

Tivendale
Transport
Consulting

CBD Pedestrian Congestion – Public Transport Access

City of Melbourne

Melbourne
January 2012
Version 3.0

*This document is confidential and is intended solely for
the use and information of the client to whom it is addressed.*



This page is intentionally blank

Executive Summary

The City of Melbourne currently attracts 800,000 people each weekday. This figure is expected to grow to 1.2 million people each weekday by 2030. A significant proportion of these additional trips will be made on the city's rail networks. Having used the rail network (both metro and tram) most passengers then need to walk through the public realm to reach their final destination.

This study is focused on areas of high congestion and access to transport nodes in peak periods. The aim is to ensure that the public realm which provides access to these transport nodes remains safe and functional as passenger demand and pedestrian volumes increase.

In some locations, peak pedestrian demands on footpaths and pedestrian crossings are already outstripping supply of space for pedestrians to move. The City of Melbourne has identified eight transport nodes that generate pedestrian congestion points in weekday peak periods. These include all the City Loop Metro Stations and three platform tram stops (Federation Square, Melbourne University and Town Hall).

In these locations there are concerns that overcrowding of pedestrians is not just detracting from the CBD economy and quality of transport but is also creating safety problems (for example when pedestrians resort to walking along the traffic lanes because there is no space remaining on the footpath).

This study has looked at the pedestrian crowding that occurs in these locations and has developed a range of potential short and long-term improvement options.

Key to the study is the ceiling on capacity of each of the transport nodes. For example, each metro station has a finite capacity over any time period that is governed by the throughput and capacity of trains and the capacity of the internal station movement networks. Put simply, the number of people able to exit a station is limited by the capacity of the trains, gates, escalators and stairs that people need to use.

The maximum number of people likely to exit each of the stations in the morning peak period can be determined by multiplying the width of specific facilities by the time it takes for people to use them. In some cases the existing capacity of the public realm (footpaths and crossings) is less than the number of people trying to use the facility in the peak period.

The afternoon peak provides a different and more challenging problem. This is because there is no control on when people leave work and the peak period can include sharper peaks of demand. When a stairwell entrance to a station is approached by twice the number of people who can actually fit on the stairwell, people begin to queue around the entrance and can obstruct other movements.

A challenge related to this is that pedestrian demand does not spread evenly across all the available entrances. For example Parliament Station has a theoretical maximum capacity of around 6,000 exiting passengers in the peak 15 minutes. However, the two largest entrances are under-utilised. This means that congestion problems may occur at one station entrance while another entrance is barely used at all.

Again using Parliament Station as an example, peak period passenger demand is forecast to grow by 60% by 2031. This may not be a significant issue if the new passengers all use the underutilised entrances. However, chances are they will use the entrances that are currently most popular which will exacerbate congestion issues at street level. Improvements to

signalling or train configuration could increase capacity of both the track and train carriages. This could further increase the theoretical maximum capacity of each station.

At tram stops the ceiling on capacity is related to vehicle capacity and the ability to move vehicles through the platform stop. For example at Federation Square each morning, the number of passengers seeking southbound trams exceeds the capacity of the tram network to move them. This results in delays to passengers (who have to wait for the second or third tram before they can board). This becomes an issue when the queue to access the tram platform stop extends into the traffic lanes or back onto the footpath (blocking traffic lanes).

This study has investigated the public realm and its capacity to cope with current and future pedestrian demands around transport nodes. The study has developed a range of improvement options for further investigation. None of the options have been costed, or fully checked in terms of technical feasibility.

Broadly the study considered two main improvement options:

- Enhancing lesser used entrances or creating new entrances to disperse pedestrian flow away from congested entrances; and
- Improving pedestrian facilities (such as wider footpaths or new connections) around congested station entrances to make pedestrian flows safer.

Specifically, the study recommends investigating:

- Additional station entrances (not controlled by the City of Melbourne) at four locations;
- Enhancing station entrances (not controlled by the City of Melbourne) at five locations;
- Improving pedestrian crossing facilities (installation of zebra crossings) at three locations; and
- Widening footpaths in proximity to stations at several locations.

Table Of Contents

Executive Summary	ii
1. Introduction	1
1.1 Background.....	1
1.2 Study Aims.....	1
1.3 Study Area	1
1.4 Study Method & Structure.....	2
2. Principles	5
2.1 At each station	6
2.2 Capacity of footpaths	6
3. Site Assessments.....	8
3.1 Flagstaff Station.....	8
3.2 Flinders Street Station	13
3.3 Melbourne Central Station	21
3.4 Parliament Station	27
3.5 Southern Cross Station.....	36
3.6 Town Hall Tram Stop (Collins St)	43
3.7 Melbourne University Tram Stop (Swanston St).....	46
4. Conclusion.....	49
5. References	50

List of Figures

Figure 1-1 Melbourne CBD Study Area	2
Figure 2-1 Walking Speed variations by Supply of Pedestrian Space	6
Figure 2-2 Level of Service Diagram for a Queuing Area	7
Figure 3-1 Pedestrian Space Approaching Flagstaff Station from the South	9
Figure 3-2 Improvement Ideas around Flagstaff Station.....	10
Figure 3-3 Improvement Ideas around Flagstaff Station (Little Lonsdale Street).....	11
Figure 3-4 Existing and suggested entrances to Flinders Street Station	16
Figure 3-5 Improvement Ideas around Flinders Street Station	16
Figure 3-6 Improvement Ideas around Flinders Street Station (Elizabeth St).....	18
Figure 3-7 Improvement Ideas around Flinders Street Station (Elizabeth St).....	19
Figure 3-8 Melbourne Central Station Improvement Ideas	22
Figure 3-9 Melbourne Central Station Improvement Ideas (La Trobe Street).....	23
Figure 3-10 Short Term Melbourne Central Station Improvement Ideas	24
Figure 3-11 Short Term Melbourne Central Station Improvement Ideas	24
Figure 3-12 Melbourne Central Station Footpath Narrowing	25
Figure 3-13 Long Term Melbourne Central Station Improvement Ideas.....	26
Figure 3-14 Pedestrian Congestion in Spring Street	29
Figure 3-15 Parliament Station Improvement Ideas (Lonsdale Street Entrance).....	30
Figure 3-16 Parliament Station Improvement Ideas (Lonsdale Street Entrance).....	31
Figure 3-17 Parliament Station Improvement Ideas (Lonsdale Street Entrance).....	31
Figure 3-18 Parliament Station Improvement Ideas (Gordon Reserve Entrance)	32
Figure 3-19 Parliament Station Improvement Ideas (Collins Street Entrance)	33
Figure 3-20 Parliament Station Improvement Ideas (Collins Street Corner).....	34
Figure 3-21 Parliament Station Improvement Ideas (Collins Street Entrance)	34
Figure 3-22 Improvement Ideas around Southern Cross Station	38
Figure 3-23 Southern Cross Station Improvement Ideas (Bourke Street)	39
Figure 3-24 Southern Cross Station Improvement Ideas (Spencer Street at Collins Street) 40	
Figure 3-25 Southern Cross Station Improvement Ideas (Collins St – Batman's Hill)	41
Figure 3-26 Spanish Solution Platforms - Concept.....	44
Figure 3-27 Improvement Ideas around Melbourne University Tram Stop	48

List of Tables

Table 1-1: Entrances in the Study Area	3
Table 3-1: Capacity of Flagstaff Station.....	8
Table 3-2 Initiatives to improve passenger flows around Flagstaff Station.....	12
Table 3-3: Capacity of Flinders Street Station	13
Table 3-4 Initiatives to improve passenger flows around Flinders Street Station	20
Table 3-5: Capacity of Melbourne Central Station	21
Table 3-6 Initiatives to improve passenger flows around Melbourne Central Station	26
Table 3-7: Capacity of Parliament Station	27
Table 3-8 Initiatives to improve passenger flows around Parliament Station	35
Table 3-9: Capacity of Southern Cross Station.....	37
Table 3-10 Initiatives to improve passenger flows around Southern Cross Station.....	42
Table 3-11: Capacity of the Town Hall Tram Stop	43
Table 3-12 Initiatives to improve passenger flows around Town Hall Tram Stop	45
Table 3-13: Capacity of the Melbourne University Tram Stop	46
Table 3-14 Initiative to improve passenger flows around Melbourne University Tram Stop .	48

1. Introduction

This report considers pedestrian congestion occurring in Melbourne's Central Business District (CBD) specifically around major transport hubs such as Metro Stations and tram stops. Tivendale Transport Consulting has prepared it on behalf of the City of Melbourne.

1.1 Background

The City of Melbourne is a key centre of Victoria's productivity and innovation. Just 15 years ago, 200,000 people worked in the municipality; by 2030 this is expected to grow to 550,000. Over the last 10 years the residential population has doubled to almost 100,000 as more people have made the city their home, attracted to its services, convenience, and lifestyle and work opportunities. This is projected to grow to 177,000 by 2030. By then more than one million workers, students, residents and visitors will be in the city on a daily basis. The rapid increase in activity will significantly increase the number of pedestrians in the CBD.

Council's Transport Strategy 2012 aims to create an excellent and safe walking environment for residents, workers and visitors with seamless high-priority links between the city's public spaces and the public transport system. The strategy also seeks to increase the amount of walking in the city and to improve the efficiency of transport in the city by prioritising space-efficient transport modes. It also seeks to provide pedestrian priority and access to public transport.

This reflects the intent of the Future Melbourne community plan, especially the visions for a Connected City, a People City and a Prosperous City. It also builds on the city's achievements over the last 20 years of transforming its walking environment, guided in part by the Places for People studies in 1994 and 2004. This has included widening footpaths, laying good quality pavements, encouraging outdoor dining, reducing traffic signal cycle times to prioritise pedestrian movement and attracting more people to the city.

Without improvements to pedestrian amenity in the CBD, productivity and efficiency cannot be maximised. Access to the CBD via Metro is a particular issue, as the entrances attract mass movement of people during the morning and afternoon peaks. In many cases the pedestrian realm surrounding the station entrances is not adequate for the volume of pedestrian movement today, let alone future increases in demand.

The City of Melbourne therefore needs to develop potential improvements to the pedestrian environment around CBD rail stations and some tram stops to cater for existing and future pedestrian demands.

1.2 Study Aims

This study aims to:

- Understand current and future pedestrian use patterns at key congestion locations; and
- Suggest improvements to the pedestrian environment around the hotspots.

1.3 Study Area

The study areas are defined as the areas immediately surrounding key pedestrian hotspots in Melbourne. These are:

- Flinders Street Station/Flinders Street/Elizabeth Street/Federation Square tram stop
- Southern Cross Station
- Parliament Station

- Melbourne Central Station - Latrobe and Swanston tram stop (Swanston Street)
- Flagstaff Station
- Melbourne University Tram Stop (Swanston Street)
- Collins and Swanston Street tram stop (Collins Street)

The study area is depicted in Figure 1-1 below.

Figure 1-1 Melbourne CBD Study Area



1.4 Study Method & Structure

This study involved multiple site visits to each site in the study area. Information and data available to the City was analysed to provide current estimates of pedestrian movements and forecast growth. The data and site visit notes were developed into an assessment of each site including identifying the locations that are most congested and specific capacity issues at those locations.

Having reviewed international literature regarding pedestrian amenity and capacity, this study then considered what improvements could be made to the study area sites. Consideration was also given to how entrances that are not at capacity might be improved to disperse more of the pedestrian flow to these other entrances.

There are 32 public transport station¹ entrances in the study area. The location of these entrances is shown in Table 1-1 below.

Table 1-1: Entrances in the Study Area

Sites for Study	Entrances	Location of Entrances
Flagstaff Station	2	1. La Trobe St & William St - Northwest corner 2. La Trobe St & William St - Southwest corner
Flinders Street Station	7	3. Flinders St at Elizabeth St - Southern side of road 4. Flinders St at Degrares St - Southern side of road 5. Degrares St at Degrares PI - Southeast corner 6. Flinders St & Swanston St - Southwest corner 7. Swanston St opposite Federation Sq. information centre 8. Swanston St opposite Princes Walk 9. Flinders Walk at footbridge over Yarra River
Melbourne Central Station	5	10. Swanston St & Knox Place 11. La Trobe St at Melbourne Central – Southern side of road 12. La Trobe St ramp – Northern side of road 13. La Trobe St stairs – Northern side of road 14. Elizabeth St at the ME Bank Tower
Parliament Station	5	15. Spring St at Ulster La 16. Gordon Reserve opposite Lt Collins St 17. Spring St at Bourke St – Southwest corner 18. Spring St & Lonsdale St – Southeast corner 19. Nicholson St & Lonsdale St – Southeast corner
Southern Cross Station	5	20. Spencer St at Bourke St – Western side 21. Spencer St & Lt Collins St – Western side 22. Spencer St & Collins St – Northwest corner 23. Collins St opposite The Age Building 24. Bourke St Pedestrian Bridge
Town Hall Tram Stop	4	25. Collins St & Swanston St – Northwest corner 26. Collins St & Swanston St – Southwest corner 27. Collins St at Manchester La – northern side 28. Collins St at Manchester La – southern side
University of Melbourne Tram Stop	4	29. Swanston St at Faraday St – Western side 30. Swanston St at Faraday St – Eastern side 31. Swanston St north of Grattan St – Western side 32. Swanston St north of Grattan St – Eastern side

Also considered in this study was the role that other nearby train stations can have. For example introduction of Bus Route 401 from North Melbourne Station to Melbourne University has significantly reduced the pedestrian load at Melbourne Central (particularly people transferring to trams in Elizabeth or Swanston Streets. In addition the study team has

¹ Including platform tram stops

recently visited every laneway in Melbourne's CBD and noted the ability for any of the lanes to disperse pedestrian flows to and from significant public transport nodes.

The remainder of this report is structured as follows:

- **Section 2 – Background** – Provides background to the study and outlines the principles applied through the study.
- **Section 3 – Site Assessments** – reviews available data regarding the study sites, assesses the existing provision of pedestrian facilities around each site and recommends improvements that the City of Melbourne should further investigate regarding public transport access.
- **Section 4 – Conclusions** – Provides a summary of the project outcomes.

2. Principles

Consideration of pedestrian crowding related public transport should normally consider the peak 15 minutes of the day. This consideration results in a more accurate reflection of the “most crowded” moment. Current demand has been determined by analysing the information available to the City of Melbourne.

Changes to train operating patterns in recent years have led to a decline in the number of passengers exiting from some stations (such as Parliament) and an increase in passengers alighting from others such as Flinders Street. This is due to:

- Werribee Line trains now travel direct to Flinders Street;
- Express trains on the Frankston line now travel direct to Flinders Street; and
- All Clifton Hill group trains now travel clockwise through the city loop (arriving at Flinders Street first) at all times of day.

The City of Melbourne expect the number of people in the CBD each weekday to increase from around 800,000 now to 1.2 million (50% increase) over the next 30 years. Currently in the peak 15 minutes at each entrance the station entrances are operating at or close to maximum capacity. Future growth in visitor numbers will spread the peak 15 minutes over a longer period of the day.

Future demand for space on the street at many of the pedestrian congestion points is constrained by physical infrastructure of the railway stations, as each entrance has a definable maximum capacity.

International experience shows that the ability to move people from the platform (train and tram capacity) is equally important. For example, at very busy stations there are times when some or all station entrances need to be closed in order to prevent overcrowding of the station platforms (this already occurs at some stations in London Underground, New York Subway and Paris Metro).

