Willingness and Ability to Pay for a New Public Transport: a Case Study of Korat City, Thailand

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Abstract: Willingness to pay (WTP) and ability to pay (ATP) have been studied in several services to provide suggestion on service charge; for example, in water supply service, health care service, electric service, and education service. With regard to willingness to pay (WTP) and ability to pay (ATP) for using a new public transport can guide governments to justify suitable fare structure policy. This paper reports a study of WTP and ATP for a new public transport system in Korat city, Thailand, which could be a guideline for other small and medium size cities in developing countries.

Key Words: Willingness to pay (WTP); Ability to pay (ATP); Public transport; Value of travel time (VOT); Thailand

1. INTRODUCTION

Public transport systems in small and medium size cities in developing countries are typically in special forms of para-transit. They are usually unreliable, inconvenient and unsafe, while car and motorcycle are very convenient and relatively low travelling cost. Thus, car users and motorcyclists are highly captive to their respective modes (Emberger, 2008). Developing a high quality public transport system is extremely expensive for developing countries. Fare level based on full infrastructure and operation costs would be unaffordable by travellers.

Concerning on willingness to pay (WTP) and ability to pay (ATP) for using new public transport system can guide governments to justify suitable fare structure policy. For example, for a basic service of public transport, government may set a fare structure based on ATP which is affordable for most of travellers. With regard to better services, fare may be set based on WTP. This is particularly important in developing countries, where supporting public transport from government (subsidy) is limited, and most travellers cannot afford to pay for the full cost of services.

Willingness to pay (WTP) is an average highest value that customers are willing to pay for the service. In the case of public transport, WTP is the average highest fare that travellers are willing to pay for using the system.

Ability to pay (ATP) is an average highest value that customers have ability to pay for the service. In the case of public transport, ATP is the average highest fare that travellers have ability to pay for using the system. This is particularly important for low income travelers.

WTP and ATP have been studied in several services to provide suggestion on service charge; for example, in water supply service (Raje, et al., 2002; Al- Ghuraiz and Enshassi, 2005; Gunatilake et al., 2007), in health care service (Donaldson, 1999; Mataria et al., 2006), in electric service (Bose and Shukla, 2002), and in education service (Genshu, 2002).

In transport sector, there are a number of studies on the values of time and transport service, which can be interpreted as willingness to pay for time saving and service (for example, in MVA Consultancy et al., 1987, 1994; Wardman, 1998, 2001, 2004; Jara-Diaz, 2000; Lam and Small, 2001; Brownstone et al., 2003; Mackie et al., 2003; Khattak et al., 2003; O'Garra et al., 2007; Shires and de Jong, 2009; Rose et al., 2009). Fare schemes can considerably affect how travellers' decision to use public transport, so measuring WTP for fare policy changes is useful for a fare scheme reform (Chung and Chiou, 2017).

On the other hand, there are a few studies on ATP for transport service. This ATP may be referred as affordability. This refers to the extent to which an individual can afford to travel when they want to, and can be considered as the ability to make necessary journeys to work, school, health and other social services, etc. without having limit other essential activities (Carruthers, et al., 2005). It was suggested that in developing countries a reasonable level of household expenditure on bus travel should not exceed 10% of household income (Armstrong-Wright and Thiriez; 1987).

This paper reports a study result[1] on WTP and ATP for a new public transport system in Korat city, Thailand, which may be a guideline for other small and medium size cities in developing countries. The paper firstly reviews studies on willingness to pay for travel time reduction and ability to pay for public transport in Bangkok in Section 2. The study method and data collection, which conducted travellers' behaviour in Korat, basing on a stated preference (SP) technique, is presented in Section 3. The behaviour model of travellers in Korat is analysed and presented in Section 4. Then, WTP and ATP to pay for using a new public transport in Korat are presented in Sections 5 and 6, respectively. Finally, conclusion is in Section 7.

2. WILLINGNESS AND ABILITY TO PAY FOR PUBLIC TRNSPORT IN THAILAND

Over the last two decades, there have been a number of studies on willingness to pay (WTP) for public transport in Bangkok, Thailand. But the study on the ability to pay (ATP) was limited. This section reviews the WTP and ATP for public transport in Bangkok. However, they are not applicable for small and medium size cities. The study of WTP and ATP for a medium size city (Korat) is presented later in Section 3 and 4.

