Evaluating Accessibility to Bangkok Mass Transit System: Case Study of Saphan Taksin BTS Station

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Abstract—Access to the mass transit system, including rapid elevated and underground transport has become an outstanding issue for many cities. The mass transit access development should focus on behavioral responses of the different passenger groups. Moreover, it should consider about the appearance of intent-oriented action related accessibility that was explored from user's satisfaction and attitudes related to services quality. This study aims to evaluate mass transit accessibility from passenger's satisfaction, therefore, understanding the passenger's attitudes about mass transit accessibility. The study area of this research is Bangkok Mass Transit system (BTS Skytrain) at Saphan Taksin station. 200 passengers at Saphan Taksin station were asked to rate the questionnaires survey that considers accessibility aspects of convenience, safety, feeder connectivity, and other dimensions. The survey was to find out the passenger attitudes and satisfaction for access to the BTS station, and the result shows several factors that influence the passenger choice of using the BTS as a public transportation mode and passenger's opinion that needs to concern for the development mass transit system and accessibility performance.

Keywords—Urban transportation, user satisfaction, accessibility, Bangkok mass transit.

I. Introduction

MASS transit system has become an outstanding issue for many cities. However, enhancing high usage of the systems often conflicts with providing suitable accessibility and has become an increasing criticism on long term of transportation sustainability. Thus, the issue of accessibility has reached a crisis point in many expanding cities.

The quality of urban mass transit system depends on many aspects, such as the standard of the connections between different transport modes [1]. In many mass transit systems, there are many problems posed by inconvenient transit trip from several transfers.

With the mass transit development, the station accessibility is the most important. Accessibility to the station is a factor of the transportation efficiency and effect to passengers. The convenient accessibility attracts more passengers. Thus, the station should be developed with the accessibility for all passenger groups. The way travelling to the station should be sustainable that promotes walking, cycling, and public transit [2], [3]. Based on the previous research, the main way to access the transit node can be divided into four ways. Access by car

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requires parking area and drop off area. Access by public bus can decrease traffic jam and pollution around the station [4]. However, the users have to spend more time for travelling to the station because they need to wait for the bus. Time schedule at transit station should be related with other transit system. For the access by walking, the design of the pedestrian around the station is important to attract the passengers to the station [5]. The environment of the pedestrian such as convenient, safety and security and easy for access could be attractive for more passengers, and the success of the public transportation depends on how to access the station especially by pedestrian [6]. The last one is the access by bike that could attract passengers more than walking, because travelling time to the station is faster than walking. Access by bike could reduce waiting time for the bus and reduce pollution around the station [7].

Accessibility to the station should smoothen transfers from one mode transit to another mode transit that could attract and enable high accessibility for all users. However, the passengers may arrive at the station by many ways, the station planning and design should provide comfort accessibility for all user and all modes of transportation. Walking mode is the last mode of transportation before boarding to transit vehicle, planning and design should be smooth transfer and safe movement of pedestrian between one to other modes at the station.

This study aims to evaluate mass transit accessibility performance across user by multi-dimensional indicators. The findings can be useful for improving and development on the mass transit project in the study area and other areas.

II. Accessibility to Bangkok Mass Transit Systems

A. Bangkok Mass Transit System

Bangkok seems to have an urban transit system, where urban and transport planning is not necessarily executed keeping the interest of the people. The Bangkok Skytrain has been operated since 1999 and has helped to serve people with their demands on travel and the advantage as the mass transit mode compared to the buses. The Bangkok skytrain is possibly a step in the right direction to solve the public transport issue. The skytrain consists of 36.92 kilometers elevated railway system that operates above the street system in Bangkok. The skytrain has two lines that it operates, the Sukhumvit line and the Silom line. There are today 35 stations along two routes. However, Bangkok mass transit has many problems posed by inconvenient transit trip from several transfers such as the connection area, environmental around transit station, and have not yet achieved the main goals to reduce the number of private vehicles and attract more ridership.

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B. Accessibility

Consideration needs to be given to the item inventories of the mass transit system in the prospect of the availability and quality in enhancing mass transit accessibility.