Discussion about future demand needs to have regard to the capacity of each station in terms of pedestrian movement through the existing entrance (including down to the platforms and in terms of absolute train capacity that is dependent on the capacity of each train (passengers per train) and the capacity of the railway signalling (trains per hour).

Capacity of a station is limited by a range of factors (such as escalator capacity in the Station and signalling on the track). In the case of city loop stations, capacity is most often limited by the access arrangements (stairwells, walkways and escalators).

In the case of the tram stops highlighted for investigation, capacity is more often limited by the frequency of services. In the peak, trams are often queued up to use the two stops that are part of this study. This queuing of vehicles limits capacity of each stop. Tram stop infrastructure is easier to change (to increase vehicle capacity) although both the tram stops in this study have been upgraded to platform stops, and are unlikely to be significantly upgraded again in the next ten years.

Each site in the study has been assessed in terms of what factor is most likely to limit the egress of pedestrians from the station or tram stop. The capacity of each entrance has then been used to determine the likely maximum future flow of pedestrians around the site.

The space required to enable safe, efficient and high amenity movement of people around transport nodes is directly related to the number of people using the space and what they

are using it for. Each element of the movement network (such as walkways, stairs, escalators and footpaths) has specific maximum capacities.

2.1 At each station

The theoretical maximum capacity of each station entrance is determined by the existing supply of infrastructure (for pedestrian movement) in each station. The supply of pedestrian facilities inside the station is important because it informs the maximum flow rate out of the station (usually in the morning peak) and the maximum capacity to accept people (usually in the afternoon peak).

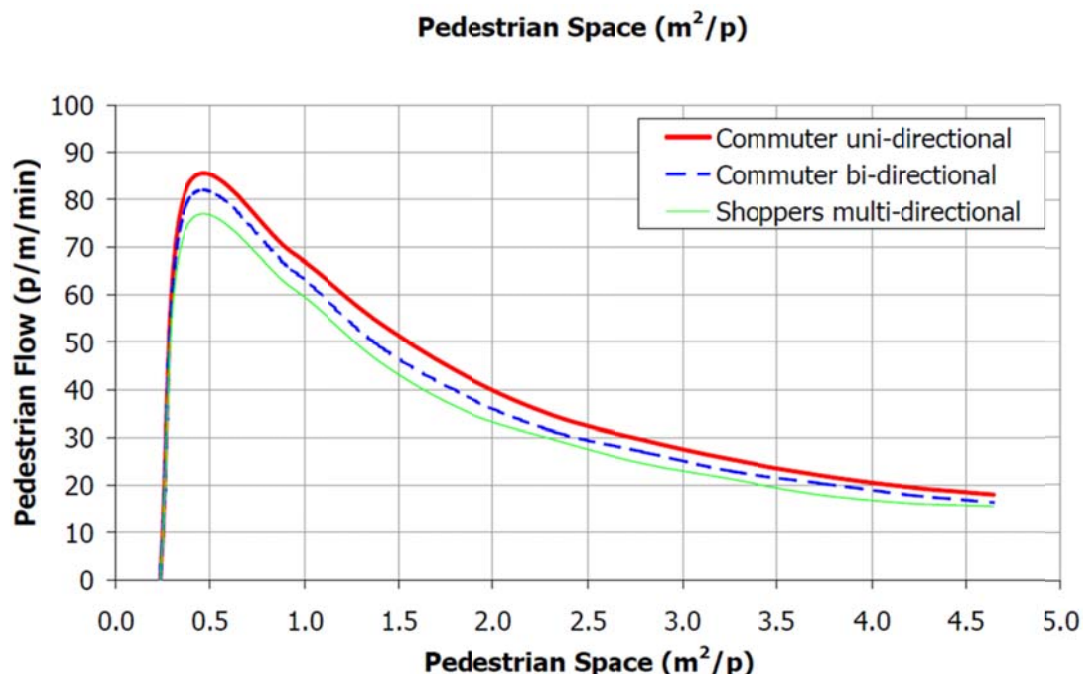
When this maximum capacity to accept more intending passengers (usually in the afternoon peak) is exceeded, queues can form outside the station entrance. These queues can then bank-up and require more space. In problematic situations, queues spill onto the traffic lanes in an unsafe manner.

The maximum theoretical capacities of each station entrance are discussed in the previous section of this report. There is an expectation of significant growth in CBD visitors per weekday. Operational changes such as signalling and carriage configuration will increase railway capacity such that the maximum theoretical capacity of each entrance provides a reasonable estimate of the possible pedestrian flow that the surrounding footpath will need to cope with.

2.2 Capacity of footpaths

Footpath capacity is influenced by the walking speed and space required for each person. The relationship between pedestrian space and flow rates is shown in Figure 2-1 below.

Figure 2-1 Walking Speed variations by Supply of Pedestrian Space



Source: *Transit Capacity and Quality of Service Manual (TCRP 100) – 2nd Edition*

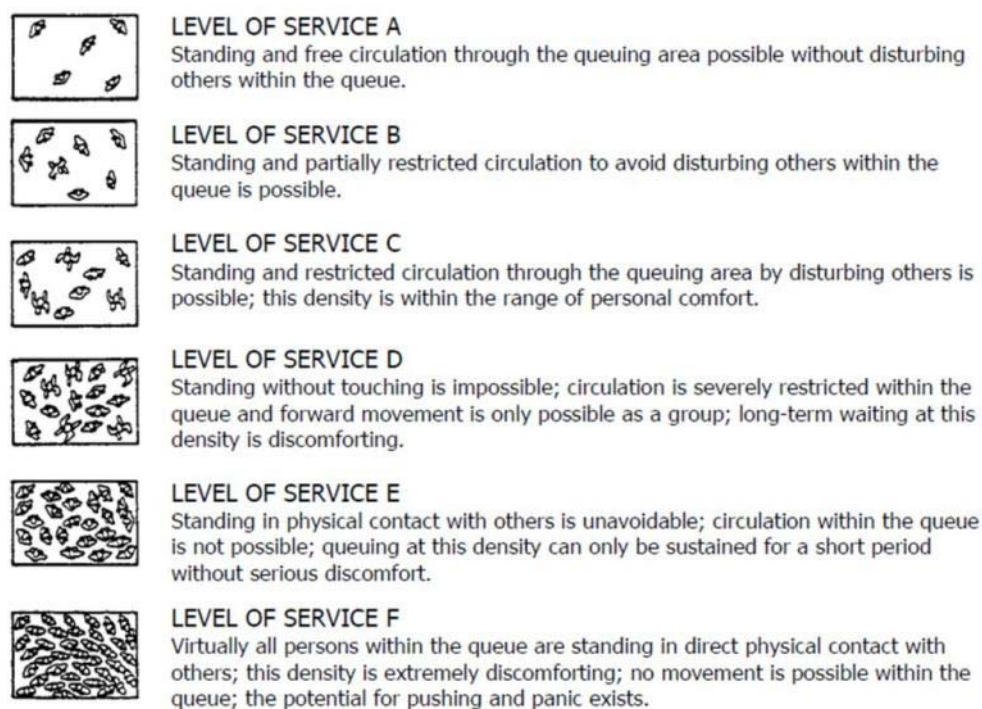
Maximum flow rates are achieved in very high density (and uncomfortable) conditions. These conditions can also get dangerous, as small disturbances in the flow can cause greater significant discomfort due to crowding. Free flow conditions are those in which people can choose the speed at which they walk and can pass others easily, without

obstructing others travelling in other directions. This is a flow rate of about 13 people per metre of width per minute.

This study is focused on areas of high congestion and access to transport nodes in peak periods. The aim is to ensure that the public realm which provides access to these transport nodes remains safe and functional as passenger demand and pedestrian volumes increase. As such the notion of free flow conditions is irrelevant, as the study is focused on times when free flow conditions do not occur. Furthermore, designing any infrastructure to achieve free flow conditions at peak times would mean that the place is relatively deserted at non-peak times.

Therefore, when discussing capacity of footpaths and queuing areas around transport node entrances; this study focuses on the level of service that is most desirable for the infrastructure to provide at peak times. The level of service provided in a queuing area at various densities is shown in Figure 2-2 below.

Figure 2-2 Level of Service Diagram for a Queuing Area



Source: *Transit Capacity and Quality of Service Manual (TCRP 100) – 2nd Edition*

Given the focus of this report on peak period movements, facilities should be planned to meet level of service C during average weekday peak times with an understanding that the level of service will drop to D or E at some times (such as during a major event). Note that level of service F is inherently dangerous particularly in areas where pedestrians are not physically separated from fast moving vehicles.

This study has considered the demand and supply for space in the public realm around the entrances to public transport hubs. The scope of this study has been a high level initial pass to identify some ideas that should be further investigated. Only a small number of the recommendations are suitable for implementation without further design, costing and detailed evaluation. As these are high level ideas for discussion the ideas have been presented in picture form (predominantly using aerial photographs) as a concept plan.

3. Site Assessments

The structure of each site assessment is focused on:

- Current and future demand;
- Existing supply; and
- Recommendations.

Assessments for each site are provided below.

3.1 Flagstaff Station

Current and future demand

Flagstaff is reliant on a single entrance on the southwest corner of the intersection. There is a preference for passengers using the southern exit with about half the people who are travelling north still using the southern exit. Over 10% of the total passenger volume was exiting the southern entrance and then travelling north. This is likely to be due to the:

- Location of some buildings (Commonwealth Law Courts) to the immediate north of the southern entrance to the station; and
- Lack of escalators at the northern entrance.

Escalators have a significant impact on passenger decisions about how to exit an underground station and a lesser impact on decisions about entering the station. It is therefore likely that the afternoon peak shows greater use of the northern (stairs) entrance and slightly reduced use of the southern entrance.

Capacity at Flagstaff Station is clearly weighted towards the southern entrance which provides for over 75% of the theoretical capacity of the station. The capacity of Flagstaff Station is shown in Table 3-1 below.

Table 3-1: Capacity of Flagstaff Station

Location of Entrances	Limited by	Maximum Capacity (peak 15 mins)
La Trobe St & William St - Northwest corner	Stairwell	1,613
La Trobe St & William St - Southwest corner	Escalators	4,050

The southern entrance is currently being used by 80% of passengers. Most development (particularly office development) is likely to occur south of the station, which means that the southern entrance is likely to continue being the dominant entrance. The City of Melbourne should therefore focus on catering to demand specifically at the southern entrance.

Geological conditions make it difficult to expand capacity of the existing station. This means that the current capacity of the station is likely to reflect the long term ultimate capacity.

In the medium term there is likely to be a significant increase in the number of tram services in William Street. This will place additional pressure on the southern entrance to the station and more people use William Street tram services to access Flagstaff Station (the pressure will come from those who currently do not use Flagstaff at all, but change behaviour as tram services increase).

The Network Development Plan for Metropolitan Rail (PTV, 2012) shows that in the longer term an additional metro line and station is expected to be built under the existing Flagstaff

Station. The existing station has significant capacity constraints including the building over the southern entrance. It is therefore likely that any additional metro line would also require a new concourse and additional entrances. This study has therefore proceeded on the assumption that the existing capacity of the southern entrance is unlikely to increase.

However there is limited ability to alleviate the demand at the southern entrance, because any new entrance is unlikely to be located further south (unless in the Royal Mint site). Even a new metro entrance inside the Royal Mint site would struggle to attract significant demand away from the existing southern entrance as the majority of demand is on the western side of William Street and so is the station concourse.

The result will be a situation in the afternoon peak period whereby passengers need to queue to get into the station entrance, and these queues will continue to grow as activity in the CBD increases. As the queues increase in length some people (particularly those wanting to travel beyond the station entrance) will be tempted to walk along the traffic or parking lanes. This is an unsafe situation that already occurs at some peak times.

Existing supply

The forecourt of the southern entrance to Flagstaff Station has very limited area for passengers to queue. The footpath is 3m wide although to the south there are only two 1m wide channels because 1m near the kerb is occupied by trees, bins and other infrastructure and a pole is situated in the middle of the remaining walkway as shown in Figure 3-1 below.

Figure 3-1 Pedestrian Space Approaching Flagstaff Station from the South



The maximum theoretical capacity of the footpath is around 1,400 people in the peak 15 minutes. This is just 34% of the maximum theoretical capacity of the escalators. Currently some people are forced to walk in the traffic lane during peak times. As use of the station increases and as development around the station continues more people will be forced to walk in the traffic lanes more often.

Widening the footpath by 3m and relocating obstacles would provide enough width to cater for the full theoretical capacity of the escalators. This will be enough to cater for the station's future passenger demands. The footpath will need to be widened between the station

entrance and Little Lonsdale Street, which is the first point where pedestrians can turn different directions.

The footpath around the northern entrance of Flagstaff Station has capacity to meet current demands. The entrance is surrounded by Flagstaff Gardens so any increase in passenger volumes will not be constricted by the built environment.

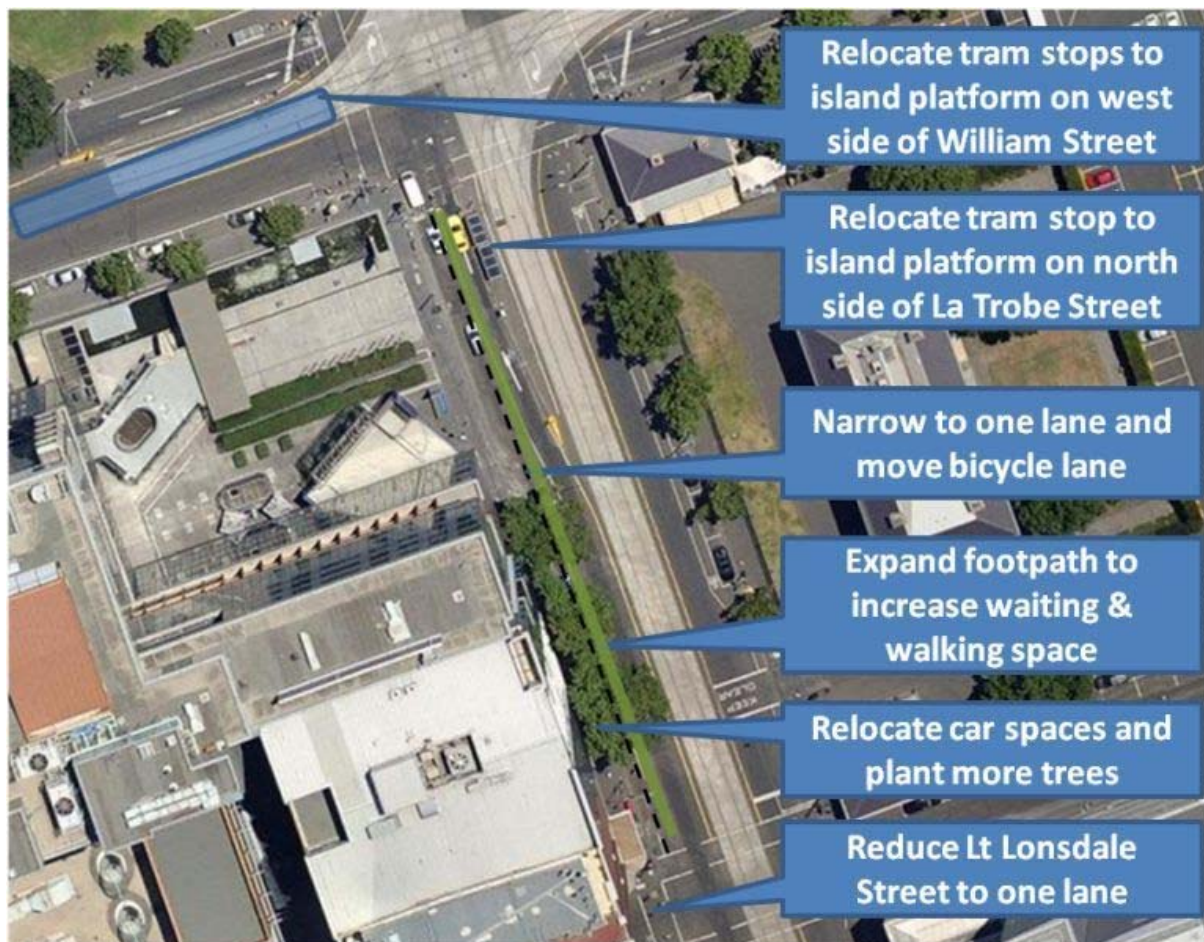
Recommendations

Critical elements of the public realm around Flagstaff Station are the footpath along William Street, crossing of Little Lonsdale Street and location of the tram stops.