Previously, in Bangkok, values of travel time (VOT) 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, as shown in Table 1.

[1] The result is a part of a Study on Traffic and Public Transport Development Master Plan for Nakhon Ratchasima (Korat) City, in Thailand. This study was submitted to the Office of Transport and Traffic Policy and Planning (OTP), Ministry of Transport, Thailand (OTP, 2010).

Table 1. Values of travel time in Bangkok based on the 25% of average household hourly income in the year 1995

Vehicle availability group	Trip proportion	1995 Value of time (Baht[2] / minute)
No vehicle available	23.0%	0.44
One motorcycle available	34.4%	0.46
One car available	21.3%	0.95
Multi vehicle available	25.7%	1.30
Average		**0.80**

(Source: OCMLT, 1998)

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, as shown in Table 2.

Table 2. Values of travel time (VOT) in Bangkok based on the 2004 revealed preference (RP) data

Travel modes	Values of time (Baht / minute)	
	Work trip	Non-work trip
Car	0.85	0.72
Motorcycle	0.35	
Taxis	0.85	
Low comfort public transport	0.37	0.27
High comfort public transport	0.58	

(Source: OTP, 2004; OTP, 2005)

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.

In 2009, the study of “Development of Fare Structure for Public Transport and Integrated Systems”, based on the stated preference (SP) approach, found that the values of travel time saving in Bangkok (Table 3) are relatively higher than the previous studies’ values. The WTP for each mode were calculated based on the travel cost of their current modes plus travel time reduction (different travel times between using current mode and using MRT) multiplied by the value of travel time saving (VOT), as shown in Table 4.

Table 3. Value of travel time saving for different modes of travel in Bangkok in 2009

Travel modes	Value of time (Baht per minute)
Non-air condition bus	0.80
Air-condition bus and Van	1.03
Boat and Commuting train	0.85
MRT	1.20
Car	2.01

(Source: Jaensirisak and Paksarsawan, 2011)

[2] 1 USD is about 35Thai Baht in February 2017.

Table 4. Willingness to pay (WTP) for using MRT by each traveller group

Traveller groups	Average travel distance (km)	Willingness to pay for using MRT
		Baht per km
Non-air condition bus	9.9	2.6
Air condition bus	9.0	4.9
Van	12.3	4.0
MRT	8.7	4.6
Boat and Commuting train	10.4	2.2
Car	11.9	4.3

(Source: Jaensirisak and Paksarsawan, 2011)

The study also estimated the ability to pay (ATP) for using MRT. It was found that the average ATP is 3.9 Baht per km., which is at 65th percentile. At 50th percentile (50% of travellers have ability to pay for using MRT), ATP is 2.3 Baht per km (Jaensirisak and Paksarsawan, 2011).

Lately, in 2016 the “Study of Bus Development Master Plan in Bangkok” based on the stated preference (SP) experiment survey, estimated the values of travel time saving in Bangkok, as presented in Table 5).

Table 5. Value of travel time saving for different modes of travel in Bangkok in 2016

Travel modes	Value of time (Baht per minute)
Car	2.77
Air condition bus	1.61
Non-air condition bus	1.01
MRT	2.77
Boat	1.01

(Source: Department of Land Transport, 2016)

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).

3. METHODOLOGY

Korat is commonly known as a short name of Nakhon Ratchasima. It is one of the big major cities in the North-Eastern region in Thailand, about 250 km away from Bangkok. Korat city and its urban vicinity has about 400,000 residents within the area of 327 km^2. The current modal split is 31% for car, 50% for motorcycle and 19% for Songtaew.

A stated preference (SP) technique was used to examine values of travel time in Korat city. The data collection and modelling issues are explained as follows. The analysis results are used to estimate the WTP for using a new public transport system in Korat city.

3.1 Stated Preference (SP) Technique

Stated preference (SP) techniques are based on the presentation of hypothetical scenarios that are plausible and realistic to respondents. Each scenario represents a package of different attributes. The design process of an SP experiment can be summarised in four steps:

(a) Selection of a set of attributes. The characteristics of the hypothetical scenarios are represented by attributes that influence preferences.

