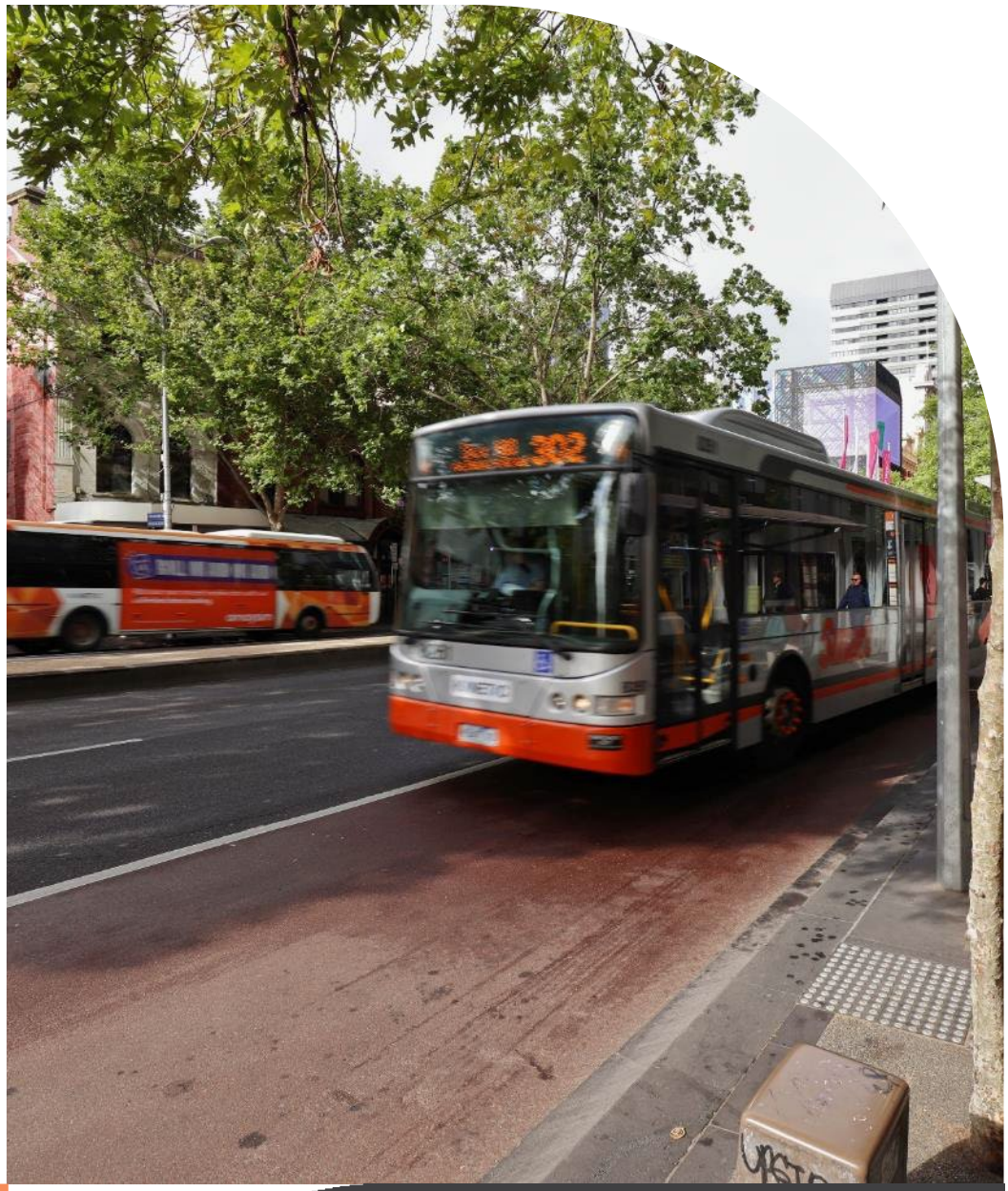

INFRASTRUCTURE VICTORIA

December 2023

Fast, frequent, fair

How buses can better connect Melbourne

About us

Infrastructure Victoria is an independent advisory body with 3 functions:

- preparing a 30-year infrastructure strategy for Victoria, which we review and update every 3 to 5 years
- advising the government on specific infrastructure matters
- publishing research on infrastructure-related issues.

Infrastructure Victoria also helps government departments and agencies develop sectoral infrastructure plans.

Infrastructure Victoria aims to take a long-term, evidence-based view of infrastructure planning, and we inform community discussion about infrastructure provision.

Infrastructure Victoria does not directly oversee or fund infrastructure projects.

Acknowledgement

Infrastructure Victoria acknowledges the Traditional Owners of Country in Victoria and pays respect to their Elders past and present, as well as Elders of other First Peoples' communities. We recognise that Victoria's infrastructure is built on land that has been managed by Aboriginal people for millennia.

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Summary

Buses can play a much larger role in Melbourne

Buses can provide fast, frequent and direct public transport services for Melburnians, especially in outer suburbs and new growth areas that are not currently served well by public transport. Because they have lower costs compared to other forms of transport, they lead the way to delivering affordable public transport options sooner.[1]

Melbourne's trams and trains have supported the city's growth and provided convenient connections between inner Melbourne and the suburbs for over a century.[2,3] However, the rapid pace of development in Melbourne's outer and new growth suburbs means that many new homes are not inside the catchment of the city's tram and train networks. Growth area residents are least likely to consider catching the bus compared to people living in other parts of Melbourne, even when this is the only public transport option available.[4]

Many Melburnians are willing to switch from their cars if the bus system can deliver a fast, frequent, safe, connected and reliable service. We found that up to 25% of people would love to get rid of their cars but do not feel that they have a viable alternative.

Melbourne is a car dependent city already experiencing high levels of road congestion.[5] Seventy per cent of Melburnians say they could not survive without a car[6] and private vehicle trips are likely to continue to be a significant part of how Melburnians choose to travel. However, if they have a competitive public transport alternative, more people can have an opportunity to choose a different way to access jobs, education, services and recreation.

Buses can play a much larger role in moving people around Melbourne. The metropolitan bus network currently carries the lowest number of passengers of all forms of public transport, despite buses offering over 5 times more scheduled service kilometres than the city's tram or train networks.[7] Melbourne's buses cost over $800 million to operate each year. [8] They make up 30% of funding for metropolitan public transport operations and account for approximately 25% of overall public transport patronage.

Almost 6.5 million people are expected to call Melbourne home in 2036.[9] The planning and investment in Melbourne's transport network will affect where people live, how they access jobs, education and services, guide Victoria's pathway to net-zero emissions and influence social equity across the city.[10]

Comprehensive reform is needed to create a fast, fair and better-connected bus network

There is a huge opportunity to elevate the role buses play in moving Melburnians around the city.

Buses can provide faster and more frequent services, operate for longer hours and use routes that better connect shopping precincts, train stations, and other activity centres. This will give more people access to public transport, reduce road congestion, improve social equity and cut Victoria's transport emissions.

A modern bus network should meet the needs of all Melburnians. But the bus system is missing several features needed to make buses a viable choice for all, such as safe pedestrian crossings, real-time and accessible service information, and tailored community transport options.

Like other cities in Australia and across the world, Melbourne can also benefit from a network of bus rapid transit connected to activity centres and the rail network. This would radically change the way Melburnians move across the city and locate high quality transport near more homes, schools and businesses. We estimate that bus rapid transit has the potential to return around $2.60 for every dollar invested in a new bus rapid transit network, including the benefits from public transport user travel time savings and the land value uplift around new bus rapid transit stations.

Long-term planning is needed to guide network investment decisions and better align land use and infrastructure delivery. Residents in growth areas are waiting on average more than 3 years before their first

bus service begins operation. New suburbs in Melbourne's west have some of the longest wait times with one community in Wyndham waiting 14 years before a bus was delivered close to homes.[11] Long-term public transport plans can provide certainty and better inform these communities. A dedicated fund for growth area bus services can support these transport plans.

Now is the time to rethink Melbourne's buses

Victoria's bus plan is the Victorian Government's long-term strategy to deliver bus reform.[12] Our research complements this plan, quantifies the benefits of bus reform, and advises how government should prioritise investment in better buses. We have undertaken extensive modelling and research on how to achieve a faster, frequent and fairer bus network to better connect Melbourne.

We found that investing in higher frequency buses across Melbourne could return around $1.40 in benefits for every dollar invested, while full scale reform could deliver $2.4 to $3.3 billion worth of travel time saving benefits to public transport users over the 20 years after implementation.

Full scale reform like combining frequency upgrades, better-connected routes and bus lanes, supported with sustained investment, can modernise Melbourne's bus network to meet the city's changing needs. A staged and long-term approach is needed to match the scale of reform required and the diverse needs of local communities. This means rolling out sequenced improvements in targeted areas of Melbourne, rather than a single uplift across the city.

Improving Melbourne's buses is more than just a transport vision. It has the potential to transform lives and boost access to places right across Melbourne. The benefits from transforming Melbourne's bus network are comparable to any one of Victoria's big road and rail projects, at much less cost.[13] With full scale reform and sustained investment, buses can perform a leading role in Melbourne's transport network. A better bus network also plays a vital role in improving social outcomes. Whether it is young people trying to get their first job, the elderly accessing health services, or people experiencing poverty, investment in buses removes transport barriers and improves independence.[14]

Our recommendations

Our 10 recommendations collectively provide ways the government can make buses a mode of choice for all Melburnians. No single recommendation will fix the challenges of Melbourne's bus network. Instead, many of the recommendations can be combined to achieve a better outcome through smarter investment in bus services, supporting infrastructure and network planning to maximise the benefits from bus reform.

Making Melbourne's buses a competitive choice

Recommendation 1: Increase the frequency of bus services beginning with outer suburbs and growth areas.

Immediately upgrade the frequency of bus services in Melbourne, starting with trunk and connector bus routes operating in outer and new growth suburbs like Tarneit, Craigieburn, Epping, Cranbourne and Frankston.

Set minimum frequency targets for bus routes across Melbourne, based on route category. Then, deliver suitable trunk and connector bus routes for frequency upgrades in inner and middle suburbs including Point Cook, Footscray, Reservoir and Clayton.

Recommendation 2: Optimise the existing bus network through fast and direct routes.

In the next year, begin delivering faster and more direct routes to parts of the existing metropolitan bus network. Immediately begin with areas in Melbourne's north and north-east where bus reform consultation has already taken place.

Over the next 5 years, deliver faster and more direct routes in outer and growing suburbs like Melton and Endeavour Hills, while also redesigning relevant bus services to prepare for Big Build projects coming online, including the Metro Tunnel and North East Link.

Recommendation 3: Extend operating hours to match passenger demand and improve timetable integration.

Begin extending operating hours of bus services across Melbourne, especially to activity centres like Chadstone and Northland on weekends.

Progressively deliver ongoing timetable improvements to improve the user experience for bus passengers, including the integration of bus timetables with other connecting public transport services and the rollout of rapid running services.

Recommendation 4: Strengthen the role of community transport.

In the next year, work with the community transport sector to identify service gaps and coordinate services for users unable to access the primary bus network. Then, provide dedicated funding for community transport providers to help cover service gaps and assist in the maintenance and modernisation of community transport fleets and user experience.

Buses in the fast lane

Recommendation 5: Speed up buses through on-road priority and smarter technology.

In the next 5 years, implement a suite of bus priority measures across the network to improve bus travel speeds and network reliability.

