Northern Councils Alliance

NORTHERN Metropolitan Partnership

VICTORIA State Government | Jobs, Precincts and Regions

Northern Region Transport Study Stage 2: Bus Networks

Prepared by Movement & Place Consulting on behalf of the Northern Councils Alliance 2022 Funded by the Northern Metropolitan Partnership

The Northern Region Transport Study Stage 2: Bus Networks was overseen by the Northern Councils Transport Working Group on behalf of the Northern Councils Alliance in partnership with the Victorian Government and project partners including the Department of Transport, Melbourne Airport and La Trobe University.

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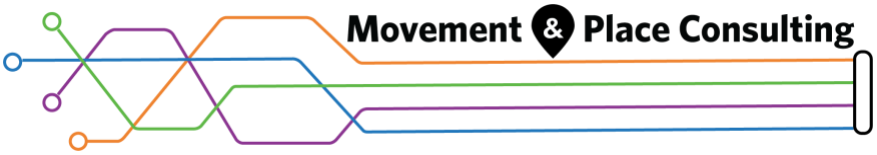
Acknowledgement of Country

Movement & Place Consulting acknowledge the Traditional Custodians of Country throughout Australia and their connections to land, sea and community. We pay our respects to their rich cultures and to Elders past, present and future. Our office and employees exist and survive thanks to previous generations caring for Country. In particular the Bunurong, Wadawurrung and Wurundjeri Peoples of the Kulin Nation.

Victoria's transport sector is imposing increasingly negative impacts on Country due to inefficient use of space, impacts on habitat and sourcing of construction materials. To Heal Country the community needs to embrace more efficient transport modes. This starts by embedding sustainable practices, policies and strategies when planning precincts and the transport networks that serve them.

To enable growth in Melbourne whilst healing Country and enabling all residents to take light footsteps, requires a different mindset and new ways of creating communities around highly efficient movement networks.

This Bus Review project seeks to contribute to this future vision by highlighting priority improvements to the bus network that will improve transport choices for people in Melbourne's north and enable them to minimise their impact on Country.



Executive Summary

Melbourne's northern region is home to just over 1 million people and will grow to house almost 1.5 million people by 2036. The region is underserved by public transport, and consequently suffers from higher levels of traffic congestion. This impacts access to education, employment, health and other services for all residents, but will be felt most acutely in the northern growth corridor.

The Northern Region Transport Study (NRTS) has been commissioned by the Northern Councils Alliance (NCA) to identify transport advocacy and investment priorities that will improve public transport connectivity and encourage sustainable transport growth.

NRTS stage 1 identified the following key issues in the northern metropolitan region:

- Unreliable public transport
- Poor connections in growth areas
- Inadequate bicycle infrastructure
- Poor east to west connections
- Congestion on roads
- Safety concerns on public transport

NRTS stage 2 focuses on strategic improvements to the bus network, in particular:

- Improvements to existing SmartBus Routes
- A high-quality route that could mimic the benefits of Suburban Rail Loop (SRL)
- Improvements to key destinations – Melbourne Airport and La Trobe University
- Services required in Growth Areas

The study's key findings are summarised below.

Implementing a Suburban Rail Loop Bus (SRLB)

An SRLB would provide a continuous, rapid and direct east-west public transport connection from Melbourne Airport to Box Hill, mimicking the proposed alignment of SRL North stations. Adding an additional stop at Keon Park brings significant time savings for commuters from Mernda with minimal impact on overall journey time for other customers.

SmartBus 901, 902, 903 review

To maximise patronage and connectivity in the north, we recommend:

- Realigning SmartBus 901 to service Greenvale and to terminate at Airport West Shopping Centre (instead of Melbourne Airport)
- Realigning SmartBus 902 to terminate at Melbourne Airport (instead of Airport West Shopping Centre) to improve access for airport employees
- Improving spatial distribution of Smartbus 901 and 902 and local routes through Greensborough to improve user experience, accessibility and convenience

Improving connections to La Trobe University (LTU)

LTU is poorly served by public transport compared to universities such as University of Melbourne and Monash. LTU is planning significant growth with a private sector partner, which will bring an additional 12,000 residents, 40,000 students and 20,000 employees.

This growth can be provided for with improved public transport. If services are not improved, the resulting car trips will create significant congestion in Melbourne's north. The bus connectivity improvements required include:

- Local connections to Viewbank, Watsonia and Yallambie
- Longer distance routes to northern suburbs such as Mill Park, South Morang, Mernda, Diamond Creek and Hurstbridge
- Cross Yarra connections including existing routes, and new direct connections between LTU and Bulleen, Kew and Hawthorn

Improving connections to Melbourne Airport

Melbourne Airport and the surrounding business park is a key employment hub in the north, with over 20,000 employees distributed across an estate of approximately 450Ha.

Existing public transport services do not meet the needs of shift workers in the area, with many businesses operating '24-7'. To improve employee access, we recommend:

- Creating new direct connections to key employee catchments including Craigieburn, Gowanbrae and suburbs around Sunbury
- Increasing service levels on key links and through key areas including the business park and express services to Broadmeadows Station
- Creating a direct link between Melbourne Airport and the La Trobe NEIC via Coburg improve east-west connectivity and connections to four train lines

Serving Mitchell Shire's growing population

Wallan and Beveridge in Mitchell Shire sit within metropolitan Melbourne's northern growth corridor and will house over 200,000 people by 2051, quadruple the entire Mitchell Shire's current population. This growth will create a jobs deficit in the Mitchell Growth Area, requiring residents to travel 10-25km to access jobs and services. If these trips are by car, the Hume Highway (a key National Freight Route) will be overwhelmed.

We recommend establishing direct public transport connections to key employment areas including Broadmeadows, Epping, La Trobe University, Melbourne Airport and the surrounding business park and Thomastown to provide real options for journeys to work that avoid entrenching car dependence in the Mitchell Growth Area.

Mitchell Growth Area and townships would also benefit from aligning bus timetables with train services, and longer term east west links between Whittlesea and Woodend.

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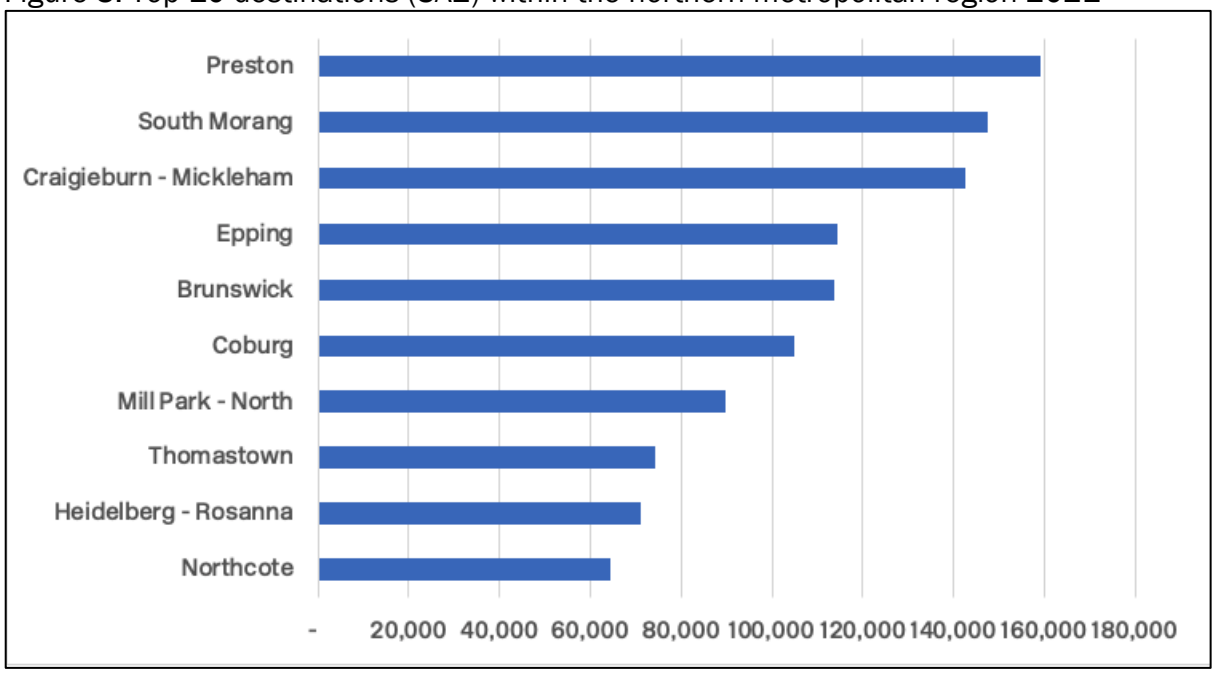

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1 Northern Metropolitan Region's Transport Context

The northern metropolitan region is experiencing significant population growth, particularly in Whittlesea, Hume and Mitchell. The region must prepare for unprecedented travel flows through the region as employment opportunities burgeon in key activity centres, such as the La Trobe NEIC, and the Broadmeadows and Epping Metropolitan Activity Centres.

The report is structured as follows:

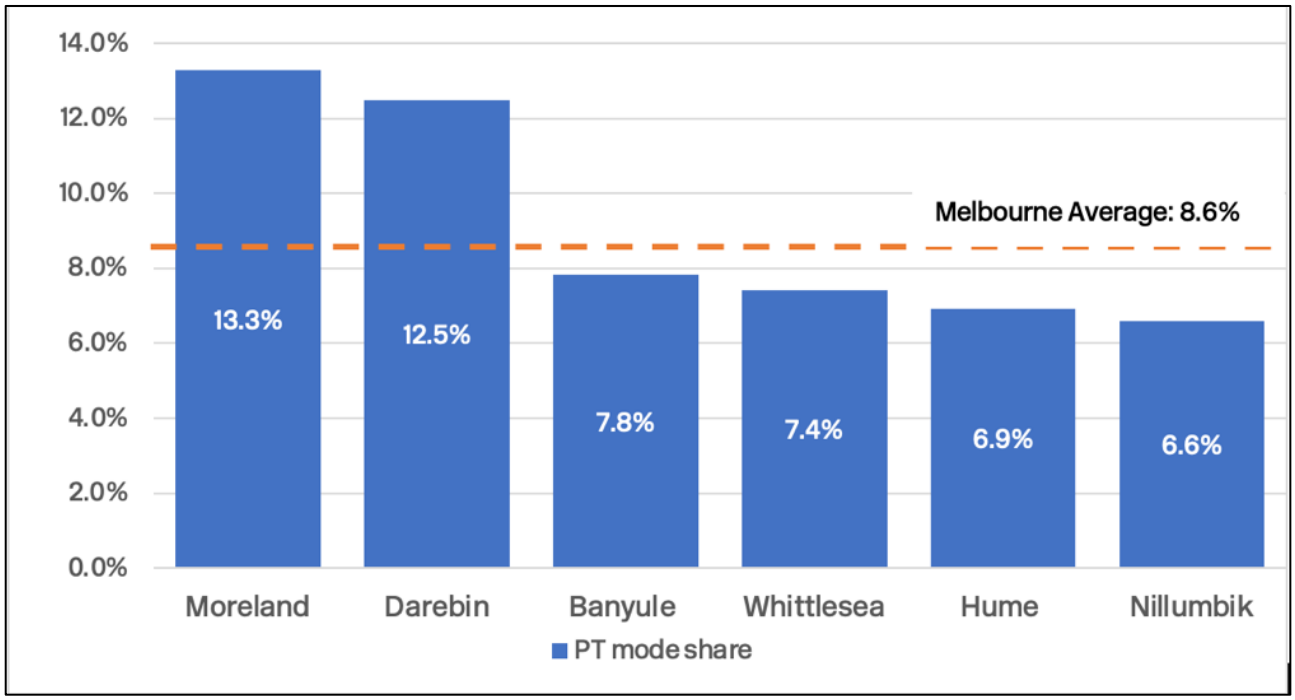
- Chapter 1 introduces the northern metropolitan region's existing context and considers future trip growth for key areas in the region
- Chapter 2 investigates potential route alignments for a Suburban Rail Loop Bus (SRLB) between Melbourne Airport and Box Hill
- Chapter 3 reviews and proposes route alignment and intersection improvements for SmartBus 901, 902 and 903
- Chapter 4 outlines key travel patterns to/from La Trobe University (LTU), proposing connectivity improvements
- Chapter 5 outlines key travel patterns to/from Melbourne Airport, proposing connectivity improvements
- Chapter 6 proposes connectivity improvements for Mitchell Shire, considering the high growth context of Beveridge and Wallan, located in Melbourne's northern growth corridor
- Chapter 7 concludes the study

1.1 Current context

Melbourne's northern metropolitan region is comprised of the Cities of Banyule, Darebin, Hume, Moreland, Nillumbik, Whittlesea and Mitchell Shire (Beveridge and Wallan). The north is home to over 1 million people and will grow to house almost 1.5 million people by 2036. As population grows, the number of trips being made will also grow, emphasising the need for public transport improvements. Car ownership will also grow (not least because the region is underserved by public transport, especially in the growth municipalities of Hume, Whittlesea, and Mitchell). As such, if public transport improvements are not made, then congestion will grow, and both productivity and liveability will fall.

Figure 1 is a summary of public transport mode shares for the metropolitan municipalities within the northern metropolitan region.

Figure 1: Public transport mode shares in the northern metropolitan region



Source: DoT with M&PC analysis. Note that VISTA does not provide a public transport mode share estimate for Mitchell Shire, and as such it is not included within the figure

The average public transport mode share in Melbourne is 9% according to VISTA, which is lower than the public transport modes share in Moreland and Darebin, but higher than every other northern metropolitan region municipality. Generally, PT mode shares decrease the further the municipality is from Melbourne CBD.

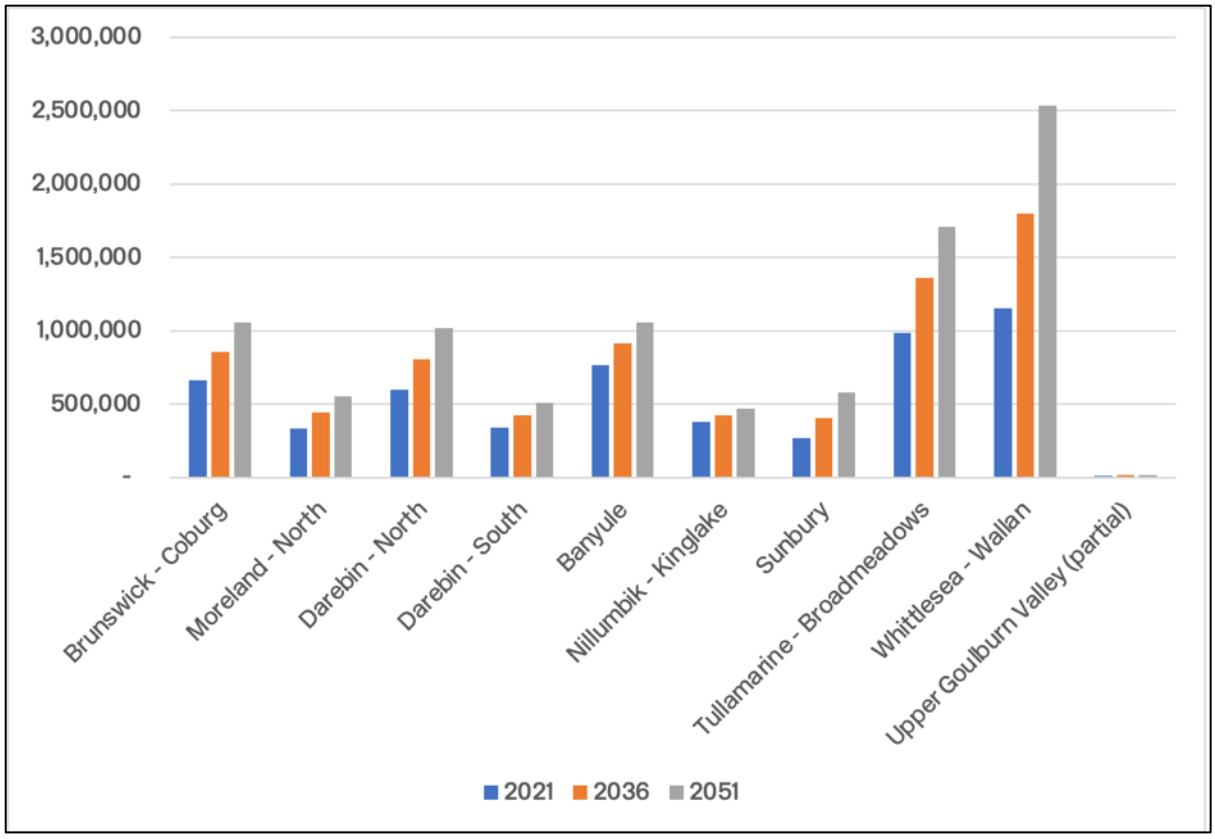
1.2 Growth in trips to 2051

In order to understand the northern metropolitan region's travel context now and into the future, and to support modelling (for example, section 2.11), a trip estimation and distribution process was developed. The model is calibrated to VISTA travel data using population and employment figures from Victoria-in-Future 2019 (the State Government's official population projection). The model uses 2011 Census SA2, SA3 and SA4s as the basis for its travel zones. The model estimates total trips of all purposes for each zone pair now and in the future. This enables the identification of key destinations within the northern metropolitan region and where the trips originate from.

Overall, the northern metropolitan will experience a 32% growth in trips to 2036 and a 66% growth in trips to 2051. Growth is not uniform however, with Whittlesea – Wallan (Whittlesea and Mitchell Shire) anticipated to have a 57% increase in trips to 2036, and a 120% increase in trips to 2051. Sunbury (Hume) is anticipated to experience similar trip growth rates to 2036 (+50%) and 2051 (+118%), albeit from a much smaller trip base in 2021. Strong trip growth is also anticipated in Tullamarine – Broadmeadows (Hume) (+74%) and Darebin – North (Darebin) (+71%) to 2051. Areas which are anticipated to have the slowest growth to 2051 are Nillumbik – Kinglake (Nillumbik Shire) (+25%) and Banyule (Banyule) (+37%).

Appendix A summarises the number of forecast trips to 2051 across the northern metropolitan region. Note that the high growth in internal trips for Sunbury and Whittlesea – Wallan indicate the need to not only consider regional connectivity across the northern metropolitan region, but also the local connections within municipalities, particularly ones strategically planned to become strong employment and education hubs.

Figure 2: Growth in trips from 2021-2051 (SA3)



Source: DoT with M&PC analysis

1.3 Key destinations to 2036

Figure 3 shows the top ten destinations within the northern metropolitan region with the greatest number of total trips to the area in 2021. This excludes any internal trips within an area. The top five origins to each destination are also shown.

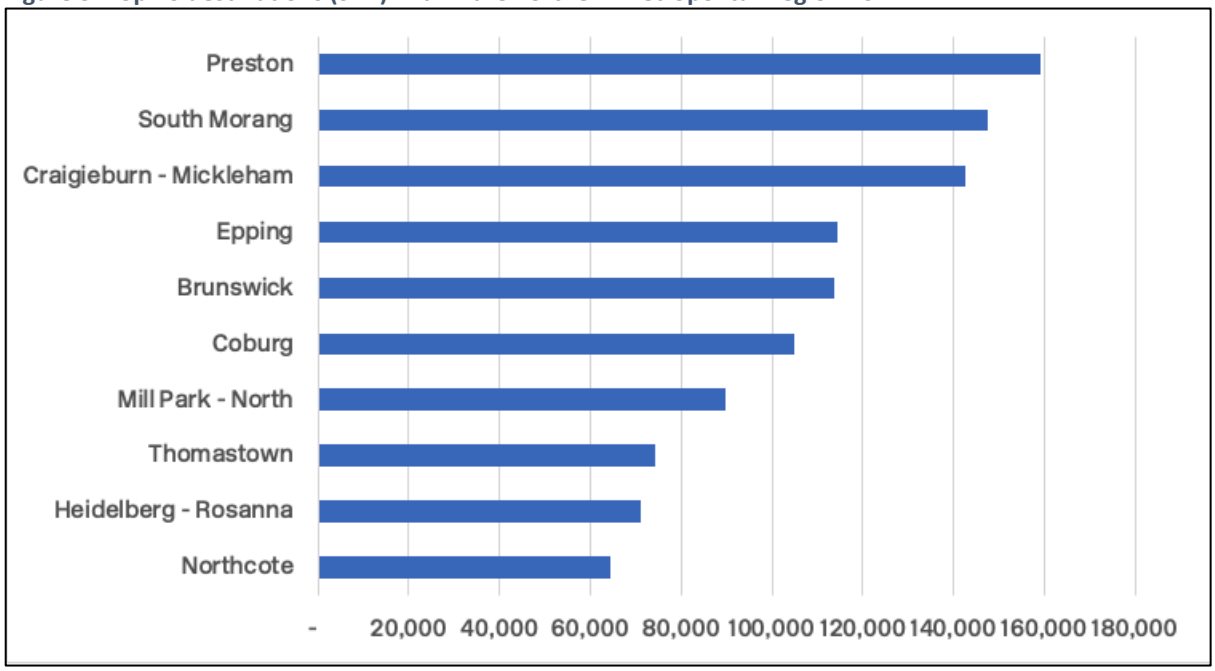
There is a general trend across all destinations for travel to originate from neighbouring suburbs/municipalities. These key destinations generally have clusters of employment and retail activity. For example, Preston, Coburg, Brunswick, Epping, South Morang, Mill Park - North and Northcote all contain activity centres with some concentration of commercial activity. Other areas, such as Thomastown and Craigieburn – Mickleham contain significant industrial areas which act as key employment hubs.

The key origins outside of the northern metropolitan region into the region are Melbourne City (City of Melbourne), Yarra (City of Yarra), Essendon (City of Moonee Valley), Keilor (City of Brimbank) and Melbourne - North West (Macedon Ranges Shire).

Melbourne Airport does not feature in the top ten destinations within the northern metropolitan region, partly because of how VISTA data is captured. Only trips to and from home are captured by the VISTA survey, excluding a key trip segment to/from Melbourne Airport, which is that of visiting travellers. While VISTA data includes work journeys to Melbourne Airport, they constitute a very small portion of overall trips to/from Melbourne Airport. Additionally, Melbourne Airport is a specialised zone, with little trips made other than that for employment or air travel.

Similarly, Kingsbury which contains La Trobe University does not feature in the top ten destinations in the northern metropolitan region, because it is also a specialised zone. The overwhelming majority of trips to/from La Trobe University are for employment and education purposes. Regardless, both Melbourne Airport and La Trobe University are strategic destinations which will only grow in importance and visitation into the future and will be considered in subsequent sections of this report.

Figure 3: Top 10 destinations (SA2) within the northern metropolitan region 2021

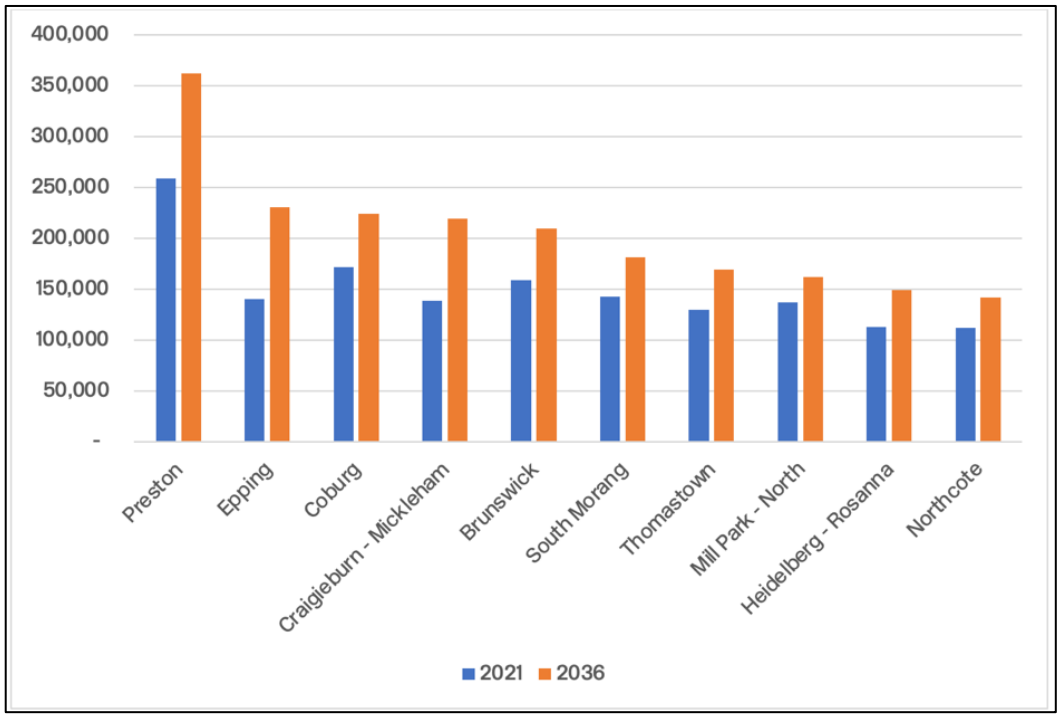


Source: DoT with M&PC analysis

The key destinations in 2021 will continue to be key destinations in 2036. Figure 4 shows the growth in all trips for each of the top destinations within the northern metropolitan region. Preston, Epping and Craigieburn – Mickleham in particular will experience a greater rate of growth in trips to 2036.

The key origins outside of the northern metropolitan region into the northern metropolitan region will continue to be Melbourne City (City of Melbourne), Yarra (City of Yarra), Essendon (City of Moonee Valley), Keilor (City of Brimbank) and Melbourne - North West (Macedon Ranges Shire) in 2036.

Figure 4: All trips to/from key destinations (SA2) in the northern metropolitan region (2021 and 2036)



Source: DoT with M&PC analysis

1.4 Network and service planning principles

In order to guide the development of bus services in the chapters which follow, it is necessary to define an overarching framework of network and service planning principles. Following discussions with the Northern Councils Alliance (NCA) Transport Working Group (TWG), the principles agreed were:

- **Simple**: a simple network is easier for customers to understand and navigate. Wherever possible, services should operate in both directions (rather than one-way)
- **Direct**: customers like direct services to key nodes providing swift transport, with journey times as low as reasonably possible
- **Frequent**: service frequency is highly important to customers, because it provides choice in departure time. Step changes in patronage and network effect occur with 4, and again at 6, services per hour
- **Reliable:** Customers need confidence that the bus will get them to their destination on time. Priority through congested traffic helps to ensure reliability
- **Nearby**: DOT currently aims to have a bus route within a 400m buffer of 90% of all residents. For consistency, we propose to retain these parameters, though special consideration should be given to treatment of the SRL bus route given its unique characteristics
- **Safe**: access to bus stops should be as safe as possible, with good quality footpaths and pedestrian priority
- **Brand and marketing (fleet)** – high quality in-vehicle experience
- **Brand and marketing (stops)** – high-quality bus stops (for example, with cover, seating, easy to understand timetables and real-time passenger information, which is accurate and reliable

2 Suburban Rail Loop Bus (SRLB)

2.1 Introduction

Improving the quality of east-west links within the NCA area is of critical importance. These links provide access to both education and employment. The need for improving the links has been identified by the government through the Suburban Rail Loop (SRL) project. Whilst the SRL North will provide this infrastructure once built, the improvements are required to meet current needs.

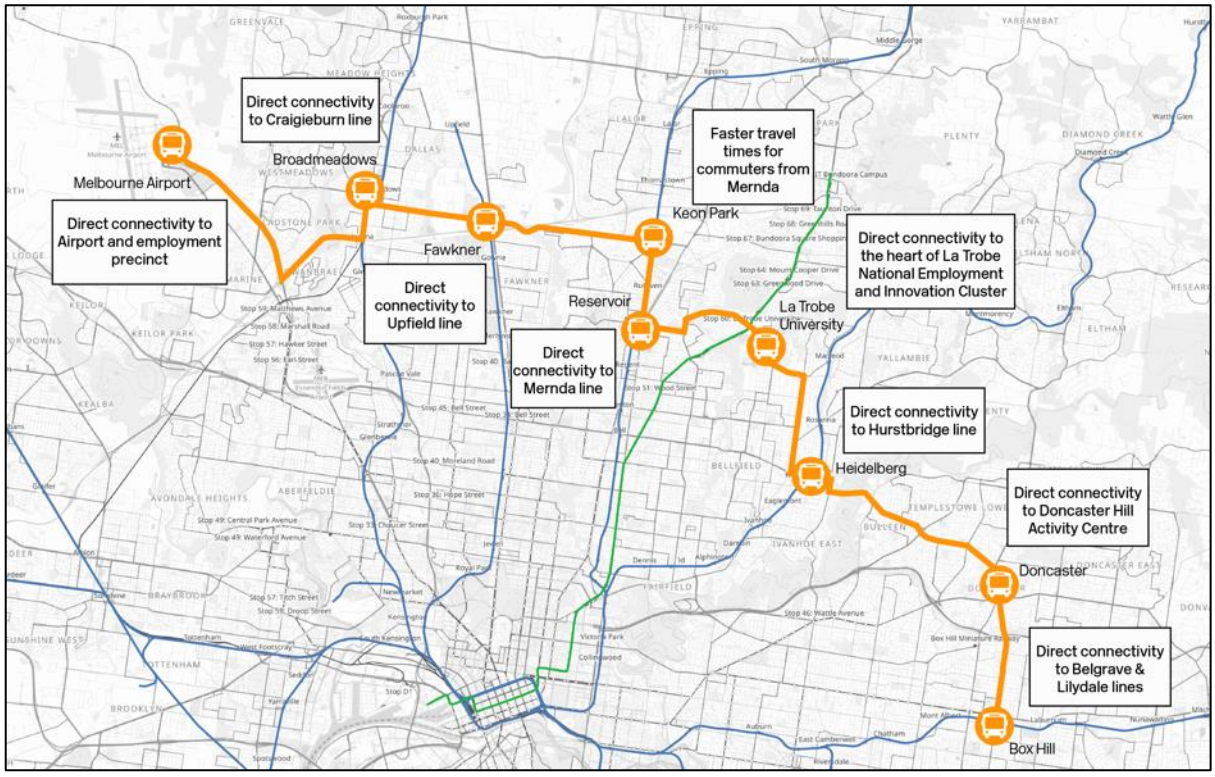
Communities in Melbourne's North should not need to wait until 2053 before east-west connectivity is improved.

East-west connectivity should be improved through an express bus route that mimics the alignment proposed for the Suburban Rail Loop. This Suburban Rail Loop Bus (SRLB) would traverse the SRL North alignment creating new connectivity and rapid journeys for the community. In the process it will influence travel patterns and increase the future patronage of SRL North.

Summary of key recommendations

The end-to-end journey will take between 56-108 minutes, depending on traffic congestion and the level of bus priority provided along the route. The recommended route alignment is shown in Figure 5 below.

Figure 5: Recommended SRLB alignment and rationale



Based on the multi-criteria analysis (MCA) formulated in section 2.2 to ensure that the SRLB is rapid and direct, Figure 6 shows the Stations and maximum peak-period travel times for each trip segment.

Figure 6: Recommended SRLB route alignment and peak travel times

In addition to serving the eight stations on SRL North, it is also recommended that Keon Park station is served by SRLB. This would provide additional connectivity benefits for a negligible impact on the journey times of SRLB.

2.2 Developing the SRLB alignment

For specifying each station-to-station section of the Northern SRL (for example, Melbourne Airport to Broadmeadows), it is necessary to:

- Define a Multi-Criteria Analysis (MCA) framework for assessing the suitability of route options
- Identify potential route alignment options for the SRLB
- Assess the potential route alignments against the MCA to identify a preferred option

The overarching assumption underpinning this assessment is that the SRLB needs to be rapid and direct between each 'station'. It will operate as an express bus route similar to existing express shuttles to universities.

The MCA therefore includes assessment of:

- Travel time (AM peak) – defined as the Google Maps estimate of the maximum expected end-to-end journey time by car in the AM peak, with 08:00 as the departure time in an eastbound direction
- Travel time (PM peak) – defined as the Google Maps estimate of the maximum expected end-to-end journey time by car in the PM peak, with 17:00 as the departure time in an eastbound direction
- Travel time (interpeak) – defined as the Google Maps estimate of the maximum expected end-to-end journey time by car in the interpeak, with 12:00 as the departure time in an eastbound direction
- Bus priority measures – an assessment made of the level of bus priority measures (if any) that are in place along the alignment (noting that the travel times above are by car, and that the presence of bus priority measures should help improve on those speeds)
    - In addition, route kilometres are also estimated and reported

Google Maps shows an expected range of times for each of the three trip types above. Our assessment has been made on the maximum expected time in an attempt to approximate the potential effects of congestion and delays. However, we also gathered information on Google Maps prediction of the minimum expected time, in order to provide a more granular assessment. It was found that:

- If a route option is clearly superior, then it does not matter whether the comparison is made on maximum or minimum time – it will still be ranked as the better option
- If, however, the route options are very similar with regard to maximum travel time, the minimum expected time can be useful in helping to differentiate between them

The approach to scoring for the MCA is shown in Table 1 below.

Table 1: Multi-criteria analysis for SRLB route segments

	0	1	2	3	4
Bus priority measures	No bus priority measures in place	Bus priority measures in place for <5% of the route	Bus priority measures in place for 5-15% of the route	Bus priority measures in place for 15-25% of the route	Bus priority measures in place for >25% of the route
Travel time (AM peak, interpeak, PM peak)	Max journey time >25mins	Max journey time 21 - 25 mins	Max journey time 16 - 20mins	Max journey time 11 - 15mins	Max journey time ≤10mins

For simplicity and brevity, the analysis only considered travel times for eastbound buses. It is almost never the case that both directions (in this case eastbound and westbound) have the same travel time. However, the travel times across the various roads from which a route choice needs to be made are expected to vary, at the same time of day, in the same manner. As such, no systemic bias is expected from the simplification of using single-direction travel times.

2.2.1 Melbourne Airport – Broadmeadows

From the main terminal of Melbourne Airport to Broadmeadows Station/Pascoe Vale Road bus interchange there are two relatively direct route options:

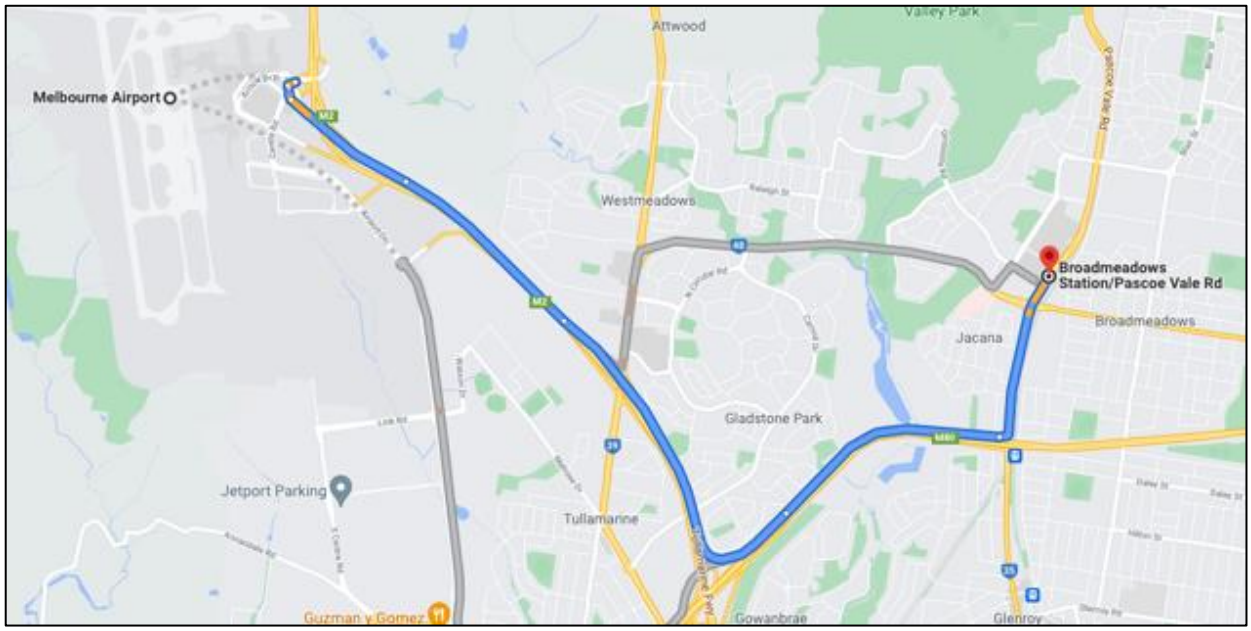
1. Tullamarine Freeway (M2) and Western Ring Road (M80) (Route Option 1)
2. Tullamarine Freeway (M2), Mickleham Road and Broadmeadows Road (Route Option 2)

Other suggested options were less direct and excluded from analysis.

Option 1: Melbourne Airport to Broadmeadows station via M2 & M80

This option has the fastest predicted maximum travel time between Melbourne Airport and Broadmeadows Station. The route is predicted to be impacted by moderate congestion during the PM peak. Option 1 has a slightly longer distance (9.3km) than Option 2 (7.7km).

Figure 7: Melbourne Airport to Broadmeadows station Option 1 (AM Peak)



Source: Google Maps

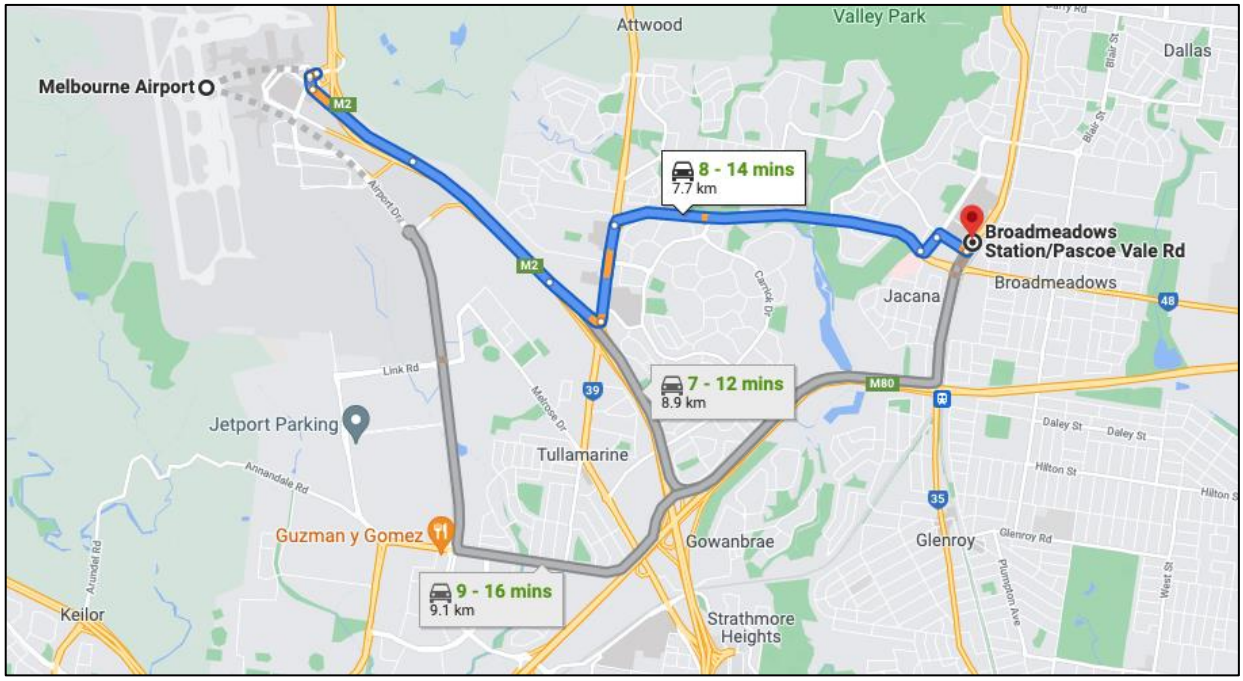
Table 2: Melbourne Airport to Broadmeadows station Option 1 overview

Criteria	Assessment
Bus Priority	No
Max. AM peak travel time	12mins
Max. interpeak travel time	16mins
Max. PM peak travel time	20mins (Google Maps predicts moderate congestion)
Route kilometres	9.3km

Option 2: Melbourne Airport to Broadmeadows station via M2 & Broadmeadows Road

While Option 2 (7.7km) travels a shorter distance than Option 1 (9.3km), it has slightly slower predicted maximum travel times, and is also predicted to be impacted by moderate congestion in the PM peak.

Figure 8: Melbourne Airport to Broadmeadows station Option 2 (AM Peak)



Source: Google Maps

Table 3: Melbourne Airport to Broadmeadows station Option 2 overview

Criteria	Assessment
Bus Priority	Yes – 515m bus priority lane (Mickleham Road) and 1 queue jump lane (Mickleham Road/International Drive)
Maximum AM peak travel time	14mins
Maximum interpeak travel time	18mins
Maximum PM peak travel time	20mins (Google Maps predicts moderate congestion)
Route kilometres	7.7km

Table 4 below provides an MCA summary of the performances of Options 1 and 2. At the aggregate level of the MCA, journey times are comparable and Route 2 has the advantage of some bus priority measures. However, in our view, the level of bus priority offered in Option 2 is not enough to offset the longer journey times (by car) that Option 2 has (compared to Option 1). As such, we recommend the inclusion of Option 1 in the SRLB.

It is noted that for route segments such as this where the choice between options is marginal, this can be used to the advantage of SRLB through the driver switching to the

'other' route if there is congestion on the 'chosen' route. This is possible due to the express nature of the SRLB (customers are not inconvenienced by the actual route alignment so long as it is the fastest and there are no missed stops)[1]. This flexibility is currently adopted by the Skybus service when there is significant congestion on the Tullamarine Freeway.

Table 4: Melbourne Airport to Broadmeadows station route options MCA

Criteria	Route Option 1 (via M2)	Route Option 2 (via Broadmeadows Road)
Bus Priority Measures	**0**	**1**
Maximum AM peak travel time	**3**	**3**
Maximum Interpeak travel time	**2**	**2**
Maximum PM peak travel time	**2**	**2**

Recommendation: Route Option 1 (via M2)

2.2.2 Observations on Fawkner SRL station

Before discussing route choices for Broadmeadows – Fawkner – Reservoir, it is worth noting the intent of SRL (and the SRLB) with regard to Fawkner. Whilst the SRL North alignment shows 'Fawkner' as a chosen stop, there are some issues associated with this:

- The existing Fawkner Station footprint (specifically with reference to Fawkner Memorial Park) means there is a significant question over whether the Fawkner SRL Station is intended to be directly adjacent, or whether greater catchment can be achieved through a more pragmatic choice of station location further north (for example at the very northern extent of Fawkner near Campbellfield Plaza)
- Examination of the PTPI (as shown in Figure 22; see also section 2.4) demonstrates that relatively little patronage is likely to be drawn into the SRLB through placement of stops very close to the existing Fawkner station. This is principally due to no patronage being generated in the buffer area covering Fawkner Memorial Park, and the light industrial area to the east of Fawkner Station and Sydney Road. Locating an SRLB stop near Fawkner Station is unlikely to generate significant demand

[1] *Note that this is not the case for the Fawkner – Reservoir section where a stop at Keon Park is recommended*

- A bus cannot cross Merri Creek between Mahoneys Road and Murray Road (5km south). Diverting the SRLB to Fawkner Station would be an inefficient outcome, as:
    - Access to and from Mahoneys Road would be wasted travel time for people on longer journeys
    - Operating SRLB along Sydney Road and Murray Road would duplicate existing services in those corridors
    - People from the Sydney Road corridor wishing to access SRLB could use the direct Route 531 along Sydney Road and interchange at Mahoneys Road

For the above reasons we recommend the SRLB should be aligned to Mahoneys Road between Broadmeadows and Keon Park with a stop serving the northern boundary of Fawkner near Campbellfield Plaza.

For SRL North, based on the above assessment it would appear that a new train station at the northern end of Fawkner (bordering Campbellfield) would be a more appropriate site than in the middle of Fawkner Memorial Park. A new station in this location could also serve the Upfield line, given its existing alignment through the area. This would obviously allow for direct interchange between the SRL and Upfield line.

Regardless of final SRL location, it is clear the Sydney Road corridor needs to be connected to the SRLB stop (currently the Route 902 SmartBus Stop) at the northern boundary of Fawkner with Campbellfield. This can be achieved through either a new shuttle route or increasing service levels on the existing Route 531 service. A shuttle would be similar to the 'Knox Tram Link' in Vermont South which provides a bus to meet every single tram service throughout the week.

Alternatively, the connection could be provided through an increased service frequency on existing Route 531, from the Route 19 tram terminus in Coburg North to Upfield Station. Bus Route 531 currently provides the key link to tram Route 19 but with only one service per hour on weekdays and no services on weekends.

The service level on Route 531 should be increased to include a service every 15 minutes seven days a week - noting that tram Route 19 operates every 6 minutes on weekdays and every 8 minutes on Saturday and Sunday. This solution would lead to roughly every second tram meeting a Route 531 bus for passengers to continue their journey.

2.2.3 Broadmeadows – Fawkner

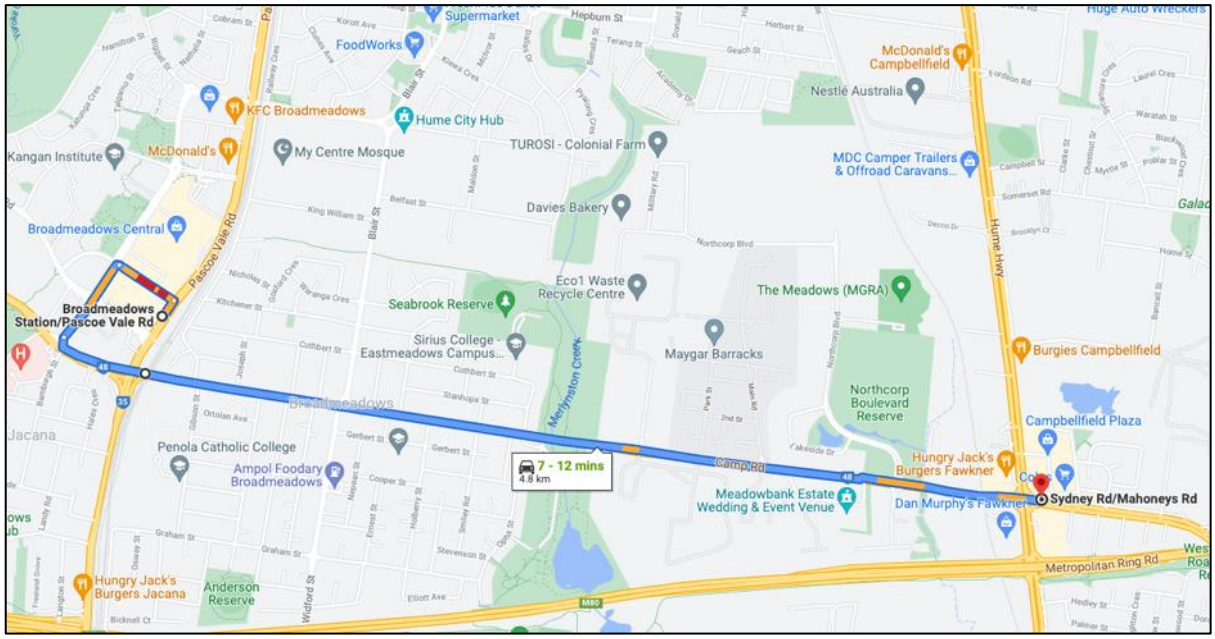
From Broadmeadows station/Pascoe Vale Road bus interchange to Sydney Road/Mahoneys Road there are two relatively direct route options:

1. Camp Road (Route Option 1)
2. Blair Street and Camp Road (Route Option 2)

Option 1: Broadmeadows station to Fawkner via Camp Road

This option has the fastest predicted maximum travel time between Broadmeadows Station and Fawkner, and is predicted to be impacted by moderate congestion in the interpeak and PM peak. Option 1 (4.8km) also travels a much shorter distance than Option 2 (6.2km). Option 1 has 56m of bus priority lane on Mahoneys Road (just before the Sydney Road/Mahoneys Road bus stop) and one queue jump lane and bus priority signalling at the intersection of Mahoneys and Sydney Roads.

Figure 9: Broadmeadows station to Fawkner Option 1 (AM Peak)



Source: Google Maps

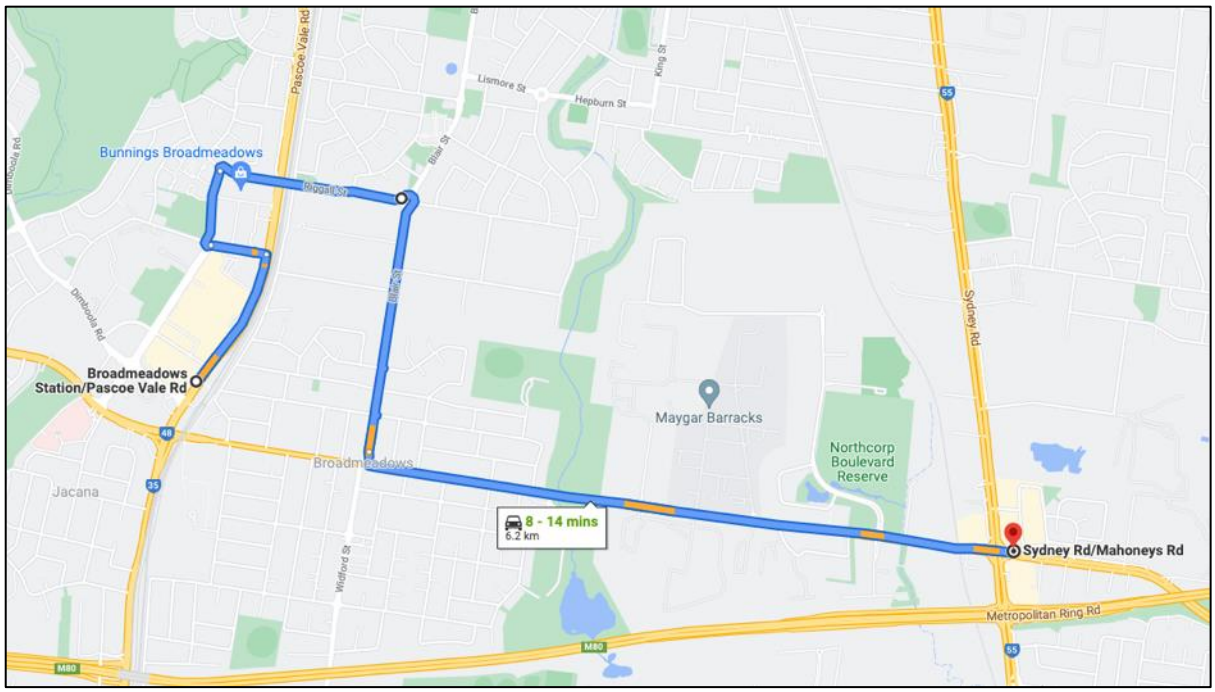
Table 5: Broadmeadows station to Fawkner Option 1 overview

Criteria	Assessment
Bus Priority	Yes – 56m of bus lane along Mahoneys Road and 1 queue jump lane + bus priority signal (Sydney Road/Mahoneys Road intersection)
Maximum AM peak travel time	12mins
Maximum interpeak travel time	16mins (Google Maps predicts moderate congestion)
Maximum PM peak travel time	14mins (Google Maps predicts moderate congestion)
Route kilometres	4.8km

Option 2: Broadmeadows Station to Fawkner via Blair Street

Option 2 takes a more circuitous route from Broadmeadows to Fawkner, and is predicted to be impacted by moderate congestion in the interpeak and PM peak. Option 2 also has 56m of bus priority lane, a queue jump lane and bus priority signalling on Mahoneys Road (just before the eastbound Sydney Road bus stop on Mahoneys Road).

Figure 10: Broadmeadows Station to Fawkner Option 2 (AM Peak)



Source: Google Maps

Table 6: Broadmeadows Station to Fawkner Option 2 overview

Criteria	Assessment
Bus Priority	Yes – 56m of bus lane along Mahoneys Road and 1 queue jump lane + bus priority signal (Sydney Road/Mahoneys Road intersection)
Maximum AM peak travel time	14mins
Maximum interpeak travel time	16mins (Google Maps predicts moderate congestion)
Maximum PM peak travel time	18mins (Google Maps predicts moderate congestion)
Route kilometres	6.2km

Table 7 below provides an MCA summary of the performances of Options 1 and 2. At the aggregate level of the MCA, journey times are comparable and both routes have the same bus priority measures. However, Table 5 and Table 6 showed that Option 1 has marginally faster predicted travel times.

Table 7: Broadmeadows Station to Fawkner route options MCA

Criteria	Route Option 1 (via Camp Road)	Route Option 2 (via Blair Street)
Bus Priority Measures	**1**	**1**
Maximum AM peak travel time	**3**	**3**
Maximum Interpeak travel time	**2**	**2**
Maximum PM peak travel time	**2**	**2**

Recommendation: Route Option 1 (via Camp Road)

2.2.4 Fawkner – Reservoir

From Sydney Road/Mahoneys Road bus stop to Reservoir Station there are two relatively direct route options:

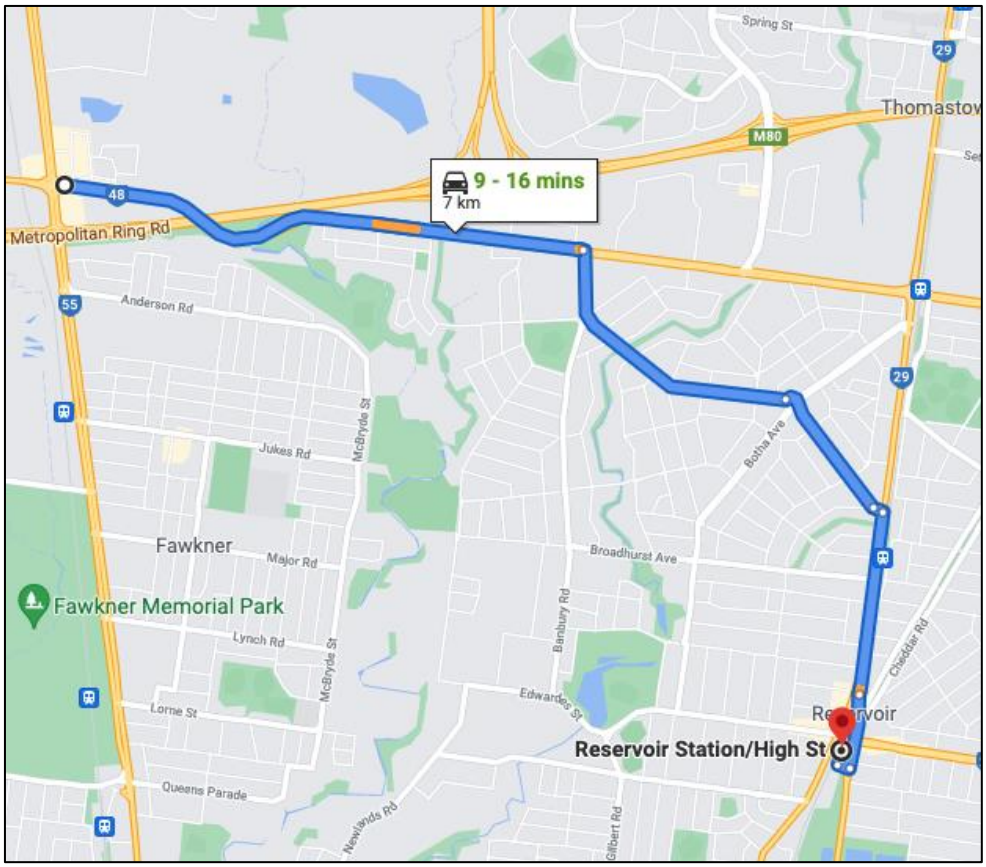
1. Via Mahoney Road & Hughes Parade (Route Option 1)
2. Via Mahoney Road and High Street (Route Option 2)

Other suggested options were less direct and excluded from analysis.

Option 1: Fawkner to Reservoir Station via Mahoneys Road & Hughes Parade

Option 1 has the fastest predicted maximum travel times across all three travel periods, and is predicted to have no congestion impacts. Option 1 travels 7.0km whilst Option 2 travels 7.5km. Option 1 has 212m of priority bus lane along Mahoneys Road.

Figure 11: Fawkner to Reservoir Station Option 1 (AM Peak)



Source: Google Maps

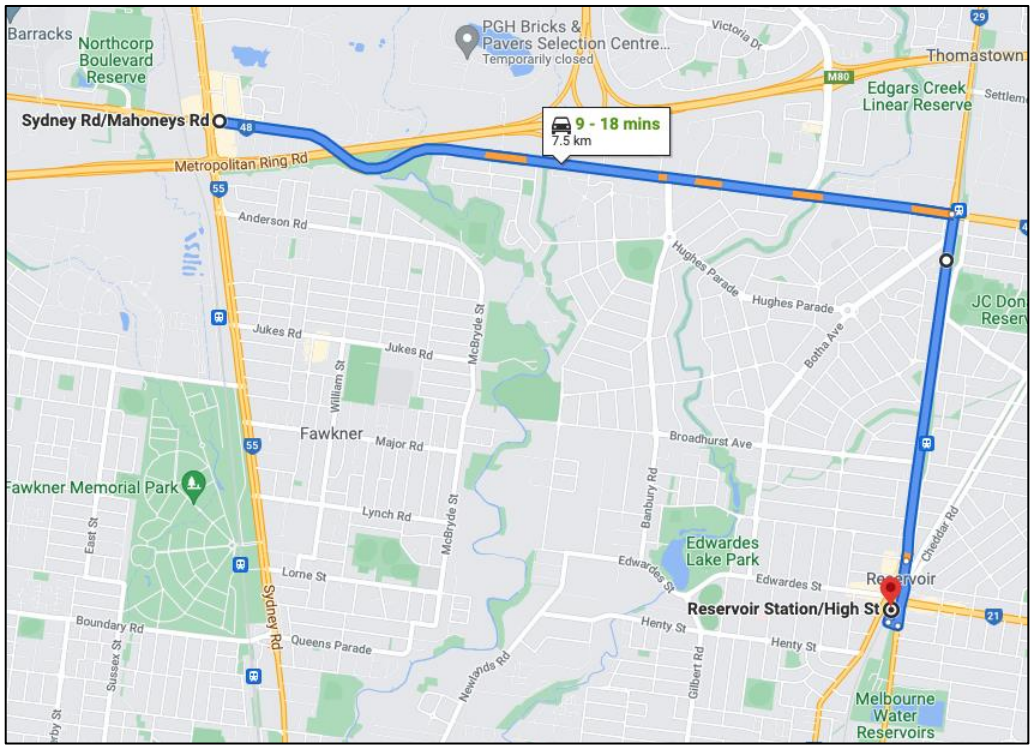
Table 8: Fawkner to Reservoir Station Option 1 overview

Criteria	Assessment
Bus Priority	Yes – 212m of bus lane along Mahoneys Road
Maximum AM peak travel time	16mins
Maximum interpeak travel time	18mins
Maximum PM peak travel time	18mins
Route kilometres	7.0km

Option 2: Fawkner to Reservoir Station via Mahoneys Road and High Street

Despite travelling the same distance, Option 2 has slower predicted maximum travel times compared to Option 1 during the interpeak and PM peak. Option 2 is predicted to have moderate congestion during the interpeak. Option 2 has greater bus priority than Option 1, having 1,086m of bus priority lane along Mahoneys Road and Keon Parade.

Figure 12: Fawkner to Reservoir Station Option 2 (AM Peak)



Source: Google Maps

Table 9: Fawkner to Reservoir Station Option 2 overview

Criteria	Assessment
Bus Priority	Yes – 1,086m of bus lane along Mahoneys Road/Keon Parade
Maximum AM peak travel time	18mins
Maximum interpeak travel time	20mins (Google Maps predicts moderate congestion)
Maximum PM peak travel time	20mins
Route kilometres	7.5km

Table 10 below provides an MCA summary of the performances of Options 1 and 2. Table 8 and Table 9 indicate that Option 1 has slightly faster travel times than Option 2 with less susceptibility to congestion, even though the MCA indicates no difference in travel times at the aggregate level.

However, it is noted that using minimum predicted travel times (rather than maximums) would have shown Option 2 being slightly faster travel times than Option 1. Clearly there is relatively little difference between journey times for these options.

Noting that Option 2 also has over 850m more bus priority measures than Option 1, there is an additional reason why Option 2 is recommended. Option 2 takes the SRLB close to the footprint of Keon Park Station. At present, stopping close to Keon Park (and avoiding

the need for looping into the station) would require stops just to the south of Mahoney's Road. It is noted that:

- The announcement of LXRA works at Keon Park[2] and the fact that a new station will be built, means there is an opportunity for NCA to advocate for good quality bus stops to be introduced to the south of Mahoney's Road. This would allow for improved links between Keon Park, existing services (such as Route 555) and SRLB
- Significant east-west connectivity benefits arise from inclusion of Keon Park as a stop on the SRLB, including:
    - Travel time savings for journeys between the Mernda train line and areas to the west
    - Improved access to the Thomastown employment area that surrounds Keon Park Station

Further discussion on the potential for an SRLB stop at Keon Park is in section 2.6.5.