The location of the tram stops is mainly important because of the impact that location has on the ability to complete other improvements. It is partly important to encourage tram passengers to access the station from the northern entrance – thereby reducing the passenger demand through the southern entrance.

The improvement ideas for Flagstaff Station surrounds are shown in Figure 3-2 below.

Figure 3-2 Improvement Ideas around Flagstaff Station



The optimum location for future platform tram stops in William Street from a public realm perspective will be on the northern side of La Trobe Street. This will encourage passengers to use the northern entrance to the station and will enable the footpath outside the station to be widened.

The future platform tram stops in La Trobe Street would ideally be located on the western side of William Street. This is due in part to the likelihood that passengers transferring between the train are travelling to or from the west (Docklands) rather than the east (served

by Melbourne Central Station). The other reason is that the train station entrances are all on the western side of William Street, and locating the tram stops on the same side of the road will reduce the need for passengers to cross William Street.

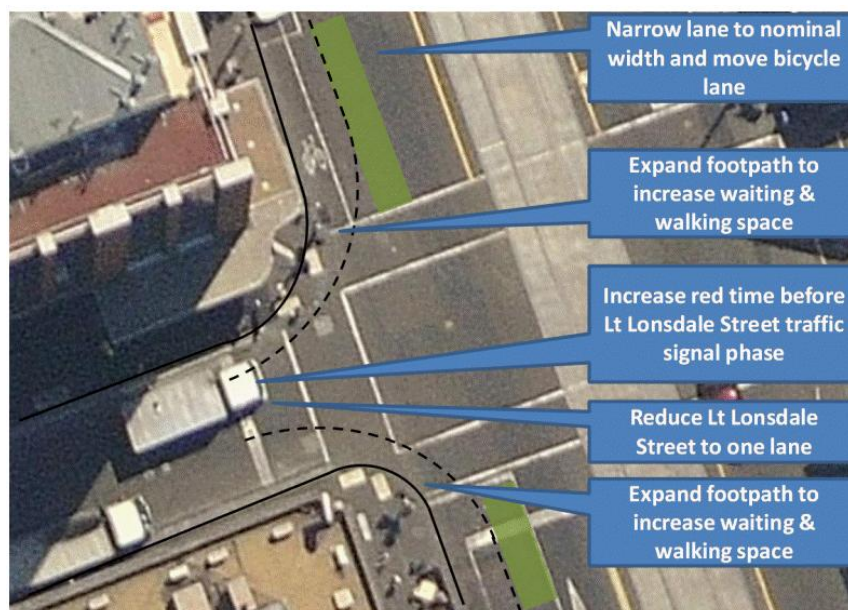
There is currently insufficient footpath space in front of the southern entrance to the station. The footpath should be widened as soon as possible, as some pedestrians are already forced to walk in the traffic lane at peak times. The footpath can be widened by about 3 metres by extending the footpath into the parking lane. This may be difficult to achieve in the short term but is expected to be sufficient to meet medium term demand.

In the longer term and specifically if another metro line expands Flagstaff Station consideration should be given to closing southern leg of the intersection (William Street). Alternatively locating additional station entrances on the eastern side of the road or in the Royal Mint site would ease congestion around the existing entrance.

South of the entrance at the intersection of Little Lonsdale Street and William Street significant queuing occurs and pedestrians make unsafe crossings of Little Lonsdale Street. This is due to the high volume of people, the low volume of traffic and the small amount space provided for pedestrians. At this location the optimal outcome needs to make crossing Little Lonsdale Street safer and should increase the amount of space available for pedestrians when they need to stop for the traffic in Little Lonsdale Street.

Improvement ideas at Little Lonsdale Street are shown in Figure 3-3 below.

Figure 3-3 Improvement Ideas around Flagstaff Station (Little Lonsdale Street)



A traffic count of Little Lonsdale Street should be obtained (including the proportion of turning traffic) to determine the impact of narrowing the street to a single traffic lane. The current situation in practice has one traffic lane as parking is permitted on the southern side of Little Lonsdale Street. The problem for pedestrians is that the single traffic lane is relatively wide which takes a long time to cross and enables traffic to travel at maximum speed. With an expansion of the William Street footpaths the impact on traffic of narrowing Little Lonsdale Street can be minimized, as space for one or two left turning vehicles could be provided enabling vehicles travelling through to pass on the right hand side.

The northern entrance could be made more attractive to passengers with the installation of a single escalator between the mezzanine and street level, operating in the peak direction

only. If demand increases significantly, the northern entrance to Flagstaff offers the best opportunity to expand passenger capacity, as the parkland surrounding the existing entrance could easily accommodate an alternative or wider access point.

A list of the initiatives suggested for further investigation to improve passenger flows around Flagstaff Station is provided in Table 3-2 below.

Table 3-2 Initiatives to improve passenger flows around Flagstaff Station

Location	Timeframe	Initiatives
Northern Entrance	Medium	Install escalator (peak only direction) between mezzanine & street levels
	Long	Investigate relocating tram stops to western side of William Street and northern side of La Trobe Street and use signage to encourage tram users to interchange via the northern entrance. The exact location of the tram stops will depend on track geometry and other road engineering constraints. Preserve options to expand entrance
Southern Entrance	Short	Investigate widening footpath on William Street between Little Lonsdale & La Trobe Streets when tram tracks on William Street are upgraded.
	Long	Investigate relocating tram stop to northern side of La Trobe Street and narrow traffic to one lane in each direction. Investigate reducing William Street to one lane in long term to allow further footpath widening.
Little Lonsdale Street	Short Medium	Review traffic signals to investigate opportunity to increase the inter-green time before the Little Lonsdale Street phase Investigate widening footpaths on Little Lonsdale Street by 1.4m in total (both sides) and reduce traffic lane width

3.2 Flinders Street Station

Current and future demand

Flinders Street Station is the busiest in the Melbourne network and includes connections to the busiest tram stop in the Melbourne network (Federation Square). Other connections to tram routes in Elizabeth and Flinders Streets are also significant.

Capacity at many of the station entrances is regularly tested in peak periods, with queues forming particularly to exit the station in the morning peak. The number of gates has a significant impact on queuing at some entrances including Elizabeth Street, Yarra River Pedestrian Bridge and Degrares Street Subway.

There is currently significant capacity for queues to form on either side of the barriers at all Swanston Street entrances. The Degrares Street entrances have some ability to cater for moderate queues. The Elizabeth Street entrances (at both ends of the Elizabeth Street subway lack significant space for queuing to occur before pedestrians spill into stairwells or onto traffic lanes.

Flinders Street Station has seven major entrances mainly on the north and south sides of the Station. Passenger demand is growing (particularly as a result of more direct services being introduced) and reaches the limits of capacity at peak times. The pedestrian space required around Flinders Street correlates directly to the maximum capacity of the Station entrances. The theoretical maximum capacity of each entrance is shown in Table 3-3 below.

Table 3-3: Capacity of Flinders Street Station

Location of Entrances	Limited by	Maximum Capacity (peak 15 mins)
Flinders St at Elizabeth St - Southern side of road ²	Stairwell	6,000
Flinders St at Degrares St - Southern side of road	Gateline & signalling	2,100
Degrares St at Degrares PI - Southeast corner	Stairwell	3,200
Flinders St & Swanston St - Southwest corner	Gateline ³	2,700
Swanston St opposite Federation Sq. information centre	Gateline	2,400
Swanston St opposite Princes Walk	Gateline	3,000
Flinders Walk at footbridge over Yarra River	Gateline, walkway & stairwell	1,900

There is likely to be growth in demand from development on all sides of Flinders Street Station at locations such as Southbank, the CBD, along St Kilda Road, above the railway tracks between Russell and Exhibition Streets and even over the railway station itself.

The Melbourne Metro Project is expected to have a significant impact on Flinders Street Station (though it will take ten years to build). It is expected that a larger proportion of people will transfer to the Metro train in order to reach Domain Interchange (reducing the proportion of people transferring to the Swanston Street tram).

² At some times this entrance is used as a one-way only entrance

³ This location also serves pedestrians walking along Flinders Street or Swanston Street this increases the maximum possible demand significantly. It has been assumed that when this demand is at a peak alternative arrangements are usually in place (such as on New Year's Eve). This demand is therefore not included in the analysis.

The impact of the Metro Project on the pedestrian demands at the street level are unknown as the authors are unaware of the final design for how passengers would interchange and what underground walkways might be constructed. However the construction phase of the project is likely to have a significant impact on the streetscape. At this stage, the opportunity should be taken to redesign the intersection of Flinders Street and Swanston Street to reduce the number of traffic lanes and increase the pedestrian capacity of the area.

The other significant State government project that could impact on the area is the Flinders Street Station Design Competition which could lead to a redevelopment which generates more pedestrian movement in the area.

The long term growth of demand at the station will potentially require closure of Flinders Street to traffic between Flinders Court and Chapter House Lane in order to cater for a significantly greater volume of pedestrian movement.

Continued development of residential and commercial buildings in Southbank will also increase demand on the Elizabeth Street subway, and the station entrances at either end of the subway. The subway is already at capacity during peak periods, with queues from some platforms regularly forming (queues up to 40 seconds were observed) in the morning peak. This will cause the need for a significant improvement (duplication) of the pedestrian infrastructure linking Elizabeth Street with Southbank.

Federation Square Tram Stop

This platform tram stop provides access to both Federation Square and Flinders Street Station. It is served by nine tram routes is the busiest tram stop in Melbourne. If compared with train stations in terms of passenger use, the Federation Square tram stop would be one of the top five busiest in Melbourne.

It is considered to be part of the Flinders Street Station transport node. There are two facing platforms on opposite sides of the tram tracks. Each platform is 60m long and 3m wide. There are entrance ramps at each end of both platforms which lead to pedestrian crossings across the two northbound (one dedicated for cyclists) and two southbound traffic lanes.

The volume of passengers using the southbound platform in the morning peak often exceeds the practical capacity of the platform. This leads to queuing on (and beyond) the access ramps, delays to passenger boarding and safety issues.

The Department of Transport and Public Transport Victoria has modelled the future use of the tram stop once the Melbourne Metro is built. The Melbourne Metro project would result in the tram stop being rebuilt. Potential short term improvements to the tram stop include:

- Widening the southbound platform by 3m towards Federation Square; and
- Lengthening the platforms to accommodate more trams.

Longer term options include:

- Rebuilding the platforms as an island with the tracks on either side; and
- Closing Swanston Street to vehicle traffic and merging the footpath with the tram stop (while still accommodating the bicycle movements).

These options are currently being considered as part of other State and local government projects and have not been analysed in detail as part of this project.

Existing supply

Capacity at many of the station entrances is regularly tested in peak periods, with queues forming particularly to exit the station in the morning peak. There is currently significant capacity for queues to form on either side of the barriers at all Swanston Street entrances. The availability of queuing areas around the Swanston Street entrances reduces the need for the City of Melbourne to worry about footpath capacity in the immediate area (relative to other entrances which do not have as much queuing capacity).

The Degrares Street entrances have some ability to cater for moderate queues. The Elizabeth Street entrances (at both ends of the Elizabeth Street subway lack significant space for queuing to occur before pedestrians spill into stairwells or onto traffic lanes.

The Flinders Walk exit at the southern end of the Elizabeth Street subway is constricted by a small flight of stairs that is 2.9m wide. This limits the capacity of the entrance to around 1,900 people in the peak 15 minutes.

The subway exit at Elizabeth Street also copes with a complex set of different pedestrian movements. In total there are three staircases each three metres wide (two from the subway and one from platform 1). The total theoretical capacity of these stairs is just over 4,500 people in the peak 15 minutes. At the top of the stairs beyond the gate-line there is a footpath that is 3 metres wide.

The traffic signals operate to a 90 second cycle with a maximum wait for pedestrians of 72 seconds. This is enough time for over 350 people to queue at the kerb of the intersection. The space required for this queue is over 320 square metres. The footpath currently provides around 200 square metres of queuing space and cannot cope with a small number of pedestrians trying to pass the crowd queuing to cross Flinders Street.

Recommendations

Improvement ideas for Flinders Street Station are focused on encouraging greater use of Degrares Street subway, and improving movement around each end of the Elizabeth Street subway. The Swanston Street entrances are very busy, but all have significant queuing space around them.

One specific option to increase the number of entrances is to construct a temporary entrance using stairs between platform 10 and Flinders Walk. This would need to be temporary as Public Transport Victoria (PTV) plans to reinstate the railway track in this location. A longer term (though much more difficult option) would be to extend the Degrares Street subway to exit directly onto Flinders Walk.

The existing entrances to Flinders Street Station and a potential new entrance to platform 10 are shown in Figure 3-4 below.

Figure 3-4 Existing and suggested entrances to Flinders Street Station



Plans currently being considered by the City of Melbourne seek to reallocate space in Swanston Street from vehicles to bicycles and pedestrians may provide additional space at the Swanston Street end of the station to meet medium term pedestrian needs. Long term consideration of closing Princes Bridge to traffic, enabling an extension of Federation Square to meet the station concourse will be required.

The two most congested entrances are those at either end of the Elizabeth Street subway. Specific improvement ideas for the Flinders Walk entrance are shown in Figure 3-5 below.

Figure 3-5 Improvement Ideas around Flinders Street Station



The Flinders Walk entrance consists of three gates (with additional gates along the subway), a set of stairs (2.9 metres wide) and a ramp that doubles back on itself. The stairs are constrained in width because the ramp exit is located to the immediate east of the stairs. The ramp exit could be relocated to connect into Flinders Walk, enabling the stairs to be widened by around 3m. This would better align the stairway capacity with the capacity of the subway and entrance gates.

At the other end of the Elizabeth Street subway there is a longer line of entrance gates and three sets of stairs (each 3m long). One set of stairs connects only to platform 1. This set is used much less constantly than the other sets of stairs, but is used to capacity when trains arrive. One set of stairs connects to the subway – which is the main link between Elizabeth Street and Southbank. The overall result is a relatively steady flow of people exiting the stairs in the morning peak and entering the stairs in the afternoon peak with a small (yet significant) amount of counter peak flow.

A key issue at this location is that 80-90% of the pedestrians want to cross Flinders Street at Elizabeth Street. The traffic lights operate on a 90 second cycle which can result in 72 seconds of time for queuing to occur on the footpath around the station entrance. Crowding between the stairs and the kerb significantly obstructs the ability for pedestrians walking along Flinders Street to pass this point. Typically any pedestrians trying to walk through have to wait until the pedestrian signals turn green before they fully pass the waiting crowd.

Observation suggests that the number of pedestrians travelling through on Flinders Street well exceeds the number of people in private vehicles travelling through the intersection. Despite this, vehicles are given approximately double the amount of green time that pedestrians are given in the intersection.

