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เรื่อง ขออนุมัติงบประมาณสนับสนุนการนำเสนอบทความวิชาการในการประชุมวิชาการระดับนานาชาติ

เรียน รองคณบดีฝ่ายวิจัยและบริการวิชาการ

ด้วย นายสิทธิา เจนศิริศักดิ์ ตำแหน่งผู้ช่วยศาสตราจารย์ ระดับ 8 สังกัดภาควิชาวิศวกรรมโยธา คณะวิศวกรรมศาสตร์ มหาวิทยาลัยอุบลราชธานี ได้รับการตอบรับให้นำเสนอผลงานวิจัย/ผลงานทางวิชาการ เรื่อง Values of bus travel time savings and services in Bangkok ในการประชุม/สัมมนาวิชาการนานาชาติ เรื่อง The 15th HKSTS International Conference ระหว่างวันที่ 11-14 ธันวาคม 2553 ณ เขตปกครองพิเศษฮ่องกง ประเทศสาธารณรัฐประชาชนจีน จัดโดย Hong Kong Society for Transportation studies และ Department of Civil and Structural Engineering , Hong Kong Polytechnic University

งบประมาณในการเดินทางทั้งสิ้น 62,750 บาท(หกหมื่นสองพันเจ็ดร้อยห้าสิบบาทถ้วน) ขณะนี้อยู่ระหว่างการขอสนับสนุนจากมหาวิทยาลัยอุบลราชธานี จำนวน 40,000 บาท(สี่หมื่นบาทถ้วน) ดังนั้น เพื่อเป็นการสร้างชื่อเสียงให้กับคณะวิศวกรรมศาสตร์ ภาควิชาวิศวกรรมโยธา จึงขออนุมัติงบประมาณการนำเสนอผลงานวิชาการในการประชุมวิชาการระดับนานาชาติ สำหรับบุคคลดังกล่าว จำนวน 22,750 บาท (สองหมื่นสองพันเจ็ดร้อยห้าสิบบาทถ้วน) รายละเอียดดังนี้

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27.9.53

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THE 15TH HKSTS INTERNATIONAL CONFERENCE

11-14 December 2010, Hong Kong

Organizers:



Hong Kong Society for Transportation Studies



Department of Civil and Structural Engineering,
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NOTES FOR PREPARING THE FULL PAPER

1. GENERAL INSTRUCTIONS

The full paper, in **MS WORD** or compatible formats, should be submitted to the online submission website (<http://editorialexpress.com/hksts2010>) by *July 31, 2010*. If you cannot submit the full paper through online submission, please send a floppy disk or CD containing the full paper by airmail to:

Dr. Agachai Sumalee
Chairman of the 15th HKSTS International Conference
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The Hong Kong Polytechnic University
Hung Hom, Kowloon, Hong Kong

Late submissions will not be selected for publication in the HKSTS Conference Proceedings.

The manuscript should be in English.

2. PAPER FORMAT

- A4 paper (210 mm wide by 290 mm deep) with 25 mm margins on all sides
- Times New Roman typeface in 11 point pitch
- Single spacing
- **8 pages maximum, including figures, tables, references, and appendices**
- Leave a blank line between paragraphs without indent
- Text should be justified across whole page width

3. STRUCTURE OF PAPER

3.1 First page

The first page of the manuscript should only contain the following, and in the order specified below:

- The title of the paper
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3.2 Second and following pages

These include the main body of the paper, divided into sections and (optionally) subsections with sub-subsections. Sections must be numbered and their title typed in bold capitals (for example, **1. SECTIONS**). Subsections must be numbered using two digits and their titles typed in bold typeface (for example, **1.1 Subsections**). Sub-subsections must be numbered using three digits and their titles typed in bold typeface (for example, **1.1.1 Sub-subsections**). Two blank lines must be left before each title of the sections and one blank line before each title of the subsections and sub-subsections, with the exception of new pages.