(b) Specification of the number and magnitude of the attribute levels. Variations of the attribute values across scenarios need to be large enough for respondents to trade-off, otherwise they may be ignored.

(c) Experimental design – combination of the attribute levels. Design of the hypothetical scenarios is based on an experimental design which is usually fractional factorial rather than complete factorial. A complete factorial design contains all possible combinations of the attribute levels. A great advantage of the fractional factorial design is that the number of scenarios can be dramatically reduced from the full factorial design, while it still ensures that the main effects of the attributes are independent from the significant interaction effects, so that the main effects can be estimated efficiently.

(d) Design of response measurement. Respondents are asked to state their preferences towards each scenario. These responses are able to provide information based on how individuals evaluate the attributes in the designed scenarios.

In addition to the SP experiment, other components are also needed in a survey, for example questions gathering individuals' actual travel situations relevant to the study context, questions about the attributes of existing alternatives, questions about attitudes to alternatives, and personal details. These additional data are useful in analysis of SP data and explanation of the behavioural responses.

In this study, the SP exercises contained three attributes including: travel cost, in-vehicle travel time, and waiting time. Each attribute had three levels. Levels of the attributes were selected according to an assumed travelling between an origin and a destination. The SP survey was to study choice behaviour. Individuals were asked to choose between two choices: current mode, or a high quality bus (new public transport). The new transport mode was briefly described to respondents as an air-condition bus or light rail running on a dedicated lane. Two SP experiments were designed for car and motorcycle user groups. 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. A practical detail of the design of choice experiments can be found in Hensher et al. (2005).

3.2 Data Collection and Sample Characteristics

The main data collection was conducted during May and June 2016 by interviewing three travel mode users, including: car, motorcycle and Songtaew (an existing low standard public transport). In total there are 1,221 samples.

Table 6 presents the distribution of monthly household income for each traveller group. It clearly shows that most of those who use car are considered as high income group. Most of those who use motorcycle and Songtaew are from medium and low household income groups.

Table 6. Distribution of monthly household income for each traveller group

Monthly household income (Baht)	Car	Motorcycle	Songtaew
Number of samples	406	415	400
Less than 10,000	2%	12%	6%
10,000 - 19,999	22%	37%	18%
20,000 - 29,999	31%	26%	31%
30,000 - 39,999	16%	11%	19%
40,000 - 49,999	12%	5%	4%
50,000 or more	16%	9%	23%

3.3 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. The 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.

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

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, as defined in Equation 2.

$$V_{ij} = \sum_{k=1}^{K} \beta_{jk} X_{ijk} \tag{2}$$

The estimation process of utility parameters (β_{jk}) in equation (2) 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.

4. BEHAVIOUR MODEL OF TRAVELLERS IN KORAT CITY

This section presents data analysis results analysed from the SP data. This is based in the methods presented in Section 3.2. The utility function of each travel mode was set as a function of travel cost (in unit of Thai Baht), and travel time and wait time (in unit of minutes). The purpose of the SP experiment and this analysed model is for estimating value of travel time.

Table 7 reports the coefficients and t-ratios of the variables in the utility function of using each travel mode. The overall goodness of fit (ρ^2) is very high (with figure around 0.2 that SP models typically achieve in more conventional travel choice contexts). The coefficients of travel cost, travel time and wait time have significant negative effects on utility functions, as expected. When travel time and cost increase, the utilities would be reduced. The alternative specific constant (ASC) are significant positive for car and motorcycle, while the ASC for Songtaew is negative. These reflect that car and motorcycle would be more preferable than the new public transport, but Songtaew would be less preferable than the new public transport; when travel cost, time and waiting time are equal.