Through a targeted review of congestion and bus delays across Melbourne, explore on-road priority measures like new bus lanes, traffic signal improvements and queue jumps at intersections. Prioritise delivery in inner and middle parts of Melbourne along high frequency routes and around busy activity centres like Footscray, Glen Waverley, Box Hill and precincts like Fishermans Bend.

Recommendation 6: Plan and deliver bus rapid transit across Melbourne.

In the next 5 years, undertake detailed assessment, reserve land corridors and begin delivery of bus rapid transit corridors across Melbourne. Prioritise delivery of bus rapid transit routes that serve major activity centres, beginning with outer and growth area suburbs like Point Cook, Caroline Springs, Braybrook, Broadmeadows, Clayton and Rowville.

Creating a convenient, accessible and inclusive network

Recommendation 7: Improve the bus stop and interchange experience.

Over the next 5 years, plan for and fund bus user experience upgrades through real-time and accessible service information, provide safe and connected pedestrian footpaths to access bus services, and improve bus stop and interchange infrastructure. Prioritise upgrades along busy bus corridors like Lonsdale Street in inner Melbourne, and busy suburban bus interchanges like Werribee, Moonee Ponds, Box Hill and Dandenong.

Recommendation 8: Substantially reduce bus fares relative to other modes.

In the next 3 years, substantially reduce bus fares relative to other forms of public transport to encourage people to make better use of bus services, while maintaining an integrated ticketing system as part of the new ticketing contract.

Setting strategic corridors and supporting urban growth

Recommendation 9: Update the Principal Public Transport Network.

In the next year, update the Principal Public Transport Network (PPTN) to accurately align it with existing and committed future mass transit bus routes delivered through *Victoria's bus plan*. Ensure the PPTN is updated every 3 years so that it is accurately reflected in strategic land use planning across Melbourne, including helping to achieve aspirations of the new plan for Victoria.

Recommendation 10: Provide funding certainty for growth area buses.

In the next 2 years, establish a long-term growth area funding program dedicated to supporting the delivery of buses in Melbourne's growth areas during their early stages of development. Direct funding to priority growth suburbs that are currently underserved by the existing public transport network like Tarneit, Rockbank, Donnybrook and Clyde. Ensure that delivery of new bus services is informed by population and employment growth in these areas and is aligned with the route design in the updated Principal Public Transport Network.

By the numbers

Developing a fast, fair and better-connected bus network in Melbourne has many benefits.

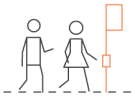
Current state

Melbourne's buses on average arrive every 40 minutes on a typical weekday, extending out to 50 minutes on Sundays.

Across all growth areas of Melbourne, almost 60% of residents cannot access a service that arrives at least every 20 minutes or better. Many local government areas with the highest levels of disadvantage are serviced by some of the lowest levels of public transport provision.

Victorian motorists will face a 46% increase in road congestion between 2026 and 2036. Without bus reform, 84% of bus routes will get slower by 2036, limiting the access of Melburnians to jobs, education and services.

Up to 25% of Melburnians would love to get rid of their cars but don't feel like there is a viable alternative.



Melburnians are willing to walk further for a more frequent bus service. Those currently walking 5 minutes (or 400 metres) to their local bus stop would be willing to walk 10 minutes (approximately 800 metres) to a bus stop if the bus came every 20 minutes instead of 30.

Benefits of bus reform

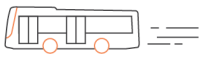
Bus reform is cheaper and faster to deliver (typically 2 to 5 years) than other major transport projects (typically 7 to 12 years). The overall cost of providing bus services is 70 to 80% less than rail services per additional trip.

Increasing the frequency of Melbourne's bus services can deliver up to $2 billion in travel time savings over 20 years for public transport users and improves access to jobs for almost all Melburnians.

New bus lanes can make journeys faster, increasing bus patronage along key corridors by up to 110%.

By combining interventions like increased frequency, more direct routes and new bus lanes, full scale reform results in an extra 164,000 bus boardings and removes over 63,000 vehicles from Melbourne's roads every day. This is more than the daily number of vehicles that travel through the Domain Tunnel.

Early delivery of bus services in Melbourne's growth areas can improve access to job opportunities by up to 20% and provide public transport travel time savings of up to 20 minutes.



Bus rapid transit can reshape how Melburnians access jobs, education and services, attracting over 83,000 boardings every weekday and delivering travel time savings worth between $1.5 and $2.1 billion to public transport users over 20 years.

See endnotes section for all references associated with the above infographic.[15]

The case for a better bus network

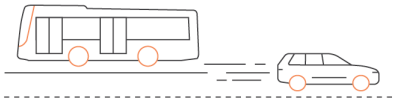
Melbourne is growing fast and its public transport system must grow with it.

Our evidence

Our discussion paper got things rolling

We published our discussion paper, *Get on board – making the most of Melbourne's buses*, which focused on the current challenges surrounding Melbourne's bus network. It was a conversation starter to help shape our research on bus reform and inform our recommendations to the Victorian Government.

We identified 4 key themes in our discussion paper *Get on board: making the most of Melbourne's buses.*

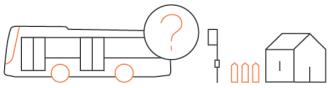


Buses are rarely a competitive alternative to cars and other transport

Low frequencies, limited operating hours, and slow and complex routes makes buses a less appealing alternative.

The existing bus network is inequitable

Access to safe, reliable and affordable transport, especially in growth areas, gives more Melburnians the opportunity to participate in work, attend social events and study.



Customers find using the bus difficult and complex

People who do take the bus often lack real-time information, access to quality stop infrastructure and experience unreliable service levels.

Victorians can get better value from the bus network

The government spends over $800 million every year on the metropolitan bus network, yet some communities see limited benefit.

See endnotes section for all references associated with the above infographic.[16]

We conducted the largest known survey of Melburnians' perspectives on buses

Our community research heard from a representative sample of 4,000 Melburnians between November and December 2022.

The purpose was to find out how they feel about using buses, their current awareness of the bus network, and their acceptance of potential reform options.

We also used a choice model to better understand how people value the various features of a bus service, like frequency and journey times, and the trade-offs they would be willing to make for a bus service that better meets their needs.

Many of the results of *Next stop: community insights into Melbourne's buses* are highlighted throughout this report.

We met with industry, local government and other stakeholders

After the release of our discussion paper, we engaged with key stakeholder groups including local government, bus operators, transport and community advocacy groups, academics and Victorian Government departments and agencies.

We also hosted 2 public webinar events about bus reform with expert panellists from industry, academia, advocacy and government.[17]

We modelled different scenarios to inform our recommendations

Transport modelling can be a useful way to measure the benefits and opportunities of reform by assessing different scenarios. Our modelling considered how Melbourne's bus network could look in 2026 and 2036. We tested a selection of scenarios to help inform our recommendations.

Our modelling scenarios are not our final recommendations. Rather, we used them to guide our recommendations, and inform us on how best advise the Victorian Government in designing and implementing further investment in Melbourne's bus network.

Scenario 1: Operations reform
More frequent services across Melbourne, and better-connected bus services in a study area in Melbourne's north.

- We assigned route categories to all of Melbourne's bus services.[18]
- We modelled increased frequency of Melbourne's bus services to better align with route categories.
- We improved the coordination of the bus and train timetables for study areas in Melbourne's north.

Scenario 2: Bus priority corridors
Around 260 kilometres of new bus priority lanes across Melbourne.

- We designed around 260 kilometres of new bus lanes by either expanding (150 kilometres) or converting existing lanes (110 kilometres).
- We modelled how this could change the speed of buses and other road users. Due to model limitations, we excluded bus priority at signalised intersections, however this is covered in quantitative evidence from Victoria's Smarter Roads program.

Scenario 3: Network redesign – Melbourne's north-east
New and more direct bus routes in Darebin and Whittlesea

- We optimised the bus network in Melbourne's north-east by straightening out and consolidating bus routes.
- The result was a redesigned network in Darebin and Whittlesea using a grid-based network with more direct and higher frequency routes, running within the existing operating budget.
- This scenario shows what could happen in other areas across Melbourne if similar improvements were made.

Scenario 4: Full scale reform
A faster, frequent and better-connected bus network

- We combined the operations, bus priority and network redesign changes listed above into a single scenario.
- This provided us with insight into the benefits of comprehensive bus reform through combined interventions.

Scenario 5: Bus rapid transit
A high speed bus network connecting activity centres

- We tested the rollout of 10 new bus rapid transit routes, as well as a 2.1 kilometre busway connecting the city to the future Eastern Busway.
- Similar to rapid transit corridors like Sydney's T-way, Brisbane's busways or Adelaide's O-Bahn, rapid transit is designed to connect activity centres across Melbourne and provide travellers with a competitive, high speed, rail-like experience.

Scenario 6: Growth area bus upgrades – Melbourne's south-east
A high quality bus network for Cardinia and Casey

- We redesigned and implemented early delivery of a high quality strategic bus network across one of Melbourne's largest population growth fronts within the local government areas of Cardinia and Casey in the south-east.
- This scenario helps to show what is possible in growth areas across Melbourne.

From a coverage perspective, we tested how access to destinations across Melbourne changes by implementing different bus reforms. We used the Conveyal accessibility tool, which uses open data sources to visualise and analyse accessibility (or areas reachable within a certain travel time) throughout Melbourne.[19] Through millions of computations, we were able to better understand the accessibility benefits from individual journey times, including capturing the walk time, wait time and transfer time of Melburnians making their trip on public transport.

From a patronage perspective, we tested how travellers would respond to different bus reform scenarios using the Victorian Integrated Transport Model. By making changes to the bus routes and services, our modelling shows how the network will respond and the increased patronage benefits through bus reform.

Further detail can be found in the supporting technical modelling reports found on Infrastructure Victoria's website.

The scope of our research

This research is focused on bus services in Melbourne and does not encompass regional areas, which face a unique set of challenges and opportunities. However, our findings for Melbourne may be relevant for regional cities such as Ballarat, Bendigo and Geelong.

Rail replacement, disruption bus services and school bus services are not included as part of this research. Bus reform can have broader flow-on effects to the school bus network, including faster travel times and better interconnectivity between school buses and other public transport modes.

Why we need bus reform

Much of Melbourne's current bus network is infrequent, inaccessible and indirect. What if buses were a competitive alternative that offered a simpler, faster and more reliable way to travel?

Currently, Melburnians face the second longest average commute time to work by public transport among 15 comparator cities, like Seattle and San Francisco.[20] Compared with 50 international cities, Melbourne is also among the worst performers for what expatriates think of the quality and affordability of the city's public transport and its walkability.[21]

It doesn't have to be this way. Around the world, buses are the public transport workhorse of many modern cities. In recent years, cities have begun reimagining their bus networks into convenient, fast, and reliable services for travellers. Portland has invested heavily in delivering frequent bus services,[22] Barcelona has been busy restructuring its network for faster more direct services[23] and Los Angeles plans to deliver 48 kilometres of bus lanes by the end of 2023.[24]

Modern cities need modern bus networks. The Victorian Government should ensure that buses are not left out of the equation when it comes to investing in infrastructure and the state's Big Build.[25] Infrastructure Victoria's research details how to make buses better through practical recommendations for the Victorian Government.

