

Factors influencing commuters' bicycle parking choices at suburban railway stations

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1. Introduction

A sustained demand for public transport services within the metropolitan Melbourne region has seen an increased strain placed on the rail network. Within the 2016 financial year, rail ridership stood at 235.4 million passenger trips, up 1.6 percent on the previous year, putting further pressure onto a rail network struggling to meet patronage capacity demands on peak periods (Currie 2011, Public Transport Victoria 2017a). In response to the growth in patronage, the Victorian government has committed to investment in infrastructure projects and rolling stock including the Melbourne Metro Rail project (a new underground rail link) and high capacity trains. These actions focus on increasing the network patronage capacity but fail to consider the implications of increased station access.

To access the train station, over half of Melbourne train commuters walk (56.1%). However, the suburban sprawl, the result of relatively low population density, fosters a car-centric culture that has contributed to almost one in five commuters driving to the station (18.25%) (Public Transport Victoria 2017b).

Motor vehicle-based station access requires the provision of car parking spaces in suburban areas where land is limited and infrastructure is costly. Recently a multistorey car parking facility was commissioned for one Melbourne suburban station (Syndal) at a cost of \$10.8 million. The facility adds 250 car parking spaces, equating to a unit cost of approximately \$40,000 per parking space. Even with such increases in car parking capacity, the demand for dedicated station parking outstrips current supply resulting in facilities being filled early in peak periods with commuters often parking illegally in surrounding streets, potentially impacting the residents living near stations. This also gives rise to increased levels of parking related congestion issues affecting areas nearby the train station (Mead et al 2016). With the share of vehicle-based station access expected to increase with the continued growth in rail patronage levels, alternative access modes need to be encouraged.

Cycling to the train station is a potential alternative access mode, as demonstrated in the Netherlands where a third of all station access trips are made by a bicycle (Rietveld 2000). Accessing the station by bicycle provides a convenient door to door option, increasing the station catchment area to distances comparable with motor vehicle access. Often referred to as bike-and-ride, cycling to the station also provides many secondary benefits ranging from improving individuals' physical fitness through incidental exercise and, for commuters who shift their mode from driving to cycling, lowering vehicle congestion and reducing transport externalities such as air/noise pollution. There is also an economic basis for encouraging a greater bike-and-ride share compared to the facilitation of motor vehicle based access as

cycling infrastructure is considerably less expensive and the land area required to cater for cyclists' parking needs have a much smaller footprint (Martin and den Hollander 2009).

Currently less than 1 percent of the total station access trips are made by a bicycle (Public Transport Victoria 2017b). This low share of bicycle access can partially be explained by the lack of bicycle parking facilities at stations needed to minimise the risk of bicycles being stolen or vandalised (Rietveld 2000, Barajas 2012, Sweanor 2015). As an initiative to provide greater security for bicycles parked at stations in Melbourne, Public Transport Victoria introduced 'Parkiteer' caged bicycle parking facilities (Figure 1) able to store 26 bicycles. Of the 208 train stations in the Melbourne metropolitan network, 75 train stations have an operational Parkiteer which is utilised by 950 cyclists daily (Bicycle Network 2017). However, across the Parkiteer network there is high variability in usage. Facilities at some stations consistently operate at capacity (Laverton) while other sites operate at less than 5 percent capacity (Roxburgh, Diggers Rest) (Rose et al. 2013). This variability can, in part, be explained by the commuters' bicycle parking choice with a sizeable number of cyclists choosing to park at alternative facilities around the station (e.g. bike hoops, fences, railing and street furniture).

Eight additional Parkiteer facilities are already planned to be installed across the rail network in 2017. At a cost of \$120,000 per facility, Parkiteers are considerably more expensive than alternative bicycle parking facilities such as bike hoops. Given the limited budget available for cycling infrastructure, it is important to evaluate why cyclists choose to use, or not use, such facilities.