Analysis shows that 435 square metres of footpath space on the southern side of Flinders Street is required to store the number of pedestrians who could be waiting at the lights in the peak period while achieving the desired level of service (LOS C).

This amount of space is not currently available due to the proximity of the gateline to the traffic lanes. An option to assist in the short to medium term is to minimize the width of the single westbound traffic lane through the intersection of Flinders Street and Elizabeth Street. On the eastern side of the intersection there are two lanes while on the western side of the intersection there is only one. Furthermore, only one lane of traffic can enter this section of Flinders Street past the Swanston Street tram stop. Realigning the kerb and channel to reduce the intersection to one traffic lane will provide some additional space for pedestrians.

The kerb in front of the gateline can be extended by approximately 3m, tapering down to a 1m extension of the kerb at the western end of the intersection. The bus bay could be retained to the east of the intersection, though it should be shortened, as it currently presents a safety issue when vehicles are parked in it and pedestrians cannot see beyond to the traffic stream.

The existing left traffic lane has been designed to minimize delays to the one bus route operating on this section of Flinders Street. However, Route 605 terminates at Flinders Street Station and during most of the day vehicles layover in a bay about 50m before the intersection. Moreover, the lane is available as a loading zone and parking for coaches, which when in use, eliminates the ability to provide for Route 605. The bus route therefore does not need the minimal advantage provided by the additional lane space. Making the space available for pedestrian use would generate much more significant benefits.

The traffic signal timing can be adjusted to significantly improve pedestrian crowding at the station. The through traffic phase of the signal cycle could be halved in time, resulting in a

shorter wait for pedestrians between each pedestrian phase. This would reduce the average wait time by almost 50% and have a similar impact on crowding levels. This change in signal timing will also benefit tram passengers who currently have to queue for significant time to get to or from the tram stop. In some cases this leads to passengers missing connecting services or crossing the traffic stream illegally (against the signals).

Currently the pedestrian flows from all three stairways converge on the same half of the intersection. Greater dispersal of pedestrians across the intersection width would reduce the crowding that occurs in front of the entry gates. This could be achieved using temporary (peak only) fencing erected between the entry gates and the pillar to the west of the gates. This will force pedestrians from the Elizabeth Street underpass and from platform 1 to use the western half of the intersection.

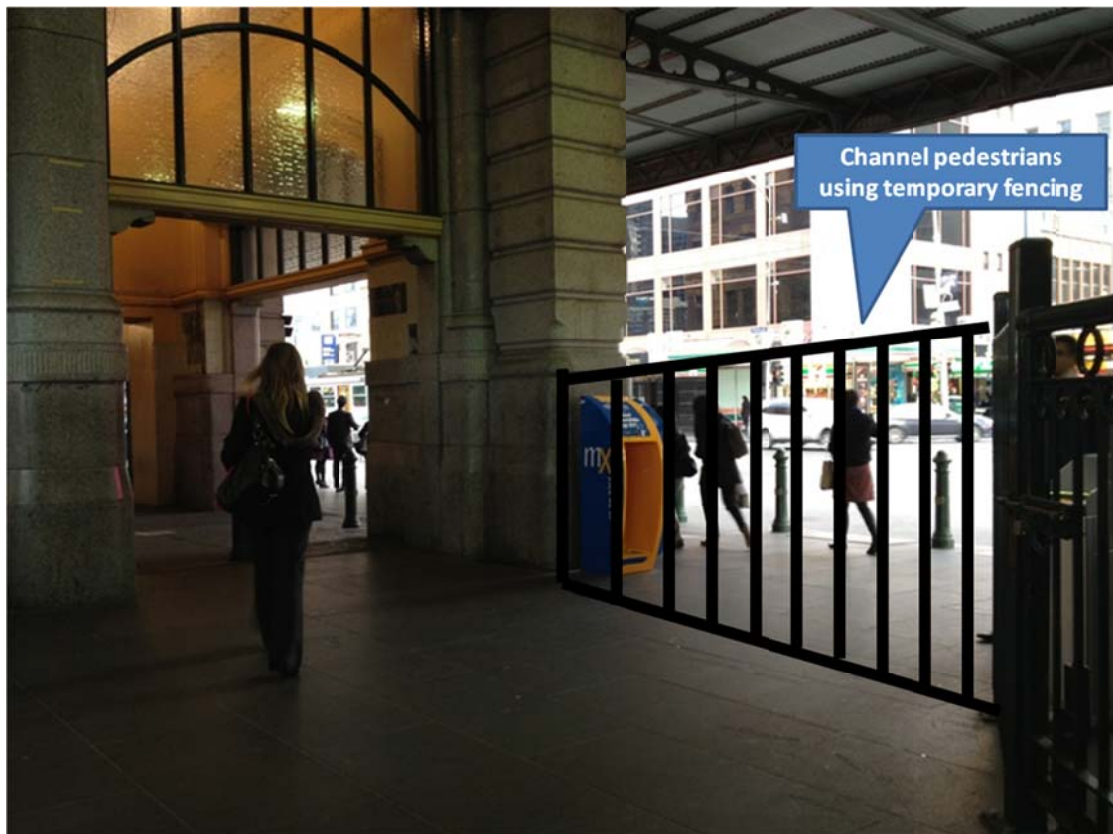
In the medium to longer term the Elizabeth Street underpass needs to be widened to cater for peak flows (of passengers and non-passengers walking between the CBD and Southbank).

The improvement ideas for Flinders Street Station at Elizabeth Street intersection are shown in Figure 3-6 and Figure 3-7 below.

Figure 3-6 Improvement Ideas around Flinders Street Station (Elizabeth St)



Figure 3-7 Improvement Ideas around Flinders Street Station (Elizabeth St)



The second figure above (Figure 3-7) shows how fencing could be used to channel pedestrians and reduce queuing between the gateline and kerb of Flinders Street.

Another option is to make it easier for pedestrians to cross Flinders Street at another location. For example, a mid-block pedestrian zebra crossing at the western end of the tram stop (aligned with the Victoria University arcade and Mill Place) would make it easier for some pedestrians to cross the road at this location, and would reduce the number of pedestrians waiting at Elizabeth Street.

Degraves Street subway is an existing alternative to crossing Flinders Street at Elizabeth Street. It connects with a number of lanes and arcades right through to Bourke Street. Although not under the control of the City of Melbourne there are several things that can be done to improve the attractiveness of this entrance (when compared with Elizabeth Street).

- The main stairwell (into Degraves Place) could be replaced with escalators that operate in the peak direction. This could be a one-way entrance, as there are two other (narrow) stairwells on the northern side of Flinders Street that can be used by people travelling in the non-peak direction.
- Additional gates can be provided in the gate line. At peak times the queue to exit or enter the station through the Degraves Street subway. There is enough space to increase the number of gates in the subway which would alleviate these queues.
- The ambiance of the subway could be improved with a refresh of the décor and specialty retail that is targeted to the passenger segments that we want to draw away from Elizabeth Street.

A list of the initiatives suggested for further investigation to improve passenger flows around Flinders Street Station is shown in Table 3-4 below.

Table 3-4 Initiatives to improve passenger flows around Flinders Street Station

Location	Timeframe	Initiatives
Flinders Walk (existing)	Short	Realign the ramp access and widen the staircase
	Long	Widen the Elizabeth Street underpass
Flinders Walk (new)	Short	Construct a temporary new exit from platform 10 onto Flinders Walk
	Long	Extend the Degrares Street subway to a new exit on Flinders Walk
Elizabeth Street	Short	Pilot temporary (peak only) fencing between the entry gates and the pillar to the west Investigate shortening the through traffic phase of the signals in peak periods to reduce the time between each walk phase including a consideration of the impact on customers of other modes, particularly trams.
	Medium	Widen footpath on southern side of Flinders Street by 1-3m Widen footpath on northern side of Flinders Street into the parking lane
	Long	Widen the Elizabeth Street underpass
Degrares Street (north side of Flinders St)	Short	Install additional gates at the entrance Investigate ways to encourage pedestrian access to Flinders Street Station via Degrares Street, possibly to include investigating the impact of street trading on Degrares Street. City of Melbourne is currently working with Metro Trains to increase signage.
	Medium	Install escalators at the Degrares Place entrance
Flinders St opposite Degrares St	Medium	Investigate removal of bus route 605 along Flinders Street and options to widen footpath on southern side of the road by 3m
Swanston St (all entrances)	Short-Long	Widen footpath and consider closing Princes Bridge to minimise the obstruction between Federation Square and the station concourse

3.3 Melbourne Central Station

Current and future demand

There is currently high demand at Melbourne Central Station through a significant part of the day. This is due to the wide range of attractors that Melbourne Central provides access to, including universities, employment, retail, recreation and residential land uses.

The entrances on Elizabeth Street and Swanston Street are the busiest. This is due in part to their importance in connecting with tram services, and because they provide access to the highest number of activity generators. As development continues demand will increase, particularly from the areas to the north and west of the Station.

Demand at Melbourne Central is expected to continue to grow significantly. This is due to the large catchment that the station has (including the universities and hospital precinct) and the significant scope for development (and increased density of activity) in that catchment. The future flow of people into and out of the station will be limited by capacity of the station entrances. The theoretical maximum capacity of Melbourne Central Station entrances is shown in Table 3-5 below.

Table 3-5: Capacity of Melbourne Central Station

Location of Entrances	Limited by	Maximum Capacity (peak 15 mins)
Swanston St & Knox Place	Walkway	4,700
La Trobe St at Melbourne Central – Southern side of road	Walkway	2,800
La Trobe St ramp – Northern side of road	Walkway	1,900
La Trobe St stairs – Northern side of road	Stairwell	1,100
Elizabeth St at the ME Bank Tower	Escalators	4,000

The Melbourne Metro Project is expected to have a significant impact on Melbourne Central Station (though it will take ten years to build). It is expected that a larger proportion of people will transfer to the Metro train in order to reach Melbourne University (reducing the proportion of people transferring to the Swanston Street tram).

Growth in pedestrian demand is likely to be greater at the western (Elizabeth Street) end of the station, as there is more scope for re-development in this part of the CBD. However, unforeseen re-development of RMIT buildings and the CUB site (on Swanston Street) could even-up increases in demand over time.

Existing supply

The main entrances to Melbourne Central Station are located within the Melbourne Central shopping centre. This helps to disperse pedestrian demand though also makes it difficult for the City of Melbourne to differentiate between passenger and shopper demands. Footpaths in Swanston Street are wide enough for current demand and as wide as they can be whilst also providing for the platform stop that serves the tram track in the centre of the road.

Footpaths around the exits on La Trobe Street (both on the northern and southern side of the road) are adequate for the existing levels of demand, although the footpath on the southern side of La Trobe Street is particularly narrow. The entrance on the southern side of La Trobe Street is also an entry for the whole shopping centre. If demand at this location increases significantly, the footpath will need to be widened. Some widening of the footpath

is due to occur when the La Trobe Street bicycle lanes are constructed in mid-2013. This is anticipated to be enough to meet current and foreseeable future demands.

The footpath on the eastern side of Elizabeth Street is 5.3 metres wide and currently copes with most pedestrian demands. The escalators have the capacity to deliver around 4,000 people in the peak 15m onto the footpath. Dispersal of pedestrians north and south along the footpath and east into Melbourne Central reduces the load on each area significantly.

The footpath in Elizabeth Street and the pedestrian crossing on the southern side of La Trobe Street struggle to cope with the number of passengers seeking to transfer between tram services and the station. This is due to the narrow width of the pedestrian facilities, clutter of wayside infrastructure at the corner and car parking reducing the space available for pedestrians.

Recommendations

The ideas to improve access and egress from Melbourne Central Station are focused on dispersing the density of passenger movement across the entrances that are underutilized. Due to the private realm (Melbourne Central Shopping Centre) having significant control over the space between the concourse and the public realm (footpath) the City of Melbourne has a very limited toolkit to improve crowding around this station.

One idea is to consider an additional entrance between Knox Lane and the Melbourne Central Shopping Centre which would disperse some passengers away from the Swanston Street tram stop (which can get highly congested in peak times). The existing and potential entrances to Melbourne Central Station are shown in Figure 3-8 below.

Figure 3-8 Melbourne Central Station Improvement Ideas



In order to disperse passenger movements, particularly through the less utilized entrances on La Trobe Street, the eastbound and westbound tram stops could be located on the west side of Swanston Street. This may not be technically feasible (due to the depth of the station concourse, but should be investigated as an option that helps direct passenger flows away from the congested station entrances.

In addition, a zebra crossing could be installed at the western end of the new platform tram stop. This would further improve the appeal of these two station entrances for passengers. Improvement options for Melbourne Central Station (La Trobe Street) are shown in Figure 3-9 below.

Figure 3-9 Melbourne Central Station Improvement Ideas (La Trobe Street)



Footpaths in this block of La Trobe Street are currently being widened as part of the La Trobe Street bicycle lane construction. Improvements to the intersection of La Trobe and Swanston Streets to increase the pedestrian queuing space should also be considered.

At the Elizabeth Street entrance of Melbourne Central Station the main congestion issue⁴ is related to passengers who need to interchange between the Elizabeth Street tram routes and the Station. In the morning peak the dominant movement is from the Station to northbound trams while in the afternoon peak it is from southbound trams to the Station. Both passenger movements create significant congestion at each tram stop and generate unsafe situations as passengers try to cross (and often spill onto) the intersection.

The number of passengers regularly exceeds the capacity of the northbound tram stop on weekday mornings. It has been widened to have a maximum capacity of around 130 people. This is barely sufficient to cater for current demand and passengers spill onto the intersection (pedestrian crossing) at busy times.

Short term improvements that can be applied to this site include:

- Extend the northbound tram stop by around 30m to Little Lonsdale Street;
- Moving the northbound stop-line in Elizabeth Street back and widening the pedestrian crossing to the south by about 6m; and
- Install new pedestrian crossings over the southbound traffic lane only that are aligned with the southern end of the northbound tram stop and the northern end of the southbound tram stop.

All these works are relatively easy to design complete (compared with alternatives) and will provide some improvement that caters for a modest increase in passenger demand. The short term improvement ideas for Melbourne Central Station (Elizabeth Street entrance) are shown in Figure 3-10 and Figure 3-11 below.

⁴ The footpaths in Elizabeth Street are not the main congestion issue as they have already been widened. They cannot be widened further unless private vehicles are banned from Elizabeth Street. This is currently considered impractical, and is therefore discussed as a long term option below.