The earlier we act, the easier it is to make buses better. Our research shows that there are immediate ways to make buses more attractive, like fast and frequent services and operating for extended hours of the day. Approximately 43% of existing bus users are under the age of 25.[26] This means the Victorian Government also has an opportunity to shape more sustainable travel habits of future generations, reduce car dependency, and address climate change with a simple solution: investing in Melbourne's bus network.

Transport is Victoria's second largest source of emissions. Victoria's commitment for all new bus purchases being zero emissions from 2025 is a positive step towards net zero.[27] However, shifting more car drivers to become bus users has the potential to further reduce transport emissions – an emissions reduction of up to 82% for each converted trip.[28]

Better buses are a small change for big impact to the lives of many Melburnians who experience the shortcomings of the bus network today. Communities have spoken directly to the challenges they face using infrequent, inaccessible and indirect services. They include:

- A young Victorian who waits at their local library every day after school until their parents can pick them up in the evening.[29]
- Children who wait and travel up to an hour to get to and from school, a journey that could be done in less than 15 minutes. [30]
- A worker who leaves home at 6am and walks alone in the dark for 25 minutes to the nearest bus stop.[31]
- A Victorian with a disability where the lack of accessible kerbs, footpaths and crossings impacts their access to public transport and can extend their trip time by almost 70%. A lack of audible and visual announcements also limits their ease of understanding the network.[32]
- A university lecturer who commutes to work must spend 90 minutes catching 2 buses compared to driving for 35 minutes.[33]
- Locals and students who seek refuge on a narrow grass strip in the middle of 6 lane roads to get to the bus stop.[34]

Our research shows that better buses contribute to improving the lives of all Melburnians, regardless of where they live, how they choose to travel, or how much they earn. Investment in faster, frequent and fairer

buses, connected to activity centres and other public transport modes, results in a better outcome for Melburnians.

The case for better buses

Melbourne's existing bus network is lagging behind other transport modes

Without change, public transport will continue to play a relatively small role in Melbourne's transport task into the future. Our modelling shows that public transport is forecast to make up only 10% of all trips across Melbourne over the next decade, with a majority of the remaining 90% of trips in private vehicles.[35]

Improving how Melburnians access transport and connect to jobs, education and services into the future will require an integrated transport and land use approach. To help facilitate a shift in travel patterns, the Victorian Government needs to further invest in public transport in the face of rapid population growth.[36]

The metropolitan bus network currently carries the lowest number of passengers of all forms of public transport in Melbourne, despite buses offering over 5 times more scheduled service kilometres than the city's tram or train networks.[37] Costing over $800 million each year to operate, Melbourne's buses account for 30% of funding for metropolitan public transport operations, and 25% of public transport trips in Melbourne.[38] Melbourne's buses are also forecast to lag behind the patronage growth of metropolitan train and tram services (Figure 1).

Figure 1: Growth in bus patronage lags behind other public transport modes

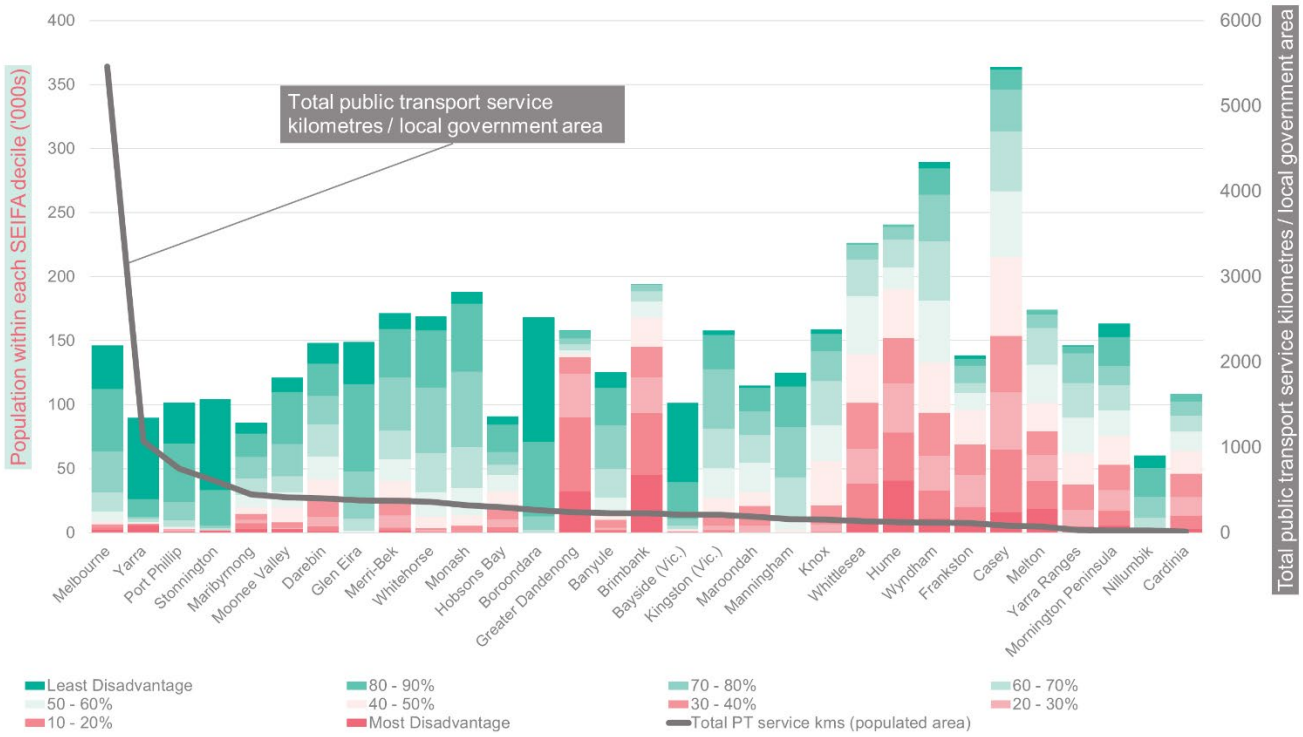
Public transport boardings in Melbourne, 2026 and 2036. Source: Infrastructure Victoria analysis of WSP bus reform modelling.

The existing Melbourne metropolitan bus network is operated by private operators under contract to the Victorian Government. 30% of the network is contracted via the Melbourne Bus Franchise, currently operated by Kinetic until mid-2031. The remaining metropolitan bus services are delivered by 11 operators through 23 separately negotiated contracts which were implemented in 2018. The process of recontracting 30% of the metropolitan bus network is underway and will be completed so that new contracts commence mid-2025. Under the recontracting process, bus operators have been asked to submit proposals on how to boost passenger experience, deliver network and operating efficiencies and optimise the transition to zero emissions buses.[39] The remaining 40% of the network will be recontracted ahead of the end of the contract term in mid-2028. As many existing bus services have not changed much since services were first introduced on the network,[40] there is an opportunity for government to implement some of the reforms recommended in this paper in parallel with the new contracts.

Low public transport provision is leading to equity in outer and new growth areas

Victoria's *Transport Integration Act* highlights the importance of social and economic inclusion to minimise barriers to accessing opportunities like jobs and services.[41] However, current transport service provision is mismatched against areas with higher levels of disadvantage. As shown in Figure 2, many local government areas with the highest levels of disadvantage are serviced by some of the lowest levels of public transport provision.

Figure 2: Public transport service provision is not keeping up in outer suburbs and growth areas



Source: Infrastructure Victoria analysis of ABS Census 2021 and GTFS data.

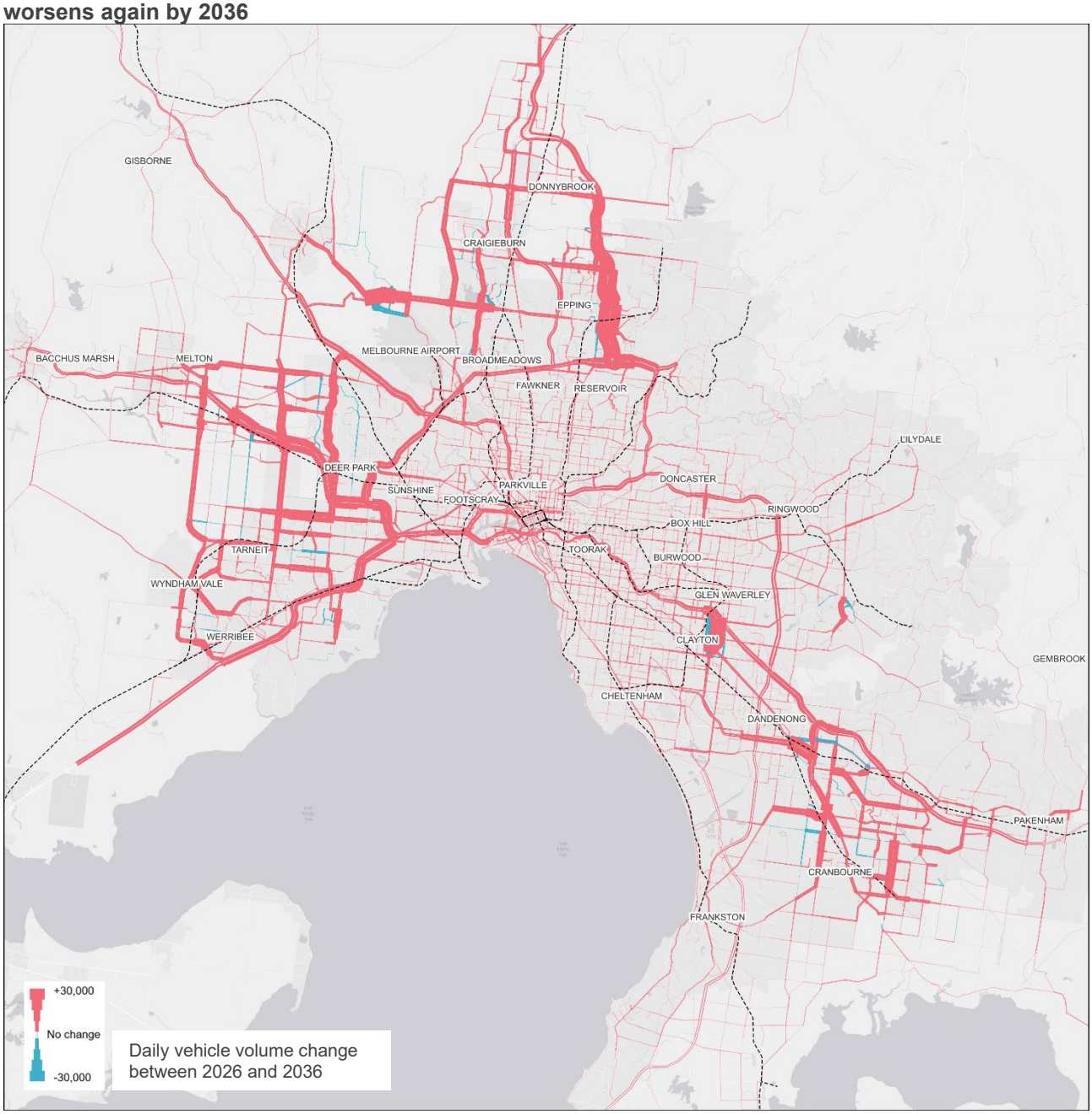
Everyone on the road is slowing down

Melbourne has experienced unprecedented investment in road and public transport infrastructure over the last decade. Victoria will soon benefit from even more capacity to move people and freight across the city with over 70 level crossings removed, the Metro Tunnel and West Gate Tunnel projects nearing completion, and a pipeline of Big Build projects like the Suburban Rail Loop and North East Link underway.[42] Demand across Melbourne's transport network has also rebounded from the lows of the COVID-19 pandemic and is forecast to reach new heights, despite changes to how Melburnians live, work and commute.[43] Buses have rebounded strongest of all metropolitan public transport modes, reaching between 80 and 90% of pre-COVID patronage in 2023.[44]

Car trips and the number of people who travel across Melbourne are expected to accelerate over the next decade. In 2018, there were 14.4 million weekday car trips across the city. Our modelling shows by 2026, 15.8 million weekday car trips are forecast using Melbourne's roads, growing to 18.5 million by 2036.[45] Rapidly growing local government areas of Melton, Wyndham, Hume, Casey and Whittlesea together are forecast to account for 47% of that growth. This is expected to result in significantly higher traffic volumes in these areas as shown in Figure 3.

