PERSON TRIP DATA IN BANGKOK & FUTURE TRAFFIC DATA DEVELOPMENT PERSPECTIVE IN DEVELOPING COUNTRIES

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1. Introduction

The comprehensive transportation studies which were done based on person trip surveys in Bangkok are good examples to consider the future direction of person trip survey study in developing cities. During early stage of urban development in Bangkok, many transportation studies had been conducted with assistances from not only JICA but also other foreign organizations such as WB, ADB, etc., and now many relevant studies have been assigned to domestic consultancies with the responsibility of Thai government.

In this paper, the urban growth and development in transportation sector in Bangkok are firstly introduced. Secondly, main contents of the comprehensive studies on person trip surveys which were conducted during 1989-2004 periods are compared regarding relationship between urban growth and survey scale, uniqueness on travel behavior and survey method, etc. Also, significant issues on the design of person trip survey in developing cities like Bangkok were summarized. Thirdly, the paper presents the results from our travel behavior survey which was conducted in residential area of Thonburi side in order to compensate the modal choice model of TDMC III and introduces it as an example of person trip survey to meet with local context. Finally, we discussed future direction of person trip survey in developing cities.

2. Urbanization and Transportation Development

The urbanization in Bangkok generating from the national strategies for attentive urban based industrialization development to boost economic growth according to the first till the sixth master plans in 1961-1991, have brought about rampant migratory movements, overpopulation, spatial congestion and shortage, severely traffic chaos and accidents and hence significantly affecting household lifestyle and travel behavioral pattern. As people moving out of the city to seek for better quality of life with affordable housing areas to live in, it is no doubt that individuals will desire for mobility to travel farther in their average 1-2 hours journey work[1), 2)]. A new form of travel patterns will definitely be generated particularly increased number of transfer trips resulting in a longer travel time. In the past, there were only a few public transportations available in Bangkok, i.e., train, ferry, buses, taxis, tuk-tuk and rickshaw. Passengers could access to bus transport merely by walking or cycling. Then in the mid of 1970s another form of public transports came into service for feeding bus transport, i.e., ridesharing known as Song-taew (light-duty truck) and Si-lor-lek (small compact 4-wheelers). Later in 1980s, economic growth versus rapid motorization began, other means of transport such as motorcycle taxi, boat and vanpool have become alternatively available mode choices to cushion the rapid increase of travel demand and to ease passengers to arriving at their destination exactly just in time. In 1999, Bangkok mass transit system (BTS-Sky-train) was opened to service. The number of its ridership was not as many as expected at first due to it short distance operation and costly. Later on in 2004, metro line known as MRT was in operation. Still private transport plays a dominant role as the supply of public transportation does not meet a risen travel demand. A study of Chairatananon, 2002 shows that more than 40 percent of private car, 38 percent of bus transports and the rests share the modes.[3)] Nevertheless, there is an interesting missing link in terms of road network and travel pattern and characteristics (i.e., passengers using ferry, boat or motorcycle taxi to access to bus transports or mass transit) of people living in Thonburi side which should be brought into study and discussion for further direction of person trip survey.

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*Keywords: person trip survey, transportation studies

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3. Comprehensive Studies Based on Person Trip Survey in Bangkok