Table 10: Fawkner to Reservoir Station route options MCA

Criteria	Route Option 1 (via Mahoneys Road)	Route Option 2 (via Mahoneys Road and High Street)
Bus Priority Measures	**1**	**2**
Maximum AM peak travel time	**2**	**2**
Maximum Interpeak travel time	**2**	**2**
Maximum PM peak travel time	2	**2**

Recommendation: Route Option 2 (via Mahoneys Road and High Street)

2.2.5 Reservoir – Bundoora (La Trobe University)

It is noted that the SRL North station locations are yet to be defined by government. For the purposes of designing the SRLB, the optimal location for the Bundoora stop is at the existing Science Drive Bus Station, where the existing express shuttle terminates.

From Reservoir Station bus interchange to Science Drive Bus Station at La Trobe University there are two relatively direct route options:

[2] www.levelcrossings.vic.gov.au/projects/keon-parade-keon-park

1. Via Dunne Street (Route Option 1)
2. Via Plenty Road (Route Option 2)

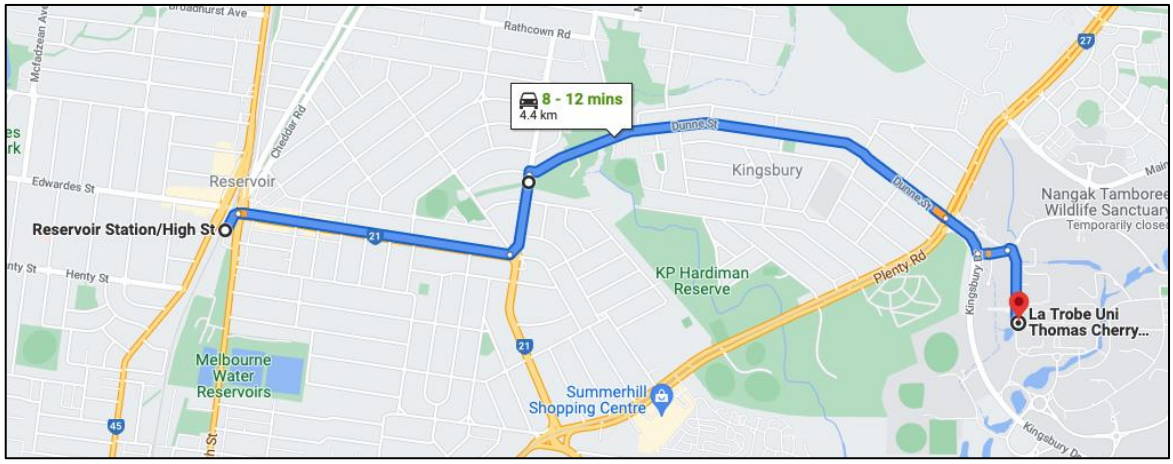
Other suggested options were less direct and excluded from analysis.

Option 1: Reservoir Station to La Trobe University via Dunne Street

Option 1 (4.4km) travels a shorter distance than Option 2 (4.9km) and has faster predicted maximum travel times than Option 2. Option 1 has no bus priority along the route.

The Option 1 alignment is already served by a successful express bus between Reservoir and La Trobe University. Route 301 is the only segment of the SRLB that currently exists in Melbourne's north.

Figure 13: Reservoir Station to La Trobe University Option 1 (AM Peak)



Source: Google Maps

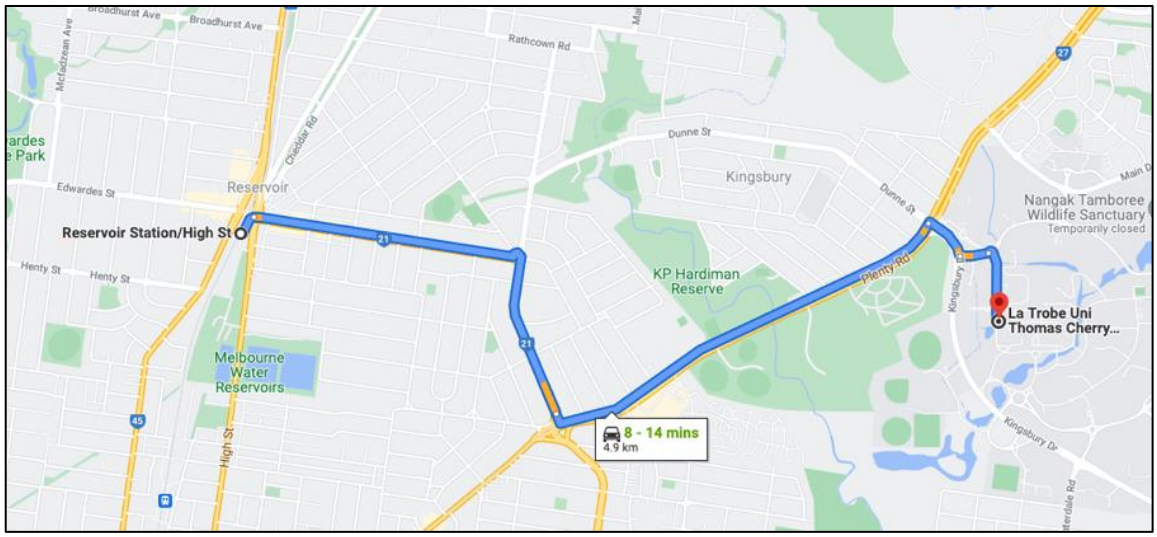
Table 11: Reservoir Station to La Trobe University Option 1 overview

Criteria	Assessment
Bus Priority	No
Maximum AM peak travel time	12mins
Maximum interpeak travel time	12mins
Maximum PM peak travel time	12mins
Route kilometres	4.4km

Option 2: Reservoir Station to La Trobe University via Plenty Road

Option 2 has slower predicted maximum travel times than Option 1 and has no bus priority along the route.

Figure 14: Reservoir Station to La Trobe University Option 2 (AM Peak)



Source: Google Maps

It is noted that the route for Option 2 passes through more areas of activity than Option 1. However, as there are no stops between Reservoir and La Trobe University, Option 2 would still not generate additional patronage (compared to Option 1) along its route.

Table 12: Reservoir Station to La Trobe University Option 2 overview

Criteria	Assessment
Bus Priority	No
Maximum AM peak travel time	14mins
Maximum interpeak travel time	14mins
Maximum PM peak travel time	14mins
Route kilometres	4.9km

Table 13 below provides an MCA summary of the performances of Options 1 and 2. Table 11 and Table 12 show that Option 1 has slightly faster travel times than Option 2, even though at the aggregate level the MCA does not distinguish between them.

Table 13: Reservoir Station to La Trobe University route options MCA

Criteria	Route Option 1 (via Dunne Street)	Route Option 2 (via Plenty Road)
Bus Priority Measures	**0**	**0**
Maximum AM peak travel time	**3**	**3**
Maximum Interpeak travel time	**3**	**3**
Maximum PM peak travel time	3	3

Recommendation: Route Option 1 (via Dunne Street)

2.2.6 La Trobe University – Heidelberg

We recommend including a new bus stop along Studley Road outside the Heidelberg Station entrance, because the Heidelberg Station/Yarra Street interchange is at capacity, and a new bus stop along Studley Road provides a better connection to the Austin Hospital complex. Given the need for left turns into Banksia Street / right turns from Banksia Street, it is also noted that Yarra Street is unsuitable as the Heidelberg SRLB stop (due to a median strip on Banksia Street at Yarra Street).

From La Trobe University Thomas Cherry Building/Science Drive bus stop to Heidelberg Station/Studley Road there are two relatively direct route options:

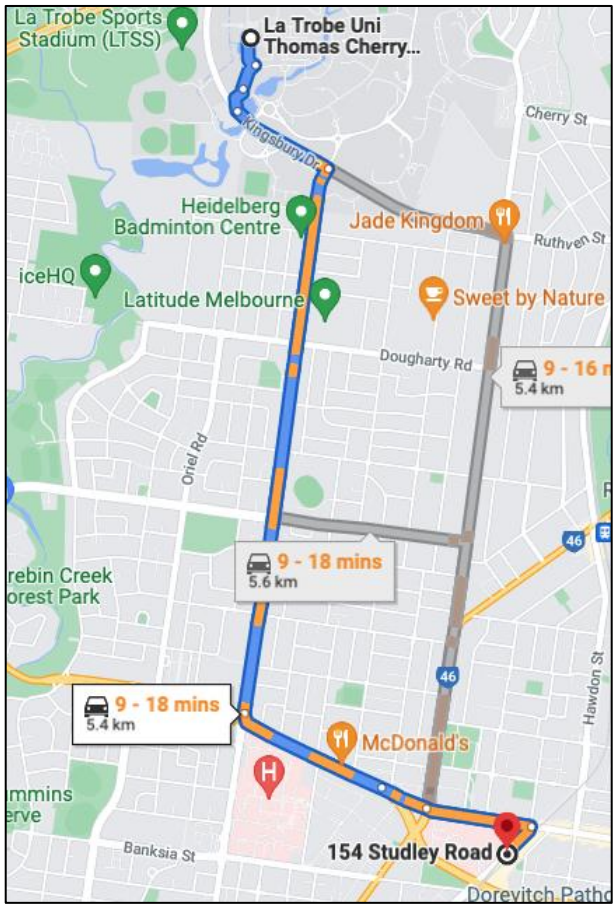
1. Via Waterdale Road (Route Option 1)
2. Kingsbury Drive and Waiora Road (Route Option 2)

Other suggested options were less direct and excluded from analysis.

Option 1: La Trobe University to Heidelberg Station via Waterdale Road

Option 1 and Option 2 are the same distance (5.4km), but travel times are slightly longer on Option 1 than on Option 2. Option 1 is predicted to experience moderate congestion during the peak periods. Option 1 has no bus priority along its route.

Figure 15: La Trobe University to Heidelberg Station Option 1 (AM Peak)



Source: Google Maps

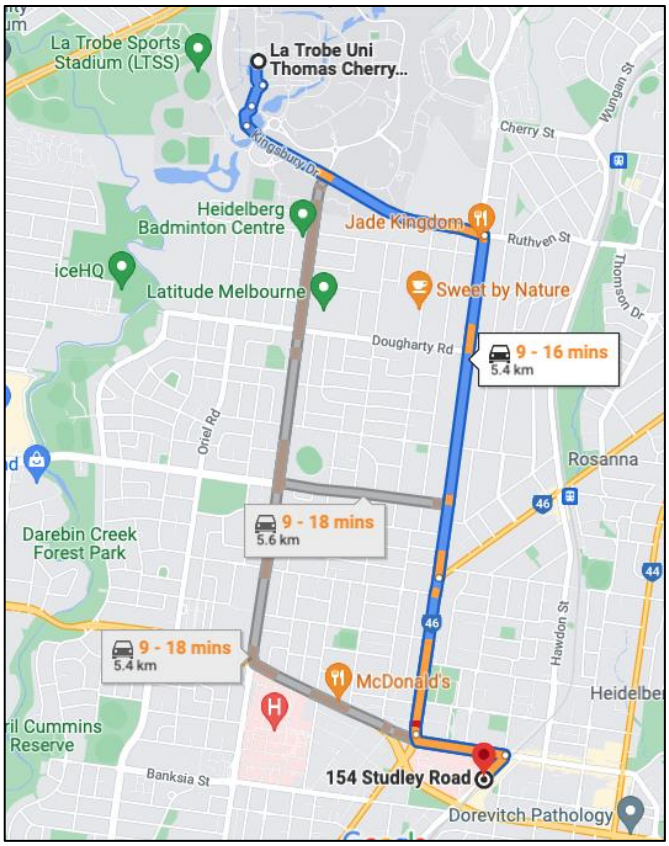
Table 14: La Trobe University to Heidelberg Station Option 1 overview

Criteria	Assessment
Bus Priority	No
Maximum AM peak travel time	18mins (Google maps predicts moderate congestion)
Maximum interpeak travel time	18mins
Maximum PM peak travel time	16mins (Google maps predicts moderate congestion)
Route kilometres	5.4km

Option 2: La Trobe University to Heidelberg Station via Kingsbury Drive and Waiora Road

Option 2 is predicted to experience moderate congestion during peak period, but is predicted to have faster travel times than Option 1. Like Option 1, it does not have bus priority along its route.

Figure 16: La Trobe University to Heidelberg Station Option 2 (AM Peak)



Source: Google Maps

Table 15: La Trobe University to Heidelberg Station Option 2 overview

Criteria	Assessment
Bus Priority	No
Maximum AM peak travel time	16mins (Google maps predicts moderate congestion)
Maximum interpeak travel time	16mins
Maximum PM peak travel time	16mins (Google maps predicts moderate congestion)
Route kilometres	5.4km

Table 16 below provides an MCA summary of the performances of Options 1 and 2, showing no difference at the aggregate level. Table 14 and Table 15 showed that Option 2 has slightly more competitive travel times than Option 1, although looking at minimum predicted travel times instead there is no difference between the options. Overall, there is little to separate the two options with almost identical performance.

Table 16: La Trobe University to Heidelberg Station route options MCA

Criteria	Route Option 1 (via Waterdale Road)	Route Option 2 (via Kingsbury Drive and Waiora Road)
Bus Priority Measures	**0**	**0**
Maximum AM peak travel time	**2**	**2**
Maximum Interpeak travel time	**2**	**2**
Maximum PM peak travel time	2	2

Recommendation: Route Option 2 (via Waiora Road)

2.2.7 Heidelberg – Doncaster

From the recommended Heidelberg Station/Yarra Street bus stop to stop to Doncaster SC/Williamson Road bus interchange there are three relatively direct route options:

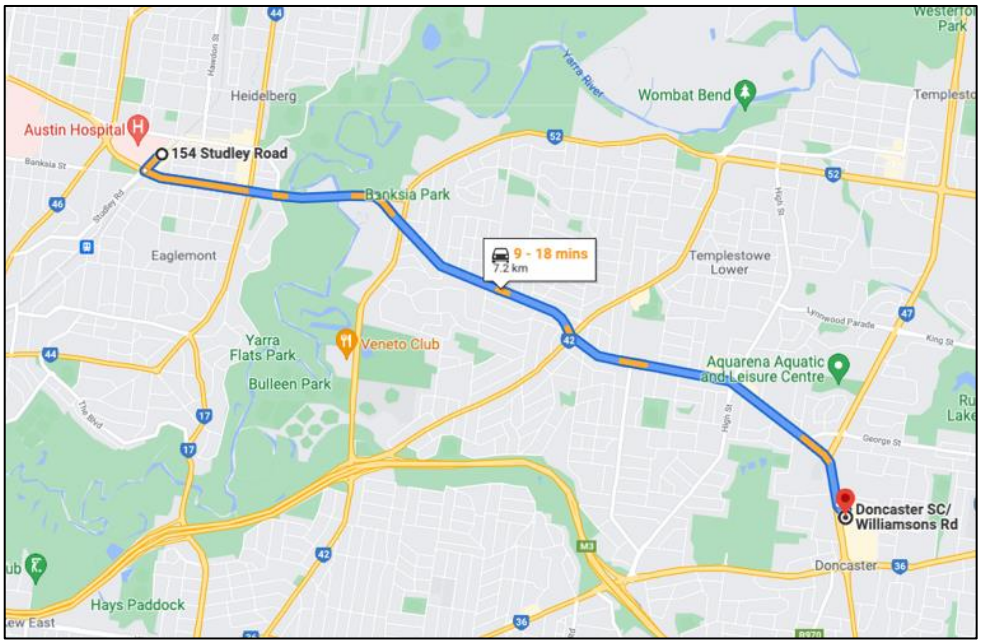
1. Via Manningham Road (Route Option 1)
2. Via the Eastern Freeway and Elgar Road (Route Option 2)
3. Via the Eastern Freeway and Doncaster Road (Route Option 3)

Other suggested options were less direct and excluded from analysis.

Option 1: Heidelberg Station to Doncaster via Manningham Road

Option 1 (7.2km) has faster predicted travel times than both Option 2 (10.6km) and Option 3 (9.7km), and travels shorter distances. Option 1 is predicted to have moderation congestion throughout the day. Option 1 has 900m of bus priority lane along Manningham Road and one bus priority signal at the intersection of Manningham and Williamsons Roads.

Figure 17: Heidelberg Station to Doncaster Option 1 (AM Peak)



Source: Google Maps

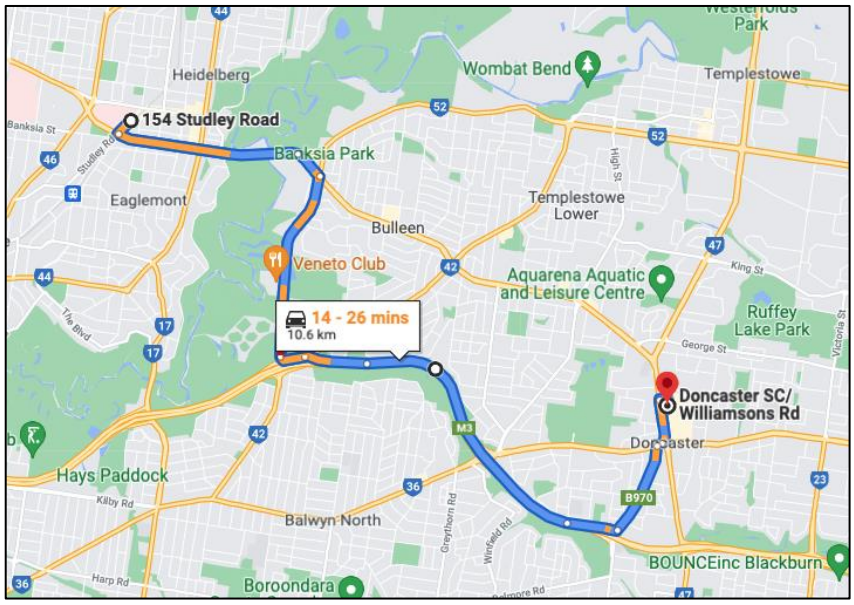
Table 17: Heidelberg Station to Doncaster Option 1 overview

Criteria	Assessment
Bus Priority	Yes – 900m of bus lane along Manningham Road and one bus priority signal at the Manningham Road/Williamsons Road intersection
Maximum AM peak travel time	18mins (Google maps predicts moderate congestion)
Maximum interpeak travel time	22mins (Google Maps predicts moderate congestion)
Maximum PM peak travel time	20mins (Google Maps predicts moderate congestion)
Route kilometres	7.2km

Option 2: Heidelberg Station to Doncaster via Eastern Freeway and Elgar Road

Option 2 is predicted to have moderate congestion during the AM, PM peaks and interpeak.

Figure 18: Heidelberg Station to Doncaster Option 2 (AM Peak)



Source: Google Maps

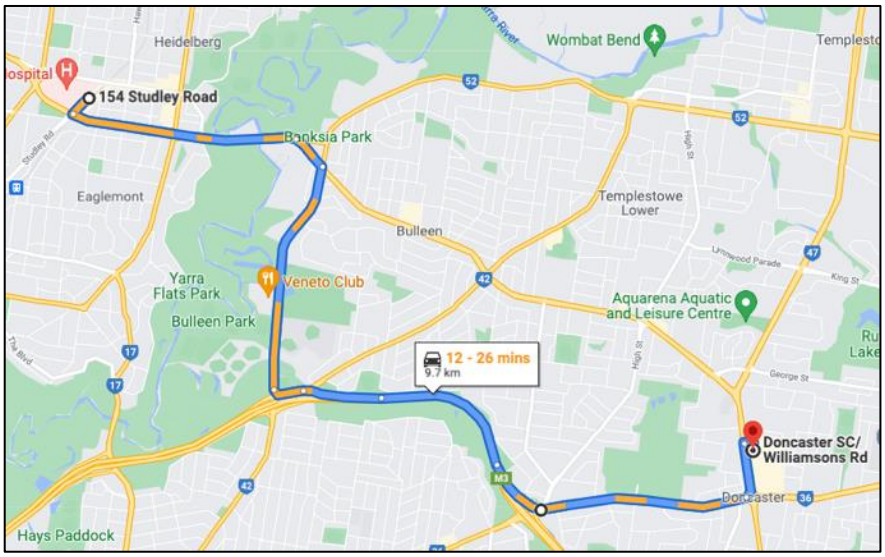
Table 18: Heidelberg Station to Doncaster Option 2 overview

Criteria	Assessment
Bus Priority	No
Maximum AM peak travel time	26mins (Google Maps predicts moderate congestion)
Maximum interpeak travel time	26mins (Google Maps predicts moderate congestion)
Maximum PM peak travel time	26mins (Google Maps predicts moderate congestion)
Route kilometres	10.6km

Option 3: Heidelberg Station to Doncaster via Eastern Freeway and Doncaster Road

Option 3 is predicted to have moderate congestion during the AM, PM peaks and interpeak. It has 1,100m of bus priority lane along Doncaster Road.

Figure 19: Heidelberg Station to Doncaster Option 3 (AM Peak)



Source: Google Maps

Table 19: Heidelberg Station to Doncaster Option 3 overview

Criteria	Assessment
Bus Priority	Yes – 1,100m of bus lane along Doncaster Road
Maximum AM peak travel time	26mins (Google Maps predicts moderate congestion)
Maximum interpeak travel time	26mins (Google Maps predicts moderate congestion)
Maximum PM peak travel time	28mins (Google Maps predicts moderate congestion)
Route kilometres	9.7km

Table 20 below provides an MCA summary of the performances of Options 1, 2 and 3. This shows that Option 1 is clearly the better option. Whilst it has 200m less of bus priority measures than Option 3, it travels a significantly shorter distance, such that the percentage of the route that has priority measures for Option 1 (13%) is marginally higher than Option 3 (12%).

Table 20: Heidelberg Station route to Doncaster options MCA

Criteria	Route Option 1 (via Manningham Road)	Route Option 2 (via Elgar Road)	Route Option 3 (via Doncaster Road)
Bus Priority Measures	**2**	**0**	**2**
Maximum AM peak travel time	**2**	**1**	**1**
Maximum Interpeak travel time	**1**	**0**	**0**
Maximum PM peak travel time	**1**	**0**	**0**

Recommendation: Route Option 1 (via Manningham Road)

2.2.8 Doncaster – Box Hill

From Doncaster SC/Williamson Road bus interchange to Box Hill Bus Station via Station Street there are two relatively direct route options:

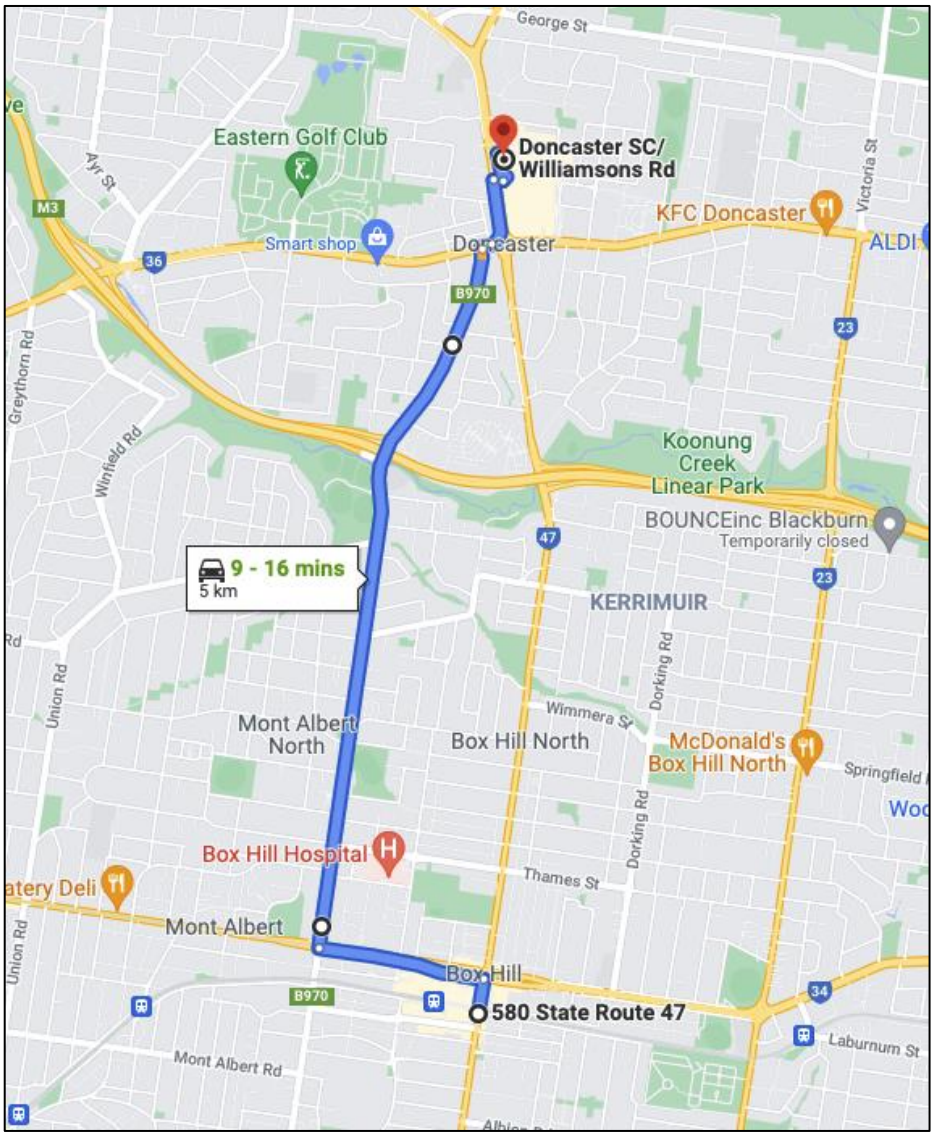
1. Via Elgar Road (Route Option 1)
2. Via Station Street (Route Option 2)

Other suggested options were less direct and excluded from analysis.

Option 1: Doncaster to Box Hill via Elgar Road

Option 1 (5.0km) travels a longer distance than Option 2 (4.2km) and has longer predicted maximum travel times. Option 1 is predicted to have moderate congestion in the interpeak. Option 1 has a queue jump lane and bus priority signal at the intersection of Williamsons and Doncaster Roads.

Figure 20: Doncaster to Box Hill Option 1 (AM Peak)



Source: Google Maps

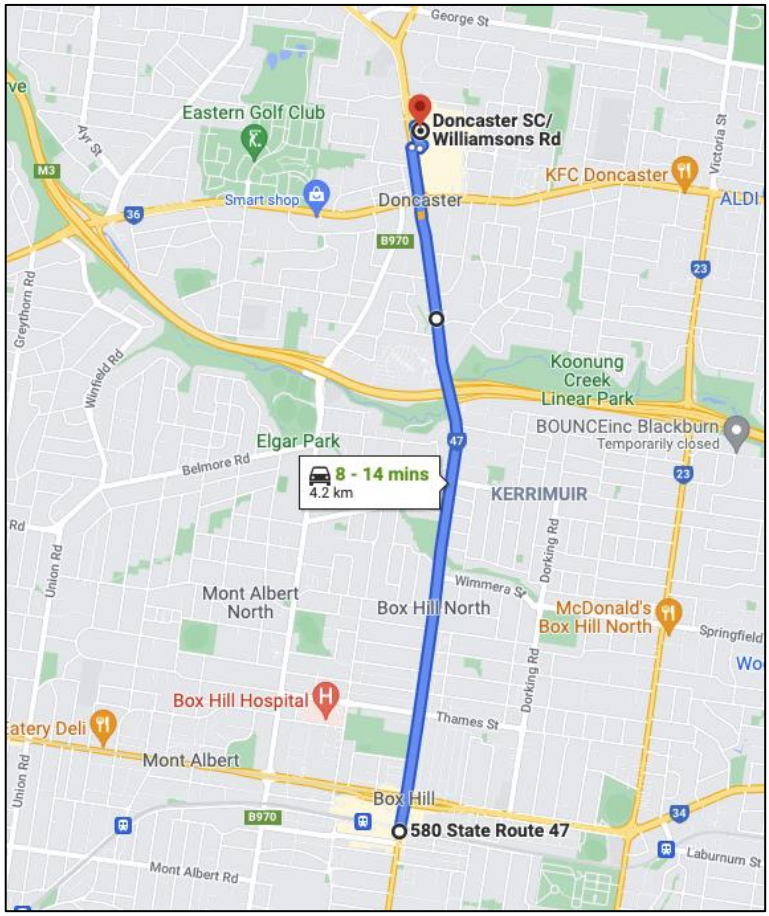
Table 21: Doncaster to Box Hill Option 1 overview

Criteria	Assessment
Bus Priority	Yes – Queue jump lane and bus priority signal at the Williamsons Road/Doncaster Road intersection
Maximum AM peak travel time	16mins
Maximum interpeak travel time	20mins (Google Maps predicts moderate congestion)
Maximum PM peak travel time	20mins
Route kilometres	5.0km

Option 2: Doncaster to Box Hill via Tram Road

Option 2 is predicted to have moderate congestion in the interpeak and PM peak. Option 2 also has a queue jump lane and bus priority signal at the intersection of Williamsons and Doncaster Roads.

Figure 21: Doncaster to Box Hill Option 2 (AM Peak)



Source: Google Maps

Table 22: Doncaster to Box Hill Option 2 overview

Criteria	Assessment
Bus Priority	Yes – Queue jump lane and bus priority signal at the Williamsons Road/Doncaster Road intersection
Maximum AM peak travel time	14mins
Maximum interpeak travel time	16mins (Google Maps predicts moderate congestion)
Maximum PM peak travel time	16mins
Route kilometres	4.2km

Table 23 below provides an MCA summary of the performances of Options 1 and 2. The MCA, Table 21 and Table 22 indicate that Option 2 is clearly the better option.

Table 23: Doncaster options to Box Hill MCA

Criteria	Route Option 1 (via Elgar Road)	Route Option 2 (via Tram Road)
Bus Priority Measures	**1**	**1**
Maximum AM peak travel time	**2**	**3**
Maximum Interpeak travel time	**2**	**2**
Maximum PM peak travel time	**2**	**2**

Recommendation: Route Option 2 (via Tram Road)

2.3 Building patronage on the SRLB via existing routes

As described in section 2.2 above, the guiding principles for the SRLB route alignment were simplicity and directness. In setting up the SRLB for success, another consideration is whether there are existing routes that align with the SRLB. In some cases, the SRLB will make some existing routes redundant. This would consolidate resources into a longer distance east-west link that can better meet the communities' needs.

Note however that as an express service, the SRLB would provide for longer distance trips without meeting other local travel needs in each corridor. Route efficiencies are therefore limited to consideration of routes that are already operating an express pattern (such as Route 301) or have very limited exclusive catchment (such as Route 551).

2.3.1 Route 301 / Route 561

The SRLB section from Reservoir Station to Bundoora overlaps with Route 301 (express shuttle) and Route 561. Both routes could operate in the same corridor or all services could be branded as SRLB services to make customer information and marketing easy. In this scenario all patronage on Route 301 would shift to SRLB, and the higher service frequency and regular operating pattern would also generate additional patronage from people currently driving to La Trobe University and from those travelling by train via Ivanhoe or Heidelberg.

With Route 301 rebranded, resources allocated to it could be used towards SRLB.

2.3.2 Route 551

The SRLB section from La Trobe University to Heidelberg Station overlaps the catchment of Route 551. While this local route also serves a few bus stops in the middle of the block, none are beyond the 400m catchment of Waiora or Waterdale Roads (which both have local buses on them). Up to 90% of the patronage on Route 551 is travelling the full length of the route between La Trobe University and Heidelberg Station – and a significant portion of that patronage is transferring to Route 901 towards Doncaster and Box Hill. Therefore 90% of the patronage on Route 551 will be served by SRLB. In addition, the service frequency increase and additional span of hours will increase patronage on this corridor.

Route 551 would not be needed and the resource savings could be used towards SRLB.

2.3.3 Route 903

The SRLB section from Heidelberg Station to Doncaster and Box Hill overlaps with SmartBus Route 903 along Manningham Road. SRLB would be an express version of Route 903. The local service provided by Route 903 would however, still be needed. As such, only longer distance patronage would be diverted to SRLB and no cost reduction is possible.

2.4 Ensuring that SRLB serves the in-scope population

Public transport networks are typically successful when they are well-matched to the population that they are intended to serve. There are four main factors which influence the level of patronage that a bus service can expect to generate:

- **Population density**: bus patronage will typically be higher where population is most densely located. ABS census data can be used to derive the number of people per square KM per SA1 area
- **Population age**: the young and the elderly are typically more intensive users of public transport than the rest of the population. As such, the number of young and elderly in the overall population will have an influence on the level of bus patronage across the study area. ABS census data can be used to derive the proportion of the population in each SA1 area that is either under 19 or over 55
- **Levels of car ownership**: as levels of access to a car grow, the likelihood of using public transport decreases. ABS census data can be used to derive the proportion of households per SA1 area which have less than 2 cars
- **Household income**: higher household income is usually associated with increased access to a car, and is therefore inversely correlated with propensity to use public transport. ABS census data can be used to derive the proportion of households that earn less than $1,00 per week

Each of the four factors above can be interpreted spatially through GIS. If combined together into a single aggregate measure within GIS, then this can be used visually to demonstrate those areas which are most likely to use public transport.

Creation of this single 'Public Transport Propensity Index' (PTPI) has been carried out to help identify how well the current SmartBus routes align with potential customer demand.

Scores range from 0-24 on the PTPI, as shown in Table 24 below.

Table 24: Summary of PTPI scoring

Propensity Score	Meaning
0-6	Very low propensity to use public transport
6-12	Low propensity to use public transport
12-18	Medium propensity to use public transport
18-24	High propensity to use public transport

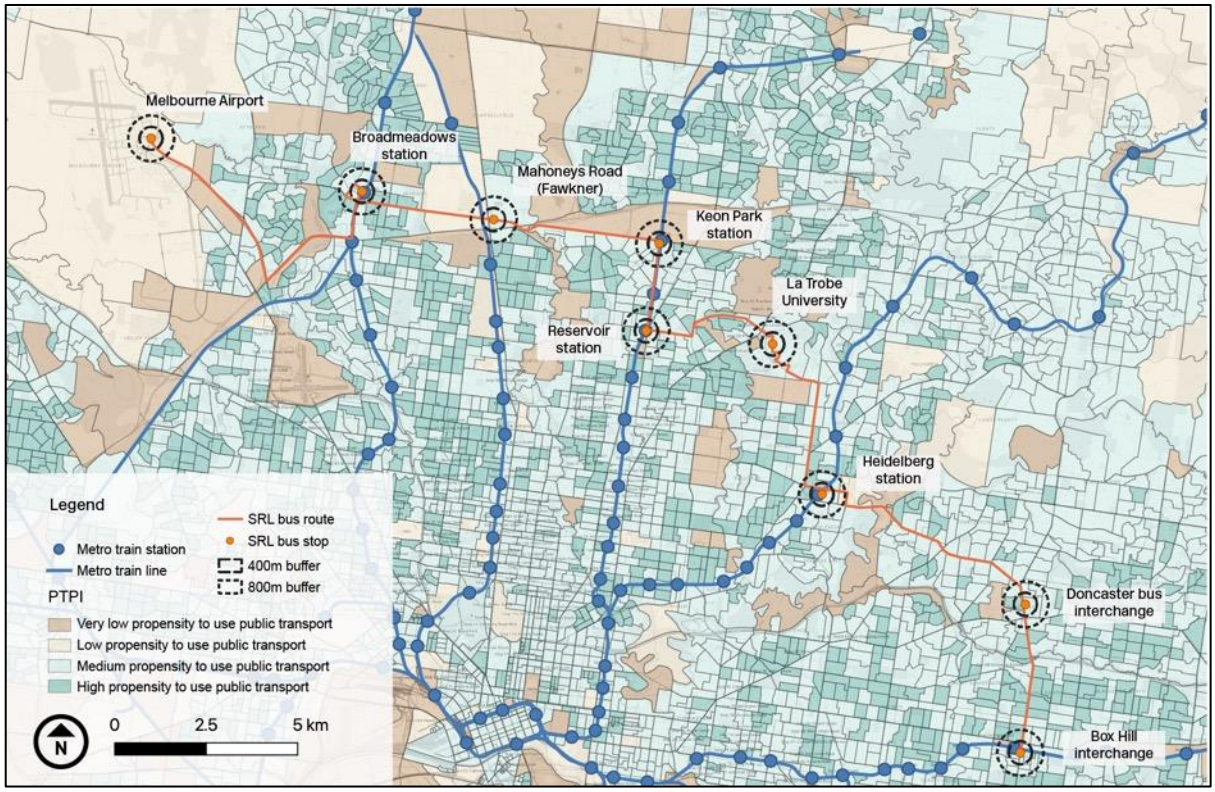
Each of these four bands is then assigned a colour; Figure 22 provides an overview of the propensity scores along the SRLB, with a 400m (and for illustration) 800m buffer around the route. These buffers represent the catchment which SRLB will service, with DOT currently aiming to have a bus route within a 400m buffer of 90% of all residents (see section 1). For consistency, we have adopted a 400m buffer in our calculations.

An 800m buffer would be more typical of what would be expected for the catchment of a heavy rail service (such as SRL). Whilst SRLB cannot be considered equivalent to SRL, its limited stop nature (faster journey times and improved reliability) means some customers may well be prepared to walk further than 400m. Some studies have shown that customers state they will walk further for higher levels of service quality[3].

Apart from Melbourne Airport, every other stop along the proposed SRLB route services an area with a medium to high propensity to use public transport. This indicates the proposed route is likely to satisfy the principle of being 'nearby' for residents (see section 1).

[3] https://ses.library.usyd.edu.au/bitstream/handle/2123/19115/ITLS-WP-17-17.pdf?sequence=1&isAllowed=y

Figure 22: Public transport propensity scores along the proposed SRLB route



Source: ABS 2016 with M&PC analysis

2.5 Detailed route planning, service frequency and priority lanes

The majority of the proposed SRLB route runs along state arterial roads, with a not-insignificant level of bus priority provision, particularly where the proposed SRLB overlaps with SmartBus Routes 901, 902 and 903. Where the proposed route runs along a non-arterial road, roads which already host bus services, such as Dunne Street and Tanderrum Way were chosen. Therefore, we can say with some certainty that it is physically possible to run the SRLB along its proposed route using existing road space. Besides the Fawkner stop, topography and natural environmental features did not pose an issue along any other route segment.

Our analysis identified three areas where service may be impacted by congestion or delays. The first section is along the M2 freeway from Melbourne Airport to Broadmeadows, particularly during the PM peak. It is not cost effective to provide full bus priority along the freeway segments, but some partial bus priority could be considered in the left emergency lanes, or through an extension of the high occupancy vehicle lanes currently used by the SkyBus. As discussed in section 2.2.1, an option to avoid congestion is for the bus to travel along the alternative option evaluated (Melbourne Airport to Broadmeadows Station via Mickleham Road). The limited stop nature of SRLB would lead to no customer disbenefit from taking such an alternative route during times of congestion.

The right turn from Mahoneys Road onto High Street is a potential pinch point along the Fawkner – Reservoir route segment. As Mahoneys Road already has a leftmost bus priority

lane, improving bus priority along Mahoneys Road just before its intersection with High Street is fairly cost effective. A bus priority signal which allows the bus to turn right from the bus lane (see Figure 23) will likely cost under $100,000 and would provide travel time savings of approximately 30 seconds per service during the peak period.

Figure 23: Potential intersection improvement for SRLB (Mahoneys Road/High Street)

Source: Nearmaps with M&PC annotation

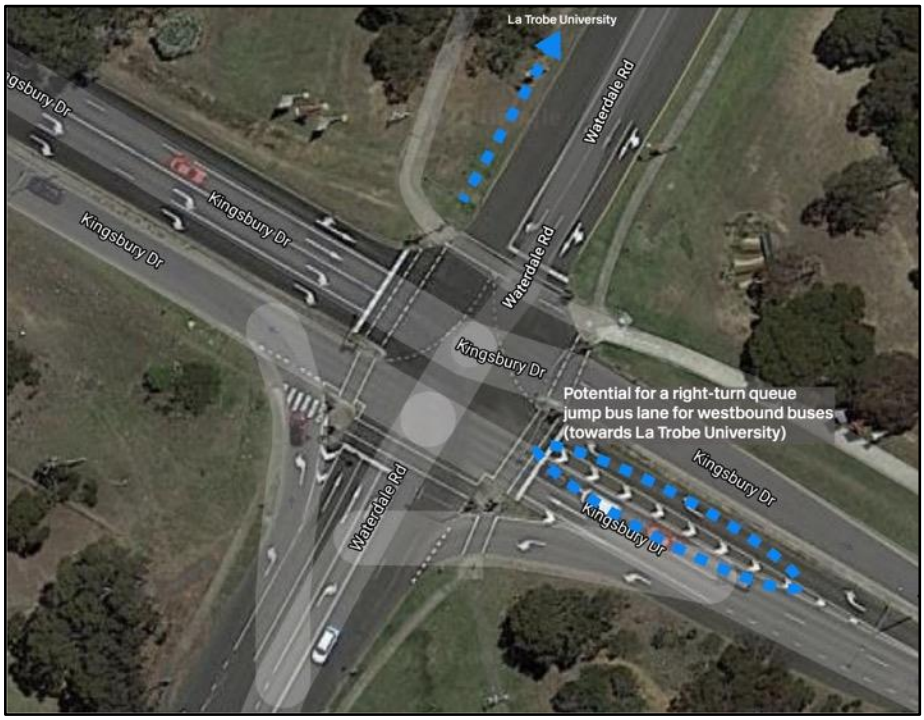
Installing bus priority signalling at the intersection of Mahoneys Road and High Street would also allow the bus to stop close to the intersection, allowing passengers to transfer to the Mernda line via Keon Park Station (as discussed in section 2.2).

The intersection of Kingsbury Drive and Waterdale Road also presents a potential pinch point along the Bundoora – Heidelberg route segment. Waterdale Road is impacted by congestion at irregular times of day. Eastbound SRLB services would have to make a left turn from Waterdale Road onto Kingsbury Drive, while westbound SRLB services would have to turn right onto Waterdale Road from Kingsbury Drive. Installing bus priority signalling and a right-turn queue jump bus lane on Kingsbury Drive might mitigate potential delays associated with this right turn (see Figure 24). This is a low-cost solution under $100,000 which would result in travel time savings of 30 seconds per bus, improving public transport access to the La Trobe NEIC (not just SRLB). The travel time savings would likely cover the cost of the infrastructure within one year.

The queue jump lane would likely have minimal impact on other vehicles, particularly because it does not remove an existing traffic lane. This type of queue jump facility is used

on the SmartBus 901 alignment turning from Foote Street into Fitzsimons Lane in Templestowe.

Figure 24: Potential intersection improvement for SRLB (Kingsbury Drive/Waterdale Road)



Source: Google Maps

In summary, the two priority improvements that we would suggest are:

- Bus priority signal which allows the bus to turn right from the bus lane at the intersection of Mahoneys Road and High Street - likely cost under $100,000
- Installing bus priority signalling and a right-turn queue jump bus lane on Kingsbury Drive - likely cost under $100,000

2.5.1 Service parameters

As a precursor to the SRL, the SRLB should provide a high level of service commensurate with similar public transport service offerings. Table 25 and Table 26 provide a summary of cross-town line service parameters within the northern metropolitan region.

Table 25: Weekday frequency on cross-town lines in the study area

Service	Service headway (minutes)				
	Early	AM Peak	Interpeak	PM peak	Late
Train (towards CBD)					
Craigieburn line (Broadmeadows Station)	9-20	4-10	11-20	5-12	20-30
Upfield line (Fawkner Station)	16-20	14-20	19-20	14-20	20-30
Mernda line (Reservoir Station)	6-20	6-20	6-20	6-19	19-30
Hurstbridge line (Heidelberg Station)	6-34	4-10	8-20	4-22	14-30
Bus (eastbound)					
SmartBus 901 (Broadmeadows Station)	18-30	14-15	13-16	15-17	12-28
SmartBus 902 (Broadmeadows Station)	13-22	14-17	11-15	13-16	13-30
SmartBus 903 (Heidelberg Station)	8-19	6-16	8-17	7-15	8-32

Source: PTV timetables (reference day: 27 October 2021)

Table 26: Service span of cross-town lines in the study area

Service	Direction	Span (Hours)		
		Weekday	Saturday	Sunday
Train				
Craigieburn line (Broadmeadows Station)	To CBD	19	24	24
	To Craigieburn	19	24	24
Upfield line (Fawkner Station)	To CBD	19	24	24
	To Upfield	19	24	24
Mernda line (Reservoir Station)	To CBD	19	24	24
	To Mernda	19	24	24
Hurstbridge line (Heidelberg Station)	To CBD	19	24	24
	To Hurstbridge	19	24	24
Bus				
SmartBus 901 (Broadmeadows Station)	To Melbourne Airport	19	18	15
	To Frankston	19	18	15
SmartBus 902 (Broadmeadows Station)	To Airport West	19	18	15
	To Chelsea	19	19	15
SmartBus 903 (Heidelberg Station)	To Altona	19	18	14
	To Mordialloc	19	18	14

Source: PTV timetables (reference day: 27 October 2021, 30 October 2021, 31 October 2021)

Based on the service frequencies and service spans of the cross-town lines in the northern metropolitan region, and the (high frequency) service pattern envisaged on SRL, we recommend:

- The SRLB has a 19-hour service span all week (from 05:00 to 00:00)
- For all 7 days of the week, there are 4 services per hour 05:00 – 07:00
- For all 7 days of the week, there are 6 services per hour 07:00 – 19:00
- For all 7 days of the week, there are 4 services per hour 19:00 – 00:00

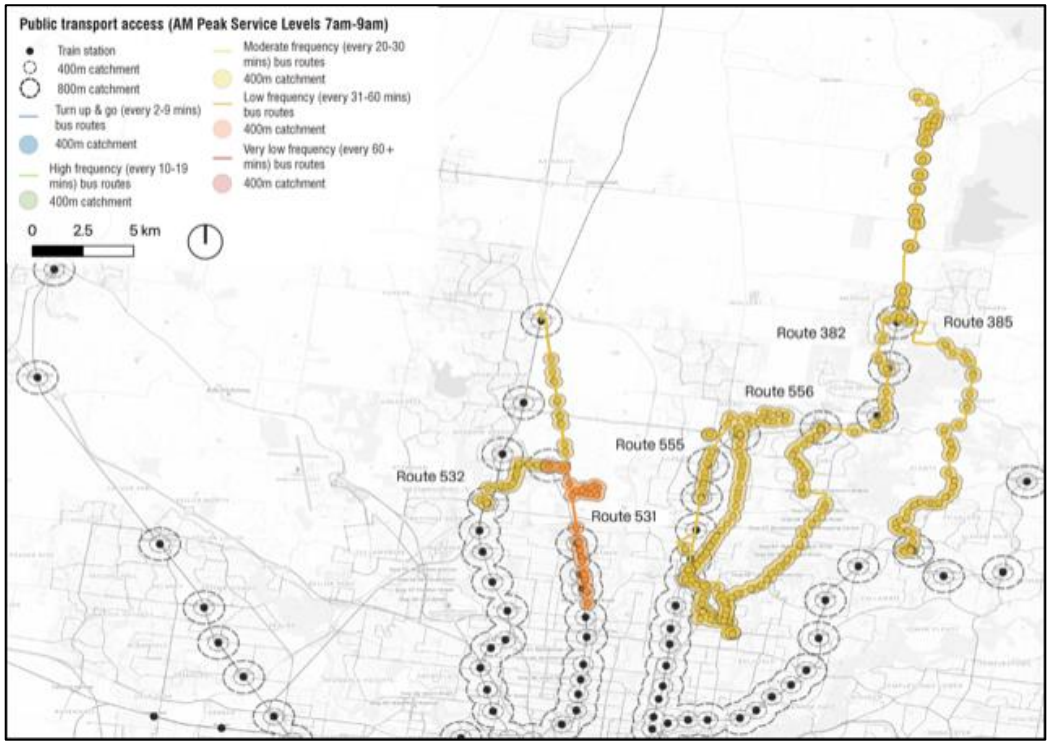
2.6 Maximising North-South connectivity

2.6.1 Current North-South connectivity

Whilst the key focus of SRLB is to improve east-west connectivity, it can play an important role in maximising north-south connectivity in the region as well.

Figure 25 below shows the key north-south connections that are currently available in the region; in addition, service frequencies on the north-south corridors are also highlighted. It can be seen that low to moderate frequency services are quite common in the north-south corridors.

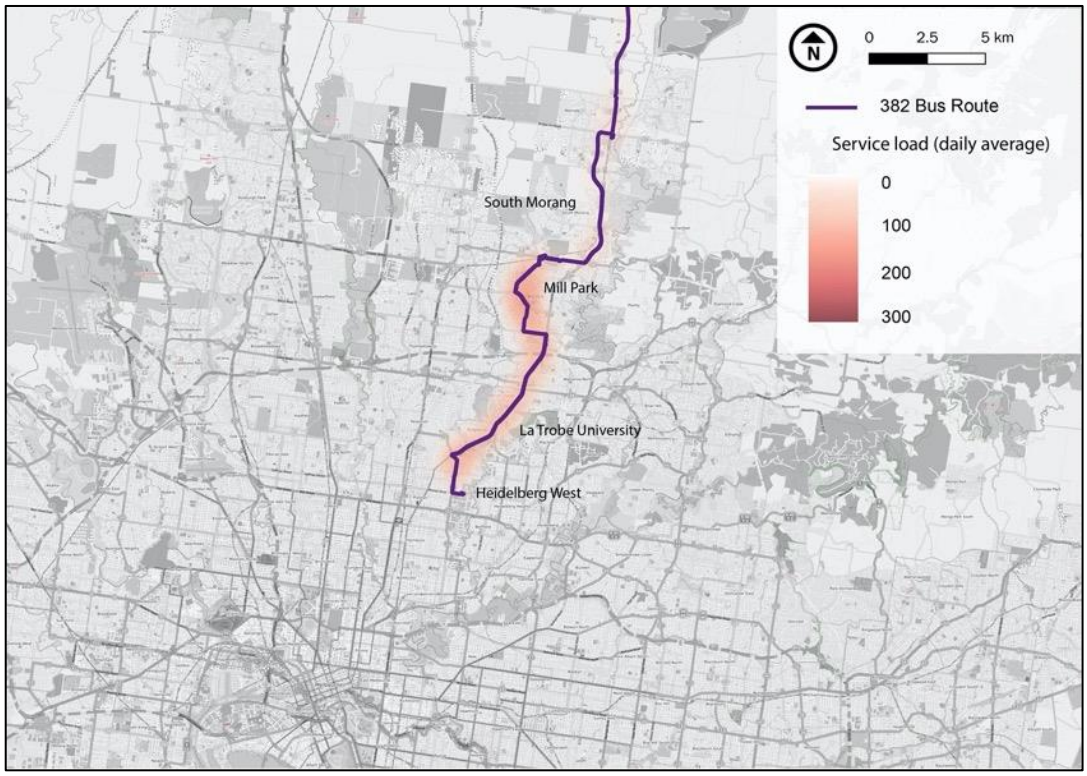
Figure 25: Current North-South connections and service frequencies



Source: PTV 2021 with M&PC analysis

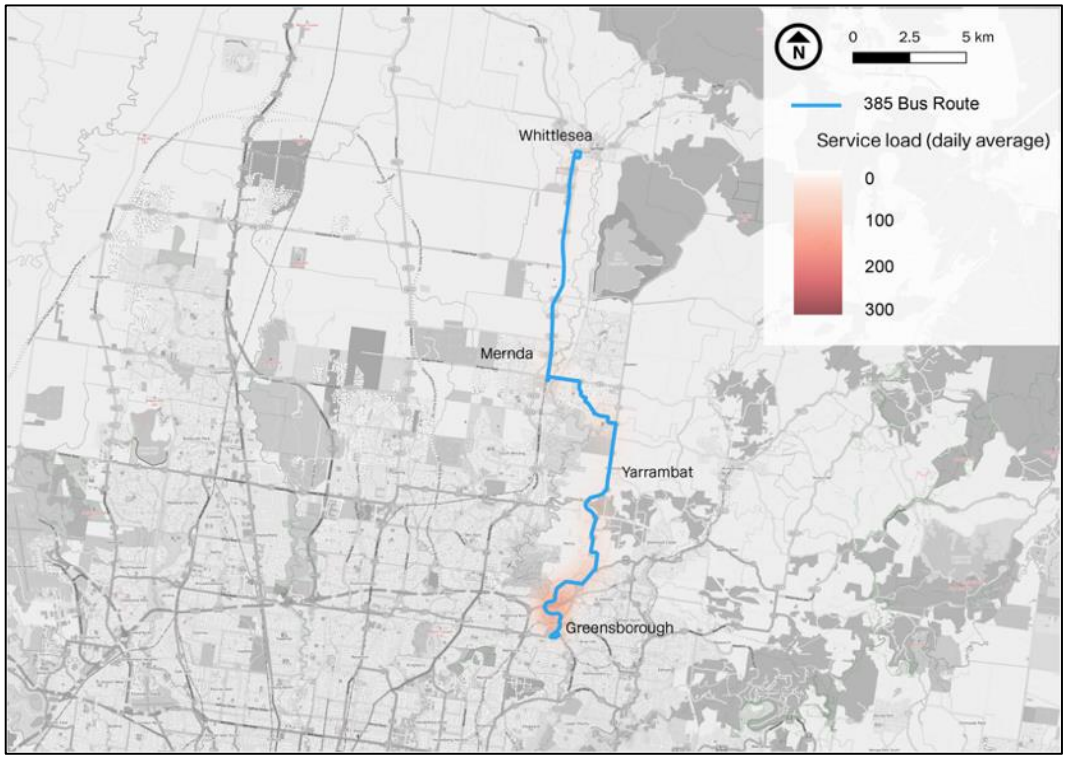
Analysis of existing north-south services shows that in general, patronage loads are light, reflecting the relatively poor service quality offered with regard to frequency. Figure 26 - Figure 31 below show the average loadings for the main north-south corridor routes (Routes 382, 385, 531, 532, 555 and 556).