Table 7. Coefficients (t-ratio) of variables in the utility function for different travel modes

Variables	Car	MC*	ST*	New PT*
ASC	0.6192 (2.0)	0.8280 (2.6)	-0.2340 (-2.0)	
Cost	-0.0275 (-9.2)	-0.0384 (-12.7)	-0.0685 (-6.5)	-0.0255 (-4.3)
Travel time	-0.0470 (-11.2)	-0.0470 (-11.2)	-0.0470 (-11.2)	-0.0470 (-11.2)
Waiting time			-0.0584 (-9.4)	-0.0584 (-9.4)
Number of observations	10,989			
ρ^2	0.5266			

*Note: MC = Motorcycle, ST = Songtaew, PT = Public transport

From the models in Table 7, the values of travel time (Coefficient of time / Coefficient of cost) for different modes of travel were estimated as shown in Table 8. These values can be interpreted as willingness to pay for travel time saving by different travel mode users. The value of time for the new public transport is slightly higher than the value for car. This reflects travellers' expectation that travelling by the new high standard bus would be as convenient and comfortable as using car. Thus, a dedicated lane for the bus would be necessary.

Table 8. Value of travel time saving for different modes of travel in Bangkok

Travel modes	Value of time (Baht per minute)
Car	1.71
MC	1.22
ST	0.69
New PT	1.84

5. WILLINGNESS TO PAY FOR MRT

The willingness to pay (WTP) for using the new PT by each traveller group are shown in Table 9. The WTP for each group is calculated based on the travel cost of their current modes plus travel time reduction (different travel times between using current mode and using the new PT) multiplied by the value of travel time saving (VOT). The values of willingness to pay are in the unit of Baht per trip. Then they are divided by average travel distance to get to unit of Baht per km.

The values of WTP are different among travel mode users. The values of WTP by car, motorcycle and Songtaew users are 25 Baht per trip (2.01 Baht per km), 18 Baht per trip (1.59 Baht per km) and 23 Baht per trip (2.67 Baht per km), respectively.

The WTP per km by Songtaew users for a standard bus is higher than other mode users. This is likely because the current service by Songtaew is very slow and inconvenient, so they tend to more for a much better services. The WTP by motorcycle is lower that other mode users because travelling by motorcycle is very convenient with low travel cost, so they would willing to less than others.

Table 9. Willingness to pay (WTP) for using the new PT by each traveller group

Traveller groups	Average travel distance per trip (km)	Willingness to pay for using the new PT	
		Baht per trip	Baht per km
Car	12.4	25	2.01
MC	11.3	18	1.59
ST	8.5	23	2.67

6. ABILITY TO PAY FOR THE NEW PUBLIC TRANSPORT

In order to estimate the ability to pay (ATP) for using a new public transport, it is assumed that current travel expenses in each household is the maximum ability to pay for travelling on the best available travel modes[3]. In each household, each member is likely to use different travel modes, and each person is likely to use different travel modes for different purposes. However, the total household's travel expenses (by every member and on every travel modes used) should be limited in each household[4].

Therefore, if we assume that everyone in household travel by the new public transport, ATP per person per kilometre (km.) is equal to the total household's travel expenses divided by number of member in household and travel distance. ATP for using the new public transport per person per trip is equal to the total household's travel expenses divided by number of member in household and average number of travel trips.

In this study, as presented in Table 10, it was found that household's travel expenses (not include inter-city travelling cost) vary according to household income. With this available data, it is not possible to estimate ATP by different travel mode users. The ATP for using the new public transport in Korat city on average is 14 Baht per trip or 1.25 Baht per km. For those from low income group (less than 10,000 Baht per month), ATP is only 8 Baht per trip or about 0.7 Baht per km, which is much lower than the average value.

Table 10. Average Ability to pay for using the new public transport in Korat city by each household income group

Monthly household income (Baht)	Proportion (%)	Travel expense (Baht/month)	Average ability to pay per trip (Baht/trip)	Average ability to pay per distance (Baht/km)
No income	5	506	8	0.68
<5,000	10	620	8	0.75
5,000-9,999	24	653	8	0.72
10,000-14,999	23	905	12	1.09
15,000-19,999	14	1,352	18	1.63
20,000-24,999	11	1,468	21	1.83
25,000,29,999	7	1,642	23	2.05
30,000-39,999	3	1,857	26	2.32
40,000+	3	2,107	30	2.67
Average		**1,032**	**14**	**1.25**

[3] This is likely for low and medium income households, but may underestimate ATP for high income households. To the authors' knowledge, there is no theoretical basis to support this assumption. In other studies, ATP is calculated from travellers' survey.