Bangkok Transportation Study (BTS) was first conducted in 1975 by German advisory Team. The study recommends three land-use patterns combined with two network strategies: a network oriented primarily towards the private car and public transport and a policy of restraint on the acquisition and use of private cars and no restraint on private cars. [4] In 1989, the first person trip survey (PTS) was carried out under assistance of Japan International Cooperation Agency or JICA to collect travel characteristics of BMA residents. [5] 15,000 households (1.2%) were selected for direct interview. Binary Logit Model was developed based upon trip purposes and mode choices between public transport, i.e., bus, expressway bus and rail and private transport, i.e., car, motorcycle, taxi and tuk-tuk. The survey was conducted within outer ring road, divided into 87 zones. PTS study provides significant outputs in terms of distribution and flow of person trips, modal split of traffic demand, etc. The study covering most of Bangkok's urbanized area however it does not follow administrative boundaries of larger Greater Bangkok Area or Bangkok Metropolitan Region (BMR), containing the provinces of Nonthaburi, Pathum Thani and Samut Prakarn. It also limits mode choices like feeder mode or paratransit in the study. The JICA model formulates a Trip Generation/Attraction Submodel as a linear function of population, employment and car ownership. According to Ratchapolsitte, 1989, he points out that its Model Split Submodel cannot be utilized to test changes in fares since it is formulated based upon the trip-end approach which does not take into account the effects of fares on mode choice. [6] In 1995, Urban Transport Database and Model Development Project (UTDM) was launched by Office of Commission for Management of Land Transport or OCMLT (which is currently OTP) aiming at studied the developments of appropriate transport models applicable to varying transport conditions in BMR, and a consistent transport planning database and procedures for its periodic updating. [7] The UTDM model comprised of person trip model and goods vehicle model. It structured to accommodate movement of people and goods by all modes including road, rail, water and air transports. Unlike JICA model and other models, the UTDM was intended to develop as the standard model to be used as the national model (NAM) which contains private transport, trip movement on road network and various means of public transport such as inter-provincial buses, trains, planes and ferries. 520 zones were selected in the study. Later in 1997, TDMC I (Transport Data and Model Center) was developed to enhance UTDM database system so as to provide transport and traffic information system suitable for using in planning, control, monitoring and decision making.[8] In the following years, TDMC II and TDMC III were implemented to improve and maintenance transport, traffic database system and traffic models for national level, and BMR & neighboring provinces and lastly to develop model for using at local level and being tool to plan and solve traffic condition in short term purpose in 2001 and 2004 respectively.[9], [10] Table 1 represents person trip survey studies in Bangkok.

Table 1: Person Trip Survey Studies in Bangkok

Launched year	Project	Agency	Model type	Mode	Household vehicle availability	Trip purpose	No of zones/ samples	Study area	Improvement from previous projects	Differences from previous studies	Recommendation for future project
1989	JICA*	JICA	Binary logit model to split public & private transport - Existing proportion to split private mode - Existing proportion to split public mode	Private, i.e., car, motorbike, taxi, tuk-tuk; Public, i.e., bus, expressway bus and rail	Vehicle available, No vehicle	Work, School, Business, Private	87 / 15000	BMA outer ring road	N/A	estimate independent variable, i.e., travel time, cost, no. of transfers	N/A
1995	UTDM**	OCMLT	Binary logit model to split public & private transport - Existing proportion to split private mode	Private, i.e., car, motorbike, taxi and special bus; Public, i.e., up-market & standard market	No vehicle One motorcycle One car Multi-vehicle	HBW HBE HBO NHB	520 / N/A	BMA and 4 adjacent provinces	N/A	recalibrate parameters, i.e., coefficient of time, cost and value of time	N/A
1997	TDMC I***	OCMLT	Binary logit model to split public & private transport - Existing proportion to split private mode	Private, i.e., car, motorbike, taxi and special bus; Public, i.e., up-market & standard market	No vehicle One motorcycle One car Multi-vehicle	HBW HBE HBO NHB	521 / N/A	BMA and 5 adjacent provinces	Improve network, urban transport planning data, analyze value of time	recalibrate parameters, i.e., coefficient of time, cost and value of time	Logit model will be of importance in detail analysis for more accuracy
2001	TDMC II	OCMLT	Binary logit model to split public & private transport - Existing proportion to split private mode	Private, i.e., car, motorbike, taxi and special bus; Public, i.e., up-market & standard market	No vehicle One motorcycle One car Multi-vehicle	HBW HBE HBO NHB	1521 / 2500	BMA and 5 adjacent provinces	Improve network, urban transport planning data, analyze value of time	recalibrate parameters, i.e., coefficient of time, cost and value of time	Consideration of Multinomial, Nested-logit and Mixed multi nomial logit model
2004	TDMC III	OTP	Binary logit model to split public & private transport - Existing proportion to split private mode	Private, i.e., car, motorbike, taxi and special bus; Public, i.e., up-market & standard market	No vehicle One motorcycle One car Multi-vehicle	HBW HBE HBO NHB	1521 / 1028	BMA and 5 adjacent provinces	Improve network, urban transport planning data, analyze value of time	recalibrate parameters, i.e., coefficient of time, cost and value of time	It should include the utility function of motorcycle taxi and also splite mode choice by using more choice model rather than existing proportion

