

Travel Time Cost for Private Car in Bumi Serpong Damai (BSD) City: Income and Mode Choice Approach

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Abstract : *Travel time cost is one of the primary aspects that considered, especially with respect to its economic impact. To account for the increment of road users, often travel time cost has to be highlighted and further investigated. One technique to compute travel time costs is by using travel time evaluation as a loss opportunity that used to produce traveling needs. The aim of the study is to compute travel time cost for the private transportation users in BSD City by employing two methodologies. Income approach is the first method, which requires only two factors to be computed (capital income and amount of annual working hour assuming that time used to produce one product as function of personal income). For mode choice approach, the method uses the travel time cost from the model to estimate the choices comparison from the specified mode traffic. In this model, comparisons of choices are assumed as a function of two independent variables; operational cost and time cost. Travel time cost is defined as the comparison between parameter of travel time cost against the operational cost. Additionally, the study adopted stated preference techniques surveys, which have been undertaken in BSD town area to derive the travel time cost. The survey focused on the private car passengers where background information collected were traveling distance, time of travel, journey characteristics, education level, employment and income of the respondents respectively. Subjects were asked to choose between different scenarios of mode choices. For income approach method, the results showed that the travel time cost for the private transport commuters was Rp 6,272 / hour/ person and Rp. 11,828 / hour / person by using mode choice approach. It was found that the value of time has increased as the income increases. Thus, value of time is significant in accounting for personal income.*

Keywords : *Income, Mode Choice, Stated Preference*

INTRODUCTION

The road transportation management of BSD city is intended to implement a safe, comfortable, convenient, efficient and affective road transportation and traffic system for the city. At the inception stage, the focus will be emphasized on the transportation problem in the urban areas. BSD city councils have set a policy to increase the town road networking system that is able to serve local activities with the neighborhood areas. From the observation made, BSD has rapidly grown and indeed

needs more infrastructures to be developed in the future to accommodate the soaring demand. In this regard, an economic analysis is required to be undertaken to evaluate the anticipated potential benefits of the proposed development schemes. Retrenchment of travel time (travel time saving), which is part and partial of the economic analysis, can be performed to achieve this objective.

Travel time cost is one of the largest costs in transportation. According to Henser (2015) often travel time saving is the primary factor that usually needs to be justified prior

to implement transportation infrastructure developments/improvements. Various studies have been developed and performed to estimate the travel time cost (value) for different users and travel conditions. Travel time cost is one of the factors that normally will be measured to account for the increment of road users. Additionally, this factor also plays an important role in the economic appraisal of transportation schemes.

On the other hand, passenger time value is a vital aspect to measure the total benefits prior to implement a new road scheme with respect to its fuel costs and vehicle operating costs against its construction cost. In general, the primary intention of building a new/alternative road is to decrease the travel time. It appears that the most crucial economic benefit from such scheme is the passenger time saving. With this respect, the aim of this study is to measure the travel time costs for private transportation in BSD area by using two methods; Income approach method and mode choice approach method with stated preference technique as the survey methodology.

RESEARCH METHODOLOGY

There were two attributes in the data analysis; time and travel cost attribute. In addition, the study will also illustrate the tendency of the behavior types. Based on stated preference survey method used in the study, representative of mode choice in data rating of each attribute combination gives five choices of mode preferences trend for the selection by the respondents. Respondents were given with two conditions/options; maintain the current situation (old mode) or new transportation mode. All these results were then compiled and analysed by using regression statistical method.

For the statistical analysis, multiple regressions analysis was applied due to the fact that the study adopted the theory of stated preference-based survey. This techniques have become an accepted part of the transport planning tool kit. In general they are implemented as stated-choice experiments, in which respondents are asked to choose

between two or more alternatives described to them (Axhausen, 2010). For analysis, multi linear regressions computation was executed by using SPSS 17.00

Prior to start the statistical analysis for the results obtained, data consistency checking was undertaken to adhere with stated preference logic. This logic particularly relevant with the respondent preferences against travel situation where if respondent choose time of minimal time value level, subsequently choices at highest level for time cost could be time or money, but at minimal time value level the respondent might chooses money so that the next choices should be money. In this case, if the respondent has a low-income level, the time is could be trivial. Hence, the screened data was used to perform the regression analysis for two attributes; time and cost.