From the beginning of BTS skytrain, a total of 13 routes of free shuttle bus feeder service were provided by BTSC, and they yielded quite good performance. It could handle approximately 20,000 passengers/day. Unfortunately, shuttle bus service was reduced to six routes in 2001, four routes in May 2004, only one route in September 2004 under the responsibility of private company as a result of financial problem. Unlike developed countries, there are many ways to access mass transit station other than walking and public bus in present such as, hired motorcycle, taxi, mini bus, Tuk-tuk. Normally, the passengers access to the station by four modes; walking, private vehicle, public bus, and paratransit (such as hired motorcycle, taxi, mini bus, Tuk tuk). Three most popular means to BTS station are walking, bus, and hired motorcycle within 2-kilometer radius from the stations [8].

III. METHODOLOGY

This research aims at integration of multi concepts of accessibility such as transport connection, environment, psychosocial, for evaluating mass transit accessibility performance with empirical methods and it improves environments and accessibility of the station to facilitate passengers travel to the station and increase the number of passengers. The evaluation process of the study is in combination with various aspects of mass transit accessibility based on a proper set of indicators to demonstrate appropriately the mass transit accessibility performance.

A. Site Selection

The criterion for selection of site station depends on the visibility, the city accessibility characteristics, factors, and impacts based on data supporting research process. The Saphan Taksin BTS station was selected for survey in this study.

B. Questionnaire Survey

The passengers' questionnaires were completed by 200 individuals interviewing BTS passengers at the Saphan Taksin station. Data collection was administered in various times on different days of week. The questionnaires were therefore composed of three parts related to individual passenger information, such as gender, age, occupation, origin and destination, time and cost, and other crucial dimensions such as environment, comfort, connectivity, safety and security, mass transit access trip, and attitude to use BTS. Survey participants were chosen randomly within the station. The survey was based on qualitative research conducted through in-depth face to face interviews. The data were disaggregated by different social groups including men, women, the elderly and disable people.

In the general question, the respondents were asked about their personal information and frequency of using mass transit. In the mass transit access trip, the respondents were asked to explain their trip patterns and detail of access the BTS station such as walking time, waiting time, vehicle time, and number of modes used for access to the station. Moreover, they were requested to explain why they selected that station, and reasons for selections. In the attitudes, all of respondents were asked about their knowledge for mass transit, their attitudes with access to the station, service quality, and access facilities at the station. All respondents were requested to rate their attitudes on five-point satisfaction scale, with rating ranging from "1 = very dissatisfied", "2 = dissatisfied", "3 = average", "4 = satisfied", and "5 = very satisfied".

C. Data Analysis

The responses to the questionnaires were analyzed using various statistical methods and different criteria. The relationship between characteristic of respondents and factors such as accessibility service, safety was determined by chi-square test. The influence of gender, age, income, occupation also was test using chi-square test.

IV. RESULTS

A. An Overview of Site Station

Saphan Taksin BTS station was established in high development area with business and commercial. Diversity of uses nearby the station is a major driver of intense activity centers that can enhance accessibility. The population, housing, and physical surroundings density at the stations are very high. Moreover, Saphan Taksin station was the only one BTS station that connected to a river transportation. Based on site survey, Saphan Taksin station presents a variety of feeder modes including bus, taxi, hired motorcycles, boat and other para-transit modes.

B. The Passenger's Characteristics

Table I shows the passenger's characteristics; more than half (64%) were female, and only 1.5% were over 50 years old, disable people accounted for about 2.47%. The respondents around 84.89% are Thai people, and 15.11% are foreigner. The majority of the respondents are within the worker group around 61.40%, and 38.60 of respondents are non-worker group including students and unemployed group. The average income falls in the rage of 10,000 – 15,000 THB/month (USD285-428). More than half have one or two vehicles in household.

In addition, the respondents were given a question asking them to indicate their current residential location and their destiny. Almost 76% of respondents live far from the station (more than 500 m radius) where the results are classified by three categories including location A: live within 500 m radius from the station and can walk to the station with 5-10 minutes (24%), location B: live beyond 500 m radius from the station within the same station district (74.3%), and location C: live outside station district (1.7%).