Sources: *JICA: Medium and Long Term Plan for Road Construction at Bangkok in Thailand, 1989
**UTDM: Urban Transport Database and Model Development Project, 1998
***TDMC: Transport Data and Model Center, 1997, 2001, 2004

Note: The structure of mode choice model of all projects is identical originate from UTDM.
For the later projects, they just surveyed Personal Trip to update Value of Time for using as a parameter inner the model.

4. Introduce Alternative model for future traffic data study

According to the review of PT survey studies, it is apparent that these travel choice models may not be applicable to the project planning associated with para-transit and other new modes. For instance, a project planning of Blue Line extension subway to Thonburi side, some travelers have to commute between Thonburi and Bangkok sides by using para-transit (e.g. motorcycle taxi) and ferry. Note that the subway/metro line is quite a new mode of transport for Thonburi side living people. Hence, the exiting modal choice models may not be able to apply to this local context because their models do not include these modes. Our study team has therefore conducted the PT survey that is able to help develop mode choice model enabling to model these para-transit and subway choice's behavior using residential areas in Thonburi side as a case study. The following section describes PT survey procedures.

(1) Person-trip Survey of Blue Line Subway Extension Project

a) Study Area

The residential areas along the extension line of Blue Line Subway Project which is located at the west side of Chao Phraya River, Thonburi side are targeted. In this west area, there is mass rapid transit available except inter-provincial railway of SRT. In particular, car, motorcycle, route bus, para-transit and ferry play dominant modes. The households which have not owned vehicle usually use the route bus, para-transit and ferry for commuting.

b) Model Structure and Questionnaire Design

Since Bangkok people always have to make decision which mode to use among many available modes to travel/commute, it is factually appeared that more than two modes have been chosen. Therefore, our study team decided to apply the Multi-Logit model to capture Bangkok people travel behavior in this case. The modal choice model in the study includes car, motorcycle, taxi, bus, para-transit, ferry and subway. The designed variables are travel time, travel cost and transfer frequency.

Since the subway has not operated yet, we decided to develop the questionnaire design by assuming that subway is operating and being one of alternative modes through Stated Preference (SP) survey method. The questionnaire is designed to ask respondents to compare and choose among existing modes and subway. The example of SP question is shown in Figure 1. Note that Reveal Preference (RP) questions were also included in the questionnaire, i.e., travel purpose, travel pattern, socio-economic, etc.

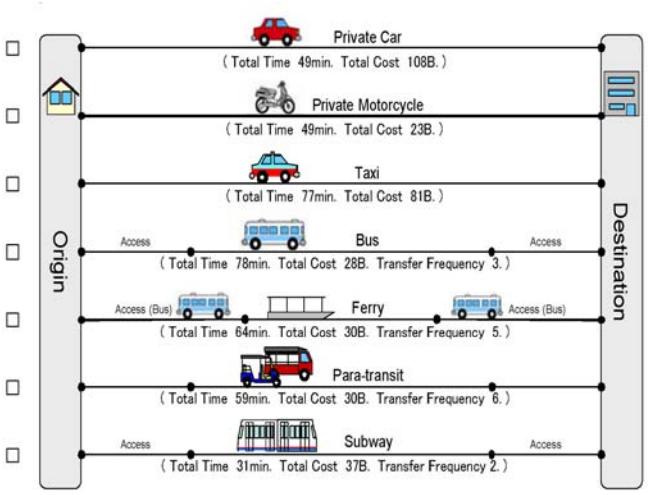

Figure 1: Example of mode choice questionnaire of SP survey

c) Statistical Analysis of Questionnaire Results

According to the RP survey, its result reveals respondents' choice behavior in selecting the exiting modes as shown in Table 2. More than a half of respondents chose to travel by route bus whereas a quarter chose private car. And, it is noticed that approximately 15% of them chose to commute by para-transit and ferry. This result was compared with existing portion of mode split from DTCM model there is no sign of any significant difference, however.