4. EQUATIONS, TABLES AND FIGURES

4.1 Equations

Equations must be typeset with the same word processor. They must be numbered and appear in the following format:

$$a + b = c \quad (1)$$

4.2 Tables

Tables must be numbered sequentially, with their title centered above the table.

4.3 Figures

Figures must be drawn in ink or with good quality graphic software. They must be numbered, with their title centered below the figure.

5. REFERENCES

The Harvard System of referencing must be used (see, for example, *Transportmetrica*). In the body of the text, papers or documents are referred to by the author's surname with the year of publication in parenthesis; if the quotation is itself in parenthesis, the year of publication is separated by a comma. If the reference has more than two authors, only the surname of the first author followed by *et al.* in italics will appear in the body of the text.

At the end of the paper, complete references must be given alphabetically by author's surname including: surname(s) and initials of author(s), separated by a comma, year of publication in parenthesis, title of the paper, title of the journal in italic typeface, volume of the journal, and first and last pages. In the case of books, the title of the book must be in italic typeface, with first letter capitals; the publisher and the city of publication must also be indicated. Examples:

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- Kanafani, A. and Abbas, M.S. (1987) Local air service and economic impact of small airports. *Journal of Transportation Engineering* 113, 42-55.
- Button, K.J. (1982) *Transport Economics*. Heineman, London.
- Nash, C.A. (1988) Integration of public transport: an economic assessment. *Bus Deregulation and Privatisation: An International Perspective*, eds J.S. Dodgson and N.P. Topham, pp. 17-46. Wiley, New York.
- Grant, R.A. (1989) Building and testing a causal model and information technology's impact. *Proceedings of the Tenth International Conference on Information Systems*, Boston, MA, pp. 173-184.
- Cardell, N.S. (1989) Extensions of multinomial logit: the hedonic demand model, the nonindependent logit model and the ranked logit model. Ph.D. Thesis, Harvard University, U.S.A.

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Department of Civil and Structural Engineering,
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Our ref: MS-139

31 August 2010

To: Sittha Jaensirisak
Email address: sittha.j@gmail.com

Dear Dr. Sittha Jaensirisak,

Acceptance for Presentation and Publication in Conference Proceedings

On behalf of the Organizing Committee of the 15th HKSTS International Conference, we are pleased to inform you that your paper:

Title: Values of bus travel time savings and services in Bangkok
Author(s): Sittha Jaensirisak, Agachai Sumalee, Sumet Ongkittikul

has been accepted for presentation and publication in the Conference Proceedings of the 15th HKSTS International Conference.

We also regret that we are unable to provide any financial assistance on airfare, accommodation and registration fee.

Please visit the conference website (<http://home.netvigator.com/~hksts/conf.htm>) for the latest updates regarding the Conference. Should you have any enquiries, please contact by e-mail the Conference Secretary, Dr. H.W. Ho, at: cehwho@polyu.edu.hk.

We thank you for your contribution and look forward to your participation in the 15th HKSTS International Conference.

Yours sincerely,

Dr. Agachai Sumalee
Chairman of the Organizing Committee of
The 15th HKSTS International Conference
c/o Department of Civil and Structural Engineering
The Hong Kong Polytechnic University

Values of bus travel time savings and services in Bangkok

Sittha Jaensirisak

Civil Engineering Department, Ubon Ratchathani University, Thailand

Agachai Sumalee

Department of Civil and Structural Engineering, Hong Kong Polytechnic University, Hong Kong

Sumet Ongkittikul

Thailand Development Research Institute (TDRI), Thailand

Abstract

A number of studies have been done on values of travel time savings in developed countries. It was found that the values of walking and waiting time were valued on average at twice or more in-vehicle travel time. In developing countries, cost-benefit analysis and travel demand analysis simply and often used this as a basic ratio. There is not clear whether this is applicable in their countries. This paper reports research in Bangkok on values of bus services, including: in-vehicle travel time, wait time, number of interchange, and crowded level on bus. The study found that waiting time is valued only 15% higher than in-vehicle travel time. Passengers are willing to travel 22 or 35 minutes longer on a bus to avoid one or two interchanges, respectively. Passengers are willing to wait 14 minutes at the bus stop for an un-crowded bus. The study also found that the values are influenced by trip purposes, travel time and vehicle ownership.

