Moda Choice of Public Transportation on Banyumanik-Johar Route Based on Travel Time

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After and making comparisons between public transportation types of bus and "angkot," travel time for Banyumanik-Johar route, shows that using "angkot" is faster than using the bus. "Angkot" takes time 1 hour 2 minutes 56 seconds with speed 20–30 km/hr, and bus 1 hour 40 minutes 58 second with speed 10–30 km/hr. Time difference both 38 minutes 2 seconds. While in the opposite route, Johar-Banyumanik the results shows that using bus is faster than using "angkot." Bus takes time 1 hour 15 minutes 14 seconds with speed 20–30 km/hr, and "angkot" takes time 1 hour 44 minutes 72 second, with speed 20–40 km/hr. Time difference both 29 minutes 2 seconds.

Keywords: Public Transportation, Moda Choice, Travel Time.

1. INTRODUCTION

Transport planning is a process with the objective of developing a transportation system that allows people and goods to move or move places safely and cheaply.[10] Along with the development a city, will also participate with the increase of population. Still according to Warpani, transportation planning is needed as a consequence of growth, traffic conditions and urban development. In order to require a mature transport planning to avoid transportation problems that occur.

Semarang city is a city with a population that continues to increase every year. So, development of this city is also increasing, consequently the development spread to the suburbs of Semarang as well as its activities. The inhabitants of Semarang city in carrying out a movement are offered in two types of transportation modes, namely public transportation and private transportation. According to Morlok,[4] the priority of traveling on the road should be given to public transport, rather than private vehicles. This can be used as an effort to reduce congestion. The object of research taken is public transportation of Banyumanik-Johar route and the reverse direction, with bus and "angkot" modes. Therefore, it is necessary to study the selection of transportation modes on the route of Banyumanik-Johar based on travel time, to save time and make the travel more effective and efficient.

This paper is organized in 5 section. In Section 1, introduction. In Section 2, moda choice of public transportation theory and methods. In Section 3, calculation of travel time on Banyumanik-Johar route. In Section 4, the experimental results of comparing travel time between bus and "angkot." And in the last section is conclusions of the study.

2. MODA CHOICE OF PUBLIC TRANSPORTATION THEORY AND METHODS

In transport planning the classification of movements is differentiated into goals, based on time and by type of person. Time-based movements are divided into 5 categories: movement to work, to school, to shopping, social movement, etc.[6] While based on time can be divided into movements based on busy hours and hours are not busy. And the movement based on the type of person (individual) is distinguished by income level, vehicle ownership level and household size.

In planning the overall transportation Kamarwan,[2] introduced four-stage transportation planning model, transportation planning model, namely: Trip generation, Trip distribution, trip assignment, and modal selection (moda choice). However, in this article will only be discussed about the modal selection (moda choice). Where used to know how the traveler chooses the mode to be used, in other words the mode selection can be defined as the division of the number of trips into different ways or modes of different trips. Factors that influence a person in choosing a mode of transportation can divided into three categories:[6] 1. Characteristics of travelers, 2. Characteristics of travel, an 3. Characteristics of the transportation system.

The research approach used in this research is quantitative comparative that is based on modal split theory. Then in the analysis process is done travel time analysis, which consists of running time and stopping time. After that, done mode selection analysis to decided best transportation mode, based on time efficiency. The scope of this research is Banyumanik-Johar route of bus and "angkot."

3. CALCULATION OF TRAVEL TIME ON BANYUMANIK-JOHAR ROUTE

Banyumanik-Johar route (round trip) consist of two trips, first trip is travel from Banyumanik for starting points, and second trips is the opposite to way back. Both are not going in the same directions. Either by bus or "angkot," each having different directions on the round trips route.

3.1. Banyumanik-Johar

Trips from Banyumanik to Johar, public transportation type of "angkot" through starting point Banyumanik (Damar Market) - Jatingaleh - Java Mall - Jl. M.T. Haryono – Johar Market, with 25 stop points, namely on Damar Market - Al-Muhajirin Mosque Banyumanik - Mandiri Bank Banyumanik - Arfa Barbershop Banyumanik - Gas Station Jl. Setiabudi - ADA Swalayan - Mandiri Bank Jl. Setiabudi - Srondol Bumi Indah housing Gate - Horse Statue (across UNDIP gate) - Horse Statue (near police station Jl. Setiabudi) - Chandra Shop Jl. Setiabudi- Jl. Gombel Lama – Jatingaleh Market – traffic lights (Before Akpol Gajahmungkur) - Candi Sari Hotel - Graha Candi Golf gate - Candi Lama mosque - Jl. Dr. Wahidin - Fish & Co restaurant Jl. Dr. Wahidin - Karang Anyar Gunung housing - Java Mall - Sharp Shop Java Mall area – Peterongan public market - KFC Jl. M.T. Haryono - Ayam Kalasan restaurant Jl. M.T. Haryono - Final Post Johar Market, Old Town Area.

