URBAN TRAVEL BEHAVIOR IN DEVELOPING COUNTRIES: A CASE STUDY OF KHON KAEN CITY, THAILAND

Pattamaporn WONGWIRIYA[1], Fumihiko NAKAMURA[2],
Shinji TANAKA[3], Ryo ARIYOSHI[4]
and Shino MIURA[5]

[1]Member of JSCE, Doctoral student, Graduate School of Urban Innovation, Yokohama National University
(79-5 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan)
E-mail: pattamaporn-wongwiriya-cs@ynu.jp
[2]Member of JSCE, Executive Director, Vice President, Graduate School of Urban Innovation, Yokohama National
University (79-1 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan)
E-mail: nakamura-fumihiko-xb@ynu.ac.jp
[3]Member of JSCE, Associate Professor, Graduate School of Urban Innovation, Yokohama National University
(79-5 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan)
E-mail: stanaka@ynu.ac.jp
[4] Member of JSCE, Associate Professor, Graduate School of Urban Innovation, Yokohama National University, Japan
(79-5 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan)
E-mail:ariyoshi-ryo-np@ynu.jp
[5]Member of JSCE, Assistant Professor, Graduate School of Urban Innovation, Yokohama National University
(79-5 Tokiwadai, Hodogaya-ku, Yokohama 240-8501, Japan)
E-mail: miura-shino-xr@ynu.ac.jp

Recently, transport situation in many developing countries including Thailand changes quite rapidly especially an increasing number of private vehicles especially the number of the registered motorcycles and cars. This situation is one of the main reasons which caused the reduction of public transport usage in Thailand. Furthermore, the problem with private vehicle-dependent societies lies with its significant impact in the urban areas on both the environment and the quality of life. Therefore, it has been challenged to all Thai transportation planners for coping with this situation, one of the challenges is how to attract more public transit users in the urban areas. In other words, the study to support the reduction of the private vehicle usage is needed in Thailand. Thus, the study for encouraging Thai people to shift their mode to public transport should not look over. Then, the study to understand travel behavior of individuals in the city is the urgent issue. Therefore this paper provided the study regarding the travel choice behavior in Khon Kaen City among three modes which are Songtaew, motorcycle, and car to identify significant factors tending individuals to decide travel mode in the city. The result will be useful for improving the performance of urban transit in Khon Kaen City. This study would help to increase passengers on public transportation to support the sustainable transportation in the future.

Key Words : Travel Choice Behavior, Multinominal Logit Model, Developing Countries, Thailand

1. INTRODUCTION

Urban Transportation problem especially the rapid growth of motorization has become one of the main problems faced by many cities in developing countries. This situation is one of the main reasons which caused the reduction of public transport usage in Thailand. Furthermore, the problem with private vehicle-dependent societies lies with its significant impact in the urban areas on both the environment and the quality of life. Therefore, it has been challenged to all Thai transportation planners for coping with this situation, one of the challenges is how to attract more public transit users in the urban areas. In other words, the study to support the reduction of the private vehicle usage is needed in Thailand. Thus, the

study for encouraging Thai people to shift their mode to public transport should not look over. Therefore, this paper focuses on the travel choice behavior of people in Khon Kaen City to understand travel behavior of individuals in the city which is the urgent issue as mentioned previously.

This paper provided the study regarding the travel choice behavior in Khon Kaen City among three modes which are Songtaew, motorcycle, and car to identify significant factors tending individuals to decide travel mode in the city. The result will be useful for improving the performance of urban transit in Khon Kaen City. Moreover, this study would help to increase passengers on public transportation to support the sustainable transportation in the future.

This paper begins by providing the motivation of the study in this introduction part, followed by the overview of Khon Kaen City, the data collection and the research methodology. Finally, the paper concludes with the findings of the significant factors tending individuals to decide travel mode in the city of Khon Kaen as well as the recommended urban transportation policy to support the sustainable transportation in the future.