Figure 26: Route 382 average loading per service 2018-9 (Weekday)



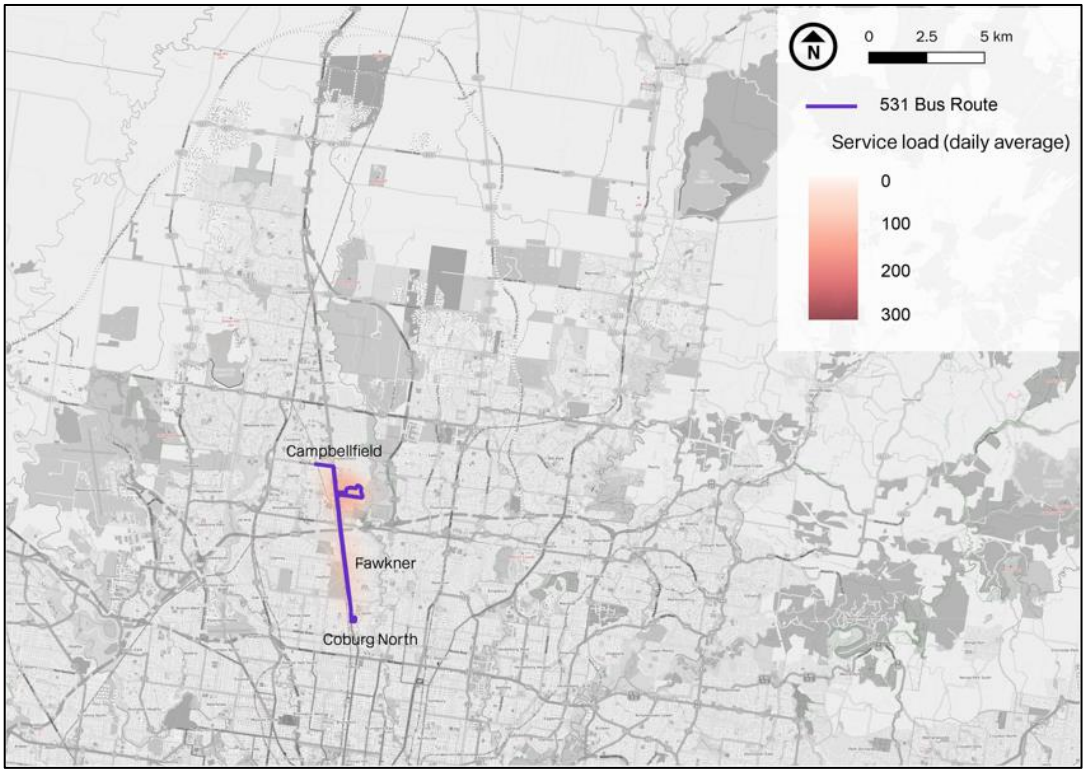
Source: DoT with M&PC analysis

Figure 27: Route 385 average loading per service 2018-9 (Weekday)



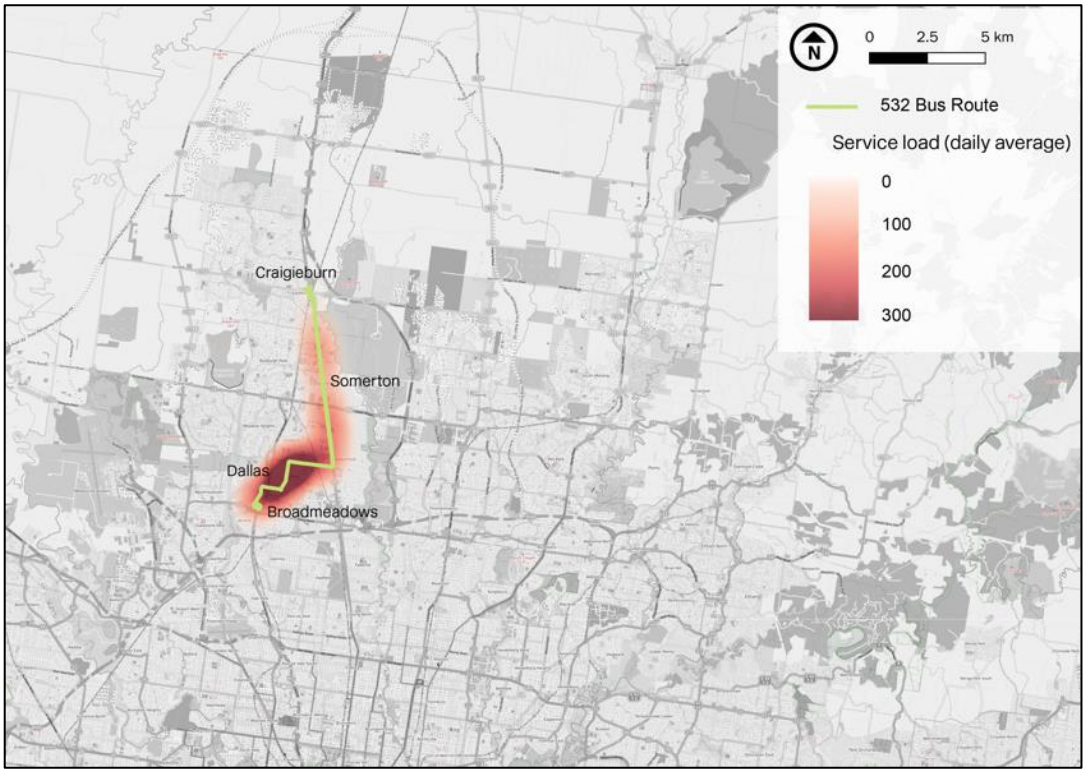
Source: DoT with M&PC analysis

Figure 28: Route 531 average loading per service 2018-9 (Weekday)



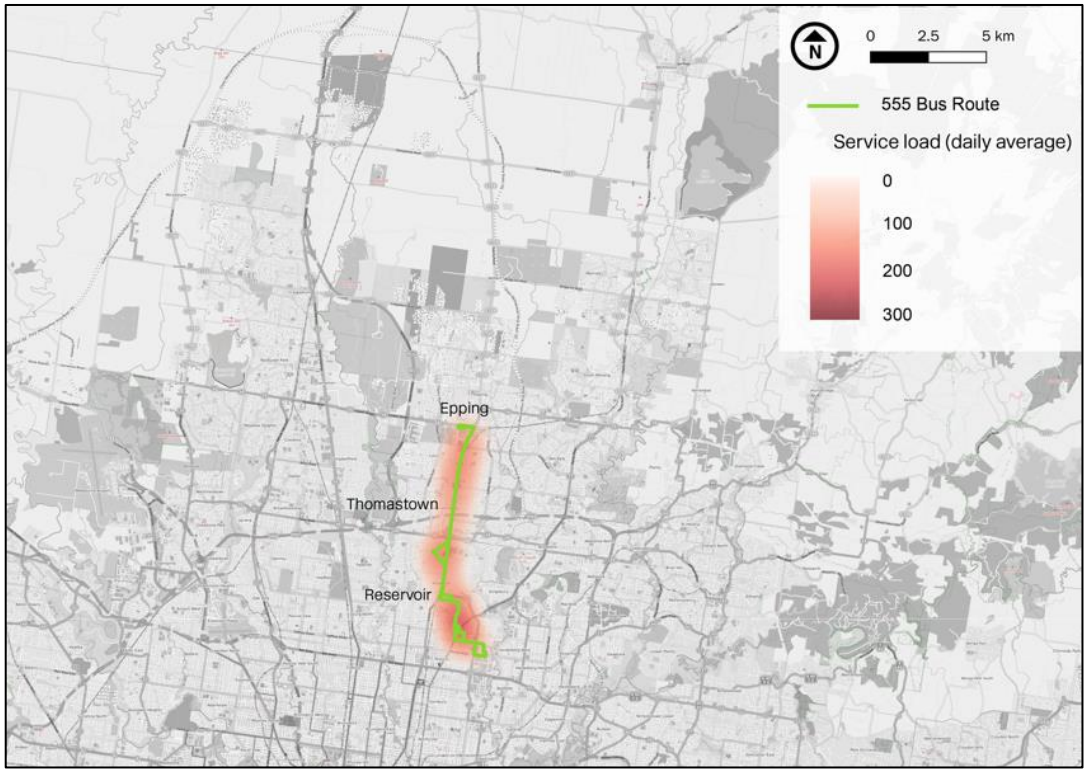
Source: DoT with M&PC analysis

Figure 29: Route 532 average loading per service 2018-9 (Weekday)



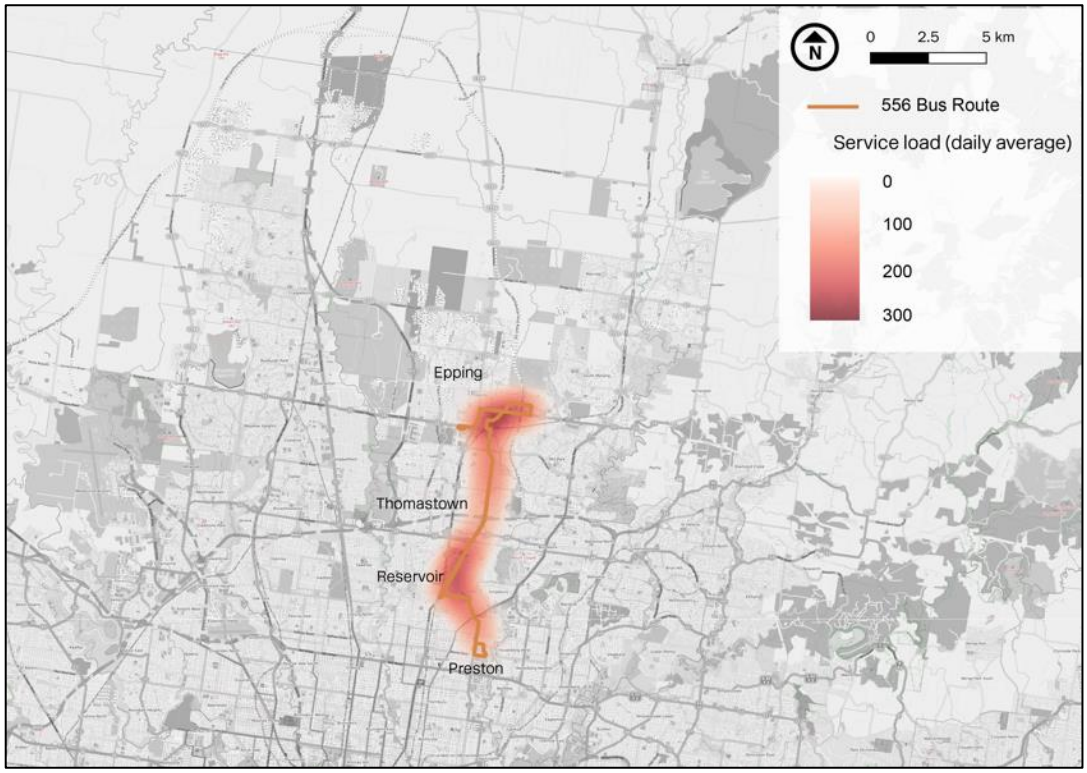
Source: DoT with M&PC analysis

Figure 30: Route 555 average loading per service 2018-9 (Weekday)



Source: DoT with M&PC analysis

Figure 31: Route 556 average loading per service 2018-9 (Weekday)



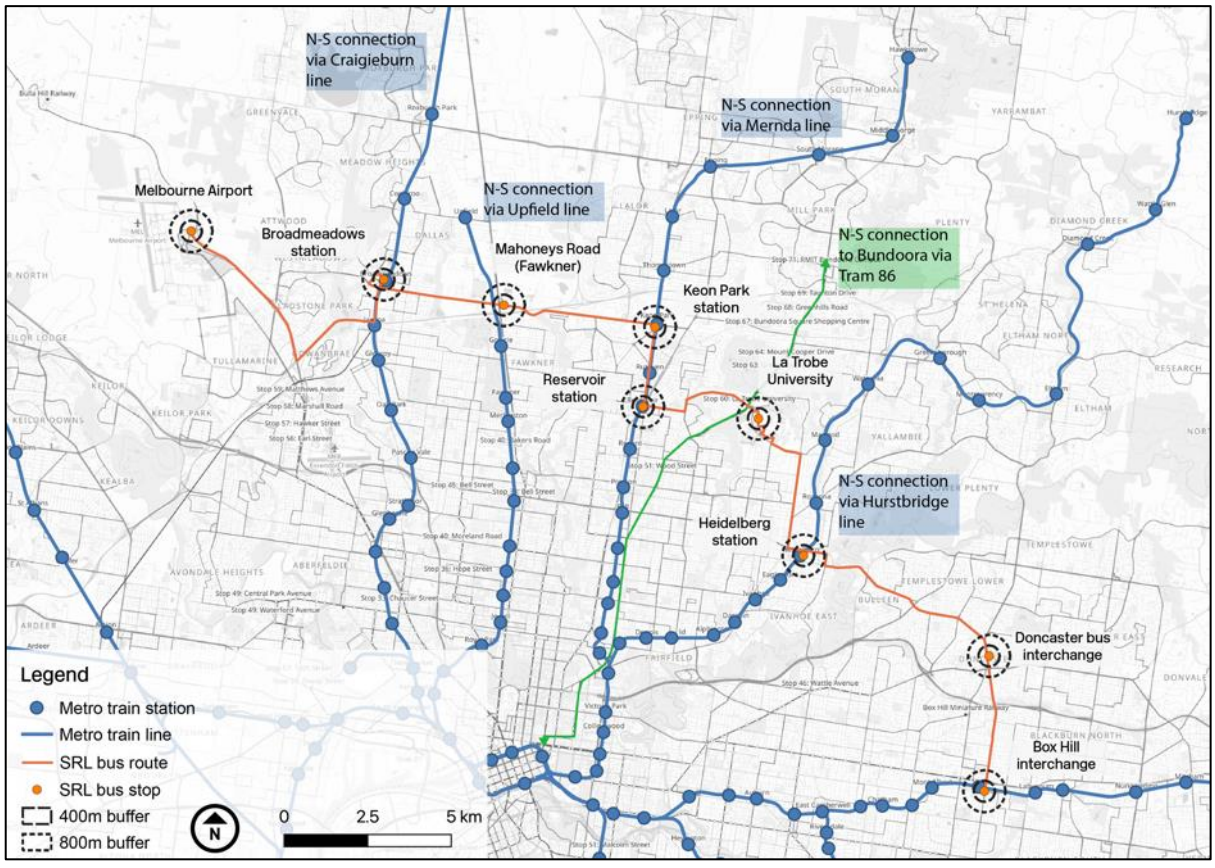
Source: DoT with M&PC analysis

In general, it can be seen that the few areas where higher patronage loads are seen (Route 556 and the southern end of Route 532) are correlated with higher service frequencies, where multiple services overlap and lead towards Major Activity Centres.

2.6.2 North-South connectivity and the proposed SRLB route

The proposed SRLB route improves public transport connectivity through the northern metropolitan region, by linking with north-south transport corridors at key transport hubs. As Figure 32 indicates, SRLB connects with most metro train lines within the northern metropolitan region, enabling transfers between lines that allow for multi-directional travel within the region. The only exception is the lack of a direct connection to the Upfield line due to the lack of a station at Campbellfield. This connection is made to bus Route 531 which connects to tram Route 19 at North Coburg and duplicates much of the Upfield corridor.

Figure 32: Key north-south connections with SRLB



Source: PTV 2021 with M&PC analysis

2.6.3 Improved north-south connectivity for the La Trobe NEIC

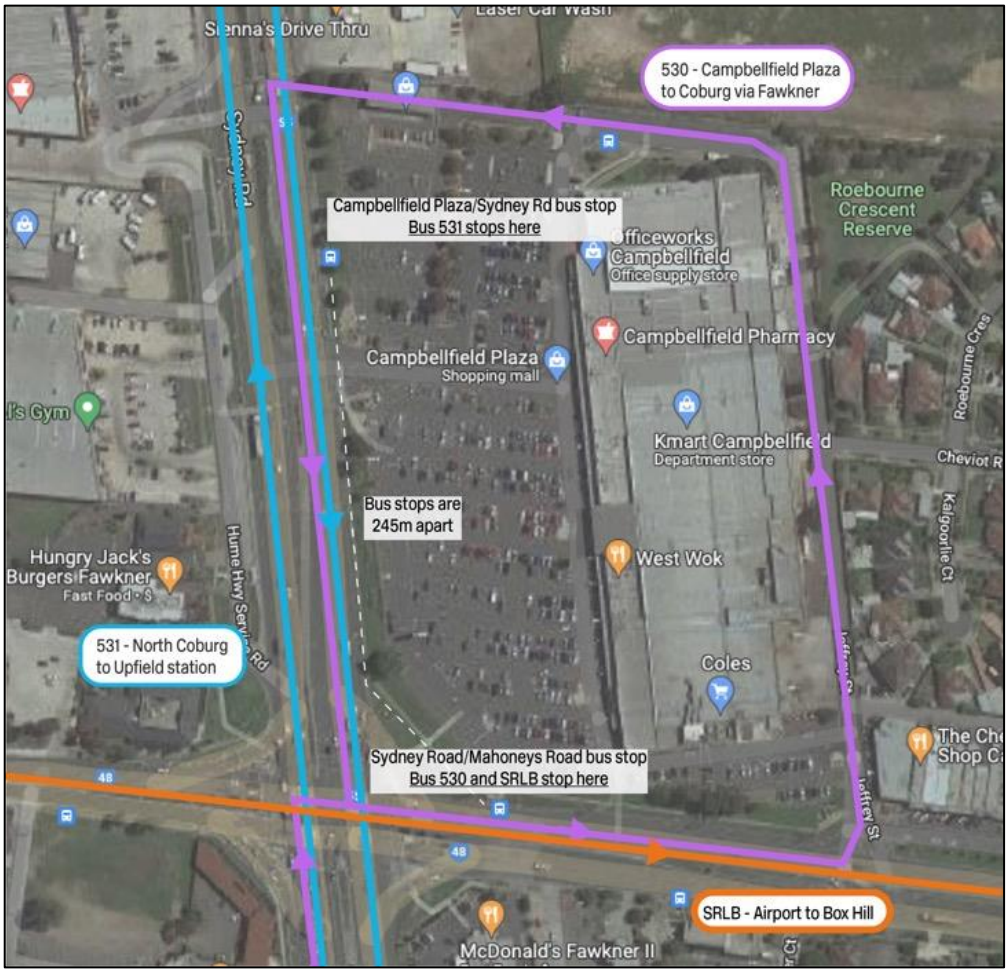
Within the La Trobe NEIC, there is a key transfer opportunity with Tram Route 86 that runs to Bundoora, connecting the RMIT Bundoora campus to the heart of the La Trobe NEIC. SRLB also interchanges with other key north-south lines, such as Route 382 and 550 which travel south to Northland Shopping Centre. This will improve connectivity to La Trobe

NEIC from areas southwest of La Trobe University, such as Heidelberg Heights, Heidelberg West and Preston.

2.6.4 Maximising north-south connectivity in Fawkner

The SRLB stop along Mahoneys Road in Fawkner/Campbellfield improves cross-town connectivity for Fawkner, which is currently poorly serviced by public transport. SRLB would interchange with Route 530 at the Sydney Road/Mahoneys Road bus stop, improving public transport connectivity for Fawkner residents living south of Mahoneys Road. Fawkner's main north-south bus connection, Route 531, runs along Sydney Road, stopping at the Campbellfield Plaza/Sydney Road bus stop which is 245m away from the SRLB Fakwner stop (Figure 33). The transfer between Route 531 and SRLB requires a 4-minute walk which is relatively convenient. Future reviews of bus services in Fawkner/Campbellfield may consider relocating the Campbellfield Plaza bus stop such that the transfer between Route 531 and SRLB is more convenient and has high-quality pedestrian linkages.

Figure 33: North-south transfer opportunities at SRLB Fawkner stop



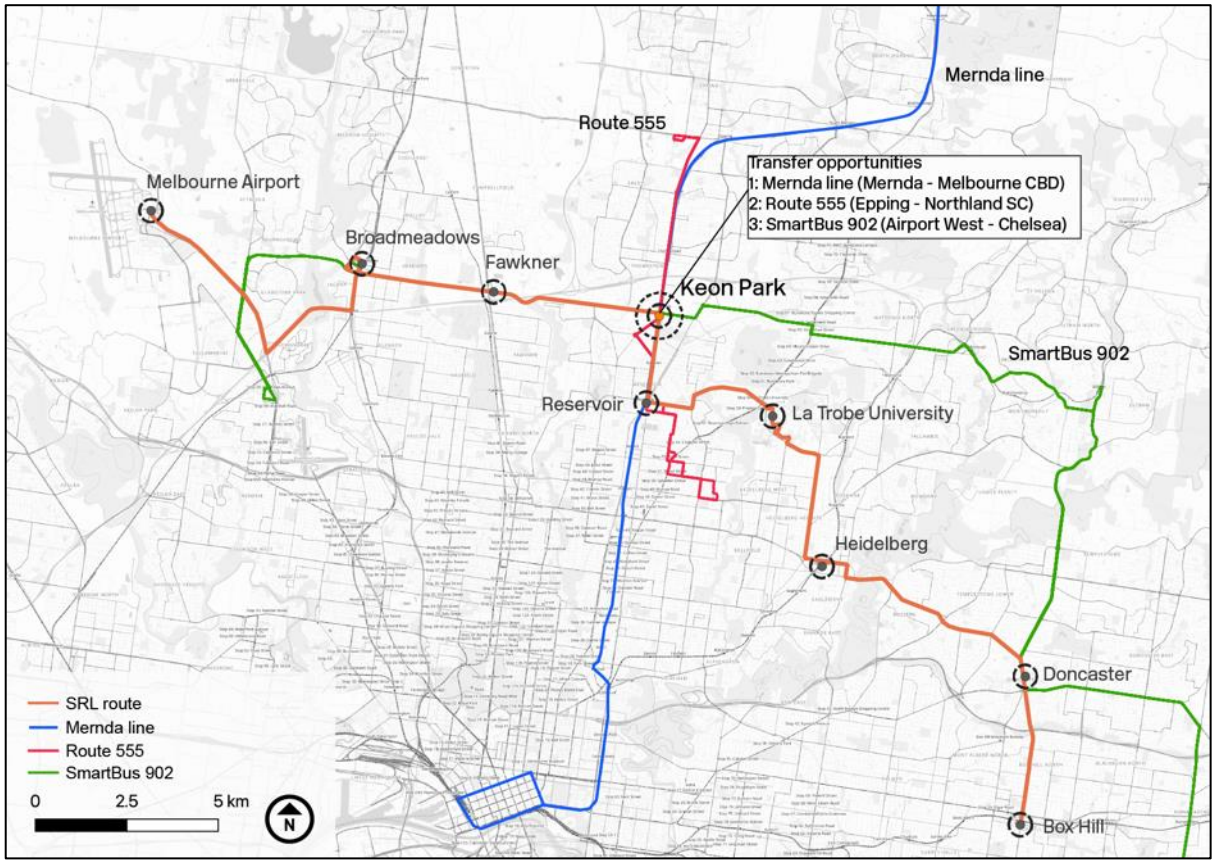
Source: Google maps with M&PC annotation

2.6.5 Improving north-south connectivity via a Keon Park SRLB stop

As discussed in section 2.2, a Keon Park SRLB stop would improve connectivity to the west for Keon Park and areas north of Keon Park, as commuters would be able to transfer directly from the Mernda line to the SRLB without having to travel further south towards Reservoir to transfer, resulting in significant travel time savings.

Commuters would also be able to transfer onto Route 555 which runs from Epping to Northland Shopping Centre via Thomastown and Lalor, and make a quicker transfer onto SmartBus 902 to access Greensborough and Eltham.

Figure 34: Transfer opportunities at Keon Park SRLB stop



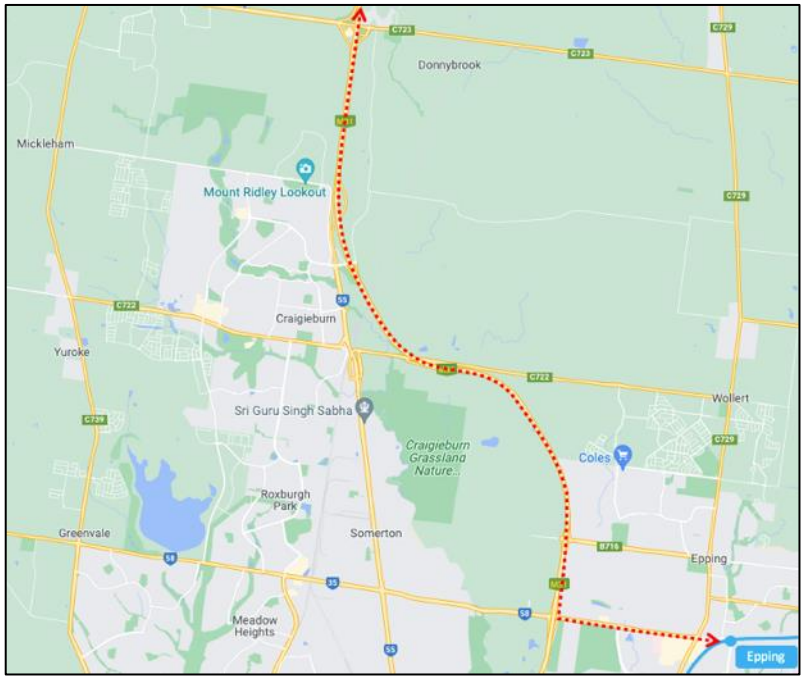
Source: DoT with M&PC analysis

2.6.6 Express north-south services to support SRLB connectivity

There is an opportunity to support connectivity to the SRLB for rapidly growing areas on the northern fringe, such as Beveridge in Mitchell Shire. For example, running an express service along the Hume Freeway directly to Epping would improve connectivity to employment and education (Figure 35). People living in northern growth areas would be able to transfer to the Mernda line to access employment destinations such as Thomastown, or education and employment opportunities in the La Trobe NEIC via SRLB.

This is further explored (in relation to Mitchell Shire) in section 6 of this report.

Figure 35: Potential express transit corridor along Hume Freeway



Source: Google maps with M&PC annotation

2.7 Potential diversion into City of Whittlesea

Diversions of the SRLB into City of Whittlesea (or other NCA's) are possible, and have the potential to increase patronage on the SRLB. Any such diversion needs to consider:

- **Dilution of the brand offering** – it is assumed that the SRLB will be marketed as an express service improving east – west connectivity across the region. Any diversions from this 'core' make the proposition more confused, not least if the proposition is stated as being a pre-cursor for SRL (that is, SRLB will be easiest to communicate if it follows the route of SRL)
- **Likely net patronage change** – in our experience, it is likely that a small diversion to a key destination node will produce a net positive result, while a longer diversion to an equal or lessor destination node will produce negative results

Pacific Epping Shopping centre was suggested in the project brief as a potential diversion from the core SRLB. It is estimated that from the closest SRLB stop (Keon Park), it is 5.9km one-way to Pacific Epping, or an 11.8km return trip given that a 'return' to the core SRLB route is required. It is noted that:

- For all customers travelling from Reservoir (or east) to Broadmeadows (or west), and vice versa, 11.8km of journey time is added to their trip. This would likely represent a minimum of 15-20mins of additional journey time for all these customers. Depending on how far they were travelling, this would represent journey times increases of up to 100%

    - Through application of a transport journey time elasticity of -0.3[4], this would imply that on some route segments, patronage would fall by up to 30% as a result of the diversion
- For a net increase in patronage to occur, patronage for the SRLB at Pacific Epping Shopping centre or other stops included along the route[5] would need to be larger than the patronage lost due to the diversion
    - It is noted that a good quality north-south connection to SRLB would already be possible for many potential users through connection at Keon Park, given that the Mernda line has stops at Lalor, Thomastown and Epping which would give quicker journeys than any bus-based alternative
    - In addition, the existing Route 555 and Route 556 provide high quality connections on either side of the rail corridor, on the roads the SRLB would need to use if it diverted to Epping

As such, we believe there is no case for considering diversions from the core SRLB route.

2.8 SRLB sections vs continuous route

For bus services, it is a known issue that reliability can suffer when routes are operated over longer distances. This is mainly due to:

- The length of time each bus trip takes can overlap part of a peak period or even multiple peak periods
- The number of timing points where each service is expected to align with other services such as train connections
- Difficulty in allowing sufficient 'recovery' time into the timetable (or more specifically the driver schedules) such that if a route is delayed, there is not a knock-on effect on the services that follow
- Delays along the route compounding such that reliability of the timetable is compromised, and buses can end up bunching (with either inefficient use of resources, or passengers penalised by being 'held' to regulate the service)

Whilst there is general agreement that routes should not be 'too long', defining at what point a route becomes 'too long' is somewhat harder. Academic studies on the topic have also tended to focus on urban bus routes (with relatively frequent stops) as opposed to a limited service stop of the type proposed for SRLB. In addition, many studies rely on theoretical application of models rather than before and after observations[6].

Whilst 'shorter' routes can be more efficient, they do have their shortcomings. For SRLB customers, this can mean transfers if the route section does not cover the full trip that they wish to make. In addition, each route section serves a smaller area and offers less

[4] Best estimate of the in-vehicle time elasticity is -0.3 in 'Review of Passenger Transport Demand Elasticities' (Transfund NZ Research Report 248)
[5] It would theoretically be possible to stop at Lalor and Thomastown Station as well. This would increase journey times on SRLB again, and for little benefit given that customers on the Mernda line would not alight at Lalor or Thomastown for the SRLB (an interchange at Keon Park would be more time efficient for them)
[6] https://www.research-collection.ethz.ch/handle/20.500.11850/73039

connectivity. Both these factors ultimately lead to the route generating less patronage. It is also noted in the discussion around Figure 41 (section 3.4.1) that at present there is little evidence of longer distance east-west trips taking place on SmartBus Route 901 (as the best current proxy for the SRLB). To some extent, this may of course be a function of demand being suppressed by a lack of density along the route (as shown in Figure 36) and from relatively long journey times (associated with frequent stops, and from "fat" in timetables (as discussed in section 3.4).

SmartBus routes are typically longer than the average bus route. Table 31 (section 3.4) shows that reliability varies across SmartBus routes, but this is a function of congestion along routes as well as the quality and number bus priority measures in place.

Even if a decision was made to split the route, choosing the exact location can be difficult as some passengers will have their journey split into two segments with a forced transfer. Typically, it is best to anchor bus routes at key destinations such as activity centres and train stations, providing an anchor destination at each end of the route. However, on more regional routes, there are passengers who travel through these destinations that would be disrupted if the route is cut in two. Therefore, splitting a route needs to be based on quality data about passenger loadings and benefits that would arise from the alternative.

This is a difficult trade-off of factors to consider. On balance, and in line with the same decision that has effectively been made for the orbital SmartBus Routes 901, 902 & 903 we recommend that a continuous route is operated. This is most in line with the core brand proposition for SRLB and most likely to encourage east-west trips to take place on SRLB.

2.9 SRLB bus stop locations

Section 2.2 above describes the stops that we believe the SRLB should make along its route. With the exception of Fawkner (where we have recommended a stop near Campbellfield Plaza – discussed in more detail below), the stops are all located at either a railway station or a bus interchange. As such, all stops bar one already have walkable access and crossing points as part of existing infrastructure. It is assumed that space can be made at all existing interchanges to accommodate one additional bus route, except in Heidelberg where we recommend the SRLB stops in Studley Road on the western side of Heidelberg Station. It is also noted that DoT have access to technology that can provide dynamic bus bay allocation and have implemented head of rank departures in some locations where space is tight. These can all be considered at each SRLB stop location.

Finally, there are several locations where DoT determines which routes have priority to access the interchange if capacity is an issue. This already happens in Heidelberg with Route 513G and 513LP not having access to the Station interchange (and instead have a bus stop on a nearby road). If there was absolutely no capacity left at a particular location DoT would be in a position to determine which routes are most important to include within the interchange and which routes should be relegated to alternative locations nearby.

For Fawkner (Campbellfield Plaza), as described in section 2.6, the exact location of the stop will depend on whether future reviews of bus services in Fawkner/Campbellfield

recommend relocating the Campbellfield Plaza bus stop to improve transfers between Route 531 and SRLB. As such, we have not considered an exact location for the stop.

2.10 Summary of costs

Based on the service frequency assumptions laid out in section 2.5, and the route alignment and kilometres detailed in section 2.2, our operational cost estimates are shown in Table 27 below.

Table 27: Summary of annual SRLB cost estimates – operating costs

Cost line	Estimated annual cost	Key assumptions / notes
Cost of fleet	$1.5m - $2.5m p/a	Based on the estimated timetable, we have assumed a Peak Vehicle Requirement of 23 buses. We have assumed buses are leased, with the annual lease cost being an amortised figure over 10 years plus interest
KM costs	$3m - $5m p/a	Includes a conservative assumption of 15% dead running. KM costs include (but are not limited to) fuel costs, maintenance and depot operational costs
Bus hourly costs	$3.5m - $5.5m p/a	Principally driven by driver costs per hour (i.e., wages)
Total operating costs	$8.0m - $12.0m p/a	

For capital expenditure costs, our assumptions are shown in Table 28 below.

Table 28: Summary of SRLB cost estimates – capital expenditure

Cost line	Estimated cost	Key assumptions / notes
Depot	$0m	Whilst a depot will be required to operate the SRLB, detailed operational planning is required to establish whether this could be done from an existing depot, or whether a new build would be required. At this stage, we have assumed that an existing depot could be utilised and, as such, no capital costs are assumed
Wayside infrastructure	$0.5m	As the SRLB will predominantly use existing bus infrastructure (such as SmartBus bus stops), there will be little capital cost associated with SRLB infrastructure. Some new signage would be required at each stop, and completely new stops may be required in the Campbellfield and Bundoora areas. The total cost associated with wayside works is expected to cost under $0.5m
Bus priority costs	$0m	Whilst section 2.5 provides options for bus priority which are estimate at a total cost of $0.2m, these have not been assumed to be in place for the purposes of our journey time estimates and for consistency, are not assumed as a cost item here
Total capital expenditure	$0.5m	

For potential cost savings, our assumptions are shown in Table 29 below.

Table 29: Summary of potential cost savings associated with SRLB

Cost line	Estimated annual cost	Key assumptions / notes
Route 301	$1.5m - $2m p/a	Section 2.3 details how removal of Route 301 might be possible should SRLB be introduced at a high frequency. We estimate that the annual opex costs associated with Route 301 are of the order of $1.5m - $2m per annum. Note that demand between Reservoir and La Trobe University would require the resources on Route 301 to remain in this corridor
Route 903	$0.5m - $1.0m p/a	Route 903 currently has 'additional short' services in peak periods between Box Hill and Heidelberg. These could be converted to express running between Box Hill and Heidelberg. This will mitigate the resources required to operate SRLB, save peak buses and travel time on Route 903
Route 551	$0.5m - $1.0m p/a	Section 2.3 details how removal of Route 551 might be possible should SRLB be introduced. We estimate the annual opex costs associated with Route 551 are of the order of $0.5m - $1m per annum
Total potential savings	$2.5m - $4.0m p/a	Note that this includes Route 301 – although future service levels might need to be increased (above the SRLB service level) in future if regional passenger numbers are high

On the assumption of no cost savings (i.e., with Table 29 excluded), we estimate that the cost of operating the SRLB would be of the order of $3.25 - $3.45 per kilometre.

Assuming cost savings of $2.5m - $4.0m p/a (in line with Table 29), we estimate the incremental cost per KM of operating the SRLB would reduce to $2.05 – $2.55.

2.11 SRLB patronage estimation

Using a trip generation and distribution model calibrated to VISTA data and using Victoria-in-Future 2019 demographic projections for population and employment, we estimate that the existing person-travel market between each of the destinations along the route is relatively small, at about 23,000 trips per day (increasing to about 30,000 by 2036). Less than 1,000 (4%) of these currently use public transport (increasing to 1,200 by 2036, if public transport mode shares stay the same as today).

Using existing roads, SRLB would be about 43km long and the total travel time would be about 108 minutes (including stops) from Box Hill to Melbourne Airport. The travel time is estimated assuming that there are zero additional bus priority measures put in place. If additional bus priority measures are deployed, they could enable some reductions in the estimated bus travel times along the route.

Allowing for express operations, at moderate frequency, reliability using existing bus lanes and priority signals and a high-quality of passenger comfort, safety, information and branding, we have estimated the patronage that could be attracted to the SRLB. Compared

to the existing public transport in the corridor, we expect the SRLB service would attract at least 2,200 trips a day at present demand levels, increasing to 2,700 in 2036, giving a mode share in the corridor of about 9%.

Although this is a large increase in public transport mode share in the corridor, the resulting patronage is relatively small in terms of boardings per route-km. Significantly, the number of private vehicles in the corridor would reduce commensurate with the increase in SRLB passengers. Across the entire route the reduction in private vehicle traffic is equivalent to removing a whole lane of traffic for 30 minutes each day.

Stopping the SRLB at more locations is likely to increase patronage across the route (with more short trips), but would be accompanied with significant dilution of the brand offering (as discussed in previous components of this section). We consider that mimicking the SRL alignment and operations is a key part of the service offering that needs to be achieved to establish the brand proposition for customers.

When Airport Rail opens in 2029, and SRL East opens in 2036, it is likely that SRLB would then provide a significant 'missing link' (to be filled later by SLR North) and could attract additional trips from that wider travel market. This could conceivably add another 50% to its patronage (although Airport trips from much of the eastern suburbs would still be quicker via Airport Rail through the city), thus improving patronage further.

2.12 Summary of benefits

Based on the patronage calculation assumptions laid out in section 2.11, our estimate of some of the benefits associated with SRLB are shown in Table 30 below.

Table 30: Summary of potential benefits associated with SRLB

Benefit line	Change in 2021 (i.e., if introduced now)	Change projected for 2036
SRLB daily trips	2,200 daily trips	2,700 daily trips
Person-trips transferring from car to bus	From the 2,200 daily trips made on SRLB, 1,200 would be person-trips by car, that transfer to PT	From the 2,700 daily trips made on SRLB, 1,500 would be person-trips by car, that transfer to PT
Vehicle-km of travel saved[7]	12,200km per day	14,700km per day
Congestion benefits[8]	$2,900,000 per annum	$3,500,000 per annum
Environmental benefits[9]	$400,000 per annum	$500,000 per annum

[7] Assumes that abstracted trips travelled the same KMs as the equivalent SRLB section
[8] Based on arithmetic average of Table 1.6.7 of ATC National Guidelines Volume 4 www.atap.gov.au/sites/default/files/National_Guidelines_Volume_4.pdf uprated to Dec 2021 values
[9] Based on Section 3.3, Table 2 of www.atap.gov.au/sites/default/files/documents/pv5-environmental-parameter-values-public-consultation-draft.pdf uprated to Dec 2021 values

All of the benefits above are driven by the patronage assumed to be carried on the SRLB. Noting that detailed four-step modelling of patronage is beyond the scope of this project (and would be carried out independently by DoT regardless of any figures presented in this report), the following should be noted in relation to deriving high-level estimates of patronage on SRLB:

- A relatively small number of east-west trips are currently made by public transport. Traditional approaches to estimating the uplift in patronage along a transport corridor rely on elasticity assumptions being applied to reductions in journey time (in this case, as a result of faster east-west journeys along SRLB). This approach is limited when a step change improvement in connectivity is proposed (that is, an elasticity approach is likely to undercount the step change increase in patronage)
- Increases in the intensity of land use along the corridor will help to generate patronage for SRLB and SRL and should be a focus for each NCA municipality to align growth in residential and commercial activity to the Principal Public Transport Network (PPTN) currently including in each Council's Planning Scheme, and specifically the areas of the PPTN have existing SmartBus routes and future SRLB services
- The creation of express services in the SRLB corridor has the potential to generate completely new trips that would not otherwise be contemplated. This is particularly the case for first in family access to university education because the current lack of transport choices and long public transport travel times could be discouraging some potential students from considering or accepting university places

3 SmartBus 901, 902, 903 review

3.1 Overview

SmartBus 901, 902 and 903 are three key orbital routes which connect municipalities in the north to areas in Melbourne's east, southeast and west. SmartBus 901 runs from Frankston to Melbourne Airport, and serves the outermost and middle rings of the northern metropolitan region. SmartBus 902 runs from Chelsea to Airport West, serving the middle ring of the northern metropolitan region. SmartBus 903 runs from Mordialloc to Altona, serving the inner ring of the northern metropolitan region.

SmartBuses are a premium-branded service, with higher service levels and consistent branding.

This chapter includes a patronage analysis, service level review and discussion of potential route alignment and intersection improvement options. The PTPI (discussed in section 2.4) informs the identification of potential SmartBus improvement options.

Key findings

- Current service frequencies are adequate in the north, based on existing patronage
- Swapping the western termini of SmartBus 901 Melbourne Airport) and 902 (Airport West shopping centre) would improve employee access to Melbourne Airport
- Reducing duplication between SmartBuses 901 and 902 and local routes in Greensborough and Eltham (particularly with Route 513) could result in significant cost savings
- Realigning SmartBus 901 via Somerton road and Mickleham road would improve connectivity for Greenvale, an underserved, rapidly growing suburb
- Bus priority improvements (priority lanes and signalling) should be investigated at key intersections such as the Fitzsimons Lane and Main Road roundabout, and Bell Street and Pentridge Boulevard

3.2 Define the needs to be met

In assessing which areas could be added to the SmartBus network, it is first necessary to define what we consider the key factors in a successful rapid bus network are - noting that this may not necessarily reflect the customer experience of some aspects of the current SmartBus network. For example, consistent branding is a key aim of the SmartBus network, but not all operators have successfully delivered on this promise (Transdev having deployed non-SmartBus liveried fleet on non-SmartBus routes).

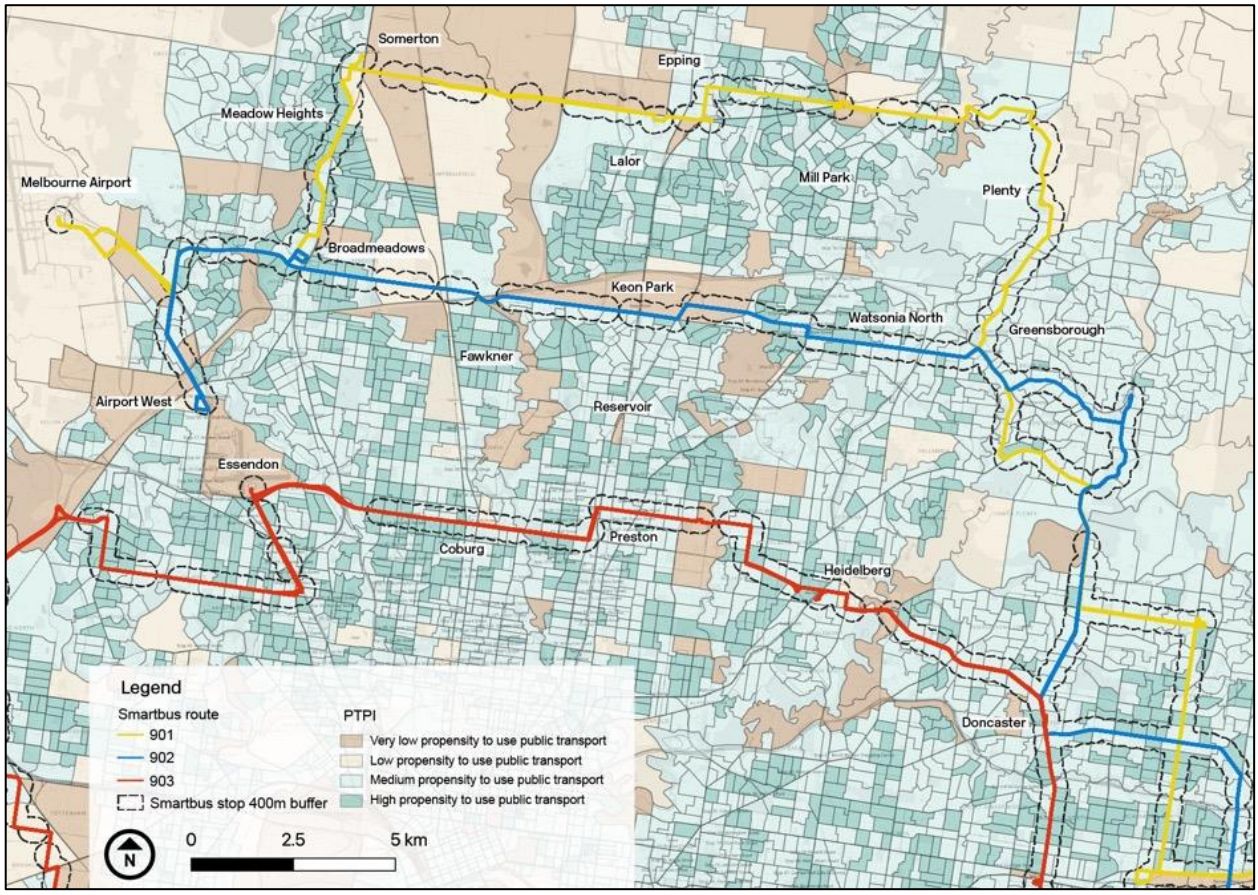
As discussed in section 1.4, the overarching network and service principles agreed for the NRTS Stage 2 study were that routes should be simple, direct, frequent, reliable, safe and nearby. In addition, fleet and bus stops should offer a high-quality experience.

3.3 Define the areas that warrant SmartBus services

The PTPI (as discussed and defined in section 2.4) provides an analytical framework within which demand for public transport can be assessed. Through modelling the PTPI along and around the SmartBus corridors, it is possible to see which areas warrant SmartBus services and whether modifications to the route are desirable.

Figure 36 provides an overview of the PTPI scores along and around the SmartBus 901, 902 and 903 corridors. The average PTPI score across all three routes sees each sit in the 'Medium propensity to use public transport category' (as defined in Table 24).

Figure 36: Public transport propensity along SmartBus Routes 901, 902 & 903

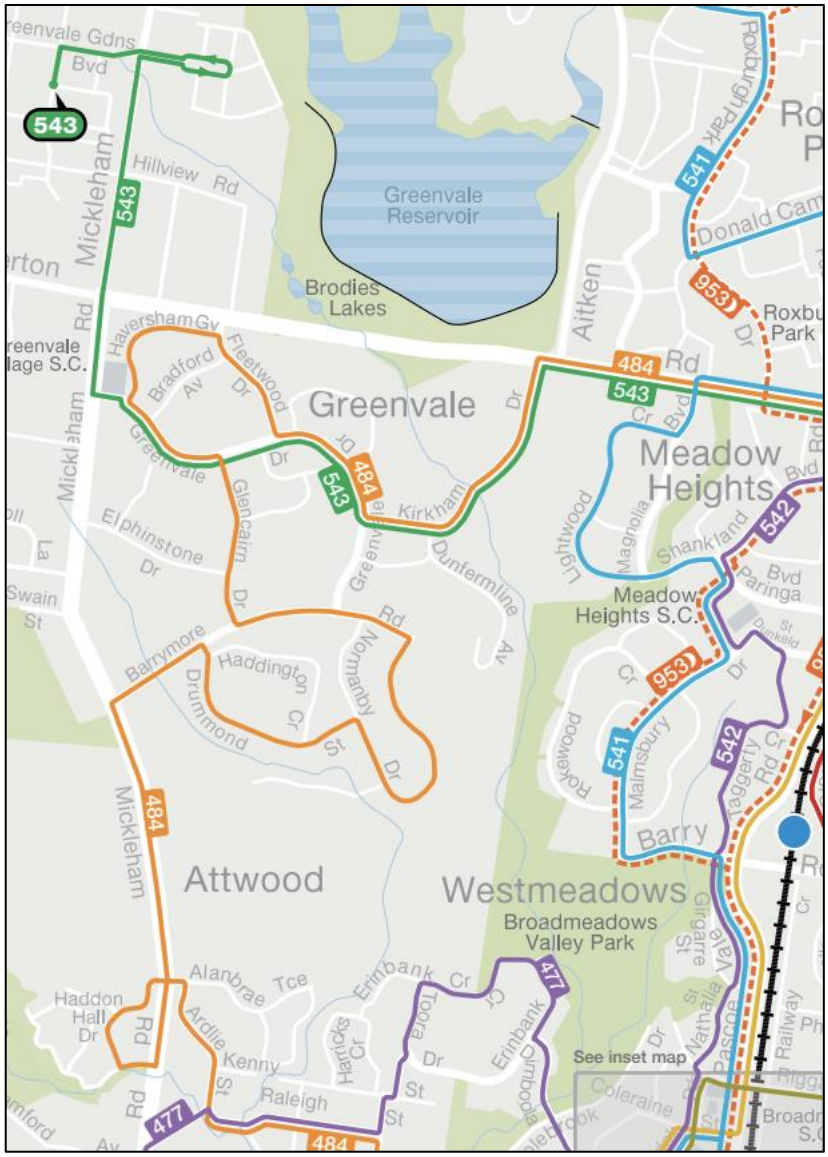


Source: ABS, 2016; PTV, 2020 with M&PC analysis

3.3.1 Specific PTPI observations for SmartBus 901

Greenvale, Attwood and Westmeadows in the City of Hume have a medium to high propensity to use public transport and are currently only served by local bus routes (Routes 477, 484, 543) (Figure 37). There is an opportunity for SmartBus 901 to service the area without significantly impacting overall travel times along the route (or resources required).

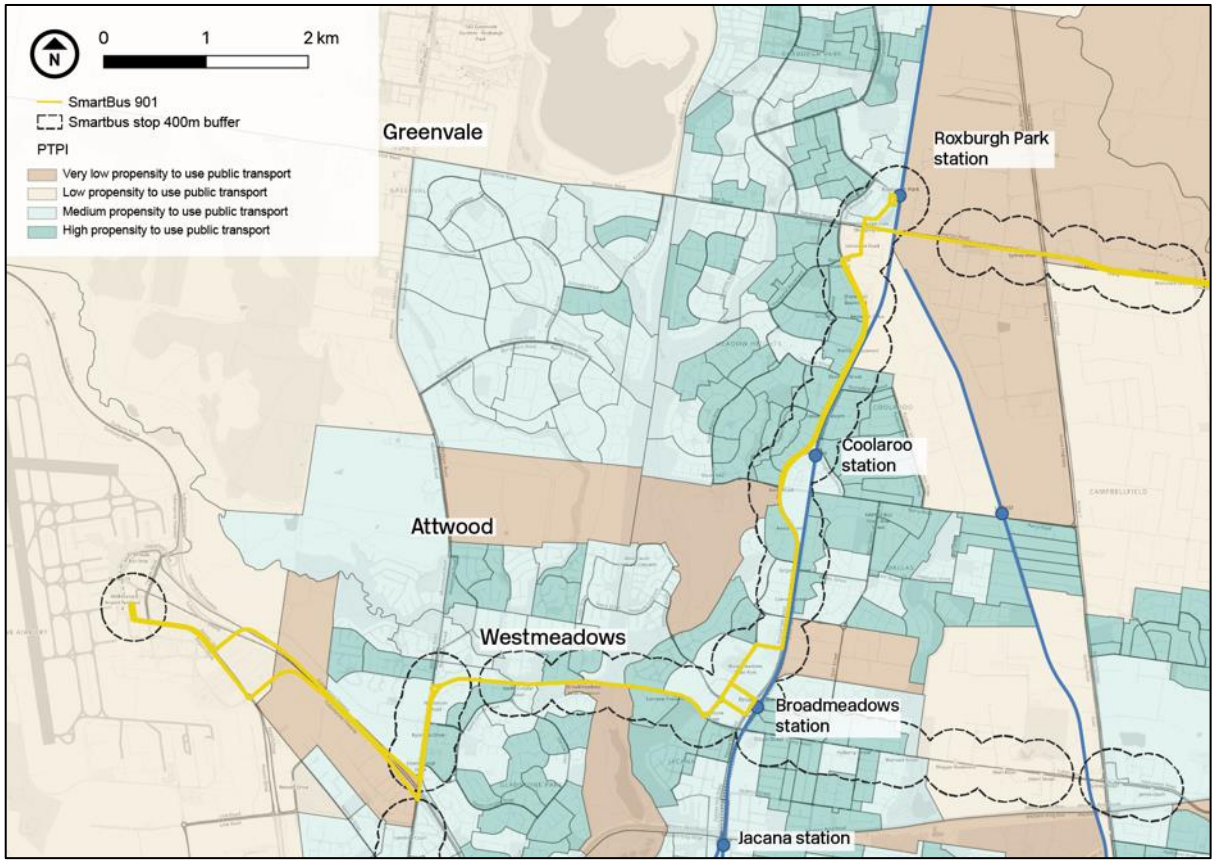
Figure 37: Bus network in Greenvale, Attwood and Westmeadows



Source: PTV

Such a route realignment would however, remove the direct access to Broadmeadows for people along that route, reduce service in the Pascoe Vale Road corridor and remove direct access to Melbourne Airport for people in the Pascoe Vale Road corridor (they would have to transfer twice, rather than their current direct service).

Figure 38: Public transport propensity near SmartBus Route 901 in Greenvale



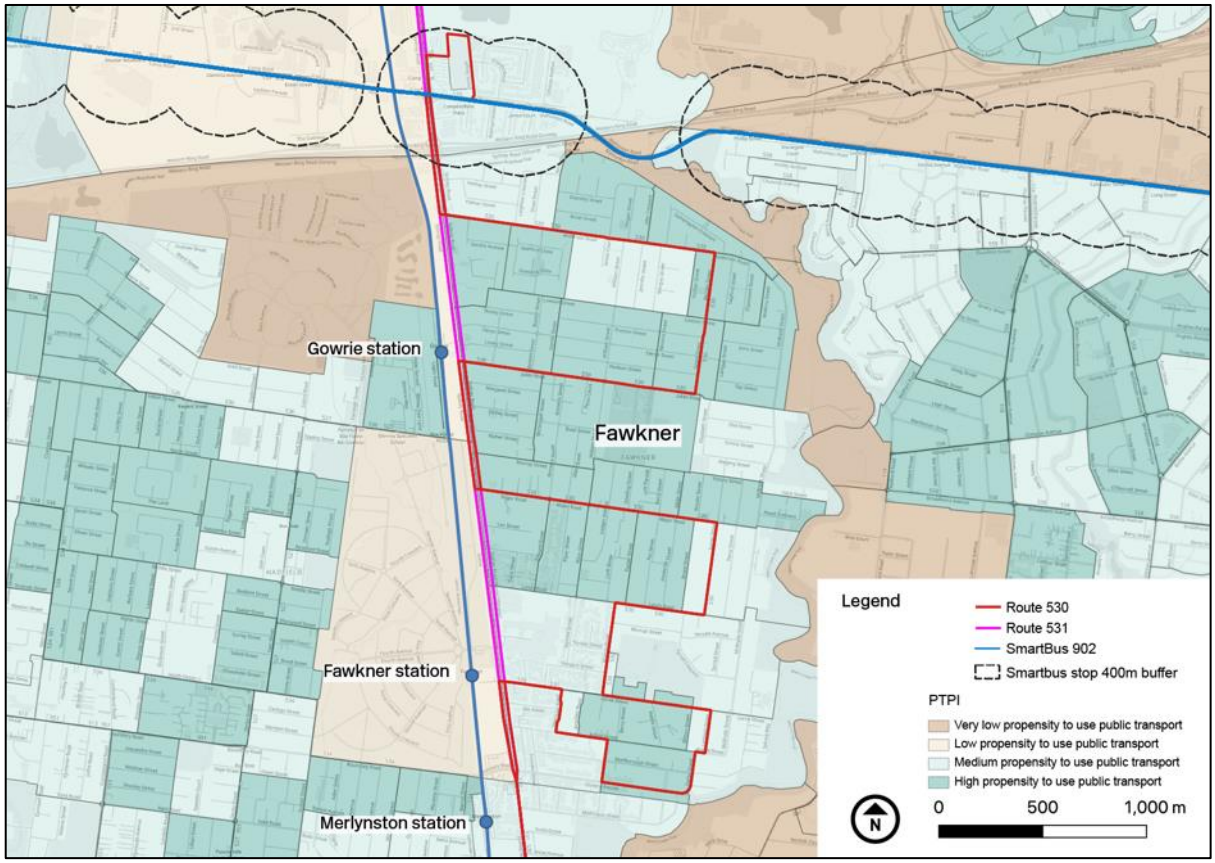
Source: ABS, 2016; PTV, 2020 with M&PC analysis

3.3.2 Specific PTPI observations for SmartBus Route 902

The Fawkner area has a high propensity to use public transport and is currently serviced by Routes 530 & 531 (one of which is direct and the other is fairly indirect).

Deviating SmartBus 902 to better service the Fawkner area is not feasible due to the physical barrier presented by the Merri creek (a similar issue faced by the SRLB). There are however many residential areas on the southern side of Mahoneys Road that have low density and low propensity to use public transport. There is significant opportunity to better align the Darebin Planning Scheme provisions (zones in particular) with the SmartBus corridor along Mahoneys Road. A similar opportunity exists (to a lesser extent) in the Hume Planning Scheme along the corridor. This is illustrated in Figure 39 below which highlights how the planning controls have led to a higher intensity in areas further away from the SmartBus corridor. This is discussed further in section 3.3.4.

Figure 39: Public transport propensity near SmartBus Route 902 in Fawkner



Source: ABS, 2016; PTV, 2020 with M&PC analysis

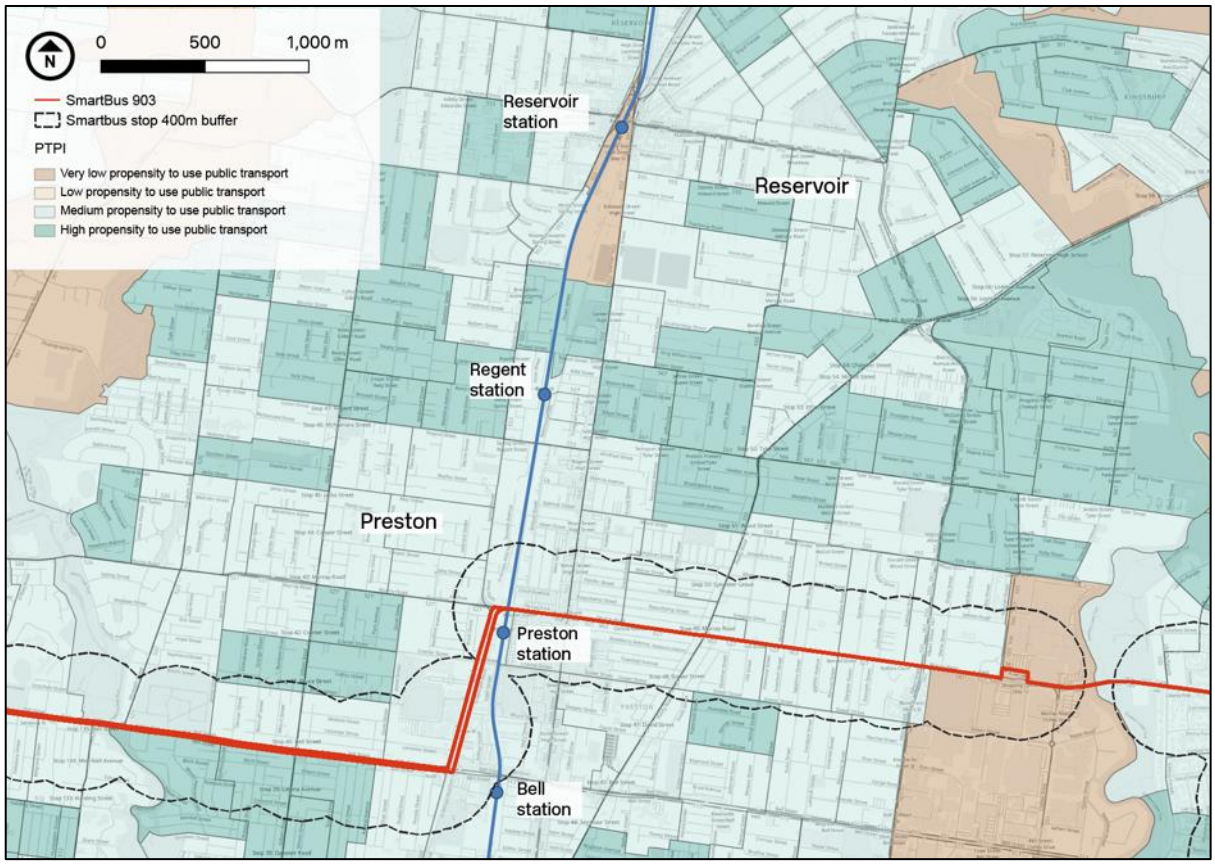
There are also opportunities to strengthen the connection and coordination between Routes 530 & 531 and SmartBus Route 902. This would make it easier for passengers to transfer between the services. The public transport network would also be improved with the introduction of a new station on the Upfield line (as discussed in section 2.2.2).

3.3.3 Specific PTPI observations for SmartBus 903 in Preston

The Reservoir community has a relatively high propensity to use public transport and is served by many bus routes, the Mernda train line and tram Route 86 which connects RMIT Bundoora to Docklands via La Trobe University and Northcote.

As Reservoir is relatively well-serviced by a wide range of public transport services, there is less of an impetus to deviate SmartBus 903 to service the area. The PTPI map highlights that there is an opportunity to better align the Darebin Planning Scheme with the high frequency SmartBus corridor (discussed further in section 3.3.4). As shown in Figure 40 below, there are many areas of lower PTPI due to a lack of density along Bell Street and Murray Road.

Figure 40: Public transport propensity areas near SmartBus Route 903



Source: ABS, 2016; PTV, 2020 with M&PC analysis

3.3.4 Use of planning zones to drive patronage

High density built form generates more trips, and corridors of higher density tend to generate public transport trips. The SmartBus corridors have been recognised as the premium bus corridors in Melbourne for around a decade. The various Planning Schemes that apply across the NCA area include a reduction in car parking requirements along these corridors, but do not include any other significant guidance on seeking increased density along the SmartBus corridors.

For example, along Murray Road (Preston) the General Residential Zone is applied to most land on both sides of the road, while along the east side of Plenty Road in the same area the Residential Growth Zone is applied. Likewise, along Mahoneys Road (Reservoir West) the General Residential Zone is applied, which limits Council's ability to increase population density along the high frequency bus corridor provided by SmartBus Route 902.

All NCA Planning Authorities should seek to better align the land use zones along SmartBus corridors with regard to increasing the development intensity in proximity to these high quality public transport services. Over the longer term this will encourage and prioritise growth in the specific locations that are guaranteed to have high quality public transport services into the future.

Specific consideration should be given to large land holdings located along SmartBus corridors and smaller parcels fronting SmartBus corridors if they have rear laneway access. These locations could provide for a significant amount of population and employment growth in locations that are highly accessible by public transport and provide rapid high-quality links to other nodes.

3.4 Existing service and patronage review

3.4.1 Patronage review

The patronage review is based on two sets of data provided by DoT:

- Boarding data for 2018-19 - used to produce the temporal profiles of bus usage which are shown in this section
- Service load data for 2018-19 – used to produce the spatial heatmaps shown in this section

The service load data was produced by the BusSUM model, which combines myki-based patronage estimates with Bus Tracking System data. This method is not designed to produce accurate estimates of loads on individual services, so averages have been used for comparison rather than as an indication of actual total patronage. The data is an aggregation of departure loads at each stop across the day, therefore express sections with no stops show as having zero load.

SmartBus Route 901 patronage review

In 2018-19, SmartBus Route 901 had a total annual patronage of around 3.34m (across the whole route), slightly lower than each of the two other SmartBus Routes 902 and 903.

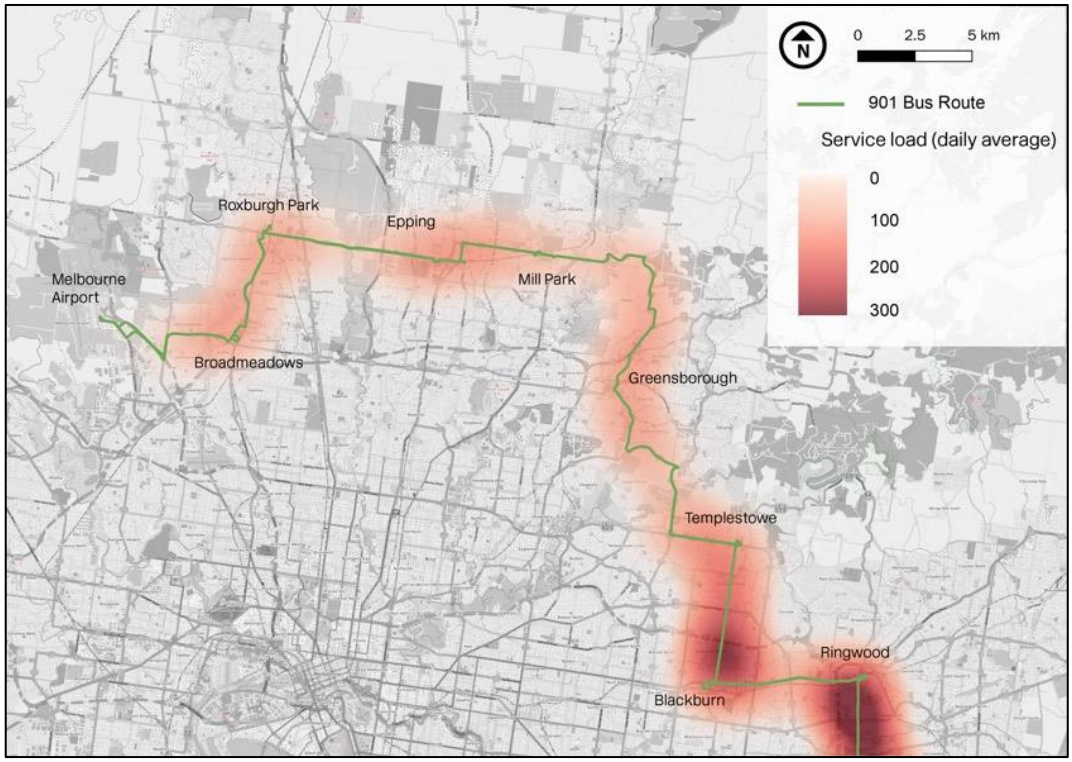
Across the traffic week on the northern section of the route, SmartBus Route 901 is busiest in the Ringwood and Blackburn areas (outside of the NCA area). Noting the PTPI for the route (Figure 36), the relatively lower patronage across the rest of Figure 41 would simply appear to reflect land use intensity; that is, the number of dwellings and destinations located along the corridor. To achieve higher patronage, the intensity of land use would need to be increased across the northern section of the Route 901 alignment.

Figure 41, Figure 42 and Figure 43 summarise the average loadings per service in 2018-19. The figures show an aggregation of the number of people on a bus at any given location in both directions.

There are relatively lighter loadings on the route between some points (such as Epping and Roxburgh Park). The implication is that the route is busy with passengers who are travelling locally in those areas (most probably heading to or from Roxburgh Park / Epping Stations) rather than travelling longer east-west distances.

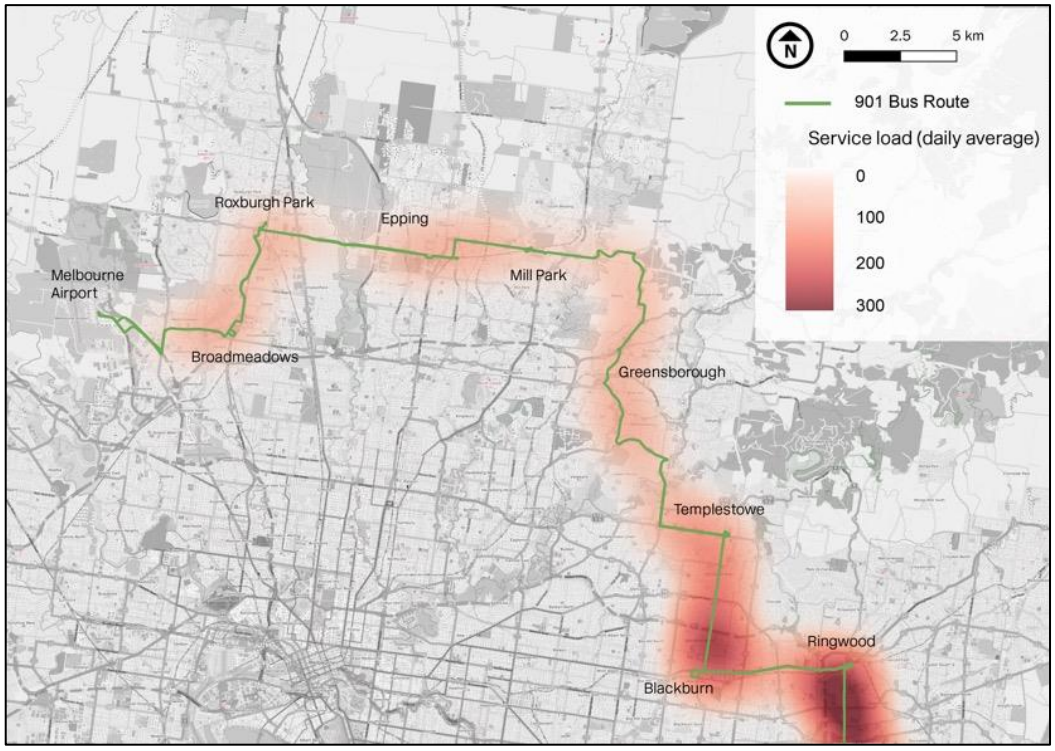
The areas with the lowest loads are Campbellfield/Fawkner and Melbourne Airport. This is consistent across weekdays and weekends. On weekends, Mill Park has a lower load compared to other areas.

Figure 41: SmartBus Route 901 average loading per service 2018-19 (Weekday)



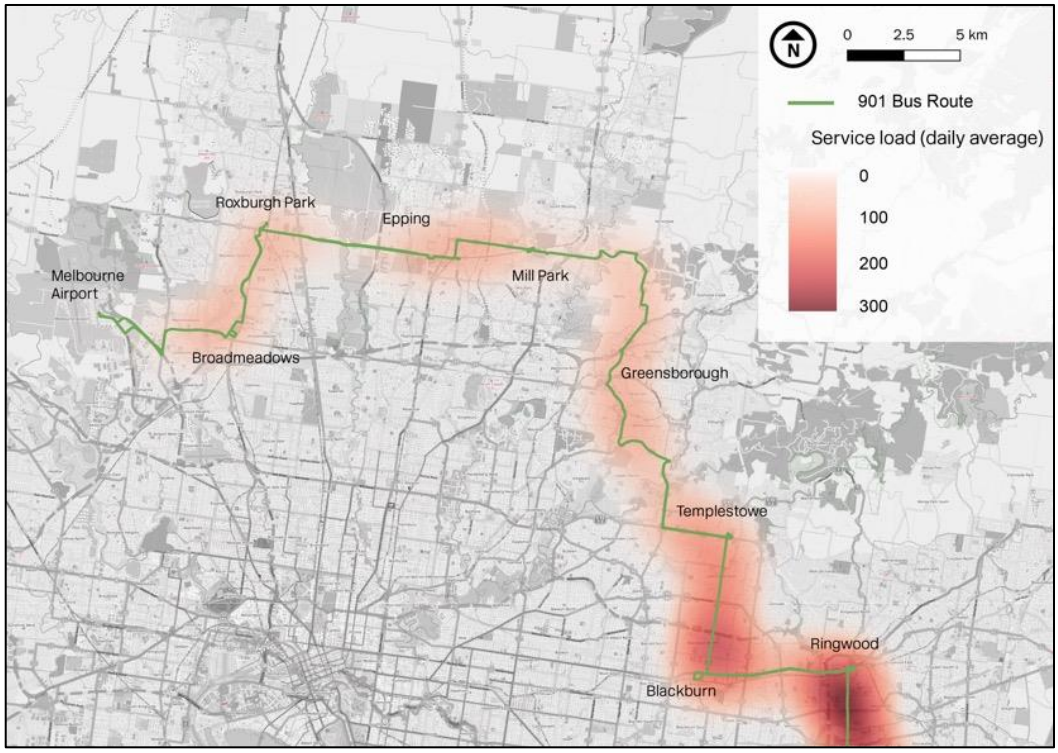
Source: DoT with M&PC analysis

Figure 42: SmartBus Route 901 average loading per service 2018-19 (Saturday)



Source: DoT with M&PC analysis

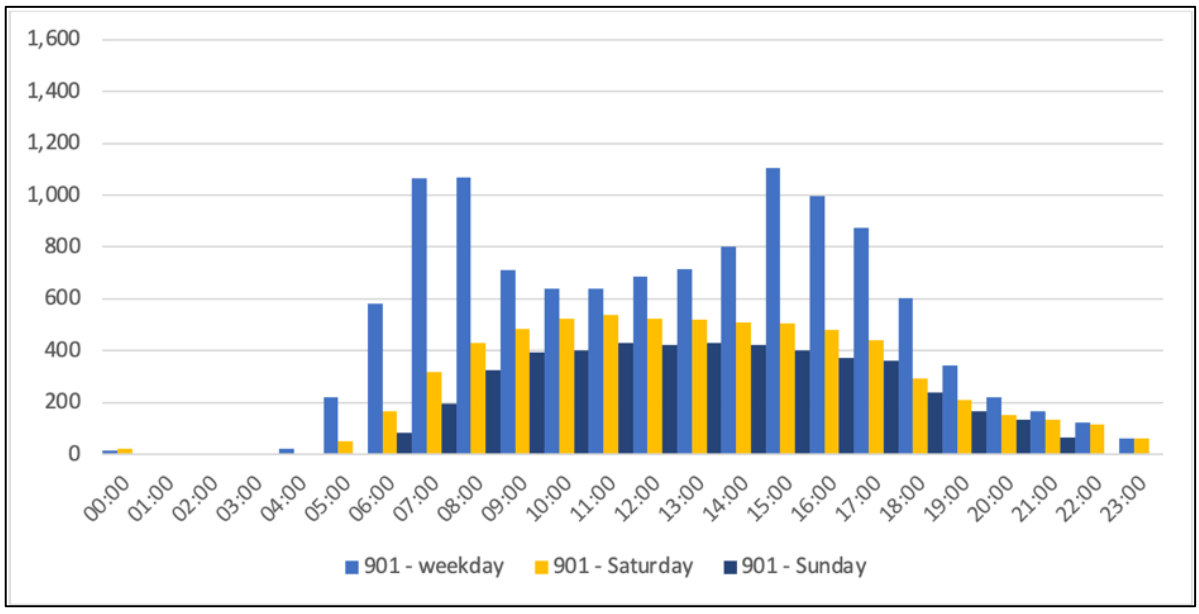
Figure 43: SmartBus Route 901 average loading per service 2018-19 (Sunday)



Source: DoT with M&PC analysis

Figure 44 shows the daily average patronage for SmartBus Route 901 by time of day. On an average weekday, patronage is highest from 07:00-09:00 (AM Peak) and 15:00-16:00 (PM peak), with fairly high patronage in the interpeak between 09:00-15:00. Patronage is slightly higher on Saturday than on Sunday. Patronage is highest on the weekends between 10:00-14:00, but is fairly consistent between 09:00-18:00.

Figure 44: SmartBus Route 901 daily average patronage 2018-19



Source: DoT with M&PC analysis

In summary, the highest performing areas are outside of the northern region (such as Ringwood and Blackburn). Within the region, moderate patronage is generated at:

- Epping
- Broadmeadows
- Greensborough

It was also observed that the following route sections are relatively poorly performing:

- Campbellfield/Fawkner
- Melbourne Airport

SmartBus Route 902 patronage review

SmartBus Route 902 had a total annual patronage of 3.67m in 2018-19 (across the whole route), slightly higher than SmartBus Route 901 but lower than SmartBus Route 903.

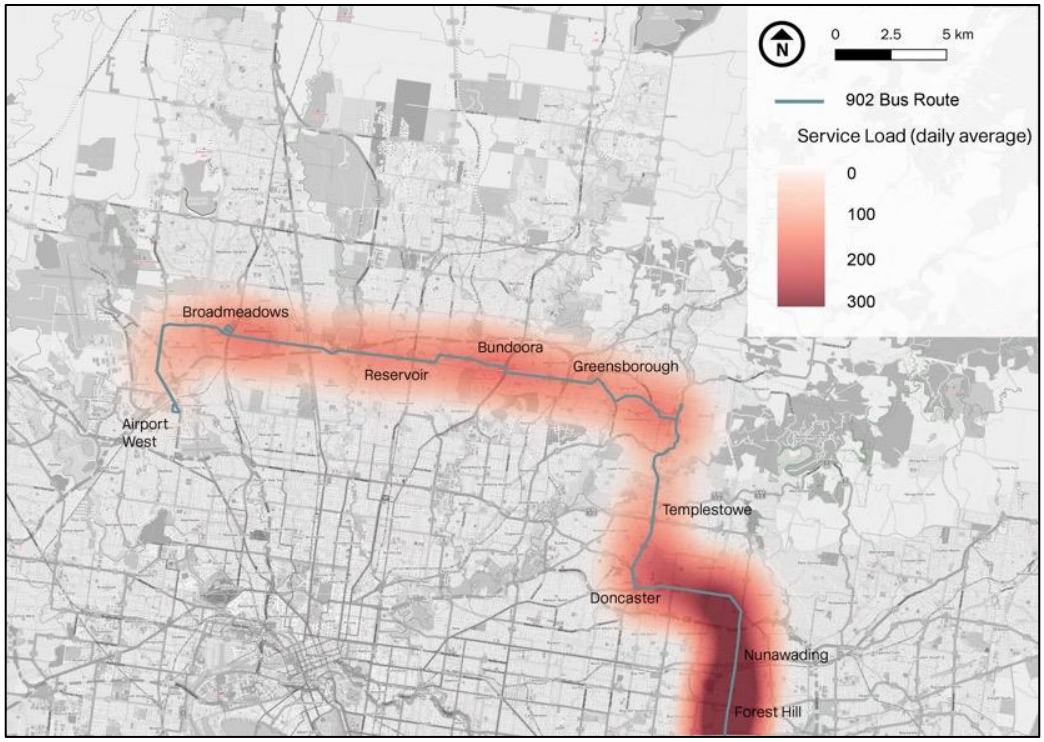
Compared to Route 901, it is immediately apparent that loadings across the northern region are generally higher, and that there are fewer areas where average loadings are low. This implies a number of longer distance trips are taking place (or that boardings and alightings are relatively synchronised in those areas). Again, noting the PTPI for the route (Figure 36), the relatively higher patronage loads than SmartBus Route 901 are logical in the context of the northern route section of SmartBus Route 902 passing through areas of higher development intensity.

Figure 45, Figure 46 and Figure 47 summarise the average loading per service in 2018-19. The figures show an aggregation of the number of people on a bus at all stops in both directions.

Similar to SmartBus Route 901, the highest loads appear to be outside the study area (Forest Hill to Nunawading has the highest load, followed by Doncaster). Within the study area, Broadmeadows, Bundoora and Greensborough generate the highest loads.

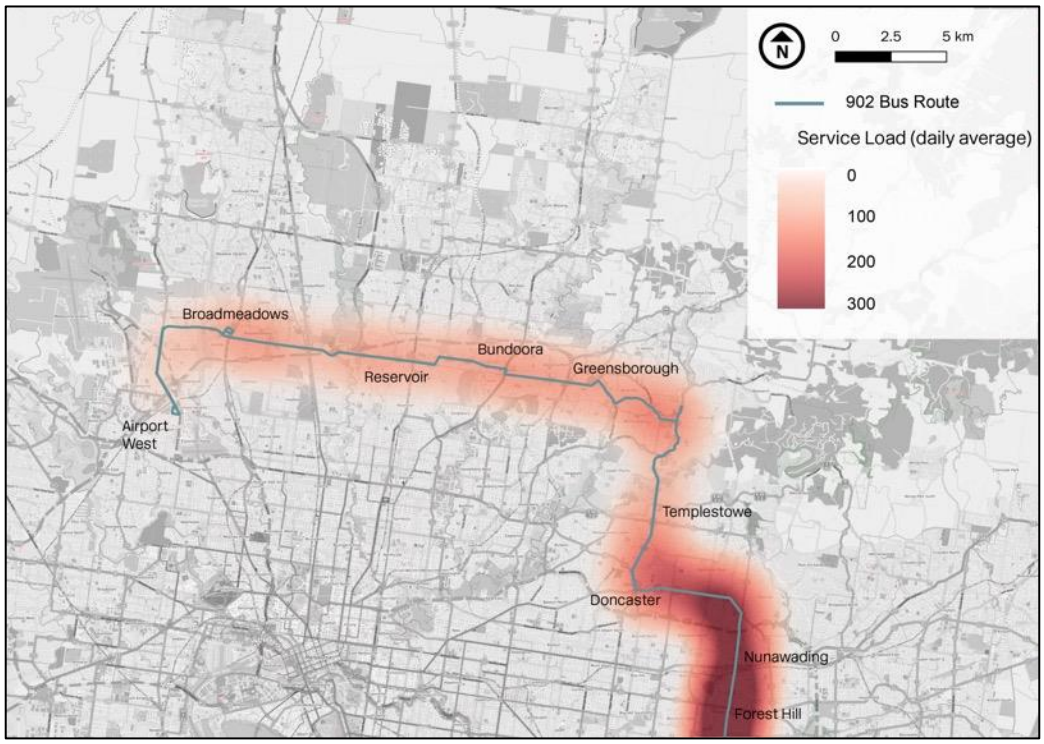
The loading profile on weekdays is higher than on the weekend. The area with the lowest load is Airport West; as the termini of the route it is unsurprising that loadings are lower, but the low passenger numbers reflects a combination of low density activity (dwellings and commercial) and a reduction in longer distance trips that could be provided for if the route continued to Sunshine.

Figure 45: SmartBus Route 902 average loading per service 2018-19 (Weekday)



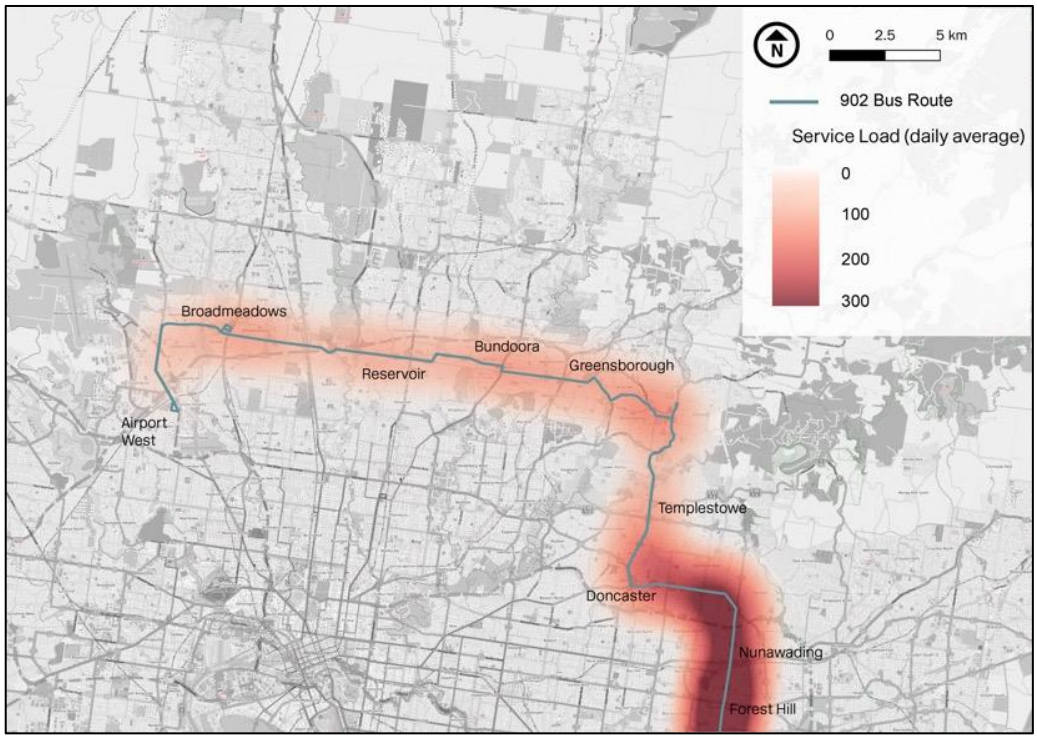
Source: DoT with M&PC analysis

Figure 46: SmartBus Route 902 average loading per service 2018-19 (Saturday)



Source: DoT with M&PC analysis

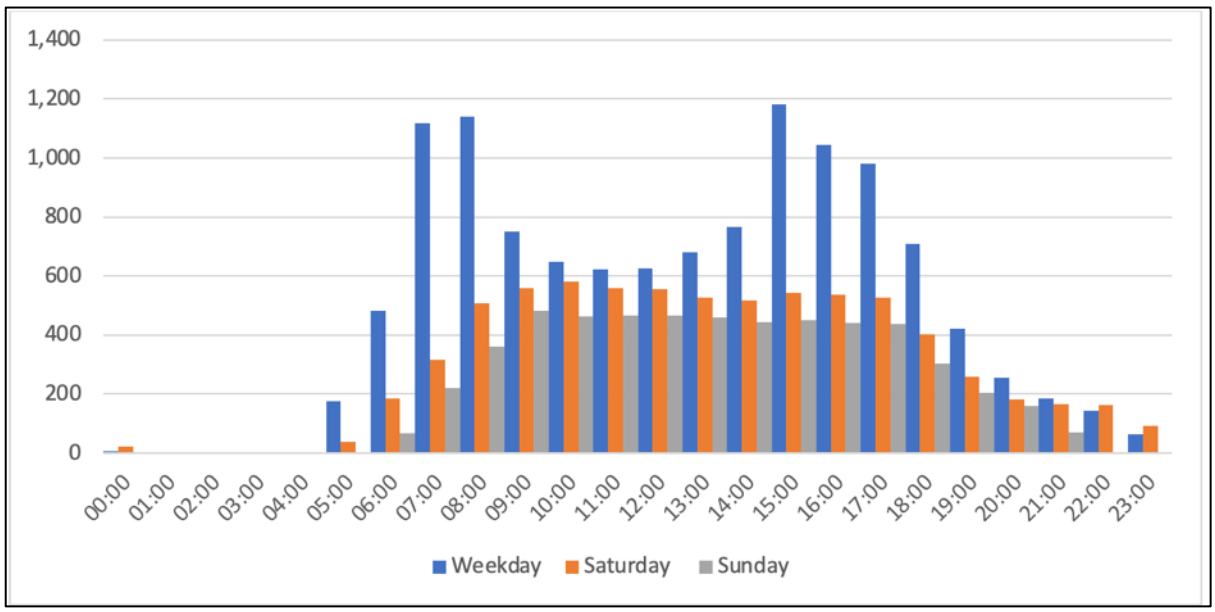
Figure 47: SmartBus Route 902 average loading per service 2018-19 (Sunday)



Source: DoT with M&PC analysis

Figure 48 shows the daily average patronage for SmartBus 902 by time of day. On an average weekday, patronage is highest from 07:00-09:00 (AM Peak) and 15:00-16:00 (PM peak), with fairly high patronage in the interpeak between 09:00-15:00. Patronage is slightly higher on Saturday than on Sunday. Patronage is highest on Saturday between 10:00-11:00, but is fairly level between 09:00-18:00. Patronage on Sunday is highest between 09:00-10:00, but is fairly level between 09:00-18:00.

Figure 48: SmartBus Route 902 daily average patronage 2018-19



Source: DoT with M&PC analysis

In summary, the highest performing areas appear to be outside of the northern region (such as Forest Hill, Glen Waverley and Nunawading). Within the region, good patronage loads are generated at:

- Broadmeadows
- Bundoora
- Greensborough

It was also observed that the following route sections are relatively poorly performing:

- Airport West

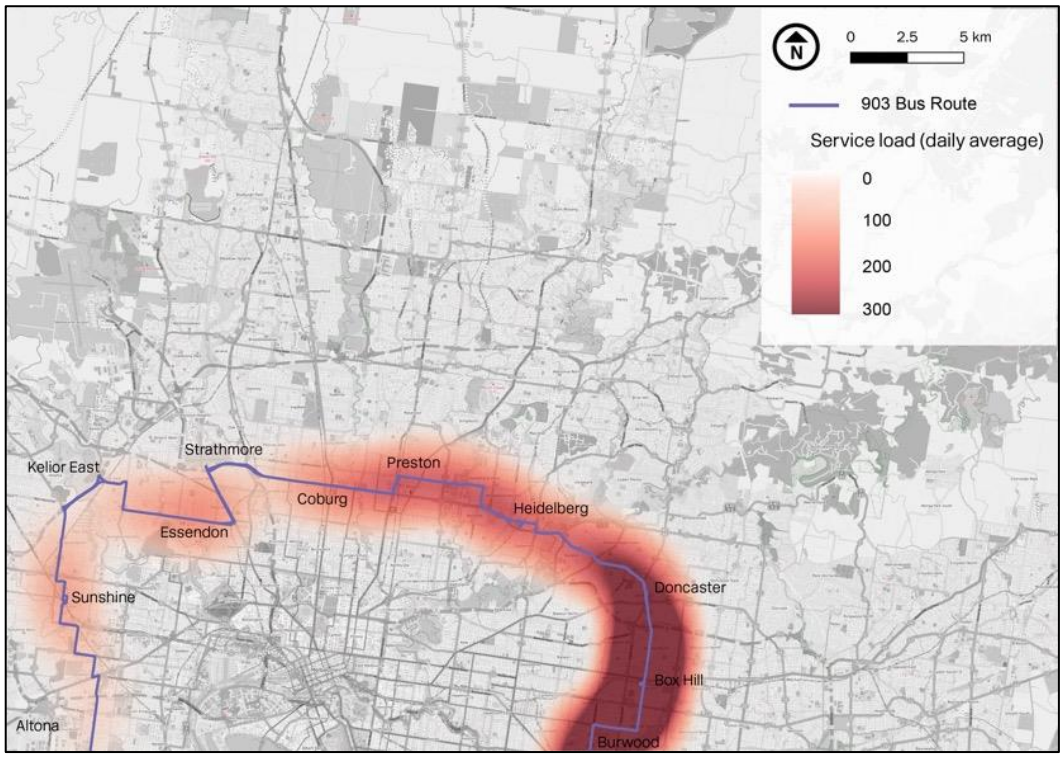
SmartBus Route 903 patronage review

SmartBus Route 903 had a total annual patronage of 4.45m from 2018-19 (across the whole route), markedly higher than SmartBus Routes 901 and 902.

As with SmartBus Routes 901 and 902, the highest loads are outside the study area (Burwood to Doncaster. The section between Heidelberg, Preston and Coburg also performs strongly. Again, noting the PTPI for the route (Figure 36), the relatively higher patronage loads than SmartBus Routes 901 and 902 are logical in the context of the higher level of activity suggested by the PTPI for SmartBus Route 903. The areas with the lowest loads are Keilor East and Altona (noting that Altona is at the end of the route and that average loadings would be expected to be slightly lower).

The average loadings per Route 903 service in 2018-19 is shown in Figure 49 below. They show an aggregation of the number of people on a bus at all stops in both directions.

Figure 49: SmartBus Route 903 average loading per service 2018-19 (Weekday)



Source: DoT with M&PC analysis

A further notable difference (compared to SmartBus Routes 901 and 902) is the strength of weekend loadings. Comparison of Figure 49 and Figure 50 shows that in some areas (such as Heidelberg), loadings are actually higher at the weekend (noting that there are fewer services at the weekend for passengers to use).

Whilst there are some corridor sections where loadings are consistent (suggesting either longer journey trips or a synchronised set of boardings and alightings) such as Heidelberg to Preston and Coburg, further east than Coburg there are gaps in loadings where it is clear that SmartBus Route 903 is almost empty and fewer regional trips are being made.

A key reason for the lower patronage west of Preston is the duplication that occurs between five routes in the Bell Street corridor. Specifically through Coburg there are four separate bus routes on Bell Street and a fifth (Route 512) operating 400m to the south on Munroe Street.

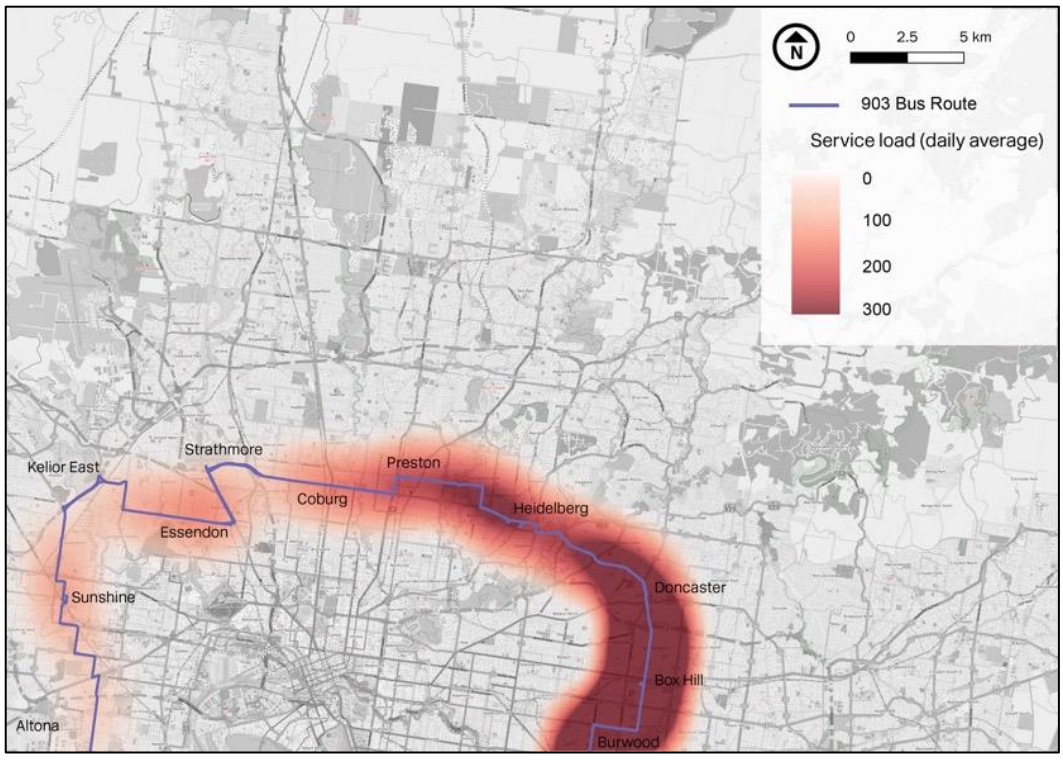
Analysis in this project has identified an opportunity to reduce this duplication by re-aligning Route 561 to be more direct along Gaffney Street and Murray Road.

DoT should explore opportunities to make the network easier to understand and operate (potentially creating efficiencies while increasing patronage) in this area including:

- Realigning Route 512 to Reynard Street and Rennie Street
- Removing Route 513 or Route 527 from the corridor

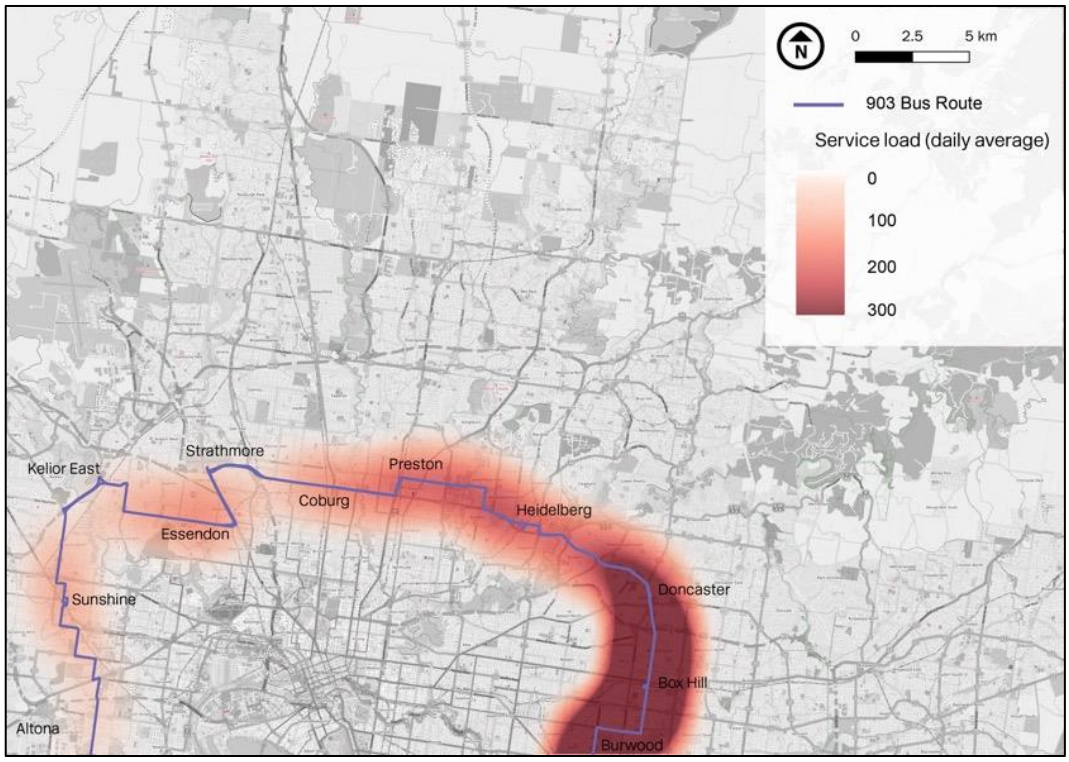
The average Route 903 loading on weekends is shown in Figure 50 and Figure 51 below.

Figure 50: SmartBus Route 903 average loading per service 2018-19 (Saturday)



Source: DoT with M&PC analysis

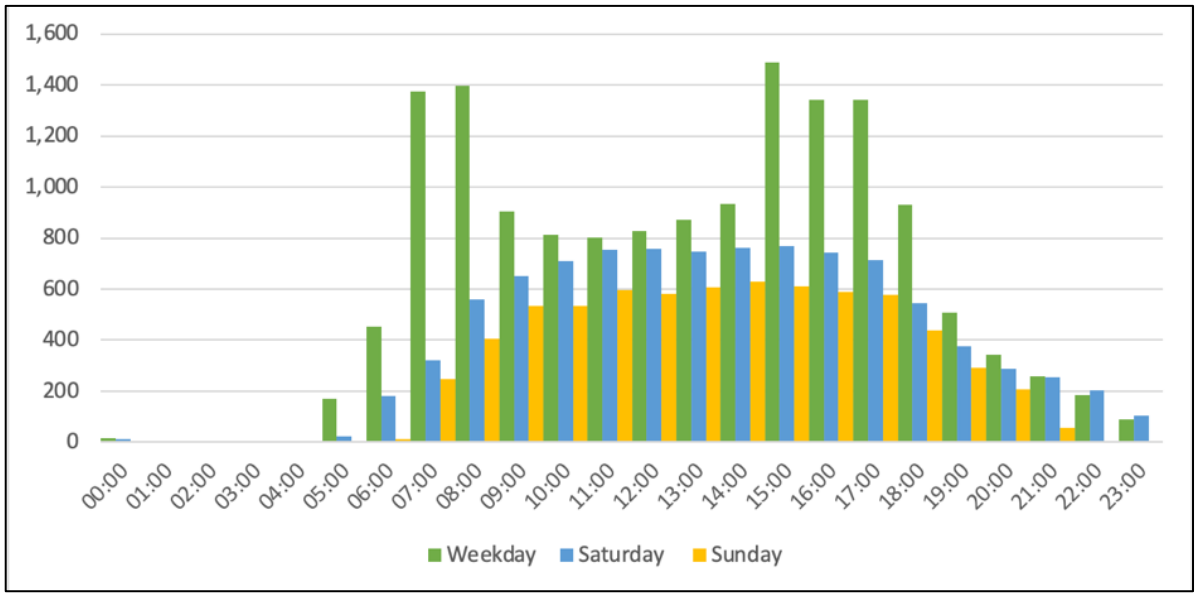
Figure 51: SmartBus Route 903 average loading per service 2018-9 (Sunday)



Source: DoT with M&PC analysis

Figure 52 shows the daily average patronage for SmartBus Route 903 by time of day. On an average weekday, patronage is highest from 07:00-09:00 (AM Peak) and 15:00-16:00 (PM peak), with fairly high patronage in the interpeak between 09:00-15:00. Patronage is slightly higher on Saturday than on Sunday. Patronage is highest on Saturday between 11:00-13:00, but is fairly level between 10:00-18:00. Patronage on Sunday is highest between 14:00-15:00, but is fairly level between 11:00-18:00.

Figure 52: SmartBus Route 903 daily average patronage 2018-2019



Source: DoT with M&PC analysis

In summary, the following route sections are relatively highly performing:

- Heidelberg
- Preston
- Coburg

It was also observed that the following route sections are relatively poorly performing:

- Keilor East
- Altona

3.4.2 Reliability review

As shown in Table 31 below, SmartBus Routes 901 and 902 are the least reliable of all SmartBus Routes, with 3% fewer services on time than the network average.

Table 31: Reliability data for SmartBus Routes 901, 902 & 903

Route	% of services on time	Bus priority measures
901	90.0%	Bus priority along some roads
902	90.3%	Bus priority along some roads
903	94.4%	Bus priority along some roads
905	90.8%	Bus lanes and signal priority along significant sections
906	91.1%	Bus lanes and signal priority along significant sections
907	93.0%	Bus lanes and signal priority along significant sections
908	94.8%	Bus lanes and signal priority along significant sections
Average	**93.3%**	**Metro Network Average (for reference)**

Source: PTV NetBI Metropolitan Bus Performance (Sep 2020 to Sep 2021)[10]

Generally, reliability is a function of the congestion experienced in the areas that routes operate in, and the level of bus priority along the route. For example, Route 908 is a shorter route (during off-peak it does not even serve the CBD) which operates along corridors which are typically less congested, whereas Route 901 is a longer route with less bus priority.

It is also the case that timetables can often have significant "fat" built in. This is mainly driven by the DoT's demands of low rates of 'late running' which means the operator is very nervous of a lean timetable, and therefore seeks a timetable which minimises their risk of financial penalty. The end result is that – outside of times where congestion is a significant issue – journey times can be artificially inflated by having to wait at timing points after the driver has run "ahead" of the generous timetable. In many cases drivers are aware of this slack in the timetable and habitually operate the bus at 20-30% below the speed limit, rather than driving to the traffic conditions.

[10] https://tinyurl.com/mvwn5ure

3.5 SmartBus access improvements

Ensuring people can access SmartBus stops easily is important in reducing overall travel time and improving the safety of people's journeys. In some cases, access improvements are also required to comply with DDA requirements.

The current access arrangements often require passengers to cross arterial roads to access bus stops (in one or the other direction), often at locations without priority or protection and without properly designed (DDA compliant) ramps. Over twenty examples of this type of crossing point can be found along the Mahoneys Road corridor from Broadmeadows to Keon Park. These stops are located more than 20 metres from DDA compliant crossings and typically more than 80 metres from protected crossings where the nearest DDA access is likely to be found. One of these locations is shown in Figure 53.

Figure 53: SmartBus Route 902 on Mahoneys Road

The NCA will need to work with DoT to develop improvements at all these locations and seek State funding for a comprehensive project of improvements across the SmartBus network in the NCA region. This has an element of time criticality given the deadline of 31 December 2022 for all bus stops to be fully accessible under the Disability Standards for Accessible Public Transport. The NCA Councils should be on the front foot about this issue, particularly along State arterial roads which are typically more difficult to cross and have higher intensity of surrounding land use generating patronage.

3.6 SmartBus frequency improvements

It is noted that any increase in the efficiency of resources used (as discussed in the remainder of this section) will lead to reduced operational costs. Once enough of these cost reductions are accrued, then the efficiencies can lead directly to increases in service frequency at no net cost.

As shown in section 3.4, there is no evidence for an increase in frequency in the northern region for SmartBus Routes 901 and 902, given the relatively light patronage in most areas at present.

Whilst section 3.4 showed that SmartBus Route 903 did have higher levels of patronage on some route sections, it is also noted Route 903 already has additional peak services timetabled to come into service in the Heidelberg area[11].

3.7 SmartBus alignment and bus priority improvements

Whilst options exist for improving the effectiveness and frequency of services, it is noted that it may not be possible to simultaneously satisfy these needs (for example, higher frequency services may not make the overall customer experience more effective if there are congestion issues along certain parts of the route which are not addressed. It is also important to note that not all components of the customer journey are weighted equally – customers prefer to spend (say) 5 minutes on a bus, rather than 5 minutes at a bus stop). On longer routes, there are many potential transfers that can be made, and a much more diverse range of trips are being provided for. Any route change will impact on existing customers and should only be made if there is a degree of certainty that the change will benefit significantly more existing or potential passengers.

It is also noted that any increase in the efficiency of resources used will lead to reduced operational costs. Once enough of these cost reductions are accrued, then the efficiencies can lead directly to increases in service frequency at no net cost.

It is also worth noting that there is value in maintaining logical, direct and long-standing routes or service corridors. This is because it takes the local community 24-36 months to understand changes in service. Even with significant marketing, it takes this long for patronage to stabilise (at a higher level) after service improvements.

Having considered the strategic documents, available data and stakeholder comments, along with community group documents such as the VTAG 'Networking The North' report[12], we have developed a long list of potential improvements. These are split between route improvement options (section 3.8) and bus priority / intersection improvement options (section 3.9). Where the options have been discussed in community reports, the mapping from those reports is used and source identified. Note that for the route improvement options, it would not be possible to act on all the options as some of them involve different approaches for the same section of the route (for example, Options 4 and 6 could not both be implemented as they propose different solutions for the Montmorency / Eltham area).

3.7.1 MCA framework

In order to assess and rank the SmartBus improvement options, it is necessary to define a Multi-Criteria Analysis (MCA) framework for assessing the suitability of options, and to assess those options against the MCA.

The approach to scoring for the MCA is shown in Table 32 below. The MCA is designed to be aligned with the network and service planning principles (section 1.4).

[11] https://d309ul1fvo6zfp.cloudfront.net/1643854379126/bus-13690-2022-01-31-2022-04-10.pdf
[12] https://drive.google.com/file/d/1FVZrhuKELo91i2KkmDOY-YHY5rmEwqfH/view

Table 32: Multi-criteria analysis framework for SmartBus route improvement options

	0	1	2	3	4
Simple	No improvement to ease of navigation / understanding	Limited improvement to ease of navigation / understanding	Some improvement to ease of navigation / understanding	Route is much easier to navigate / understand	Route is very much easier to navigate / understand
Direct	No improvement to directness / journey times	Limited improvement in directness / journey times	Some improvement in directness / journey times	Much improvement in directness / journey times	Significant improvement in directness / journey times
Reliable	No improvement in reliability	Limited improvement in reliability	Some improvement in reliability	Much improvement in reliability	Significant improvement in reliability
Feasible	Very hard to implement	Hard to implement	Some challenges to implement	Easy to implement	Very easy to implement
Nearby	No improvement in PTPI	Limited improvement in PTPI	Some improvement in PTPI	Much improvement in PTPI	Significant improvement in PTPI
Risk	High risk to implement		Medium risk to implement		Low risk to implement

3.7.2 Overview of recommendations

Detail of the route improvement options is provided in section 3.8. In summary, based on the MCA carried out in Table 32, we recommend the following:

- **Route improvement Option 1**: Swap the western termini of SmartBus 901 and 902, such that SmartBus 901 terminates at Airport West Shopping Centre and SmartBus 902 terminates at Melbourne Airport
- **Route improvement Option 6**: Reduce duplication Greensborough and Eltham between SmartBus 901, 902 and local routes
- **Route improvement Option 7:** Realigning SmartBus 901 via Greenvale

Detail of the bus priority improvement options is provided in section 3.9. In summary, based on the MCA carried out in Table 35, we recommend the following:

- **Priority Option 10**: Investigate a right-turn bus priority signal at the intersection of Diamond Creek and Yan Yean Roads
- **Priority Option 17:** Investigate bus priority through the intersection of Cooper Street and Edgars Road
- **Priority Option 20:** Investigate bus priority through the intersection at Mahoneys and Edgars Roads
- **Priority Option 22:** Investigate bus priority through the intersection of Grimshaw Street and Greensborough Bypass
- **Priority Option 24:** Investigate bus priority lanes in both directions on Manningham Road, near intersection with Dora Street
- **Priority Option 32:** Investigate bus priority lanes in both directions on Fitzsimons Lane, near intersection with Porter Street
- **Priority Option 33:** Investigate bus priority lanes and signalling in all directions at the Fitzsimons Lane and Main Road roundabout
- **Priority Option 37:** Investigate westbound bus priority signalling at the intersection of Bell Street and Pentridge Boulevard

3.8 SmartBus route improvement options evaluation

3.8.1 Option 1: Swapping the western termini of SmartBuses 901 and 902

Currently, SmartBus Route 901 terminates at Melbourne Airport and SmartBus Route 902 terminates in Airport West. Under Option 1, SmartBus 901 would instead run to Airport West while SmartBus 902 would run to Melbourne Airport (see Figure 54 below. This would provide a more direct connection between Melbourne Airport and Greensborough, as well as a more direct connection to the Mernda Line via Keon Park Station.

Figure 54: Swapping the western termini of SmartBus 901 and 902

Source: Networking the North (VTAG)

There would be no net change in public transport propensity scores across the two routes, because all existing stops would be serviced. However, stakeholders indicated that more airport employees live along the SmartBus 902 corridor than the SmartBus 901 corridor.

Subsequent analysis using 2016 Census journey-to-work data, found that 383 people who work in the Melbourne Airport destination zone live along the SmartBus 901 corridor, while 419 people who work in the Melbourne Airport destination zone live along the SmartBus 902 corridor. Of these workers, 3.1% of those along the SmartBus 901 corridor take public transport, while 7.9% of those along the SmartBus 902 corridor take public transport.

On this basis, it seems clear that SmartBus 902 better matches the needs of airport workers and would make it easier for them to access the airport with a direct service (rather than having to transfer, as would be the case at present).

Option risks

- Low – changes are within one operator, involve no change to service km & involve no loss of service at any stop

Summary commentary

- This option mimics the SRL alignment from Melbourne Airport to Keon Park
- Employees in Roxburgh Park & Epping would lose direct service to the airport, but overall workers at the airport should benefit from the change
- SmartBus Route 901 could better serve Attwood and Greenvale (reducing duplication in Pascoe Vale Road)
- Enables clearer customer messaging when SRLB is introduced, as Mahoneys Road would have two SmartBus routes, one operating express to key Stations and the other stopping at every stop if needed

Recommendation

- Option 1 is recommended for further investigation by DoT

3.8.2 Option 2: Realign Route 903 via Highpoint Shopping Centre

Currently, SmartBus 903 runs through Aberfeldie between Essendon and Sunshine along Buckley Street, duplicating Route 465 which has seven services an hour in the peak and 3 each hour at other times. Route 903 then connects to Sunshine via the Western Ring Road and the industrial area of North Sunshine.

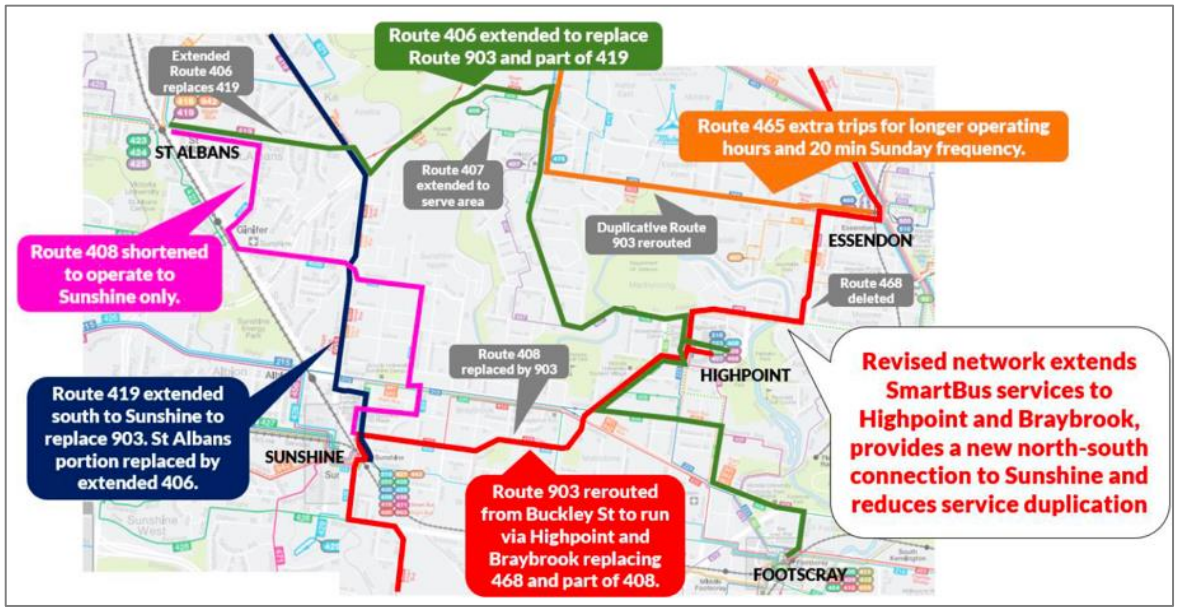
The current route alignment misses significant destinations and trip attractors, as it is 2km north of Highpoint Shopping Centre, and 1.5km east of Sunshine Hospital, Wellbeing and Employment Precinct.

Realigning SmartBus Route 903 via Highpoint would improve access to the shopping centre from Coburg, Pascoe Vale and Preston. The realignment also presents the opportunity to replace the Highpoint-Sunshine segment of bus Route 408 and the entirety of bus route 468 with higher quality services.

This option would increase the propensity score along the SmartBus Route 903 corridor, serving areas with a medium to high PTPI in Aberfeldie, Maidstone and Maribyrnong. It would also provide a clear distinction between the inner orbital route and a potential future extension of Route 902 from Airport West Shopping Centre to St Albans and Deer Park.

The route realignments and service changes envisaged by VTAG are shown in Figure 55.

Figure 55: Potential realignment of SmartBus Route 903 via Highpoint



Source: Networking the North (VTAG)

These options have not been analysed extensively as they are outside the NCA area and the alternative realignment options are further outside the area (in the City of Brimbank).

Option risks

- High – involves multiple operators and external stakeholders
- Changes are entirely external to the NCA area and would need engagement with the two Council's affected

Summary commentary

- Significantly improves access to Highpoint for people in Coburg and Pascoe Vale (40% reduction in transit travel time)
- Also has potential to save around 10mins of travel time and 3.7km on each trip
- Requires significant network realignment to replace former sections of route
- Is a faster orbital connection, but removes service from middle distance suburbs (where it is needed), in order to increase service in some inner suburbs that are already very well served

Recommendation

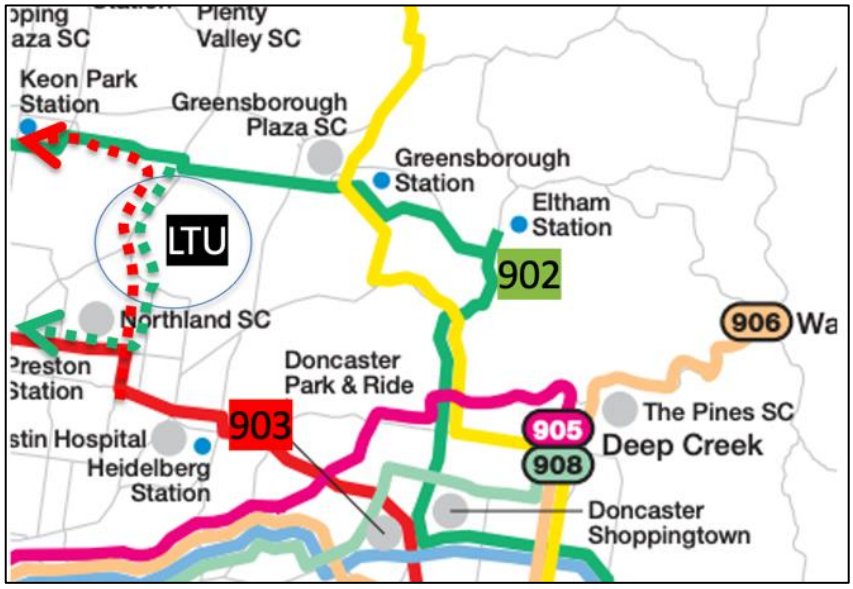
- Option 2 is not recommended for further investigation by DoT

3.8.3 Option 3: Crossing SmartBus 902 and 903 at La Trobe University

La Trobe University, is at the heart of the La Trobe NEIC, but is not currently serviced by any SmartBus routes. Compared to the University of Melbourne and Monash University, both at the centre of their own NEICs, La Trobe University has poor public transport service (as discussed in more detail in section 3).

An option to improve public transport connectivity to the NEIC, would be to realign SmartBus Routes 902 and 903 to both travel via La Trobe University (see Figure 56).

Figure 56: Realigning SmartBus Routes 902 and 903 via La Trobe University



Source: PTV with M&PC annotation

This option would increase the catchment of both SmartBus services by serving Bundoora, which has a medium to high propensity to use public transport. However, it would also duplicate existing high frequency services on tram Route 86, and bus Routes 250 & 350. It would require additional resources and would delay passengers currently travelling through (on either route) who would need to transfer (between the routes).

It is clear that this realignment would improve access to La Trobe University. However, it is unclear how many people would be negatively affected by the change. For example, anyone currently travelling from the east towards Northland would be delayed by an average of 17 minutes (including the transfer penalty). Likewise, anyone travelling to Greensborough from west of Plenty Road would be delayed by a similar amount.

This is slightly more than the current delay for passengers currently wanting to transfer from the SmartBus routes onto other services that connect to La Trobe University.

Option risks

- High – would break east-west connectivity between stations, shopping, heath and job hubs between Heidelberg and Northland

Summary commentary

- Would add 6.8km and 20mins travel time to every service on both routes (likely to cost 6 peak buses)
- Likely to cost over $6.5m per annum
- Weakens network legibility
- Duplicates catchment and connectivity of existing routes

Recommendation

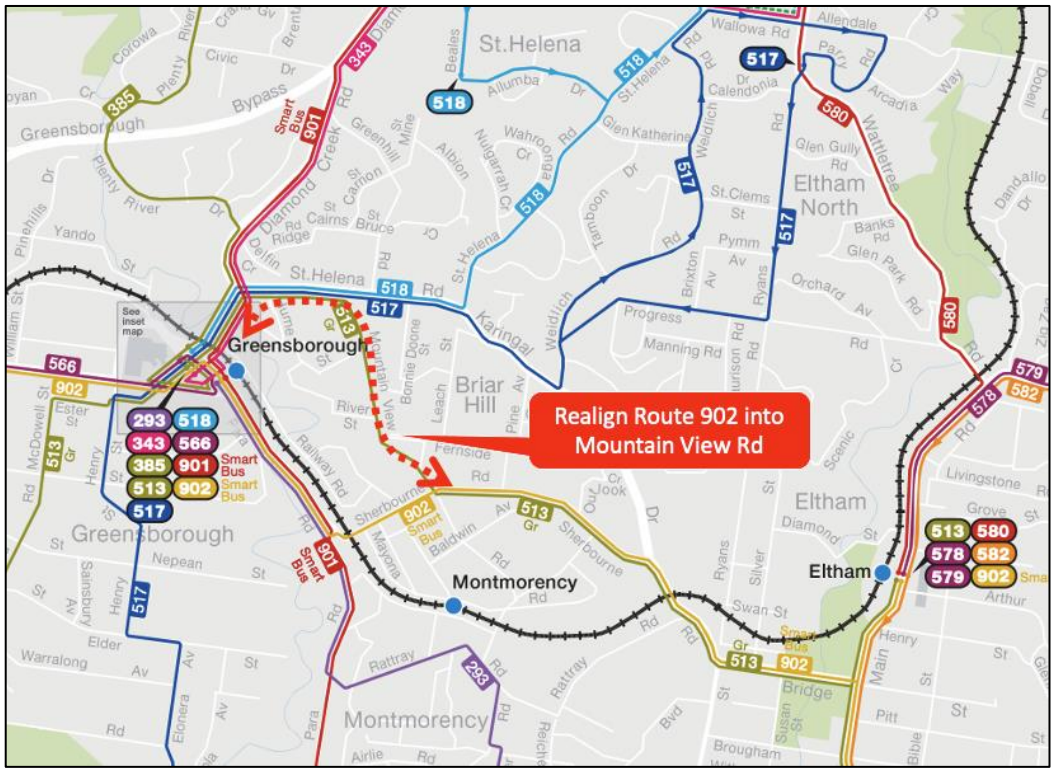
- Option 3 is not recommended for further investigation by DoT

3.8.4 Option 4: Reducing duplication in Greensborough and Eltham (Mountain View Road)

Between Eltham and Greensborough, SmartBus 901 & 902 are duplicated by other services. This is a particular issue on the north branch of Route 513 (which in itself is confusing for customers). Resolving the duplication of Route 902 and Route 513 would free up significant resources on Route 513. It creates an opportunity to achieve a much stronger north-south link by combining the remainder of the Route 513 northern branch with Route 343 from Hurstbridge. This could then be extended to La Trobe University to improve access to education from Diamond Creek and St Helena.

The duplication that Route 513 provides (of service coverage already provided by the higher frequency Route 902) was agreed through community consultation a decade ago as part of the Banyule-Nillumbik Bus Service Review. Resolving this duplication would slightly increase patronage along SmartBus Route 902 in Montmorency which has a medium public transport propensity score.

Figure 57: Removing duplication of Route 513 with SmartBus Route 902



Source: PTV with M&PC annotation

Option 4 and Option 6 both recommend changes to the Eltham / Montmorency / Greensborough area. Whilst both options have their merits, it is noted only one could be pursued (given that they are different solutions to the same problem).

Option risks

- Medium – involves multiple operators
- One pair of bus stops in Sherbourne Road would not be served (nearest retained bus stop is 250m away)

Summary commentary

- Relatively straight-forward network simplification
- Small walking distance increase for passengers at one stop in Sherbourne Road
- Complicates Route 902 access at Greensborough Station, because the Route would either need to double back on itself to reach the Station or, would not have an interchange at the Station with the nearest stop being in Main Street
- Reduced access on Para Road; this is largely an industrial area and remains served by Route 901
- Some minor cost savings could accrue from reduced duplication, but these are dependent on the degree to which directly serving Greensborough Station is required. Savings could be overwhelmed by the need to bring Route 902 around the block in both directions to access the Station directly

Recommendation

- Option 4 is worthy of consideration but overall Option 6 (discussed below) is preferred

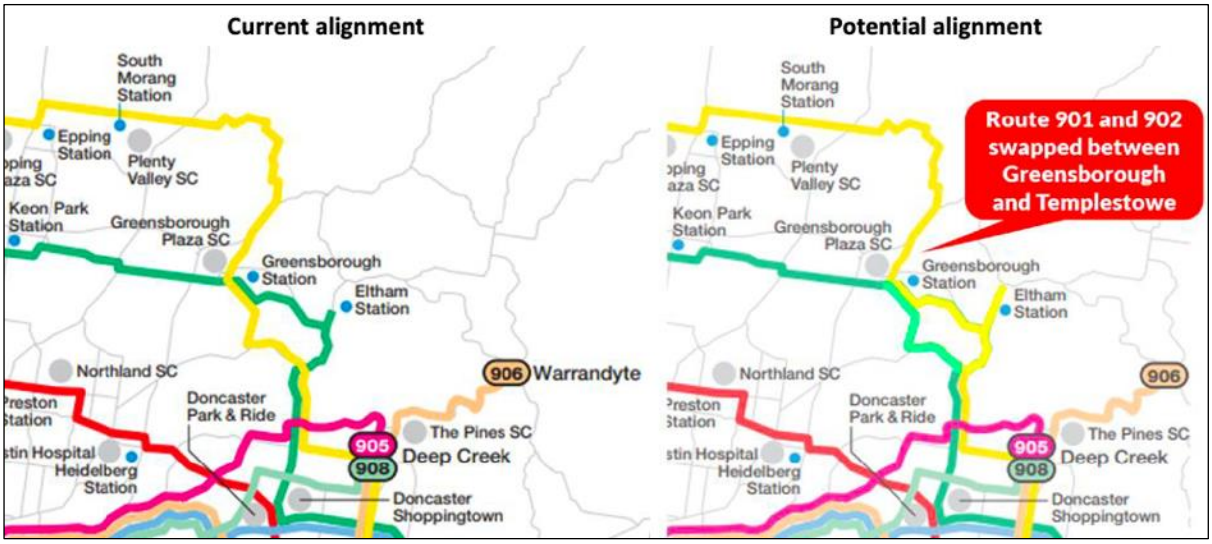
3.8.5 Option 5: Swapping SmartBus Routes 901 & 902 between Greensborough and Doncaster

Travel between Greensborough and Doncaster, both significant trip attractors, is possible directly on Route 902 which travels via Eltham (thus taking longer than it needs to). The alternative more direct Route 901 comes from Mernda and Epping via St Helena and crosses the Yarra River but then turns towards The Pines (forcing a transfer for passengers wanting to reach Doncaster).

The current route alignments prioritise frequent, fast connections between Eltham and Doncaster over a fast connection between Greensborough and Doncaster. Route 293 also provides a direct connection from Greensborough to Doncaster (and continues on to Box Hill), but only half as often as the SmartBus Routes.

An option to swap the alignment of each route between Greensborough and the Yarra river crossing has been put forward by a community interest group as shown in Figure 58 below. This change would create no net difference in public transport propensity scores across SmartBus 901 and 902, because all existing stops would be serviced.

Figure 58: SmartBus Routes 901 and 902 between Greensborough and Doncaster



Source: Networking the North (VTAG)

It should be noted that the Route 901 vehicles have specially designed fuel tanks because they need additional capacity to complete the long trip from Frankston to Melbourne Airport. It is unclear if the additional distance to serve Eltham would impact on the ability of the buses to reach their destination without re-fuelling.

It is also worth noting that the North East Link (NEL) will create a new fast connection between Greensborough and Doncaster on the freeway that buses could use. This would beat either option and make any change redundant. The routes have been in place for

over a decade, and NEL will be complete in less than that time. Therefore, the time and effort required to market and raise awareness of the route change (several years is required to stabilise patronage after improvements are made) would be a significant issue.

Option risks

- Low – noting that some people would need to transfer to complete trips that are currently direct

Summary commentary

- Unclear if there are any significant benefits in providing a slightly more frequent link between Greensborough and Box Hill
- Unlikely to save any resources unless Route 293 is removed which would then delete the direct connection to Box Hill and the Ringwood railway corridor

Recommendation

- Option 5 is not recommended for further consideration

3.8.6 Option 6: Reducing duplication in Greensborough and Eltham (Wattletree Road)

Between Eltham and Greensborough, SmartBus 901 & 902 are duplicated by other services including the Hurstbridge line. In addition, Route 901 is aligned to the south (along Main Road) but then heads north from Greensborough towards St Helena and South Morang.

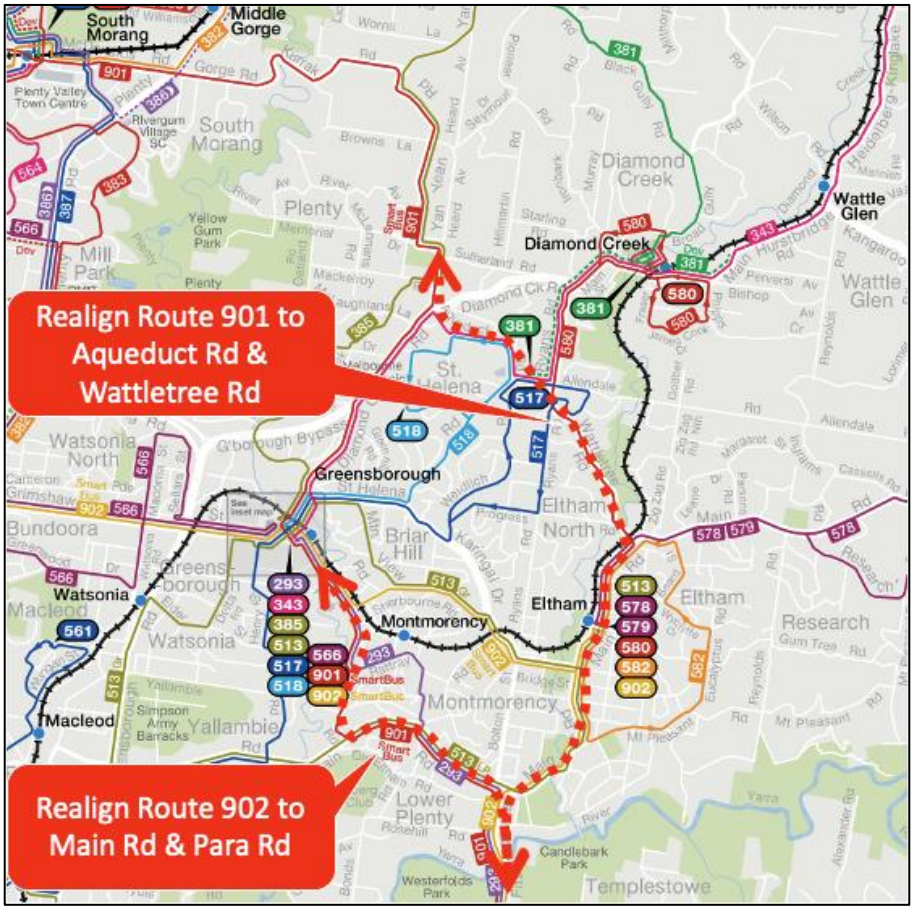
Resolving the duplication of Routes 901 & 902 through Montmorency as shown in Figure 59 would free up significant resources including:

- 0.6km and 1.5minutes of travel time on every service on Route 901
- 2.6km and 6.5 minutes of travel time on every service on Route 902
    - The impact of these travel time savings could lead to a potential reduction of one peak vehicle on Route 902, with an associated annual operational cost reduction of approximately $1m per annum

This creates an opportunity to achieve a much stronger north-south link between Doncaster East, Eltham and South Morang, while saving significant resources (potentially a peak bus). These resources could then be reinvested in part of the network that needs additional capacity (such as links to La Trobe University).