1. Introduction

A number of studies have been done on values of travel time savings in developed countries. For several decades, the valuation of travel time savings has been an important for social appraisal of public investments (Jara-Diaz, 2000). Thus, travel time reductions are quantified and valued. For example in UK, in 1980 the Department of Transport commissioned a major study of the value of travel time savings (MVA et al., 1987). Later in 2000, a further study of value of time also addresses other service values, e.g. value of walk time, wait time and service headway, associated with public transport use (Mackie et al., 2003). These values are also derived from a meta-analysis using a large data set of British empirical evidence (Wardman, 2001, 2004; Shires and de Jong, 2009).

For major road schemes, travel time savings is the most significant benefit, which may account for around 80% of the monetized benefits within the cost-benefit analysis (Mackie et al., 2001). Travelling by public transport involves walking and waiting for the services. Walk and wait time can be expected to be crucial values, which may be much greater than in-vehicle travel time (IVT). This is because there are fewer opportunities for making productive use of time, and it may be undertaken in a less pleasant environment (Wardman, 2004).

It was believed that the values of walk and wait time were valued on average at twice or more in-vehicle travel time. In a review of evidence from a number of developed countries, Steer Davies Gleave (1997) concluded that walking time is usually valued at between 1.8 and 2.4 times IVT (an average of 2.0 is recommended), and that waiting time is valued up to 4.5 times higher than walking time (a ratio of 3 times is recommended). For a review of British stated preference (SP) evidence, Wardman (2001) found that the values of walk, wait and headway were, on average, valued at 1.66, 1.47 and 0.80 times IVT, respectively. However, a more recent results reviewed by Wardman (2004) concluded that with erroneously influenced by SP evidence the values of walk and wait time are too low. It is recommended that it is reasonable to value walk time at twice IVT, and a weight of 2.5 for

wait time. In addition walk and wait time values can be expected to vary according to a wide range of socio-economic and situational factors.

In developing countries, a number of research conducted values of travel time, but there is lack of research on other service valuations. The ratio of twice of IVT for walk time may be used as a basic ratio. However, there is not clear whether this is application in their countries. This requires further research in developing countries.

Thus, the research in Bangkok (which to some extent may represent other congested cities in developing countries) reported here is to estimate values of bus services, including: in-vehicle travel time, wait time, number of interchange, and crowded level on bus. The paper firstly reviews studies on values of time in Bangkok in Section 2. The study method and data collection, which conducted bus users' attitudes and behaviour basing on a stated preference (SP) technique, is presented in Section 3. The behaviour model of bus users responding to service improvements is analysed and discussed in Section 4. Finally, conclusion is in Section 5.

2. Review of values of travel time in Bangkok

Previously, in Bangkok, values of travel time were estimated basing on income rate. In the Urban Transport Database and Model Development (UTDM) project (OCMLT, 1998) the values were based on 25% of average household hourly income in the year 1995. The values are different across household vehicle ownership. Average value of time is 0.80 Baht per minute. Households with no vehicle have the lowest value of time (0.44 Baht per minute), while households with multi vehicles have the highest value (1.30 Baht per minute).

Later, there are a few studies on values of travel time in Bangkok. The following selected results are based on reveal preference (RP) and stated preference (SP) surveys. During 2001-2005, under the two projects: Transportation Data and Model Center (TDMC) II and III (OTP, 2004; OTP, 2005), the values of travel time for different travel modes were estimated basing on a revealed preference (RP) data. The values of time vary among different travel modes and trip purposes. The highest value is 0.85 Baht per minute for work trip of car use. The lowest value is 0.27 Baht per minute for non-work trip of low comfort public transport (e.g. non air-condition bus and boat).

During 2006-2007, Bangkok Metropolitan Authority (BMA) studied feasibility of bus rapid transit (BRT) project (Krungthep Thanakom, 2007). It was found that the value of travel time saving on BRT was 1.20 Baht per minute. This estimation was based on SP data and mode choice multinomial logit model.

The most recent study in 2010 is the development of fare structure for public transport and integrated systems (OTP, 2010). The values of travel time for different modes of travel were estimated, basing on SP data. The highest value of time is 2.01 Baht per minute for car use, while the lowest value 0.80 Baht per minute for non air-condition bus.

Obviously, the values of travel time vary across the studies. They show that values of travel time are different among socio-economic groups and modes of travel. The variation is also likely to be because (1) the estimation methods are different, (2) the values have increased over time (due to increase of income and congestion level), and (3) the SP experiments are different in purposes of studies, choices offered, attributes included, and levels of attributes. This follows some considerable debate on the influence of the choice of method on the values of time, for example in Brownstone and Small (2002), and Wardman (2004).

For other service components of public transport use, e.g. wait time, walk time and interchange, there have no such study in Thailand, and also cannot find in other developing countries. The ratio of twice

of IVT for walk and wait time may be used. However, there is no evidence whether this is application in their countries.

3. Methodology

A stated preference (SP) technique was used to examine bus values of travel time and other service in Bangkok. The data collection and modelling issues are explained as follows.

3.1 Data Collection and Sample Characteristics

The main data collection was conducted by interviewing bus users during February and March 2009. The responses obtained did not indicate any problems with the SP exercise. The data set available for modelling purposes removes those who have not fully completed the questions contains 1,632 individuals.

The survey found that average travel time by bus from origin to destination in Bangkok is 65.7 minutes. This includes average access time 7.5 minutes (11%), wait time 12.6 minutes (19%), in-vehicle travel time 39.0 minutes (59%), and egress time 6.1 minutes (9%).

The SP survey was to study choice behaviour. Individuals were asked to choose between non air-condition and air-condition buses. The SP exercises contained five attributes including: bus fare, in-vehicle travel time, wait time, number of interchange, and crowded level on bus. Fare was in the unit of money. In-vehicle travel time and wait time were in the unit of minute. Three levels of the number of interchange were 0, 1, and 2. Three levels of crowded level on bus were "low", "medium" and "high".

If all attributes were presented in one exercise, respondents might have ignored some attributes because there were too many variables to consider. To overcome the problem, separate designs were used. Three SP exercises were designed. Each exercise contained three attributes: two basic attributes that were fare and in-vehicle travel time, plus an additional attribute (wait time for Exercise 1, number of interchange for Exercise 2, and crowded level on bus for Exercise 3). For each SP exercise, the fractional factorial design was used for selecting a subset of a full factorial design. In total, nine service scenarios were presented to each respondent.

3.2 Modelling Issues

The most straightforward means of analysing discrete choice is to calibrate a multinomial logit (MNL) model (Standard model). This can demonstrate the overall effects for the whole sample. Then the segmentation analysis can apply to examine the effects of personal characteristics.

The standard multinomial logit (MNL) model is a common analysis method for explaining choice behaviour, based on the random utility theory (Domencich and McFadden, 1975). It expresses the probability (P) that an individual *i* chooses some alternative *j* as a function of the utilities (V) of the *M* alternatives in the choice set, as defined in Equation 1.

$$P_{ij} = \frac{e^{V_{ij}}}{\sum_{m=1}^M e^{V_{im}}} \quad (1)$$

The utility (V) for any alternative *j* is related to relevant attributes (*X_j*) representing the alternative and individual situation, e.g. time and cost, which is defined as $V_{ij} = \sum_{k=1}^K \beta_{jk} X_{ijk}$. The estimation process

of utility parameters (β_{jk}) is widely based on the maximum likelihood estimation. The utility parameters (β_{jk}) can be interpreted as an estimate of the weight of attributes k in the utility function V_j of alternative j .