Figure 3-10 Short Term Melbourne Central Station Improvement Ideas

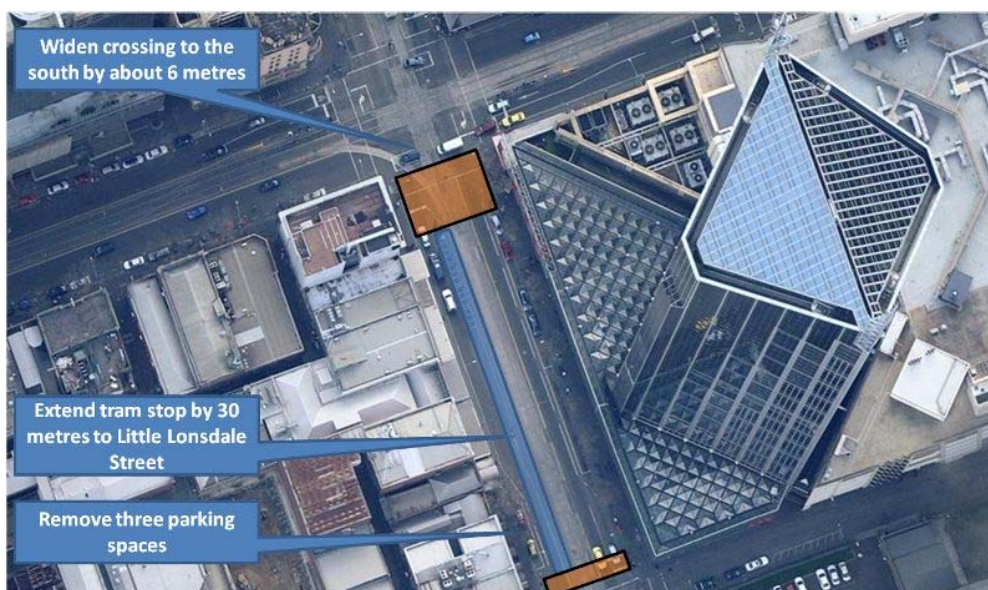


Figure 3-11 Short Term Melbourne Central Station Improvement Ideas



In addition, there is currently a newspaper stand that obstructs the walkway reducing the footpath width to just 2m. A photograph of this situation is shown in Figure 3-12 below.

Figure 3-12 Melbourne Central Station Footpath Narrowing



As soon as possible this newspaper stand should be relocated to sit directly south of the Station sign (also shown in the photo above). The lack of any obstruction at this location results in many passengers walking (or running) directly from this point to the tram stop on the other side of Elizabeth Street (often in unsafe situations). The relocation of the newspaper stand, bin and fencing about 20m south will help to solve this problem and will increase the capacity of the footpath, because the newspaper stand will sit opposite the station forecourt (which has additional space for passengers to queue and circulate).

These works won't however solve the pedestrian congestion problem (by catering for future demand) in the area. Longer term options include relocating tram stops to the southern side of La Trobe Street and the western side of Elizabeth Street. This will serve several purposes:

- Better aligning pedestrian movements with the location of the Station entrance;
- Encouraging use of the La Trobe Street entrances for access to La Trobe Street tram services; and
- Providing appropriate passenger waiting space by using island platform stops that cope well with unbalanced peak loading demands.

The longer term improvement ideas for Melbourne Central Station (Elizabeth Street entrance) are shown in Figure 3-13 below.

Figure 3-13 Long Term Melbourne Central Station Improvement Ideas



The use of an island platform is a second best option, necessary only if the street must remain open to private vehicle traffic. If Elizabeth Street could be closed to traffic between Little Lonsdale Street and La Trobe Street (like Swanston Street is) then the optimal passenger outcome would be to have two facing platforms based on kerb extensions much like the new tram stops in Swanston Street.

A list of the initiatives suggested for further investigation to improve passenger flows around Melbourne Central Station is provided in Table 3-6 below.

Table 3-6 Initiatives to improve passenger flows around Melbourne Central Station

Location	Timeframe	Initiatives
Knox Lane	Short	Remove the fence separating Knox Lane from Knox Place
	Medium	Re-form the public realm in Knox Lane and encourage activation of the streetscape
Swanston Street	Long	Investigate locating both La Trobe Street tram stops on the western side of Swanston Street. Align the tram stop entrance with the La Trobe Street entrances to the station Consider minor changes to improve pedestrian waiting and movement around the La Trobe Street and Swanston Street intersection
Elizabeth Street	Short	Widen the pedestrian crossing to the south by about 6 metres Lengthen the northbound tram stop by 30 metres to Little Lonsdale Street Install a pedestrian crossing (over the southbound lane only) at the southern end of the northbound tram stop if it cannot be lengthened to Little Lonsdale Street
	Medium	Relocate the Elizabeth Street southbound tram stop to the southern side of La Trobe Street in an island platform configuration
	Long	Close Elizabeth Street between Little Lonsdale and La Trobe Streets. Widen the footpath to provide platform stops either side of the tram tracks for the entire block similar to those in Swanston Street
La Trobe Street (northern side)	Short	Use signage to encourage use of this entrance
	Long	Install escalators linking towards Little La Trobe Street
La Trobe Street (southern side)	Long	Install escalators in part of the stairwell

3.4 Parliament Station

Current and future demand

Parliament is one of the busiest stations at peak hour, though significantly less busy at non-peak times. This is due to a high proportion of large office buildings being within an easy walk of the Station. There is potential for development in the surrounding area (such as the Windsor Hotel development), though Spring Street parkland and heritage buildings constrain the quantum of development compared with areas around other stations.

Parliament Station consists of two main concourses (at the northern and southern end of the station). Both concourses have multiple entrances (stairs only). These stairwells are the critical element that needs to be understood in terms of capacity to plan for adequate space on the footpath. The capacity of each entrance is shown in Table 3-7 below.

Table 3-7: Capacity of Parliament Station

Location of Entrances	Limited by	Maximum Capacity (peak 15 mins)
Spring St at Ulster La	Stairwell	3,700
Gordon Reserve opposite Lt Collins St	Stairwell	4,800
Spring St at Bourke St – Southwest corner	Stairwell	1,800
Spring St & Lonsdale St – Southeast corner	Stairwell	4,100
Nicholson St & Lonsdale St – Southwest corner	Stairwell	4,800

Each concourse has a limit on the flow of passengers between the concourse and platforms due to a limited number of escalators, specifically a maximum of:

- two escalators operate in the peak direction at the Lonsdale Street (northern) end of the station; and
- three escalators operate in the peak direction at the Collins Street (southern) end.

These escalators have maximum capacities of 2,700 and 4,000 passengers (in 15 minutes) respectively. There is significant space to allow for queuing at the top of the escalators before the gateline. There is also significant space between the gateline and each pedestrian portal.

In the event of high passenger volumes inside the station, safety protocols require that the gateline would be opened. The resulting maximum flow of pedestrians exiting would be equivalent to the maximum capacity of the escalators to the concourse tempered by the maximum flow rate up each stairwell to the street. The maximum flow rate (for the peak 15 minutes) is the maximum rate that needs to be planned for on the footpath at each entrance.

In terms of accessing the station the stairway entrances are the key factors that limit capacity and provide the maximum 15 minute flow into the station. If the number of people trying to access the station exceeds the capacity of the stairwell, queues will form on the footpath. In this situation the footpath will need to cater for an increasing number of people until the flow drops below the maximum capacity of the stairwell.

Existing supply

The Nicholson Street entrance to Parliament Station has sufficient capacity on the footpath for pedestrians to queue at the traffic signals (at the intersection of Lonsdale and Nicholson Streets) and walk along the footpaths to access nearby destinations. If a significant

development (in terms of density of activity) is proposed for any site north east of the station entrance, the capacity of the intersection and footpaths to cope with the additional pedestrian demand should be assessed.

The entrance onto Lonsdale Street at Spring Street requires passengers to queue for traffic signals to cross either Lonsdale Street or Spring Street. Crossing Lonsdale Street would take the vast majority of pedestrians out of their way and is therefore unpopular. Of the pedestrians observed, 95% crossed Spring Street before crossing Lonsdale Street (if they crossed Lonsdale Street at all).

Due to the lack of traffic in Spring Street and the need for left turning vehicles to give way to pedestrians crossing Lonsdale Street, 80% of pedestrians cross whenever they believe it is safe (rather than wait for a green pedestrian signal). This presents a significant safety issue, as cars can be moving fast (due to the lack of traffic) and pedestrians can get into the habit of crossing the road without proper consideration of the traffic signals or oncoming traffic.

There is over 120sqm of space available for pedestrians to queue before crossing Spring Street. However, the capacity of the space is rarely tested, because most pedestrians cross Spring Street relatively soon after exiting the station.

Once on the other side of Spring Street, those pedestrians seeking to also cross Lonsdale Street queue on the south-western corner waiting for the pedestrian signal. In this location there is 31.5sqm of space available for pedestrians to queue in this area who have a maximum wait of about 80 seconds. This storage area has a theoretical maximum capacity of 35 people at LOS C and 105 people at LOS E. The signal timing and capacity of the entrance could lead to over 300 people needing to wait at this location.

Currently with around 80 pedestrians waiting for the signals to change, some of them spill onto the traffic lanes. The other significant impact is that the pedestrians are funnelled onto a narrow pedestrian crossing (5m wide) which means it takes longer for the queue of pedestrians to clear the intersection for left turning vehicles. On some signal phases, only one or two left turning vehicles are able to turn (because the time between the pedestrian flow stopping and the signals turning orange is so short. In order to efficiently clear the crowds that currently form a pedestrian crossing that is 8-10m wide is required. If crowds reach the maximum theoretical capacity of the entrance then 30m would be required to enable the crowd to cross the road in the time currently available in the signal phase.

The area and footpaths around both the Bourke Street and Gordon Reserve entrances are all wide enough to cope with the current and expected future pedestrian demands.

The southern (Collins Street) entrance to the station is located in Spring Street just north of Collins Street. The footpath south of the Collins Street entrance is 3m wide, although it reduces to 2.3m wide where the traffic signal control box is located. This has a maximum theoretical capacity of 1,300 pedestrians in the peak 15 minutes.

Exacerbating the congestion, any pedestrians waiting to cross Collins Street block the path of those wishing to walk around the corner into Collins Street. At this point pedestrian capacity for those wanting to use the footpath on the northern side of Collins Street can drop to less than 400 people in the peak 15 minutes.

The current situation results in pedestrians walking on the roadway (parking and bicycle lanes) to avoid the congestion (particularly when walking in the opposite direction to the peak flow). An example of this is shown in Figure 3-14 below.

Figure 3-14 Pedestrian Congestion in Spring Street



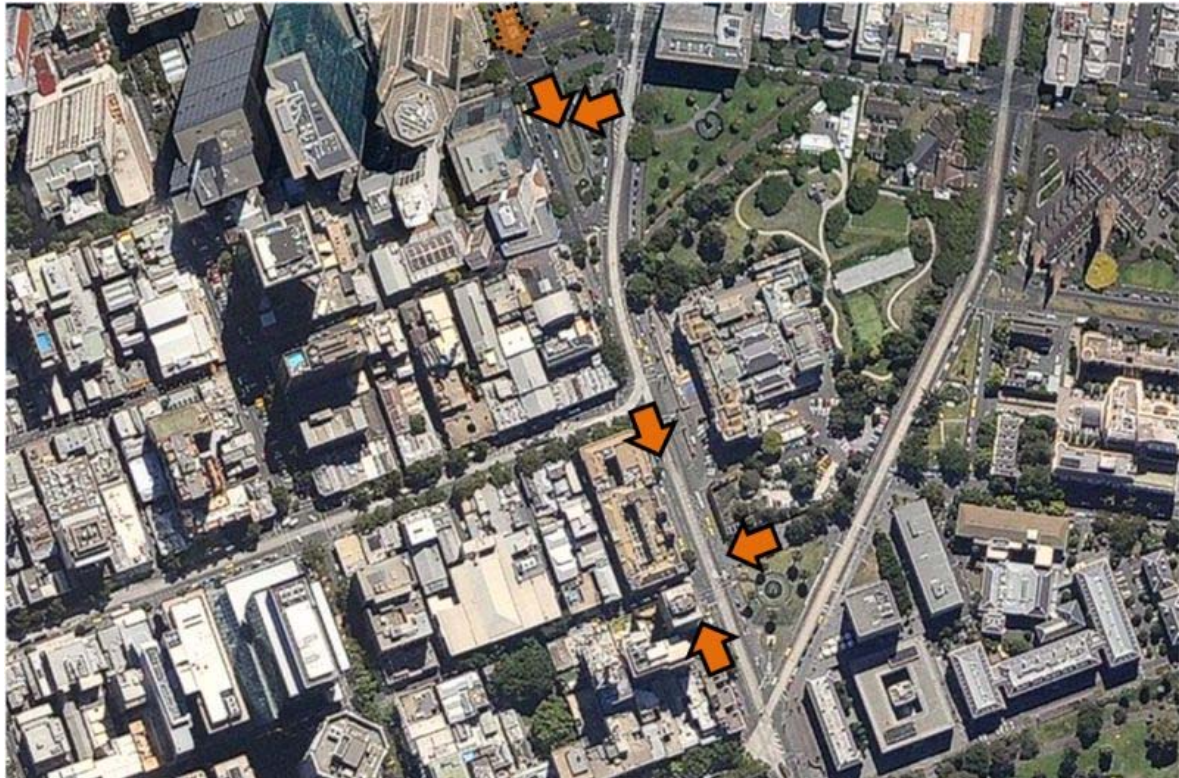
Recommendations

The five entrances to Parliament Station are disbursed along two blocks of Spring Street. Only the Bourke Street and Gordon Reserve entrances do not currently have pedestrian congestion issues.

Of the Lonsdale Street entrances the one near Spring Street has the most significant pedestrian congestion. This is because most passengers are travelling to or from the northern side of Lonsdale Street, while the entrance is on the southern side of Lonsdale Street. A long term improvement for this situation would be to extend the pedestrian subway beneath Lonsdale Street to a new portal on the northern side of the road. This is likely to require closure of at least some part of Spring Street (as the road space would be used for the portal).

The current and potential entrances at Parliament Station are shown in Figure 3-15 below.

Figure 3-15 Parliament Station Improvement Ideas (Lonsdale Street Entrance)



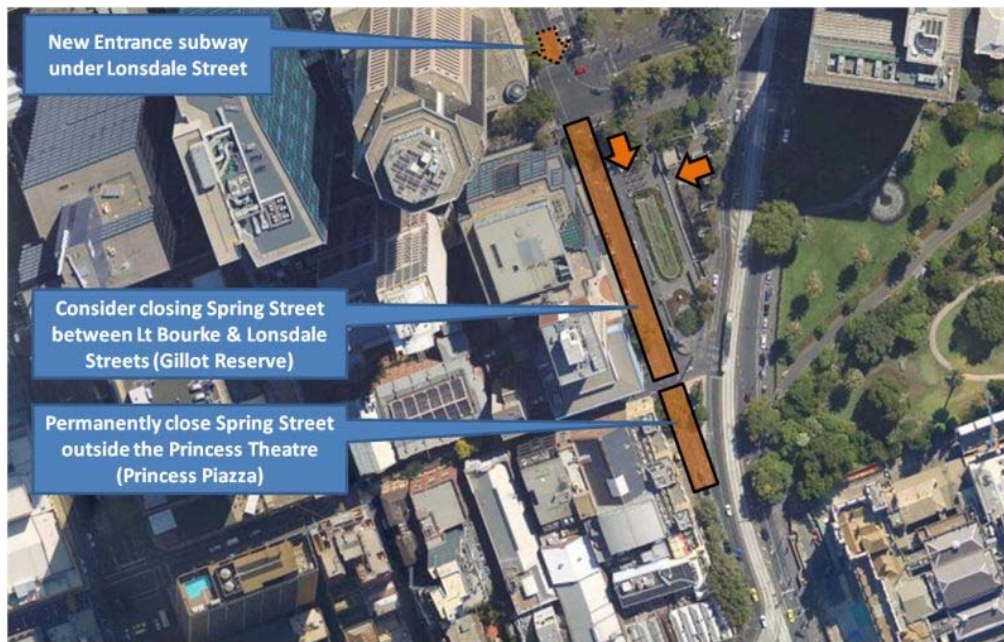
As an interim step Spring Street south of Lonsdale Street and south of Little Bourke Street could be closed in two sections. The short section of Spring Street outside the Princess Theatre should be closed to traffic immediately. This is because the road geometry leads to excessive vehicle speeds and unsafe conditions (particularly in the morning peak).