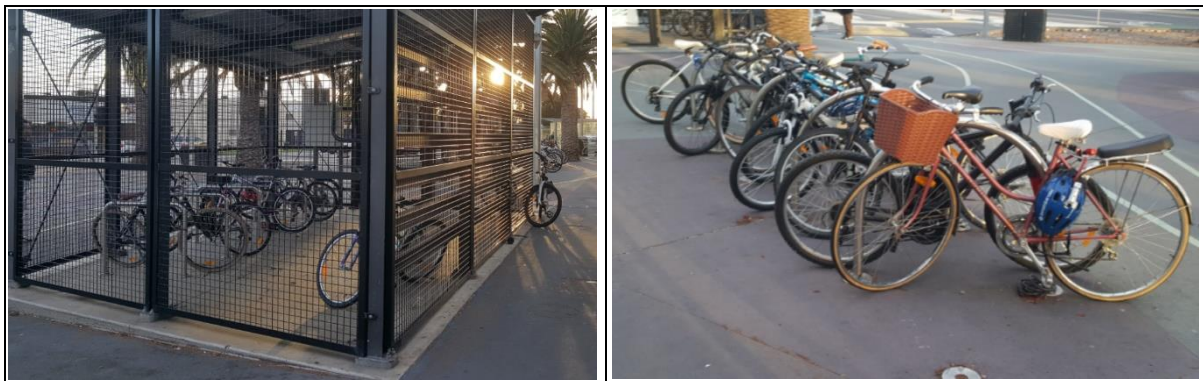


Figure 1. Parkiteer facility (left) and alternative bicycle parking facilities – hoops (right) (Photo: Hesara Weliwitiya)

This study aims to examine the factors which influence whether a cyclist parks their bicycle in a Parkiteer or elsewhere at a station. More broadly the research aims to provide insight into how improvements can be made to bicycle parking facilities at railway stations to increase user satisfaction levels and encourage greater use of the bicycle as a station access mode.

2. Methodology

This study used an intercept survey targeting people who have cycled to a train station in metropolitan Melbourne to investigate the factors influencing their bicycle parking choice and usage. This section discusses the selection of the stations where the surveys were conducted, the nature of the survey undertaken and the methods employed in the analysis of the responses.

2.1. Station site selection

The survey was conducted at 36 of the 208 stations across the Melbourne metropolitan rail network. The target stations were selected based on Parkiteer usage rates and cycling access frequencies, an emphasis was placed on selecting stations with high levels of each criteria for efficient deployment of field staff. Of the 36 stations, 34 had an operational Parkiteer bicycle

storage facility. Stations were also selected to provide a spread across the metropolitan rail network.

2.2. Bicycle parking survey

The survey was a self-completion questionnaire. To evaluate bicycle parking choice, that is whether cyclists used a Parkiteer or alternative facility (e.g. bike hoops or street furniture), respondents were asked about their current parking experiences, perceptions about secure bicycle parking facilities and satisfaction levels with various parking features.

The self-completion questionnaire was four pages in length and distributed to all cyclists who rode to the target stations and parked within the station precinct. The surveys were distributed directly to cyclists immediately after parking their bicycle and contained questions relating to their journey from home to station, experiences with station parking facilities, train use and commuting habits. In addition to this, demographic information, primarily relating to age and gender were gathered and respondents were asked if they would be willing to be contacted for future surveys.

Respondents had the option of filling out the survey online (via website or scanning a QR code), or by completing a paper copy handed to them and sending it back in a reply-paid envelope which was provided. To encourage a response, participants were able to enter into a prize draw to win a \$200 shopping voucher.

2.3. Analysis methods

Data analysis included cross tabulating data, examining descriptive statistics and conducting inferential statistics through t-tests. Consistent with the objective of this paper, two key questions from the survey were the focus of this analysis:

- *Parkiteer user experiences and nonuser perceptions*: to identify the factors which influence bicycle parking choice and usage
- *Parking feature satisfaction levels*: to explore bicycle parking facility improvements that can be made to encourage greater levels of bicycle access to stations

For each question respondents were required to provide answers using a 5 point Likert scale with responses coded into integer values between -2 to 2. Mean scores were calculated, enabling comparisons to be drawn based on descriptive and inferential statistics. An assumption made is that the strength of agreement is measured on a linear scale and the attitudes can, in fact, be measured by a Likert scale (Likert 1932, Allen and Seaman 2017).

3. Results and discussion

A total of 326 questionnaires were distributed to cyclists at 36 stations. Of those, 170 were completed and returned resulting in an overall response rate of 52.1%. The response rate varied geographically across the regions with the highest being in the South-East (70%) compared to the lowest in the inner-city region (26%). Most of the respondents filled the questionnaire online (71%) and had used a Parkiteer (62%) to store their bicycle at the station.