[4] This may not be suitable on high income household group. However, it is a small proportion in developing countries.

7. CONCLUSIONS

This paper has reported a study result on willingness to pay (WTP) and ability to pay (ATP) for using a new standard bus in Korat city, which is considered as a medium size city in Thailand. The values of WTP are different among travel mode users. The lowest WTP is by motorcycle users, which is 18 Baht per trip (1.59 Baht per km). The highest WTP is by car users, which is 25 Baht per trip (2.01 Baht per km). The ATP for using the new public transport on average is 14 Baht per trip or 1.25 Baht per km. However, for low income group, ATP is only 8 Baht per trip or about 0.7 Baht per km, which is much lower than the average value.

The study found that travellers tend to be willing to pay more than they can afford. This is because the ATP in this study is estimated from current household's travel expense on their existing travel modes. When they face a better service, they may be willing to pay more. This however would increase their total household's expenses, which is likely to be a problem for low income people.

The WTP and ATP are important factors to be considered in the process of setting up fare structure for the new public transport, which is acceptable and affordable by most travellers. Therefore, for Korat city, the new public transport's fare between 0.7-1.6 Baht per km or 8-18 Baht per trip (between lowest ATP and WTP), should be tested in demand forecasting model. Then travel demand and revenue can be estimated. However, selecting a suitable level is depended on various factors, e.g. subsidy supported by government. If fare level is low, high subsidy is needed. The other issue is modal shift. If fare level is low, the new public transport will be crowded (level of service is low), which high demand are shift from Songtaew, thus there will be low modal shift from car.

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REFERENCES

Al-Ghuraiz, Y. and Enshassi, A. (2005) Ability and willingness to pay for water supply service in the Gaza Strip. *Building and Environment*, Vol. 40, 1093–1102.

Armstrong-Wright, A. and Thiriez, S (1987) Bus Services – Reducing Costs, Raising Standards*, World Bank Technical Paper No. 68*, The World Bank.

Bose, R.K. and M. Shukla (2001) Electricity tariffs in India: an assessment of consumers' ability and willingness to pay in Gujarat. *Energy Policy*, Vol. 29, 465-478.

Brownstone, D., Ghosh, A., Golob, T.F., Kazimi, C., and van Amelsfort, D. (2003) Drivers' willingness-to-pay to reduce travel time: evidence from the San Diego I-15 congestion pricing project. *Transportation Research Part A*, Vol. 37, 373–387.

Brownstone, D., and Small, K. A. (2002) *Valuing time and reliability: Assessing evidence from road pricing demonstrations*. Irvine: University of California.

Carruthers, R.; Dick, M. and Saurkar, A. (2005), *Affordability of Public Transport in Developing Countries*, Transport Sector Board, The World bank.

Chung, Y.S. and Chiou, Y.C. (2017) Willingness-to-pay for a bus fare reform: A contingent valuation approach with multiple bound dichotomous choices. *Transportation Research Part A*, Vol. 95, 289-304.

Department of Land Transport (2016) *Study of Bus Development Master Plan in Bangkok*, Department of Land Transport (DLT), Ministry of Transport, Thailand.

Domencich, T.A. and McFadden, D. (1975) *Urban Travel Demand: A Behavioural Analysis*. North-Holland, Amsterdam.

Donaldson, C. (1999) Valuing the benefits of publicly-provided health care: does ability to pay' preclude the use of `willingness to pay?. *Social Science & Medicine*, Vol. 49, 551-563.

Emberger G, Pfaffenbichler, P, Jaensirisak S and Timms P (2008) Ideal decision making processes for transport planning: a comparison between Europe and South East Asia. *Transport Policy*, 15, 341-349.

Genshu, L. (2002) Cost recovery for higher education: a study of undergraduate students' ability and willingness to pay in the Chinese Mainland. *International Journal of Educational Development*, Vol. 22, 549–550.

Gunatilake, H., Yang, J.C., Pattanayak, S. and Choe, K.A. (2007) *Good Practices for Estimating Reliable Willingness-to-Pay Values in the Water Supply and Sanitation Sector*, Economic and Research Department, Asian Development Bank, Philippines.