Closing this small section of Spring Street and converting it into a piazza at the front of the Princess Theatre also has significant other advantages in terms of a range of Council policies including those related to economic development and the urban forest strategy. From a parking perspective, the closure is likely to make more parking spaces available as the removal of this particular intersection would create more kerb space.

The only negative impacts of this idea are that vehicles would need to make a slower turn into Little Bourke Street and then turn into Spring Street, resulting in them getting to their destination a few seconds slower.

Road closure ideas around Parliament Station (Lonsdale Street Entrance) are shown in Figure 3-16 below.

Figure 3-16 Parliament Station Improvement Ideas (Lonsdale Street Entrance)



In the short and medium term options at the Lonsdale Street entrance are limited to slowing the speed of traffic on surrounding roads and encouraging passengers to use the Nicholson Street entrance. The traffic speeds on Spring Street can be reduced by narrowing the traffic to one lane, and banning left turns in the peak period. These left turns can occur at the intersection of Nicholson and Lonsdale Street with very minimal impact on travel time.

The Nicholson Street entrance can be made more appealing to passengers through the introduction of escalators and a zebra crossing to the tram stop. These improvement ideas are shown in Figure 3-17 below.

Figure 3-17 Parliament Station Improvement Ideas (Lonsdale Street Entrance)



At the Bourke Street entrance there are few if any congestion issues. Making the Bourke Street entrance more appealing to passengers could help to ease congestion at the other entrances at much less cost. A range of options exist to do this including making the entrance more 'interesting' than others using an art installation that provides shelter for passengers.

At Gordon Reserve the entrance is not congested, although making this entrance more appealing to passengers may significantly reduce congestion around the Collins Street entrance. Improvement options most worth considering are:

- Relocating the pedestrian traffic signals on Spring Street to align with the Little Collins Street intersection; and
- Installing escalators on the southern side of the stairwell.

These initiatives would particularly appeal to pedestrians in Little Collins Street who would then be more likely to cross the road and access the station from Gordon Reserve rather than turn the corner to use the Collins Street entrance. The improvement ideas for Parliament Station (Gordon Reserve Entrance) are illustrated in Figure 3-18 below.

Figure 3-18 Parliament Station Improvement Ideas (Gordon Reserve Entrance)



The Collins Street entrance at Parliament Station has one of the most congested public realm surrounds of all those in the CBD. This is in part due to the width of the footpath in this block of Spring Street (which has yet to be widened to match footpath widths to the north and south), and partly to do with the blind corner created by Alcaston House on the corner of Collins and Spring Streets.

Most important is the widening of the footpath, which will also assist to resolve the issue of the blind corner. In peak times, pedestrians waiting to cross Collins Street queue and fill the footpath space at the corner. This leaves minimal (if any) space for pedestrians to walk around the corner. A wider footpath will provide more space for queuing to occur and free up space for pedestrians to move. The traffic treatments in this block of Spring Street (northbound) are out of date, inconsistent and unsafe, for example:

- The traffic lane is 4.5m wide when it could be less than 3m wide;

- There is a “Form one Lane” sign yet by Little Collins Street there are two lanes;
- The bike lane runs into the tree, then continues again; and
- People using the disabled parking spaces are expected to get in and out of their car in close proximity to a confusing intersection and fast moving traffic.

Integral to this initiative is the relocation of parking spaces (including three disabled permit spaces) from the western side of Spring Street. These should be provided in the nearby area (the other side of Spring Street or in Collins Street) as they seem to be related to the proximity of the Returned Serviceman’s League (RSL). These parking spaces could be provided at the kerb of the widened footpath, in what is currently the left hand traffic lane.

An innovative option would be to provide two disabled parking spaces for RSL use in Ulster Lane. This lane is just north of the station entrance and is currently closed to traffic (it is part of the forecourt around the entrance). If this was necessary to get the footpath widened the net outcome would be positive, as the negative impact on Ulster Lane would be less than the benefits afforded a vast number of pedestrians.

The improvement ideas for Parliament Station (Collins Street Entrance) surrounds are shown in Figure 3-19 and Figure 3-20 below.

Figure 3-19 Parliament Station Improvement Ideas (Collins Street Entrance)

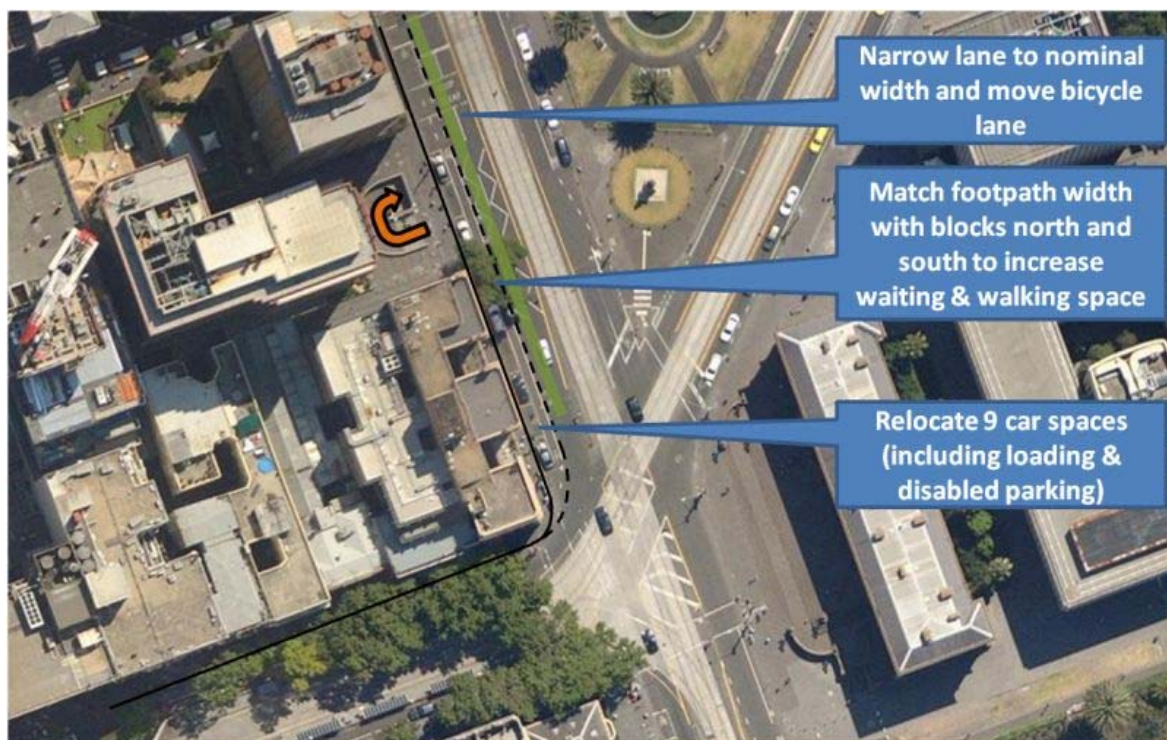
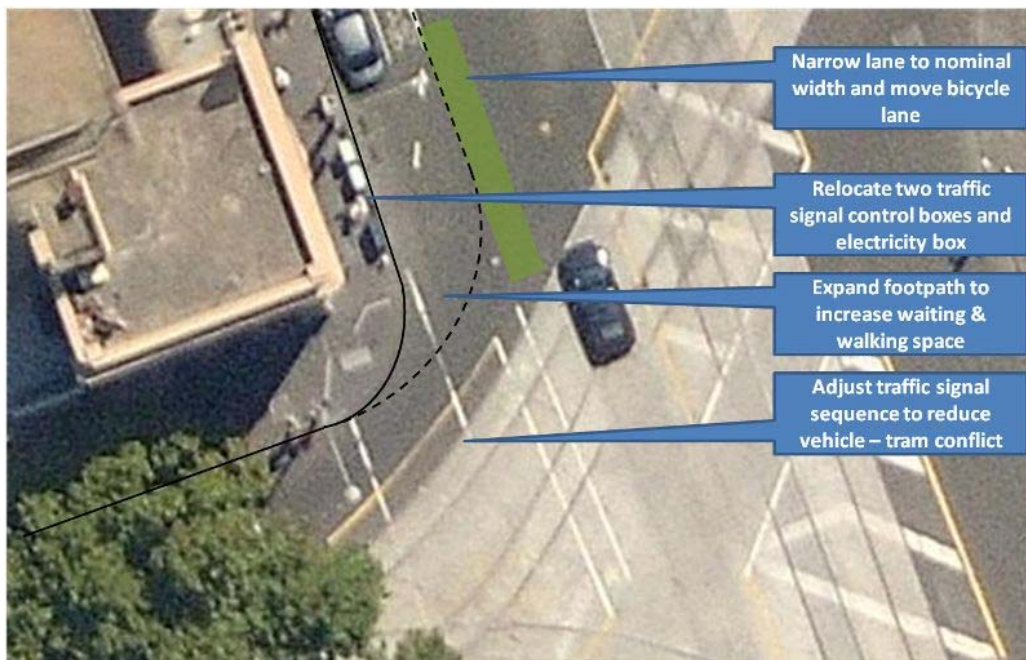


Figure 3-20 Parliament Station Improvement Ideas (Collins Street Corner)



Also important is the obstruction caused by traffic signal boxes and an electricity box on the footpath near the intersection. While expensive to move, it would be beneficial if this and any other wayside infrastructure could be moved to the other side of Spring Street (on the corner of Gordon Reserve).

Overall these improvements would enable a much wider pedestrian crossing and those queuing to cross the road would be able to move out of the way of pedestrians continuing around the corner. A photograph of the intersection of Collins and Spring Streets with notations specific to the kerb alignments is provided in Figure 3-21 below.

Figure 3-21 Parliament Station Improvement Ideas (Collins Street Entrance)



A list of the initiatives suggested for further investigation to improve passenger flows around Parliament Station is provided in Table 3-8 below.

Table 3-8 Initiatives to improve passenger flows around Parliament Station

Location	Timeframe	Initiatives
Lonsdale Street (at Spring Street)	Short	Investigate reducing the roadway to one traffic lane and widen the footpath south of Lonsdale Street by around 3 metres and prohibiting left hand turns from Spring Street into Lonsdale Street in the morning peak period Close the small section of Spring Street south of Little Bourke Street to traffic
	Medium	Investigate closing Spring Street to traffic between Little Bourke Street and Lonsdale Street
	Long	Consider extending the pedestrian underpass beneath Lonsdale Street to a new entrance in Spring Street on the north side of Lonsdale Street
Lonsdale Street (at Nicholson Street)	Long	Install escalators in the southern third of the stairwell Provide weather protection over the entrance Investigate installing zebra crossing across Nicholson Street at the southern end of the tram stop
Bourke Street	Short	Consider ways to make this entrance more attractive to passengers through signage, weather protection, installation of an escalator and an artistic approach to the entrance that captures people's attention while still being functional
Gordon Reserve	Medium	Realign the signalised pedestrian crossing to the intersection of Little Collins Street and Spring Street Install an escalator in the stairwell between the concourse and ground level
Collins Street	Short	Investigate relocating disabled parking bays to Collins Street, the eastern side of Spring Street or Ulster Lane Investigate narrowing the traffic lane and widening footpath on western side of the road by around 3 metres to match the kerb alignment on the southern side of Collins Street and the northern side of Little Collins Street Re-splay the north western corner of Collins and Spring Streets to maintain a traffic lane while increasing the pedestrian storage area as much as possible
	Medium	Relocate traffic signal control boxes and electricity box to Gordon Reserve

3.5 Southern Cross Station

Current and future demand

Southern Cross station was recently rebuilt. The new design and layout of the station removed the underpass access to suburban platforms which also connected underneath Spencer Street into Little Collins Street and Francis Street. While the outcome is a much nicer customer (and pedestrian) experience, it also results in significantly more people needing to cross Spencer Street at grade using pedestrian signals. This causes crowding around the pedestrian signals (particularly in the morning and afternoon peaks).

The station has been designed with enough space to cater for these crowds (in the morning peak). In the afternoon peak, the crowds need to wait in Collins and Bourke Streets to cross Spencer Street. The lack of footpath space in Bourke and Collins Streets results in pedestrians spilling onto the traffic lanes in a situation that is unsafe and highlights the lack of pedestrian amenity and facilities.

Pedestrian volumes in Bourke and Collins Streets currently spill onto the traffic lanes during each peak hour (in almost every traffic signal cycle). In Collins Street pedestrians spill mainly into the parking lane on the northern side of the road. In Bourke Street the problem occurs on both sides of the road, on the northern side pedestrians spill into the parking lane, while on the southern side of the road they spill into the left turn lane.

Pedestrian volumes accessing Southern Cross station are expected to increase significantly. All areas surrounding Southern Cross station are currently undergoing development of residential and or commercial buildings. In addition to the development of single buildings on specific sites in proximity to the station, there are long term plans for development of E-Gate and Fisherman's Bend that will continue growth within the tertiary catchment of Southern Cross station for decades to come.

The problems of pedestrians spilling into the traffic lanes will continue to get worse. In Bourke Street the ability to provide for left turns is directly related to the time it takes to clear the pedestrian volumes across the intersection. If the pedestrians are mainly corralled in a narrow space (though some never will be), it takes longer to funnel them across the intersection. As the number of pedestrians at this location grows it will perform more like the Elizabeth Street entrance of Flinders Street Station.

The capacity of the station to handle large crowds exiting the station is relatively good, with very large queuing areas at traffic signals and inside the station. The public realm (particularly in Bourke Street and Collins Street) is the focus of congestion. The biggest problems occur in the afternoon peak when large queues form on the eastern side of Spencer Street as pedestrians wait to cross.

The capacity required on the footpaths outside the station is determined by the pinch points inside the station which regulate the flow of passengers exiting. In most cases these pinch points are gate-lines, escalators and stairs that can only cater for a specific number of people in the peak 15 minutes.

The capacities of each entrance are shown in Table 3-9 overleaf.

Table 3-9: Capacity of Southern Cross Station

Location of Entrances	Limited by	Maximum Capacity (peak 15 mins)
Spencer St at Bourke St – Western side	Stairwell & Escalators	18,400
Spencer St & Lt Collins St – Western side	Doorway	2,900
Spencer St & Collins St – Northwest corner (from Metro)	Stairwell & Escalators	5,700
Spencer St & Collins St – Northwest corner (from V/line)	Gateline	3,300
Collins St opposite The Age Building	Gateline	6,300
Bourke St Pedestrian Bridge	Gateline	6,300

It should be noted that the figures above cannot be totalled to provide a total capacity for the whole station, as other factors impact on that figure. In addition the theoretical maximum capacity of each piece of infrastructure is calculated independently of other elements, as an extreme situation (such as a sporting event) may see capacity being reached at one entrance while another entrance remains relatively quiet.

Existing supply

Southern Cross Station consists has five main entrances, three minor entrances (which are small and do not lead to major thoroughfares) and multiple gate-lines leading to platforms (serving both metropolitan and regional trains).

On the western side of Spencer Street (at Bourke Street) there are two escalators, four stairwells (totalling 19m in width) and 3m of walkway (from platform 1) all providing pedestrian access into and out of the station. This provides for a theoretical pedestrian capacity of 12,000 people in the peak 15 minutes. However this level of capacity is rarely if ever required for weekday peaks, and reflects the demand that occurs when an event is being held at the 50,000 seat stadium in Docklands. On these occasions, it is possible to deploy police to specifically manage the intersection of Bourke and Spencer Streets.