3.2. Demographics

3.2.1. Gender

As in most countries where cycling has a low share, there is an under-representation of female riders (Pucher and Buehler 2008) and this is evident in this study with female cyclists comprising 22% of respondents. Of the female cyclists who rode to the station, 65% parked their bicycle in a Parkiteer, slightly higher than male cyclists (61%).

3.2.2. Age

Respondents ranged from 18 to 69 years of age. On average, female respondents were younger than male respondents (37.5 years compared to 40.5 years). The choice of parking facility used does not, however, seem to be affected by age as Parkiteer users had an average age of 39.6 years compared to alternative facility users with an average age of 40.1 years.

3.4. Parkiteer user experience and non-user preconceptions

To identify factors influencing bicycle parking choice, the use and non-use of the Parkiteer facility were evaluated. All respondents, regardless of their choice of parking facility, were asked about their level of agreement with several statements about the Parkiteer facility (Table 1). Responses to these statements captured the differing opinions about the Parkiteer facility from current users and nonusers. Evaluating these opinions provide a means to identify the factors which influence bicycle parking choice and usage at metropolitan railway stations in Melbourne.

Table 1 outlines the mean scores calculated for the two parking choice groups. In general, the respondents who park in a Parkiteer tend to agree with the statements to a greater extent compared with nonusers.

Table 1: Responses to statements about Parkiteer (n=141)

Statements	Parked in Parkiteer (users)	Did not park in Parkiteer (non-users)
Parkiteer facility at the train station provides the most convenient protection against the rain	1.61	0.98
Parkiteer provides the most secure location to park my bicycle at a train station*	1.27	0.35
Transfer time to catch train is greater if I use a Parkiteer facility	1.21	0.57
Registration process for Parkiteer access is convenient	0.93	0.35
Waiting time for a Parkiteer access card is acceptable	0.41	-0.02
Station I ride to is a safe place to leave my bicycle unattended	0.3	0.41

* n=140, mean score scale: -2 (Strongly disagree) to 2 (Strongly agree)

A feature of the Parkiteer that users most strongly agree with is that the caged facility provides the most convenient protection against the rain, non-users also agree with this statement although not as strongly. The difference in means, while both groups tend to agree, is statistically significant highlighting the desire to protect the bicycle from adverse weather conditions may influence bicycle parking choice.

Perceptions about whether the Parkiteers provide the most secure location to store a bicycle at the stations differed significantly between users and non-users of the Parkiteer. Users were more likely to agree that Parkiteers were the most secure location at the station while nonusers tended to be neutral. Differences in opinion about the security provided by the Parkiteer facility may be a critical factor which influences the choice of bicycle parking used. Further strengthening the notion that differing perceptions about security affect parking choice can be seen by the responses to the statement about the station being a safe place to leave the bicycle unattended. For this statement the nonusers tended to agree more compared with Parkiteer users. This shows that nonusers are more likely to consider the station as a safe environment to leave their bicycle and this may influence their choice to not use a secure caged facility. This perception may be related to the levels of passive and active security provided at the stations.

Users agree that using a Parkiteer increases the transfer time between parking a bicycle and catching a train, while nonusers perceive the transfer time to be affected but not to the same extent. This highlights users of the Parkiteer facility are willing to pay a transfer time penalty for the added security.

When users register on-line to get access to a Parkiteer there is usually a waiting time of 5 to 7 days for their application to be processed, access cards are mailed out and then the user is required to activate the card on-line. In terms of the registration process and that wait time significant differences in opinions about the convenience and timely nature were noted. Users were more likely to consider the process convenient and timely compared with nonusers. The initial barrier in the form of the registration process and wait time may be a factor which impacts bicycle parking choice. For Parkiteer operators it may be worthwhile trying to streamline the registration process. This may have positive implications on usage especially for sites that are currently attracting low numbers of users.

