

Chapter I

Introduction



1.1 Background

There is a growing trend of dependency on private modes of transportation, particularly automobiles, in many metropolitan areas in developing countries, such as those in South East Asia. The growth rate of motorization cannot be sustained by road network expansion. Hence, serious traffic congestion, increasing number of traffic accidents, excessive use of petroleum energy, and deterioration of air quality are undoubtedly at the top of the list of these major cities' problems. To deal with these problems, greater utilization of public transportation must be promoted. Recently, there are five countries in the region where mass transit systems for their capital cities are developed, four systems of which are heavy-rail.

A major problem faced by mass transit authorities in countries like Thailand and Philippines is that the ridership has failed to meet the forecasted level. The main reasons of the failure include limited rail transit network coverage comparing to road network, competition rather than complementarily with other mode of public transportation (e.g. bus service) in same corridor, and the lack of accessibility for trips from origin to transit station. It was found that the majority of beneficiaries of mass transit are likely to be existing public transport users in developing cities while switching from private car to mass transit is less likely to occur [1]. In order to make mass transit work effectively, transit system should be attractive enough to magnetize a large number of passengers. To solve the problem by rail network expansion is very expensive and takes a long time to implement. Moreover, bus route operational reforms usually receive little attention from policymakers and sometimes need more synchronization among transportation institutions. Therefore, one potential to attract directly as many people as possible by the improvement transit accessibility should be explored more toughly in order to provide a cost-effective and efficient solution.

Studies from advanced countries revealed that factors affecting mass transit ridership can be categorized into four groups: transit level of service, accessibility,

land use, and users' characteristics [2]. The first group and certain elements of the second group are in the transit operator's domain where the operators have full authorities to enhance the system in order to gain more ridership. Pedestrian accessibility to transit has been long recognized as an important factor in determining ridership. Transit use decreases as walking distance to reach station increases. It was showed that transit ridership declines exponentially with walking distance to the transit stop [2]. This research concentrates on accessibility to mass transit system in order to attract more passengers, especially to attract those who live within mass transit's catchments areas. Other study showed that to focus on those people has great potential in increasing overall transit ridership [3].

1.2 Research Objectives

Unlike other transit studies, this research concentrates more on convenience and comfort issues related to making access trips reach mass transit station. For example, the role of station features, such as the availability of escalator, is taken into account. The objective of this research is to propose effective policies on station accessibility improvements in order to increase mass transit ridership for selected mass transit systems in developing countries, particularly in Thailand and Philippines.

There are many accessibility parameters that might influence mass transit use. Therefore, the main problem that the research aims to answer is how improvement of station accessibility parameters can increase mass transit ridership. More specifically, how parameters of accessibility on the path to reach the station and access facilities of the station can increase mass transit attractiveness in order to gain more ridership by persuading more travelers to use the system more frequently and encouraging mode shifting to mass transit. This problem can be decomposed into several sub-problems as follow: (1) what are the important factors that can encourage the use of mass transit system; (2) how do accessibility parameters influence the mode shifting to mass transit within mass transit corridor areas; (3) how do the station accessibility components (i.e. access mode facilities, layout and vicinity) and their interaction with people who want to use the mass transit system can be evaluated and be formularized as station accessibility measure; and (4) how can the accessibility measure be applied to evaluate improvement program in order to increase mass transit ridership.

Note that the accessibility of public transportation can be evaluated as the interaction between components of the transportation system and people who attempt to use it. The understanding of how these factors affects the likelihood of using mass transit which will be achieved by mode choice modeling and frequency modeling as the critical tools to address the research questions.

1.3 Research Assumptions, Limitations and Terminologies Used

The main assumption in this research is that the characteristics of mass transit service such as fare, train headway, train speed and train capacity are the given condition. This assumption leads to the research limitation that although fare discount and service improvement might have role in transit use, their influence is not the main issue that will be addressed by this research.

Another important assumption is that, within station coverage area, each individual has free choice to use at least two access modes, with walking as one of them, to reach his or her desired station. Thus, the locations in remote areas where there is a high dependency of car user, for example, are not considered. Also, the elderly and people with disability are not a major concern in this research.