At the pedestrian signals to cross Spencer Street there is around 300 square meters of storage space for queuing pedestrians. However the amount of this space that aligns to the pedestrian crossings is closer to one quarter of this amount of space.

On the eastern side of the intersection pedestrian space is much more constrained, on 3-4m wide footpaths. In the peak periods, pedestrians regularly need to walk in the parking lane on the northern side of the Bourke Street (morning peak) and the traffic lane on the southern side of Bourke Street (afternoon peak). The queuing areas are inadequate for the pedestrian volumes in the afternoon peak resulting in significant delays to pedestrians.

At Little Collins Street there is a 3m wide doorway into the station which does not align with any high demand of the station (such as platform access). This access point does align with the pedestrian crossing over Spencer Street into Little Collins. Pedestrian demand at this location is not exceeding the capacity of the intersection. In Collins Street the footpath on the southern side of the street is narrow. This does create congestion for pedestrians walking to or from the station.

On the western side of Spencer Street (at Collins Street), is the main entrance to the station. The capacity constraints at this location are the access to metropolitan platforms (stairs and

escalators), the gateline for regional platforms and the footpaths outside the building on Collins and Spencer Streets. Crossing Spencer Street there is another capacity constraint in the width of the pedestrian crossing, which is hemmed in between the tram stop and traffic flow. The crossing also narrows from west to east as the Collins Street footpath on the eastern side of Spencer Street is narrower than on the western side of Spencer Street.

There is ample space for passengers queuing to exit the station in the morning peak. The problem for this entrance is with the width of the footpath on the northern side of Collins Street east of Spencer Street. The footpath at this location is 5m wide. This is not wide enough to cater for the pedestrian demand in most weekday afternoon peak periods. During these times some pedestrians are forced to walk and queue on the eastbound traffic lanes.

Pedestrian movement at this location is complicated and congested by passengers alighting from tram services. Some of the trams continue to the Batman's Hill tram stop outside the Collins Street entrance to the station, but even these trams tend to unload passengers for the station on the eastern side of Spencer Street.

The entrance onto Collins Street (on Batman's Hill) is the most direct entrance to the metropolitan train platforms. This entrance has a theoretical maximum capacity of 6,300 passengers moving through the gateline in the peak 15 minutes. The footpath on the north side of Collins Street is coping with the current level of demand generated.

A large number of passengers seek to access the tram stop in the middle of Collins Street at this location. The movement of pedestrians between the tram stop and the Station is impeded only by one lane of traffic that passes on the northern side of the tram stop. This traffic can be moving at 50km/h and is difficult to see for passengers on the tram stop due to the visual bulk of the tram stop infrastructure. In addition the pedestrian crossing to the tram stop is only 2-3m wide and restricts the flow of pedestrians causing congestion.

Recommendations

Initiatives at Southern Cross Station focus the ease with which passengers can cross Spencer Street and Collins Street. The existing entrances to Southern Cross Station are shown in Figure 3-22 below.

Figure 3-22 Improvement Ideas around Southern Cross Station



It is understood that the Collins Street pedestrian subway still exists beneath Spencer Street but it is filled with service pipes (such as electricity and gas). It could not be used to connect directly to platforms as the internal layout of the underpass has changed significantly.

This study did consider reopening the Little Collins Street pedestrian subway. The recommendation is not to pursue this option as the cost (of relocating existing infrastructure) would most likely outweigh the benefits (given that pedestrians would need to travel below ground then up again to the first concourse and up another two levels before reaching the metropolitan concourse).

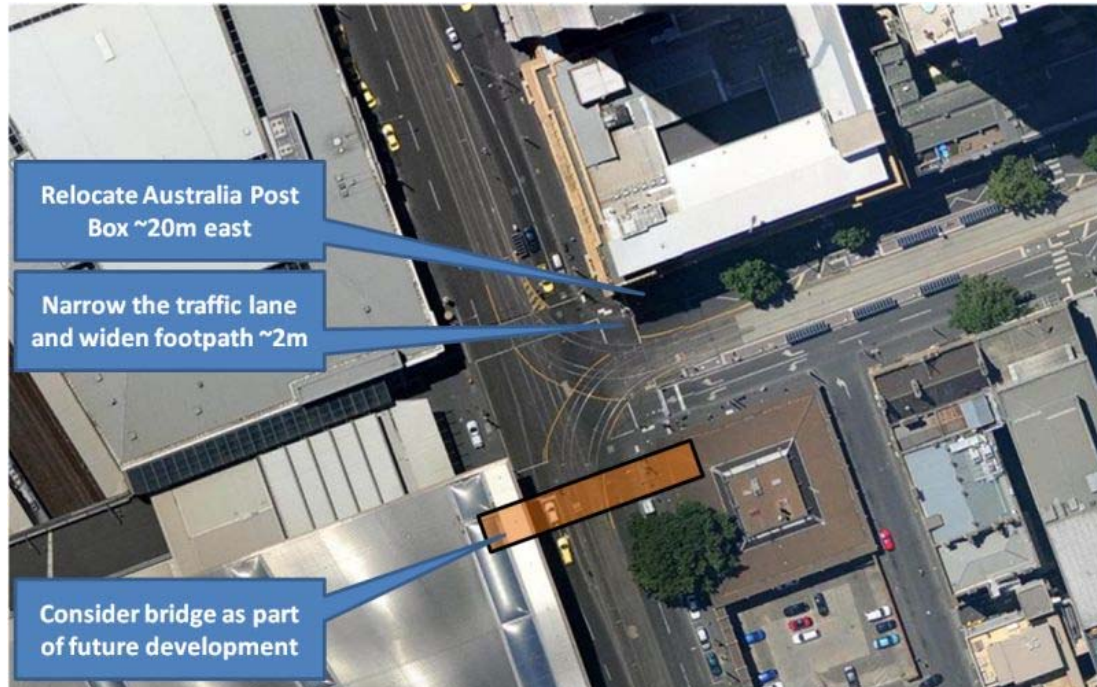
At Bourke Street a large volume of pedestrians cross Spencer Street (also at grade). The time taken by pedestrians has a direct impact on the tram network (as the intersection is a complex junction) and on the ability to provide for vehicles on Spencer Street.

Short term initiatives include making more space available for pedestrian queuing on the eastern side of Spencer Street, specifically by moving some wayside infrastructure such as the Australia Post mailboxes. In addition the footpath could be widened as the eastbound traffic lane is currently much wider than it needs to be.

In the longer term there will be development at the site on the south eastern corner of Bourke and Spencer Streets. This development could include a pedestrian over-bridge at the correct height to carry pedestrians directly onto the Bourke Street pedestrian bridge from escalators on the eastern side of Spencer Street.

These improvement ideas for Southern Cross Station's Bourke Street entrance are shown in Figure 3-23 below.

Figure 3-23 Southern Cross Station Improvement Ideas (Bourke Street)



At the entrance on the corner of Spencer and Collins Streets the same problem of pedestrian crowding in the afternoon peak occurs to a greater extent. At this location there is less opportunity to provide a grade separated pedestrian crossing, and capacity of the station forecourt is much higher than the capacity of footpaths in the surrounding area. Therefore improvement initiatives are focused on increasing pedestrian capacity of Collins Street east of Spencer Street.

In the short term improved line marking could help to segregate pedestrians who want to access the tram stops from those crossing the road fully. The traffic island in Spencer Street could also be realigned to increase the width of the pedestrian crossing on the northern side of Collins Street. A zebra crossing could be installed between the tram stop and the footpath on the northern side of Collins Street. It is noted that the zebra crossing may cause traffic to back up to Spencer Street, however the current situation is much less safe as a high volume of pedestrians cross the lane (often running for a tram) in front of traffic without any protection.

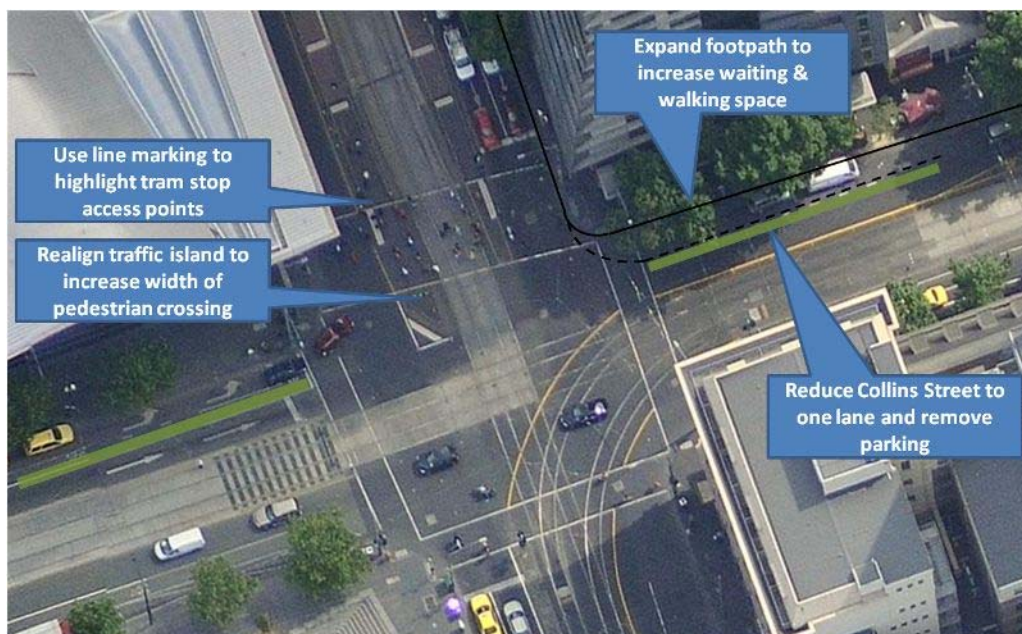
In the medium term the eastbound lane in Collins Street east of Spencer Street should be narrowed as much as possible and the footpath should be widened as possible. This will require removal of all the parking between Spencer Street and the tram stop. A short term option to alleviate safety issues that are occurring currently (pedestrians walk in the traffic lane every weekday evening) would be to line-mark the road pavement based on the likely design of the traffic lane. Additional features such as bollards and planter boxes could also be used to separate vehicles and pedestrians if necessary.

The medium term initiatives are put as medium term because they require some design before implementation. This is of equal importance and urgency to any other initiative due to significant safety issues resulting from the current lack of space.

In the longer term consideration could be given to a pedestrian underpass of the intersection or closing Collins Street to traffic between King and Spencer Streets. These more extreme solutions are likely to be required if the volume of pedestrians accessing the station doubles (which it seems expected to do over the next 30 plus years).

The improvement ideas for the Spencer Street at Collins Street entrance to Southern Cross Station are shown in Figure 3-24 below.

Figure 3-24 Southern Cross Station Improvement Ideas (Spencer Street at Collins Street)



The Collins Street (Batman's Hill) entrance provides the most direct access to the metro platforms. Improvements at this location could ease congestion at the entrance on the corner of Spencer and Collins Streets. For example one of the Collins Street tram services (Route 48) serves this entrance directly. However most passengers on these trams who are

transferring to Southern Cross get off the tram one stop earlier and then add to the congestion of pedestrians crossing Spencer Street.

Two things can be done relatively quickly to help reduce the impact that these passengers have on pedestrian congestion in Spencer Street, specifically:

- Install a passenger information display (PID) inside the gateline of the metro concourse at Southern Cross Station – the PID should display the estimated arrival time of the next eastbound tram on Collins Street using *Tramtracker™*.
- Request Yarra Trams drivers on Route 48 (from Kew depot) heading eastbound as they approach the Spencer Street tram stop to announce that passengers for Southern Cross Station should remain on the tram until the next stop.

In addition a zebra crossing should be installed at the eastern end of the Southern Cross Station tram stop in Collins Street. This is because the tram passengers are currently in an unsafe position on the crest of Batman's Hill trying to look past the tram stop infrastructure to see oncoming traffic.

The improvement ideas for Southern Cross Station Collins Street entrance are shown in Figure 3-25 below.

Figure 3-25 Southern Cross Station Improvement Ideas (Collins St – Batman's Hill)



A list of the initiatives suggested for further investigation to improve passenger flows around Southern Cross Station is provided in Table 3-10 below.

Table 3-10 Initiatives to improve passenger flows around Southern Cross Station

Location	Timeframe	Initiatives
Spencer Street (Bourke Street)	Short	Narrow the traffic lane on the northern side of Bourke Street and widen the footpath by around 2 metres. Relocate the Australia Post box 20 metres to the east
	Long	Investigate a pedestrian bridge over Spencer Street as part of any development on the south eastern corner of the intersection
Spencer Street (Little Collins Street)	Short	Better align pedestrian crossing timings to when traffic is stopped in Spencer Street
	Long	Reopen the subway between the concourse and the exit in Little Collins Street including escalators at each end
Spencer Street (Collins Street)	Short	Use line-marking to delineate a future kerb outstand for additional pedestrian storage on the north eastern corner of the intersection Install a zebra crossing at the western end of the tram stop to the footpath on the northern side of Collins Street. It is understood that discussions are under way to install pedestrian signals at this location. The delay between pedestrians calling (pushing the button) their phase and the green man appearing should be minimised.
	Medium	Narrow the traffic lane and widen footpath on north eastern side of Collins Street by around 3 metres
	Long	Consider linking under the intersection of Collins and Spencer Streets with an underpass Consider closing Collins Street between King Street and Spencer Street
Collins Street	Short	Create a zebra crossing at the eastern end of the tram stop in Collins Street Install passenger information displays that provide estimated tram arrival times to passengers before they reach the gates to exit the metro trains concourse Educate tram drivers on Route 48 to announce "Please continue on this tram for Southern Cross Station" as each eastbound tram approaches the Spencer Street tram stop
	Medium	Provide a Melbourne Bike Share rank at the Collins Street entrance to the Metro trains concourse

3.6 Town Hall Tram Stop (Collins St)

Current and future demand

Passenger demand at this tram stop is relatively high throughout the day, with significant peaking occurring during lunchtime. Demand is less related to potential development around the tram stop as travel to this part of the city is highly focused on retail activity. There will always be a proportion of the total number of visitors to the CBD who want to visit the retail core, and for many this requires using the local tram stops. As development in Collins Street docklands continues demands such as this will increase.

This tram stop is already congested and research by Monash University has shown that vehicle loading is slower at these stops due to the lack of space to handle the crowd of passengers waiting to board and the passengers trying to alight. This is a significant issue for the tram operator, the State government and Council which impacts on the ability to provide reliable services, cost of those services and the productivity of the CBD.

Demand at this location is likely to increase in line with total CBD visitation. This will increase pressure on the tram stop to a point where there are too many people on the stop and no space for people who are alighting from the trams. This situation already occurs to some extent in the peak periods (particularly the weekday lunch peak). The severity and duration of each occurrence will increase as the CBD gets busier.

Vehicular traffic in Collins Street is currently heavily congested at peak times and is likely to remain congested in future. It may get worse if a significant number of new car spaces are built at the Docklands end of Collins Street, or changes to the CBD road network increase reliance on Collins Street as a through traffic route. Given that Collins Street is not meant to cater for through traffic, there is merit in considering closure of the street between Regent Place and Manchester Lane. This would remove the through traffic without affecting the ability of anyone to travel by car to any specific part of Collins Street

The capacity of the Town Hall Tram Stop is shown in Table 3-11 below.