Regarding the results from the SP survey, as assumed subway was in operation, the change of mode choice between exiting mode and subway reveals significantly difference as shown in Figure 2. It shows that more than 60 % of users of all existing modes swift to use subway. Especially, it is nearly 80% of para-transit and ferry users swift to use subway. This result significantly proves that the mode choice model which is able to model para-transit is necessary.

Table 2: Summary of data from RP survey

Mode	Samplers	%
Car	131	24
MC	35	6
Taxi	23	4
Bus	287	52
Ferry	29	6
Para-transit	42	8
Total	547	100

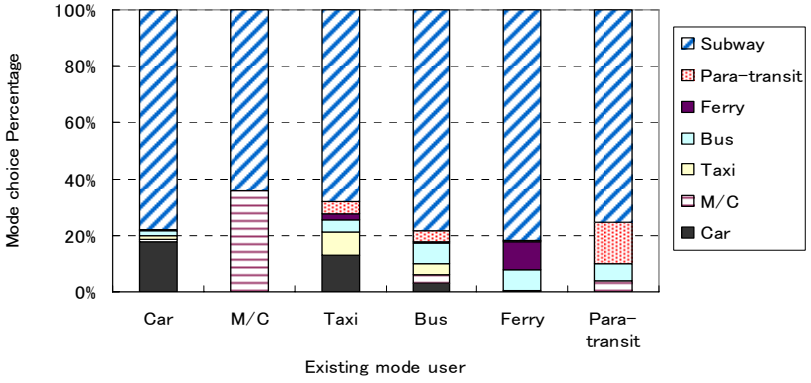

Figure 2: Change of mode choice from existing mode to subway

d) Results of Model Analysis

The results of model analysis are indicated in Table 3. The t-values of all variables, except transfer frequency, are statistically significant at 95% level of confidence and hence, the transfer frequency was eliminated from the model. The parameters of travel time and cost variables yield correctly minus value as if travel time and cost increase, the possibility of mode choice decrease. The parameters of constant variable of all existing modes have minus values. This implies that, assuming all of variables are identical, the travelers prefer to travel by subway. The likelihood ratio and hit ratio were high accuracy value. In conclusion, this developed model could positively model all modes, including subway, para-transit and ferry.

Table 3: Summary of results of model analysis

Variable	Parameter	t-value	Model accuracy
Constant term Car	-1.14E+00	-3.4	Roh 0.44781
Constant term M/C	-1.61E+00	-12.8	Roh_bar 0.44699
Constant term Taxi	-2.71E+00	-11.1	chi-square 2102.81984
Constant term Bus	-2.02E+00	-15.8	Hit-Ratio1(%) 76.31265
Constant term Ferry	-2.12E+00	-8.9	Hit-Ratio2(%) 61.00531
Constant term Para-Transit	-2.42E+00	-15.5	sample 1676
Travel Time	-6.74E-03	-3.8	
Travel Cost	-8.90E-03	-2.2	

5. Conclusion and Recommendation

Results of the study indicate a significant implication which helps to contribute to concluding in that the developed model could positively model all transport modes, including subway, para-transit and ferry. The study also entails some crucial issues and recommendations for future tasks in terms of:

- Micro level planning: recently many micro simulation models have applied the data from PT survey. Thus, on the process of model structure and questionnaire design, it would be better to consider the application on micro level planning as well.
- Motorcycle mode: the motorcycle is one of main transport modes for commuting not only in Thailand but also in other Asian countries. It is suggested to not exclude the influence of motorcycle on the transportation planning. It should be taken into consideration of including the motorcycle as one mode in the PT survey.
- Intra-zonal Trip: the matrix of TDMC3 includes the intra-zonal trip. It is however difficult to model on the assignment model
- Validation method: the four-step model results in daily traffic volume/passenger. However, in recently study, there is no traffic count through 24 hour. Therefore, it would be better to develop the data base of the validation.

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