2. OVERVIEW OF KHON KAEN CITY

Khon Kaen City is centrally located in the northeast region of Thailand. Its total area is 46 square kilometers. The city is home to 326,643 people (in 2014)8). Moreover, Khon Kaen City has known as the central of economic, education, traffic and urban development in the north-east region part of Thailand. Khon Kaen City has the polycentric pattern of employment and education centers that allow people make many trips around the city. Sri-Jan Road is one significant arterial road of Khon Kaen City which is crossing the heart of its central business district (CBD).
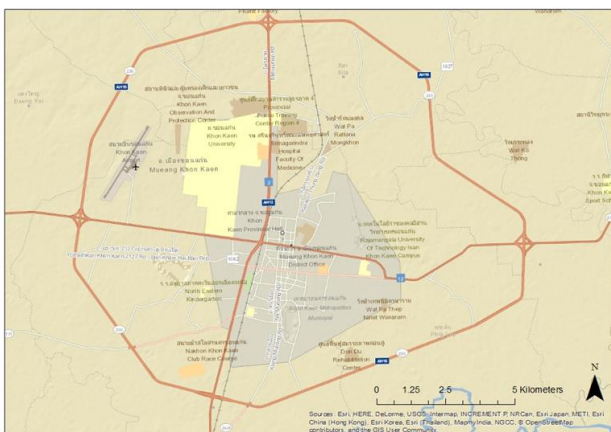

Fig.1 Khon Kaen City Map.

3. THE URBAN PUBLIC TRANSPORTATION IN KHON KAEN

Considering transport system in Thailand, there are various transport modes including paratransit. Nowadays paratransit plays a role as the predominant urban public transport mode in many developing countries, especially in Thailand where has various types of paratransit such as motorcycle-taxi, Tuk-tuk, Songtaew, and Silor-lek. Especially, Songtaew or a modified pick-up truck taking passengers on the back with an overhead cage and two-row seat in the back that can accommodate up to 20 passengers, operates as the primary mode of public transportation in many medium-sized cities of Thailand in cluding Khon Kaen City.

Based on the authors' field survey conducted in August 2015 about the existing Songtaew service, there are a total of 19 Songtaew service routes operated in Khon Kaen City as shown in **Fig.3**[4]. It can accommodate up to 20 passengers on any trip. Moreover, a flat-fare system is used, with adults costing 9 Baht and students costing 5 Baht. In Khon Kaen City, Songtaew is usually modified from a pick-up truck such as Toyota Hilux, ISUZU D-MAX, and ISUZU D-LUX as shown in **Fig. 2**. It operates by the private sector and local cooperative as a hail and ride service on fixed-route in the city as shown in **Fig.4 and Fig.5**.

At present, most of Songtaew waitng areas in Khon Kaen City can be categorized into two types which are 1) normal shelter with no route information, providing only number of songteaw route on the Songtaew stop stand as shown in **Fig.4**, and 2) no shelter and no route information as shown in **Fig.5**. The waiting areas of Songtaew must not be overlooked because the comfort of Songtaew stop can courage the people to use Songtaew service as well as can decrease risk of safety issues.
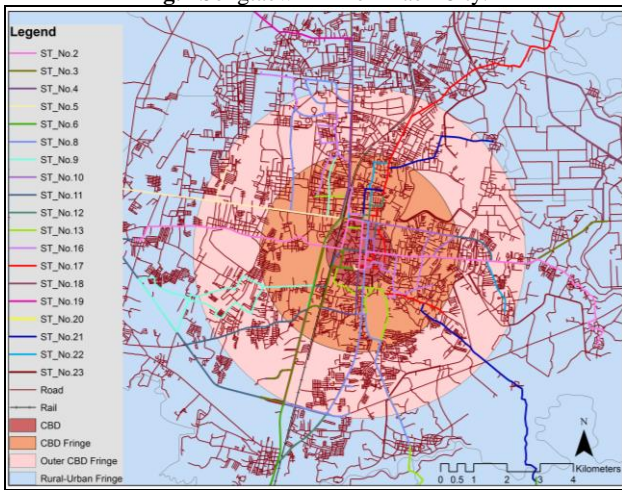
Fig.2 Songtaew in Khon Kaen City.

