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Urban transport interchanges: A methodology for evaluating perceived quality

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ABSTRACT

Travel patterns in urban areas are becoming increasingly complex, and many public transport users need to transfer between different modes to complete their daily trips. Transport interchanges play a key role as urban transport network nodes, and the quality of the service provided in an urban transport interchange therefore has a direct influence on travellers' daily experience. This study proposes a useful methodological framework to identify the potential strengths and weaknesses of urban transport interchanges and to manage resources more efficiently. It is based on a two-step analytical procedure combining the classification and regression tree model and importance-performance analysis. A travellers' attitudinal survey was carried out in the Moncloa transport interchange (Madrid, Spain) and the methodological framework was applied to the data collected. The greatest strengths of the interchange from the users' point of view are the information provision through signposting, the features of the internal design of the interchange which have a direct influence on aspects related to safety performance, and security conditions, particularly during day-time.

1. Introduction

The trend towards urban sprawl in European cities has led to more complex travel patterns, and diminished the attractiveness of public transport. Travel times and distances travelled are increasing in urban areas, resulting in fewer destinations that can be reached within a limited time (Gakenheimer, 1999; Banister, 2011). Sustainable urban mobility is therefore one of the current priorities for European policy-makers. In this context, the EU Green Paper on Urban Mobility (COM, 2007) emphasised that sustainable mobility aims to tackle three challenges: reducing congestion; improving the quality of public transportation services to achieve a modal shift from private car to public transport; and promoting soft modes such as walking and cycling.

These three challenges must be addressed with measures designed to improve the quality of PT services. Many public transport users today need to transfer between different modes to complete their daily trips, and thus the top priorities in the field of urban mobility are currently to streamline transfers and provide a seamless travel experience. Beirão and Sarsfield Cabral (2007) pointed out the need for a clear understanding of travel behaviour and consumer needs and expectations. Another key variable influencing trip choices is *total travel time*, which includes *in-vehicle*, *transfer* and *waiting* times. Good connectivity at public transport stops and stations is therefore critical to the overall effectiveness of the transportation network (Iseki and Taylor, 2010).

Several studies have dealt with the consequences of intermodal transfers and, more specifically, the importance of optimising transfer time for multimodal journeys (Deb and Chakroborty, 1998; Guihaire and Hao, 2008). Transport interchanges

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play a key role as urban transport network nodes, and are one of the main measures deployed to enhance public transport use and encourage modal redistribution (Lopez-Lambas and Monzon, 2010).

This research aims to identify the potential strengths and weaknesses of urban transport interchanges. For that, it proposes a methodological framework based on a two-step analytical procedure to allow interchange managers to formulate adequate strategic decisions designed to enhance the transfer experience, improve the quality of service, and manage resources more efficiently. The study looks at a set of attributes related to infrastructure design and user efficiency and accessibility. These elements were collected in an *ad-hoc* survey designed to capture users' needs and perceptions, and identify current levels of satisfaction with the services and facilities at urban transport interchanges.

This paper is organised as follows. Section 2 presents a review of the literature on customer satisfaction with public transport services and facilities. The design of the travellers' attitudinal survey and method of implementation are shown in Section 3. Section 4 describes the methodological framework developed to identify the potential strengths and weaknesses of urban interchanges. Sections 5 and 6, respectively, contain a description of the case study and the main results of the analysis. Finally, some recommendations for transport interchanges are provided along with the main conclusions of the study.

2. Perceived quality of transport services and facilities: background

There is little research into customer satisfaction and service quality in the context of urban transport interchanges. Studies have tended to focus on the 'on-board' services (dell' Olio et al., 2011a). However, the quality of a public transport system depends on other aspects, such as the standard of the connections between different transport modes (Guo and Wilson, 2007). Some recent studies have begun investigating the quality of public transport infrastructures in response to the growing interest in developing smart and efficient facilities for intermodal transfers. Guo and Wilson (2011) concluded that improving the transfer experience could significantly benefit public transport.

The travellers' perspectives are of particular importance in determining the best policy measures for transport interchanges, as travel decisions are often motivated by the perceived quality of the services provided. Terzis and Last (2000) emphasised that transport interchanges should meet sustainability standards and be attractive to users, given that travellers' physical experiences and psychological reactions are significantly influenced by the design and operation of the interchange. This section presents several studies that analyse user satisfaction with different aspects of the design and quality of public transport infrastructures, and the perceived quality of transport services.

Iseki and Taylor (2010) used an importance-satisfaction analysis and ordered logistic regression models to examine transport users' perceptions of services and the built environment at stops and stations in the Los Angeles metropolitan area. They concluded that the most important determinant of user satisfaction had little to do with the physical characteristics of stops or stations, and much more to do with access to frequent, reliable service in an environment of personal safety. The same methodology was applied by Cherry and Townsend (2012) to identify passengers' perceptions of the intermodal connections between subway stations and bus services in Bangkok, Thailand. They conducted a survey of subway and bus users and discovered high levels of dissatisfaction with specific aspects of the transfer, and also with the experience as a whole. The results indicated that improvements were needed in coordinating subway and bus services – particularly in improving accessibility to stops – and ensuring public safety.

Dell' Olio et al. (2011b) conducted a stated preferences survey in a multimodal area in Santander (Spain) to estimate willingness to pay for improving service quality in a multimodal area. This study concluded that the most important attribute for most users was the quality of the travel information available (times, frequencies, bays, delays and so on), regardless of their socioeconomic characteristics.

Cascetta and Cartenì (2014) proposed a quantitative analysis of the perceived hedonic value of railway stations. The study compared two stations where the main difference was the standard of the architecture. Their research concluded that a station's architectural quality had a substantial impact on users' choices. Female travellers in particular showed a significant preference for station quality, approximately 33% more than for male travellers.

Finally, eight different urban transport interchanges in the Lisbon metropolitan area (Portugal) were studied by Abreu e Silva and Bazrafshan (2013), who collected data on user satisfaction with the intermodal transfer facilities. They applied a structural equation model to determine the aspects of an interchange which most directly affected customer satisfaction, and found that satisfaction levels were significantly influenced by the presence of guidance signs, and negatively impacted by litter and graffiti.

In conclusion, these studies show that the quality of service provided in an urban transport interchange has a direct influence on travellers' daily experience. These elements have become fundamental tools for reducing transfer inconveniences. Capturing users' perceptions is therefore crucial in defining an efficient urban transport interchange.

3. Design and implementation of travellers' attitudinal surveys

The best way to collect and understand users' views and needs is through an attitudinal survey. An *ad-hoc* survey was therefore designed to capture traveller's perceptions of the various aspects and elements of an interchange. The survey was intended to provide a better understanding of the emotional responses to interchanges, such as '*perception of a secure environment*' and '*an agreeable place to spend time when not travelling*'. This section presents the design and structure of the survey, and describes the procedure for collecting the data.

3.1. Design and structure of the survey

A number of aspects affecting travellers' decision-making are related to their socioeconomic characteristics and trip habits. The survey was therefore composed of three parts: