

# Assessing the potential to influence railway station access travel decisions: Melbourne Australia case study<sup>1</sup>

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## Abstract

Many heavy rail systems rely on Park and Ride to (PNR) for car-based station access. Providing parking adjacent to stations is expensive, can create local congestion and discourage alternative access modes. Travel surveys in Melbourne, Australia are used to examine current station access mode choice decisions and the potential to reduce reliance on PNR. Station access mode choice decisions vary depending on socio demographic factors, access distance/travel time and line haul travel time/distance. Current PNR user decisions are strongly influenced by parking prices at the ultimate destination and the perception that the car is a faster station access mode than other options. The bicycle is perceived to be cheaper and easier to park access option, but concerns emerge about safety and its travel time, reliability. Nearly half of respondents were interested in accessing the station by bicycle highlighting the scope for tailored programs to influence current station access decisions.

## 1 Introduction

Improving the sustainability of urban transportation systems is a priority in cities around the world. The negative externalities associated with transportation systems which rely on personal vehicles are well documented (Sperling and Gordon, 2009). Encouraging the uptake of public transport (PT) offers an alternative to private vehicle use. Many factors underpin decisions to choose public transport over the private car but the quality of train station access, often referred to as the first-mile and last-mile component of the trip, is important when seeking to increase train ridership (Curtis Lesh, 2013, Locquiao, 2016, Peers, 2017, Martens, 2007).

Commuter rail has distinctive station access challenges, particularly in low density residential areas where stations are usually spaced further apart, and many passengers do not live within walking distance of a station. Many commuter rail

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systems rely on Park-and-Ride (PNR) facilities to support station access (Habib et al., 2013). Heavy reliance on PNR can create traffic congestion around stations (Spillar, 1997) and in some cases reduce the attractiveness of station access by local transit and bicycles.

There is also a long-term risk associated with heavy reliance on PNR as a key station access option. Transportation network companies (TNC) have entered the market for the provision of PT access (Peers, 2017).

Encouraging people who currently use PNR to use an alternative access mode provides scope to reduce the investment required in station parking. Any attempt to influence station access decisions, through what could be generically described as a travel demand management initiative, requires a thorough understanding of the underlying travel behaviour (Ben-Akiva et al., 1998, Rose and Ampt, 2001). **This research aims to assess the potential to influence railway station access travel decisions to reduce the reliance on PNR.** The specific objectives of the research are to identify the characteristics of station access trips, the factors influencing current PNR decisions and the potential for train travelers to adopt alternative access modes. Melbourne, the capital of Victoria, Australia is used as a case study and the research highlights the insight which can be obtained by drawing on both general community-wide travel surveys as well as bespoke surveys targeting station access decisions.

The paper is organized as follows. First, insight from the literature related to station access mode choice decisions and travel behavior is synthesized before the methods and data underpinning this study are described. The empirical results are then presented before the conclusions are summarised and directions for future research are identified.

## 2 Literature review

Rail-based PNR schemes were first introduced in the 1930s (Noel, 1988) followed by bus-based PNR schemes during the 1960s and 1970s (Meek et al., 2009). While studies have confirmed the mode shift potential of PNR schemes, their potential for growth is often limited by a range of factors.

Train station access mode choice is influenced by several factors including availability of station access mode options, station amenities, car parking, quality of feeder services (bus and streetcar or light rail), local environment and climatic conditions, urban form, population density and a range of socio-demographic and socio-economic factors (Bhat and Sardesai, 2006, Cervero, 2006, Akar and Clifton, 2009). The literature provides limited insight into the richness of the travel patterns associated with station access travel choices or the extent to which there is scope to encourage more sustainable station access mode decisions.

The travel behavior literature has moved from aggregate representations of travel demand to a richer examination of trip chaining and tour behavior and their relationship to socio-demographic factors including gender, income and age. Women, for example, tend to undertake more trips and more multi-purpose tours than men (Ajay and Levinson, 1995). Currie et.al 2010 explores the trip chaining behavior of public transport users in Melbourne based on historical household survey data. In that analysis, the complexity of trip chains was identified based on the number of legs per chain (Currie and Delbosc, 2011). In contrast, other studies have categorised tour complexity based on the number of activities in the trip chain or the spatial distribution of activities together with trip chaining (Ho and

Mulley, 2013). Analysis of that type has revealed that the characterisation of tours undertaken by car vs public transport commuters are different in nature. This research seeks to extend understanding of station access travel decisions through a deeper examination of tour classification which includes considering identification of 'anchor' points in the tour pattern. The following section outlines the study methodology and describes the context for the empirical study and the data on which the study is based as well as the methodology employed.

### **3 Study context, data and methodology**

Melbourne, the capital city of the state of Victoria, Australia provides the context for this study. The city regularly vies with Vancouver (Canada) and Vienna (Austria) for the title of the World's Most Livable City. Melbourne has a population of just under 5 million and is home to three quarters of the state's population (ABS, 2018). Melbourne has an established train network, comprising approximately 403km network of track and 178 stations (Bureau of Infrastructure, 2015). The network, which is radial in nature and focused on the central business district, carries about 750,000 riders on an average weekday (Jefferson, 2017).

