds, the performance of Mal Taman Anggrek-Lebak Bulus direction was the best during the morning period (32.2 kph) and was the worst during the evening period (23.5 kph). In the opposite direction, the between stops mean travel speeds were almost uniform in the four observation periods, i.e. between 28.2 kph to 30.9 kph.
- b. Due to different land use pattern on Lebak Bulus and Grogol, in general, on Mal Taman Anggrek-Lebak Bulus direction number of on bus passengers in the afternoon and evening periods were significantly larger than the number of on bus passengers in the morning and noon periods. On the Lebak-Bulus-Grogol Direction number of on bus passengers in the evening periods was significantly smaller than the number of on bus passenger in the other periods.
- c. In general mean boarding rates and mean alighting rates were almost uniform in four observation periods.
- d. Except for morning observation period, the mean travel speed between stops with at grade intersection is significantly lower than mean travel speed between stops with at grade intersection on Mal Taman Anggrek-Lebak Bulus direction, whilst on Lebak Bulus-Grogol direction, this was only true if data from all of four periods of observation were pooled together.
- e. On Mal Anggrek-Lebak Bulus direction, except for noon observation period, mean number of bus passengers on middle stops was significantly higher than mean number of bus passengers on the other stops. On Lebak Bulus-Grogol direction, except for noon and evening observation periods, mean number of bus passengers on middle stops was significantly higher than mean number of bus passengers on the other stops.
- f. In general stop times were determined by the driver based on demand. This was against the policy regarding uniform stop time of about 20 seconds.

The following recommendations are suggested in order to promote the performance of the Jakarta BRT system:

- a. Although the passenger demand of line eight was still limited, maintaining the standard maximum bus headway to provide reliability of bus schedule is recommended. If passengers are satisfied with the service, they will spread the news to other potential passengers.
- b. To increase travel speed, some improvements of at grade intersection are recommended.

ACKNOWLEDGMENT

I herewith acknowledge the Head of Transjakarta Public Service Agency, Mrs. Rini Ekotomo and her public relation staff, Ms. Evta and her operational staff, Ms. Retno for providing the permission to conduct the on bus survey on Line Eight of Transjakarta. I also acknowledge the help of 41 Urban Transport Management class students of Civil Engineering Department (Even Semester 2008/2009), Tarumanagara University in the data collection process, especially Kelvin, Yoas, Jennyfer and Eka Evalina.

REFERENCES

- _____. 2004. *The Decree of the Governor of Jakarta No.84/2004*. Jakarta: Dinas Perhubungan, Pemerintah Daerah DKI Jakarta.
- Manurung, E.C., Ilraswari, I., Santosa, W., Sutandi, A.C. 2007. "*Prakiraan Perpindahan Moda pada Jalur Pelayanan Busway Koridor IV di Jakarta.*" **Proceeding of the 10th Symposium of FSTPT**. Jakarta, Indonesia.
- Melissa, Rahman, H., Driejana. 2007. "*Evaluasi Lingkungan Dampak Operasi Jalur Transjakarta Pulogadung-Harmoni Koridor II.*" **Proceeding of the 10th Symposium of FSTPT**. Jakarta, Indonesia.
- Putranto, L.S. 2007. "*The Operational Characteristics of the Jakarta Bus Rapid Transit Services.*" **Proceeding of the 7th Eastern Asia Society for Transportation Studies**. Dalian, China
- Suharso, B., Priyanto, S. 2007. "*Analisis terhadap Beberapa Faktor yang Mempengaruhi Pengguna Transjakarta Busway.*" **Proceeding of the 10th Symposium of FSTPT**. Jakarta, Indonesia.
- Sunggiardi, R., Najid. 2007. "*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.