DISCUSSION AND RESULT

The study database was collected and hence constructed based on the survey conducted during January and February 2015. Subjects were randomly chosen from those that presented a very simple activity for trips distribution; home-travel-work-travel-home. The selection of respondents was based on their mode preferences either using private car or public transport to perform their traveling from an origin to the destination (Base on O-D). Interviews and survey questionnaires have been used to collect the data. There were several locations where the study survey has been performed, which were namely office district, higher education institution, activity center of communalities, and residential areas. Survey for the office district was conducted during office hours, whereas for residential areas was conducted outboard of office hours.

Permian and Swanson (1999) deduced that the minimum sample requirement for travel time study is amongst 75 until 100 respondents for each segmentation. The minimum sample requirement for this study was 268 respondents. Initially, the data was prepared for 500 respondents and upon the consistency test conducted by using statistical

method, the data has been reduced to 268 respondents (i.e. 53.6% from the total respondents). There were several factors involved in the respondent's reduction:

1. Subjects were not familiar with Stated Preference Survey Form.
2. Some respondents did not express their commitment during filling the survey form.
3. Respondents suspicion against survey activity (sometimes superfluous and ineptitude).

Consequently, data grouping for respondents are as follow:

a. Travel Distance

Average of respondent travel distance is 1 to 15 km. Frequency distribution of travel distance from respondents is illustrated in figure 1.

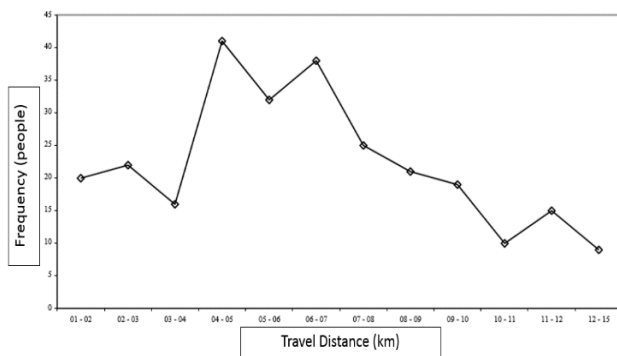


Figure 1. Frequency distribution of the respondents travel distance

From figure 1, it appears that frequency distribution is uneven and non-compliance with travel time distribution.

b. Travel Time

Travel time to work location for the respondents' return trips (O-D) that consumed private transport.

c. Income per month

Income per month distribution (Figure 3) shows uneven distribution. Generally, the frequency decreases when income increases.

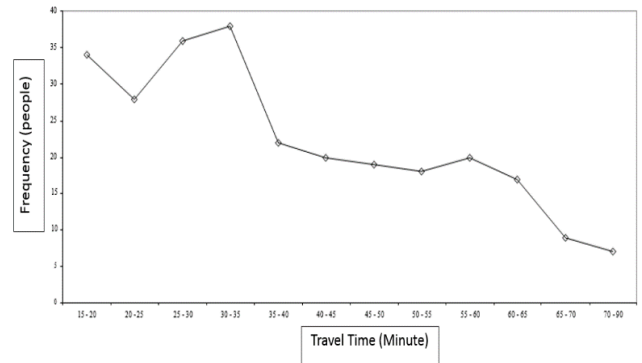


Figure 2. Frequency distribution of travel time from respondent

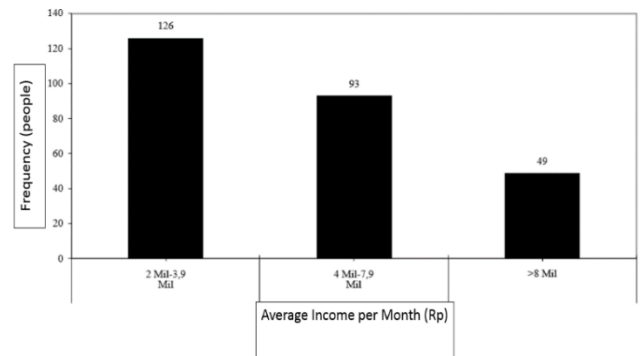


Figure 3. Frequency distribution of respondent income

d. Level of Education

From the Figure 4, it appears that majority of the respondents possessed SMA/SMK qualification, which accounts for 74.26% of the sample. 16.88% possessed tertiary education (university level). The remaining 8.86% of the respondents were the people who only finished their primary schooling (lower education standard)