Some terminology that will be used in this research and defined as follow:

- Transit is defined as a form of public transportation with fixed route and operating schedule (e.g. bus and train).
- Station coverage area is defined as a circular area with radius of 1000 meters from mass transit station. Vuchic [4] suggested using maximum walking distance to define the coverage area; however, the distance varies in many studies. For instance, Stringham [5] used the distance of 1,200 meters while Halden [6] used 2,000 meters. In studies with GIS application, it is common to use the distance of 800 meters to access mass transit [7]. In the case of Singapore, it was found that to access mass transit stations, about 90% of users were willing to walk the distance shorter than 1,000 [8].
- An existing mass transit user is defined as a passenger whose trip originated within the station coverage area and often or regularly uses the mass transit system. On the other hand, a potential mass transit user is defined as an individual who trip originated within the station coverage area but never or rarely uses mass

transit system. The potential users are the main target in this research in order to increase more mass transit ridership.

- Access trip is a trip from originating point (e.g. home) to the desired station in order to use transit. Egress trip is a trip from the end transit station to the desired destination.
- The literal meaning of walking accessibility is how easy it is to walk to reach transit station. Similarly, station accessibility is defined as how easy a station can be accessed regardless of mode. In this research, accessibility can be seen as the results of interaction between transit elements and individuals who attempt to use the transit system. Thus, the idea of accessibility is related to assessing how these elements become obstacles to access the station which can be affected by the design of transit infrastructure, terminal layout, and the station's vicinity.
- Metro Manila or Manila Metropolitan covers thirteen cities including the City of Manila. In this research, the name of Manila is associated with Metro Manila. The study area of Bangkok is associated with Bangkok Metropolitan Area (BMA) while Sapporo is associated with the City of Sapporo.

1.4 Expected Research Results and Its Benefits

The results from this research can give a better picture of how well transit system provides a convenient way for traveling, especially for commuting trips. The integrated accessibility parameters and model of mass transit use will have several advantages as follow:

- It can be used to assess the quality of access trip more in detail. Effect of transit accessibility on travel behavior can be captured and investigated more easily.
- Transit coverage area can be altered to maximize the benefit improvements of the access conditions such as reducing effort of walking to access station, more feeder modes, and adding new station, extension transit line, or applying new transit technology.
- The assessment framework of accessibility can be applied to prioritize policies to upgrade transit access facilities in order to increase transit ridership, especially in developing countries. Market share strategies to attract more passengers can be drawn from the results of this research.

1.5 Structure of the Dissertation

This dissertation comprises nine chapters. First chapter is the introduction chapter that describes research motivation, objective, general research assumption and limitation, expected results, and their benefits.

The second chapter provides discussion of the literature related to this research. In the first part of the chapter, various factors that affect transit ridership are reviewed. In the second part, characteristics and evaluation methods of walking as a transportation mode and access mode are outlined. A discussion of the lack of transit ridership that this research attempts to address is provided in the first part, whereas the reasons for the lack of walking to access are discussed in the second part.

The research framework, one of the critical parts of this dissertation, is presented in the third chapter, which explains the research activities in chronological order, followed by discussion on the methods that were used for developing the mode choice model and ridership evaluation. How to integrate accessibility parameters into those assessments is also discussed as well in this chapter.

The fourth chapter discusses data collection and data processing. Characteristics of mass transit system in the study areas are presented first, followed by the description of data collection process. Data summary and initial analysis are presented at the end of the chapter.

The development of mode choice model is presented in the fifth chapter. How to encourage mode shifting to mass transit is examined with the data of the both study areas are. The development of station accessibility measure and its application into the mode choice model is discussed in the following chapter.

The seventh chapter discusses the development of frequency of transit use model. How to persuade people to use mass transit more often is examined. The eighth chapter discusses the walking accessibility model. Summary of findings from the models development is presented in the last chapter. The discussion about research conclusion and policy implications from the research results is presented as well, including some suggestions for future research.