Our modelling shows that by 2036, despite investments in new and widened roads, average speeds slow down to what they were in 2018 (37 kilometres per hour) across the network, and will continue to slow into the future. This decline in speed will be reflected in more congestion for motorists, lower freight productivity, reduced access to jobs, services and education, and a deteriorating public transport network with trams and buses increasingly stuck in traffic.

Figure 3: Melbourne's traffic volumes have quickly rebounded from COVID-19 and congestion worsens again by 2036

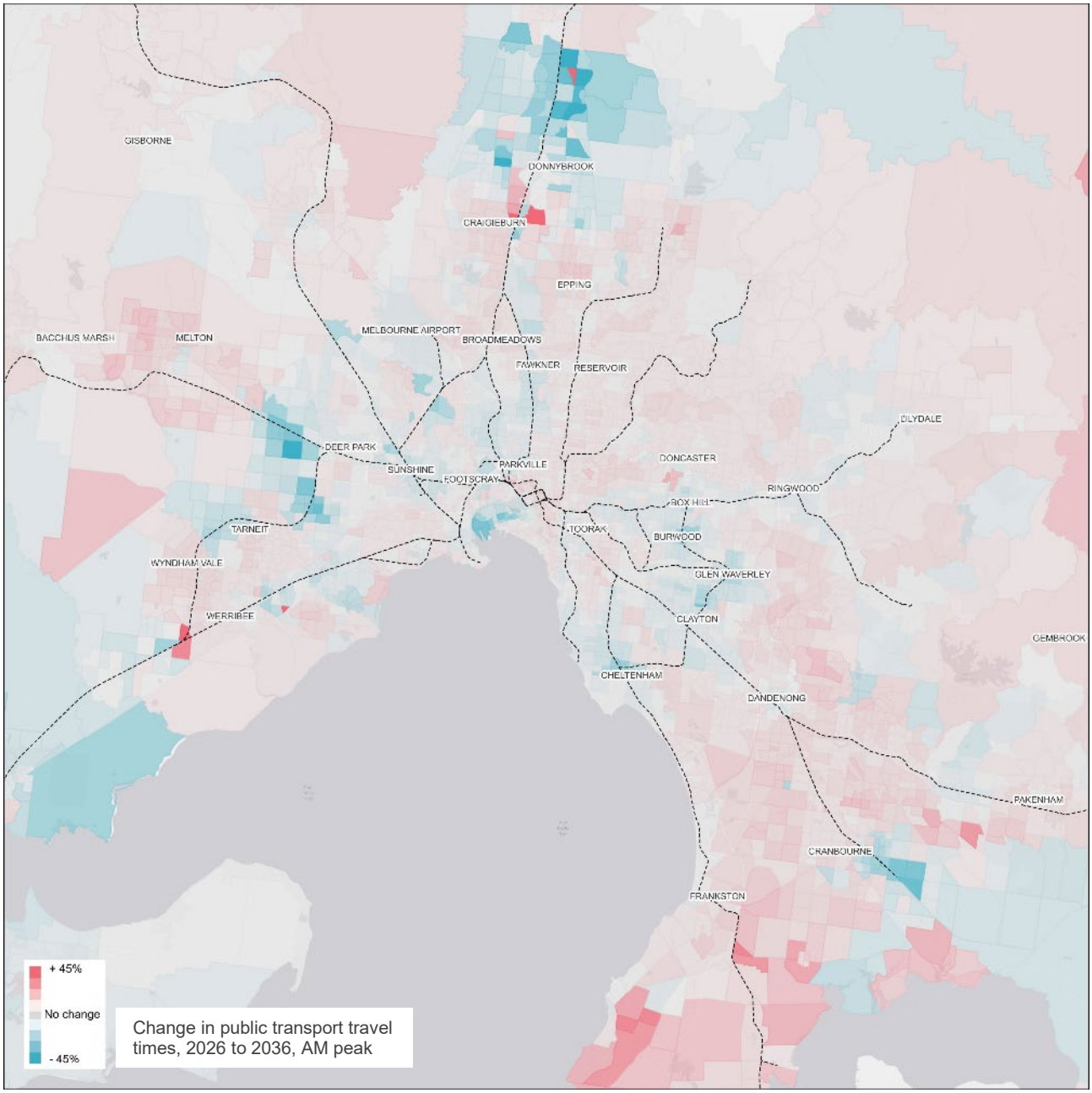


Source: Infrastructure Victoria analysis of WSP bus reform modelling.

Minimal investment in on-road bus priority infrastructure leads to declining bus performance. With only 52 kilometres of dedicated bus lanes across the entire network, and steadily increasing private vehicle trips, buses will be increasingly stuck in congestion.[46] This impacts travel time, worsens reliability and increases operational costs.

With buses taking more time to complete their journey, the Victorian Government would have to reduce the frequency of bus services or purchase and run more buses just to keep to the current timetable. Without intervention, 84% of bus routes will get slower by 2036. As shown in Figure 4, areas close to new train lines continue to benefit from fast public transport travel times by 2036. However, areas away from Melbourne's rail lines will face increased travel times, reflecting the declining speed of buses and trams which share the roads with private vehicles.

Figure 4: Public transport trips will take longer across most of Melbourne by 2036



Source: Infrastructure Victoria analysis of WSP bus reform modelling.

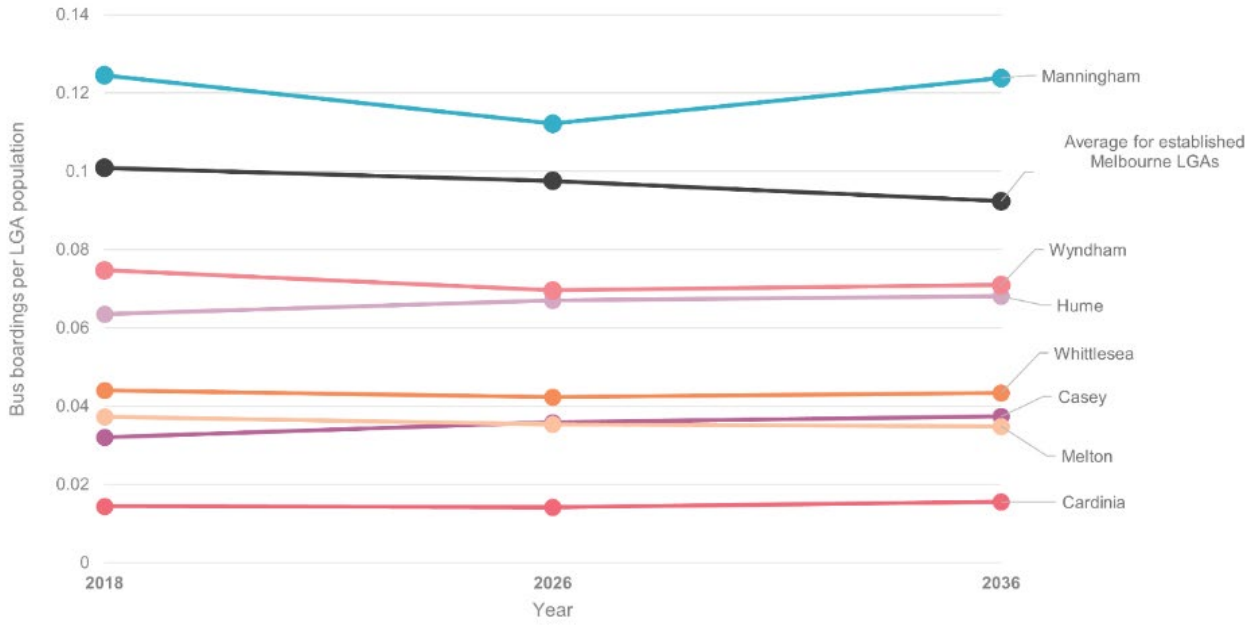
An expanding city creates more challenges

The average household motor vehicle ownership in Melbourne is 1.8, which increases to 2.0 in the growth areas.[47] As the city expands, the distance people need to travel to access jobs and education will also increase, as will the dependence on cars to get to these destinations.

The radial nature of Melbourne's train network also means that the distance between rail lines grows with distance from the central city. Although buses are the main form of public transport in many outer and growth areas, as shown in Figure 5, bus boardings per person in these areas remain low and are projected to stay low into the future.

For example, in both 2026 and 2036, there will be around one boarding a day for every 15 people living in Hume, and one boarding per 28 people in Casey. The average bus boardings per person for established parts of Melbourne is currently around one in 10.

Figure 5: Bus boardings in growth areas lag behind the rest of Melbourne, despite buses being one of the only public transport options in these areas



Source: Infrastructure Victoria analysis of WSP bus reform modelling (2023).

This level of bus patronage matches results from our community research on bus reform perceptions (Figure 6). Almost 40% of residents in the Manningham area with high quality bus services were positive about using the bus, but only up to 22% of residents in new growth areas felt the same way.

Figure 6: New growth area residents were least likely to agree that buses were 'for people like [them]'

'Buses are for people like me'

Source: Infrastructure Victoria bus reform community research.

Case study

Modern cities invest in modern bus networks

Melbourne shares many urban planning and transport similarities with North American cities like Houston, Seattle and Washington DC, including their population density, high car proportion, and low active and public transport mode shares.[48] In recent years, some cities in the United States of America have made significant attempts to reverse declining public transport patronage by improving their bus services. This is especially important in the face of constrained funding.

Houston is an example of bold and successful bus reform resulting in an 11% patronage increase within the first year.[49] In 2015, Houston undertook a complete redesign of its suburban bus network, focusing delivery of services to suburban employment areas, creating interchange opportunities and increasing weekend bus service frequency to weekday interpeak levels. This resulted in a Sunday patronage increase of 30%.[50]

In August 2023, the Seattle Department of Transportation released the Seattle Transportation Plan, detailing their future fast, reliable and frequent bus service.[51] Seattle's proposed network is a tiered system with bus corridors nominated for services every 15 minutes at a minimum. Bus routes are designed based on data inputs including existing and future patronage, projected population and employment density, equity priority areas and interchange access to stations for regional transport. The plan also nominates public transport priority locations and capital improvements, including bus lanes, upgraded passenger facilities and improved bike access to bus stops.[52]

The Washington Metropolitan Area Transit Authority has just begun consultation on their Better Bus network redesign.[53] The authority has commenced multi-stage public engagement, produced a draft bus network co-designed with users and stakeholders featuring a 4-tier system, with prominent high frequency routes servicing large parts of the metropolitan area. Similar to Seattle, each bus route tier has a set frequency level tied to population and employment densities along the route.[54]

Below: Seattle, United States. Photo by Zhifei Zhou on Unsplash.