Fig.3 Khon Kaen City and Songtaew (ST) route service.
Source: Wongwiriya et al., 2017.

Fig.4 Songtaew waiting area:
normal shelter with no route in formation.

Fig.5 Songtaew waiting area:
no shelter and no route information.

4. DATA COLLECTION AND ANALYSIS

To study the travel choice behavior, the author analyzed results from a dataset derived from a comprehensive field survey conducted among urban travelers in Khon Kaen City, in order to investigate the travel choice consideration of people in Khon Kaen City. This study was carried out in Khon Kaen City to capture travel behavior, attitude on Songtaew service. 602 samplings were successfully obtained for respondents whose their trips were made for going to work or going to school in Khon Kaen City.

The modal shift might be defined as the primary goal of this research. The approach to be taken before considering modal shift are to identify individuals' perception and their travel behavior through the analysis of mode choice model among car, motorcycle, and Songtaew in the urban area of Khon Kaen City. To clarify this issue, the specific research objective is defined as to identify significant factors tending individuals to decide travel mode choice for regular trips in the urban area of Khon Kaen City. Moreover, taking into account possibility of Songtaew development in Khon Kaen City to support the sustainable transportation which aims to reduce the dependency of private vehicles, the research needs to identify policy variables influencing individual selecting Songtaew or private motorized vehicles through the comprehensive field survey conducted among urban travelers in Khon Kaen City. Then the recommendation for Khon Kaen City should be made to reduce the use of private vehicles as well as to encourage more Songtaew usage to support the sustainable transport in the future.

Based on the previous studies, there is a relationship between travel mode choice and individual characteristics such as their attitudes and perception, type of activities and socio-economic profile. The level of service of alternatives is also affecting travel mode option. Therefore, **Fig. 6** shows the framework of the trip mode choice study in Khon Kaen City. There are three primary transport modes in Khon Kaen City; 1) Songtaew (ST), 2) Motorcycle (MC), and 3) Car for Khon Kaen citizen to choose for their regular trip both going to school and going to work as can be seen in **Fig. 6**. According to the previous paper studied by the authors, the factors which affect the user of Songtaew in Khon Kaen City are safety, comfort, reliability, and flexibility. Therefore, these factors also have been considered in this study to find the significant factors tending individuals to decide travel mode choice for regular trips in the city center of Khon Kaen City besides travel cost, travel time, driving license ownership, income, gender, age, and

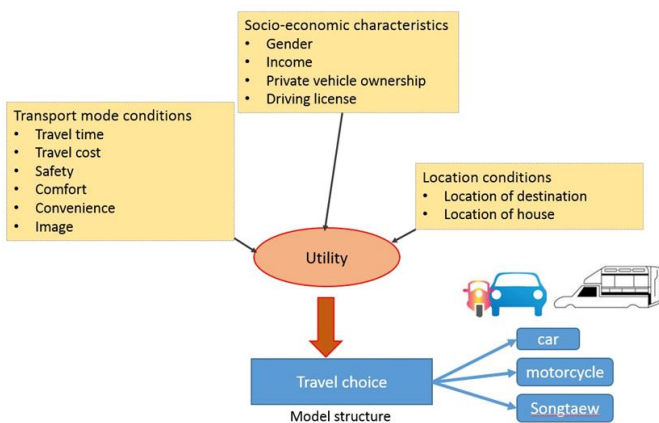other socio-economic factors of the travelers.

Fig.6 The framework of travel mode choice study.

The multinomial logit model of regular trips in Khon Kaen City was developed among car, motorcycle, and Songtaew to analyze the mode choice behavior in the city center. In particular, the discrete choice model is the random utility theory used for comparing choice behavior. This model is familiar to analyze both individuals and household's behavior mainly related to the transportation policy. Discrete choice model is widely used in the demand analysis, the evaluation of the effectiveness of the transportation strategies (Chen et al., 2014). Many studies examined the significant factors in the commuters mode choice to support urban transit management by developing Multinominal Logit Model (MNL) which is one of the discrete choice models, and MNL can deal with more than two alternatives which suit to the situation of the urban transport in this study since there are mainly three different options for the travelers in Khon Kaen City.

In this study, the author adapted multinomial logit model (MNL) using the mlogit packages developed by Yves Croissant, Universite de la Reunion. Croissant noted that "Mlogit is a package for R which enables the estimation of the multinomial logit models with individual and alternative specific variables" (Croissant, 2015).

5. MODE CHOICE MODEL OF TRAVEL CHOICE BEHAVIOR IN KHON KAEN CITY

Since this study applied MNL to analyze the preference of travelers under different transport mode conditions and determine the factors that significantly affect their mode choice behavior, in order to improve the urban transportation in Khon Kaen City efficiency. Then MNL was developed among car, motorcycle, and Songtaew in the urban area of Khon Kaen City.

602 travelers were the respondents for modeling choice considering behavior among car, motorcycle, and Songtaew. Choice Set alternatives were defined as 1: for Car, 2 for Motorcycle (MC), and 3 for Songtaew (ST). The mode choice model estimation was summarized in Table 8.1. The model estimation results show that the overall model performance was significant. However, some of the explanatory variables were not significant. Considering the significance, some of the estimated parameters are significantly different from zero at 95% and 99% confidence level. All standard errors are reasonable. Moreover, the model performs rather well; McFadden's R squared was 0.529 suggesting a rather strong explanatory power of variables. In other words, a model is well fit. Values of 0.2 to 0.4 for rho-squared represent EXCELLENT fit (Hensher and Stopher,1979). The output illustrated that the Songtaew constant obtained from the MNL model is statistically significant. Travel cost, travel time, Image of transport mode, safety condition of the transport mode and house location are playing an important role in traveler's choice behavior for regular trips in Khon Kaen City. This study excluded the status of car ownership, driving license, comfort, reliability and flexibility issues since the t-value were not significant. Moreover, the standard errors were also not stable.

6. CONCLUSIONS

According to this analysis, travel cost, travel time, safety, image condition of the transport mode and individual characteristics have considerable effects on Khon Kaen City travelers' travel choice. Based on the estimated model, it can be concluded that travel cost, travel time, safety and image condition of the transport mode should be the policy variables which are influencing people in Khon Kaen City selecting their travel mode choice. Considering the encouragement of reducing private vehicles' dependency in the city to support the sustainable transportation in Khon Kaen City. The policy plan for Khon Kaen Transportation Development in order to encourage more Songtaew use is needed following the findings of this study.

Regarding model results, more travelers would shift to Songtaew if shortening the travel time, reducing the travel cost and increasing the satisfaction of safety issue. Thus the reduction of the travel time of Songtaew service which means all the waiting

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time and the in-vehicle time would significantly enhance the possibility of the Songtaew service chosen by people in Khon Kaen City. In conclusion, this paper analyzed the travelers' choice behavior through discrete choices model in Khon Kaen City. The cost, travel time, safety and image were the essential variables that have a significant impact on the travel choice behavior in the city. Some recommendation were provided after identifying the influence of these factors on the selection model results. Such as improving the Songtaew service by shortening the travel time including the waiting and in-vehicle time, enlarging transit service coverage areas and increasing the safety issue primarily control the drivers' driving behavior. The fare of Songtaew is already acceptable since cheaper than another mode. However, it should not be set too high in the future. Because of the median and low-income people tend to choice Songtaew to make their trip.

Moreover, it is necessary to enhance the connection with the new public transport mode which will be proposed to the city in the future to form the role of Songtaew and integrate with the other modes such as feeding of the passengers. If all the recommendation policies can be carried out together, this can lead the car and motorcycle users to select public transportation which is Songtaew and improve the choice probability of public transit as well to support the sustainable transportation and make Khon Kaen City is more sustainable in the future.

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