Based on Table I is known that total time to travel from Banyumanik to Pasar Johar using "**angkot**" is 1 hour 2 minutes 56 seconds, with speed of 20–30 km/hr. This result is obtained from total stopping time and total running time.

$$\begin{aligned}
\text{Running Time} &= 41 \text{ minutes } 21 \text{ seconds} \\
\text{Stopping Time} &= 21 \text{ minutes } 35 \text{ seconds} \\
\text{Travel Time} &= \text{Running Time} + \text{StoppingTime} \\
&= 41'21'' + 21'35'' \\
&= 62 \text{ minutes } 56 \text{ seconds} \\
&= 1 \text{ hour } 2 \text{ minutes } 56 \text{ seconds}
\end{aligned}$$

While for public transportation type of bus, Banyumanik-Johar route through Jl.Sukun - Jatingaleh Terminal – Jl.Tugu Muda - Paragon Mall – Johar Market, with 20 stopping points, Sukun Terminal (starting points) - Horse Statue (across UNDIP gate) - Jatingaleh Market - PLN Jatingaleh - Noormans Hotel – across Station TVRI housing – across BPJS Gajahmungkur office – SMK Ibu Kartini bus stop – Superindo supermarket Jl. S. Parman - Gajahmungkur bus stop - William Booth Hospital – across Dr. Kariyadi hospitals (before traffic lights) - Dr. Kariyadi Hospitals (across Garuda Pavillion) - Jl. Dr. Sutomo - Near Wira Tamtama Military Hospitals - Tugu Muda traffic lights (across Domenico Savio Junior High School) - Tugu Muda T-junction (near Pandanaran building) - Paragon Mall - Toko Oen restaurants – Johar Market, Old Town (end point).

Based on the Table II is known that total time to travel from Banyumanik to Pasar Johar using **bus** is 1 hour 40 minutes 58 seconds. This result is obtained from total stopping time and total running time.

$$\begin{aligned}
\text{Running Time} &= 39 \text{ menit } 16 \text{ detik} \\
\text{Stopping Time} &= 61 \text{ menit } 42 \text{ detik} \\
\text{Travel Time} &= \text{Running Time} + \text{StoppingTime} \\
&= 39'16'' + 61'42'' \\
&= 100 \text{ minutes } 58 \text{ seconds} \\
&= 1 \text{ hour } 40 \text{ minutes } 58 \text{ seconds}
\end{aligned}$$

Table I. "Angkot" stopping points of Banyumanik-Johar market route.

No.	Stop point	T (Minute.second) Running time	Stopping time	Speed (Km/hr)
1	Damar market	–	09.00	20
2	Al-Muhajirin mosque Banyumanik	05.00	05.00	30
3	Mandiri bank Banyumanik	02.00	00.30	20
4	Arfa barbershop Banyumanik	01.00	00.30	20
5	Gas station Jl. Setiabudi	04.00	00.10	20
6	ADA Swalayan	01.30	03.40	20
7	Mandiri bank Jl. Setiabudi	01.00	00.15	20
8	Srondol Bumi Indah housing Gate	00.30	00.10	10
9	Horse statue (1)	01.54	00.20	10
10	Horse statue (2)	00.20	00.43	10
11	Chandra shop Jl. Setiabudi	01.00	00.10	10
12	Jl. Gombel Lama	01.20	00.05	10
13	Jatingaleh market	02.28	00.52	10
14	Traffic lights (before Akpol Gajahmungkur)	02.24	00.10	20
15	Candi Sari hotel	02.39	00.10	20
16	Graha Candi Golf gate	00.25	01.15	20
17	Candi Lama mosque	00.10	00.10	20
18	Jl. Dr. Wahidin	00.52	00.10	30
19	Fish & Co restaurant Jl. Dr. Wahidin	00.48	00.10	30
20	Karang Anyar Gunung housing	00.54	00.05	30
21	Java Mall	01.11	00.10	30
22	Sharp Shop Java Mall area	01.24	00.05	30
21	Peterongan public market	00.28	00.05	20
23	KFC Jl. M.T. Haryono	01.28	00.10	20
24	Ayam Kalasan restaurant Jl. M.T. Haryono	01.31	00.10	30
25	Final Post Johar Market	08.25	–	30
Total		41.21	21.35	20–30

Source: Analysis.