Segmentation techniques are used to explore differences between the personal characteristics of respondents. This can be done by using incremental factors that allow different marginal utilities across segments of the sample (MVA et al., 1987). The factors can be specified as $\sum_{y=1}^{n-1} \gamma_y d_{ky} X_{ijk}$.

Where γ_y is an incremental factor for the k^{th} attribute (X_k) and d_{ky} is a dummy variable denoting whether an observation is in the y^{th} group of n groups in a category. If so, d_{ky} is equal to one, otherwise zero. One of the groups in the category is chosen as a base. The incremental effects for other groups are relative to this base, so only $n-1$ dummy variables are defined. The utility function of

the alternative j is set as $V_{ij} = \sum_k \beta_{jk} X_{ijk} + \sum_{y=1}^{n-1} \gamma_y d_{ky} X_{ijk}$. Thus, in Equation 3, the coefficient of the

base group would be β_{jk} , and the coefficient of X_{jk} for the y^{th} group in the category would be $\beta_{jk} + \gamma_y$. This approach indicates the sign and size of any effect from the segmentation variable, and provides its statistical significance.

4. Behaviour model of bus users responding to service improvements

From the SP survey (Section 3.1) individuals were asked to choose between non air-condition and air-condition buses. Utility function of each service is shown in Equation 2.

$$\left. \begin{aligned} U_{\text{old service}} &= \beta_f (\text{Fare}) + \beta_t (\text{Travel Time}) + \beta_w (\text{Wait time}) \\ &\quad + \beta_{i1} (\text{Interchange 1}) + \beta_{i2} (\text{Interchange 2}) \\ &\quad + \beta_{c1} (\text{Crowd 1}) + \beta_{c2} (\text{Crowd 2}) \\ U_{\text{new service}} &= \text{ASC} + \beta_f (\text{Fare}) + \beta_t (\text{Travel Time}) + \beta_w (\text{Wait time}) \\ &\quad + \beta_{i1} (\text{Interchange 1}) + \beta_{i2} (\text{Interchange 2}) \\ &\quad + \beta_{c1} (\text{Crowd 1}) + \beta_{c2} (\text{Crowd 2}) \end{aligned} \right\} \quad (2)$$

Which

$U_{\text{old service}}$:	Utility of non air-condition bus
$U_{\text{new service}}$:	Utility of air-condition bus
ASC	:	Alternative Specific Constant
Fare	:	Bus fare
Travel time	:	In-vehicle travel time
Wait time	:	Waiting time at bus stop
Interchange 1	:	Dummy variable for one interchange (travelling with one interchange, "Interchange 1" = 1, and travelling without interchange, "Interchange 1" = 0)
Interchange 2	:	Dummy variable for two interchange (travelling with two interchange, "Interchange 2" = 1, and travelling without interchange, "Interchange 2" = 0)
Crowd 1	:	Dummy variable for "Medium" crowded bus (travelling on the "Medium" crowded bus, "Crowd 1" = 1, and travelling on the "Low" crowded bus, "Crowd 1" = 0)
Crowd 2	:	Dummy variable for "High" crowded bus (travelling on the "High" crowded bus, "Crowd 2" = 1, and travelling on the "Low" crowded bus, "Crowd 2" = 0)
β	:	Coefficients of the variables

The data was analysed using the standard logit model and segmentation model (Section 3.2). The alternative specific constant (ASC) for new service allows for any preference of the air-condition bus over the other, all other things equal.

For the basic model, without including the effects of personal characteristics, coefficients and their t-ratios are reported in Table 1. Tables 2-4 report the results of the models, segmented by trip purposes, household vehicle ownership, and total travel time, respectively. The overall ρ^2 goodness of fit is satisfactory, with figure around 0.1 that SP models typically achieve in conventional travel choice contexts.

The results show that the ASC has positive sign, indicating that in general the new service is significantly more preferable than the existing bus, when everything else is equal. All other variables have significant negative effects in the utility function, as expected, indicating that the utility would fall if the level of variables increases.