3.5. Parking feature satisfaction

The questionnaire included statements designed to gauge the levels of satisfaction with respect to the security of the station precinct, proximity of the bicycle parking to the station entrance and other storage based attributes (Table 2). Features such as how close parking is to the station entrance, whether the parking facility is monitored by CCTV and weather protection provided by the parking facility all scored high satisfaction levels amongst both Parkiteer users and nonusers. This is expected as operators and design standards often focus on providing bicycle parking which is close to the station entrance where there may be greater levels of active forms of security present. Provision of undercover parking, however, tends to be limited for those who use alternative facilities indicated by a significant difference in the mean satisfaction score. For each of these attributes, satisfaction levels for users of alternative facilities lag behind those of Parkiteer users, indicating there is scope for improvement.

Parking attributes with statistically significant differences in responses between Parkiteer users and nonusers included: the level of visibility of the parking area, the availability of a secure point to lock a bicycle and the provision of a well-lit storage area. The score was significantly greater for those who park in a Parkiteer as opposed to those who parked in an alternative location. Having a highly visible place to park a bicycle, a secure point to lock the bicycle and a well-lit storage area are especially critical to those who use alternative locations as these features directly influence the safety of the bicycle. When considering improvements, emphasis should be placed on these features especially if operators want to promote the use of low cost alternative parking facilities.

Table 2: Station bicycle parking satisfaction scores (n=140)

Parking attributes	Did park in Parkiteer (users)	Did not park in Parkiteer (nonusers)
Parking area is highly visible	1.51	-0.07
Parking facility monitored by CCTV	1.47	1.11
Parking close to the station entrance	1.4	1.28
Secure point to lock bicycle	1.31	-0.04
Under cover weather protection*	1.29	0.94
Well-lit storage area*	0.66	-0.19

*n=139, mean score scale: -2 (Very dissatisfied) to 2 (Very satisfied)

Measures of satisfaction levels have traditionally been employed in transport related research to identify cost effective improvements that can be made to increase rail patronage (Givoni and Rietveld 2007, Brons et al. 2009). By identifying parking attributes that lead to greater satisfaction levels, measures can be implemented to:

- improve bicycle parking services at train stations to encourage greater use of the bicycle as an access mode
- increase usage for current underperforming Parkiteer sites so a better return on investment can occur

- encourage greater use of alternative parking facilities as there is an economic argument to promote the use of alternative facilities such as hoops as opposed to Parkiteers

By improving parking attributes with a low satisfaction score, especially in the case of alternative facilities, it may be possible to increase the share of bike-and-ride users, increase the usage of current under-performing Parkiteers and promote a greater shift towards the use of alternative parking facilities which can have a significant economic benefit.

4. Conclusions and Future Research

The aims of this study were to identify:

- the factors which influence where commuters park their bicycle at railway stations
- improvements that can be made to cycling facilities at stations to encourage greater levels of bike-and-ride

These aims have been achieved by evaluating the use and non-use of Parkiteer facilities and measuring the satisfaction levels of bike-and-ride users in relation to various parking features and attributes.

By understanding the factors influencing bicycle parking choice strategic decisions can be made on the placement of parking facilities which may result in a better return on investment. This is particularly important in the current context with the expansion of the Parkiteer program set to continue across the rail network. Findings showed that Parkiteer user experiences and nonuser preconceptions may influence bicycle parking choice at railway stations in Melbourne with distinctions noted in the perceptions of security, Parkiteer registration process and transfer time to catch a train. Higher rates of agreement were reported among Parkiteer users compared with nonusers. Further, nonusers considered the station a safe place to leave their bicycle unattended compared with Parkiteer users, which may explain their choice to leave the bicycle in a less secure alternative parking facility.

Satisfaction scores were measured for various bicycle parking features and attributes. This allowed features to be identified where improvements made by rail operators had the potential to increase parking satisfaction and encourage greater levels of bike-and-ride. The results indicate a disparity in satisfaction levels amongst Parkiteer users and alternative facility users. Operators should focus on providing alternative facilities which are highly visible to the public, well-lit and has a secure point to lock the bicycle.

Further research could potentially expand the stations surveyed to explore the effects of the rapidly changing station environment such as those from the level crossing removal project. In addition to this, multivariate analysis could be used to identify the combined effects of significant variables effecting parking choice. Beyond the study of the factors which influence the decisions of users about where to park their bicycle, there is scope to expand this research to consider the factors which influence the decision to access the station by bicycle as opposed to alternative access modes such as walk, bus or car.

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