3.2. Johar-Banyumanik

Trips from Johar to Banyumanik, public transportation type of "angkot" passing Johar area - Jl. Pattimura – Jl. Dr. Cipto - Java Mall – Jatingaleh Market – Damar Market, with 21 stopping point, that is the starting point of Johar, Old Town area – Traffic Lights Jl. Pattimura - PT. Tugu Pratama Indonesia Jl. Dr. Cipto - Church of Jesus Christ, Jl. Dr. Cipto – T-junction Jl. Kompol Maksum 187 - Mega Bank – Peterongan public market - Java Mall – across Jomblang housing allay - Graha Candi Golf (gate) – across PLN Jatingaleh - Jatingaleh ojek station- UNDIP gate - Sukun Terminal (front ADA Supermarket) - Pizza Hut – Citra Perumahan Ideal gate – Mandiri Bank Banyumanik-Jati Market - Jl. Meranti Barat I – across Al-Muhajirin mosque – Damar market (end point).

Based on the Table III known that total time to travel from Johar to Banyumanik using "**angkot**" is 1 hour 44 minutes 16 seconds. This result is obtained from:

$$\begin{aligned}
\text{Running Time} &= 57 \text{ menit } 67 \text{ detik} \\
\text{Stopping Time} &= 46 \text{ menit } 9 \text{ detik} \\
\text{Travel Time} &= \text{Running Time} + \text{StoppingTime} \\
&= 57'67'' + 46'09'' \\
&= 104 \text{ minutes } 16 \text{ seconds} \\
&= 1 \text{ hour } 44 \text{ minutes } 16 \text{ second}
\end{aligned}$$

Table II.   Bus stopping points of Banyumanik-Johar route.

		T (Minute.Second)		
No.	Stopping time	Running time	Stopping time	Speed (Km/hr)
1	Sukun terminal	–	10.00	20
2	Horse statue (across UNDIP gate)	04.42	00.14	10
3	Jatingaleh market	05.15	01.18	10
4	PLN Jatingaleh	01.27	00.30	10
5	Noormans hotel	01.19	00.l0	15
6	Across station TVRI housing	02.07	02.00	15
7	Across BPJS Gajahmungkur office	01.16	00.10	15
8	SMK Ibu Kartini bus stop	01.14	00.10	20
9	Superindo supermarket Jl. S. Parman	01.25	05.00	30
10	Gajahmungkur bus stop	01.24	10.00	20
11	William booth hospital	01.47	05.00	20
12	Across Dr. Kariyadi hospitals (1)	01.35	05.00	20
13	Across Dr. Kariyadi hospitals (2)	01.26	00.30	20
14	Jl. Dr. Sutomo	01.32	05.00	20
15	Near Wira Tamtama military hospitals	02.00	05.00	10
16	Across Domenico Savio junior high school	03.13	05.00	30
17	Tugu Muda T-junction	02.10	00.10	20
18	Paragon mall	04.25	00.10	30
19	Toko Oen	02.04	07.00	30
20	Johar market	01.35		30
Total		39.16	61.42	10–30

Source: Analysis, 2017.

Table IV.   Bus stopping points of Johar-Banyumanik route.

		T (Minute.second)		
No.	Stopping points	Running time	Stopping time	Speed (Km/hr)
1	Johar old town area		10.07	20
2	Johar crossroads (across SriRatu Dept. Store)	01.30	0.10	20
3	BCA bank Jl. Pemuda	03.05	0.10	20
4	Paragon mall	05.55	01.28	20
5	Education authorities	01.09	00.05	20
6	Lawang Sewu	02.38	00.16	30
7	Domenico Savio junior high school	04.20	01.15	30
8	Dr. Kariyadi hospitals (front Garuda Pavillion)	02.42	00.10	30
9	Dr. Kariadi hospitals (2)	02.53	00.45	20
10	Gajahmungkur gas station	03.40	00.16	30
11	Superindo supermarket Jl. S. Parman	01.20	05.00	30
12	Elisabeth hospitals T-junction	02.02	02.04	30
13	Grand edge	01.38	01.27	30
14	Jl. Sultan Agung	02.03	00.20	30
15	Sultan Agung gas station	10.13	00.10	40
16	Jl. Ngesrep (front Swiss bakery)	01.23	00.05	30
17	Jl. Srondol (front SAMSAT)	01.30	00.05	30
18	Across Srondol gas station	00.35	00.05	20
19	ADA supermarket	02.00	00.20	20
20	Sukun terminal	05.00		30
Total		52.56	22.58	20–40

Source: Analysis, 2017.