Connectivity for some existing customers would be lost (for example, the Bridge Street employment precinct would rely on connection to the 513 service at lower frequency. In addition, connectivity to the Nillumbik Council offices and Diamond Valley Sports centre would rely on Route 343). However, Figure 41 and Figure 45 both showed that patronage through these areas was extremely weak at present.

Figure 59: Realigning SmartBus Routes 901 & 902 around Montmorency



Source: PTV with M&PC annotation

Option risks

- Medium – significant route change that would also require some bus priority measures

Summary commentary

- Greensborough currently has two SmartBus routes and a train corridor which provide similar east-west connections
- Route 902 currently duplicates the train between Eltham and Greensborough
- Whilst this is not a focus, implementation of Option 6 would deliver the main benefits of Option 5
- Would save significant resources (potentially $1m per annum)
- Would improve travel times between Eltham and South Morang

Recommendation

- Option 6 is recommended for further consideration by DoT

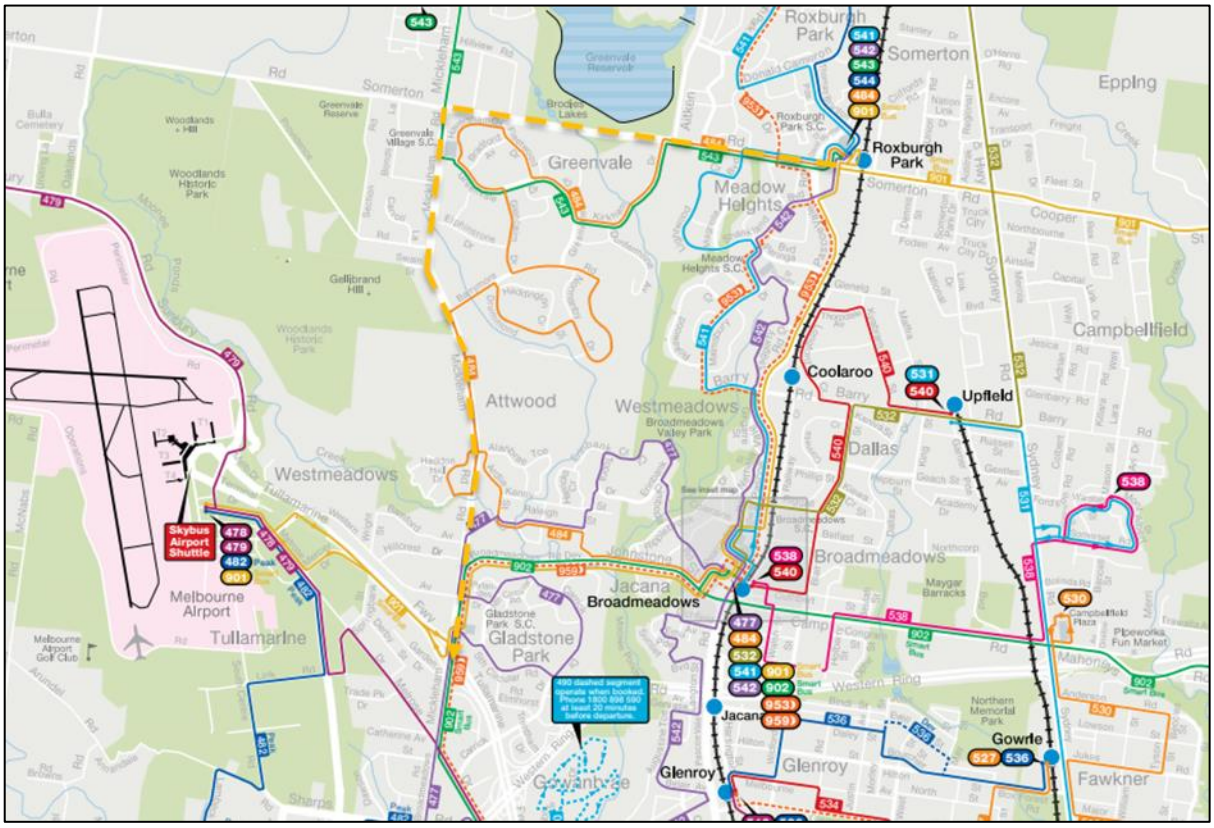
3.8.7 Option 7: Realigning SmartBus 901 via Greenvale

From Roxburgh Park to Broadmeadows, SmartBus Route 901 duplicates the catchment of bus Routes 541 and 542, and Coolaroo Station on the Craigieburn train line. It then duplicates SmartBus 902 between Broadmeadows and Gladstone Park. By contrast, the Greenvale and Attwood areas have grown rapidly and now have significant populations, but are poorly serviced by public transport (refer to section 3.3).

Under this option, SmartBus Route 901 would travel further west along Somerton Road, before travelling south along Mickleham Road as shown in Figure 60. This option would reduce service duplication and improve connectivity in Greenvale and Attwood. However, it does reduce the average public transport propensity score – along the entire SmartBus Route 901 – from 15.9 to 15.3.

This reduction in PTPI must be considered in the context that Greenvale is a new but fast-growing suburb (and that the PTPI uses census data from 2016). Collectively, the Greenvale Central, Greenvale West and Greenvale North PSPs predict that the area will house around 15,000 people, who will need a strong public transport link which a re-routed SmartBus Route 901 could potentially provide. This option also has the benefit of reducing the duplication between the high-quality SmartBus Route 901 and the Craigieburn rail corridor between Roxburgh Park and Broadmeadows.

Figure 60: Extending SmartBus 901 to Greenvale



Source: PTV with M&PC annotation

Option risks

- Medium – Some areas of Meadow Heights would have reduced connectivity but other areas of Meadow Heights would gain. Significant connectivity gains for the growing population in Attwood and Greenvale

Summary commentary

- Greenvale is a rapidly growing area that is not adequately serviced by quality public transport
- Duplication between the Craigieburn line and SmartBus Route 901 would be reduced

Recommendation

- Option 7 is recommended for further consideration by DoT

3.8.8 MCA of route improvement options

Using the MCA in conjunction with insights from the PTPI, the scoring of options is detailed in Table 33 below.

Table 33: Multi-criteria analysis scoring for Options 1-7 (route improvement options)

	Simple	Direct	Reliable	Feasible	Nearby	Risk
Option 1	0	2	0	4	0	4
Option 2	0	2	2	1	1	0
Option 3	0	0	0	1	2	0
Option 4	1	1	1	2	1	2
Option 5	0	1	0	3	0	4
Option 6	2	3	2	2	1	2
Option 7	2	1	1	3	0	2

Based on the analysis above we recommend:

- Option 1 should be discussed with DOT to improve employee access to Melbourne Airport, as more airport employees live along the SmartBus 902 corridor
- Options 4 and 6 should be discussed with DOT to improve network connections around Greensborough and St Helena. It is noted that it is not possible to implement both of these options, as they present alternative solutions to the same duplication
    - Option 6 has the potential to reduce operational costs by approximately $1m per annum and is therefore preferred to Option 4
- Option 7 should be discussed with DOT to improve public transport provision for the Greenvale Central, Greenvale West and Greenvale North PSPs

The other Options (2, 3, and 5) are not considered to provide enough strategic merit or passenger benefit to overcome the likely disbenefits to existing passengers and implementation risks.

3.9 SmartBus priority / intersection improvement options

In addition to Options 1 – 7 described above, we have identified a further 31 potential bus priority / intersection improvements which could improve the reliability of SmartBus Routes 901 / 902 / 903. These are listed in Table 34 below.

Table 34: Bus priority/intersection improvements for SmartBus Routes 901/902/903

Option	Potential improvement	Street	Intersection / cross-street
8	SmartBus 903 – Investigate bus right-turn signal priority	St Georges Road	Murray Road
9	SmartBus 901 – Investigate bus priority signal and right-hand hook turn	Main Road	Para Road
10	SmartBus 901 – Investigate right-turn bus priority signal	Diamond Creek Road	Yan Yean Road
11	SmartBus 901 – Investigate bus priority through the intersection	Gorge Road	Plenty Road
12	SmartBus 901 – Investigate right-turn bus priority signal	McDonalds Road	Cable Drive
13	SmartBus 901 – Investigate bus priority through the intersection	McDonalds Road	Civic Drive
14	SmartBus 901 – Investigate right-turn bus priority signal	Davisson Street	Cooper Street
15	SmartBus 901 – Investigate bus right-turn signal priority	Dalton Street	Cooper Street
16	SmartBus 901 – Investigate bus priority through the intersection	Cooper Street	High Street
17	SmartBus 901 – Investigate bus priority through the intersection	Cooper Street	Edgars Road
18	SmartBus 901 – Investigate bus priority through the intersection	Cooper Street	Sydney Road
19	SmartBus 902 – Investigate southbound left-turn slip lane	Mickleham Road	Melrose Drive
20	SmartBus 902 – Investigate bus priority through the intersection	Mahoneys Road	Edgars Road
21	SmartBus 902 – Investigate bus right-turn signal priority	Settlement Road	Plenty Road
22	SmartBus 902 – investigate bus priority through the intersection	Grimshaw Street	Greensborough bypass
23	SmartBus 902 – Investigate bus priority through the intersection	Main Street	Bridge Street
24	SmartBus 903 – Investigate bus priority lane in both directions	Manningham Road	Dora Street

Option	Potential improvement	Street	Intersection / cross-street
25	SmartBus 903 – Investigate bus priority signalling	Lower Heidelberg Road	Burgundy Street
26	SmartBus 903 – Investigate bus right-turn signal priority	Upper Heidelberg Road	Bell Street
27	SmartBus 903 – Investigate bus priority through the intersection	Bell Street	Waterdale Road
28	SmartBus 903 – Investigate bus priority for northbound right turns onto Oriel Road and southbound left turns onto Bell Street	Bell Street	Oriel Road
29	SmartBus 903 – Investigate queue jump lane in both directions	St Georges Road	Cramer Street
30	SmartBus 903 – Investigate bus priority through the intersection	Bell Street	Gilbert Road
31	SmartBus 903 – Investigate bus priority through the intersection	Bell Street	Sydney Road
32	SmartBus 901 and 902 – Investigate bus priority lane in both directions	Fitzsimons Lane	Porter Street
33	SmartBus 901 and 902 – Investigate bus priority lanes and signalling in all directions	Fitzsimons Lane	Main Road roundabout
34	SmartBus 901 and 902 – Investigate bus priority lane in all directions	Para Road	Sherbourne Road
35	SmartBus 901 and 902 – Investigate bus priority signalling	Para Road	Main Street
36	SmartBus 901 and 902 – Investigate bus priority signalling	Pascoe Vale Road	Tanderrun Way
37	SmartBus 901 and 902 – Investigate westbound bus priority signalling	Bell Street	Pentridge Boulevard
38	SmartBus 903 – Investigate bus lane extension from Lower Heidelberg Road to east of The Boulevard	Banksia Street	The Boulevard

3.9.1 MCA for intersection improvement options

In order to assess and rank the priority / intersection improvement options, it is necessary to define a Multi-Criteria Analysis (MCA) framework for assessing the suitability of options, and to assess those options against the MCA.

The approach to scoring for the MCA is the same as was shown in Table 32, but without the 'nearby' or 'direct' criteria (as Options 8 – 38 do not involve a modification to the route). In addition, no particular 'risk' is associated with each option.

Table 35: Multi-criteria analysis for Options 8 – 38

Option	Simple	Reliable	Feasible
8	3	2	4
9	2	1	2
10	4	4	4
11	1	2	1
12	1	1	3
13	1	2	1
14	1	1	1
15	1	1	4
16	1	3	2
17	4	4	4
18	1	2	3
19	1	2	1
20	4	3	4
21	1	1	1
22	4	4	4
23	3	3	1
24	4	4	4
25	1	1	1
26	4	4	4
27	3	3	3
28	1	1	1
29	2	1	2
30	4	2	4
31	1	1	1

32	**4**	**4**	**4**
33	**4**	**4**	**4**
34	**1**	**1**	**1**
35	**1**	**3**	**1**
36	**4**	**2**	**1**
37	**4**	**4**	**4**
38	**1**	**1**	**1**

Based on the analysis above we recommend:

- Options 10, 17 20, 22, 24, 32, 33 and 37 all score well in terms of being simple, feasible and reliable once installed
- These options (at the locations shown in Table 34 above) should be the priorities for further for investigation by DoT
- The NCA should advocate to DoT to include the above locations on red-spot improvements lists related to public transport reliability

In terms of the potential benefits from pursuing these options, we have assumed:

- Typical signal cycle time at intersections of 120 seconds
- 50% of the time, a bus service will use the signal without delay, but for the other 50% of services, a 60 second delay is introduced
- This would give an overall average delay along the route of 30 seconds per service

Using these assumptions, Table 36 below calculates the total potential time savings along the routes. In the context of a timetabled trip across the NCA region taking 2 hours of more, the potential savings represent a very small proportion of the scheduled journey.

Table 36: Potential travel time savings associated with bus priority / intersection improvements

Option	Potential improvement	901 benefit	902 benefit	903 benefit
10	SmartBus 901 – Investigate right-turn bus priority signal	30 secs (1 direction)		
17	SmartBus 901 – Investigate bus priority through the intersection	30 secs (both directions)		
20	SmartBus 902 – Investigate bus priority through the intersection		30 secs (both directions)	
22	SmartBus 902 – investigate bus priority through the intersection		30 secs (both directions)	
24	SmartBus 903 – Investigate bus priority lane in both directions			30 secs (both directions)
32	SmartBus 901 and 902 – Investigate bus priority lane in both directions	30 secs (both directions)	30 secs (both directions)	
33	SmartBus 901 and 902 – Investigate bus priority lanes and signalling in all directions	30 secs (both directions)	30 secs (both directions)	
37	SmartBus 901 and 902 – Investigate westbound bus priority signalling	30 secs (1 direction)	30 secs (1 direction)	
Average time saving per direction per route		**120 seconds**	**135 seconds**	**30 seconds**

Note: Costs for traffic signal improvements depend greatly on the existing conditions (including age of the computer controller). Rawlinson's Construction Cost Guide quotes a cost of $105,000 for new traffic signals, and this cost would be unlikely to be exceeded for each of the improvements listed above.

4 Connecting La Trobe University and NEIC

4.1 Overview

La Trobe University (LTU) is at the heart of the La Trobe National Employment and Innovation Cluster (NEIC), located 19km north of Melbourne CBD in the City of Darebin.

LTU employs over 5,000 staff and has an enrolment of over 40,000 students. This figure is anticipated to grow significantly because LTU is investing $5 billion into a future University City, which will result in an additional 12,000 residents, 40,000 students and 20,000 employees.

Significant growth in LTU and its surrounds will require significant public transport investment, particularly as LTU is not within the walking catchment of a train station and bus services do not generally run on turn-up-and-go frequencies. A significant number of students currently drive to access LTU, contributing to congestion on key arterials in the northern metropolitan region, such as Banksia Street.

Without a commensurate investment in public transport, congestion will only worsen as LTU's growth outstrips the transport network's capacity.

This chapter includes a bus service review, patronage analysis, trip origin-destination review, and a discussion of potential improvement options for LTU.

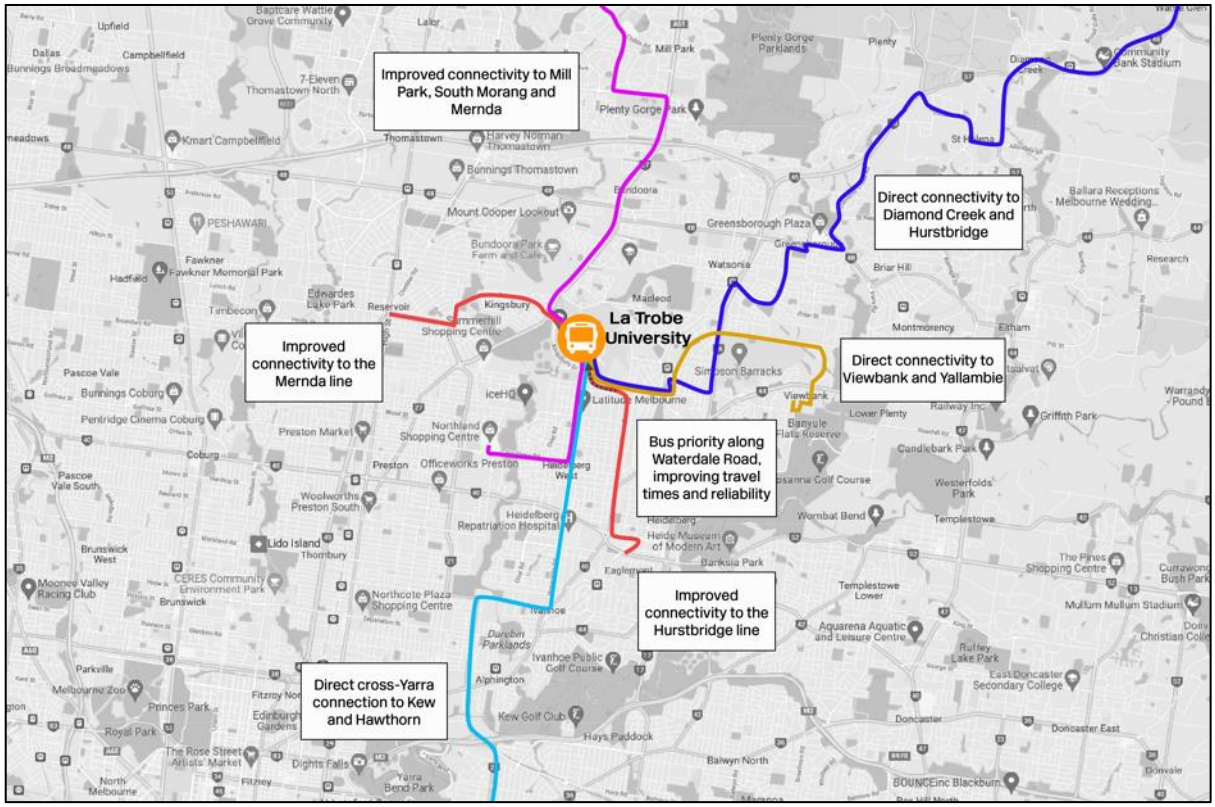
Improvement recommendations

Based on our analysis we recommend the following key improvements be investigated:

- Increase service frequency on Route 301 (direct shuttle to LTU from Reservoir Station) and run services throughout the year, rather than only during University semester
- Extend Route 301 to Heidelberg Station to improve access from the Hurstbridge line
- Reroute Route 382 to LTU via Science Drive, improving connectivity to northern suburbs in Whittlesea, such as Mill Park, South Morang and Mernda
- Connect Routes 513G and 343, and reroute them through LTU. This will improve connectivity to northeastern suburbs such as Diamond Creek and Hurstbridge
- Establish a new service between LTU and Viewbank/Yallambie, increasing LTU's potential employee and enrolment catchment
- Re-align Route 609 and extend it across the Yarra river to LTU, improving connectivity to eastern suburbs such as Kew and Hawthorn
- Investigate right-turn bus priority at the Waterdale Road/Kingsbury Drive intersection to improve service reliability

Figure 61 shows the recommended connectivity improvements for LTU.

Figure 61: Summary of improvements recommended for LTU



4.2 Review of current bus services

4.2.1 Frequency

Unlike other universities in Melbourne, La Trobe University is not near a single train line. The campus lies between two train lines, 6km away from Reservoir Station on the Mernda line and 5km from Heidelberg Station on the Hurstbridge line. Staff, students and visitors all rely on cross-regional links for public transport access to La Trobe NEIC. The Route 301 Express connection is focussed on improving access to Melbourne CBD via Reservoir Station. It results in a more consistent and reliable travel time of around 45 minutes, as a best case scenario. Variability in the travel time relates solely to the frequency of service on Route 301 and the Mernda Train line.

Comparing service frequencies with other tertiary institutions within NEICs, it can be seen that frequency on Route 301 is already sub-standard compared to LTU's 'competitors', which have very high peak frequencies (low headway between services). This is shown in Table 37 below.

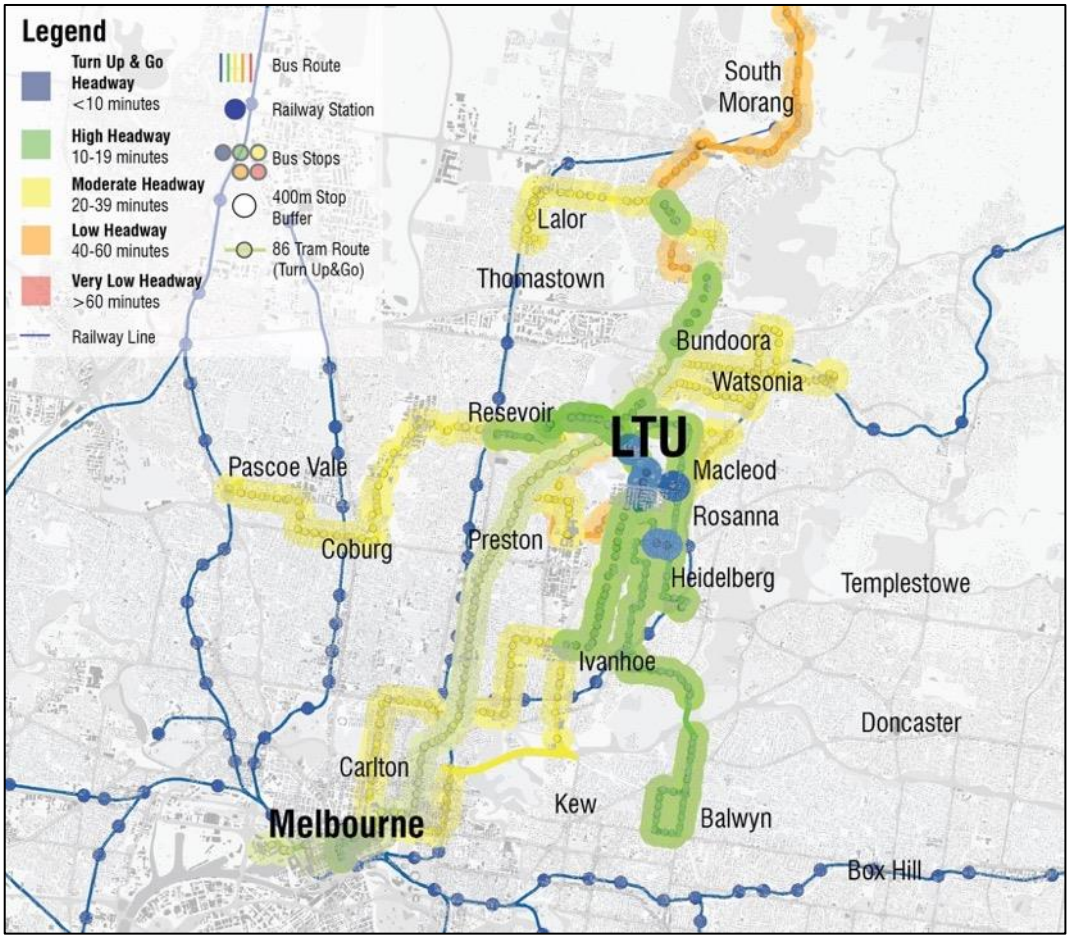
Table 37: Comparison of frequencies of key services to Melbourne universities

Routes	From (Station)	To (University)	Average Headway
1, 3, 5, 6, 16, 64, 67, 72	Melbourne Central	Melbourne Uni	< 1 min
401	North Melbourne	Melbourne Uni	3 min
601	Huntingdale[1]	Monash Uni	4 min
200, 202 & 207	Victoria Park[2]	Melbourne Uni	5 min
901	Dandenong	Chisholm TAFE	7.5 min
301	Reservoir	La Trobe University	10 min

Notes: 1. Peak service headway for Route 601 reduces to only 2 minutes – in the time it takes to fill a bus, it leaves and there is already another bus picking up left over passengers
2. The service to Melbourne Uni from Victoria Park was supplemented on 20 September 2021 with an additional six services per hour every weekday.

Whilst Route 301 is the flagship bus connection to train services, Routes 250, 350, 550, 548, 551, 301, 382, 561 and 566 serve the precinct with a range of frequencies and directness. Figure 62 shows that frequencies are generally 10-20 minutes or worse.

Figure 62: Routes frequencies for services to La Trobe University



Source: PTV with M&PC analysis

A similar analysis of bus services connecting Heidelberg and Doncaster found that frequencies had not increased since 1984 – in fact service levels had gone down over the last 30 years despite significant population growth. The disparity between service frequencies between LTU and Monash University (as alluded to in Table 37 above) is further expanded on in Figure 62 below.

Despite LTU being 5km (25%) closer to the Melbourne CBD than Monash University, the network and service level imbalance results is Monash University having (in effect) a much larger public transport catchment. This makes Monash University more attractive to potential graduates and puts LTU at a competitive disadvantage.

4.2.2 Reliability

Route reliability for the key services to LTU / NEIC are shown in Table 38.

Table 38: Reliability data for key routes serving LTU / NEIC

Route	% of services on time
250	90.3%
301	Data not available
350	85.4%
382	82.8%
548	95.0%
550	99.2%
551	98.9%
561	97.8%
566	93.5%
All Metropolitan routes (for reference)	93.0%

Source: PTV NetBI Metropolitan Bus Performance (Nov 2020 to Nov 2021)

Section 3.3 (Smartbus exiting service and patronage review) discussed how, generally, reliability is a function of the congestion experienced in the areas that routes operate in, and the level of bus priority along the route. The lower levels of reliability for Routes 350 and Route 382 are believed to reflect the operating conditions of each route. Route 350 reliability would be improved once the Hoddle Street bus lanes are made full time. For Route 382, reliability would be improved through our recommendation to realign via Science Drive (see section 4.5).

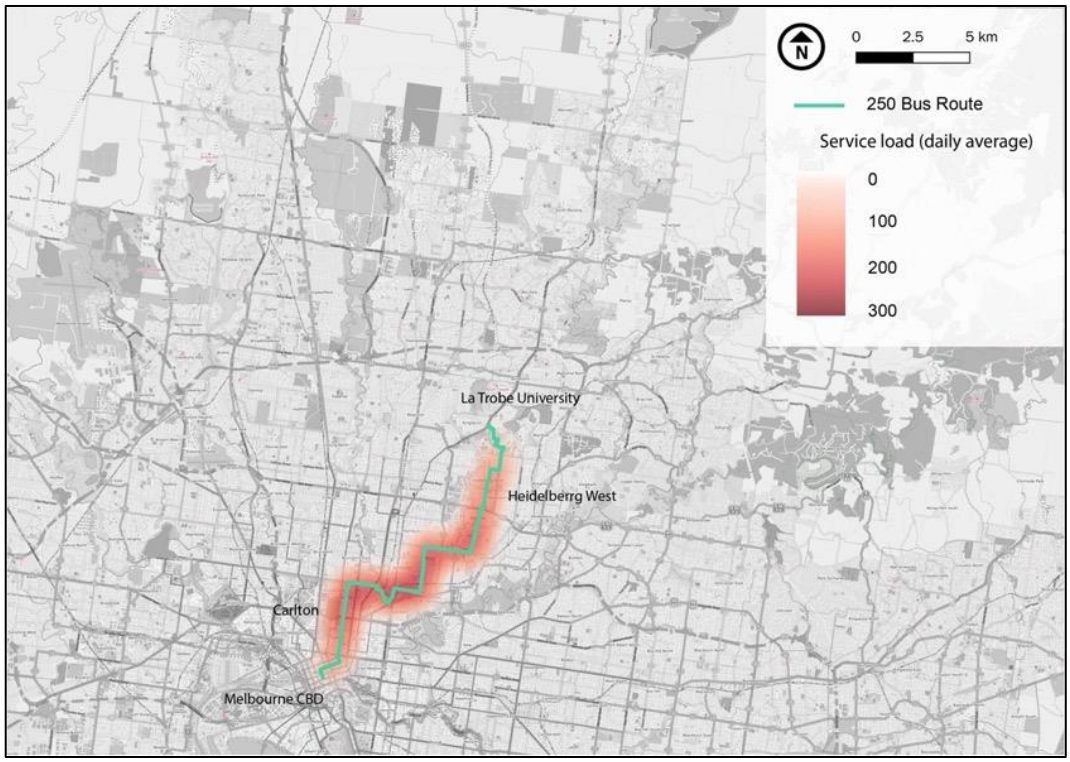
4.2.3 Patronage

Patronage analysis was conducted for routes servicing La Trobe University, using data for average service loads and average boardings per hour provided by DoT.

Route 250 Patronage Review

Route 250 runs from Melbourne CBD (Queen Street) to La Trobe University and had a total annual patronage of 574,000 in 2018-19 (across the entire route). The highest loads are in the middle of the route, from Carlton (outside the study area) to Northcote. Loads are lightest along the section from Heidelberg West to La Trobe University, as well as at the terminus in Melbourne CBD. Figure 63 shows the average loading per weekday service in 2018-19.

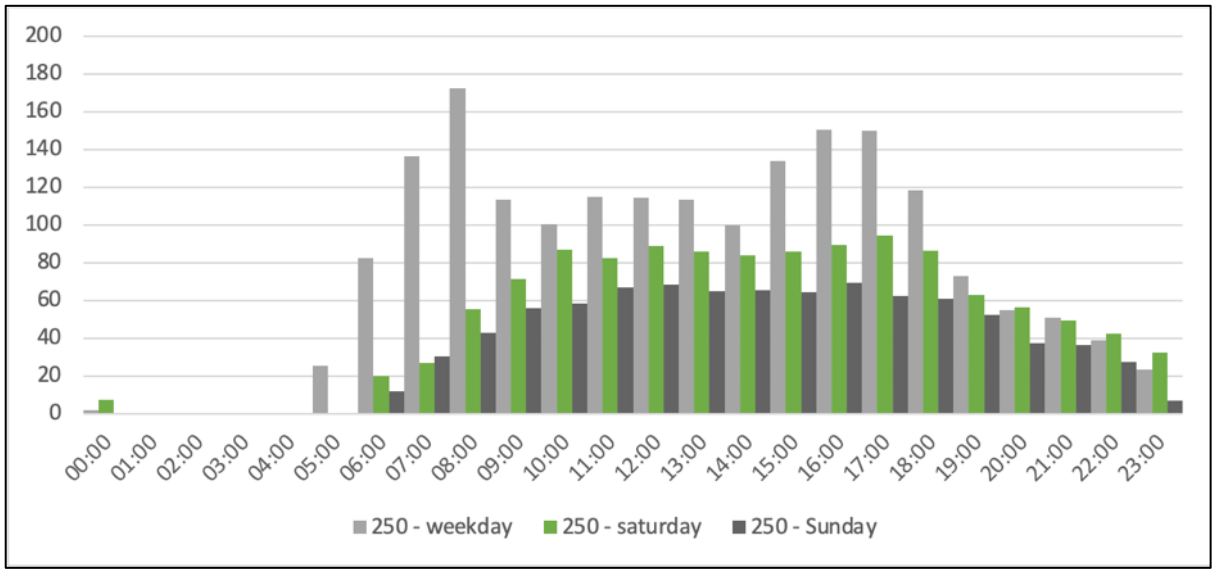
Figure 63: Route 250 average loading per service 2018-19 (Weekday)



Source: DoT with M&PC analysis

Figure 64 shows the daily average patronage for Route 250 by time of day. On an average weekday, patronage is highest from 07:00-09:00 (AM Peak) and 16:00-18:00 (PM peak). Patronage is slightly higher on Saturday than on Sunday. Patronage is fairly level across Saturday from 10:00-19:00, with slight peaks from 12:00-13:00 and 17:00-18:00. Patronage is also fairly level on Sundays from 11:00-18:00.

Figure 64: Route 250 daily average patronage 2018-2019

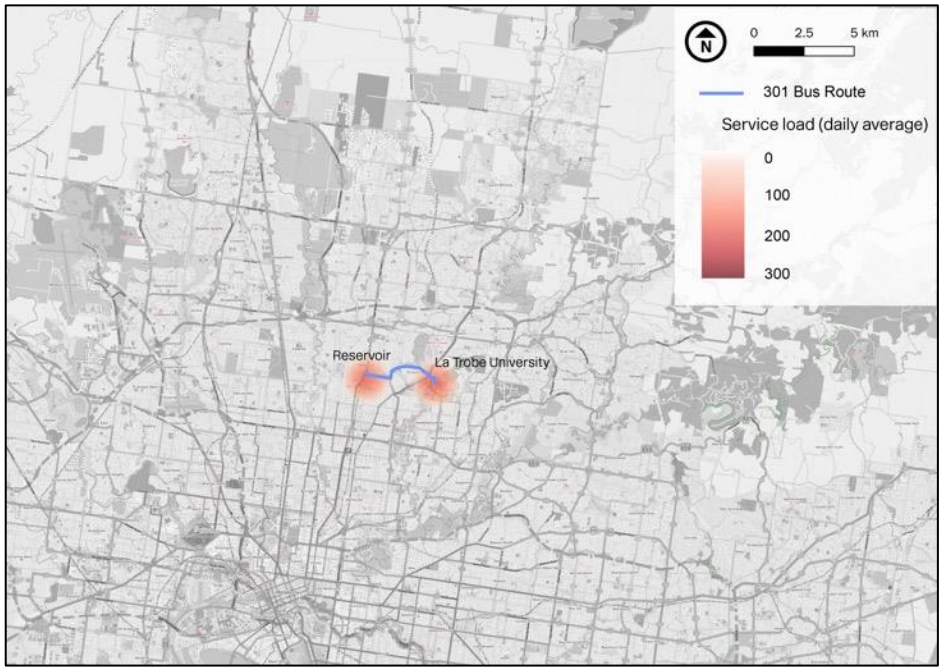


Source: DoT with M&PC analysis

Route 301 Patronage Review

Route 301 is an express shuttle service which connects Reservoir Station directly to La Trobe University. The service only runs on weekdays during the university semester. The route had an annual patronage of 282,000 in 2018-19. Figure 65 shows that Route 301 had even loads between Reservoir Station and La Trobe University which is unsurprising, given that it is a direct service between the two stops.

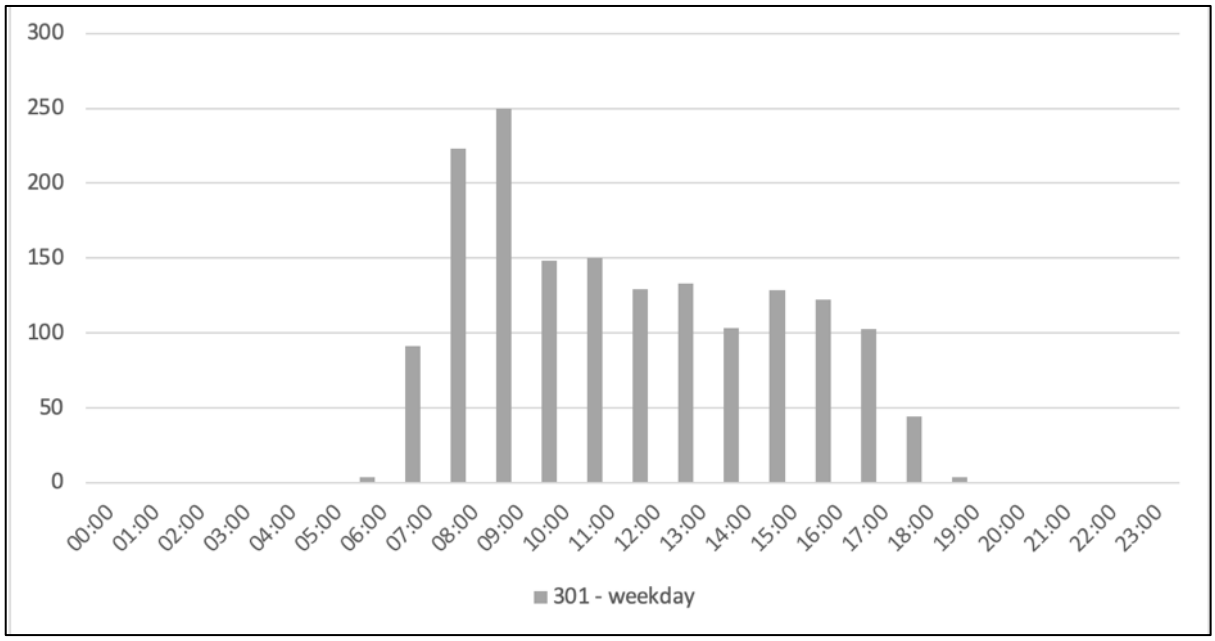
Figure 65: Route 301 average loading per service 2018-19 (Weekday)



Source: DoT with M&PC analysis

Figure 66 shows the daily average patronage for Route 301 by time of day. On an average weekday, patronage is highest from 08:00-10:00 (AM Peak), with patronage markedly lower the rest of the day (as would be expected, if a peak of patronage was generated by students attending lectures, with departure times back to Reservoir being more spread across the traffic day). Patronage at the tails of the day are zero, given the timetable does not run early or late.

Figure 66: Route 301 daily average patronage 2018-2019

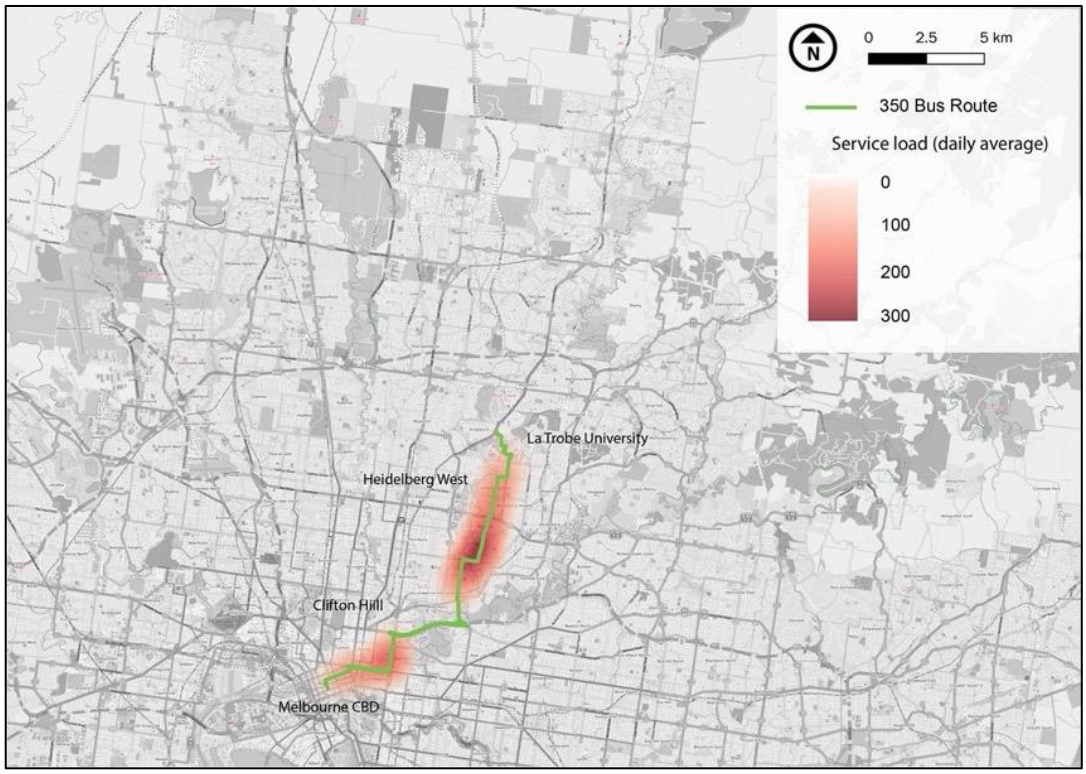


Source: DoT with M&PC analysis
Note: Route 301 does not operate on Saturday or Sunday

Route 350 Patronage Review

Route 350 runs from Melbourne CBD to La Trobe University via the Eastern Freeway, and only operates on weekdays. Annual patronage was 200,000 in 2018-19 across the entire route. Figure 67 shows that Route 350 had the highest service loads in Bellfield and Ivanhoe, with the rest of the route also relatively well-performing. As previously noted, loadings shown are departure loads at the stop level and hence the express section of the service along the Eastern Freeway, which has no stops, shows as having zero loading.

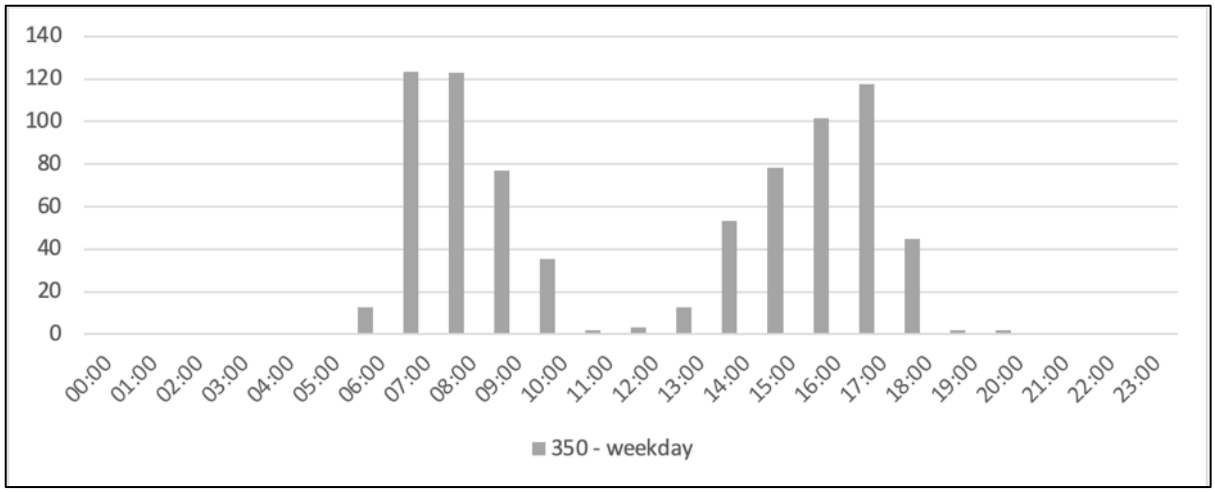
Figure 67: Route 350 average loading per service 2018-19 (Weekday)



Source: DoT with M&PC analysis

Figure 68 shows the daily average patronage for Route 350 by time of day. Route 350 runs a limited service in the interpeak, with no services leaving La Trobe University from 10:09 to 13:54. On an average weekday, patronage is highest from 07:00-09:00 (AM Peak) and 17:00-18:00 (PM peak), with patronage markedly lower the rest of the day.

Figure 68: Route 350 daily average patronage 2018-2019

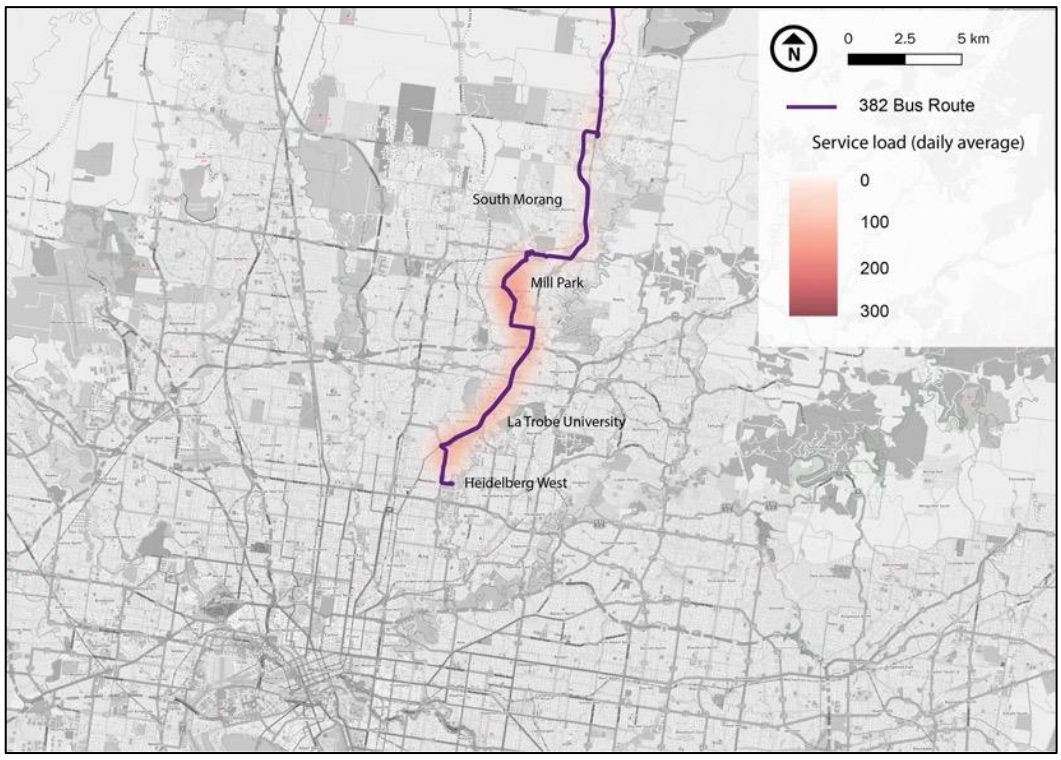


Source: DoT with M&PC analysis
Note: Route 350 does not operate on Saturday or Sunday

Route 382 Patronage Review

Route 382 runs from Northland Shopping Centre to Whittlesea, servicing La Trobe University with a bus stop on Plenty Road (near the Tram Stop) that requires a 12-minute walk to reach The Agora. The annual patronage was 388,000 from 2018-19 across the entire route. Figure 69 shows that average loads are highest in Mill Park, but there is a fairly small deviation in average loads between Heidelberg West and Mill Park. Average loads are extremely low past from South Morang onwards to Mernda.

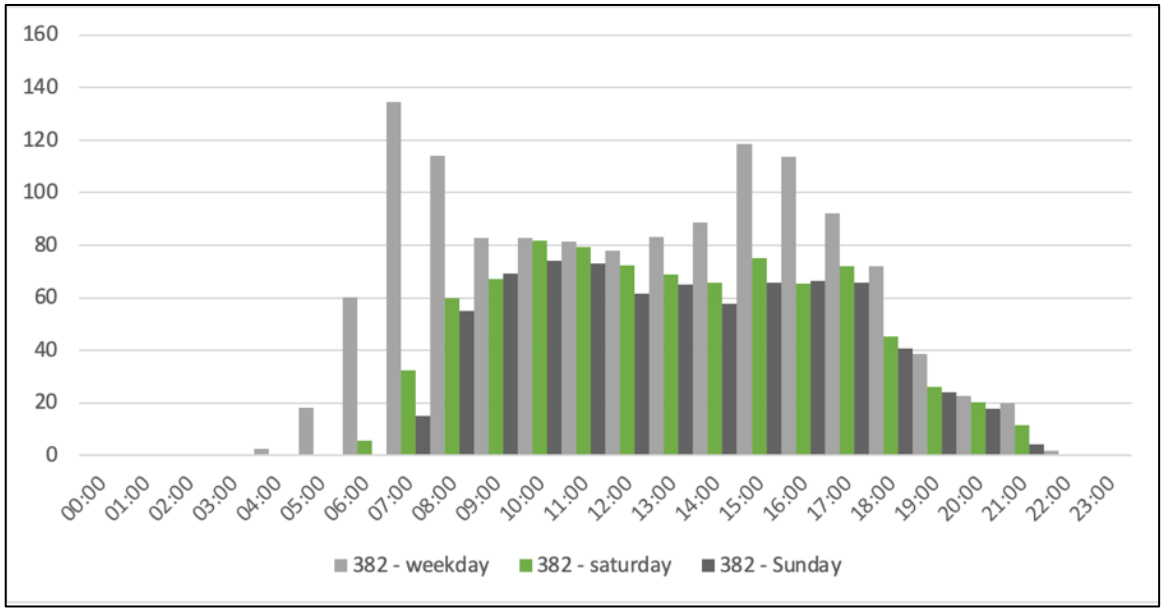
Figure 69: Route 382 average loading per service 2018-19 (Weekday)



Source: DoT with M&PC analysis

Figure 70 shows the daily average patronage for Route 382 by time of day. On an average weekday, patronage is highest from 07:00-09:00 (AM Peak) and 15:00-17:00. Patronage is very similar on Saturdays and Sundays. Patronage is fairly level across Saturday and Sunday from 10:00-18:00.

Figure 70: Route 382 daily average patronage 2018-2019

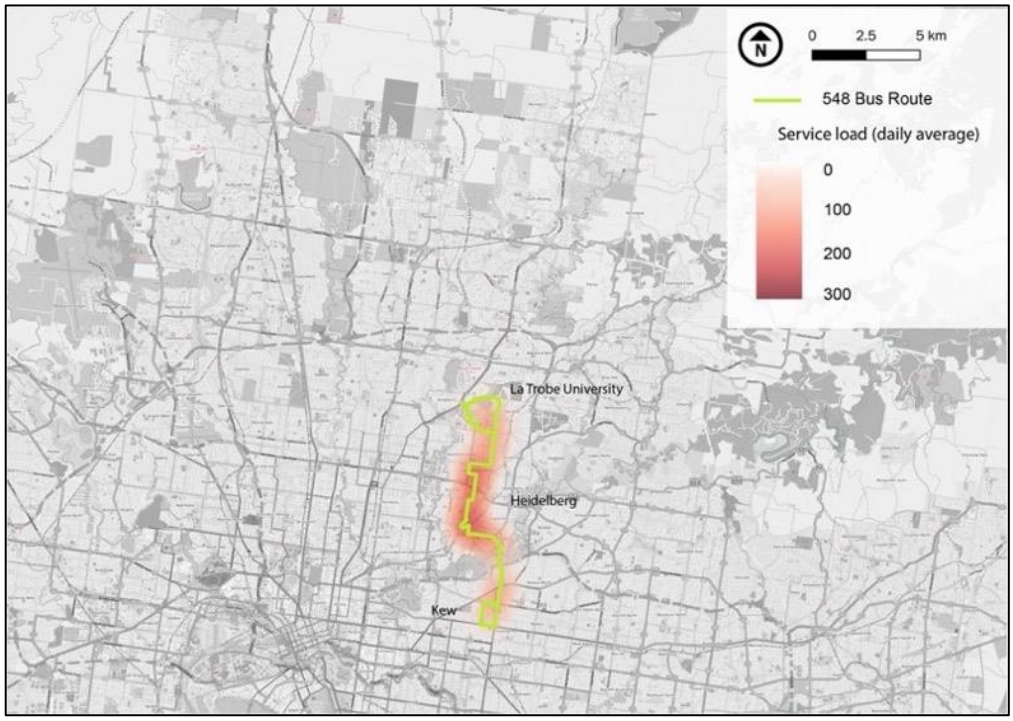


Source: DoT with M&PC analysis

Route 548 Patronage Review

Route 548 runs from Kew to La Trobe University on weekdays and Saturdays. It had an annual patronage of 289,000 in 2018-19 across the entire route. Figure 71 shows the average loads were highest from Ivanhoe to Heidelberg Heights, with the lowest loads in Kew (outside the study area).

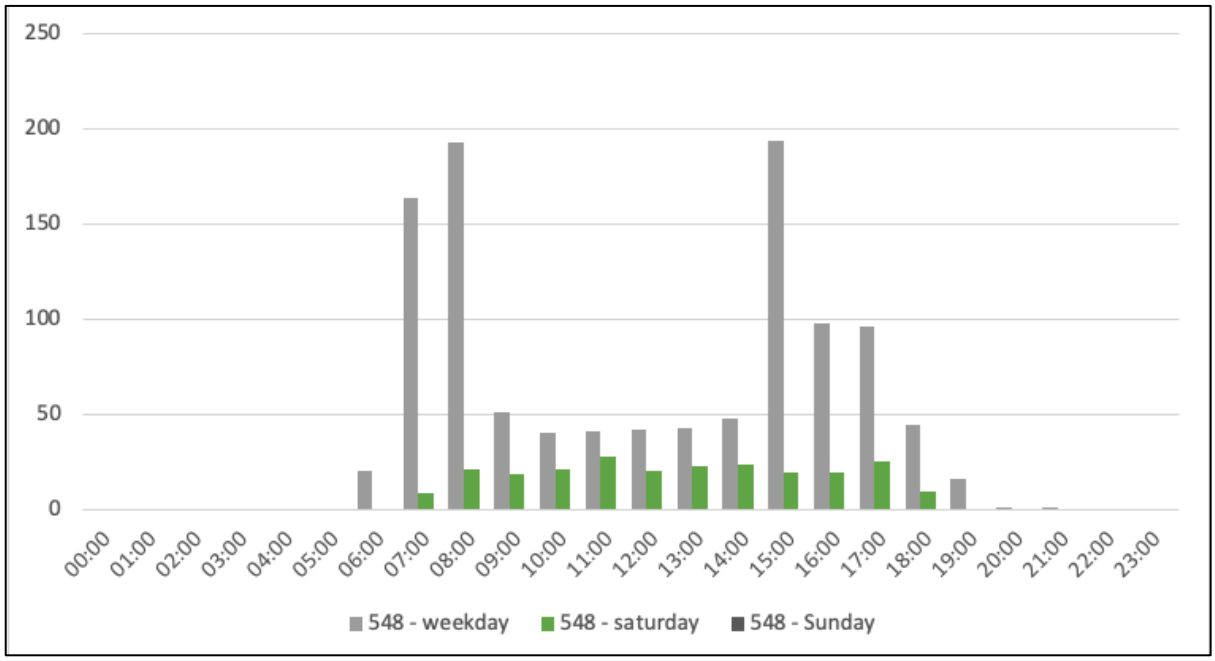
Figure 71: Route 548 average loading per service 2018-19 (Weekday)



Source: DoT with M&PC analysis

Figure 72 shows the daily average patronage for Route 548 by time of day. Route 548 does not operate on Sundays. On an average weekday, patronage is highest from 07:00-09:00 (AM Peak) and 15:00-16:00, with patronage significantly lower the rest of the day. Patronage is low but stable on Saturday, with a slight peak from 11:00 to 12:00.

Figure 72: Route 548 daily average patronage 2018-2019

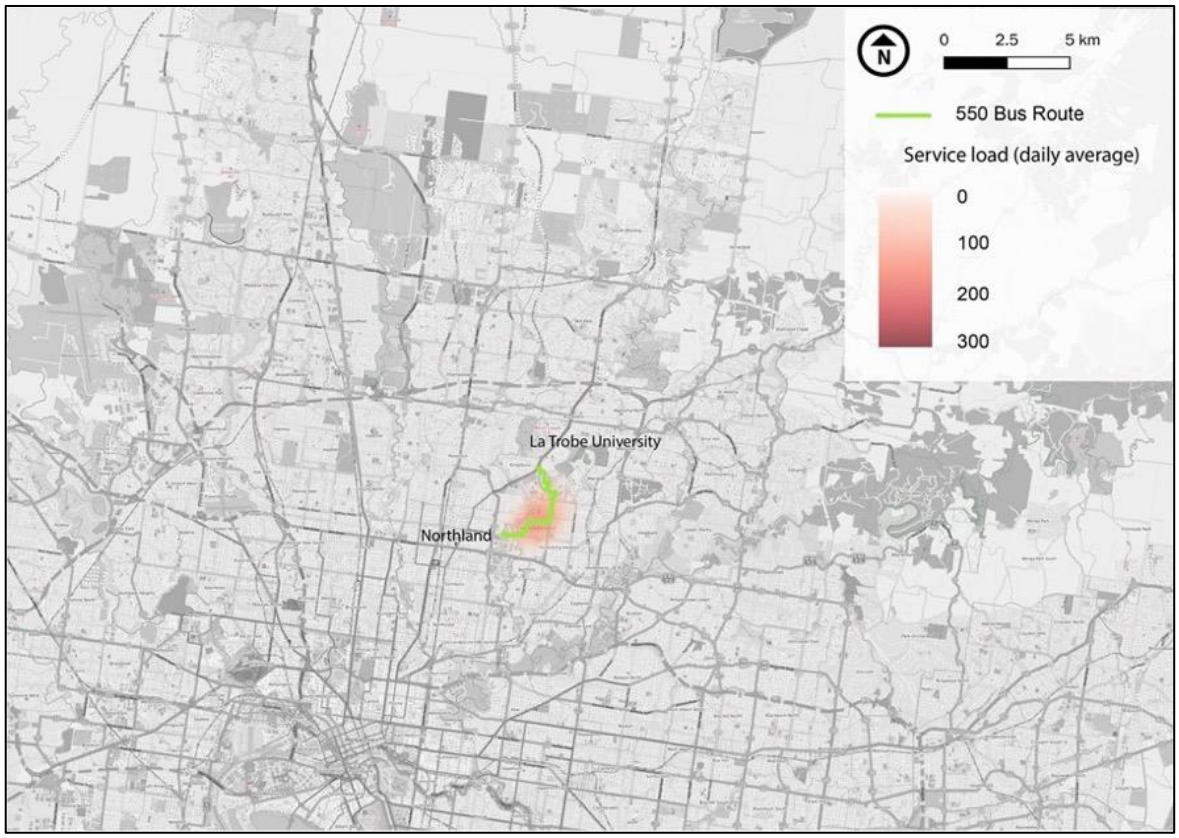


Source: *DoT with M&PC analysis*
Note: *Route 548 does not operate on Sunday*

Route 550 Patronage Review

Route 550 runs from Northland Shopping Centre to La Trobe University and had an annual patronage of 58,000 in 2018-19 across the entire route, making it the least patronised of all routes servicing La Trobe University. Figure 73 shows that average loads are fairly consistent across the route, with a slight increase in Heidelberg West.

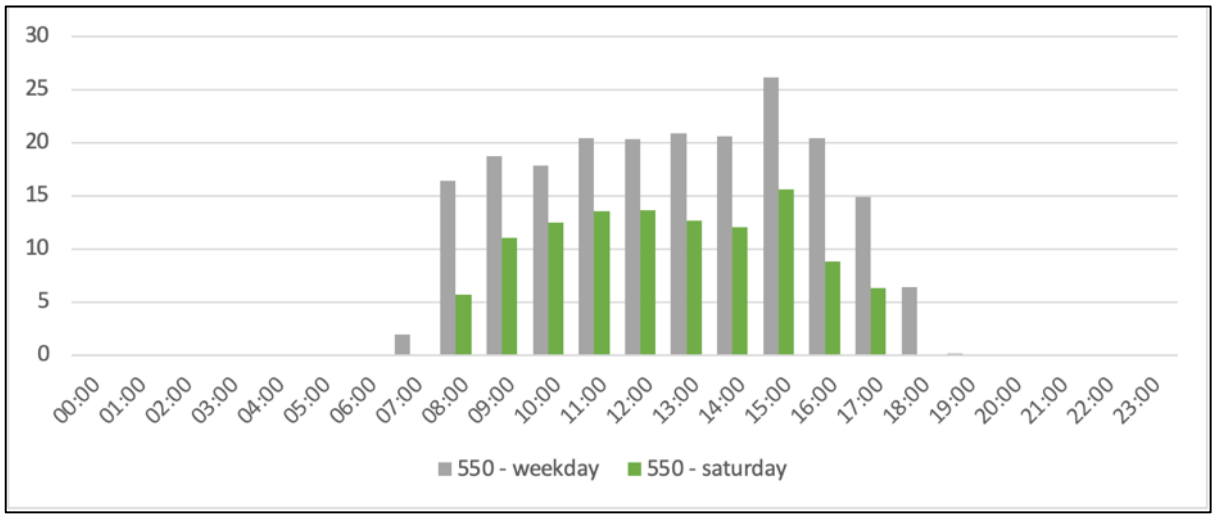
Figure 73: Route 550 average loading per service 2018-19 (Weekday)



Source: DoT with M&PC analysis

Figure 74 shows the daily average patronage for Route 550 by time of day. Route 550 does not operate on Sundays. On an average weekday, patronage is highest from 15:00-16:00, with patronage otherwise fairly level between 10:00-17:00. Patronage is not significantly lower on Saturday than on weekdays. Patronage is also highest between 15:00-16:00 and is otherwise fairly level between 10:00-14:00.