Hensher, D.A., Rose, J.M. and Greene, W.H. (2005) *Applied Choice Analysis: A Primer*, Cambridge University Press.

Jaensirisak, S. and Paksarsawan, S. (2011) Willingness and Ability to Pay for Mass Rapid Transit in Bangkok. paper prepared to present at *the 9th Eastern Asia Society for Transportation Studies Conference*, 20-23 June 2011, Korea.

Jara-Diaz, S. (2000) Allocation and valuation of travel time savings, in: D. Hensher and K. Button (Eds) *Handbook of Transport Modelling*, 304–319 (Amsterdam: Pergamon).

Khattak A.J., Yim, Y., and Prokopy, L.S. (2003) Willingness to pay for travel information. *Transportation Research Part C*, Vol. 11 137–159.

Krungthep Thanakom Co. Ltd. (2007) *Management system of Bus Rapid Transit*. Bangkok.

Lam, T.C. and Small, K.A. (2001) The value of time and reliability: measurement from a value pricing experiment. *Transportation Research–Part E*, Vol. 37, 213–251.

Mackie, P.J., Wardman, M., Fowkes, A.S., Whelan, G., Nellthorp, J., and Bates, J. (2003) *Values of Travel Time Savings in the UK*. Report prepared for Department of Transport. Institute for Transport Studies, University of Leeds.

Mataria, A., Giacaman, R., Khatib, R., and Moatti, J.P. (2006) Impoverishment and patients' "willingness" and "ability" to pay for improving the quality of health care in Palestine: An assessment using the contingent valuation method. *Health Policy*, Vol. 75, 312–328.

MVA Consultancy, Institute for Transport Studies University of Leeds, and Transport Studies Unit University of Oxford (1987) The Value of Travel Time Savings. *Policy Journals*, UK.

MVA Consultancy, ITS Leeds University, TSU Oxford University, (1994) Time savings: Research into the value of time. In: Layard, R., Glaister, S. (Eds.), *Cost-Benefit Analysis*, pp. 235–271. Cambridge University Press, UK.

O'Garra T., Mouratoa, S., Garrityd, L., Schmidtb, P., Beerenwinkelc, A., Altmannb, M., Harta, D., Graeselc, C., and Whitehouse S. (2007) Is the public willing to pay for hydrogen buses? A comparative study of preferences in four cities. *Energy Policy*, Vol. 35, 3630–3642.

OCMLT (1998) *Urban Transport Database and Model Development (UTDM) project*. Office of the Commission for the Management of Land Traffic (OCMLT), Thailand.

OTP (2004) *Transportation Data and Model Center II (TDMC II) project*, Office of Transport and Traffic Policy and Planning (OTP), Ministry of Transport, Thailand.

OTP (2005) *Transportation Data and Model Center III (TDMC III) project*, Office of Transport and Traffic Policy and Planning (OTP), Ministry of Transport, Thailand.

OTP (2010) *Development of fare structure for public transport and integrated systems*, Office of Transport and Traffic Policy and Planning (OTP), Ministry of Transport, Thailand.

Raje, D.V., Dhobe, P.S. and Deshpande, A.W. (2002) Consumer's willingness to pay more for municipal supplied water: a case study. *Ecological Economics,* Vol. 42, 391–400.

Rose J.M., Hensher, D.A., Caussade, S., Ortúzar, J. de D. and Jou, R.C. (2009) Identifying differences in willingness to pay due to dimensionality in stated choice experiments: a cross country analysis. *Journal of Transport Geography,* Vol. 17, 21–29.

Shires, J.D. and de Jong, G.C. (2009) An international meta-analysis of values of travel time savings. *Evaluation and Program Planning*, Vol. 32, 315–325.

Wardman, M. (1998) The value of travel time: A review of British evidence. *Journal of Transportation Economics and Policy,* Vol. 32, 285–316.

Wardman, M. (2001) A review of British evidence on time and service quality valuations. *Transportation Research Part E: Logistics and Transportation Review*, Vol. 37, No. 2/3, 107–128.

Wardman, M. (2004) Public transport values of time. *Transport Policy,* Vol. 11, 363–377.