Table 1 Coefficients of the variables for the standard logit model

Variables	Coefficient	t-ratio
ASC	0.2544	4.3
Fare (β_f)	-0.0495	-11.4
Travel time (β_t)	-0.0629	-17.1
Waiting time (β_w)	-0.0722	-9.0
Interchange 1 (β_{i1})	-1.3519	-18.8
Interchange 2 (β_{i2})	-2.2198	-24.4
Crowd 1 (β_{c1})	-0.3725	-4.7
Crowd 2 (β_{c1})	-1.0371	-16.0
No. of observations	14688	
ρ^2 with respect to constants	0.0952	

However, different groups of people evaluate systems and attributes differently. We explore the extent to which results differ according to the characteristics of the personal characteristics by using the segmentation model. The effects of some variables examined (including gender, age of respondent and household income) are not significant (at 95% confidence level). Some variables, including trip purposes, household vehicle ownership, and total travel time, significantly affect on the choice. The incremental factors, representing the differences among the segments, are applied to the model in Tables 2-4.

Table 2 Coefficients of the variables for the logit model segmented by trip purposes

Variables	Coefficient	t-ratio
ASC	0.2652	4.5
Fare (β_f)	-0.0499	-11.4
Travel time (β_t) based group – Home based work (HBW)	-0.0568	-10.9
<i>Incremental factor</i>		
+ Home based school (HBS)	-0.0261	-5.0
+ Home based others (HBO)	0.0065	1.3
+ Non home based (NHB)	-0.0150	-2.0
Waiting time (β_w) based group – Home based work (HBW)	-0.0543	-3.3
<i>Incremental factor</i>		
+ Home based school (HBS)	-0.0439	-2.1
+ Home based others (HBO)	0.0019	0.1
+ Non home based (NHB)	-0.0752	-2.6
Interchange 1 (β_{i1})	-1.3437	-18.7
Interchange 2 (β_{i2})	-2.2055	-24.2
Crowd 1 (β_{c1})	-0.3781	-4.8
Crowd 2 (β_{c1})	-1.0285	-15.8
No. of observations	14688	
ρ^2 with respect to constants	0.0990	

Table 3 Coefficients of the variables for the logit model segmented by household vehicle ownership

Variables	Coefficient	t-ratio
ASC	0.2767	4.6
Fare (β_f)	-0.0532	-11.7
Travel time (β_t) based group – households without vehicle	-0.0371	-8.6
<i>Incremental factor</i>		
+ households with one car	-0.0442	-9.3
+ households with more than one car	-0.0738	-11.9
Waiting time (β_w) based group – households without vehicle	-0.0408	-3.7
<i>Incremental factor</i>		
+ households with one car	-0.0604	-3.6
+ households with more than one car	-0.0672	-3.1
Interchange 1 (β_{i1}) based group – households without vehicle	-1.3208	-13.3
<i>Incremental factor</i>		
+ households with one car	-0.0671	-0.5
+ households with more than one car	-0.3969	-2.2
Interchange 2 (β_{i2}) based group – households without vehicle	-1.9982	-15.3
<i>Incremental factor</i>		
+ households with one car	-0.2985	-1.5
+ households with more than one car	-0.9478	-3.9
Crowd 1 (β_{c1}) based group – households without vehicle	-0.2805	-2.5
<i>Incremental factor</i>		
+ households with one car	-0.1263	-0.7
+ households with more than one car	-0.3079	-1.3
Crowd 2 (β_{c1}) based group – households without vehicle	-0.7099	-8.2
<i>Incremental factor</i>		
+ households with one car	-0.4365	-3.5
+ households with more than one car	-0.9063	-5.6
No. of observations	14688	
ρ^2 with respect to constants	0.1135	

Table 4 Coefficients of the variables for the logit model segmented by total travel time