Figure 74: Route 550 daily average patronage 2018-2019

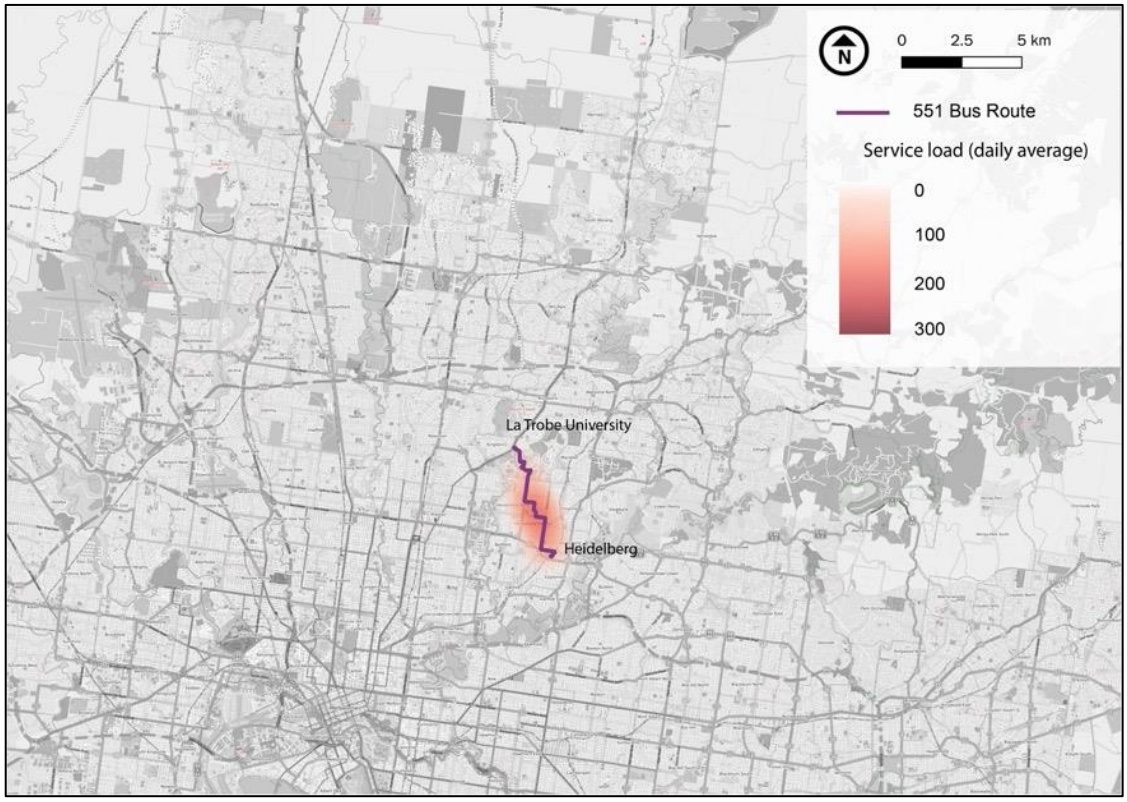


Source: DoT with M&PC analysis

Route 551 Patronage Review

Route 551 runs from Heidelberg to La Trobe University and had an annual patronage of 127,000 in 2018-19 across the entire route. Figure 73 shows that average loads are highest between Heidelberg and Heidelberg West, with lower loads at La Trobe University.

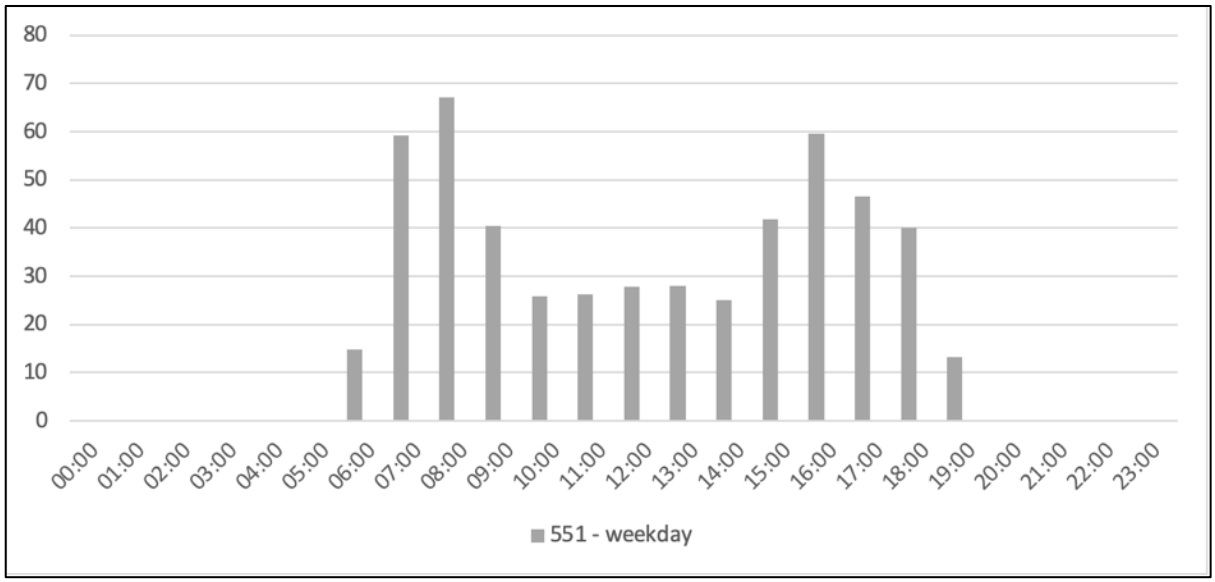
Figure 75: Route 551 average loading per service 2018-19 (Weekday)



Source: DoT with M&PC analysis

Figure 74 shows the daily average patronage for Route 551 by time of day. Route 551 does not operate on Saturdays and Sundays. On an average weekday, patronage is highest from 07:00-09:00 (AM Peak) and 16:00-17:00 (PM Peak), with patronage significantly lower in the interpeak.

Figure 76: Route 551 daily average patronage 2018-2019



Source: DoT with M&PC analysis

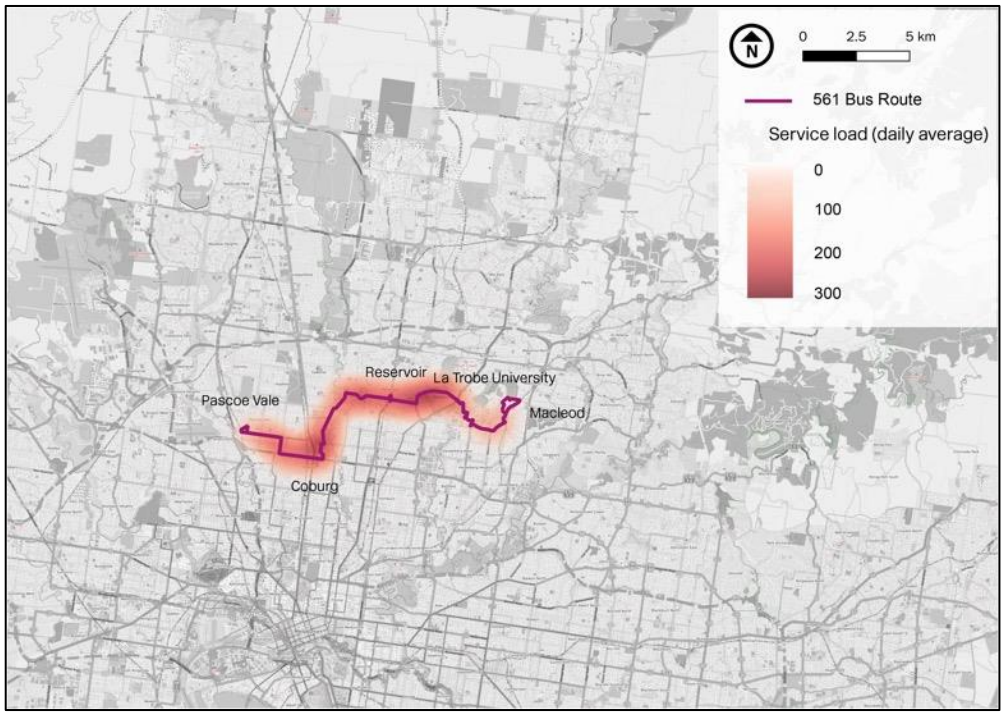
Note: Route 551 does not operate on Saturdays and Sundays

Route 561 Patronage Review

Route 561 runs from Pascoe Vale to Macleod via La Trobe University, and the annual patronage was 799,000 in 2018-19 for the entire route. It is worth noting that Route 561 operated only between Reservoir and Macleod until 2011 when it was extended to Coburg. It was only extended to Pascoe Vale in 2016.

Figure 77 shows that average loads are fairly consistent across the route, with a slight peak in Coburg and Bundoora, where La Trobe University is situated. Average loads are lowest in Macleod.

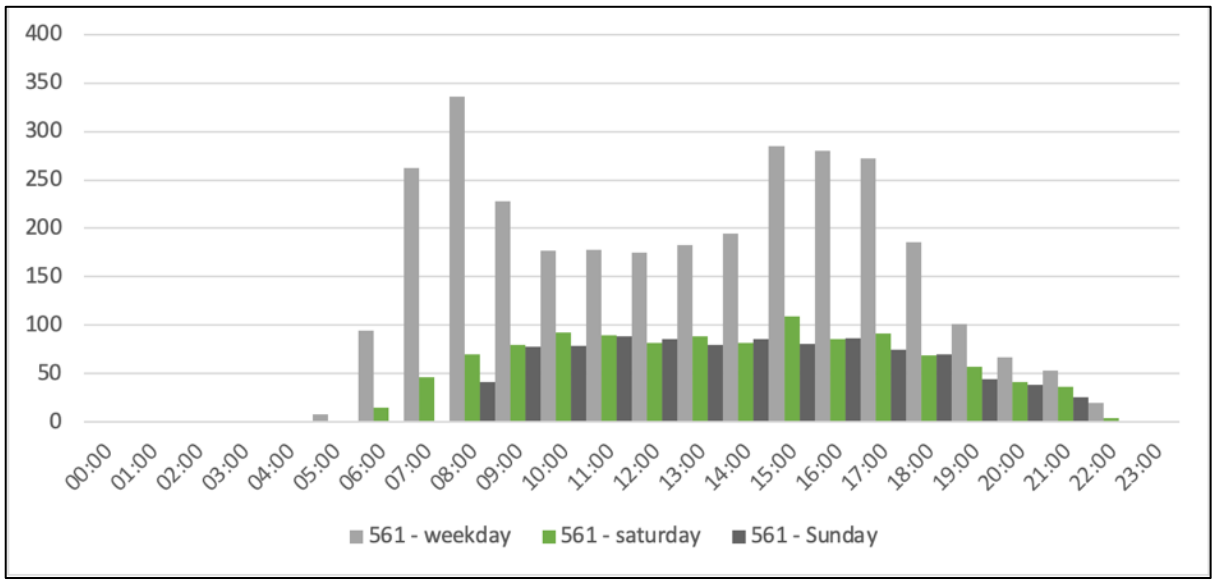
Figure 77: Route 561 average loading per service 2018-19 (Weekday)



Source: DoT with M&PC analysis

Figure 78 shows the daily average patronage for Route 561 by time of day. On an average weekday, patronage is highest from 08:00-09:00 (AM Peak) and 15:00-18:00 (PM Peak), with fairly level patronage during the interpeak. Patronage on Saturdays and Sundays are similar, with patronage highest from 09:00-18:00. On Saturdays, there is a slight peak in patronage from 15:00-16:00.

Figure 78: Route 561 daily average patronage 2018-2019

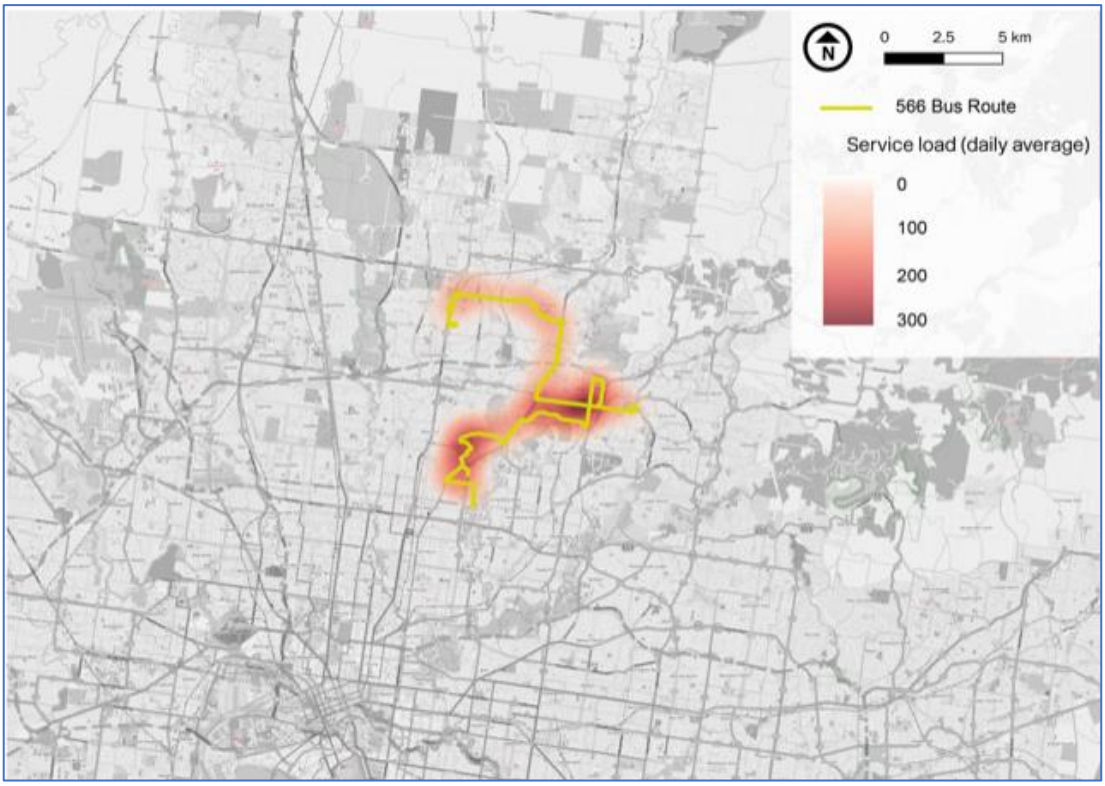


Source: DoT with M&PC analysis

Route 566 Patronage Review

Route 566 runs from Northland Shopping Centre to Lalor, servicing La Trobe University (although the bus stop is on Plenty Road near the Tram Stop with a 12-minute walk to reach The Agora). The annual patronage was 578,000 in 2018-19 across the entire route. Figure 79 shows that average loads are highest in Watsonia, followed by the section from Kingsbury to Reservoir. Average loads were lightest from Bundoora (past La Trobe University) to Lalor.

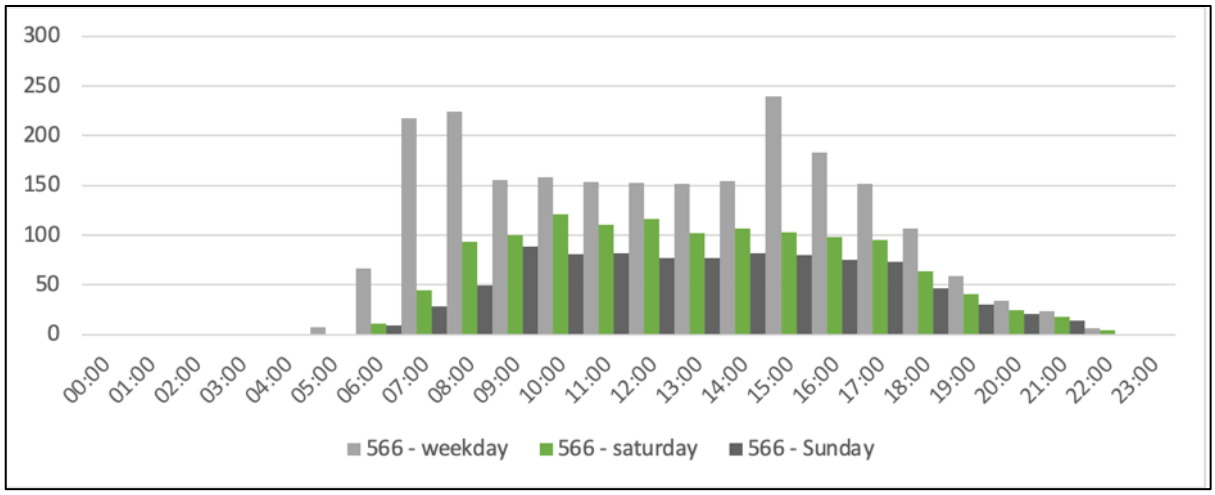
Figure 79: Route 566 average loading per service 2018-19 (Weekday)



Source: DoT with M&PC analysis

Figure 80 shows the daily average patronage for Route 566 by time of day. On an average weekday, patronage is highest from 07:00-09:00 (AM Peak) and 15:00-16:00, with otherwise fairly level patronage from 09:00-18:00. On Saturday, patronage is highest from 10:00-13:00, and is otherwise fairly level from 09:00-18:00. Patronage on Sunday is highest from 09:00-10:00, with patronage fairly level from 10:00-18:00.

Figure 80: Route 566 daily average patronage 2018-2019



Source: DoT with M&PC analysis

4.2.4 Growth and future context

Whilst the analysis above highlights the extent of current issues, LTU has significant growth plans. A new University City ($5 billion investment) is being fast-tracked and is expected to result in an additional 12,000 residents, 40,000 students and 20,000 employees located on the campus. As well as having a mixed-use Town Centre, the Research and Innovation Precinct would be expanded and a Sports Precinct developed (as home of the Matildas and Rugby Victoria).

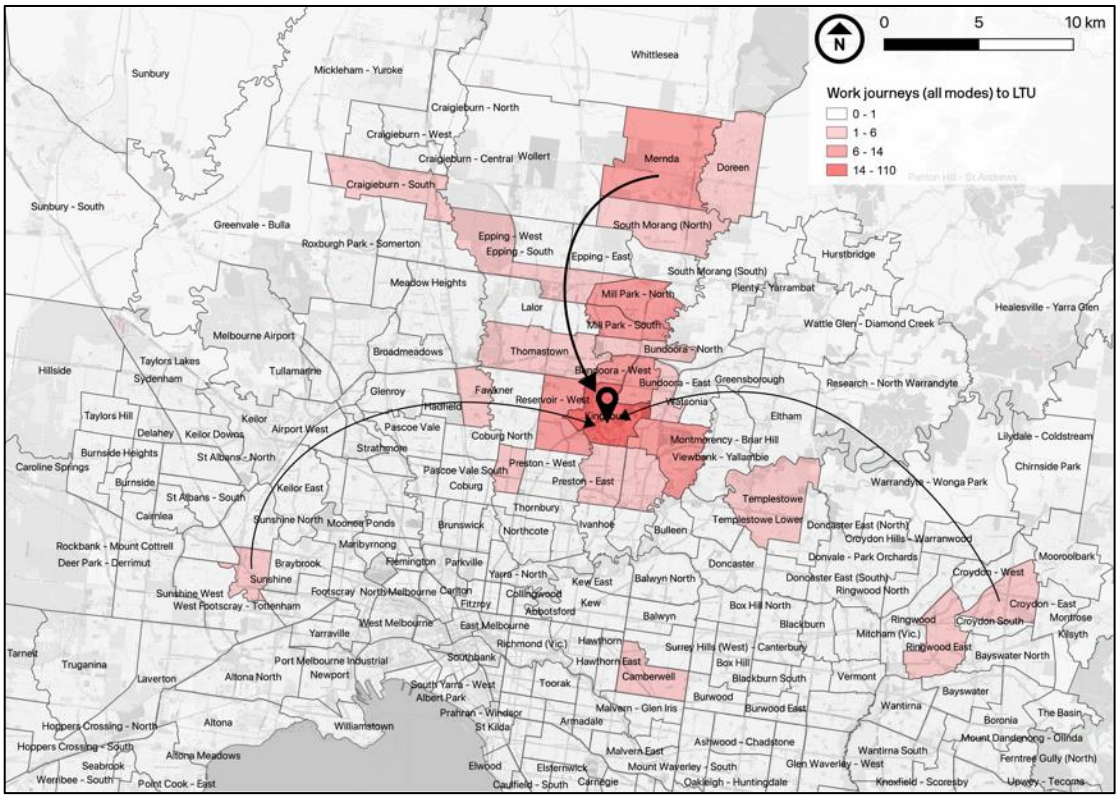
Clearly if public transport is not improved to the precinct, transport options, traffic congestion and delays in the wider network will worsen further.

4.3 Origin patterns and missing links

Figure 62 in section 4.2 above shows the limited number of direct trips that can be made to LTU by public transport. In particular, there is a lack of connectivity from the north west into the LTU campus. There are no direct connections that can be made by public transport between the area to the north west of the Bundoora campus, and the campus itself. Any trip would rely on one or more connections being made before the campus could be reached. Areas without a direct connection include Campbellfield, Mill Park, Reservoir, Thomastown, Epping, Lalor and South Morang. Poor accessibility due to a lack of direct connectivity between many parts of Whittlesea and LTU will only worsen as Whittlesea continues to grow.

In assessing the origin patterns of trips, we have examined the origin of journey to work trips captured within Census data (see Figure 81 below). However, it is noted that origin of journey is not collected for education trips (which are critically important to LTU). Figure 81 shows that whilst there are a work trips originating from most points, there is a particular focus on the north, north-west and south / south-east.

Figure 81: Origin of work journeys to La Trobe University / NEIC



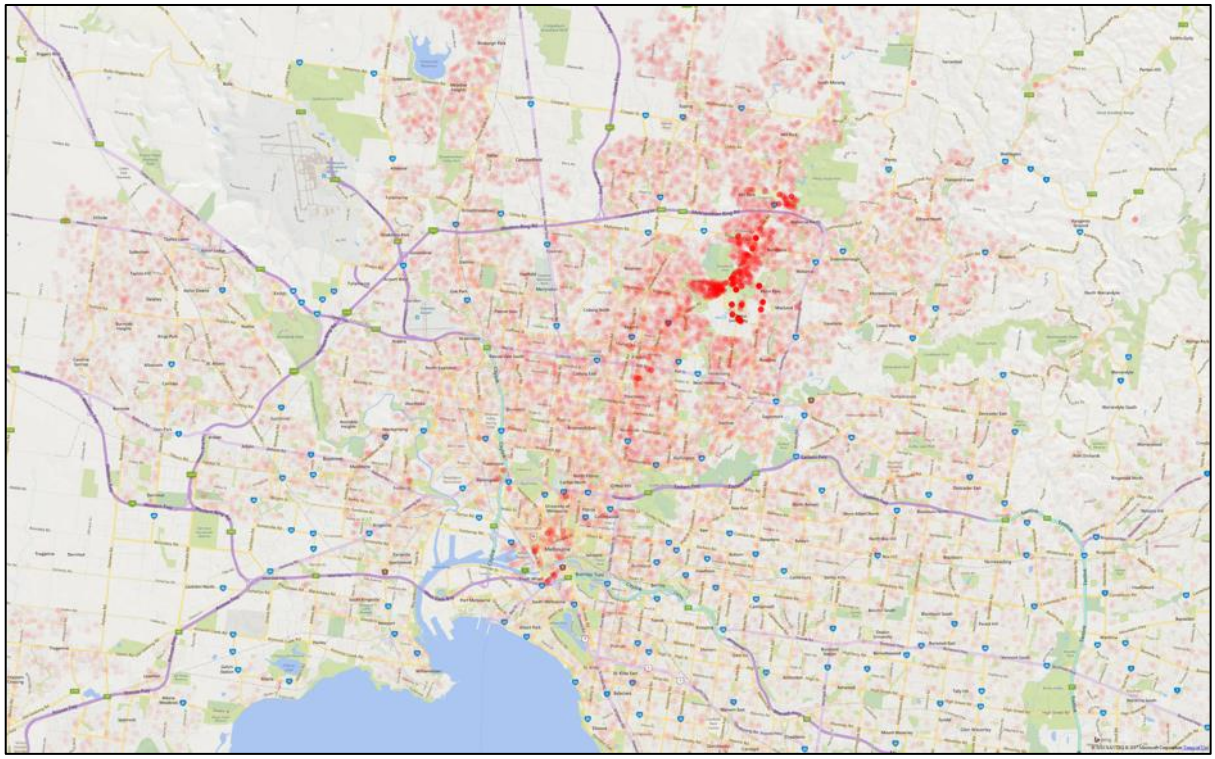
Source: ABS (2016)

In previous studies we have carried out an analysis of student and staff patterns of travel for LTU (see Figure 82). Over 5,000 staff and students live in eastern and south-eastern Melbourne and commute to LTU - let alone other sites within the La Trobe NEIC. Around 3,000 of the students reside within a reasonable public transport catchment; this includes many hundreds of students who live in Montmorency, Rosanna, Viewbank and Yallambie that do not have direct public transport access to LTU (despite its close proximity).

These poor public transport connections lead to a reliance on car as the mode used for accessing LTU (as shown in Figure 83 below). The result of this is that from south of the Yarra River to LTU, there are 2,000-3,000 cars on Banksia St, Heidelberg each day heading to LTU[13]. This is equivalent to 1.5 lanes of free-flowing traffic for an hour.

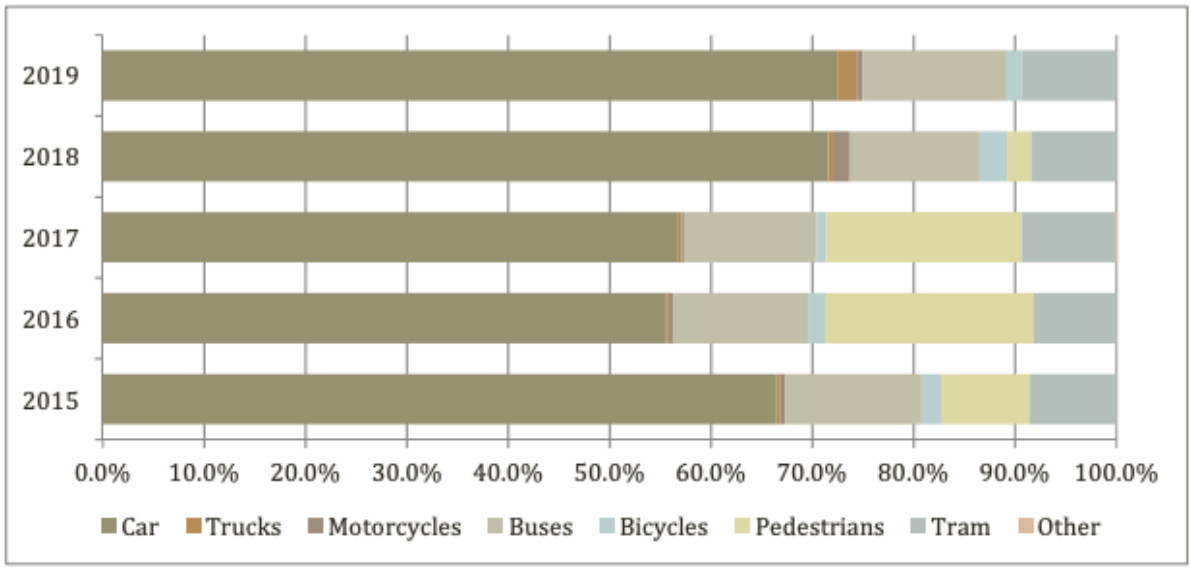
[13] M&PC analysis for LTU

Figure 82: Heat map of LTU students place of residence



Source: LTU data with M&PC analysis

Figure 83: Mode of access to LTU Bundoora campus



Source: LTU analysis

Whilst Box Hill and Doncaster are accessible transport hubs in the east, travel from Box Hill or Doncaster to LTU takes well over 60 minutes by public transport (compared to just over 20 minutes by car). A key reason for such poor travel times on public transport is the need to transfer multiple times – there is a lack of direct services between Box Hill /

Doncaster and LTU. The need to transfer between infrequent services significantly reduces mode share for public transport trips from these eastern areas to LTU.

Route 903 is the only significant public transport service to connect between the two train lines on either side of the Yarra River – but it does not serve LTU. Route 903 also has frequent stops and lacks priority at some key intersections such as along Banksia Street and Manningham Road. There is a need for a direct connection between LTU and Box Hill Station (as evidenced by the development of the SRL project). It is not feasible to redirect Route 903 (due to high volumes of through passengers in Heidelberg and Preston) and therefore a new connection (such as that offered by SRLB) needs urgent consideration.

There is the potential for a new connection between LTU and Box Hill/Doncaster to run express along the Eastern Freeway Busway, which will be delivered with the North East Link (NEL). A direct, rapid connection between Box Hill, Doncaster and LTU will significantly improve cross-Yarra connectivity and reduce the amount of car trips made into the northern metropolitan region to access education and employment. However, the current design of the busway does not facilitate easy access by buses to or from LTU or towards Box Hill. The complexity involved with accessing the busway means that it provides marginal benefit (if any) for the SRLB concept.

Route 548 connects Mont Park and La Trobe University to Deepdene. It is the only route crossing the Yarra River on Burke Road and terminates just 3km south of the river. As a result, it does not provide direct connectivity to LTU for key regional destinations including Camberwell or the heart of the Kew schools area.

4.3.1 Summary of missing links

Missing links within the North

The key areas which are badly served by public transport for accessing LTU are:

- Campbellfield, Mill Park, Reservoir, Thomastown, Epping, Lalor and South Morang
- Montmorency
- Rosanna
- Viewbank
- Yallambie

Cross-regional missing links

- Box Hill
- Doncaster
- Many parts of Melbourne south of Kew, including Hawthorn and Camberwell

4.4 Improving connectivity from train stations to LTU

In this section, we assess the best way to improve connectivity from train stations to LTU.

A key starting point is to increase frequency of the existing Route 301 express shuttle. The service level needs to be increased to be on a par with other key links to universities (as discussed in section 4.2) as the first priority.

Secondly, Route 301 needs to operate for a longer span of hours, and needs to operate on all days of the year (not just during the teaching semester). The current timetable disregards highly important work of researchers and private sector companies such as Rio Tinto who also rely on the express bus connections to ensure smooth access for employees.

The connection from Melbourne CBD to LTU previously suffered from having too many options (all of which were average at best). The result was that anybody travelling out from the CBD had to look through seven different potential public transport connections to determine which would be the best at any given time of day. Spreading resources and effort over many train stations will make the network more confusing, frustrating passengers and diminish the potential to achieve a really excellent outcome through one specific corridor.

The current focus on Reservoir as the key train connection point relates to the proximity of the station, frequency of services (now and future), catchment of the corridor (now and future) and links to the broader catchment including the future geographic catchment that relies on La Trobe University as their closest university.

However, the existing connections to other train stations including Fairfield, Heidelberg, Greensborough, Ivanhoe and Macleod will remain and can be improved in alignment with other specific needs such as connections to other regional bus routes and the Austin Health node at Heidelberg.

In particular an express connection to Heidelberg is important for the function of the La Trobe NEIC, and express services beyond to Doncaster and Box Hill are important for providing connections to the employee and student catchments to the east. These express services mimic the SRL (as discussed in SRLB) and by serving La Trobe University will significantly reduce traffic congestion around the Heidelberg and Rosanna.

4.5 Connectivity improvements

There has traditionally been poor coordination of bus network planning on each side of the Yarra River. This has resulted in weak cross-Yarra connectivity, significantly impeding access to education for the thousands of LTU students who live in Melbourne's eastern suburbs, from Kew and Hawthorn to Doncaster and Box Hill.

The lack of public transport connectivity forces many students and staff from Melbourne's east to drive to LTU (due to a 200-300% difference in travel time). This forced driving, significantly increases traffic congestion on key arterial roads in the northern metropolitan region, such as Banksia Street. On some days the lack of direct public transport to LTU from Melbourne's east could be the only thing causing the traffic congestion in Heidelberg, given that thousands of students are trying to use a road network with a total capacity of under 2,000 cars in the peak hour.

A holistic view of the bus network which includes cross-regional connectivity is crucial to reducing traffic congestion in the northern metropolitan region, and making more road space available to those that need to be driving.

This cross-regional approach is critical to increasing the sustainability of the north's transport network, and growing the ability of LTU to attract the top talented staff and students.

Another important way to reduce local traffic congestion is to better serve local LTU catchments in:

- Bundoora (by realigning Route 566)
- Mill Park (by realigning Route 382)
- Yallambie and Viewbank (by realigning Routes 513 and 517)

Traffic congestion in the Chandler Highway corridor through Fairfield can be reduced by extending bus Route 609 to LTU and providing a longer service span and higher frequency. This link is a key north south connection across the Yarra River, yet it only has five bus services per day in each direction.

To the north there is an opportunity to connect Route 343 onto Route 513 at Greensborough and then redirect the route to LTU. This would significantly improve connections to LTU from the Greensborough, St Helena and Diamond Creek areas.

A small time benefit can also be gained for passengers on Route 561 if the route is realigned to Murray Road and Gaffney Street through Coburg (serving Batman Station rather than Coburg Station). This would reduce the time to connect with Pascoe Vale Station on the Craigieburn line by about 5 minutes of travel time in each direction.

4.6 Summary of recommendations

Based on our analysis, we suggest the improvements outlined in

Table 39.

Table 39: Improvement recommendations for La Trobe University / NEIC

Improvement option	Rationale
Higher frequency Route 301 and all year operation (not stopping in mid-semester breaks)	• Improve connectivity (and specifically service span) for the key route into the campus, bringing LTU more in line with competitors (such as Monash)
Extend Route 301 to Heidelberg Station	• Extending Route 301 to reach a station on the Hurstbridge Railway line can significantly improve access to La Trobe NEIC for people in Melbourne's east and north east, addressing the poor linkages at present. There may be opportunities to reallocate resources from Route 551 to support this extension
Realign Route 382 via Science Drive, and replace Route 550 link to Northland. Consider operating express between LTU and RMIT Bundoora	• Realigning Route 382 to travel via Science Drive would significantly improve the regional connectivity to LTU from the north as the bus links to a larger catchment than Tram Route 86 and provides a direct connection to campus from beyond Mernda • This realignment would allow for the removal of Route 550 with associated cost savings; there would be a small disbenefit for existing customers travelling on to Northland on Route 550 but this is estimated to be only 2 mins extra journey time
Investigate new route serving LTU from Yallambie, Viewbank and Lower Plenty (or realign Route 517)	• The catchment east of Macleod Station has no direct public transport connection to LTU and the trip can require three bus trips to cover a short distance that would only take 10-15mins by car
70m northbound queue jump bus lane (Waterdale Road at Kingsbury Dr)	• As discussed in Section 2 (SRLB) of the report, this would improve bus priority for the SRLB as well as for services in the LTU area in general
Implement SRLB	• The lack of regional connectivity highlighted in section 2 of this report shows SRLB would be beneficial to LTU, particularly in providing express connections to Box Hill Transit Interchange, and across to key northern growth areas via Broadmeadows. • It is noted Route 301 between Reservoir and LTU is an express bus service that currently provides the link envisaged in SRLB
Connect Routes 513G and 343; extend to LTU	• A minor change that should reduce costs while improving direct connections from north of Greensborough to LTU
Extend Route 609 to La Trobe NEIC and increase service frequency and span	• The link across the Yarra River on Chandler Highway is one of the poorest public transport connections in Melbourne with just five services per day. Extending Route 609 to LTU will give it a logical northern destination that attracts passengers. Increasing service levels to match the baseline standard 7 days per week is essential to meeting transport needs in the corridor

4.7 Costs and Benefits

Estimated costs and benefits for the improvement recommendations are shown in Table 40 below. Note that these are high-level estimates based on a series of underlying assumptions about current and future travel behaviour. It is anticipated that DoT would complete its own analysis of options prior to finalizing any changes.

Table 40: Improvement recommendations for La Trobe University / NEIC

Improvement option	Costs	Benefits
Improve Route 301 with higher frequency and operating all days of the year (not stopping during mid-semester breaks)	• Estimated that doubling of additional service during current operating hours would involve additional cost of $1.0m - $1.2m • Extending the service to operate all weekdays of the year would involve additional cost of $0.3m p/a to operate on weekdays every week of the year at existing frequency and service span (7am-7pm) • Extending the service span from 7pm-1am at existing frequency (every 10 minutes) and days of service (only in semester) is estimated to cost an additional $0.6m p/a	• Increasing the service level will increase the attraction of the route, making access to LTU easier and in the longer term, increasing enrolments • 2,100 increase in PT trips per day • 4,300 Vehicle-km of travel saved per day • $65,000 Congestion benefits p/a • $675,000 Safety benefits p/a
Extend Route 301 to Heidelberg Station	• Estimated cost would be $2.0m - $2.2m p/a • Capital cost is likely to be less than $0.1M for signage, bus wrap & marketing	• Increasing the service level will increase the attraction of the route, making access to LTU easier and in the longer term, increasing enrolments • 400 increase in PT trips per day • 3,700 Vehicle-km of travel saved per day • $55,000 Congestion benefits p/a • $580,000 Safety benefits p/a
Realign Route 382 via Science Drive, and replace Route 550 link to Northland	• Overall, this is expected to be cost neutral	• Slight reductions in end to end journey times for customers by bringing the route closer to campus • 10 increase in PT trips per day • 100 Vehicle-km of travel saved per day • $1,000 Congestion benefits p/a • $10,000 Safety benefits p/a

Improvement option	Costs	Benefits
Investigate a new route serving LTU from Yallambie, Viewbank and Lower Plenty (or realignment of Route 517)	• At this stage we recommend investigating a new route; as such, there is no detailed option to assess the costs of	• At this stage we recommend investigating a new route; as such, there is no detailed option to assess the benefits of
70m northbound queue jump bus lane (Waterdale Road at Kingsbury Dr)	• As per Section 2 (SRLB), it is estimated that capital costs that are under $100,000 would be involved	• Annual bus opex savings conservatively estimated at $32k • 10 increase in PT trips per day • 60 Vehicle-km of travel saved per day • $1,00 Congestion benefits p/a • $10,000 Safety benefits p/a
Implement SRLB	• See Section 2 (SRLB) of the report	• See Section 2 (SRLB) of the report
Connect Route 513G with Route 343 and extend to La Trobe University	• Estimated to deliver a cost saving of $0.1m - $0.3m p/a based on rationalisation of services	• This is conservatively assumed to deliver operational benefits only, rather than any direct customer benefits
Extend Route 609 to La Trobe NEIC and increase service frequency and span	• Bus costs estimated at $0.4m - $0.6m p/a • KM costs estimated at $0.9m - $1.1m p/a • Bus hourly costs estimated at $1.2m - $1.4m p/a	• Improved north-south connectivity, reducing travel times and increasing the attraction of LTU to students • 800 increase in PT trips per day • 4,600 Vehicle-km of travel saved per day • $70,000 Congestion benefits p/a • $725,000 Safety benefits p/a

5 Connecting Melbourne Airport

5.1 Overview

Melbourne Airport is located in the city of Hume, approximately 22km north-west of Melbourne CBD. It is a key employment hub, with over 20,000 jobs at present, and a forecast to double that by 2038. These employees are distributed across a sprawling estate of approximately 450Ha. The airport business park houses a range of businesses with shift workers who start and end shifts outside the typical '9 to 5' workday.

Some businesses in the area are key parts of the airport operation and others have no relationship to airport operations. The airport operates without curfew, 24 hours per day, 7 days a week. It is therefore important that a foundational public transport service is provided for Melbourne Airport employees and customers.

Pre-COVID, Melbourne Airport hosted 110,000 passengers per day, and post COVID recovery, this number is expected to grow by 100% in the next 20 years.

Melbourne Airport is wedged between the Sunbury and Craigieburn rail corridors, and connectivity to surrounding areas is limited to that provided by four bus routes. The airport will have a dedicated rail connection once Melbourne Airport Rail is completed in 2029.

In addition to the four PTV bus routes, an express shuttle (SkyBus) is provided between Melbourne Airport and Melbourne CBD. This express shuttle carried almost 4 million passengers in 2019. In addition there are several other SkyBus services to places including Frankston, Ringwood and Avalon.

The SkyBus runs every 15 minutes from 4.30am to midnight. SkyBus fares are over four times more expensive than regular public transport fares, and its premium branding is targeted more towards air travellers than employees.

This chapter includes a service level review, patronage analysis, review of trip origins and purposes, and discussion of potential connectivity improvement options.

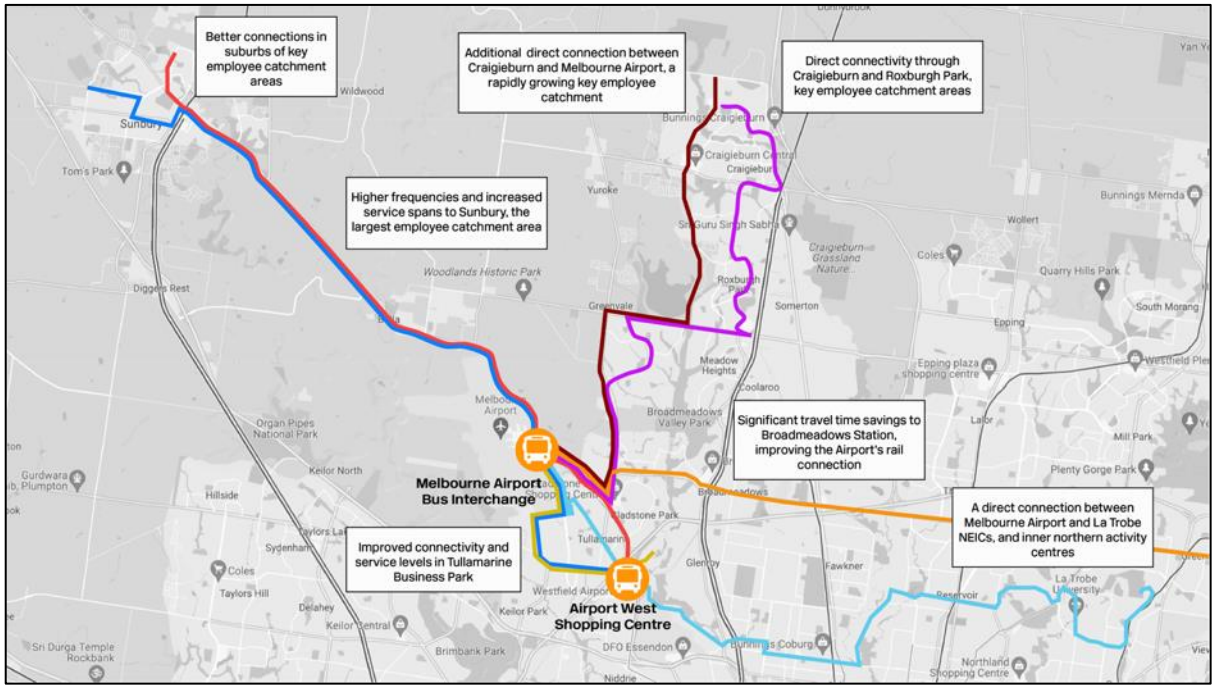
<u>Improvement recommendations</u>

Based on our analysis we recommend the following key improvements be investigated:

- A direct connection between Craigieburn and Melbourne Airport via Roxburgh Park, connecting key employee catchments to Melbourne Airport
- A new service between Craigieburn and Melbourne Airport via Aitken Boulevard, providing an additional bus service to a rapidly growing key employee catchment
- Extend Route 482 from Tullamarine Business Park to Sunbury to improve connectivity to Sunbury, which has the largest number of Airport employees
- Merge Route 479 with other local routes in Sunbury and expand the frequency and span of services to improve connectivity between Sunbury's residential areas and Melbourne Airport
- A direct connection between La Trobe NEIC and Melbourne Airport via Coburg, improving connectivity between La Trobe NEIC, the inner northern activity centres (Coburg, Brunswick, Preston) and Melbourne Airport
- A direct shuttle from Melbourne Airport to Broadmeadows Station/the implementation of SRLB, improving Melbourne Airport's rail connection
- Extend Route 490 (Gowanbrae DRT) to serve Melbourne Airport via the Airport Drive and Sharps Road area, adding key trip attractors to the route and improving connectivity for residents in Gowanbrae

Figure 84 shows the recommended connectivity improvements for Melbourne Airport.

Figure 84: Summary of improvements recommended for Melbourne Airport



5.2 Bus service review

Melbourne Airport is serviced by bus Routes 478, 479, 482 and SmartBus Route 901. This section provides an overview of service levels, reliability, and patronage of each route.

5.2.1 Service levels

Service levels on bus routes serving Melbourne Airport are typically poor. Even SmartBus Route 901 does not provide services at all hours of airport operation. For example, many airport work shifts commence around 04:00 but the first bus does not arrive until after 05:00. Service frequencies for each route are shown in Table 41 below.

Table 41: Weekday public transport service frequencies to Melbourne Airport

Service	Service headway (minutes)				
	Early	AM Peak	Interpeak	PM peak	Late
Bus (eastbound)					
SmartBus 901	18-30	14-15	13-16	15-17	12-28
Route 478	60	60	60	60	NIL
Route 479	NIL	60	60	60	60
Route 482	60	60	NIL	60	NIL

Source: PTV Timetables (Reference day: 2 December 2021)

Of the four bus routes servicing Melbourne Airport, only SmartBus Route 901 provides significant cross-suburban connectivity, connecting Melbourne Airport to the other northern municipalities of Whittlesea, Banyule and Nillumbik. Routes 478 & 482 provide a local connection to Airport West and Tullamarine. Route 479 connects Melbourne Airport to Sunbury Station, without any direct connection to the residential suburbs beyond the Station interchange.

Apart from SmartBus Route 901, service frequencies in the morning peak are relatively low. Routes 478, 479 & 482 have headways of approximately 60 minutes throughout relatively narrow service spans as shown in Table 42 below. Route 479 only runs two services per day on Saturdays and Sundays, and Route 482 has no weekend services at all. As such, it is clear that the service spans of the buses servicing Melbourne Airport are generally misaligned with the travel needs of people seeking to access the Airport including travellers and 24-hour shift work patterns across the airport precinct.

Table 42: Service spans of buses serving Melbourne Airport

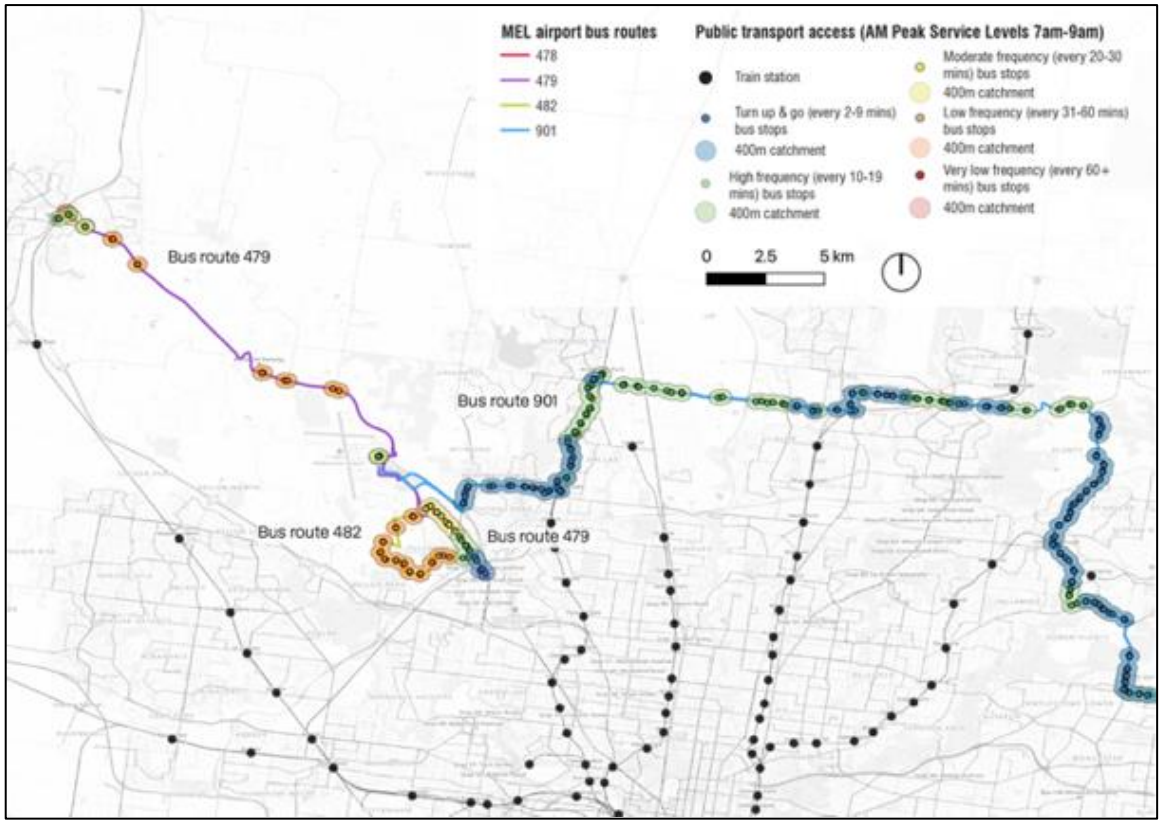
Service	Direction	Span (Hours)		
		Weekday	Saturday	Sunday
Bus				
SmartBus 901	To Frankston	19	18	15

Route 478	To Airport West	13	8	8
Route 479	To Airport West	13	2 services	2 services
	To Sunbury	13	2 services	2 services
Route 482	To Airport West	12	0	0

Source: PTV timetables (Reference days: 2, 4, 5 December 2021)

The service coverage of public transport routes directly serving Melbourne Airport and the service frequencies for each route are illustrated in Figure 85 below.

Figure 85: AM peak bus frequencies at Melbourne Airport



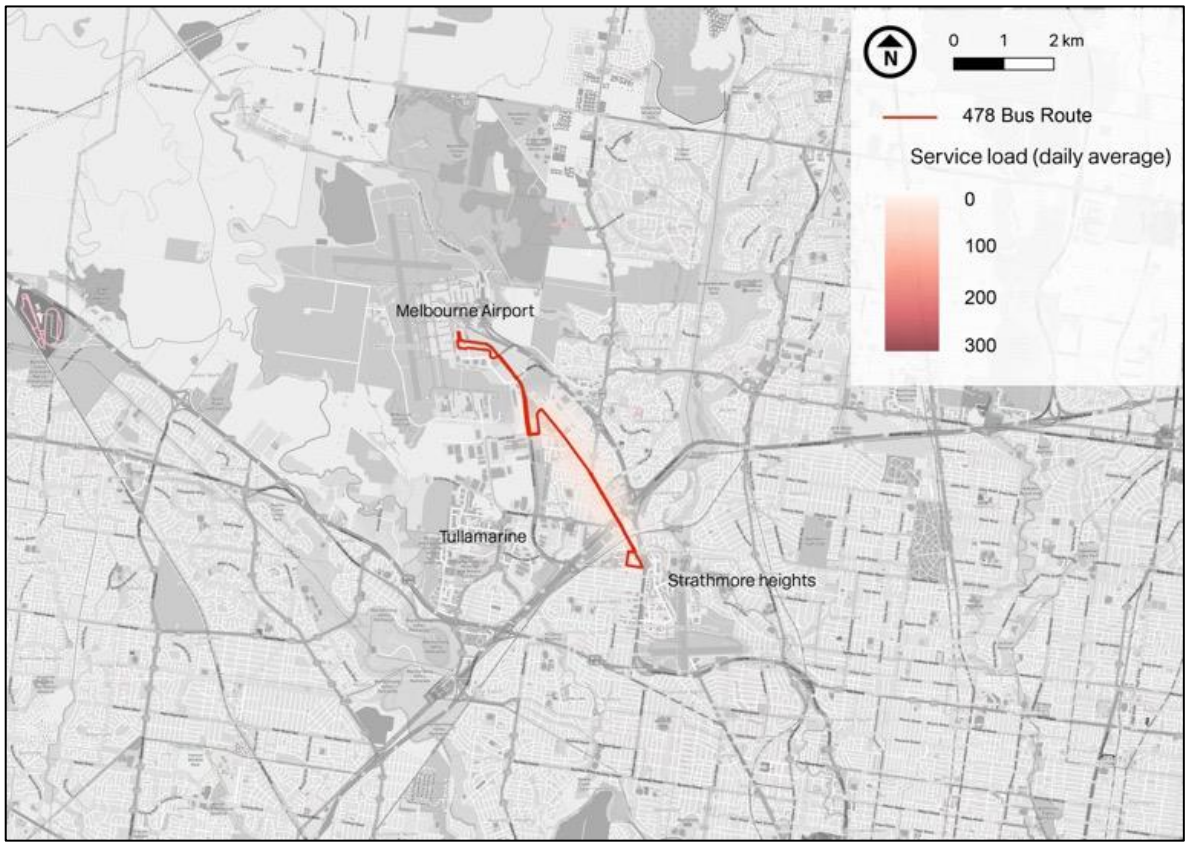
Source: GTFS with M&PC analysis

5.2.2 Patronage

Route 478

Bus Route 478 runs from Airport West shopping centre to Melbourne Airport via Melrose Drive and attracted an annual patronage of 37,000 in 2018-19. Figure 86 shows that average loads are highest at Tullamarine, but overall loads are very low across the route. Weekend services are similarly poorly utilised.

Figure 86: Route 478 average loading per service 2018-19 (Weekday)

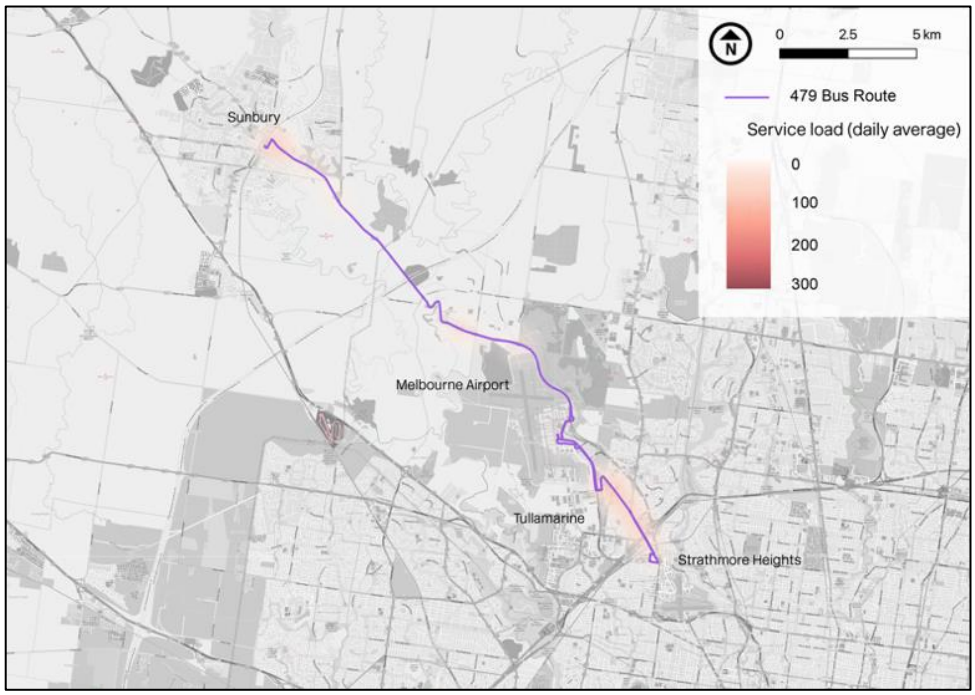


Source: DoT with M&PC analysis

Route 479

Route 479 runs from Sunbury Station to Airport West shopping centre via Melbourne Airport and had an annual patronage of 76,000 in 2018-19. Figure 87 shows that average loads are highest at Tullamarine and Sunbury on weekdays, but service loads are very low across the entire route. The situation is very similar on weekends.

Figure 87: Route 479 average loading per service 2018-19 (Weekday)

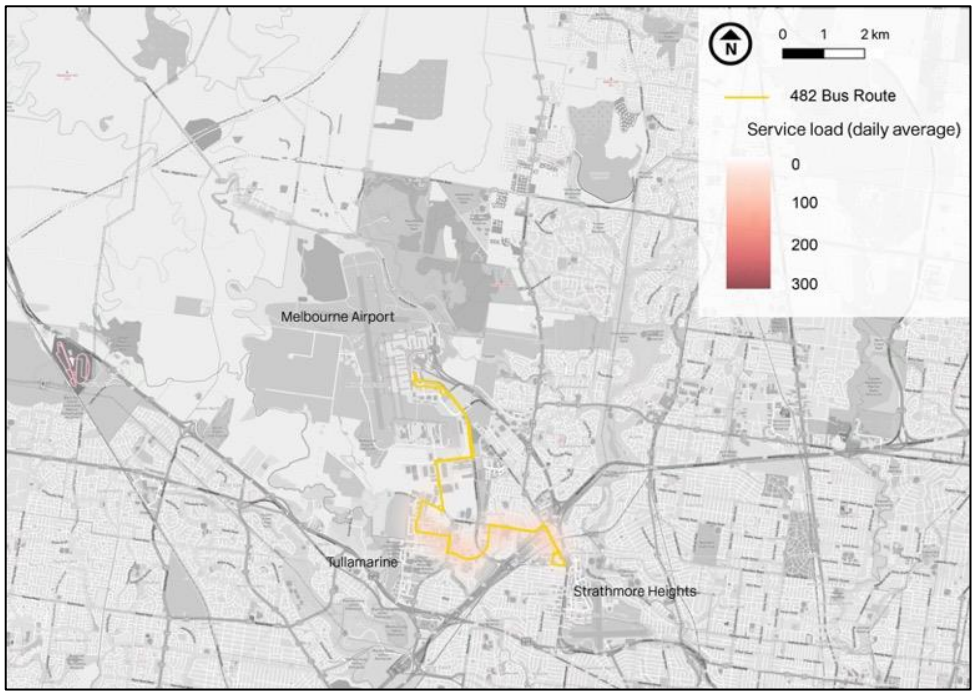


Source: DoT with M&PC analysis

Route 482

Route 482 runs from Airport West shopping centre to Melbourne Airport via Tullamarine and had an annual patronage of 34,000 in 2018-19. Figure 88 shows that patronage and service loads are very low on this route. There are no weekend services.

Figure 88: Route 482 average loading per service 2018-19 (Weekday)



Source: DoT with M&PC analysis

5.2.3 Reliability

As Table 31 shows, Route 478 and SmartBus Route 901 are the least reliable of the routes, with 3-4% fewer services on time than the network average. This is likely to reflect timetable construction and a lack of bus priority at intersections rather than highlight any inherent weakness of each route.

Table 43: Reliability data for buses serving Melbourne Airport

Route	% of services on time
478	89.6%
479	93.9%
482	96.0%
901	89.6%
Metro network average	**93.3%**

Source: PTV NetBI Metropolitan Bus Performance (Nov 2020 to Nov 2021)

Generally, reliability is a function of the congestion experienced in the areas that routes operate in, and the level of bus priority along the route. Whilst SmartBus Route 901 has some bus priority provision, it is a very long route operating on roads impacted by congestion, particularly during peak periods. In contrast, Sunbury Road – which Route 479 operates on – is not as impacted by congestion. Route 482 is a short local route, and is unlikely to have its run-time impacted by delays.

As previously discussed, timetables can often have significant "fat" built in. In this case Routes 478 & 479 have the same travel time between Airport West and Melbourne Airport but the travel time between intermediate stops (along the same alignment) are inconsistent. It is likely that the punctuality data above reports on the whole route, and includes additional fat in the travel time on the longer segment between Sunbury and Melbourne Airport. This would provide additional opportunity to make up any delays on the remainder of the route.

5.2.4 SkyBus

Melbourne Airport is also serviced by the premium-tier SkyBus, which is targeted towards airline passengers travelling to/from the airport. An adult fare is $19.75[14] one-way to Melbourne CBD. In comparison, a one-way public transport trip costs $4.60 for an adult. The service operates directly to Southern Cross Station and is not well suited to airport employees seeking an affordable option for their everyday commute.

[14] *As at 1st March 2022 www.skybus.com.au/fares and www.ptv.vic.gov.au/tickets/fares/metropolitan-fares*

As SkyBus has a limited stopping pattern and provides a direct service along its route. As such it tends to the be the fastest public transport option between Southern Cross Station and Melbourne Airport.