Our recommendations

Implementation considerations

Our ten recommendations are practical steps to create a fast, frequent and fair bus network for Melbourne. We've summarised key considerations for the Victorian Government when implementing these recommendations.

Table 1. Recommendations and implementation considerations

Recommendation	Key implementation considerations
1 Increase the frequency of bus services beginning with outer suburbs and growth areas.	• Outer and new growth suburbs need immediate frequency upgrades to improve access to jobs, education and services. • Higher frequency services provide estimated benefits of around $1.40 for every dollar invested. • Travel time savings are estimated at $1.4 to $2.0 billion for public transport users and $1.6 to $2.3 billion for road users over 20 years. • Implementing the frequencies we modelled would cost $430 to $520 million annually to operate, and $240 to $290 million in one-off capital costs.
2 Optimise the existing bus network through fast and direct routes.	• Ongoing optimisation of Melbourne's bus routes can deliver more direct bus routes with competitive travel times. • For no or very little additional spend, we estimate an optimised network in Melbourne's north-east could deliver total benefits of $500 to $820 million over a 20 year period. This includes estimated travel time savings of $110 to $160 million for public transport users and $300 to $550 million for road users over 20 years. • Similar benefits could be expected in other areas if this approach was applied throughout Melbourne.
3 Extend operating hours to match passenger demand and improve timetable integration	• Bus routes across Melbourne need longer operating hours, especially those travelling to activity centres on weekends. Timetables should also better connect buses to other public transport services like trains. • Previous bus reform in Melbourne shows that expanding operating hours can grow patronage by around 10%. • We estimate that the additional operating expenditure required to boost operating hours to these levels would be an additional $65 to $95 million per year.
4 Strengthen the role of community transport	• Community transport can support communities experiencing limited mobility options due to health and social or geographic reasons. • A similar investment by the NSW Government provided $96 million to collectively fund the Home and Community Care Program and Community Transport Program in the 2022-2023 budget.
5 Speed up buses through on-road priority	• Without intervention, 84% of bus routes will get slower by 2036 due to road congestion. Targeted bus lanes along high frequency bus routes can increase patronage by up to 110%.

	and smarter technology	• We estimate travel time benefits to bus passengers of $670 to $920 million, and a further $550 to $760 million in benefits from increased social mobility and reduced risks of social exclusion over the next 20 years. • Costs would vary depending on the location and type of bus priority implemented from under $1 million for conversion of existing lanes to a bus lane to $200 million for bus lanes involving road widening. Bus lane implementation should also consider impacts on general traffic.
6	Plan and deliver bus rapid transit across Melbourne	• A bus rapid transit system can provide a level of service in outer and growth areas equivalent to Melbourne's trams, attracting an estimated 83,000 new boardings. • Bus rapid transit has the potential to return around $2.60 for every dollar invested in a new network. • Benefits include travel time savings for passengers of about $1.5 to $2.1 billion and greater mobility options of about $620 to $850 million over 20 years. Land value benefit for the modelled BRT network is estimated at $8.5 to $9.5 billion. • The entire BRT network we modelled has an estimated capital cost of $3.4 to $4.0 billion and operational cost of $150 to $180 million per year.
7	Improve the bus stop and interchange experience	• Investing in real-time information and upgrading pedestrian infrastructure can improve the passenger experience, increase network accessibility and improve safety. • Less than 1% of all bus stops and interchanges account for more than a third of Melbourne's bus boardings, providing a clear priority for where investment can deliver value for money. • Costs for bus stop and interchange infrastructure upgrades will vary based on complexity and scope, with examples from $5 to $69 million.
8	Substantially reduce bus fares relative to other modes	• Our community research suggests that every $1 reduction in bus fares could increase bus patronage by up to 19%. • Victorians would be $520 million better off due to having more transport options, reduced crowding and congestion, and better environmental outcomes.
9	Update the Principal Public Transport Network	• The current Principal Public Transport Network is out of date and does not reflect existing busy mass transit bus routes. • An updated Principal Public Transport Network can provide certainty to communities and land use planners, and support government decision making in future transport investment.
10	Provide funding certainty for growth area buses	• Residents in growth areas are waiting more than 3 years on average before their first bus service begins operation. • We estimate that a growth area bus fund that addressed all of Melbourne's growth areas would cost around $400 to $500 million annually if fully implemented. • In the example we modelled on part of the south-east Melbourne network, travel time savings were about $280 to $390 million over 20 years, with a further $190 to $270 million of reduced car ownership benefits and $130 to $180 million of benefits from the value of additional mobility. • This illustrative network for Melbourne's south-east would be expected to cost an additional $120 to $150 million in operating expenses for 2026 and $45 to $55 million of one-off capital costs.

Making buses a competitive choice

Improved access, reduced congestion and a reliable service will help Melbourne's buses become a competitive public transport choice.

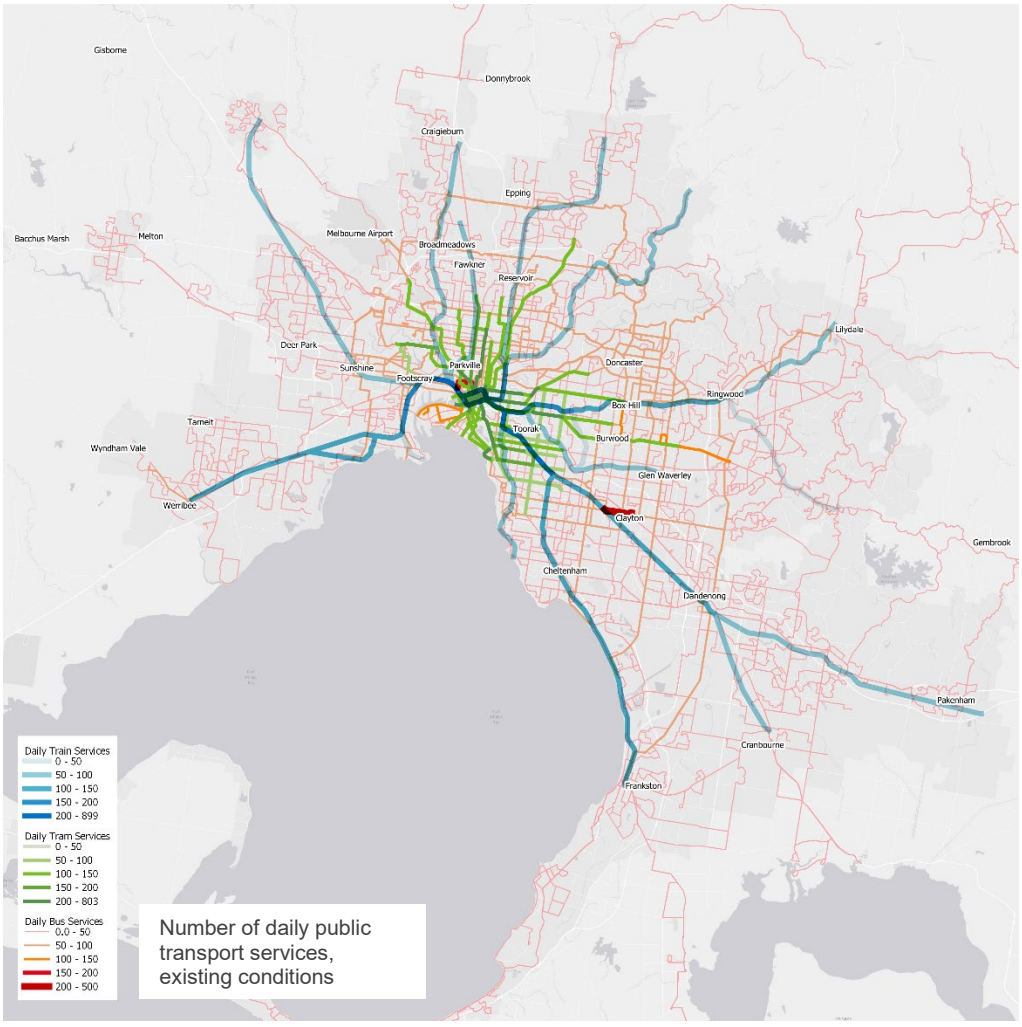
Buses provide a fast and convenient transport alternative

Melburnians told us that frequency and journey times are the 2 most important factors for using the bus network. Three in 5 people prefer other modes of transport over buses. Seven in 10 say they couldn't survive without a car.[55] If buses are to move more people (or perform an increasing mass transit role), Melburnians need convincing that they are a competitive choice for travelling around the city and suburbs.

Aside from those who live near Melbourne's train and tram corridors, most people living in remaining areas of the city rely on a patchy and inconsistent bus network. Figure 5 shows the total number of public transport services operating in Melbourne on a typical weekday. Access to high quality public transport like trams and high frequency buses is largely limited to people living in Melbourne's inner and middle suburbs.

Currently, Melbourne's buses arrive every 40 minutes on average during a typical weekday, extending out to every 50 minutes on Sundays.[56]

Figure 5: Apart from a selection of shuttle and SmartBus routes, Melbourne's buses are infrequent



Source: Infrastructure Victoria analysis of Data Vic, *PTV Timetable and Geographic Information - GTFS* [data set], 2023.

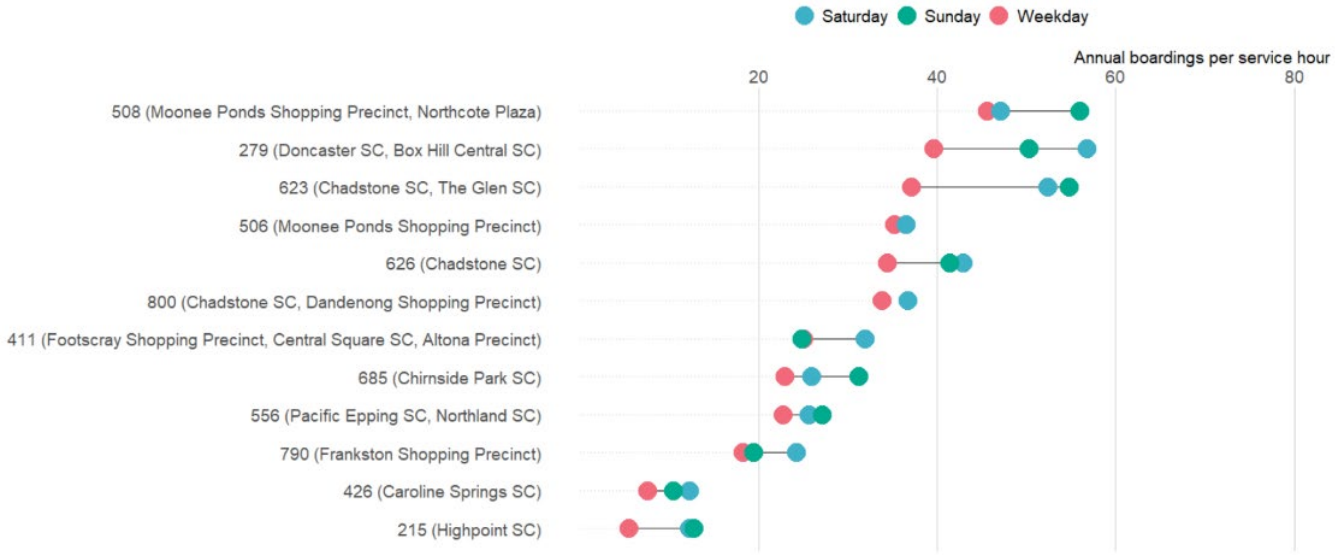
Making buses a competitive choice for more Melburnians means investing in services where they are needed most. Current levels of service provision tend to support inner city office workers catching public transport to work. However, for workers in jobs distributed across the suburbs in industries like retail, healthcare, education and manufacturing, taking public transport to work is not often a suitable alternative to driving. Access to jobs in these industries has some of the lowest public transport provision.[57]

Buses support weekend travel to shopping centres and recreation facilities

In 2020, Melburnians took over 10 times more social, recreational and shopping trips compared to work-related trips on a typical weekend.[58] Despite these travel trends, many routes across Melbourne's bus network that connect into major social, recreational and shopping destinations run to a reduced frequency on weekends.[59]

Our analysis in Figure 6 shows significant spikes in the number of passengers per service on weekends to major shopping precincts, far higher than any comparable weekday service. This suggests a mismatch between service provision and demand. In some cases, legacy routes, like those serving Chadstone, Knox, Highpoint and Northland shopping centres, have no service on busy shopping public holidays like Boxing Day.[60]

Figure 6: Many bus routes to shopping centres carry more passengers per service on weekends than they do on weekdays – despite running at reduced weekend frequencies



Source: Infrastructure Victoria analysis of Department of Transport and Planning bus boarding data and GTFS – noting there are some limitations with estimating weekend patronage using the data provided.

