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Public transport travel time perception: Effects of socioeconomic characteristics, trip characteristics and facility usage

Meng Meng*, Andreas Rau, Hita Mahardhika

TUM Create, 1 Create Way, #10-02 Create Tower, Singapore 138602, Singapore

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ABSTRACT

Perceived travel time in public transport trip directly affects passengers' satisfaction and therefore is an essential consideration when planning and operating the public transport system. However, beyond the prevalent analysis on the waiting time perception, there are few articles that have studied the travel time perception along the entire multimodal trip. In this context, this paper presents an empirical investigation of actual and perceived travel time at each stage in a bus-rail transport trip, where first mile, in-vehicle stage, transfer stage and last mile are considered. Data on actual and perceived travel time, socioeconomic characteristics, trip characteristics and facility usage are collected by accompanied survey undertaken from passengers' originations to destinations. The results from a series of paired *T*-tests show that passenger do perceive travel time to be greater than the actual amount at each stage. Three linear regression models are developed for estimation of perceived walking, waiting and in-vehicle time. Results indicate that socioeconomic characteristics, trip characteristics and facility usage seem to have an impact on passengers' travel time perception, while the travel time spent on the previous stage does not affect the perception much.

1. Introduction

Travel time is one of the core elements that heavily affects the passengers' opinions on the quality of public transport service (Krygsman et al., 2004). Nowadays, passengers often use more than one traffic mode or service to complete the trip. Accordingly, the total travel time includes all supplementary travel times between the origin and destination such as wait time, walking time, etc. An example is shown in Fig. 1, where a passenger first walks from his/her home to the bus station, then takes one bus to a Mass Rapid Transit (MRT) station, then finally walks to the office. This trip contains three traffic modes viz. walk, bus and MRT, with five trip stages, first mile, first main haul (bus), transfer stage, second main haul (MRT), and last mile. Correspondingly, the travel time in this trip includes out-of-vehicle time and in-vehicle time, where out-of-vehicle time contains walking time and waiting time.

Studies have found that passengers may not perceive the travel time accurately due to various factors (Hess et al., 2004; Psarros et al., 2011; Dewulf et al., 2012). Taking waiting time at public transport station as an example, passengers generally expect to get on the bus as soon as possible. Being exposed to lack of comfort, crowding, and poor weather condition, passengers often perceived waiting longer than they actually spent (Beirão and Cabral, 2007). Therefore, it is more reasonable to use passengers' perceived travel time instead of actual travel time in traffic planning and operation. Currently, to our best knowledge, existing studies on the travel time perception focus on one particular trip stage and none of them has investigated the travel time perception on the basis of a complete trip (Diab et al., 2015; Meng et al., 2016). Meanwhile, most of the studies put the attention on the influence of passengers'

* Corresponding author.
E-mail address: meng.meng@tum-create.edu.sg (M. Meng).

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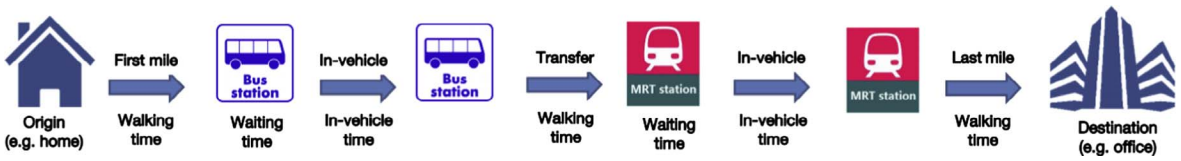

Fig. 1. Trip stages and travel time in a multimodal public transport trip.

socioeconomic characteristics and trip characteristics on the travel time perception, while the influence of facility usage and the effects of the previous trip stage have not been explored clearly.

Based on the afore-mentioned concerns, the objective of this paper is to identify the differences between perceived and actual travel time in a multimodal trip, and then quantify the perceived travel time through a linear regression model. To achieve these objectives, three questions need to be discussed through the analysis from filed survey, which are: firstly, are there always perception differences for all travel time components; secondly, what factors influence the perception; thirdly, how to quantify the perceived travel time. Having established the study's motivation, the rest of the paper is structured as followed: the next section provides a brief background of past works on travel time perception. Then, a description of our methodology and presumption is provided, followed by the models and results. Findings are summarised at last. The outcomes of this paper could provide foundation for other modellers and traffic planners, especially when considering multi-modal mode choice scenarios in a public transport system.

2. Literature review

Travel time perception has been a hot topic of interest in the public transport field with rising importance of passenger satisfaction. Actual travel time is the clock time difference between the departure and arrival. Perceived travel time is the duration that the passenger felt that he/she was spending between the departure and arrival. Generally, the perceived travel time could be either greater or lesser than the actual travel time due to various reasons. One of the classical findings on time perception by Vierordt (1868) was that short activities were usually overestimated while long activities were usually underestimated. Many similar studies were conducted on time perception (Yarmey, 2000; Block and Gruber, 2014), in which the studies on travel time perception have made good progress. Table 1 lists most of the represented studies on travel time perception in recent years.

It can be seen from Table 1 that perceived waiting time has been deeply discussed. A general conclusion has been derived that passengers are more probable to perceive more than the actual time when waiting for a public transport service, especially when no real-time traffic information is provided (Cheng and Tsai, 2014). The influencing factors that affect the waiting time perception vary from city to city, where the most common factors are age and peak period. Several studies also found that perceived walking time was often an overestimation of the actual walking time. Influence factors that affect this overestimation may include physical aspects of transfer facilities, such as signage, lighting, circulation lines and characteristics of the surrounding environment (Hall, 2001). Moreover, transfer walking time has shown to be more onerous than first and last mile walking time.

Compared with the burdensome out-of-vehicle time, passengers tend to consider in-vehicle time more acceptable (Chapman et al., 2006). As in-vehicle time is mostly determined by scheduled journey time and vehicle speeds, researchers generally quantify the value of in-vehicle time in generalised cost equations and the evaluation of stop delay. A few studies have been conducted to check whether there is a difference between perceived and actual in-vehicle time.

Overall, these estimations only focused on the single stage analysis (e.g. transfer stage), which doesn't consider the possible causation from other stages. Moreover, some studies used the data from the surveys that were conducted sometime later (few hours or one day) after the trip, which is not reliable. This research contributes to the existing literature by examining the relationship between actual and perceived travel time in a multimodal public transport trip, including walking time, waiting time and in-vehicle time while also considering the connection of different stages in the whole trip.

3. Field survey

Data was collected by accompanied survey by following the respondent from origin to destination. Respondents were selected by the surveyors from either their relatives/friends or random persons around public transport stations. Surveyor firstly asked the respondent's willingness to participate in this survey, and then made an agreement on the survey time and location. During the trip, the surveyor followed the respondent all the way to the destination. The trip is required to be the respondent's frequent trip, which ensures that the respondent is familiar with all the trip segments. Some rules were made to ensure the trip to be as natural as possible, such as minimise chatting with the respondent except questioning, follow the respondent behind and not side by side, try to measure the actual time without the respondent knowing.

Detailed information were recorded including trip start and end time, date, weather, location, trip purpose and facility usage in the trip, as well as socioeconomic attributes like age, gender, occupation. Actual travel time at each stage was measured by a stopwatch, while perceived travel time at each stage was recorded by asking the respondent right after each action performed. Below are the variables and the corresponding data input codes that are used in the survey:

1. Perceived walking time, actual waiting time and actual in-vehicle time at each stage (continuous variable).