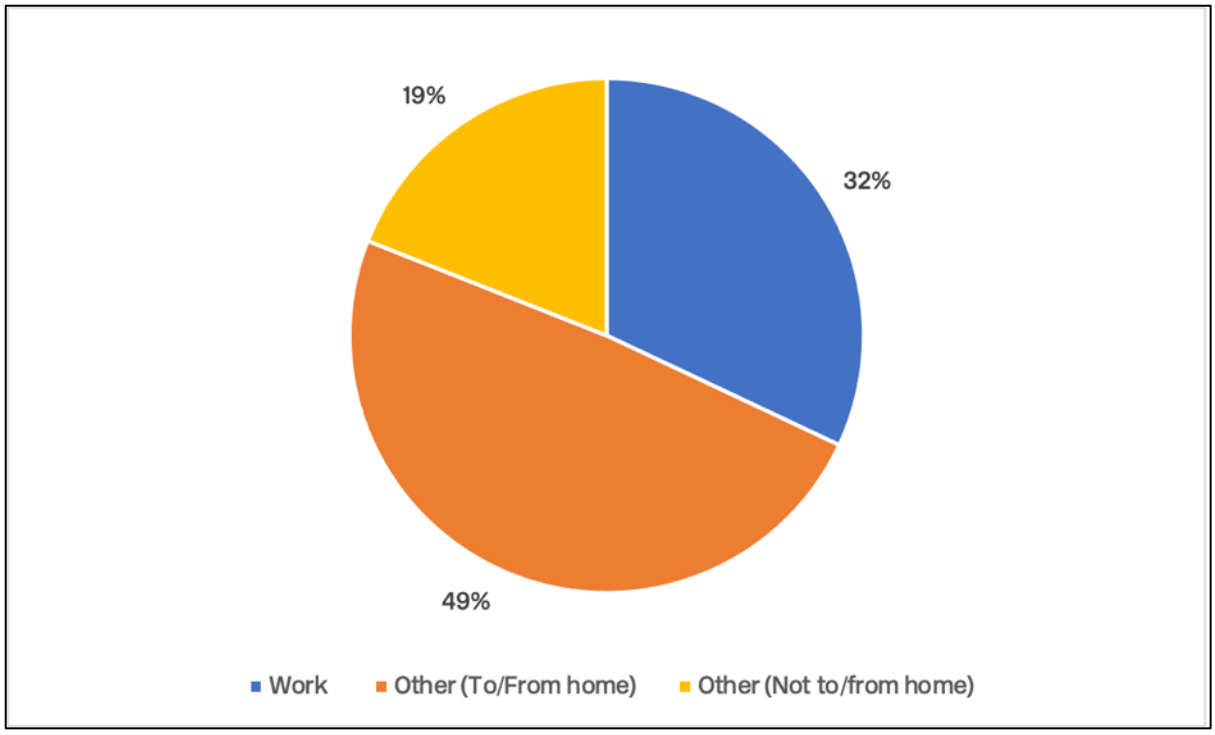
The SkyBus Eastern Express (launched in 2019 but not currently in operation) runs express between Melbourne Airport and Watsonia then Doncaster, Box Hill, Blackburn, Ringwood and Croydon. This service is of limited relevance to the NCA region, given that it only stops in Watsonia in the north. Fares on this service are also higher than normal myki fares and the service is targeted to airline travellers rather than airport employees. There could be some benefit in investigating how this service could target airport employees in the corridor, but this is of course reliant on the service coming back into service again.

5.3 Trips to Melbourne Airport

5.3.1 Trip purpose

Overall, travel to Melbourne Airport is primarily for work and air travel. Figure 89 show that work trips comprise 33% of all trips to Melbourne Airport, with the remaining 67% categorised in VISTA as 'other' trips. This 'other' category is assumed to capture Victorian-based travellers going to the airport to catch a flight, whether from home or another location. Trips made by non-Victorians, who constitute 70% of all air travellers through Melbourne Airport, would not be captured by VISTA.

Figure 89: Trips by purpose to Melbourne Airport 2021 including internal trips



Source: DoT with M&PC analysis

Importantly, the work trips occur from the same residential origin typically 4-5 days per week, whereas the airline travellers typically do not come to Melbourne Airport more than once per week. This means that the work trips are much easier to cater for using public transport, because they are relatively similar across the year. Employees are also more price sensitive than travellers and are more likely to evaluate the cost of parking compared to the other transport alternatives they have access to. Airport employees are offered discounted parking[15]. However, this likely incurs a cost to employers in the form of Fringe Benefit Tax.

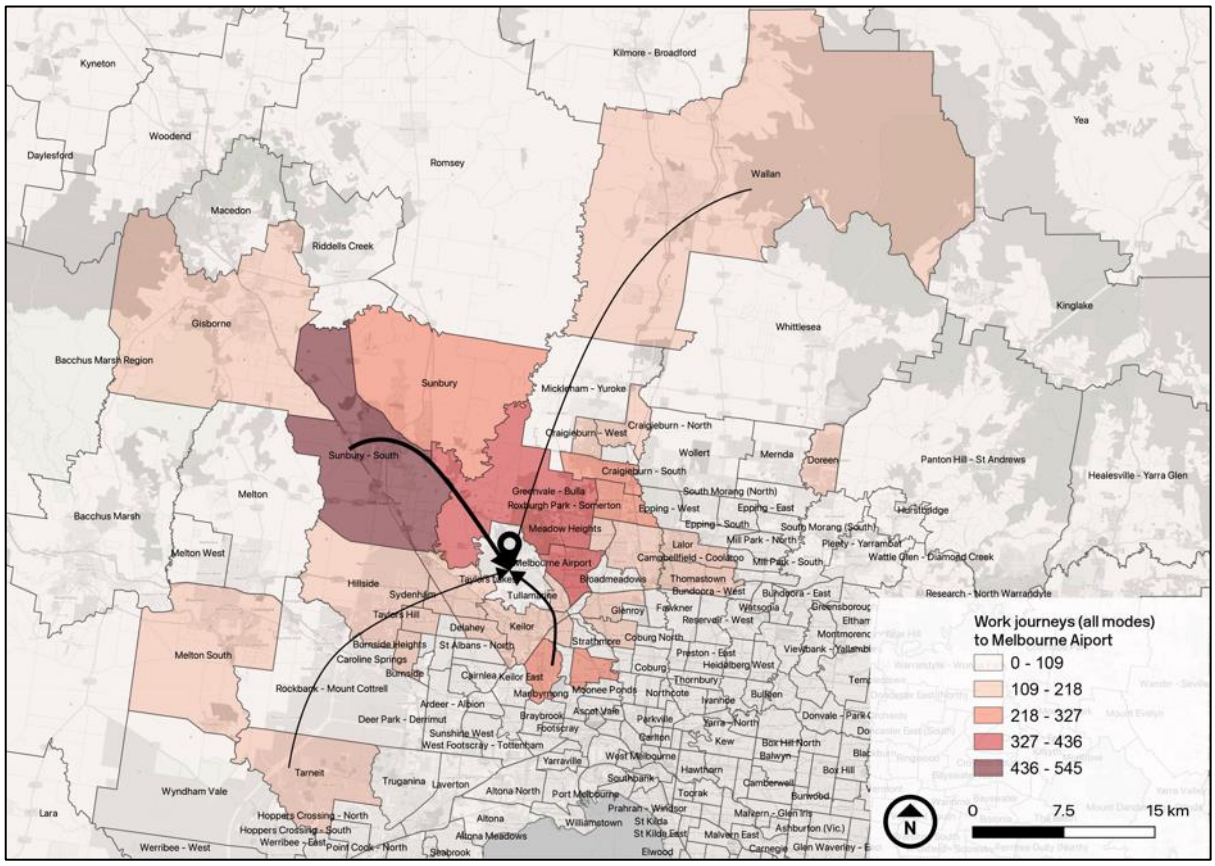
5.3.2 Work trip origins

Figure 90 shows the spatial distribution of journey-to-work origins for Melbourne Airport, as recorded by the 2016 Census. Most work journeys originate from the north and west, with a particularly high number of trips originating in neighbouring suburbs in the City of Hume. Sunbury, Greenvale, Roxburgh Park, Broadmeadows and Craigieburn are key origins for work trips to Melbourne Airport. Significant future growth is expected for Sunbury, Craigieburn and Mickleham (as per Appendix A); given the current concentration of airport employees within these areas, it is expected that there will be growth in airport employees. The employment catchment of Melbourne Airport extends beyond the metropolitan region, with workers travelling from regional locations such as Gisborne and Wallan.

Figure 91 shows the work journeys to Melbourne Airport by access mode. Car travel is particularly dominant, with 81% of employees driving to work. Public transport mode share is also much lower than the Melbourne average of 17%, with only 5% of employees commuting to Melbourne Airport via public transport. In the context of poor bus connectivity and low service levels that do not align with typical work-shift patterns at Melbourne Airport, it is unsurprising that most employees drive to work.

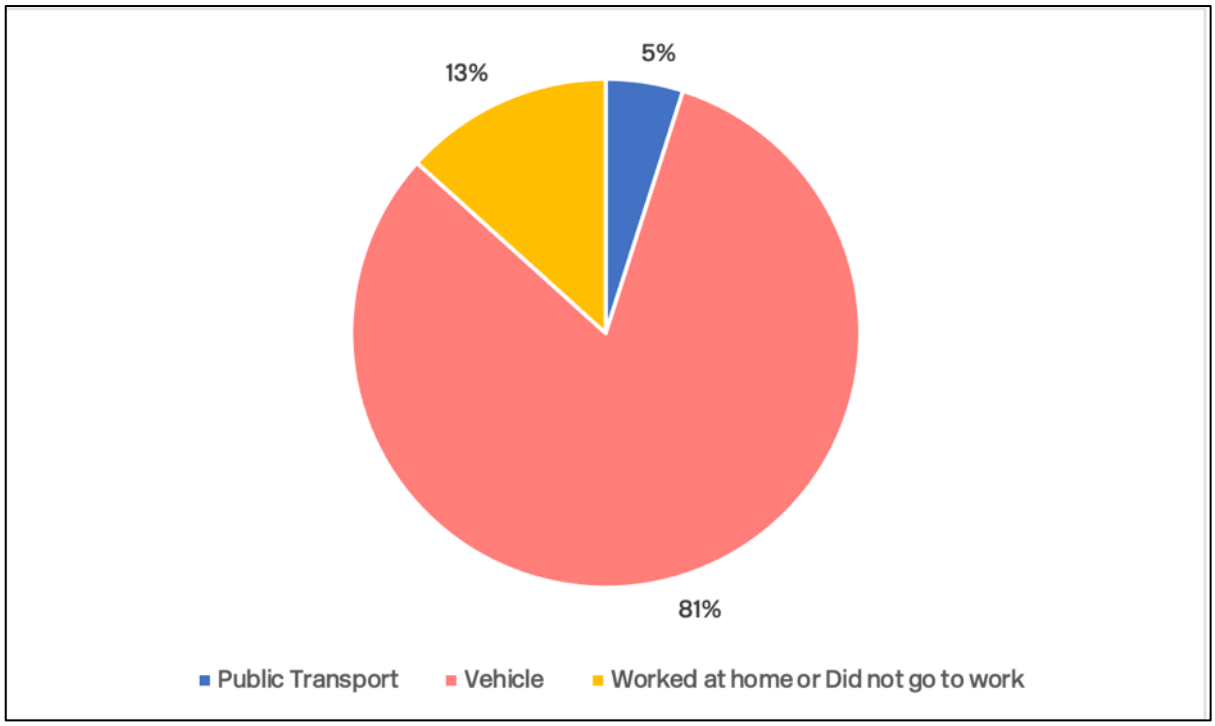
[15] www.melbourneairport.com.au/getmedia/77f1541a-09fe-470f-8b73-0f763f2bb6f6/CP-03-Staff-Parking-Card-Application2017.pdf.aspx?ext=.pdf

Figure 90: Origin of work journeys to Melbourne Airport



Source: ABS, 2016 with M&PC analysis

Figure 91: Work journeys to Melbourne Airport by access mode



Source: ABS, 2016

It is also noted (see Section 3 on the review of SmartBus Routes 901, 902 and 903) that airport workers are not best suited by the current serving of the airport by SmartBus Route 901 (as opposed to SmartBus Route 902). In section 3, we noted that swapping the western ends of 901 and 902 (such that SmartBus Route 902 served Melbourne Airport) would improve connectivity for airport workers.

5.4 Connection to activity centres

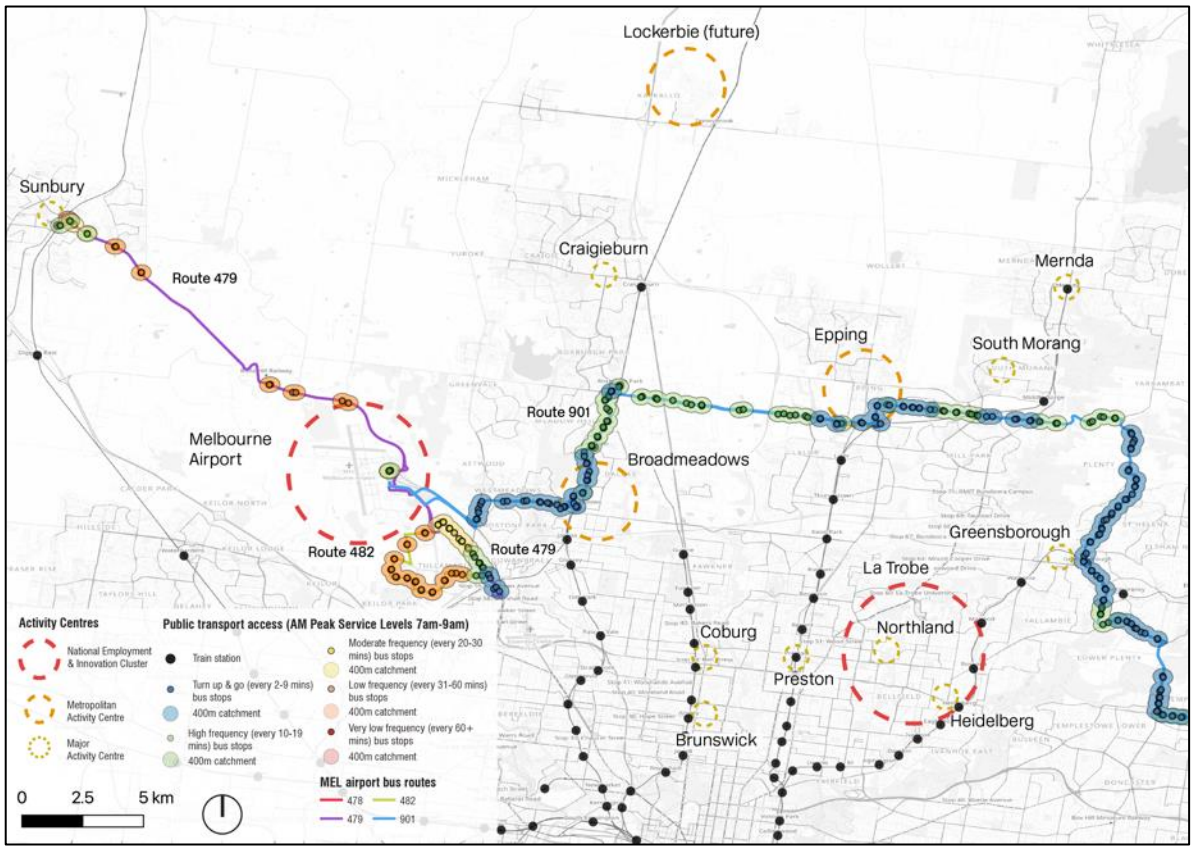
Overlaying the bus routes servicing Melbourne Airport with the key activity centres in the northern metropolitan region, Figure 92 shows that Melbourne Airport is only directly connected to the Broadmeadows, Sunbury and Epping activity centres. The proposal to swap the western ends of SmartBus Routes 901 and 902 would in effect direct swap access to Sunbury and Epping, for direct access to Fawkner and Bundoora. As noted above, this swapping would be expected to lead to an overall improvement in connectivity for airport workers.

The connection to Broadmeadows is well-serviced by SmartBus Route 901, and would continue to be even if Routes 901 and 902 had their western termini swapped. This key connection could still be strengthened – if the SRLB proposal (Section 2) was adopted, there would in effect be an express shuttle in operation from Melbourne Airport to Broadmeadows Station. This would also improve access to Melbourne Airport from the whole Craigieburn railway corridor.

The connection between Melbourne Airport and Sunbury is serviced by the low frequency Route 479. Improving the public transport connection between Melbourne Airport and the whole of Sunbury is crucial, considering it is the largest origin of work trips to Melbourne Airport (Figure 90). Route options which better connect Melbourne Airport to Sunbury's residential areas will be important for improving employment access and creating transport choice for workers to be able to use public transport for their commutes (see section 5.5).

There is a need to improve connectivity between Melbourne Airport and activity centres to the north, such as Craigieburn and Lockerbie (a future Metropolitan Activity Centre). There are currently no direct services between Melbourne Airport and either location despite a relatively large and growing number of Airport employees living in these areas. The current network requires commuters to make multiple transfers between infrequent services to reach Melbourne Airport and creates a 70+ minute journey for people who could otherwise travel for 20 minutes in a car. This significant travel time created by the existing public transport network, reduces options, minimises use of the public transport network for Airport access and increases traffic congestion and parking fees for those accessing the airport. Potential solutions are offered in section 5.5 below.

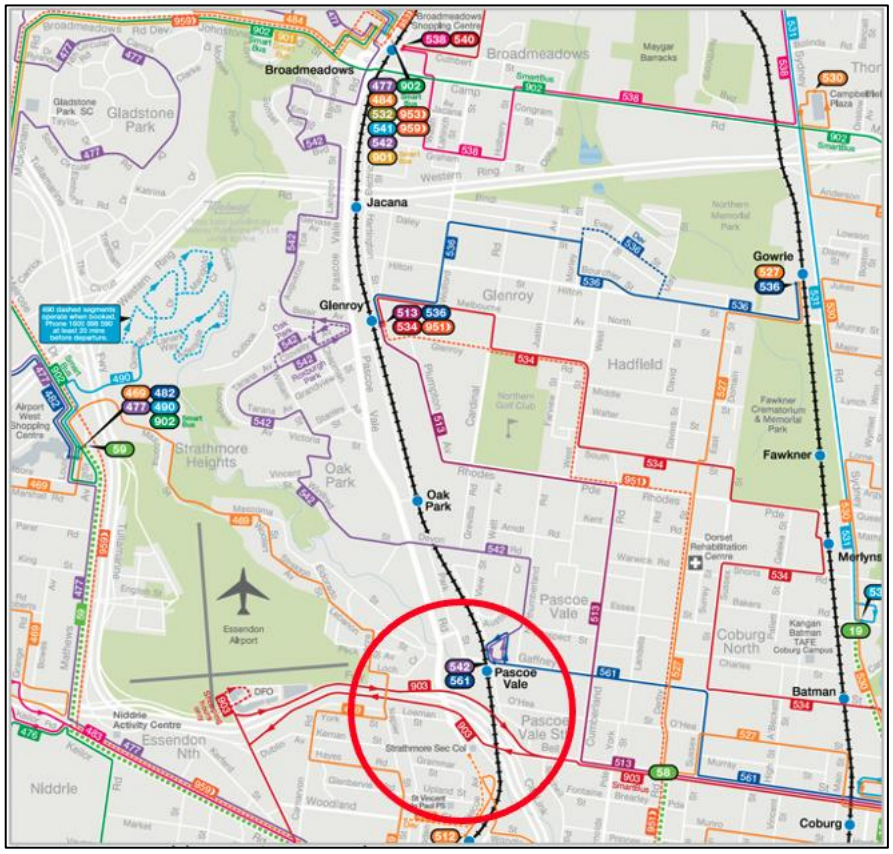
Figure 92: Bus connectivity from Melbourne Airport to key activity centres



Source: DELWP, DoT, GTFS with M&PC Analysis

There is also a need to improve bus connectivity between Melbourne Airport and the activity centres to its south, such as Preston and Coburg. There are currently no direct services which connect Melbourne Airport to either activity centre, and this is exacerbated by the limited opportunities to cross Moonee Ponds Creek. As Figure 93 shows, bus services tend to stay on either side of the Moonee Ponds Creek corridor. The only exception is SmartBus Route 903, which crosses the creek using the Tullamarine Freeway (M2), leaving the northern metropolitan region and connecting into the City of Maribyrnong.

Figure 93: Bus services along Moonee Ponds Creek



Source: PTV with M&PC annotation

5.5 Missing links to Melbourne Airport

The options below are recommended for improving connectivity to Melbourne Airport:

- A direct connection between Craigieburn and Melbourne Airport via Roxburgh Park
- A direct connection between Craigieburn and Melbourne Airport via Aitken Boulevard
- Merge Route 479 with other local routes in Sunbury and expand the frequency and span of services
- Extend Route 482 from Tullamarine Business Park to Sunbury
- A direct connection between La Trobe NEIC and Melbourne Airport via Coburg
- A direct shuttle from Melbourne Airport to Broadmeadows Station
- Extend Route 490 (Gowanbrae DRT) to serve Melbourne Airport via the Airport Drive and Sharps Road area
- Run SmartBus 902 to Melbourne Airport and SmartBus 901 to Airport West shopping centre

The following sections elaborate on the rationale for these improvement suggestions.

5.5.1 A direct connection between Craigieburn and Melbourne Airport via Roxburgh Park

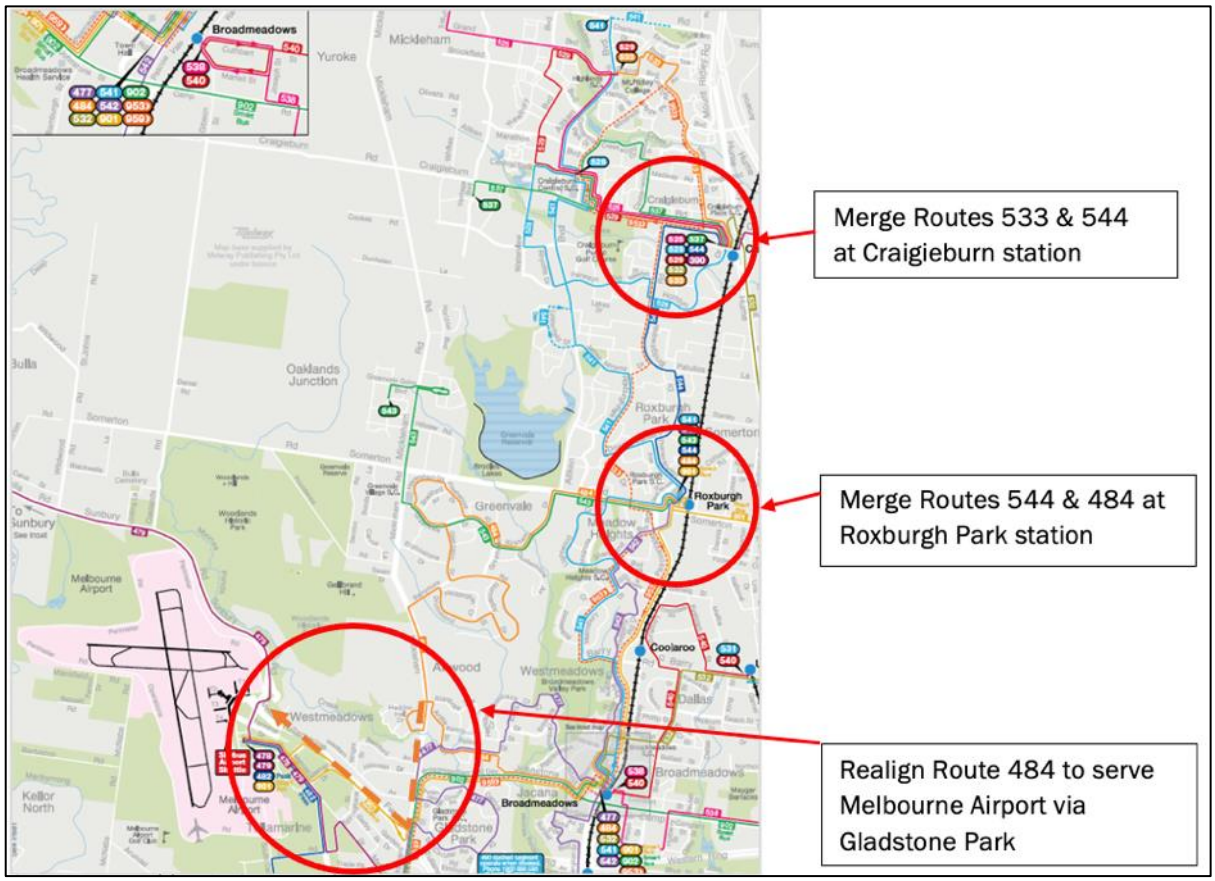
Craigieburn and the growth area to its north, do not currently have a direct connection to Melbourne Airport, despite being important origins for work trips to Melbourne Airport (see Figure 90). Routes 533 and 544 are both short routes which connect local areas to

Craigieburn and Roxburgh Park Station. Route 484 currently connects Greenvale and Atwood to Roxburgh Park and Broadmeadows Station. There is an opportunity to combine Routes 533, 544 and 484 into one route, aligned along Mickleham Road to service Melbourne Airport via Airport Drive as shown in Figure 94 below.

There would be no coverage loss from rerouting Route 484 from Broadmeadows Road to Mickleham Road, because existing SmartBus Routes 901 & 902 are currently aligned to Broadmeadows Road. For passengers wanting to access the train line or Broadmeadows Station, they could either travel to Roxburgh Park Station at the northern end of Route 484, use an alternative route (including Routes 477, 543 & 901) or transfer to the SmartBus on Broadmeadows Road.

This option would greatly improve access to Melbourne Airport from Craigieburn, removing the need to make two transfers across three public transport services.

Figure 94: Direct bus connection between Craigieburn and Melbourne Airport



Source: PTV with M&PC annotation

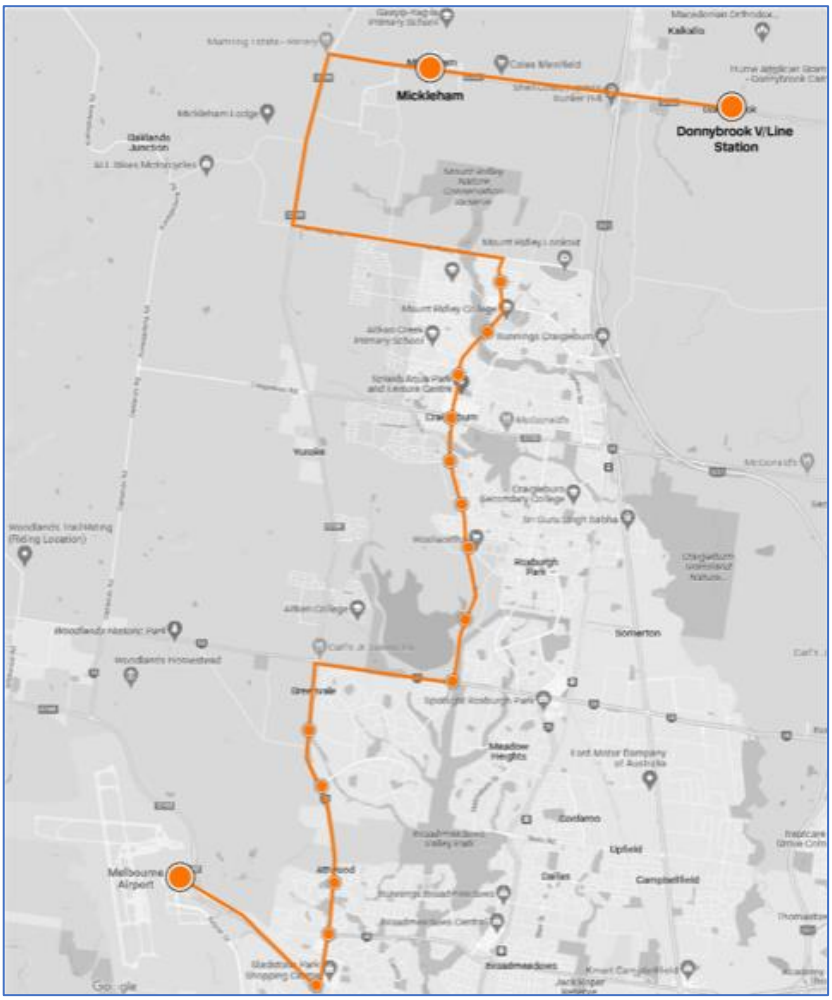
5.5.2 A direct connection between Donnybrook, Craigieburn and Melbourne Airport via Aitken Boulevard

An additional connection from Donnybrook to Melbourne Airport via Aitken Boulevard would complement the suggested route from Craigieburn to Melbourne Airport via Roxburgh Park. Aitken Boulevard has been planned as a transit corridor for high frequency bus services to link a wide region to the Growth Area.

Craigieburn, Mickleham and Donnybrook are growing rapidly and will require multiple bus connections to Melbourne Airport, as the number of Airport employees living in in the areas is expected to grow significantly. An additional connection from Craigieburn to Melbourne Airport via Aitken Boulevard, a future bus corridor, would complement the suggested route from Craigieburn to Melbourne Airport via Roxburgh Park. This route would provide a faster, more direct service from Craigieburn to Melbourne Airport, while serving a different catchment on the western edges of Craigieburn and Greenvale.

The route is approximately 32km long, and overall journey times would be approximately 75 minutes, depending on the number of stops.

Figure 95: Donnybrook to Craigieburn and Melbourne Airport via Aitken Boulevard



Source: Google maps with M&PC annotation

5.5.3 Improving the connection between Sunbury and Melbourne Airport

Despite Sunbury being the single largest origin for work trips to Melbourne Airport, only the low frequency Route 479 provides a public transport travel option between them (and even then, only to/from Sunbury Station). Route 479 currently connects Sunbury Station to Melbourne Airport. Route 479 does not serve residential areas in Sunbury, instead requiring commuters to transfer from low frequency local routes, such as Routes 485 and 486 at Sunbury Station.

Because of the very low frequencies on the routes in Sunbury (40-60 min headways), transfers are difficult to coordinate for commuters. This network design creates 60-70minute travel times for what would otherwise be a 20-minute car trip. This incentivises car travel and makes employment at Melbourne Airport inaccessible to some.

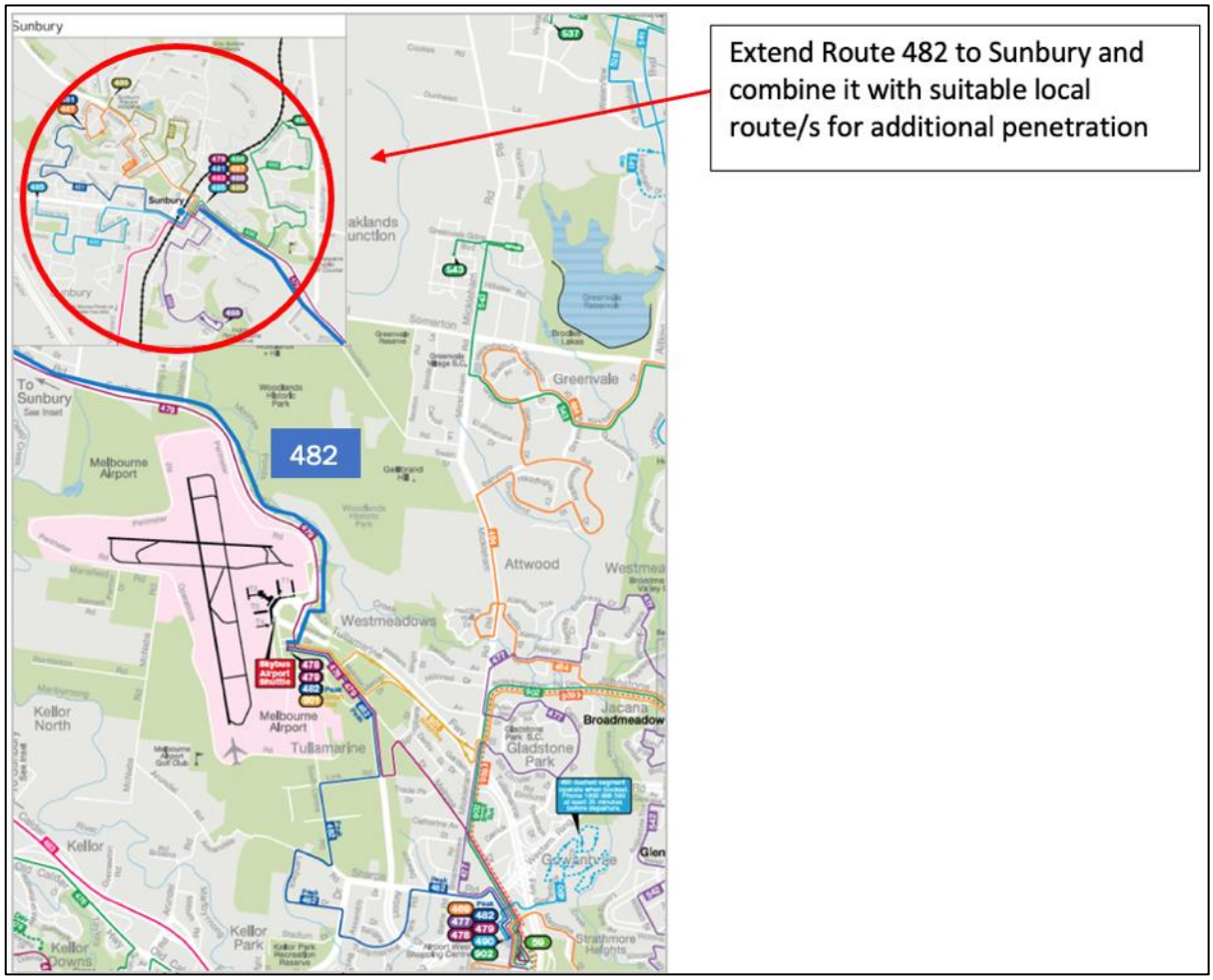
Route 482 provides peak period services to employment areas south of Melbourne Airport. However, it does not reach any of the residential areas that the employees likely come from and therefore patronage is minimised by the transfer penalty incurred when being forced to connect to/from another service to complete the journey to work.

Improving the connectivity between Sunbury and Melbourne Airport requires three key actions:

1. Extend Route 482 to Sunbury (providing direct access to the employment area south of the airport)
2. Merge Route 479 with other local routes in Sunbury
3. Improve the span and frequency of services on Route 479

Extending Route 482 to Sunbury will reduce the transfer penalty for people from this catchment trying to use public transport to get to work at the airport or in the NEIC south of the airport. Similar to Route 479 this route could then be merged with another local route in Sunbury to further increase its residential catchment.

Figure 96: Route 482 extension to Sunbury



Source: PTV with M&PC annotation

The need to extend Route 479 onto other local routes in Sunbury is urgent and able to be achieved relatively simply by combining the routes and retendering them. Merging Route 479 with a local service such as Route 485 or 486 will better connect the residential areas of Sunbury to Melbourne Airport.

The new Route 479 should then have additional service span and frequency. Ideally it would operate every 20-minutes all-day with a limited hourly service overnight to coordinate with shift-worker time patterns.

This would also improve the connection between Melbourne Airport and the V/Line train services to/from Bendigo, Echuca and Swan Hill. As Melbourne Airport is home to 24-hour shift-based work, Route 479 should ideally run a night service. Night services should run at least once an hour.

5.5.4 A direct connection between La Trobe NEIC and Melbourne Airport via Coburg

Melbourne Airport has very poor public transport connectivity to activity centres to the south (in the northern metropolitan region), such as Coburg and Preston. The limited

opportunities to cross Moonee Ponds Creek presents a further barrier to good public transport connectivity. An option to address this is to extend Route 561, which currently runs from Macleod to Pascoe Vale via LTU.

Route 561 currently terminates at Pascoe Vale Station. The route could be extended to cross Moonee Ponds Creek on Stewart Street, before travelling to Melbourne Airport along Mascoma Street and Melrose Drive[16]. The benefit of such an extension would be the ability to create a direct link between Melbourne Airport and the only other NEIC in the northern metropolitan region, (La Trobe). An extension of Route 561 would also crucially connect Melbourne Airport to the inner and middle northern activity centres, such as Coburg, as well as new residential catchments in Strathmore.

It is noted that Mascoma Street has a significant number of road humps, which would need to be considered within bus operational planning. As such, this option will require consultation with Moonee Valley City Council (noting that they are not part of the NCA).

Figure 97: Extending Route 561 to Melbourne Airport

Source: Google maps with M&PC annotation

5.5.5 Swapping the western termini of SmartBus Routes 901 and 902

Section 3.8.1 discusses how swapping the western termini of SmartBus Routes 901 and 902 can improve access to the airport for those who work there. For completeness, that recommendation is also referenced here.

[16] *This would improve connectivity between Airport West and Melbourne Airport. It is noted some groups have advocated for this to be achieved by extending Tram 59 e.g., railfutures.org.au/wp-content/uploads/2018/09/MRP2050brochure.pdf*

5.6 Shuttle services to train stations

As the previous sections highlighted, many areas within Melbourne Airport's key employment catchment lack adequate public transport connectivity to the airport, requiring the introduction or strengthening of regular services to establish a proper connection between them.

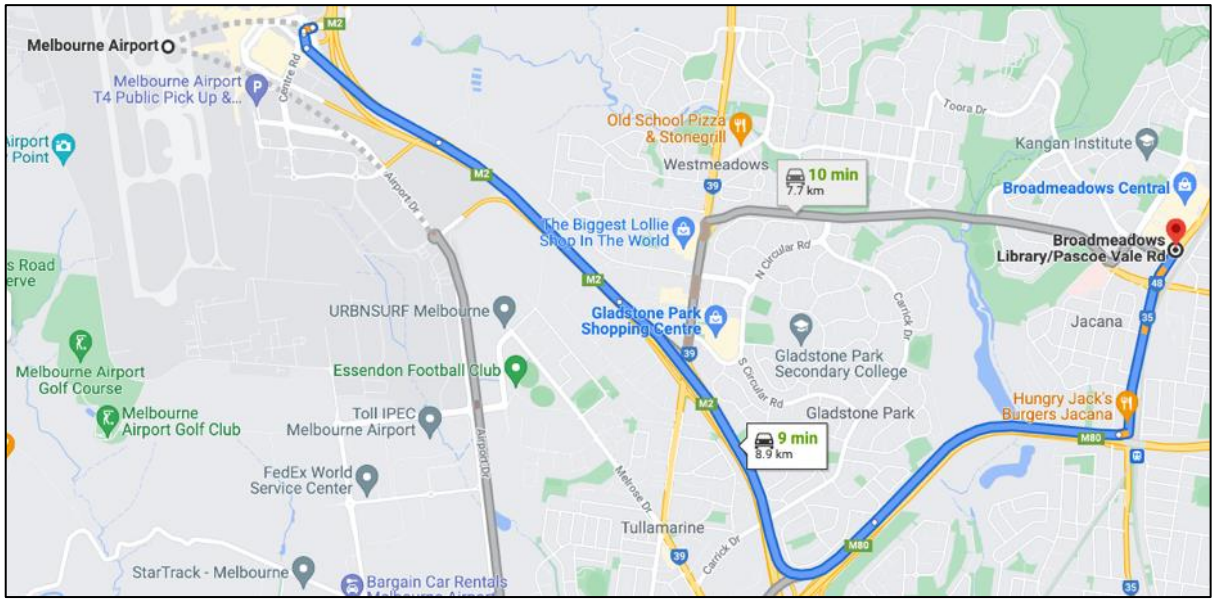
5.6.1 Broadmeadows (Craigieburn Line)

Though Melbourne Airport currently has a good connection to Broadmeadows via SmartBus Route 901 (SmartBus Route 902 if the western termini are swapped, as discussed earlier in this section), a direct shuttle service between Melbourne Airport and Broadmeadows Station would significantly improve connectivity for Melbourne Airport in the interim until the Suburban Rail Loop is built.

If the SRLB is implemented, it would serve a similar function to a direct shuttle between Melbourne Airport and Broadmeadows (see section 2 for further discussion on SRLB). As such, delivery of the SRLB is in our opinion the logical choice for improving connectivity between Melbourne Airport and Broadmeadows.

Figure 98 shows the preferred route for an express shuttle between Melbourne Airport and Broadmeadows (this is the same suggested route for the SRLB segment between Melbourne Airport and Broadmeadows, as per section 2). The express shuttle would save 7-9 minutes journey time compared to travelling on SmartBus Route 901.

Figure 98: Route option for Melbourne Airport - Broadmeadows



Source: Google Maps

5.6.2 Watergardens (Sunbury Line)

Whilst creating a new public transport connection between the Airport and Sydenham (Watergardens Station on the Sunbury line) is theoretically possible, it is noted that:

- Watergardens Station is in the City of Brimbank and is therefore outside the geographic scope of this study
- Achieving this option would be problematic, as it would involve significant duplication in the Calder Highway/Freeway corridor of Route 476 (and to a lesser extent Route 483)
- Based on Figure 6, whilst there are work trips currently being made from the Watergardens area, it is not a priority compared to the other areas highlighted in this report for improvement (for example, Sunbury)

As such, this option has not been analysed in more detail within this report.

5.6.3 Connections to future Melbourne Airport Station (on Melbourne Airport Rail Link)

Work is currently underway to determine the exact location and design of the Melbourne Airport Station. There may well be a need for short / local feeder services from the Station to the heart of the business park.

We would recommend that detailed planning on this take place once the design components (and bus access to the Station) are finalised. Given the volume of shift working undertaken at the business park, and depending on the hours of operation of railway services, we would also recommend that consideration be given to employer led solutions. These might include, for example, privately operated pooled shuttle bus services which were specifically designed to align with shift start / end times. Pooled operations across multiple businesses (assuming they were happy to work together) would bring the opportunity for lower costs to operate.

5.6.4 Demand Responsive Transit Solutions

Given the current mis-alignment of work trips to the airport and public transport offering, a theoretical solution to improving transport access would be the adoption of a Demand Responsive Transit (DRT) solution. A DRT is defined as 'a transport service which provides a convenient and flexible option that fills a 'gap' between taxi services and scheduled fixed-route transit options'[17].

On-demand transit options are not a universal solution. In Australasia, 54% of DRTs have failed[18]. This underlines the need to understand factors which enable DRTs to thrive. Some of the key factors are:

- Providing a service to niche market segments. Successful DRTs have often been focussed on elderly people and those with a physical or mental impairment
- DRT services tend to be deployed to provide an efficient transit option in places where route services are not as viable (effectively they are a lower cost and less 'reliable' type of service than a regular route bus)

[17] *Engels & Ambrosino (2004): Service typologies and scenarios*

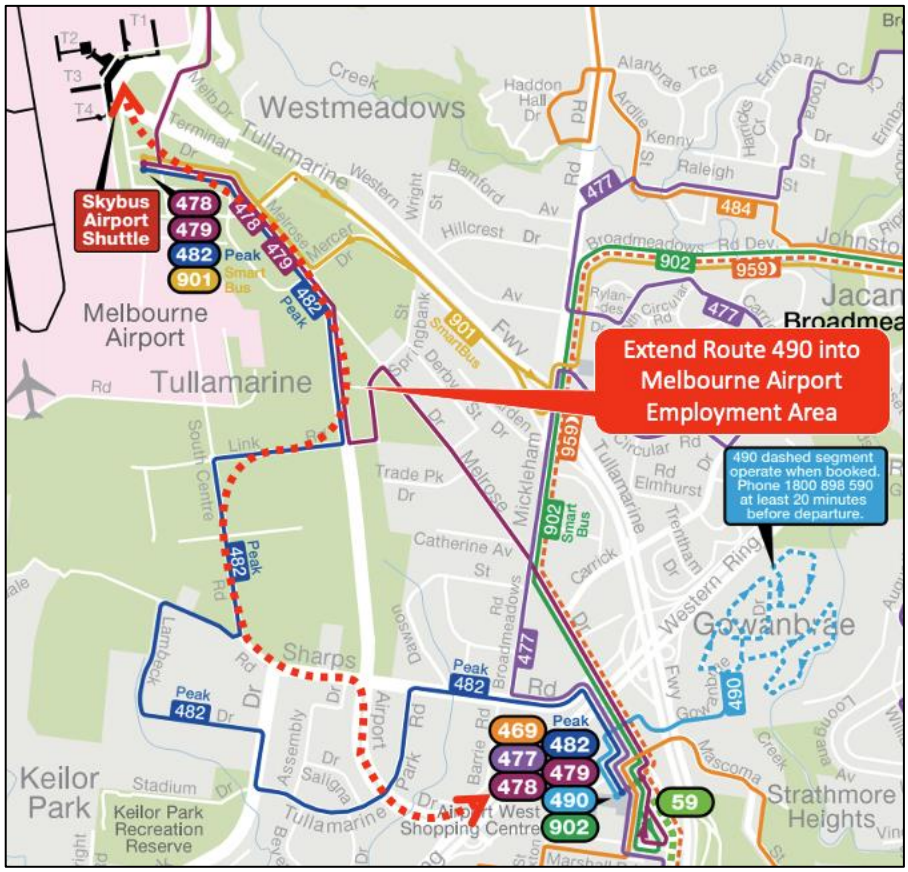
[18] *Currie, Graham & Fournier (2020): Why most DRT/Micro-Transits fail*

- DRTs tend to be more viable in areas of low residential density, beyond the catchment of conventional route based public transport. DRT typically provides a transport option for those who have few other options (because a regular route service would be unviable)
- DRTs are not typically used to address issues related to transport temporal gaps (that is, those areas where public transport services operate but at the 'wrong' times to meet user needs)

For these reasons, we do not believe that DRT services are likely to be a practical solution to improving access to the airport for workers. The type of employer organised solutions discussed above (relating to potential future connections to the Melbourne Airport Station) are more likely to be a successful solution to these needs.

One option worthy of consideration is to extend the existing Gowanbrae DRT (Route 490) to serve Melbourne Airport via the Airport Drive and Sharps Road area. This would significantly improve the destinations on Route 490 (providing direct access to large employment areas) and provide an additional (DRT style) service to employees in these areas (including Melbourne Airport). This concept is roughly illustrated in Figure 99 below.

Figure 99: Potential DRT Route option for Melbourne Airport Employment Area



Source: PTV with M&PC Analysis

5.7 Summary of recommendations

Based on our analysis, we suggest the improvements outlined in Table 44 below.

Table 44: Improvement recommendations for Melbourne Airport

Improvement option	Rationale
1. Direct connection between Craigieburn and Melbourne Airport (combining Routes 533, 544, and 484)	• Greatly improved access to Melbourne Airport from Craigieburn • Better connecting key employee catchments to Melbourne Airport
2. Create a new service between Donnybrook, Craigieburn and Melbourne Airport via Aitken Boulevard	• Creates a direct connection between Melbourne Airport, Mickleham and Donnybrook, rapidly growing areas in Melbourne's Northern Growth Corridor • In addition, a more penetrative service is needed to improve connectivity for Craigieburn residents to Melbourne Airport
3. Improving service levels on Route 479 and merging with local services	• Improve the connection between Sunbury and Melbourne Airport by improving frequency of services and merging with other local services
4. Extending Route 482 to Sunbury	• Provides direct access to the employment area south of the airport
5. Extending Route 561 to Melbourne Airport	• Create a direct connection between La Trobe NEIC, inner and middle northern activity centres and Melbourne Airport
6. Direct shuttle bus between Melbourne Airport and Broadmeadows	• The lack of regional connectivity highlighted in our analysis, and the need for a high-quality shuttle to Broadmeadows, shows that SRLB (Section 2 of this report) would be beneficial to Melbourne Airport
7. Extend Route 490 to Melbourne Airport via the employment precinct	• Provides direct access to large employment areas and an additional (DRT style) service to employees
8. Run SmartBus 902 to Melbourne Airport and SmartBus 901 to Airport West shopping centre	• Improve access to Melbourne Airport for employees

5.8 Costs and Benefits

Estimated costs and benefits for the improvement recommendations are shown in Table 45below. Note that these are high-level estimates based on a series of underlying assumptions about current and future travel behaviour. It is anticipated that DoT would complete its own analysis of options prior to finalizing any changes.

Table 45: Costs and benefits of Melbourne Airport improvement recommendations

Option	Costs	Benefits
1. Combining Route 533, 544, and 484 (Craigieburn)	• Bus costs estimated at $0.1m p/a • KM costs estimated at $0.1m p/a • Bus hourly costs estimated at $0.1m p/a	• 174 increase in PT trips per day • 1,000 Vehicle-km of travel saved per day • $15,000 Congestion benefits p/a • $160,000 Safety benefits p/a
2. New service between Donnybrook, Craigieburn and Airport via Aitken Blvd	• Bus costs estimated at $0.7m p/a • KM costs estimated at $1.6m p/a • Bus hourly costs estimated at $1.7m p/a	• Given this service is intended to accommodate future growth along the corridor, it is too speculative at this stage to attempt to estimate potential connectivity benefits
3. Improving service levels on Route 479 and merging with local services	• Bus costs estimated at $0.2m - $0.4m p/a • KM costs estimated at $0.6m - $0.8m p/a • Bus hourly costs estimated at $0.4m - $0.6m p/a	• 150 increase in PT trips per day • 850 Vehicle-km of travel saved per day • $12,500 Congestion benefits p/a • $133,100 Safety benefits p/a
4. Extending Route 482 to Sunbury	• Bus costs estimated at $0.5m - $0.7m p/a • KM costs estimated at $0.6m - $0.8m p/a • Bus hourly costs estimated at $0.6m - $0.8m p/a	• 280 increase in PT trips per day • 1,600 Vehicle-km of travel saved per day • $25,000 Congestion benefits p/a • $255,000 Safety benefits p/a
5. Extending Route 561 to Melbourne Airport	• Bus costs estimated at $0.1m - $0.3m p/a • KM costs estimated at $0.3m - $0.5m p/a • Bus hourly costs estimated at $0.4m - $0.6m p/a	• 660 increase in PT trips per day • 3,800 Vehicle-km of travel saved per day • $55,000 Congestion benefits p/a • $600,000 Safety benefits p/a
6. Direct link for Melbourne Airport and Broadmeadows	• Costs are detailed in Section 2 (SRLB)	• Benefits are detailed in Section 2 (SRLB)
7. Extend Route 490 to Melbourne Airport via the employment precinct	• Bus costs estimated at $0.1m - $0.2m p/a • KM costs estimated at $0.1m - $0.3m p/a • Bus hourly costs estimated at $0.1m - $0.3m p/a	• It is highly speculative to predict significant benefit as Route 490 has a small residential catchment • The concept is illustrative of the need to connect residential areas to Melbourne Airport employment • Finding a better connection would require a detailed bus review
8. Swap western termini of SmartBuses 902 and 901	• Costs are discussed in section 3.8	• Benefits are discussed in section 3.8

6 Mitchell Shire

6.1 Overview

Mitchell Shire currently has a population of 51,000 people. The Mitchell growth area (Wallan and Beveridge) sits within metropolitan Melbourne's northern growth corridor and will house the majority of Mitchell Shire's growing population. Whilst the population in the growth area is around 20,000 at present, it is expected to increase rapidly to 2036, with a projected population of 47,000 by 2026 and 89,000 in 2036. By 2051, Beveridge and Wallan alone will house a population of over 200,000, quadruple the entire Mitchell Shire's current population.

Journeys to work will change in quantity, diversity and length as the population grows. Much of the growth in work journey outflows will occur in Wallan and Beveridge, especially since employment in the area will lag behind population growth and there will always be a net deficit of jobs in this area. For example, the Beveridge North West PSP estimates that 50,100 people will live within the development, but there will only 3,100 local jobs available. This is because the major activity centres, hospitals and civic services are all located outside the municipality, at least 15km further south in more established areas such as Broadmeadows and Epping as shown in Figure 100 below.

Figure 100: Distance between Wallan, Beveridge and key activity nodes

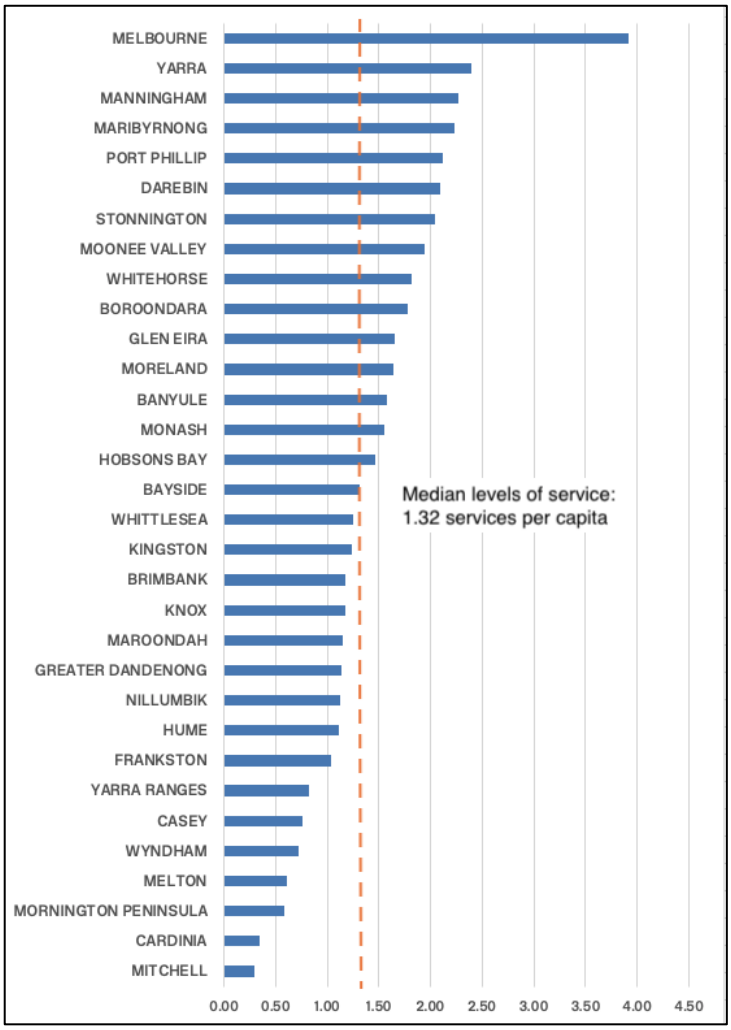
Source: Nearmap with M&PC annotation

Lockerbie, the nearest planned metropolitan activity centre, is 10km south of Beveridge, and will have 30,000 of its own residents also needing access to jobs. Growth planning in the area accepts this population and jobs imbalance as a reality. The traffic and transport issues of most residents leaving the municipality for their daily needs are significant.

To put this in context, this is akin to people living in the entire area between Nunawading and Lilydale (which is similar in size to the area between Beveridge and Wallan) needing to travel 15-30km to Melbourne CBD/inner Melbourne to access hospitals, civic centres and major employment nodes regularly. Not only are employment, education, retail and civic services a long way away from the Mitchell Shire Growth Area, there are very limited transport choices for the population that is rapidly increasing. Current services are limited to a handful of bus routes that only link to the nearest V/Line Station.

Beveridge and Wallan must have metropolitan levels of public transport service provision commensurate with population growth in the area. However, Figure 101 shows that the current level of bus service provision in Mitchell is the lowest in metropolitan Melbourne.

Figure 101: Service levels per capita across Melbourne (by municipality)



Source: Google GTFS and ABS 2016 with M&PC analysis

Furthermore, the current service levels fall well short of what is required to ensure sustainable transport is an option for current and future residents.

RMIT researchers have found that the economic, social and environmental costs of not delivering public transport early in growth areas is far greater than the economic cost of not delivering public transport early in the area's development[19].

This chapter includes a service level review, review of trip origins and destinations, and discussion of potential connectivity improvement options.

Improvement recommendations

Based on our analysis we recommend the following key improvements be investigated for the northern growth corridor:

- Direct service from Wallan and Beveridge to Melbourne Airport via Craigieburn, Roxburgh Park
- Direct service from Wallan and Beveridge to Epping
- Direct service from Wallan and Beveridge to La Trobe University (LTU) via Thomastown
- Direct service from Beveridge to Broadmeadows via Campbellfield
- Extension of Route 511 to Mernda
- A future east-west connection from Woodend to Whittlesea via Wallan and Beveridge
- Collecting bus patronage data for Wallan
- Adding late and weekend services in Beveridge and Wallan
- Aligning bus timetables in Beveridge and Wallan with trains travelling to and from Melbourne CBD

Future bus reform in Mitchell Shire townships should consider:

- Adding late and Sunday services in Seymour
- Aligning bus timetables in Kilmore with trains travelling to and from Melbourne CBD
- Adding Sunday services in Kilmore
- Introducing services in other townships in line with population growth

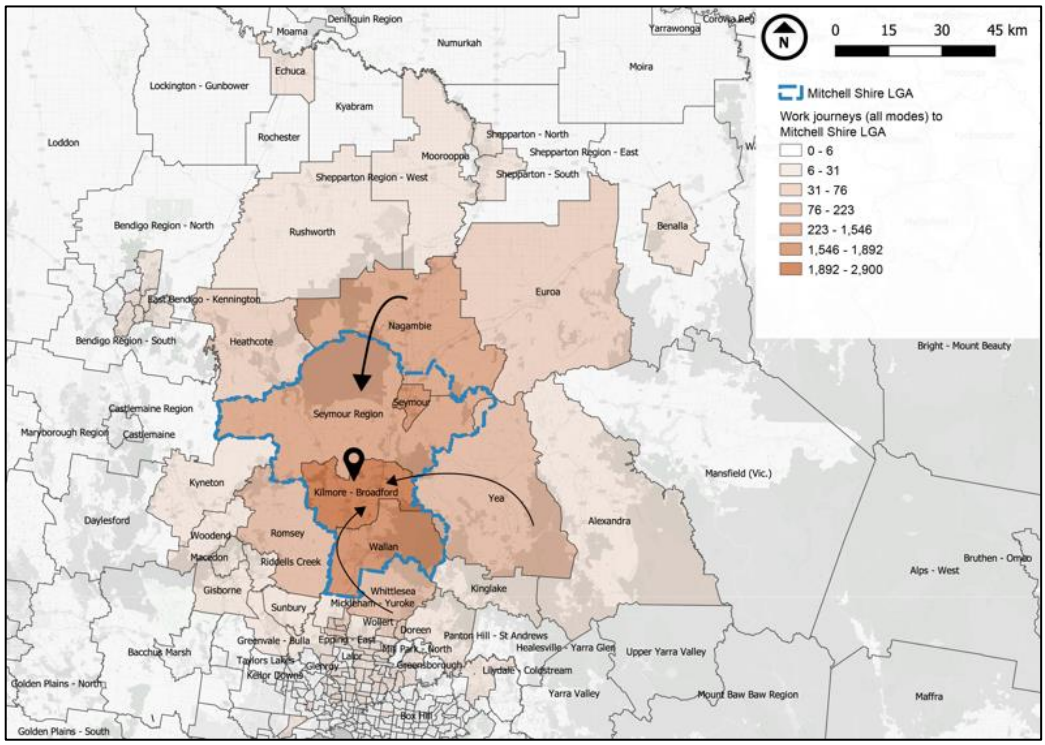
6.2 Key origins and destinations in Mitchell Shire

6.2.1 Work Journeys to Mitchell Shire

Mitchell Shire attracts a significant number of workers from surrounding regional areas, particularly Nagambie, Yea, Heathcote and Romsey, as shown in Figure 102 below.

[19] https://cur.org.au/project/equitable-healthy-transport-options-new-suburbs/

Figure 102: Work journeys to Mitchell Shire



Source: ABS, 2016 with M&PC analysis

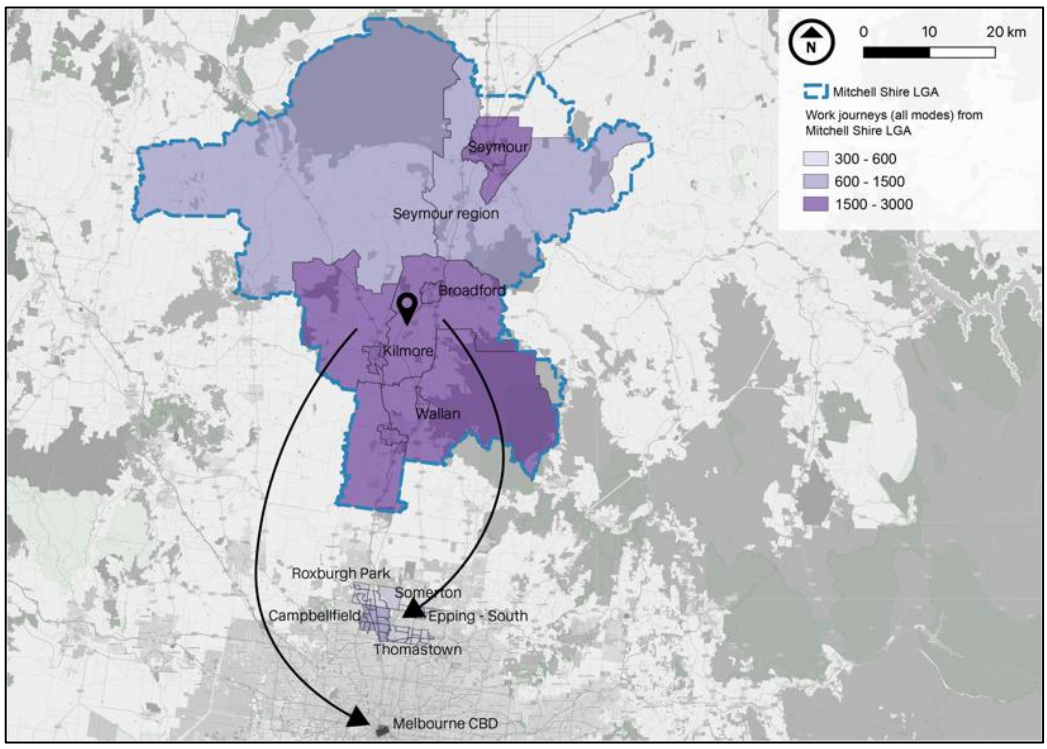
Mitchell Shire also attracts large numbers of workers from metropolitan Melbourne, particularly those living in neighbouring Whittlesea, Mernda, Doreen and Craigieburn.

6.2.2 Work Journeys from Mitchell Shire

45% of work journeys occur internally within Mitchell Shire, indicating that the majority of residents currently live and work within Mitchell Shire. Hume, Whittlesea and Melbourne CBD are the next most significant employment destinations for Mitchell Shire residents, attracting 15%, 8% and 7% of work trips currently.

As Figure 103 shows, a significant number of Mitchell Shire residents travel south to work in Roxburgh Park, Somerton, Campbellfield, Epping and Thomastown. A smaller proportion of Mitchell Shire residents travel to Melbourne CBD for employment, predominantly commuting on the V/Line train services.