Recommendation 1

Increase the frequency of bus services beginning with outer suburbs and growth areas

Immediately upgrade the frequency of bus services in Melbourne, starting with trunk and connector bus routes operating in outer and new growth suburbs like Tarneit, Craigieburn, Epping, Cranbourne and Frankston.

Set minimum frequency targets for bus routes across Melbourne, based on route category. Then, deliver suitable trunk and connector bus routes for frequency upgrades in inner and middle suburbs including Point Cook, Footscray, Reservoir, Clayton.

Residents in outer parts of Melbourne have the longest journey times and travel the longest distances to get to work compared to all other Melburnians.[61] Many residents spend upwards of 15 hours each week commuting, mostly by private vehicle.[62] Historical transport investment in these areas has often favoured expansion of suburban roads above providing time-competitive alternatives to the car.[63]

A lack of high quality transport options does not only affect work trips. Melburnians are forced to trade off access to services like education, health and childcare because they have to spend a disproportionate amount of their income on travel.[64] Reduced participation in education and training, and less involvement in social activities can then lead to further social isolation and impact quality of life.[65] We estimate that investing in our modelled higher frequency scenario could return around $1.40 of benefits for every dollar invested. This is based on strategic modelling and a high level economic analysis, which we believe could be further improved with more targeted frequency uplift.

To address the social and economic inclusion objective legislated within *Victoria's Transport Integration Act 2014,* the Victorian Government should address the low provision of public transport within and surrounding Melbourne's outer and growth areas (see Figure 5).[66]

This should start with more frequent trunk and connector routes to support fast and efficient connections to key destinations in these areas, like activity centres and train stations. We found a strong patronage response in our modelling to higher frequency services in Tarneit, Craigieburn, Epping, Cranbourne and Frankston – so these suburbs should be a priority.[67]

Frequency targets should also be set for bus route categories, such as trunk and connector routes, introduced in *Victoria's bus plan*.[68] This will ensure the investment in frequency matches and supports each route's function as part of the wider transport network. Frequency targets used as part of our illustrative scenario are shown in Table 2.

Table 2. Bus frequency based on route categories

ROUTE CATEGORY	MORNING AND AFTERNOON PEAK	OFF-PEAK	EXAMPLE
Rapid routes: high speed highways of the bus network	Every **5 min**	Every **10 min**	Future bus routes running along the Eastern Busway
Shuttle routes: high frequency university connections from stations	At least every **10 min** at all times		Route 601, connecting Monash University Clayton to Huntingdale Station
Trunk routes: arterials of the bus network	Every **10 min** all times		Orbital SmartBus route 901, connecting Frankston to Melbourne Airport
Connector routes: easy access to the rail network and local activity centres	Every **15 min**	Every **20 min**	Route 510, providing east-west connections between Essendon and Ivanhoe stations
Local routes: the local streets of the bus network	Every **20 min**	Every **30 min**	Route 151, linking local residents with nearby shopping centres and services

Time period definitions are based on set modelling time periods within the Victorian Integrated Transport Model. AM peak (7-9am), interpeak (9am-3pm), PM peak (3-6pm), off-peak (6pm-7am next day). Frequency uplift was applied only within operating hours of the existing bus network. See endnotes section for all references associated with the above infographic and WSP scenarios modelling report for further details.[69]

Residents in Melbourne's inner and middle suburbs can also benefit from more frequent bus services. Our modelling shows that increasing the frequency of services on targeted routes in Melbourne's inner and middle suburbs holds the greatest potential to gain patronage and increasingly perform a mass transit role over the next decade.[70] With increased frequency times, Wyndham, Maribyrnong, Hume, Monash and Whitehorse each experience between 5,200 and 7,000 additional daily boardings by 2036. This includes many bus routes running through Footscray, Clayton and Point Cook.

From a traveller's perspective, improved frequency provides 3 specific types of benefits:

- It reduces waiting and unproductive time. Increased frequency saves travellers from extended wait times by the roadside. [71] This can also assist in making people feel safer waiting at a stop during the evening.[72]
- It makes connections easy and improves accessibility. A network of frequent bus routes expands the number of places travellers can reach within a reasonable travel time, making buses a more compelling option for a broader range of trips.[73]
- It provides choice. If delays occur on the network for other transport modes, or when travellers need to make unexpected trips across the city, a high frequency service means the next bus is never too far away.[74] High-quality public transport has also been shown to reduce car ownership.[75]

These benefits translate directly to higher productivity. Public transport users benefit from travel time savings, valued at between $1.4 and $2.0 billion over 20 years. Motorists also benefit from fewer vehicles on the roads and less congestion, which deliver an estimated $1.6 to $2.3 billion in travel time savings for road users over 20 years. Our illustrative approach to increasing bus frequencies across all of Melbourne would require an estimated additional annual cost of $430 to $520 million to operate, and an additional $240 to $290 million in upfront capital costs, like new and expanded buses depots (2023 dollars). While this is based on an assumption of increased frequencies across the entire city, our strategic economic assessment shows that even this general approach delivers strong benefits that outweigh costs. The Victorian Government could achieve further value from its investment by targeting frequency uplift in suburbs identified earlier, by

optimising routes (see Recommendation 2) and implementing bus priority measures (see Recommendation 5).

More frequent bus services give Melburnians more flexible travel choices. Our community research, along with work conducted by academics and advocacy groups, consistently shows that frequency is one of the most important factors for using Melbourne's bus network.[76]

> The difference between a bus that runs every half hour and a bus that runs every 15 minutes is the difference between planning your life around a schedule and the freedom to show up and leave when you want.

Source: S Higashide, *Better buses, better cities: how to plan, run, and win the fight for effective transit*, Island Press, 2019.

Higher frequencies alone are capable of increasing bus boardings by up to 17%.[77] Research of observed behaviour from the United States of America shows that people reduce the number of cars they own when they have access to a high frequency bus network.[78]

Measuring the economic benefits from bus reform

Business cases in Victoria use the Australian Transport Assessment and Planning (ATAP) guidelines to help inform the economic analysis of transport projects.[79] The economic analysis behind many of our recommendations includes standard ATAP benefits for public transport users, road users, the environment, health and road crash reductions. We used discount rates of 7% and 4% for an evaluation period of 20 years from 2026.

Current ATAP guidelines focus on large capital transport projects like road and rail.[80] This means smaller-scale projects like bus service improvements will likely need to refer to additional research and guidance on costs and benefits when project-based appraisal is undertaken.

Our analysis also explores other types of benefits that have been researched, some of which are included in standard transport project appraisal guidelines in other countries.[81] We've considered additional economic benefits like the value of social mobility and inclusion,[82] car ownership reduction[83] and land value uplift.[84]

The Victorian Government should immediately invest in increasing service frequency, especially for trunk and connector routes in Melbourne's outer and new growth areas using the existing available bus fleet. For weekends, travel patterns are more dispersed, and more strongly focus on leisure and shopping activities.[85] The Victorian Government should deliver frequency improvements for weekend services, especially on routes serving activity centres.[86]

As the government begins the next round of recontracting for 30% of the metropolitan bus network,[87] work should also begin on setting and publishing minimum frequency targets for each route category. Route categories should make clear the role, purpose and function of every Melbourne bus route. This means identifying factors like whether bus routes are serving high patronage mass transit corridors between activity centres, or running along local streets, connecting local services.

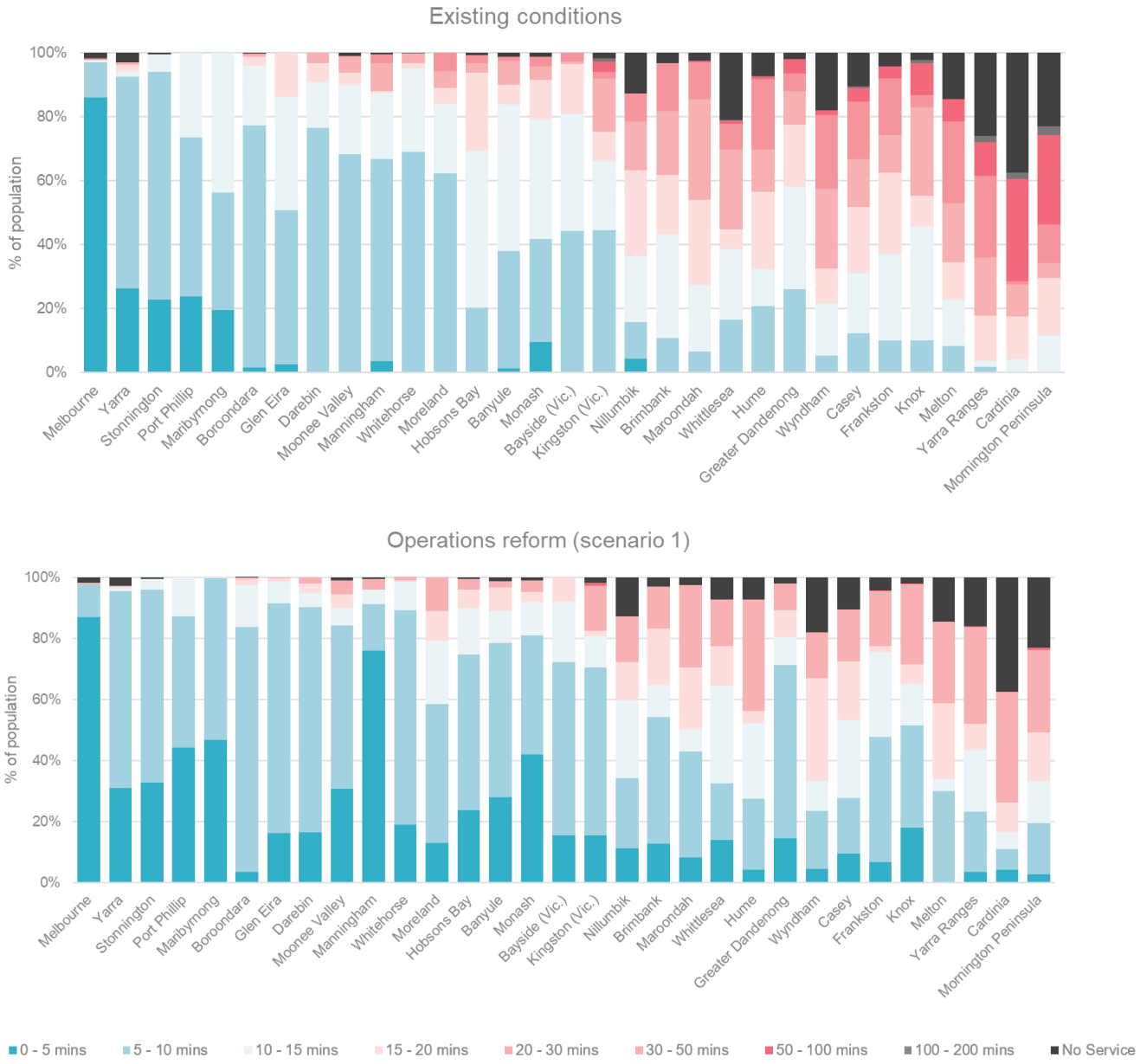
Higher frequency and less time waiting for the bus across Melbourne