While for public transportation type of bus, Johar – Banyumanik route passing Johar area - Paragon Mall – Jl. Tugu Muda – Kariadi Hospitals - Jatingaleh – Sukun Terminal, with 20 stop points, which is Johar, Old Town Area (starting point) – Johar

Table III.   "Angkot" stopping points of Johar-Banyumanik route.

		T (Minute.second)		
No.	Stopping points	Running time	Stopping time	Speed (Km/hr)
1	Johar, old town area		27.25	20
2	Traffic lights Pattimura street	04.01	02.01	20
3	PT. Tugu Pratama Indonesia Jl. Dr. Cipto	03.36	01.00	10
4	Church of Jesus Christ, Jl. Dr. Cipto	03.00	02.42	10
5	T-junction Jl. Kompol Maksum 187	08.07	01.41	10
6	Mega Bank	02.08	00.10	10
7	Peterongan public market	02.08	00.30	10
8	Java Mall	02.12	00.10	10
9	Across Jomblang housing allay	02.18	00.10	20
10	Graha Candi Golf (gate)	03.20	00.10	20
11	Across PLN Jatingaleh	05.56	00.05	20
12	Jatingaleh ojek station	00.51	00.05	20
13	UNDIP gate	05.22	02.34	30
14	Sukun Terminal (front ADA Supermarket)	07.40	09.00	30
15	Pizza Hut	00.23	00.06	30
16	Citra Perumahan ideal gate	02.23	00.05	30
17	Mandiri Bank Banyumanik	00.38	00.10	30
18	Jati Market	00.37	00.05	20
19	Jl. Meranti Barat 1	03.13	00.05	20
20	Across Al-Muhajirin mosque	00.54	00.05	30
21	Damar market	02.00		20
Total		57.67	46.09	20–30

Source: Analysis, 2017.

crossroads (across SriRatu Dept. Store) - BCA Bank Jl. Pemuda - Paragon Mall – Education Authorities - Lawang Sewu – Domenico Savio Junior high school - Dr. Kariadi hospitals (front Garuda Pavillion) - Dr. Kariadi hospitals (2) - Gajahmungkur gas station- Superindo supermarket Jl. S. Parman - Elisabeth hospitals T-junction - Grand Edge – Jl. Sultan Agung - Sultan Agung Gas Station– Jl. Ngesrep (front Swiss Bakery) – Jl. Srondol (front SAMSAT) – across Srondol Gas Station - ADA supermarket – Sukun Terminal (end point).

Based on the Table IV known that total time to travel from Johar to Banyumanik using **bus** is 1 hour 15 minutes 14 seconds. This result is obtained from:

$$\text{Running Time} = 52 \text{ menit } 56 \text{ detik}$$
$$\text{Stopping Time} = 22 \text{ menit } 58 \text{ detik}$$
$$\text{Travel Time} = \text{Running Time} + \text{StoppingTime}$$
$$= 52'56'' + 22'58''$$
$$= 75 \text{ minutes } 14 \text{ seconds}$$
$$= 1 \text{ hour } 15 \text{ minutes } 14 \text{ seconds}$$

4. EXPERIMENTAL RESULT

After calculating travel time of public transportation between "angkot" and bus with the same route, it is found that using "angkot" is faster than using the bus for Banyumanik-Johar route." Angkot" takes time 1 hour 2 minutes 56 seconds, and bus 1 hour 40 minutes 58 seconds. Time difference both is 38 minutes 2 seconds. Whereas for the opposite route, Johar – Banyumanik, using bus is faster than "angkot." Bus takes time 1 hour 15 minutes 14 seconds, and "angkot" takes time 1 hour 44 minutes 72 seconds with average speed between 20–30 km/hour. Time difference both is 29 minutes 2 seconds.

5. CONCLUSIONS

The development of a city very closely with a plan. Transport planning in a city is very helpful for the sustainability of the city itself, especially in terms of transportation. Citizen of Semarang city in carrying out a movement are offered in two types of transportation modes, namely public transportation and private transportation. However, in its development, more. The research approach used in this research is quantitative comparative, that is based on mode split theory. Then in the process of analysis, using the analysis of travel time, which consists of running time and stopping time. After making comparisons between the public transportation types of bus and "angkot," for Banyumanik-Johar route, shows that using "angkot" is faster than using the bus. And in the opposite route, Johar-Banyumanik, using bus is faster than using "angkot."

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