TRAVEL TIME MAPPING FOR MOTORISED VEHICLE IN YOGYAKARTA
Sigit Priyanto

ABSTRACT

Study on motorised vehicle travel time is important as travel time may serve as one of the parameters for road service performances in urban areas. Vehicles travel through different delays where the characteristic of one place is different from that of the others. The difference depends on several factors like road capacity, physical and geometrical condition, land use, side obstruction, and road function. The research aims at mapping speed, delay, time, and travel time of motorised vehicle on street sections in Yogyakarta municipality and indicating locations producing the same travel time to reach the city centre (the central post office). It gives the priority to the primary data obtained from the survey on 32 road sections which have major role in carrying urban transport flow in Yogyakarta. The survey records the running time and delay time during busy hours at noon when different characters of travel mix up.

The research results reveal the following: the longest delay time for going to the city centre is on Jalan Mayor Suryotomo, i.e. 109.29 seconds and for leaving the city centre is on Jalan Kanirang, i.e. 95.43 seconds; the highest percentage of delay time to overall travel time for going to the city centre is on Jalan Sudirman (Simanjuntak intersection-Gramedia), i.e. 43.57%, while for leaving the city centre is on Jalan Diponegoro, i.e. 47.57%. The highest travel mean speed is on Jalan Mangkubumi, i.e. 31.65 km/h for going to the city centre and on Jalan HOS Cokroaminoto i.e. 35.05 km/h for leaving the city centre. The lowest mean speed for going to the city centre is on Jalan Mayor Suryotomo, i.e. 10.29 km/h while for leaving the city centre is on Jalan Diponegoro, i.e. 12.48 km/h.

INTRODUCTION

Heterogeneity of travel characteristics gives effect on the environment. More motorised vehicle and private cars but lack of physical infrastructure results in traffic jam and delayed travel time. Another effect is travel quality decrease resulting from the noise and pollution produced by vehicle mobility.

Travel time as one of the criteria for road service performance is a parameter which is easy to understand and is believed to be an indicator of the quality of traffic.

1 Lecturer/researcher in the Department of Civil Engineering and Master Program on Transport System and Engineering, Gadjah Mada University
flow and transport facility operation because travel time is closely related to the network performance.

The mapping is intended to show the routes that will save travel time, which, in turn, save energy and cost apart from reducing pollution to improve environment quality, travel quality and comfort.

**RESEARCH METHOD**

This research uses primary data obtained from field survey. Vignatono (1973) suggests that it needs to take samples of at least 12 trips of travel for a research to adequately measure the mean speed and delay in each direction out of many other directions. Considering the field condition, the research takes 14 samples on each street section for each direction. The research area is limited for Yogyakarta urban area and for travels that originate from an intersection within the territory of Yogyakarta mayorality, or on street sections which have high potential in carrying traffic flow. The survey is conducted during daily peak hours at noon (between 12.00 and 14.00) with the underlying assumption that daily peak hour happens on Monday, Tuesday, Wednesday and Thursday. The test vehicle is a passenger car. In the analysis some assumptions were taken into account as follows:

a. road network was digitised based on the current available map of Yogyakarta,
b. traffic flow was constant all along the road sections,
c. travel time to pass intersection was determined 10 seconds for a simple intersection and 15 seconds for a complicated intersection.

The observation for this research is concerned with; running time and stopping time, running time after delay and stopping time caused by delay, time for entering and leaving street section, and street network location.

**FIELD SURVEY**

The study field was chosen to represent the road network condition in Yogyakarta. Therefore, it divides Yogyakarta into 5 area divisions, i.e. Southern Yogyakarta, Western Yogyakarta, Northern Yogyakarta, Eastern Yogyakarta, and Central Yogyakarta. Library research and preliminary research become the bases for route selection. The considerations for the selection are:

a. urban area in the mayorality of Yogyakarta, except Jalan Gajayana and Jalan Kaluwarang (in Sleman Regency),
b. streets with high traffic density during afternoon busy hours,
c. streets of either national or provincial status, located in three districts having high population density,
d. representative for other areas in the four Yogyakarta territories,
e. passing through areas whose land use is designated for offices, education, settlement, tourism and industry.

For this reason, the research considers the following conditions in the selection of the starting point for measurement; first in urban area and major street intersection, second the point where urban, flow traffic begins to mingle.

Note that, the research conducts its preliminary survey to obtain primary data and secondary data. The survey for primary data aims to collect information about:

a. peak hours,
b. location and segment of the streets for the survey,
c. route selection and trip origin setting,
d. potential difficulties encountered during the survey.

While, the survey for secondary data aims to obtain data on:

a. the population and population density from the Statistics Bureau, Yogyakarta;
b. street capacity, volume and vehicular ratio from DLLA Kota Yogyakarta;
c. road status, geometry and other related information on streets in Yogyakarta city, from Public Works Office, Yogyakarta Mayorality.