This study draws on three main data sources to analyse station access decisions. A general-purpose survey, the Victorian Integrated Survey of Travel and Activity (VISTA) which is conducted across Greater Melbourne and periodically in selected regional centres. The other two are special purpose, bespoke surveys, which were originally designed for two other studies. The first was a station access mode choice survey conducted at 13 stations across the network. The third survey was undertaken for a PhD project specifically focussed on park and ride access to stations. It targeted four train stations on the Glen Waverley train line to the east of the CBD.

Reflecting on the nature of the data, the analysis starts broad and then becomes more targeted. Descriptive statistics born from VISTA are used to provide insight into the relative shares of different station access modes and how those station access mode shares change over the course of the day and by trip purpose. Consideration is also given to station access distances by access mode. The same data are used to explore the complexity of the tours associated with train trips. Special attention is given to activity locations and intermediate activities between the home end and the station. The tour-based analysis provides a valuable perspective, particularly since encouraging changes in station access decisions is likely to be more difficult when multiple activities are combined into the station access tours. The focus then shifts to potential riders to identify barriers for mode shift from auto based station access modes to bike.

## **4 Results**

### **4.1 Descriptive analysis**

Across the whole day (24 hours), the main access mode to train stations is active transport (Walk and Cycling) and the second largest is Park and ride (PNR).

When comparing morning and evening peak mode share, a time of day access mode variation is observed. Most of the morning peak trips are home originated trips, and most of them access station as car drivers or passengers. It shows more station

access mode share variability at the home end compared to the destination end of the trip. The vehicle driver (PNR) access mode share is increasing when the trip origin moves away from the CBD. Three quarters of the transit users are travelling 2.5km or less to access the train station in Melbourne. In this study, PNR users have the highest median access travel distance (3.5km), and walking has the lowest (650m). Walking and bike access mode use declines after 2km and private vehicle and public transport mode share increases with the access distance.

Individual trip data from VISTA -2016 were used to obtain individual tours, combining the daily trips starting from home/accommodation, and returning to home/accommodation. After identifying the first trip made by train in the tour, any immediate trips linked to the train trip were classified as an anchor point between home and station. The tour data was analysed to understand the relationship between train user tour behavior and station access decisions.

The vast majority of train user tours are simple tours with activities at a single location. Active access mode use is higher in simple tours compared to complex tours. Auto access mode share in complex tours is greater than in simple tours. The auto access mode share increases with the complexity of the tour. A higher percentage of train users choose PNR to access the station when they undertake intermediate activity between home and the station.

## **4.2 PNR user behaviour analysis**

Survey results from a major railway in the eastern suburbs of Melbourne are used to investigate the PNR user behaviour. PNR users still prefer to use PNR to access a train station even there are no parking facilities available in the current station. Most favoured alternatives are drive to another station with a PNR facility and park in nearby roads. One third of existing PNR users mentioned that they might consider accessing the station by active modes if there is no parking provided in their regular station.

Perception of the speed of access mode and the access time to the destination has the strongest impact on access mode choice decisions of PNR users. These can be reasons why people use private vehicles to access the stations even if they can walk to the station.

## **4.3 Assessing potential for cycling as access mode**

Data obtained from station access mode choice surveys conducted at 13 stations across the network provide insights into the potential for cycling as an access mode among existing auto access mode users. More than two out of three auto access mode users can ride a bicycle, and nearly half of them are interested in riding a bicycle if better cycling infrastructure provides connectivity with the station.

The survey also provided insight into perceptions of the benefits of bike riding. Current car drivers to the station were not convinced about the relative travel time reliability, speed, and safety of riding a bicycle to the station. This shows that perceptions of existing auto access mode users towards travel time reliability, safety and speed are some of the barriers to change station access mode choice decisions.

# **5 Summary, conclusions and research directions**

This study enhances understanding of the station access decisions of train transit users drawing on both individual trip and tour-based analyses. Descriptive analysis

revealed that Car access is higher for the home end of the trip and increases as the trip origin (home) moves away from the CBD. Most of the train users make simple tours to access the station, combining activities within closer proximity to the primary activity location and not stopping between their home and the station. Nearly half of the simple tour makers use active modes to access the station. Car access increases as those tours become more complex.

Current PNR user decisions are strongly influenced by the perception that the car is a faster station access mode than other options. The bicycle is perceived to be cheaper and easier to park access option, but concerns emerge about safety and its travel time reliability.

This study lays important foundations for travel demand management policies targeting railway station access trips. Transit oriented development (TOD) has the potential to reduce the complexity of station access tours by enabling travelers to complete a range of activities near the station and lower one barrier to enable more access trips to switch to active modes. Enhancing local infrastructure to support bicycle access or highlighting existing safe bicycle access routes to the station, could address safety concerns and the reliability of bicycle access travel time. Systematically addressing those factors would provide the opportunity to promote station access by bicycle using a tailored travel behavior change program. That area would be a clear priority for future research. Reducing reliance on PNR has the potential to reduce the capital costs associated with the provision of stations car parking for operators as well as producing local environmental benefits and health benefits for users, and so should be a key priority for transport system operators.

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