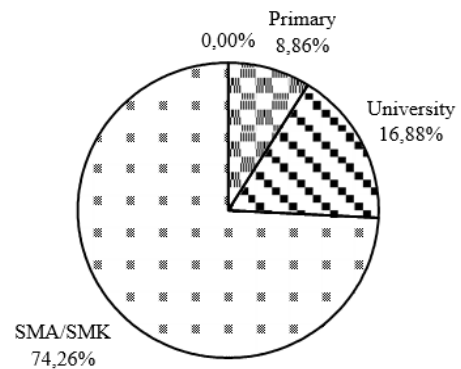


Figure 4. Level of Education of Respondent

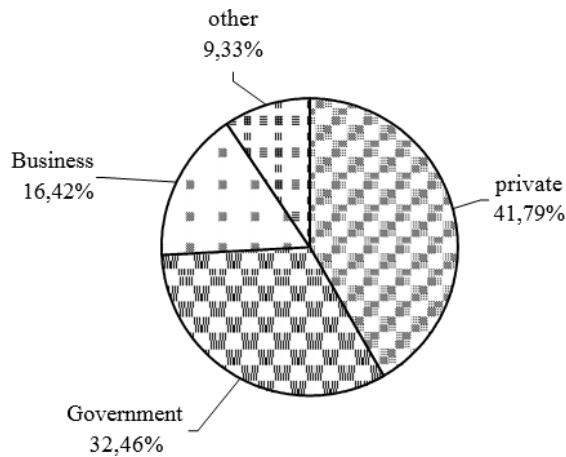


Figure 5. Employment of the respondents

From Figure 5, it appears that majority respondents are employed by private sector, which accounts for 41.79% of the total sample. Second highest is the government sector (32.46%) whereby business sector has employed 16.42% and other employment is 9.33% of the total respondents respectively.

The Income groups of the respondent are divided into 3:

- i. Rp. 2,000,000 – Rp. 3,999,999/month
- ii. Rp 4,000,000 – Rp. 7,999,999/month
- iii. > Rp 8,000,000

It also appears that different income group has different travel time costs. Assuming the ranges of the income per month as stated above did the groupings of the respondent.

Data Analysis

Mode Choice Approach Method

The most crucial data in mode choice approach is the percentage of respondent’s preferences that consumed new mode of transportation, travel time difference (minute), travel cost different (Rp) (from data compilation stage).

The formula of mode choice approach can be expressed as equation 1

$$P_q = a_0 + a_1 \cdot (C_p - C_q) + a_2 \cdot (T_p - T_q) \quad (1)$$

Where :

p = Private Car;

q = New Mode Transportation;

Equation 1 is adaptation from multilinear application where P_q is dependent variable (Y), $(C_p - C_q)$ is first independent variable (X_1), $(T_p - T_q)$ is second independent variable (X_2), a_0 is constants, a_1 is coefficient for first independent variable, and a_2 is coefficient for second independent variable.

$$Y = a_0 + a_1 \cdot X_1 + a_2 \cdot X_2 \quad (2)$$

Table 1 tabulates the results for Multi-linear regression.

Table 1. Result of Multi Linier Regression Using Mode Choice Approach

Data	Multi Linier Regression Equation
All data (Reduction data)	$Y = 0.464468 + 0.000171X_1 + 0.016656X_2$
Group 1	$Y = 0.429380 + 0.000200X_1 + 0.017634X_2$
Group 2	$Y = 0.472931 + 0.000162X_1 + 0.016496X_2$
Group 3	$Y = 0.538636 + 0.000116X_1 + 0.014443X_2$

Source: Data Analysis

Values of λ are obtained based on data from Table 1. Hence, the travel time values (λ) are shown in Table 2.

Table 2. Travel Time Value with Mode Choice Approach Method

Data	λ (Rp. / Hour / Res)	Percent of Data (%)
All Data (Data Reduction)	11,828	100,00
Group I	11,295	47,02
Group II	12.107	34,70
Group III	13.448	18,28

Source: Data Analysis

Income Approach Method

The computation of travel time by using *Income Approach Method* is quite straightforward. According to Lewis (2002) it only requires two input factors, which are namely Gross Regional Domestic Product (GRDP) of each people and annual work load (hours) of each people. Apparently, this method gives different travel time costs

compared with Mode Choice Approach Method. Analysis results for Income Approach method are as follows:

- Number of GRDP in year of 2014 = 1,971,245,936,982 (Tangsel dalam Angka,2014)
- Number of resident in year of 2014= 157,152 people (Tangsel dalam angka 2014)
- Annual working load = 2,000 hours, based on 1 week = 40 hours; 1 year = 50 effective working weeks.

Travel time cost is given by:

$$\frac{\text{GRDP/Person}}{\text{Annual Work Load/person}} = \frac{1.971.245.936.982 / 157.152}{2.000} = \text{Rp } 6.272,00$$

FINAL SUMMARY

From the comparison made between the study findings with the past researches, it was found that values of travel time costs obtained are varied. This could be affected by several factors. In summary, a few factors, which have led to the discrepancies of the results obtained, are:

- a. Discrepancy in analysis method could produce different results (values).
- b. Different basic assumptions applied in the computation methods. Despite of using the same method (income approach) but the past study has stated different assumption for annual working load. The geographical factor (different places-economy strength or currency exchange) also influences to the results obtained. Likewise, assumption for resident categories that configure GRDP, whether it refers to productive age level or it can refers to number of resident at productivity age level.
- c. Different type of survey methods conducted for the similar analysis would give different results. In the past study conducted, there were

variously method adopted in the collecting data process/stage, such as vehicle plate number recognition, questionnaires, roadside interviews, on board survey and stated preference survey.

d. Travel time cost is influenced by the journey purpose, income, and modes of transportation, viz:

- The value of business travel is higher than non-business travel
- A person with a higher income has higher time cost
- Private car commuters tend to have higher time cost compared with the public transport users.

CONCLUSION

The computed results show that travel time cost for the employees that commuted by private vehicles in BSD city (income approach) is approximately Rp 6,272/hour/person. On the other hand, with mode choice approach is Rp 11,828/hour/person. Travel time cost is different for the three different groups of income studied where the group with the highest income level has biggest travel time cost. Travel time increases proportionally with income, thus indicates that travel time is significant to the person's income.

Description of time value using income approach method and mode choice approach method was implemented based on objectives and compatibility of the methods used (e.g. convenience of data collection, results accuracy, time value sensitivity, and comparison with other methods). Income approach method only needs secondary data, which has less accuracy in the results obtained due to time value attained from approximate values for a study area. Whereas mode choice approach method is based on stated preference data survey, which enable the study to determine time value based on new mode utilities as the second preference. The time values that obtained from both methods have different values, which are not comparable due to the discrepancies in the assumptions made, fulfillment technique

applied, methodology applied, basic assumption made of the particular method used, and the survey methods used for the data collection.

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SUGGESTION

1. There were only 268 respondents have passed for the consistency test out of 500 respondents based on random sample method, which therefore has been used in the statistical analysis to obtain the study results. It is recommended that it would be better if stated preference form that used for the survey method is moderately and appropriately designed to facilitate and ensure that many respondents able to understand the conditions of choices addressed and passed the consistency test, so number of respondents according to random sample technique is fullfil.
2. To be more realistic, new attributes such as travel time and waiting time, comfortable, and number of mode transfer and also embedded number of characteristic such purpose of journey, income or living cost per month, type of transport mode, and environment condition should be added in the stated preference independent variables to ensure the accuracy of the results obtained.

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