The main survey is carried out by teams and each team is responsible for one route. It takes the following steps:

a. The observer follows a test vehicle from the measurement starting point,
b. He/she starts measuring the travel time when the test vehicle leaves the signal. Test vehicle is chosen at random from the first vehicles leaving the signal,
c. He/she also records the stopping time of the vehicle that is delayed either on street section or at an intersection. The start of delay time is when the vehicle has really stopped as indicated by the front wheels.

The survey observes two directions, both the going and the leaving directions. It is worthy to note that problems encountered during the survey may arise sometimes, a test vehicle does not continue going on the determined route. This problem is solved by recording the time right when the vehicle diverts away from the route, then taking a similar type of vehicle (of pcv=1) which runs behind the first test vehicle and goes on the route and following it and measuring its travel time until it reaches the end point. The observer finds difficulties when recording delay time and running time and at the street section he/she must record the times. These problem are solved by using the route map and then writing a code for running time, delay time, etc.

DATA CAPTURE AND ANALYSIS

The research analyses the data from field survey in the following steps.
a. counting the delay time, running time and travel time per section per direction from the survey sheets by calculating the difference of the recorded time.
b. calculating the length of the street section using Mapinfo 5.5.
c. analysing travel speed of each sample per section per direction using excel program.
d. analysing the ratio among the difference of running time, delay time, travel time, and travel speed of each section per direction using SPSS 9 program.

Data on the street length is obtained by digitizing Yogyakarta map from YUIMS (Yogyakarta Urban Infrastructure Management System). The scale used in the analysis is 1:20,000. The digitizing process is made by tracing the road network presented in the digital map. The digitized map is produced by scanning the original map whose scale has been converted according to the street network real condition. This process is aided with Mapinfo 5.5 software.

After the street length is identified, the next step is to analyse data to find out the speed using excel program. The analysis uses parametric analysis, aided with SPSS program, in which the sample has normal population and the variant is regarded homogen. The outcomes are travel time, running time, delay time, and travel speed. To find out whether or not a significant difference exists among the speed, travel time, running time, delay time for each different direction and street, the analysis applies the general linear model univariate test. After it identifies that most street sections show significant difference in the delay time per direction per street and in the speed per direction per street, it continues with comparative analysis based on each variable. To find out the ratio and level of the findings, it uses compare means test.

CHARACTERISTICS OF MOTORISED VEHICLE TRIP

The analysis result of travel time to the city centre direction can be presented as follows. The highest travel time is recorded on Jalan Mayor Suryoto, that is 349.41 seconds/km. This score proves that the traffic is so crowded that there is a short distance (the length is only 738.6 m) it takes so long time. Another possibility is that the flow is not fluent. The second highest travel time is on Jalan Jendral Sudirman. This street can be divided into two sections: Tugu-C Simanjuntak and C Simanjuntak-Gramedia. The travel time is 315.6 second/km for the first and 298.8 second/km for the latter. The first is 541.6m long while the second is only 252.8 m. With such length and high travel time, these sections prove to be crowded. The third highest is on Jalan Kolonel Sugiono with its 236.19 second/km travel time.

In addition the analysis result of delay to the city centre direction can be presented as follows. The most dominant factor of delay is intersection. The intersections which have the highest delay time are:

- Jl Mayor Suryoto, exactly at Mayor Suryoto - Senopati - Katamso intersection.
- Jalan Wahid Hasyim at Wahid - Marsadinata - Suprapto - Ahmad Dahlan intersection.
- Jalan Magelang at Magelang - Dianemoor - T Delwir - Wonokromo.

The highest delay time is at Jalan Mayor Suryoto intersection, i.e. 109.29 second or 147.96 sec/km. This is due to the street geometry condition where the divider limits the vehicle's movement. In addition, the nearby Yogyakarta central market as one of traffic generating centre in Yogyakarta contributes much to the delay resulting from the many activities around the corner located on this street, such as vehicles making a turn or switching the direction, public buses taking passengers in and out, and cars parking along the street. The heterogeneity of transport modes i.e. buses, passenger cars, motorcycles, bicycles, pedicabs and horse carts also restricts the movement (these modes have different rate of acceleration) and finally results in vehicle delay.

TIME AND SPEED MAPPING FOR MOTORISED VEHICLE

1. Delay Time Mapping

The calculation result suggests the location with the highest delay time. Delay time is very potential to give contribution to the smoothness of a trip. Delay time is mostly the time spent when a vehicle is delayed at intersections. The intersections are (from the highest delay time):

- Ploii intersection. The highest delay time is on Jalan Magelang, Jalan Diponegoro, and Jalan Tentara Pelajar.
- Semongan intersection. The highest delay time is on Jalan KHA Dahan, and Jalan KH Wahid Hasim.
- Gondamulya intersection. The highest delay time is on Jalan Mayor Suryoto and Jalan Brigjen Katamso.
- Jokteng Wetan intersection. The highest delay time is on Jalan Brigjen Katamso, Jalan Kol. Sugiono, and Jalan Parangtritis.

The characteristics of delay at each intersections are heterogeneous, different from one another. A junction is responsible for such heterogeneity as it is an area where complex traffic interacts. The complexity lies in:

- physical characteristic (number of lane, kind of surface, geometric lay out, bus stop, and pedestrian crossing).
- traffic-use characteristic (volume and turning movement, classification, speed, type of route, flow of pedestrian).
- forms of traffic control (signals, flow regulation, circle on the street, turning control, separation based on surface height).