C. The Station Facilities

The primary function of transit station is the provision of facilities. Thus, passengers can access the transit station. Table II shows the station facilities at Saphan Taksin station. According to site analysis and survey, the walking access facilities at Saphan Taksin station are unfriendly for all user

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groups especially for elderly and disable people. The station design limitations are not only in walking conditions, but also in the availability of basic facilities such as elevators and any other instrumental function. Parking services are also not available at the station.

For the feeder modes, bus transit is the major feeder of the Saphan Taksin station about 11 bus lines. Boat transit is also available at these stations to travel in Chaopraya River. Paratransits such as taxis, share taxis, hired motorcycles are also feeder for Saphan Taksin station. Based on the survey, access to the Saphan Taksin station always consists of a mixed access pattern mode, such as bus and walk, bus and boat, bus and hired motocycle, walk and boat. This phenomenon influences access costs and behavioral responses across the passenger groups.

were female passengers. Table III shows that majority of the passengers are within the working age between 20-50 years including students and college students. From the table, 63% and 3.5% of the respondents are satisfied and very satisfied respectively on service factors. However, only 28.5% and 10.5% are satisfied and very satisfied on the safety factors. There are 109 respondents (54.5%) rating at the average level for the environment around the station, while 60 passengers (30%) are satisfied and seven passengers (3.5%) are very satisfied. The mean of the item is 3.24. 102 passengers (51%) are satisfied with the accessibility convenience, and 110 passenger's respondents (55 %) are satisfied with the operation system.

TABLE I
PASSENGER'S CHARACTERISTIC

Passenger's characteristic		(%)
Gender		
Male	72	36
Female	128	64
Total	200	100
Nationality		
Thai	170	85
Foreigner	30	5
Total	200	100
Age		
<20 years old	35	17.5
21-30 years old	129	64.5
31-40 years old	20	10
41-50 years old	13	6.5
>50 years old	3	1.5
Total	200	100
Non-disable or disable		
Non-disable	195	97.5
Disable	3	1.5
Blind	1	0.5
Other physical impairment	1	0.5
Total	200	100
Income		
<10,000 THB/month	20	10
10,000-15,000 THB/month	99	49.5
15,000-20,000 THB/month	41	20.5
20,000-25,000 THB/month	10	5
25,000-30,000 THB/month	21	10.5
>30,000 THB/month	9	4.5
Total	200	100
Occupation		
Non worker	77	38.5
Worker	123	61.5
Government officer	20	10
Hired employee	103	51.5
Total	200	100
Vehicle in household		
No vehicle	85	42.5
1-2 vehicle	109	54.5
>2 vehicle	6	3
Total	200	100
Trip per week		
<5 trips/week	44	22
5-8 trips/week	102	51
>8 trips/week	54	27
Total	200	100

D. Satisfaction of the Passengers

The questionnaires were completed by 200 individual passengers, among which 36% were male passengers and 64%

TABLE II
STATION FACILITIES AT SAPHAN TAKSIN STATION

Station facilities	Conditions	
Pedestrian and bicycle access	1. Sidewalk	The width is between 1-3 m.
	2. Bicycle parking	n/a
	3. Parking area	n/a
	4. Stair/elevators/escalators	No elevator
	5. Floor	Concrete
	6. Sky walk	n/a
Disadvantage and elderly access	7. Time table	Available
	8. Priority way for disable users	n/a
	9. Information for disable and elderly users	n/a
	10. Adequate signage for blind	n/a
	11. Elevators	n/a
Connectivity	12. Bus lines	11 lines
	13. Boat	River ferry and Express boat
	14. Train	n/a
	15. BRT (Bus rapid transit)	n/a
	16. MRT Subway	n/a
	17. SRT (Suvarnabhumi Airport Rail Link)	n/a
	18. Paratransit	Available

n/a = not available

TABLE III
SATISFACTION OF THE PASSENGERS

Factor	Result				
	Services	Safety	Environment	Accessibility	Operation
Very dissatisfied	2 (1%)	1 (0.5%)	2 (1%)	1 (0.5%)	1 (0.5%)
Dissatisfied	14 (7%)	36 (18%)	22 (11%)	2 (1%)	7 (3.5%)
Average	51 (25.5%)	85 (42.5%)	109 (54.5%)	82 (41%)	70 (35%)
Satisfied	126 (63%)	57 (28.5%)	60 (30%)	102 (51%)	110 (55%)
Very Satisfied	7 (3.5%)	21 (10.5%)	7 (3.5%)	13 (6.5%)	12 (6%)
Mean	3.61	3.31	3.24	3.62	3.63

