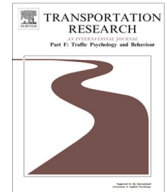




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## How do public transport users adjust their travel behaviour if public transport ceases? A qualitative study

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### ABSTRACT

Mode shift from public transport (PT) to private car when a PT shut-down occurs results in an increase in the number of car trips on the road network which may contribute to traffic congestion. Policies aimed at reducing the mode shift to car can be designed through a better understanding of PT users' mode shift in the event of a PT disruption. Furthermore, the share of car mode shift is also an important parameter for assessing traffic congestion relief associated with day to day PT provision in cities. This study sought to uncover factors influencing the mode shift to car among PT users in the event of a PT disruption. Semi-structured interviews were conducted with 30PT users from Melbourne, Australia. Grounded theory was used to derive categories and subcategories of behavioural responses. Factors affecting mode shift to car if PT ceases in the short term were classified into three main themes with several subcategories: individual-specific factors, context-specific factors and journey-specific factors. In the long term, the analysis reveals that only context-specific factors have an influence on mode shift. Findings show that car access, travel time, travel cost, trip importance, non-central business district (CBD) trips, weather, flexibility and accessibility to PT stations are the most important factors favouring use of the car if PT ceases in the short term. This acts to increase traffic congestion due to the mode shift to car. However, in the long term, removing PT is expected to have an impact on land use, leading to individuals changing their residential and workplace location.

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## 1. Introduction

With many advantages to the private car such as convenience, flexibility and safety, there has been a rapid growth in private car use, particularly in urban areas. This trend not only affects the environment but also contributes to many social problems such as traffic congestion and poor health (Greene & Wegener, 1997). Public transport (PT) is considered to be a sustainable, viable alternative to the private car in cities (Holmgren, 2007). So what will happen if PT is withdrawn? Previous research has shown that a share of PT users would switch to car, either as a driver or a passenger, leading to an increase in the number of car trips on the road network (Aftabuzzaman, Currie, & Sarvi, 2010b; Exel & Rietveld, 2001; Nguyen, Currie,

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& Young, 2015). As a result, the level of traffic congestion may increase, thereby contributing to an increase in travel delay, accidents and air pollution (Exel & Rietveld, 2009a; Zhu & Levinson, 2012).

PT shut-downs have occurred in a number of metropolitan areas around the world (Exel & Rietveld, 2009b). In 2015, Melbourne's PT system experienced tram and train strikes as unions negotiated working conditions. More recent examples of all mode PT strikes are those in Rome, Italy (Keep Talking Greece, 2016) and Athens, Greece (Wanted in Rome, 2016) in 2016. These strikes not only affected PT users to some extent, in particular their daily travel plans, but also impacted road users due to an increase in traffic congestion caused by car mode shift.

Based on the assumption that 'the removal of PT would lead to car mode shift', researchers have proposed several models to estimate traffic congestion relief associated with PT in the short term as well as the long term. Understanding the congestion impacts associated with PT can help transport authorities identify the effectiveness of PT in relieving congestion on affected routes, corridors or areas. From this, policies or improvement projects related to PT can be proposed to seek a desired level of congestion relief. However, previous studies have used simple assumptions due to the lack of an appropriate methodology for estimating this mode shift which is related to a lack of deeper understanding of the mode shift choices of PT users. In 2012, the annual urban mobility report from the Texas Transportation Institute explored the effect of PT on saving travel time in 498 urban areas in America (Schrank, Eisele, & Lomax, 2012). In this report, all commuter rail travellers were assumed to shift to private cars travelling on freeways if a PT service shutdown occurred. Another study that measured the congestion relief benefit of PT at a corridor level came from Washington, D.C. (Federal Transit Administration, 2000). Both of these studies are aggregate in nature (citywide and/or corridor level), and their fundamental assumption for measuring congestion relief benefits is that all PT users switch to private vehicles when PT services cease. These methodologies are considered limited and simplistic because there are still many alternative transport modes that PT users can choose other than a car. Hence, Aftabuzzaman, Currie, and Sarvi (2010a) argued that in practice not all PT users would shift to car if PT was removed. Indeed, they assembled reliable evidence showing that only a percentage of PT riders could switch to driving a car. From secondary research, they suggested that on average 32% of PT users would shift to driving a car, with this figure fixed for all locations. The share of mode shift to car is therefore considered as a key parameter for estimating traffic congestion relief associated with PT (Aftabuzzaman et al., 2010b; Nguyen et al., 2015). A clear understanding of this can help transport authorities in forecasting the mode shift to car and identifying the benefit of a PT system in terms of traffic congestion relief. However, identifying the share of PT users who would switch to a private car if PT ceases is a complex process since it deals with the attitudes and behaviours of PT passengers. A better understanding of the flexibility of PT passengers when PT ceases is therefore needed.

The paper presents the results of a qualitative survey of PT users in Melbourne, Australia. The key research questions addressed in this study are: How would PT users travel to their destinations if the entire PT system was no longer available (short term and long term)? What are the main factors affecting people's mode choice in this context? To explore these questions, a series of semi-structured interviews were conducted.

This paper is structured as follows: the next section outlines previous studies regarding mode shift. This is followed by a description of the study methodology. The findings are then presented, focusing on both the short and long-term effects of PT disruptions. The paper concludes with a discussion and conclusion.

## 2. Literature review

Qualitative research has been used widely to investigate issues of health, tourism, education and politics but used relatively little to explore studies of transport, particularly understanding the mode choice of transport users. Table 1 presents a summary of studies in this area with a particular emphasis on factors influencing the choice of driving a car based on interviews with car users. Key factors, among others, included travel time, cost, convenience and car ownership.

A number of other studies have explored factors influencing mode shift from private cars to PT using both qualitative and quantitative methods. Using a quantitative approach, Sen, Tiwari, and Upadhyay (2007) indicated that PT price is a major factor that encourages car users to switch to PT. Fiorio and Percoco (2007) affirmed the importance of price in the attractiveness of PT services relative to private cars. The accessibility of the PT system is another factor affecting car use (Loader & Stanley, 2009). On the other hand, many studies have also been undertaken to investigate the quality attributes of PT such as reliability, frequency, speed, comfort and convenience (Eboli & Mazzulla, 2008; Hensher, Stopher, & Bullock, 2003; Wallin Andreassen, 1995).

In contrast, there are very few studies focusing on mode shift from PT to private car when PT ceases (see Table 2). From a theoretical perspective, when the preferred alternative of PT users is removed from their choice-set, they are forced to try the next best alternative in their preference ordering (Exel & Rietveld, 2001; Exel & Rietveld, 2009a). According to Zhu and Levinson (2012), a 1966 PT strike in New York City lasting 13 days had a significant impact on the transport network. Based on home interviews of 8000 PT users, more than 67% of users was found to switch to cars as drivers and passengers. Another study focusing on a PT strike in Pittsburgh in 1976 was conducted by Blumstein and Miller (1983). Using traffic counts and survey data, they found that the strike caused an increase in vehicle occupancy of 50%, downtown garage usage of 10%, and taxi revenue of 9.9%. Only 10% and 28% of previous PT riders decided to drive alone and carpool, respectively. Exel and Rietveld (2001) reviewed studies of PT strikes between 1966 and 1998 in Europe and the United States to investigate the behavioural response of PT users. The impact of PT strikes varied depending on the type of strike, travel patterns and policy

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