Our operations reform scenario 1 reduced the wait time for almost all Melburnians who currently use the bus. Currently, about one third of Melbourne's population is close to public transport that arrives at least every 10 minutes.[88] We modelled a significant boost to bus frequency where over 56% of Melburnians would wait no

more than 10 minutes for a public transport service. This represented around a 50% increase in bus service kilometres.[89]

Only investment in Melbourne's buses can achieve this level of accessibility and reduce public transport wait times, given their vast coverage across the city. As shown in Figure 7, inner local government areas of Melbourne generally have high levels of public transport service and low wait times, commonly served by train and tram services. Increased bus frequency can significantly improve current weekday public transport average wait times in Knox from 31 minutes to 16 minutes, which matches the wait times experienced by those living in Monash. Increased frequency can also bring current wait times of 15-16 minutes in Melbourne's middle suburbs, such as Banyule and Hobsons Bay, down to 10 minutes, as experienced in inner areas of Yarra and Stonnington.

Figure 7: Frequency uplift significantly reduces long wait times in many outer and new growth areas



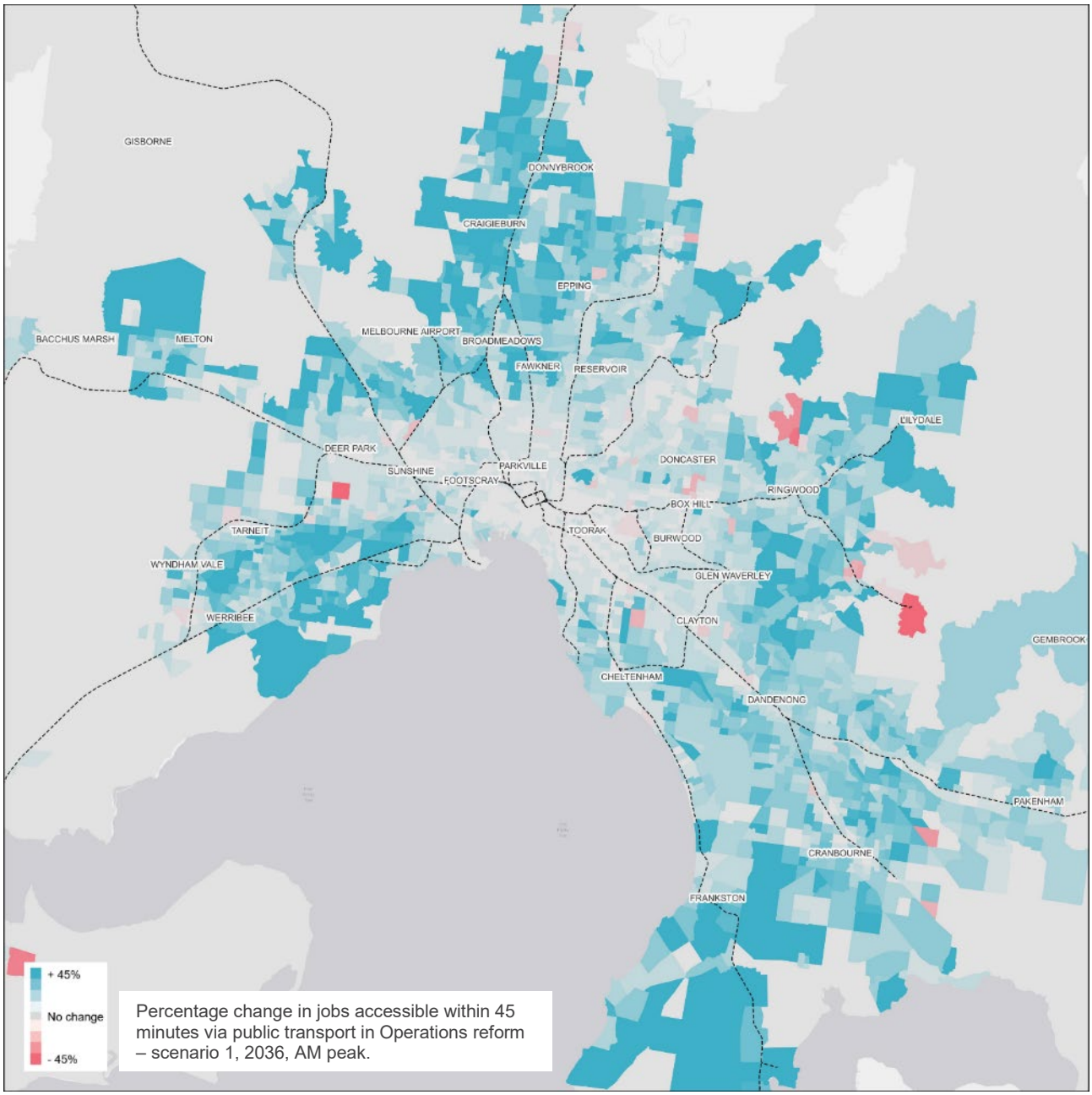
Average public transport wait times (between 6am to 8pm) by Local Government Area. Source: Infrastructure Victoria analysis of GTFS and ABS Census 2021.

Frequency improvements produce some of the largest benefits in access to jobs and services for Melbourne's growth areas. As shown in Figure 8, suburbs in Melbourne's outer and growth areas like Tarneit, Craigieburn, Epping, Cranbourne and Frankston would benefit significantly from faster travel times and a public transport network that takes residents to more destinations. For example, applying the

frequencies listed in Table 2 leads to residents in Melbourne's south-east experiencing up to a 20 minute reduction in public transport travel times. Residents in Melbourne's outer and growth areas would also experience some of the largest increases in access to jobs and services from improved frequency.[90]

This comes from improved frequencies alone, without any further changes to infrastructure like new bus lanes or re-designed networks.

Figure 8: Frequency upgrades improve access to jobs and benefit Melbourne's outer and growth areas the most



Source: Infrastructure Victoria analysis of WSP bus reform modelling.

Our modelling shows increased frequency encourages more people to choose public transport over driving. For those that continue to drive, conditions on Melbourne's roads are better by 2036 compared to the base case of minimal bus network investment. With increased bus frequency, motorists would drive 140,000 fewer kilometres in congested conditions every weekday.[91] This is most noticeable in peak periods, and in Melbourne's inner and middle suburbs, corresponding to bus corridors with the highest increases in patronage.

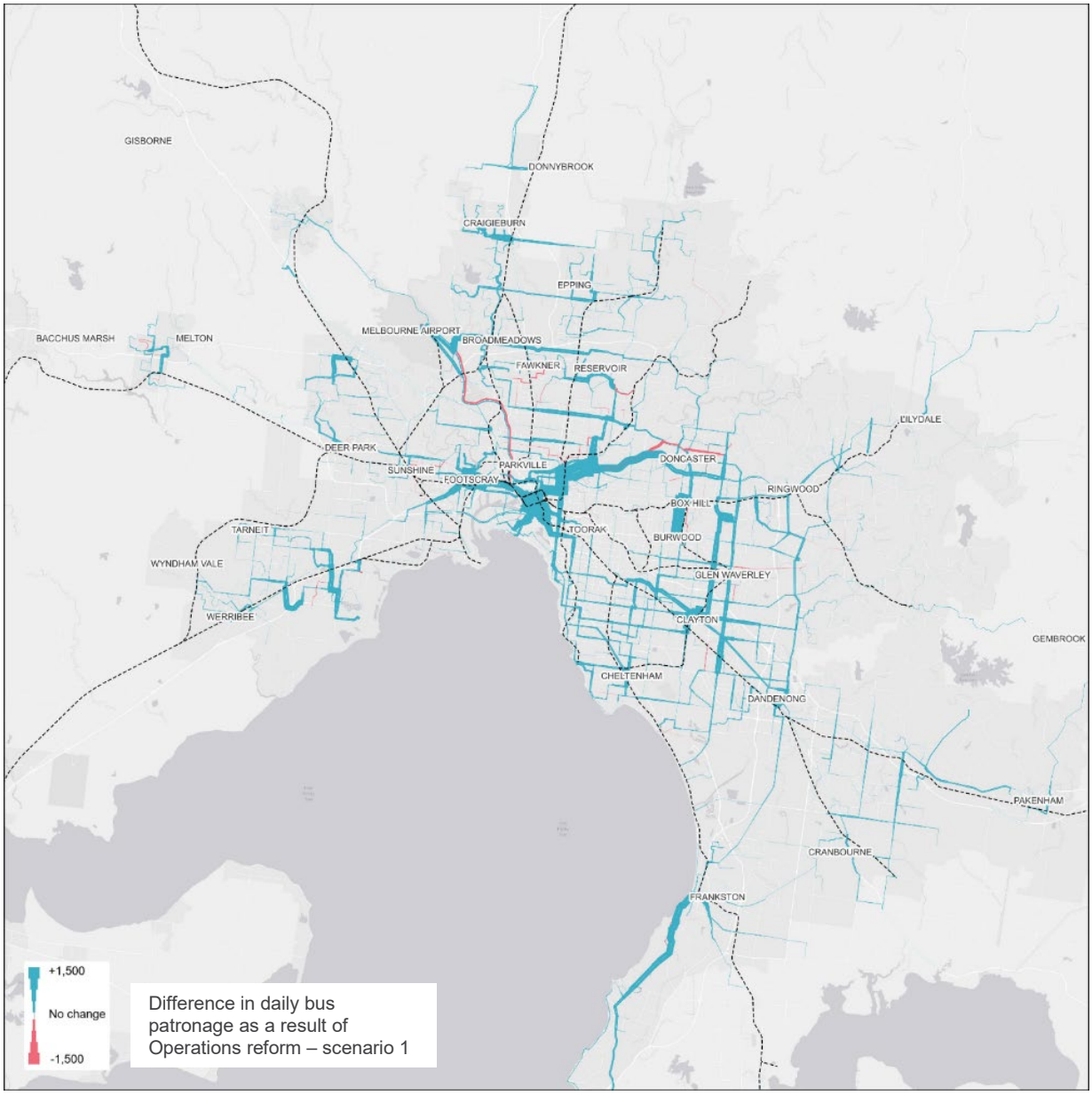
Increased frequency leads to patronage growth in Melbourne's established areas

Different parts of Melbourne face different public transport challenges. This can include long wait times between services, slow journeys that are uncompetitive with private vehicles, or a lack of access to any public transport.