E. Satisfaction of the Passengers

Table IV shows the relationship between the BTS passengers' satisfaction on various factors and their characteristics, as the frequency of use per week. The result of the Chi-Square test shows that frequency of use the BTS per week is related to satisfaction with easy to using BTS service with the significance level at 0.023. Occupation and frequency of use the BTS per week are related to the suitable of service times from 6.00 – 24.00 daily with the significance level at 0.027 and

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0.011, respectively. Age and frequency of use the BTS per week are related to satisfaction with the number and variety of shops in the station areas with the significance level at 0.029 and 0.016, respectively. In addition, the suitable of ticket fare and comfort due to presence of information in the station are related to frequency of use the BTS per week with the significance level at 0.011 and 0.003, respectively.

There is the only one variable, gender related to night time security from crime with the significance level at 0.001. This means that female passengers are less satisfied than the male passengers. Non-disable or disable is related to satisfaction on safety in and out the station and the safety of stairs connection to the station with significance level at 0.41 and 0.35, respectively. Besides, only the purpose for using BTS is related to satisfaction with the area surrounding the station with the significance level at 0.002. Furthermore, the result demonstrates that the purpose for using BTS is related to satisfaction with the factor ease of movement inside the station in rush hour with the significance level at 0.009, respectively.

Moreover, non-disable or disable is related to the factor, the number of elevators, escalators, stair and moving walkways with the significance level at 0.012. It means that the passengers who are non-disable are more satisfied with this factor than disable people.

The result of the Chi-square test demonstrates that the age, the purpose for using BTS, and the frequency of using the BTS per week are related to satisfaction with the factor, the passenger managing system in the station, with the significance level at 0.003, 0.015, and 0.052, respectively. The age, the purpose for using BTS, and frequency of use the BTS per week are also related to satisfaction with the punctuality of the vehicle time with the significance level at 0.007 and 0.002, respectively. Finally, the purpose for using BTS is related to sufficient route of the station with the significance level at 0.001. Most of the passengers used BTS when they were going to work, study, return home, and shopping about 6 times per week with rate levels of satisfaction at the average.

TABLE IV
THE SUMMARY OF CHARACTERISTICS AND FACTORS BY CHI-SQUARE TEST

	Gender	Age	Non-disable or disable	Occupation	Income	Purpose	Frequency
Service							
Easy to using the station							•
Comfort of information in the station							•
The suitable of ticket fare							•
The suitable of service time				•			•
The number and variety of shops in the station areas		•					•
Information about service delays or disruptions							
Safety							
Safety in and out the station			•				
The safety of stairs connection to the station			•				
The number of security guards							
The reliability in safety systems of the station							
The safety of the areas surrounding the station							
Night time security from crime	•						
Environment							
Air quality and pollution in the area surrounding the station						•	
Interior design of the station							
Exterior design of the station							
Cleanliness of the station							
Accessibility							
Ease of access to the station							
Ease of movement inside the station in rush hour							•
Number of elevators, escalators, stair and moving walkways			•				
Distance from the entrance of the station to the platforms							
Operation							
The maintenance of the station building							
Sufficient route of the station						•	
The passenger managing system in the station		•				•	•
The punctuality of the vehicle time		•				•	•

V. CONCLUSIONS

The purpose of this research is to evaluate the passenger's satisfaction at the mass transit node, and Saphan Taksin station was selected for this study. It is apparent that most of the passengers studied in this research are satisfied with the following factors: services, safety, environment, accessibility, and operation. However, most of the passengers were respondent on average with safety and environment around the station. The passengers feel unsafety when they are travelling to the station at night especially female passengers. The safe

and efficient movement of passengers to and from transit station to other transit mode is important for transportation development. The guideline development for mass transit node should consider more about the environment around the node but if the mass transit node has good environment and safety that could attract more passengers. For the future studies, this paper is still at a preliminary stage of the study. The passenger satisfaction should focus on the development of the mass transit system.

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