These three influence the number of delay distributed on the street users. The above intersections also show low economic benefit, so it is hoped that these requests are fixed to reduce the delay. These intersections must be the first priority for requirements.
2. Travel Time Mapping for to the City Centre Direction

Travel time relates to travel speed. From travel speed we know that a certain street with a certain length can be travelled in a certain seconds. From there the speed is made plotting of the time taken during the operation of a vehicle along that street.

To make the description easier, it makes simplification under an assumption that the time taken by a vehicle to pass one level intersection is 10 seconds, and to pass multilevel intersection is 15 seconds. It also assumes that travel time is divided equally along the street and there is no time accumulation at a certain part of the street (e.g. time accumulation at an intersection).

The areas connected with the curve have the same time to go to the city centre. The times taken to go to the city centre are 1 minute, 2 minutes, 3 minutes, etc., being indicated to be wider and darker colour. The following picture shows that the travel time to go to the city centre (marked with red flag) from the end of Jalan Surabaya is the same as that takes from Jalan Kusumanegara (SGM-Gedongkuning) and from the end of Jalan Perintis Kemerdekaan, i.e. 12 minutes. Similarly, to go to the city centre from the start of Jalan Kusumanegara, the end of Jalan Mayor Suryoto, the start of Jalan Tamaniswara, the middle of Jalan Brigjen Katama, the middle of Jalan Wahid Hasim, the end of Jalan RE Martadinata, and the middle of Jalan Kleringan, it takes the same amount of time, i.e. 5 minutes.

CONCLUSION

From the research of travel time observation some conclusion can be drawn as follows:

a. The shortest time to travel to the city centre is 113.33 sec/km, i.e. on Jalan Abu Bakar Ali, while the longest time is 349.41 sec/km, i.e. on Jalan Mayor Suryoto.

b. The highest mean speed is on Jalan Mangku Jumati, i.e. 31.65 km/h. The lowest mean speed is on Jalan Mayor Suryoto, i.e. 10.30 km/h.

c. The longest delay time to travel to the city centre is 109.29 sec/km on Jalan Mayor Suryoto. The delay is caused by the geometrical condition where the street is divided by a divider which restricts the movement and heterogeneity of transport modes which makes the vehicle unable to run smoothly (different acceleration rate), as well as by the activities at the entrance of the Yogyakarta Central Market such as vehicles making a turn or switching the direction, public buses taking passengers in and out, and cars parking along the street. The highest percentage of overall delay time is on Jalan Sudirman (Simanjuntak-Gramedia), i.e. 43.57% for going to the city centre. The shortest delay time to go to the city centre and the lowest percentage of overall delay time is on Jalan Mangku Jumati, Jalan Mataram, and Jalan Kleringan, i.e. 0 sec/km and 0%.

d. When the isochron map (of locations with the same travel time) is made periodically in several years, it will show the damage or improvement on the road system and
will give clear indication for particular parts that must be given top priority for repairment.

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THE TECHNIQUES OBTAINING CRITICAL CONDITION FOR SEDIMENT PARTICLE MOVEMENT

Koenstavanto Impasihardjo

ABSTRACT

The two important sets of measurements required for measuring initiation of sediment particle movement are pair of size Ds of particle median size and the critical unit water discharge qo associated with movement of that size. Gravel has generally been neglected compared with the fine material and predictive transport models have so far had very limited success in achieving agreement with field data. Therefore, some of the aspects of natural gravel-bed rivers which affect the initiation of motion and bed load transport process, as opposed to case for artificial channels, have been studied by the author in July, 1996 and by Hofer in 1979 (personal communication) on the Pitzbach, Austria.

Two technique are used in this study to obtain the data of critical condition for sediment particle movement from the bed load transport data from the Pitzbach, Austria. The performance of the technique which were used to obtain the data for critical condition for sediment particle movement then were assessed using existing equations of the Schorle (1962), Barthost et al (1987), Barthorst (1987) and Impasihardjo (1991). The performance of the techniques, the comparison and calculated critical unit water discharge are discussed.

The result indicated that, the Schorle (1962) and the Barthorst et al (1987) equations significantly underestimated qo with the Pitzbach data. The discrepancies are probably caused by the hiding/exposure effects which are not accounted for in both equations, while the Barthorst (1987) and Impasihardjo (1991) gives a good agreement qo. One interpretation therefore is that size is another variable which should be involved in the hiding/exposure effects for initiation of motion of non-uniform bed material. From the discussion the two techniques can be used for obtaining the critical condition for sediment particle movement from the bed load transport data.

INTRODUCTION

It is widely recognized, however, that individual size fractions do have an influence on each other. Several flume studies have shown that the larger sizes then begin moving at flows weaker than would be necessary for uniform sediments of those sizes. Conversely, smaller sizes are brought into motion at flows stronger than would be

1 Lecturer at Department of Civil Engineering, Faculty of Engineering University of Cendikia Nusantara.