Figure 103: Work journeys from Mitchell Shire



Source: ABS, 2016 with M&PC analysis

The share of work trips to Hume and Whittlesea will increase as more people move into Beveridge and Wallan, accessing jobs in key employment centres such as Craigieburn, Epping, Thomastown and Broadmeadows.

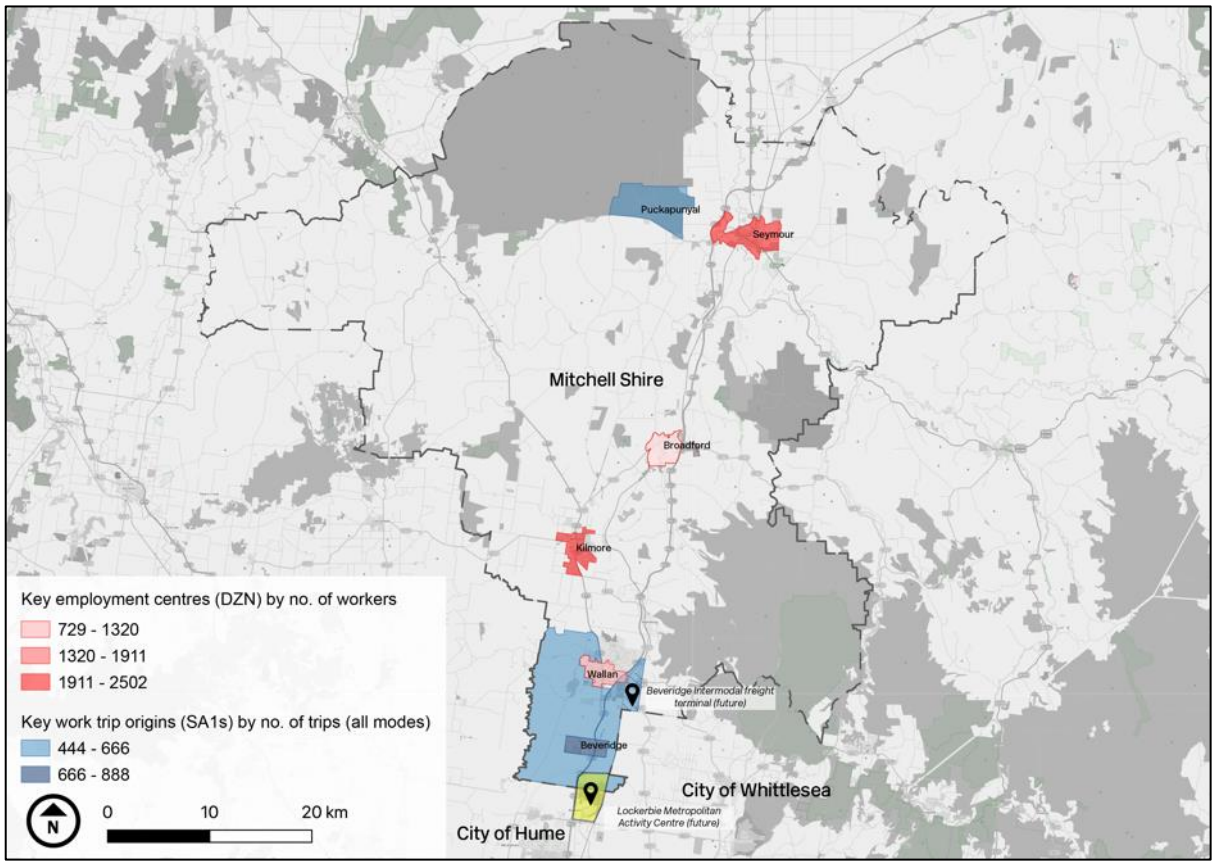
Public transport links between Wallan, Beveridge and these key employment centres are either inadequate or do not yet exist, and it is vital that quality public transport caters for these trips early in the delivery of the Beveridge and Wallan PSPs to avoid entrenching car dependence and congesting the Hume Freeway (a National Key Freight Route).

6.2.3 Points of interest in Mitchell Shire

The most recent available Census data (2016) indicates that the key employment centres in Mitchell Shire are Seymour and Kilmore, followed by Wallan and Broadford. Conversely, Beveridge, Wallan and Puckapunyal have the highest number of work trips originating within them, indicating a high outflow of work trips to employment destinations. It should be noted that when the 2021 Census data is released there is likely to be a much higher number of residents in Mitchell Shire than there was in 2016 and the key points of interest are likely to evolve as the population grows.

As Figure 104 illustrates, key origins and destinations in Mitchell Shire are geographically dispersed, necessitating long distance travel to access services and opportunities.

Figure 104: Key employment centres and work trip origins in Mitchell Shire



Source: ABS, 2016 with M&PC analysis

Future employment nodes within Mitchell Shire will include:

- The Beveridge intermodal freight terminal (BIFT)
- The future Lockerbie (Cloverton) Metropolitan Activity Centre (only the northern part is within Mitchell Shire)

6.2.4 Context of Mitchell Growth Area

Given the rapid growth in Beveridge and Wallan, it is imperative that excellent public transport choices are provided in the early development stages. Without these choices, the area will have entrenched reliance on private vehicles, land uses will align to and be designed for car access (not public transport or pedestrian access) and future efforts to encourage public transport use will fall flat.

The stakes for the Department of Transport are significant, and cannot be understated, as modelling shows that without excellent public transport connections the dispersed travel patterns and travel distances are likely to result in the need for billions of dollars of additional freeways connecting the area to employment and services.

Early provision of public transport in outer suburbs has also been identified as a significant problem by Infrastructure Australia[20]:

- Access to public transport services and service frequencies are lower, and travel times to employment are longer for residents of outer suburbs
- Public transport investment has focused on high-density corridors, neglecting the public transport needs of lower-density greenfield suburbs

The Mitchell Growth Area Integrated Transport Strategy (ITS) established the following priority actions for buses:

- Investigate the feasibility of establishing a priority route bus from Beveridge and Wallan to Craigieburn
- Use a community bus to connect Kilmore East to La Trobe University via Kilmore, Wallan and Beveridge
- Deliver the E14 road extension (Aitken Boulevard) as a busway in the first stage
- Increase Route 511 service frequencies to every 20 minutes and extending it to meet trains at Craigieburn Station

The modelling underpinning the Mitchell Growth Area ITS also assumed the following public transport upgrades:

- Local bus coverage in Wallan which connects residents to Wallan Station (2026)
- Local bus coverage in Beveridge which connects residents to Craigieburn Station (2026)
- Public transport connections to Epping, Mernda and Whittlesea (2026)
- Rail electrification to Wallan (2036)
- A new train station at Lockerbie (2036)
- Local bus coverage in Beveridge which connects residents to Lockerbie Station (2036)
- A new train station at Beveridge (2046)
- Local bus coverage in Beveridge which connects residents to Beveridge Station (2046)
- A high frequency bus corridor between Wallan and Craigieburn via Beveridge Town Centre (2046)

The Mitchell Growth Area ITS highlights the lead-time required to improve train services, and the importance of significantly improving bus services at an early stage in the development to ensure that public transport is quickly established as a viable choice for residents.

The modelling which underpins the Mitchell Growth Area ITS highlights the need for extensive public transport investment, as without it, there will be severe and ongoing congestion on key north-south corridors including the Nationally and State significant Hume Freeway by 2036.

[20] infrastructureaustralia.gov.au/publications/outer-urban-public-transport-improving-accessibility-lower-density-areas

The modelling also found that building more roads, such as the outer metropolitan ring road would further increase car trips and exacerbate congestion on all arterials leading to it. DoT needs to commit to urgent and ongoing public transport improvements to avoid entrenching an unsustainable pattern of growth in the Mitchell Shire.

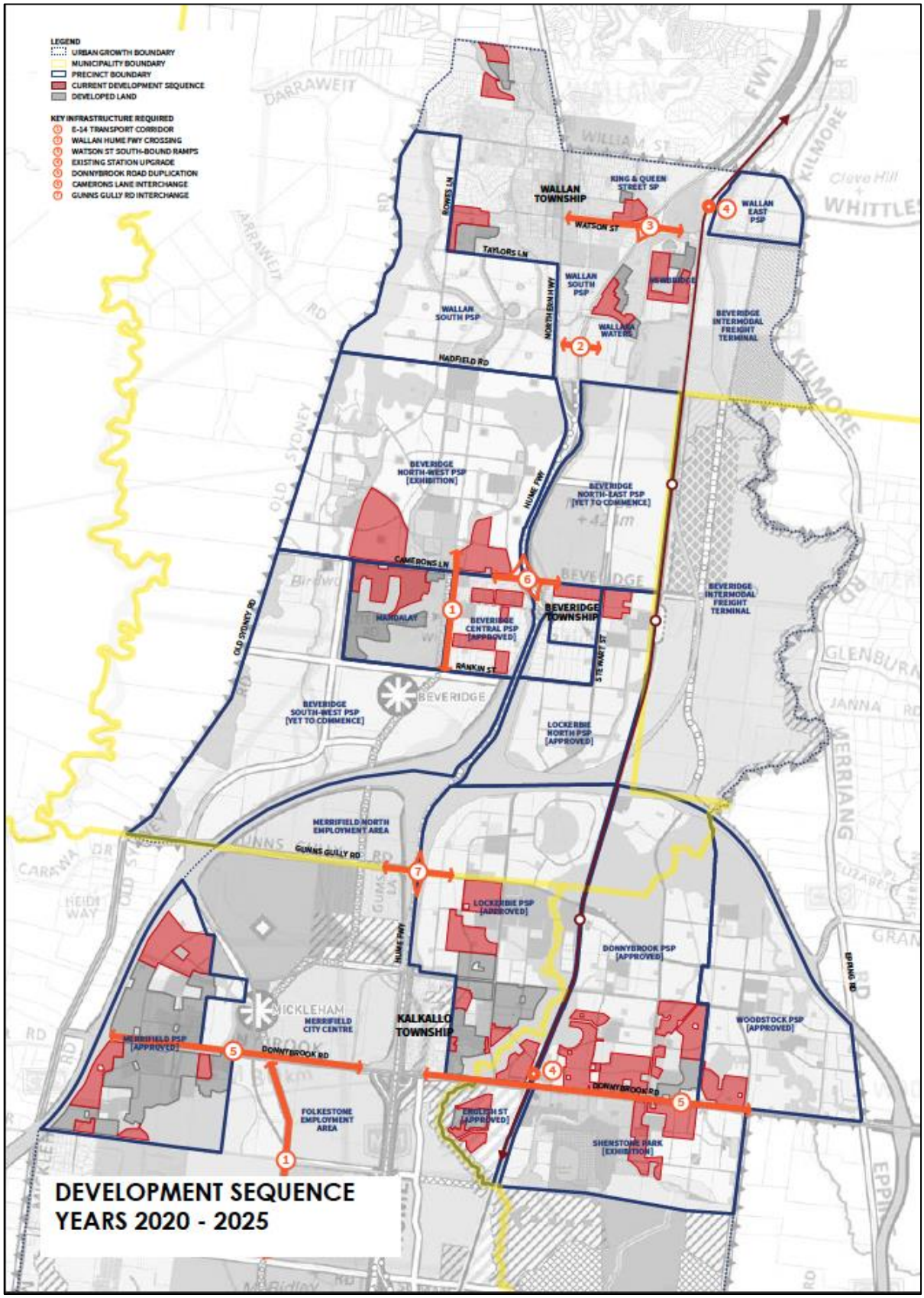
6.2.5 Northern Growth Corridor

The Northern Growth Corridor includes Wallan and Beveridge in Mitchell Shire, Donnybrook in City of Whittlesea and Kalkallo in the City of Hume. Overall, the northern growth corridor is anticipated to house 320,000 people (the size of Newcastle, NSW), and is one of the fastest growing corridors in Melbourne.

The development sequencing plan identifies key infrastructure projects needed to ensure equitable access to services and opportunities for Northern Growth Corridor residents. The key infrastructure projects in the next 10 years are presented in Figure 105 and Figure 106.

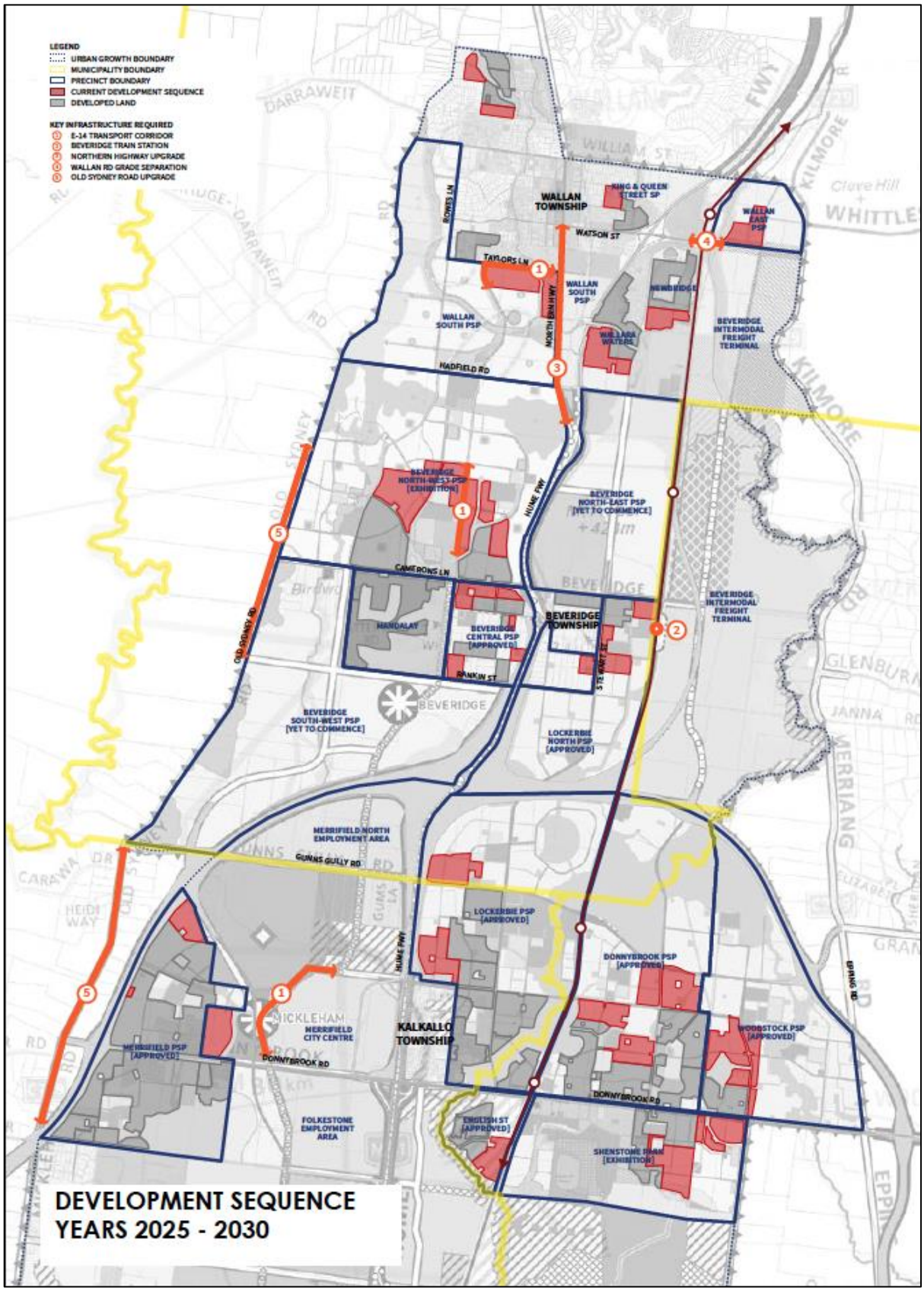
The E-14 transport corridor (Aitken Boulevard) will be an important bus corridor for north-south connectivity between Wallan/Beveridge and employment destinations further south. Advocating for its early delivery will benefit public transport connectivity for Beveridge and Wallan.

Figure 105: Northern Growth Corridor key infrastructure projects for 2020-2025



Source: Mitchell Shire Council

Figure 106: Northern Growth Corridor key infrastructure projects for 2025-2030



Source: Mitchell Shire Council

6.3 Bus service review of Wallan and Beveridge

With Wallan and Beveridge expected to absorb most of Mitchell Shire's growth, it is important this report considers bus services in the Mitchell growth area differently from bus services in its regional townships. The Mitchell growth area is integral to metropolitan Melbourne's future growth, and its residents should expect metropolitan levels of public transport service.

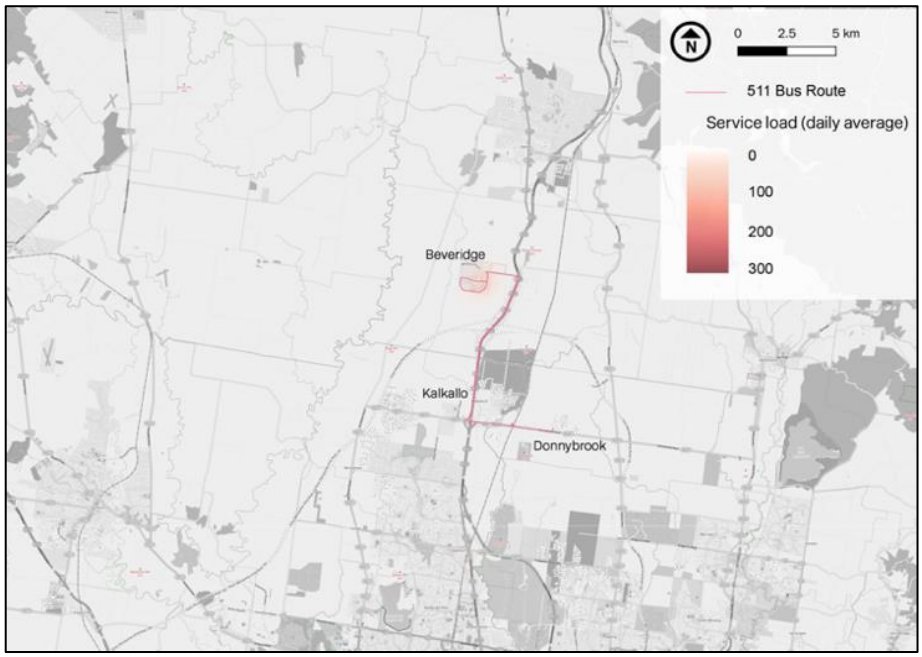
Beveridge is currently only serviced by one bus, Route 511 which runs from Beveridge to Donnybrook V/Line Station via Olivine Estate. Wallan is serviced Wallan Routes 1, 2 and Wallan Link Bus A and B, which all interchange at Wallan V/Line Station. The Wallan bus network maps on PTV's website[21] indicate the existence of a Wallan Route 3, however after comparing the maps it is clearly the same route as Wallan Link Bus B. Wallan Route 3 should be removed from the bus network map to avoid confusion.

6.3.1 Patronage

Route 511 is a relatively new service, with annual patronage of 3,400 in 2018-19. Patronage typically needs two years in order to stabilise. In this case, the timing of services and the singular purpose of the route (it only provides access to Donnybrook Station and not to any other employment areas or services) is likely to be minimising the potential patronage on the route.

Figure 107 shows average loads on this poorly performing route are highest at Beveridge.

Figure 107: Route 511 average loading per service 2018-19 (Weekday)



[21] www.tinyurl.com/2p863f93 and www.tinyurl.com/2p8dxup7

Source: DoT with M&PC analysis

Patronage data was not available for Wallan's bus services. As a first step, collecting patronage data for bus services in Wallan would benefit future bus planning in the area.

6.3.2 Service level review

Wallan is served by the Shepparton – Melbourne via Seymour, and Broadmeadows V/Line train services. The latter has 18 services in each direction per day with 30-90 minutes gaps between services, and service spans of 17 hours to Melbourne and 17.5 hours to Shepparton. The Shepparton line upgrade will be completed in late 2022, with V/Line services along the corridor increasing then. Wallan has four bus routes, but they all have very low service levels (see Table 46), with no services on Sundays (see Table 47).

Table 46: Weekday bus service frequencies in Beveridge and Wallan

Service	Service headway (minutes)				
	Early	AM Peak	Interpeak	PM peak	Late
Bus (To Station)					
Route 511	1 service	1 service	NIL	2 services	NIL
Wallan Route 1	35-47	2 services	41-67	1 service	NIL
Wallan Route 2	25-47	2 services	41-79	1 service	NIL
Wallan Link Bus A	NIL	NIL	NIL	2 services	50-98
Wallan Link Bus B	35-48	1 service	NIL	1 service	31-50
Bus (From Station)					
Route 511	NIL	1 service	1 service	1 service	NIL
Wallan Route 1	34-47	2 services	41-80	1 service	NIL
Wallan Route 2	34-47	2 services	41-79	1 service	NIL
Wallan Link Bus B	35-48	1 service	NIL	1 service	32-50

Source: PTV (Reference day: 17 December 2021)

Table 47: Service span of buses in Beveridge and Wallan

Service	Direction	Span (Hours)		
		Weekday	Saturday	Sunday
Bus				
Route 511	To Mandalay	11	NIL	NIL
	To Donnybrook Station	11	NIL	NIL
Wallan Route 1	To Wallan Station	11	15	NIL
	To Wallan Central	11	15	NIL
Wallan Route 2	To Wallan Station	11	13	NIL
	To Springridge	11	13	NIL
Wallan Link Bus A	To Wallan Station	5	NIL	NIL
Wallan Link Bus B	To Wallan Station	15	NIL	NIL
	To Wallara Waters shuttle	15	NIL	NIL

Source: PTV (Reference day: 17, 18, 19 December 2021)

A review of the V/Line and Wallan bus timetables indicate that bus services are coordinated to allow optimal transfers onto the V/Line towards Melbourne during the AM peak and interpeak, but have significant transfer times (between 17 and 42 mins) for commuters travelling towards key employment centres further north in Mitchell Shire, such as Seymour.

Beveridge Station was closed in 1990, and whilst it is assumed as infrastructure to support the Northern Growth Corridor future growth (see Figure 106) there is no definite timeline on when it will be constructed. Route 511 serves the primary purpose of connecting residents in Beveridge to Donnybrook Station, which is 7km away. Bus services in Beveridge are restricted to Route 511, with four services in each direction per weekday over an 11-hour service span and no weekend services (as shown in Table 46 and Table 47). Given such low service levels, it is unsurprising that Route 511 has low patronage.

Route 511 services are coordinated to optimise passenger transfers for those travelling towards Melbourne during the AM peak and returning in the evening. The timing of services creates significant transfer times (around 45 mins) for commuters travelling towards key employment centres further north in Mitchell Shire, such as Seymour.

Poor coordination between the bus and V/Line trains heading towards Shepparton is an issue for the Mitchell growth area, because a significant proportion of residents work live and work within Mitchell Shire, requiring access to key employment centres further north in Mitchell Shire. Future reviews of Beveridge and Wallan bus services should maximise transfer opportunities in both directions, and consider the addition of late and weekend services.

6.4 Bus service review of Seymour

6.4.1 Service level review

Seymour is a key employment centre in Mitchell Shire, and the wider Seymour region (population of 10,900) is home to 25% of Mitchell Shire's current population. Seymour is served by the Shepparton – Melbourne and Albury – Melbourne V/Line train services, and Seymour Station serves as the interchange for all five bus routes which service Seymour. Seymour has 22 services per weekday to Shepparton across a 17-hour service span, 19 services per weekday to Albury across a 14.5-hour service span, and 40 services per weekday to Melbourne across a 15-hour service span.

Broadly, Routes 1-3 provide coverage service for riders who have no other transport options, and Routes 4 and 5 provide extra service during the AM and PM peaks respectively. All bus services operate at very low frequencies across limited service spans, with no services on Sunday, as shown in Table 48 and Table 49.

Table 48: Weekday bus service frequencies in Seymour

Service	Service headway (minutes)				
	Early	AM Peak	Interpeak	PM peak	Late
Bus					
Seymour Route 1 (To Seymour East)	NIL	30-33	30	28-37	NIL
Seymour Route 2 (To Seymour North)	2 services	2 services	87-123	2 services	NIL
Seymour Route 3 (To Puckapunyal)	NIL	35-40	90-225	25-45	NIL
Seymour Route 4 (To Seymour)	2 services	1 service	NIL	NIL	NIL
Seymour Route 5 (To Seymour North-East)	NIL	NIL	NIL	1 service	31-50

Source: PTV (Reference day: 17 December 2021)

Table 49: Service span of buses in Seymour

Service	Direction	Span (Hours)		
		Weekday	Saturday	Sunday
Bus				
Seymour Route 1	To Seymour East	9	5.5	NIL
Seymour Route 2	To Seymour North	11	NIL	NIL
Seymour Route 3	To Puckapunyal	10	6	NIL
Seymour Route 4	To Seymour	1	NIL	NIL
Seymour Route 5	To Seymour North-East	1.5	NIL	NIL

Source: PTV (Reference day: 17, 18, 19 December 2021)

A review of the V/Line and bus timetables and routes indicates that Routes 1 & 3 primarily pick commuters up from Seymour Station in the AM peak and connect them to employment, education, services and amenities in Seymour/Seymour East and Puckapunyal (an army training base north of Seymour).

Route 2 has minimal transfer times in the AM peak for commuters transferring at Seymour Station to travel towards Shepparton and Melbourne, but has significant waiting times for commuters travelling towards Albury (between 60 and 70 mins).

Route 4 provides a limited service which operates in the AM peak, coordinated with V/Line services toward Melbourne, rather than to Shepparton or Albury.

Route 5, a limited service which operates in the PM peak, is primarily coordinated to pick up commuters travelling from Melbourne, but is also well-coordinated for commuters transferring onto a V/Line towards Melbourne (transfer time of less than 10 minutes).

Future bus reviews of Seymour should consider adding services in the evenings and on Sundays.

6.5 Bus service review of Kilmore

6.5.1 Service level review

Kilmore (population of 10,200) is serviced by the Shepparton – Melbourne V/Line train service via Kilmore East train Station and has 18 services per weekday towards Shepparton and Melbourne. The township is serviced by one bus route, Kilmore Link Bus, which connects residents in Kilmore to the Station, which is approximately 4km away.

Public Transport Victoria (PTV) does not currently provide a network map of the Kilmore Link Bus. A network map should be provided for Kilmore to reduce confusion for commuters.

Though Kilmore only has one bus service, service spans and frequencies on the Kilmore Link Bus are markedly better than the service levels provided in Wallan, Beveridge and Seymour as shown in Table 50 and Table 51.

Table 50: Weekday bus service frequencies in Kilmore

Service	Service headway (minutes)				
	Early	AM Peak	Interpeak	PM peak	Late
Bus					
Kilmore Link Bus (To Kilmore East Station)	19-63	30-35	19-69	26-32	33-98

Source: PTV (Reference day: 17 December 2021)

Table 51: Service span of buses in Kilmore

Service	Direction	Span (Hours)		
		Weekday	Saturday	Sunday
Bus				
Kilmore Link Bus	To Kilmore	17.5	10	NIL
	To Kilmore East Station	18	9	NIL

Source: PTV (Reference day: 17, 18, 19 December 2021)

A review of the V/Line and bus timetables indicate that the Kilmore Link Bus is coordinated to maximise passenger transfers onto the V/Line towards Melbourne in the AM peak, but has significant wait times (30 to 54 mins) for commuters travelling towards Seymour and Shepparton.

Given that Seymour is a key employment centre in Mitchell Shire, it is important that any future timetable changes for the Kilmore Link Bus allows for relatively convenient transfers

onto the V/Line in both directions. Sunday services should also be considered in future bus reviews.

Given the distance of Kilmore East Station from Kilmore township, service provision 7 days a week is critical. We recommend providing more weekend services, including the operation of Sunday services.

6.6 Other townships

Broadford (population of 5,400), Pyalong (population of 2,000) and Tallarook (population of 700) are townships in Mitchell Shire which do not currently have any local bus services. These townships have relatively stable populations, and will experience minimal population growth to 2041.

Most of the Broadford township is within 1km of Broadford Station, and there would not be sufficient demand or need to run a local bus service to supplement what is a walkable catchment.

Similarly, most of the Tallarook township is within 500m of Tallarook Station, and there would not be sufficient demand or need to run a local bus service within this walkable catchment.

Pyalong township is serviced by the Barmah – Melbourne and the Deniliquin – Melbourne V/Line coach services, which stop in the Pyalong town centre. There is less of a need to provide a local bus service to Pyalong, especially considering that it is not a key origin or destination in Mitchell Shire. It is, however, confusing for commuters to access the route and timetable information for Pyalong's coach services via PTV's online timetable, because commuters must search journey details to Barmah and Deniliquin (both towns in New South Wales) to retrieve timetable details for Pyalong services.

It is recommended that the timetables be combined and be more easily searchable (particularly for townships in Mitchell Shire).

6.7 Recommendations to address growth along the northern growth corridor

Given the context and issues outlined, we recommend the following six improvements, which should be introduced in line with population thresholds being reached:

- Direct service from Wallan and Beveridge to Melbourne Airport via Craigieburn, Roxburgh Park
- Direct service from Wallan and Beveridge to Epping
- Direct service from Wallan and Beveridge to La Trobe University (LTU) via Thomastown
- Direct service from Beveridge to Broadmeadows via Campbellfield
- Extension of Route 511 to Mernda
- A future east-west connection from Woodend to Whittlesea via Wallan and Beveridge
- Improved timetable information and mapping for the existing services

These are discussed in more detail below.

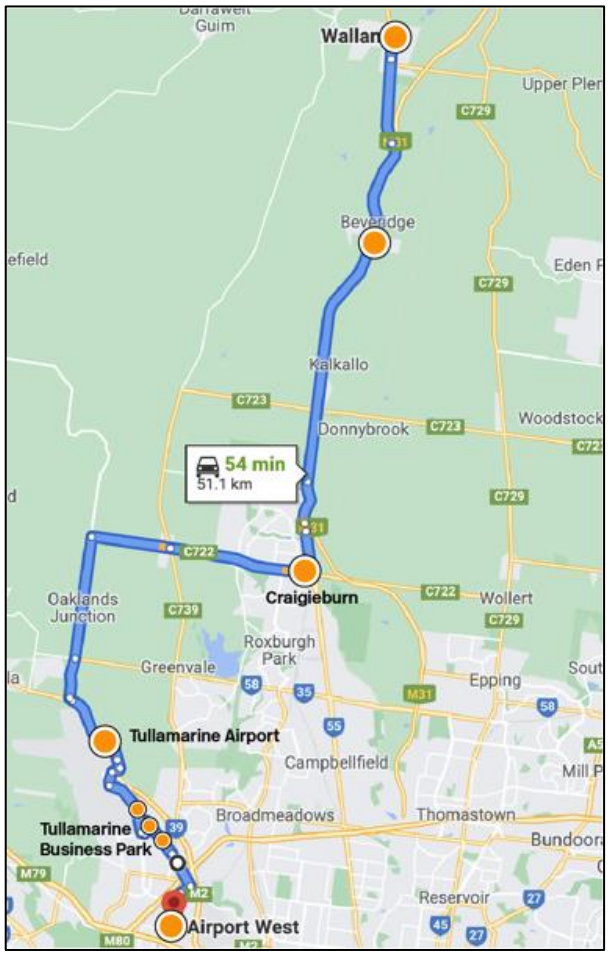
6.7.1 Direct service from Wallan and Beveridge to Melbourne Airport via Craigieburn, Roxburgh Park

Melbourne Airport and its surrounding business park is a key employment centre in the northern metropolitan region and will grow as an important employment destination for residents in the northern growth corridor. Establishing an early connection between residents in Wallan and Beveridge to jobs in Tullamarine will reduce traffic congestion on the Hume Freeway and improve freight reliability in the corridor.

There is also an opportunity to connect northern growth corridor residents to employment in the Craigieburn major activity centre.

Figure 108 shows a potential bus connection between the northern growth corridor and Melbourne Airport via Craigieburn. The bus service would stop in Wallan, Beveridge, Craigieburn, Melbourne Airport and have multiple stops in Tullamarine business park (an employment area of 700 hectares), before terminating at Airport West Shopping Centre, the nearest interchange. To maximise transfer opportunities, the bus would also stop at Craigieburn Station. In total, the bus would travel approximately 51km, running express along the Hume Freeway and between major stops. The whole journey would take approximately 60-75 minutes in each direction.

Figure 108: Direct bus service between Wallan and Melbourne Airport



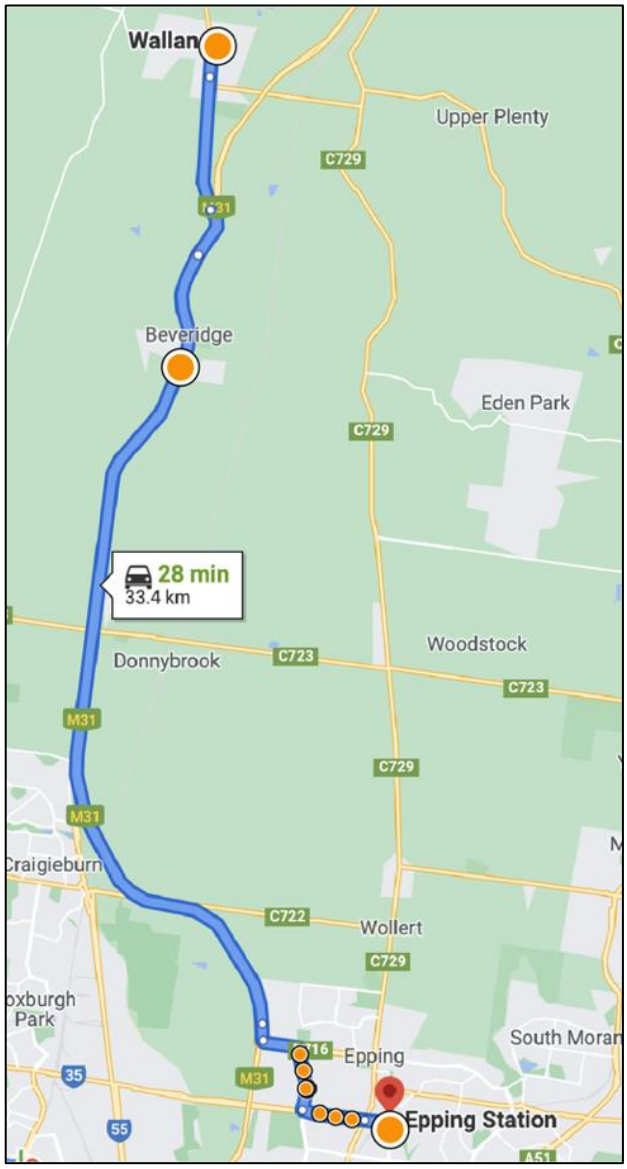
Source: Google Maps

6.7.2 Direct service from Wallan and Beveridge to Epping

Epping is currently a key employment destination for Mitchell Shire residents and will continue to remain so into the future. It provides the nearest hospital and a range of other regional facilities and employment opportunities.

Figure 109 shows a potential bus connection between the northern growth corridor and employment in Epping. The bus service would stop in Wallan, Beveridge and Epping, with multiple stops in Epping to service the business parks between Oherns Road and Cooper Street. The bus would also serve Epping hospital and Epping shopping centre. To maximise transfer opportunities, the bus would terminate at Epping Station. In total, the bus would travel around 34km in each direction, running express on Hume freeway and between major stops. The whole journey would take approximately 40-45 minutes in each direction.

Figure 109: Direct bus service between Wallan and Epping



Source: Google Maps

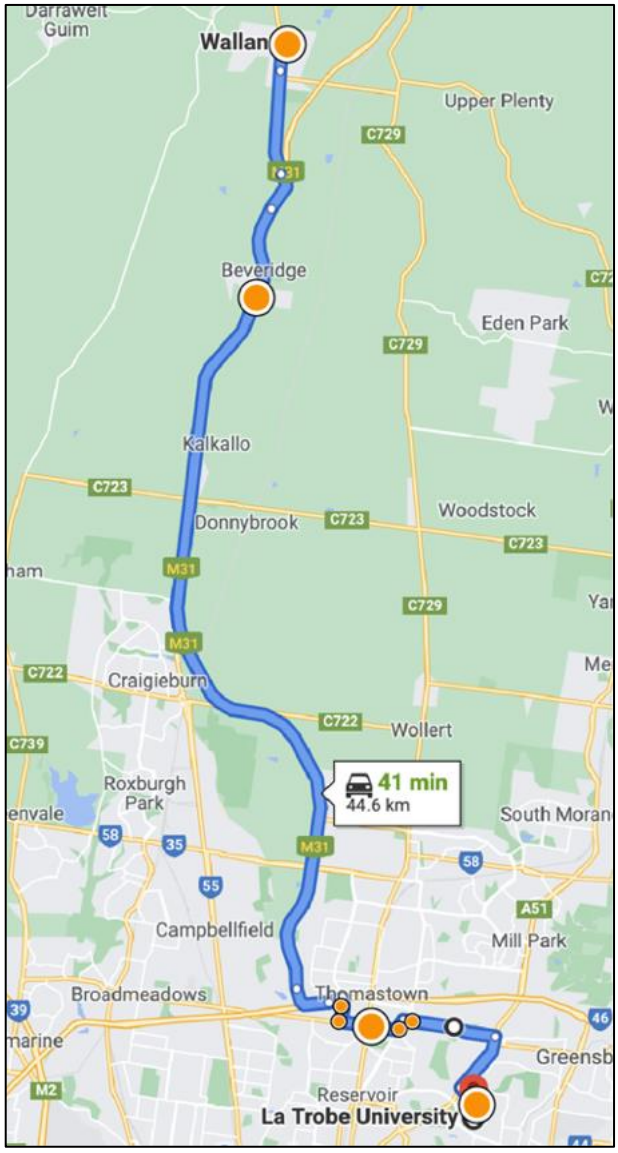
6.7.3 Direct service from Wallan and Beveridge to LTU via Thomastown

LTU is a key education node in the northern metropolitan region, functioning as the heart of the La Trobe NEIC. Establishing a direct connection between the northern growth corridor and LTU is important for improving residents' access to opportunities. There is also an opportunity to connect northern growth corridor residents to Thomastown, which is currently a key employment destination for Mitchell Shire residents.

Figure 110 shows a potential bus connection between the northern growth corridor, Thomastown and LTU. The service would stop in Wallan, Beveridge, Thomastown and LTU, with the potential for multiple stops in Thomastown to service the industrial precincts. To maximise transfer opportunities, the bus would also stop at Thomastown Station. In total,

the bus would travel approximately 45km, running express on Hume Freeway and between major stops. The whole journey would take approximately 50-60 minutes in each direction.

Figure 110: Direct bus service between Wallan and LTU



Source: Google Maps

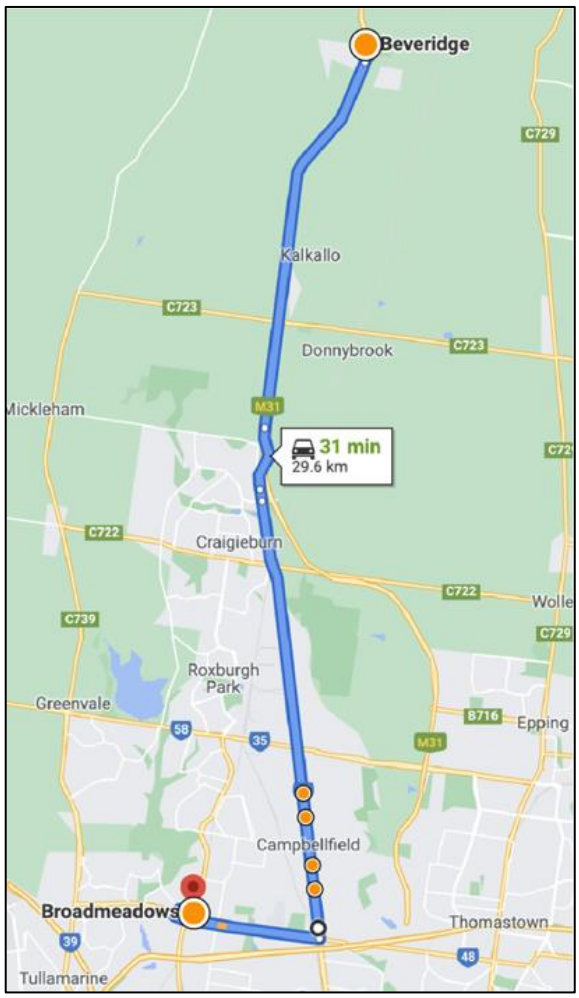
6.7.4 Direct service from Beveridge to Broadmeadows via Campbellfield

While Wallan is currently connected to Broadmeadows by V/Line train service, it will be at least two decades until Beveridge has a direct connection to Broadmeadows (section 6.2 noted modelling for the Mitchell Growth Area ITS assumed a new station in 2046). As a metropolitan activity centre and key employment node in the region, it is important residents in Beveridge have direct and convenient access to Broadmeadows.

A direct bus between Beveridge and Broadmeadows via Campbellfield will improve connectivity to the closest major employment corridor and provide a metro rail connection to Beveridge residents via the Craigieburn line.

Figure 111 shows a potential bus connection between Beveridge, Campbellfield and Broadmeadows. The service would stop in Beveridge, Campbellfield and Broadmeadows, with potential for multiple stops in Campbellfield to service industrial precincts. To maximise transfer opportunities, the bus would terminate at Broadmeadows Station. In total, the bus would travel around 30km, running express on the Hume Freeway and between major stops. The whole journey would take around 40-50 minutes each direction.

Figure 111: Direct bus service between Beveridge and Broadmeadows



Source: Google maps

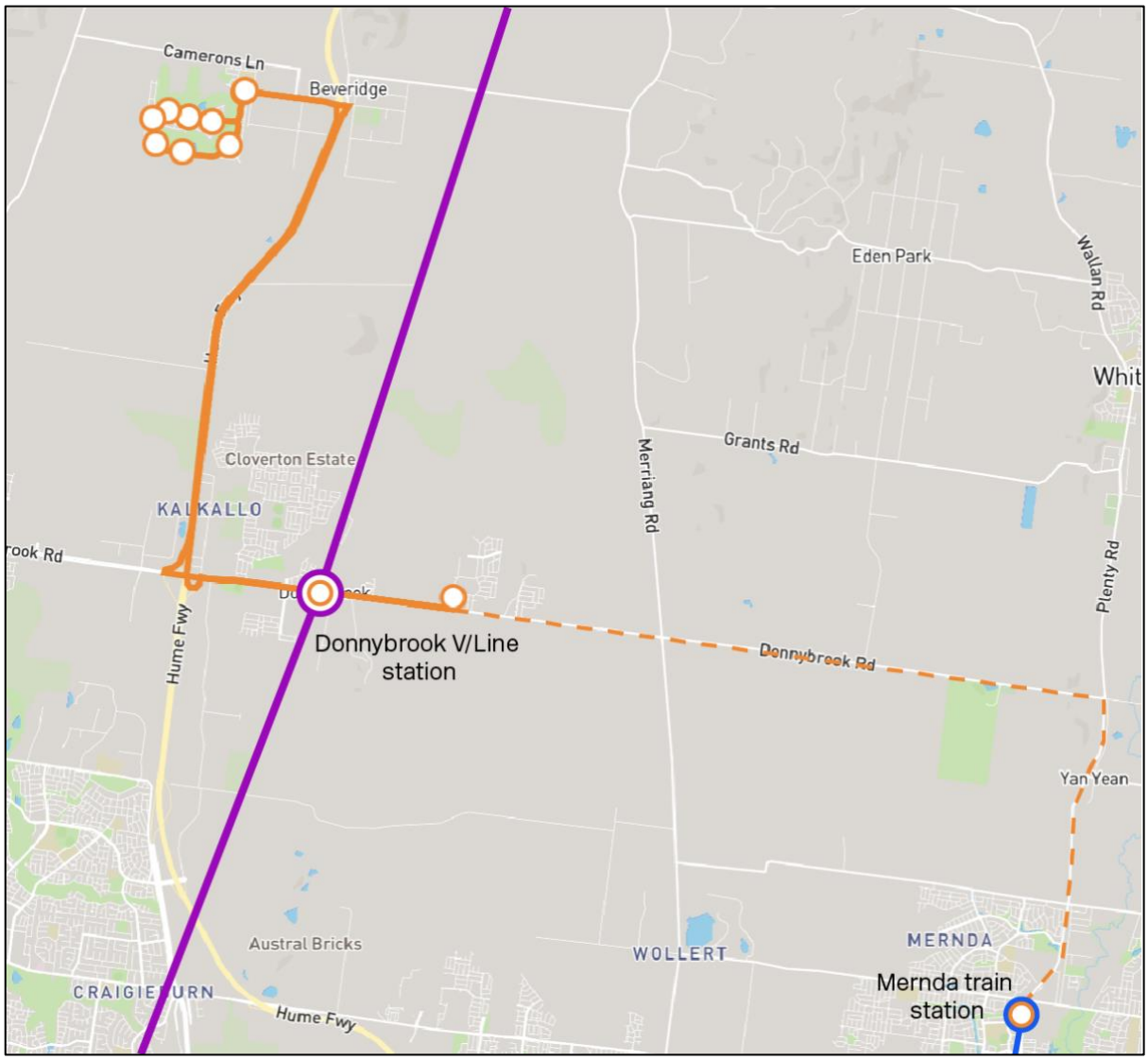
6.7.5 Extension of Route 511 to Mernda

Route 511 currently connects Beveridge to Donnybrook V/Line Station, primarily serving travel towards Melbourne CBD which is only a small portion of overall trips from Beveridge. Extending Route 511 to Mernda would create better east-west connectivity in the area, and cater for trips to key employment destinations on the Mernda line such as Epping, South Morang and Thomastown.

Figure 112 shows the proposed extension of Route 511 to Mernda Station via Donnybrook and Plenty Road. The extension would add approximately 24km and 25-30 minutes of

travel time to the route. At the start, Route 511 would run express along Donnybrook and Plenty Road, with the potential to add stops along Donnybrook Road as population milestones are reached in the area.

Figure 112: Route 511 extension to Mernda



Source: PTV with M&PC annotation

6.7.6 A future east-west connection from Woodend to Whittlesea via Wallan and Beveridge

As Wallan and Beveridge mature and hit critical population thresholds, a strong east-west public transport connection will need to cater for increasingly diverse trips to neighbouring regional and metropolitan activity nodes.

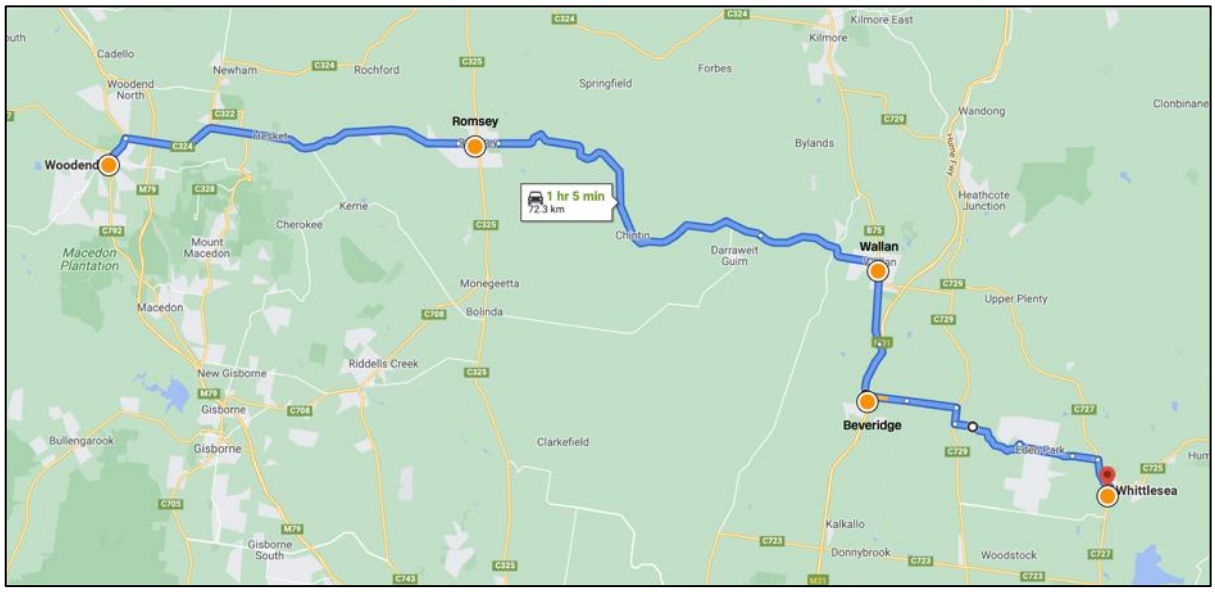
A bus connection between Woodend and Whittlesea would connect the Melbourne – Bendigo and Melbourne – Shepparton V/Line rail corridors, and potentially the Mernda metro line, if it is extended to Whittlesea in the future.

Figure 113 shows a potential bus connection between Woodend and Whittlesea which stops at Romsey, Wallan and Beveridge, with actual stops dependent on land uses and activity concentrations along the corridor. This service would probably operate on some future road corridors, such as Aitken Boulevard. Its implementation would be dependent on population and activity concentration milestones being achieved in Wallan and Beveridge.

The route will likely be approximately 75km long. The whole journey will likely take 75-90 minutes in each direction.

Due to the significant length of the service, Table 53 shows that there is a significant cost associated with the delivery of this recommendation. Noting that implementation is dependent on population and activity, there will need to be new east-west services such as this to meet the needs of the northern growth corridor.

Figure 113: Direct bus service between Woodend and Whittlesea



Source: Google maps

6.7.7 Recommendations to be considered for future bus reform in Mitchell Shire

Future bus reform in Mitchell Shire should consider:

- Collecting bus patronage data for Wallan
- Adding late and weekend services in Beveridge and Wallan
- Aligning bus timetables in Beveridge and Wallan with trains travelling to and from Melbourne CBD
- Adding late and Sunday services in Seymour
- Aligning bus timetables in Kilmore with trains travelling to and from Melbourne CBD
- Adding Sunday services in Kilmore
- Introducing services in other townships in line with population growth
- Providing east west connections to supplement the focus on north-south connectivity

6.8 Summary of recommendations

Table 52 summarises the recommended bus connections for Wallan and Beveridge, which should be introduced as early as possible in the PSPs' delivery, in line with average levels of service kilometre provision and population growth in the area.

Table 52: Summary of recommended bus connections for Wallan and Beveridge

Recommended connection	Rationale
1. Direct service from Wallan and Beveridge to Melbourne Airport via Craigieburn	• Melbourne Airport is a key employment hub in the northern metropolitan region, and will be a key employer for Beveridge and Wallan residents in the future • Craigieburn is currently a key employment destination for Mitchell Shire residents
2. Direct service from Wallan and Beveridge to Epping	• Epping is currently a key employment destination for Mitchell Shire residents • Better access to Epping's activity centres will improve access to services and amenities for Beveridge and Wallan residents
3. Direct service from Wallan and Beveridge to LTU via Thomastown	• LTU is the major education centre in the northern metropolitan region. A direct link between Wallan and Beveridge to LTU will significantly improve access to education and employment opportunities for residents • Thomastown is currently a key employment destination for Mitchell Shire residents and is home to significant industrial precincts
4. Direct service from Beveridge to Broadmeadows via Campbellfield	• Beveridge will not have a rail connection till 2046. A direct connection to Broadmeadows would strengthen rail access for Beveridge residents. • A direct link to Broadmeadows would significantly improve access to services and amenities for Beveridge residents, because Broadmeadows is a key activity centre in the northern metropolitan region • Campbellfield is a key employment destination for Mitchell Shire residents

Recommended connection	Rationale
5. Extension of Route 511 to Mernda	• Improves east-west connectivity in the northern growth areas • Improve access to employment nodes at South Morang, Epping, and Thomastown
6. Future east-west service from Woodend to Whittlesea via Wallan and Beveridge	• Additional east-west public transport connections will be needed as Beveridge and Wallan mature • A direct service from Woodend to Whittlesea would connect multiple rail corridors and activity nodes

6.9 Cost estimates

Estimated costs for the improvement recommendations are shown in Table 53 below. Note that these are high-level estimates based on a series of underlying assumptions about current and future travel behaviour. It is anticipated that DoT would complete its own analysis of options prior to finalizing any changes.

Table 53: Improvement recommendations for Mitchell Shire

Improvement option	Costs
1. Direct service from Wallan and Beveridge to Melbourne Airport via Craigieburn, Roxburgh Park	• Bus costs estimated at $0.4m - $0.6m p/a • KM costs estimated at $2.2 - $2.6m p/a • Bus hourly costs estimated at $1.2m - $1.6m p/a
2. Direct service from Wallan and Beveridge to Epping	• Bus costs estimated at $0.2m - $0.4m p/a • KM costs estimated at $1.4 - $1.8m p/a • Bus hourly costs estimated at $0.7m - $1.1m p/a
3. Direct service from Wallan and Beveridge to LTU via Thomastown	• Bus costs estimated at $0.3m - $0.5m p/a • KM costs estimated at $2.0 - $2.4m p/a • Bus hourly costs estimated at $1.0m - $1.4m p/a
4. Direct service from Beveridge to Broadmeadows via Campbellfield	• Bus costs estimated at $0.3m - $0.5m p/a • KM costs estimated at $1.3 - $1.7m p/a • Bus hourly costs estimated at $0.8m - $1.2m p/a
5. Route 511 extension to Mernda	• Bus costs estimated at $0.2m - $0.4m p/a • KM costs estimated at $1.0 - $1.4m p/a • Bus hourly costs estimated at $0.5m - $0.9m p/a
6. A future east-west connection from Woodend to Whittlesea via Wallan and Beveridge	• Bus costs estimated at $0.7m - $0.9m p/a • KM costs estimated at $3.5 - $3.9m p/a • Bus hourly costs estimated at $1.9m - $2.3m p/a

Service costings are based on the new routes operating three services per hour from 05:30 – 22:30 every day of the week.

6.10 Benefit estimates

The above services are being recommended to meet the future connectivity needs of an area which is changing rapidly (and is clearly not fully implemented). As such, whilst the services are required to ensure that car dependency is not locked in for the region, it is not practical to make an estimate of the benefits at this stage.

Not all the services would be required immediately, but a consistent approach to regularly improving both local and regional services should be applied in Mitchell Shire. This should take the form of a dollar per capita commitment for funding service increases each year as the population grows. DoT can then determine which service priorities should be implemented each year.

7 Conclusion

NRTS stage 2 aimed to improve public transport connectivity in the north by proposing improvements to the bus network. Our recommendations were informed by a range of analyses, such as service reviews, patronage analyses, trip distribution analyses, and benefit/cost estimates.

Recommendations for each chapter are summarised below:

SRLB

The following route alignment for SRLB is recommended:

1. Melbourne Airport to Broadmeadows via the M2 Freeway
2. Broadmeadows to Fawkner via Camp Road
3. Fawkner to Keon Park via Mahoneys Road
4. Keon Park to Reservoir via High Street
5. Reservoir to La Trobe University via Dunne Street
6. La Trobe to Heidelberg via Waiora Road
7. Heidelberg to Doncaster via Manningham Road
8. Doncaster to Box Hill via Tram Road

SmartBus Routes 901, 902, 903 review

The following improvements should be investigated for SmartBus 901, 902 and 903:

- Swapping the western termini of SmartBus 901 Melbourne Airport) and 902 (Airport West shopping centre) would improve employee access to Melbourne Airport
- Reducing duplication between SmartBuses 901 and 902 and local routes in Greensborough and Eltham (particularly Route 513) could give significant cost savings
- Realigning SmartBus 901 via Somerton Road and Mickleham Road would improve connectivity for Greenvale, an underserved, rapidly growing suburb
- Investigate a right-turn bus priority signal at the intersection of Diamond Creek and Yan Yean Roads (Option 10 – SmartBus 901)
- Investigate bus priority through the intersection of Cooper Street and Edgars Road (Option 17 – SmartBus 901)
- Investigate bus priority through the intersection of Mahoneys and Edgars Roads (Option 20 – SmartBus 902)
- Investigate bus priority through the intersection of Grimshaw Street and Greensborough Bypass (Option 22 – SmartBus 902)
- Investigate bus priority lanes in both directions on Manningham Road, near intersection with Dora Street (Option 24 – SmartBus 903)
- Investigate bus priority lanes in both directions on Fitzsimons Lane, near intersection with Porter Street (Option 32 – Smartbus 901, 902)
- Investigate bus priority lanes and signalling in all directions at the Fitzsimons Lane and Main Road roundabout (Option 33 – SmartBus 901, 902)
- Investigate westbound bus priority signalling at the intersection of Bell Street and Pentridge Boulevard (Option 37 – SmartBus 901, 902)

Improving connections to La Trobe University

The following improvements should be investigated to improve public transport connectivity to LTU:

- Increase service frequency on Route 301 (direct shuttle to LTU from Reservoir Station) and run services throughout the year, rather than only during University semester
- Extend Route 301 to Heidelberg Station to improve access from the Hurstbridge line
- Reroute Route 382 to LTU via Science Drive, improving connectivity to northern suburbs in Whittlesea, such as Mill Park, South Morang and Mernda
- Connect Routes 513G and 343, and reroute them through LTU. This will improve connectivity to northeastern suburbs such as Diamond Creek and Hurstbridge
- Establish a new service between LTU and Viewbank/Yallambie, increasing LTU's potential employee and enrolment catchment
- Re-align Route 609 and extend it across the Yarra river to LTU, improving connectivity to eastern suburbs such as Kew and Hawthorn
- Investigate right-turn bus priority on Waterdale Road before its intersection with Kingsbury Drive to improve service reliability

Improving connections to Melbourne Airport

The following improvements should be investigated to improve public transport connectivity to Melbourne Airport:

- A direct connection between Craigieburn and Melbourne Airport via Roxburgh Park, connecting key employee catchments to Melbourne Airport
- A direct connection between Donnybrook and Melbourne Airport via Craigieburn and Aitken Boulevard
- Merge Route 479 with other local routes in Sunbury and expand the frequency and span of services to improve connectivity between Sunbury's residential areas and Melbourne Airport
- Extend Route 482 from Tullamarine Business Park to Sunbury to improve connectivity to Sunbury, which has the largest number of Airport employees
- A direct connection between La Trobe NEIC and Melbourne Airport via Coburg, improving connectivity between La Trobe NEIC, the inner northern activity centres (Coburg, Brunswick, Preston) and Melbourne Airport
- A direct shuttle from Melbourne Airport to Broadmeadows Station via the implementation of SRLB, improving Melbourne Airport's rail connection
- Extend Route 490 (Gowanbrae DRT) to serve Melbourne Airport via the Airport Drive and Sharps Road area, adding key trip attractors to the route and improving connectivity for residents in Gowanbrae
- Run SmartBus 902 to Melbourne Airport and SmartBus 901 to Airport West shopping centre to improve employee access to Melbourne Airport

Serving Mitchell Shire's growing population

The following key improvements should be investigated for Wallan and Beveridge:

- Direct service from Wallan and Beveridge to Melbourne Airport via Craigieburn, Roxburgh Park
- Direct service from Wallan and Beveridge to Epping
- Direct service from Wallan and Beveridge to La Trobe University (LTU) via Thomastown
- Direct service from Beveridge to Broadmeadows via Campbellfield
- Extension of Route 511 to Mernda
- A future east-west connection from Woodend to Whittlesea via Wallan and Beveridge
- Collecting bus patronage data for Wallan
- Adding late and weekend services in Beveridge and Wallan
- Aligning bus timetables in Beveridge and Wallan with trains travelling to and from Melbourne CBD

Future bus reform in Mitchell Shire townships should consider:

- Adding late and Sunday services in Seymour
- Aligning bus timetables in Kilmore with trains travelling to and from Melbourne CBD
- Adding Sunday services in Kilmore
- Introducing services in other townships in line with population growth

Appendix A – Expected future growth in trips

Growth in internal and external trips from 2021-2051 (SA3)

SA3		2021	2036	2051
Brunswick – Coburg (Moreland)	External	530,541	685,265	844,310
	Internal	132,398	170,080	209,500
Moreland – North (Moreland)	External	292,851	385,212	480,586
	Internal	44,036	57,708	72,500
Darebin – North (Darebin)	External	499,800	668,975	846,260
	Internal	97,516	132,943	172,204
Darebin – South (Darebin)	External	294,551	368,772	442,317
	Internal	47,930	56,506	64,469
Banyule (Banyule)	External	584,626	701,997	815,834
	Internal	183,808	212,675	240,547
Nillumbik – Kinglake (Nillumbik)	External	290,596	331,684	367,650
	Internal	85,470	93,856	100,720
Sunbury (Hume)	External	168,712	252,670	363,661
	Internal	98,940	149,394	218,547
Tullamarine – Broadmeadows (Hume)	External	736,783	1,008,148	1,264,466
	Internal	245,639	350,068	445,124
Whittlesea – Wallan (Whittlesea, Mitchell Shire)	External	793,921	1,217,174	1,691,880
	Internal	357,239	584,624	844,878
Upper Goulburn Valley (partial) (Mitchell Shire)	External	10,644	13,116	15,817
	Internal	1,477	1,684	1,896

Source: DoT with M&PC analysis