Table 3-11: Capacity of the Town Hall Tram Stop

Location of Entrances	Limited by	Maximum Capacity (peak 15 mins)
Collins St & Swanston St – Northwest corner	Walkway	1,100
Collins St & Swanston St – Southwest corner	Walkway	1,100
Collins St at Manchester La – northern side	Walkway	1,900
Collins St at Manchester La – southern side	Walkway	1,800

Existing supply

This tram stop consists of two facing platforms each 2m wide and 40m long. The access ramps onto each platform are slightly different, between 1.1m and 1.9m wide at the Swanston Street end and western end respectively.

Each platform has a maximum theoretical capacity of 250 people. However, as more people are accommodated on the platform, circulation space diminishes to a point where unloading a tram becomes very difficult. This is a significant issue at the Town Hall tram stop and University research has proven that as a result the platform stop at Town Hall significantly

reduces tram speeds in Collins Street and impacts negatively on tram network capacity (Currie, 2012).

The eastern end of the stops each has a maximum theoretical capacity of 1,100 people in the peak 15 minutes. The western ends of the stops each have a maximum theoretical capacity of 1,900 people in the peak 15 minutes.

Traffic on Collins Street tends to be busy. On weekdays there are often queues of traffic next to each platform stop.

Recommendations

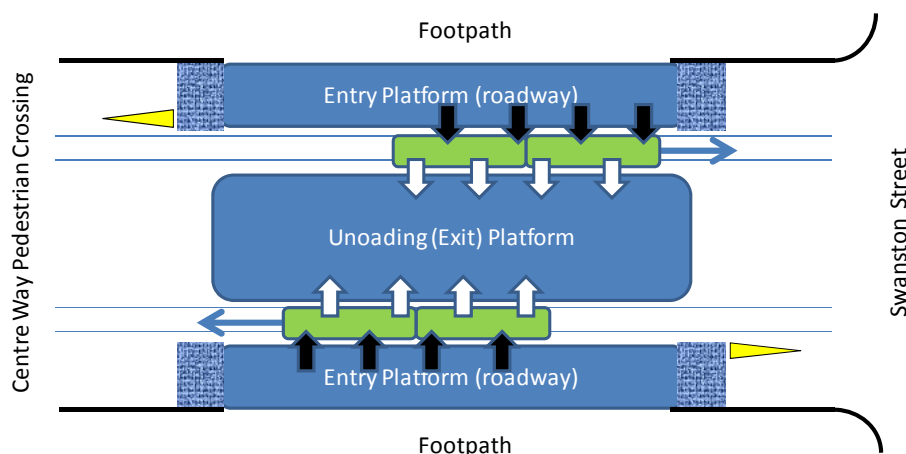
In the medium term an option exists to rebuild the entire tram stop. This would involve lengthening the stop to cater for two “E class” (33m long) trams. However without additional width the crowding of passengers on the platform will continue to be a problem.

In this location there are very limited options to widen the tram stop, for example:

- Provide platforms on both sides on each tram track;
- Spread the tracks apart and install an island platform;
- Remove the traffic lane and widen the existing platforms; or
- Stagger and widen the Platforms.

The “Spanish Solution” would enable passengers to exit the tram on one side and other passengers to enter the tram from the other side. The arrangement is complex in order to meet the needs of all road users. Cars would continue to use the edge lanes of the roadway, but they would be raised to provide an “easy access platform” (similar to the tram stop in Macarthur Street). Cars would need to give way to passengers exiting the tram. After stopping the tram driver would open the exiting doors first, enabling passengers to start to disembark. A second or two later the driver would open the entry side doors (which would open onto a centre island platform). A concept plan for the “Spanish Solution” at Town Hall tram stop is shown in Figure 3-26 below.

Figure 3-26 Spanish Solution Platforms - Concept



A list of the initiatives suggested for further investigation to improve passenger flows around Town Hall Tram Stop is provided in Table 3-12 below.

Table 3-12 Initiatives to improve passenger flows around Town Hall Tram Stop

Location	Timeframe	Initiatives
Collins Street between Manchester Lane & Regent Place	Short	Provide for signalised U-turn and right hand turn from Regent Place into Collins Street
	Long	Close Collins Street to traffic between Manchester Lane & Regent Place
Collins Street (Swanston St end)	Short	Widen the entry ramps by repositioning the bollards on the traffic lane side of each entry
	Long	Investigate alternative stop design options with Yarra Trams

3.7 Melbourne University Tram Stop (Swanston St)

Current and future demand

The Melbourne University Tram Stop in Swanston Street is the main (but not only) public transport hub for the University. It is served by nine tram routes, seven of which terminate at the stop.

The platform stop has a high capacity limited only by passengers' ability to cross the tram tracks and roadway and the line capacity of tram services. In the morning peak the tram line capacity results in a small number of passengers (at absolute most a few hundred) alighting at the stop every 90 seconds (the timing of the signals to the south).

These passengers disperse to either end of the tram stop where there are signalized pedestrian crossings that link them with either side of Swanston Street. The majority of passengers head to the north, though many just move to the nearest end (or exit) to get to the footpath most quickly.

The tram stop can fit up to three vehicles on each side of the stop over a total length of 60m. The stop is an island platform, which has enough width to cater for peaking of demand in the morning and afternoon. The tram track layout includes significant operational efficiency, with the ability for three trams to terminate or commence journeys at the same time. This means that afternoon peaks in demand

In the afternoon, there is a significant peaking of demand at the conclusion of classes. This peaking is only dampened by the location of the classes and the need for intending passengers to walk (sometimes a significant distance) to the tram stop.

The most significant limitation on the number of passengers who can reach the tram stop is the pedestrian traffic signals at either end of the platform. These signals should be used as part of the process for managing spikes in passenger demand.

There is likely to be fewer tram routes serving Melbourne University at this location. This is because demand will increase on the western side of the university (served by Royal Parade) and the Melbourne Metro project will ultimately reduce the demand from rail passengers who currently change onto the tram.

This likely reduction in tram routes will reduce the service levels could reduce overall demand (as services will be less attractive compared with the Melbourne Metro station at Parkville). This reduction in demand will be tempered by an increase in demand due to increased development and density in areas covered by the tram network (specifically Routes 1 and 8 which serve the university from the north and south).

Data regarding passenger forecasts for the tram network have not been available to the City of Melbourne. It is therefore difficult to predict future passenger volumes at this location. Consideration of the maximum theoretical capacity of the existing platform stop is the only other way of determining what capacity the surrounding public realm might need.

The capacity of the Melbourne University Tram Stop is shown in Table 3-13 below.

Table 3-13: Capacity of the Melbourne University Tram Stop

Location of Entrances	Limited by	Maximum Capacity (peak 15 mins)
Swanston St at Faraday St	Walkway & Signals	1,400
Swanston St north of Grattan St	Walkway & Signals	2,400

The figures above are the maximum number of people who could access or enter the stop in a 15 minute period. This number of people is well below the capacity of the tram network to transport people (about 4,500 passengers in the peak 15 minutes) from the stop.

Existing supply

The platform tram stop is an island 7m wide and 60m long. Total capacity of the stop to hold passengers waiting for a tram is over 800 people.

The northern entrance to the platform stop is 3m wide and joins an east-west pedestrian crossing that is 8m wide in both directions. This can cater for up to 100 pedestrians in each traffic signal cycle.

The southern entrance to the platform stop is 5m wide and joins an east-west pedestrian crossing that is 3m wide in both directions. This can cater for around 50 pedestrians in each traffic signal cycle.

The footpaths on either side of Swanston Street are relatively wide and currently cater for the level of demand observed.

In the peak 15 minutes the maximum theoretical capacity of the tram network could deliver around 400 people to the stop (depending greatly on the mix of tram vehicle type, loading and tram queuing at the terminus just north of the stop). In the afternoon peak, the network can cater for a similar level of demand departing from the stop.

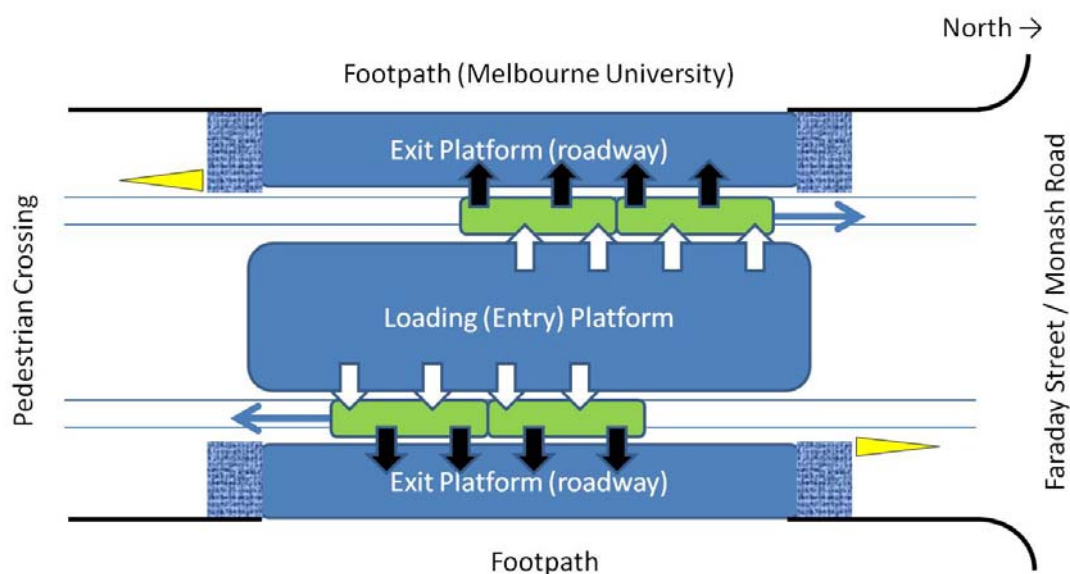
Traffic on Swanston Street at this location tends to be light, and there are rarely queues of traffic beside the tram stop. Given this it could be possible to use the road space in a different way in future.

Recommendations

There are no short term improvements suggested at the Melbourne University Tram stop. This is mainly because the available data showed there is unlikely to be a significant congestion issue in the short term future.

In the medium to long term an option exists to provide platforms on both sides on each tram track. This would enable passengers to exit the tram on one side and other passengers to enter the tram from the other side. At Melbourne University the passenger demand (different from at Town Hall) should be considered in the application of the Spanish Solution. Given most of the student demand comes from the south and the university is located to the west of the stop, the roadway should be used as the exit (minimising passenger travel time). This concept is shown in Figure 3-27 below.

Figure 3-27 Improvement Ideas around Melbourne University Tram Stop



The initiative suggested for further investigation to improve passenger flows around Melbourne University Tram Stop is shown in Table 3-14 below.

Table 3-14 Initiative to improve passenger flows around Melbourne University Tram Stop

Location	Timeframe	Initiatives
Swanston Street between Queensberry Street & Monash Road / Faraday Street	Medium	Provide for "Spanish Solution" additional platforms and segregate alighting passengers from boarding passengers

4. Conclusion

This study has investigated pedestrian movements around major transport hubs in Melbourne CBD. It focused on areas of high congestion and access to transport nodes in peak periods. The aim is to ensure that the public realm which provides access to these transport nodes remains safe and functional as passenger demand and pedestrian volumes increase. In some locations, peak pedestrian demands on footpaths and pedestrian crossings are already outstripping supply of space for pedestrians to move.

In these locations, overcrowding of pedestrians is detracting from the CBD economy, quality of transport and also creating safety problems. The maximum number of people likely to exit each of the stations in the morning peak period was determined by multiplying the width of specific facilities by the time it takes for people to use them. In some cases the existing capacity of the public realm (footpaths and crossings) is below the number of people trying to use the facility in the peak period.

The afternoon peak provides a different and more challenging problem. This is because there is no control on when people leave work and the peak period can include sharper peaks of demand. When a stairwell entrance to a station is approached by twice the number of people who can actually fit on the stairwell, people begin to queue around the entrance and can obstruct other movements.

At tram stops the ceiling on capacity is related to vehicle capacity and the ability to move vehicles through the platform stop. For example at Federation Square each morning, the number of passengers seeking southbound trams exceeds the capacity of the tram network to move them. This results in delays to passengers (who have to wait for the second or third tram before they can board). This becomes an issue when the queue to access the tram platform stop extends into the traffic lanes or back onto the footpath (blocking traffic lanes).

This study has investigated the public realm and its capacity to cope with current and future pedestrian demands around transport nodes. The study has developed a range of improvement options for further investigation. None of the options have been costed, or fully checked in terms of technical feasibility. Broadly the study considered two main improvement options:

- Enhancing lesser used entrances or creating new entrances to disperse pedestrian flow away from congested entrances; and
- Improving pedestrian facilities (such as wider footpaths or new connections) around congested station entrances to make pedestrian flows safer.

Specifically, the study recommends investigating:

- Additional station entrances (not controlled by the City of Melbourne) at four locations;
- Enhancing station entrances (not controlled by the City of Melbourne) at five locations;
- Improving pedestrian crossing facilities (installation of pedestrian crossings) at three locations; and
- Widening footpaths in proximity to stations at several locations.

5. References

Australian Standards (Standard 1428.1)

ARRB Group (2013), Guide Information for Pedestrian Facilities, Prepared for the AustRoads Research Program (Research Report AP-R423-13.

Coomes consulting & John Piper Traffic (2004) Transport Program – Pedestrian and Traffic Study Melbourne CBD, Prepared for the City of Melbourne, July 2004

Fisher, E et al (2010) Pedestrian & Bicyclist Safety and Mobility in Europe, Federal Highway Administration (U.S.), February 2010

Gehl Architects (2004) Places for People, prepared for the City of Melbourne, 2004

Kittelson & Associates et al (2003) Transit Capacity and Quality of Service Manual – 2nd Edition, Transportation Research Board, Washington D.C.

Loveday, M (2006) The Economic Benefits of Walking – presentation to Walk21 Conference, Melbourne 2006

Melbourne City Council (1985) Streets for People (draft) – A pedestrian strategy for the Central Activities District of Melbourne, City of Melbourne, 1985

Melbourne City Council et al (2003) Inner Melbourne Action Plan, City of Melbourne, 2003

Melbourne City Council (2003) Road Encroachment Operational Guidelines – Road Encroachment Policy, Melbourne, June 2003

Melbourne City Council (2007) The Active Melbourne Strategy – A plan for physical activity, City of Melbourne, June 2007

Melbourne City Council (2012) Melbourne Urban Forest Strategy, City of Melbourne, 2012

Melbourne City Council (2012) La Trobe Street bicycle lanes and parking changes (final plan), City of Melbourne, 2012

Melbourne City Council (2012) Open Space Strategy – Planning for future growth, City of Melbourne, 2012

Melbourne City Council (2012) Transport Strategy – Planning for future growth, City of Melbourne, 2012

Melbourne City Council & Places Victoria (2012) Docklands Public Realm Plan, Melbourne, September 2012

Nearmap, (2012) Aerial Photography Base

New Zealand Transport Agency, 2009, Pedestrian Planning and Design Guide, NZTA, Wellington

Parkinson, P. (1988) Urban Spaces – Concepts for Design and Construction to Create an Improved Living Environment, City of Doncaster and Templestowe, 1988

Tolley, R. (2007) Shared Spaced in Bendigo CBD: Principles, Best Practice and Proposals, prepared for the City of Greater Bendigo, February 2007

Tolley, R. (2011) Good for Busine\$\$ - The benefits of making streets more walking and cycling friendly – A discussion paper, National Heart Foundation of Australia, February 2007

Victorian Parliament, Road Safety Road Rules 2009, Melbourne 2009

VicRoads (2007) Pedestrian & Cyclist Safety in Victoria, Melbourne 2007