Variables	Coefficient	t-ratio
ASC	0.2520	4.3
Fare (β_f)	-0.0504	-11.5
Travel time (β_t) based group – total travel time less than 60 minutes	-0.0560	-14.6
<i>Incremental factor</i>		
+ total travel time 60 minutes or more	-0.0308	-6.5
Waiting time (β_w)	-0.0731	-9.0
Interchange 1 (β_{i1}) based group – total travel time less than 60 minutes	-1.1692	-15.1
<i>Incremental factor</i>		
+ total travel time 60 minutes or more	-0.9262	-5.5
Interchange 2 (β_{i2}) based group – total travel time less than 60 minutes	-2.0297	-20.1
<i>Incremental factor</i>		
+ total travel time 60 minutes or more	-0.9802	-4.6
Crowd 1 (β_{c1}) based group – total travel time less than 60 minutes	-0.3010	-3.4
<i>Incremental factor</i>		
+ total travel time 60 minutes or more	-0.3157	-1.7
Crowd 2 (β_{c1}) based group – total travel time less than 60 minutes	-0.9486	-13.3
<i>Incremental factor</i>		
+ total travel time 60 minutes or more	-0.4079	-3.1
No. of observations	14688	
ρ^2 with respect to constants	0.1007	

5. Conclusions

This paper reports research in Bangkok on values of bus services, including: in-vehicle travel time, wait time, number of interchange, and crowded level on bus. Based on the model in Tables 5-8, values of the services are calculated and presented in Table 9.

Table 9 Values of bus services in Bangkok

	Values of bus services in Bangkok						
	Preference in air-con bus (Baht)	In-vehicle Travel time (Baht/min)	Wait time (Baht/min)	Interchange 1 time (Baht)	Interchange 2 times (Baht)	Medium Crowded (Baht)	High Crowded (Baht)
Mean	5.14	1.27	1.46	27.31	44.84	7.53	20.95
Segmentation analysis based on trip purposes							
Home based work (HBW)	5.31	1.14	1.08	26.92	44.19	7.58	20.61
Home based school (HBS)		1.66	1.97				
Home based others (HBO)		1.01	1.05				
Non home based (NHB)		1.44	2.59				
Segmentation analysis based on travel time							
Less than 60 min.	5.00	1.11	1.45	23.18	40.23	5.97	18.80
60 min. or more		1.72		41.54	59.66	12.22	26.89
Segmentation analysis based on household (HH) vehicle ownership							
HH with no vehicle	5.20	0.70	0.77	24.81	37.54	5.27	13.34
HH with 1 car		1.53	1.90	26.07	43.14	7.64	21.53
HH with more than 1 car		2.08	2.03	32.27	55.34	11.05	30.36

The study found that wait time is valued only 15% higher than in-vehicle travel time. This may be because traffic situation in Bangkok is very congested, on board bus condition is not comfortable, and buses are usually crowded. Thus timing for riding (mostly standing) on the bus is not much more pleasant than timing for waiting bus. (This is very different to the situation in developed countries, which wait time is valued about twice the value of in-vehicle travel time.) However, the value of interchange is much more than the value of crowded level.

Passengers are willing to travel 22 or 35 minutes longer on a bus to avoid one or two interchanges, respectively. Passengers are willing to wait 14 minutes at the bus stop for an un-crowded bus.

The study also found that the values are influenced by trip purposes, travel time and vehicle ownership. Values of time and wait time for home based work (HBW) and home based other (HBO) trips are at the same level. Non home based (NHB) trips which usually are business trips during the day have higher values of time than home based work (HBW) trips. Surprisingly, home based school (HBS) trips have highest values of travel and wait time, which are 46% and 82%, respectively, higher than values of travel and wait time for home based work (HBW) trips. This may be because most students do not earn income themselves and often are less patient than adults, so they are likely to be careless in spending money. This may be a reason that they are willing to pay more to save time.

Those who travel longer than 60 minutes are more willing to pay more on travel time saving, less interchange, and less crowded bus than those who travel shorter than 60 minutes. As expected, households with more cars are also more willing to pay more on travel time saving, less interchange, and less crowded bus, if they need to travel by bus. This is likely to relate to income effect.

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