Benefits of accessibility to jobs and services alone make for a strong case to prioritise investment in Melbourne's outer suburbs and growth area buses.[92] However, Melbourne's investment in buses for middle suburbs can also deliver better value for money to Melburnians if buses play a greater mass transit role, as outlined in *Victoria's bus plan*.

High patronage increases in middle suburbs like Footscray, Clayton and Dandenong are due to these areas being suburban job and population centres. Many of these areas have relatively well-established trunk bus corridors which pair well with improved frequency and reduced wait times, as shown in Figure 9. Our modelling also shows that increasing frequencies on bus routes that travel through areas with a higher number of jobs, student enrolments and retail outlets, relative to population, have the strongest response in patronage growth.

Figure 9: Higher frequencies deliver strong patronage gains in established parts of Melbourne



. Source: Infrastructure Victoria analysis of WSP bus reform modelling.

Recommendation 2

Optimise the existing bus network through fast and direct routes

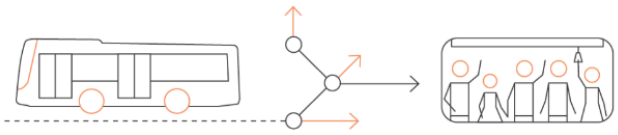
In the next year, begin delivering faster and more direct routes to parts of the existing metropolitan bus network. Immediately begin with areas in Melbourne's north and north-east where bus reform consultation has already taken place.

Over the next 5 years, deliver faster and more direct routes in outer and growing suburbs like Melton and Endeavour Hills, while also redesigning relevant bus services to prepare for Big Build projects coming online, including the Metro Tunnel and North East Link.

Many of Melbourne's existing bus routes are indirect and winding because they prioritise coverage over competitive travel times.[93] While this has led to 82% of homes being within 400 metres of a bus route, it also means that these routes are often a slow and unattractive travel choice. The Victorian Government should adopt a continuous program of route improvement to make the most out of Melbourne's network. Many of the Victorian Government's Big Build projects are set to be delivered in the next 5 years and the bus network will also need to be redesigned to maximise the benefits from new road and rail infrastructure.[94]

Victoria's bus plan sets out new bus route categories which should be tied directly to how the metropolitan bus network is upgraded and redesigned to achieve faster and more direct bus routes.

Opportunities to optimise bus networks include:



Create more direct routes

Direct routes provide fast connections between people, jobs and activity centres. They are simple and predictable routes and easily understood by users. A direct route connects more travellers with key destinations and reduces travel time, making buses more appealing.

Introduce new bus routes to better-connect people to key activity centres and other public transport services

New bus routes can give the community better access to jobs, education and services. New bus routes are best designed in consultation with the communities that will use them. Community involvement also helps build a more positive culture about the important role of buses.

Change or remove low performing routes

Changing or removing some bus routes where justified is part of building a better bus network. There are often reasons behind a poor performing bus route which should be considered. This can include inadequate frequency or operating days and hours, or a confusing route or stopping pattern, misaligned with community needs.

Where a route changes significantly or is removed, local alternative transport options must be considered, such as access to other bus routes. Community transport options should be funded to help maintain coverage gaps (see Recommendation 4).

See endnotes section for all references associated with the above infographic.[95]

Coverage standards, like being within a 400 metre (or a 5-minute) walk from a bus service, have been referenced in network design guidance as early as the 1987 *MetPlan* discussion paper.[96] However, these types of coverage standards do not sufficiently quantify or track other factors like how frequently the bus arrives, or its hours of operation.[97] Many of Melbourne's bus routes have been designed to achieve coverage outcomes. Coverage services help the bus network to support the social and economic inclusion target from Victoria's *Transport Integration Act*. However, coverage can be achieved through other mechanisms, such as

community transport (see Recommendation 4), and should be balanced with other objectives like economic prosperity, efficiency, coordination and reliability.

Improving Melbourne's bus network will require readjusting the balance between patronage and coverage services.[98] For example, our modelling of a more optimised network in Whittlesea provided 2 in every 3 residents access to a bus service that arrived at least every 20 minutes or better. Under existing conditions, less than half of Whittlesea residents had access to a service that arrived at least every 20 minutes or better. Across all growth areas of Melbourne, almost 60% of people are beyond 800 metres walking distance of a service that arrives at least every 20 minutes or better.

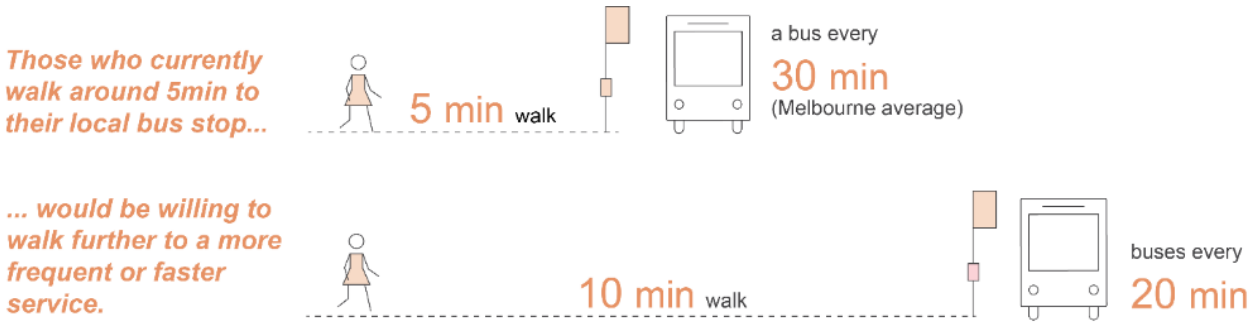
The Department of Transport and Planning's consultation on bus reform showed that around 80% of people in Melbourne's northern and north-east regions would prefer to have fewer routes but more frequent services.[99,100] This shows a clear preference for an optimised network in these consultation regions.

Our network redesign (scenario 3) showed that an optimised network in Melbourne's north-east in 2036 would almost double the number of higher patronage routes operating in the study region, from 26% to 46%.[101] More passenger boardings are occurring on the bus network, at the same cost as running the existing network in Darebin and Whittlesea. It showed increased bus boardings and access to jobs in adjacent areas benefit too, including Merri-bek and Banyule.

From this optimisation of the network's design in Melbourne's north-east alone, our strategic level economic assessment highlighted exceptional value for money, with estimated total benefits of $500 to $820 million for no or very little additional spend over a 20 year period (see section *Optimising bus routes in Melbourne's north-east* for more details).

Our community research demonstrated that Melburnians would also be willing to walk further to a more frequent bus service. Those walking 5 minutes (or 400 metres) to their bus stop would be willing to walk 10 minutes (approximately 800 metres) to a local bus stop if the bus came every 20 minutes instead of 30.[102]

Figure 10: Melburnians are willing to walk further to higher frequency bus services



Source: Infrastructure Victoria

This demonstrates that a network of optimised high quality trunk services in Melbourne, with predictable high frequency buses, can better meet the travel needs of a wider catchment compared to slow and meandering local bus routes. Higher category bus routes like trunk and connector services can also play a larger role as mass transit services. Lower category local routes that perform a coverage function can connect to these services.

Progress towards getting the most from Melbourne's bus network has stalled in recent years. Melbourne could benefit from introducing a culture of regular bus route reform. For example, Perth has achieved 9 times more bus network changes (such as adding routes or adjusting frequencies) per capita than Melbourne in the past 2 years.[103]

Melbourne has many opportunities for improving bus routes. The opening of the Metro Tunnel will support public transport use in all areas from Sunbury to the south-east growth corridor.[104] Public transport users will need to access local stations to make use of faster travel times as a result of the project. The optimisation of bus networks to serve these local stations on the Melbourne Metro rail corridor is an opportunity for the

Victorian Government to provide an alternative for users who may be beyond the immediate walking catchment of a train station.

Melbourne's outer west and east contain other examples of bus networks that require optimisation. The City of Melton has demonstrated the need for local bus reform after all the services within the Melton township experienced patronage declines despite its growing population.[105] In Endeavour Hills, the complex network of existing bus routes provides limited direct access to neighbouring activity centres, including Dandenong.[106]

Case study

Network redesign around the Suburban Rail Loop

Our modelling shows the opening of the Suburban Rail Loop (SRL) Stage One, scheduled to operate by 2035, will result in a reduction in patronage of north-south bus routes in Melbourne's eastern suburbs as passengers switch to the more convenient option of train travel.

Some corridors, like Elgar Road near Deakin University and Warrigal Road near Chadstone Shopping Centre may experience a reduction of up to 1,000 travellers per day.

The opening of a major infrastructure project like SRL East provides a clear opportunity for the Victorian Government to optimise bus routes to better connect into new SRL precincts and integrate with new stations.

While SRL East will deliver faster travel times for users travelling between stations, the bus network will continue to play an important role in filling the gaps and connecting residents and workers to nearby stations.

In some areas, like Glen Waverley and Cheltenham, our modelling suggests that bus patronage will increase as a result of SRL East, directing travellers towards the new infrastructure and maximising the project benefits.

This is a similar strategy to other cities. For example, the opening of the Underground Elizabeth line in London was coordinated with a further 30 bus route changes designed to provide additional capacity, faster connections, and a rebalance of bus provision in line with changes in demand.[107]

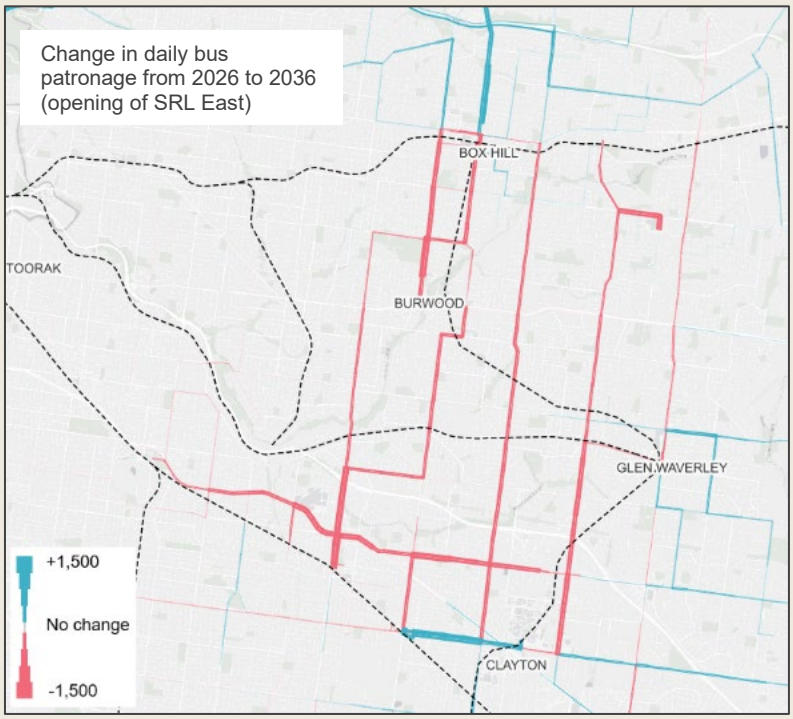


Figure 11: Bus patronage declines in 2036 around SRL precincts. This bus network requires optimisation after the opening of SRL East to make the most out of the new infrastructure investment

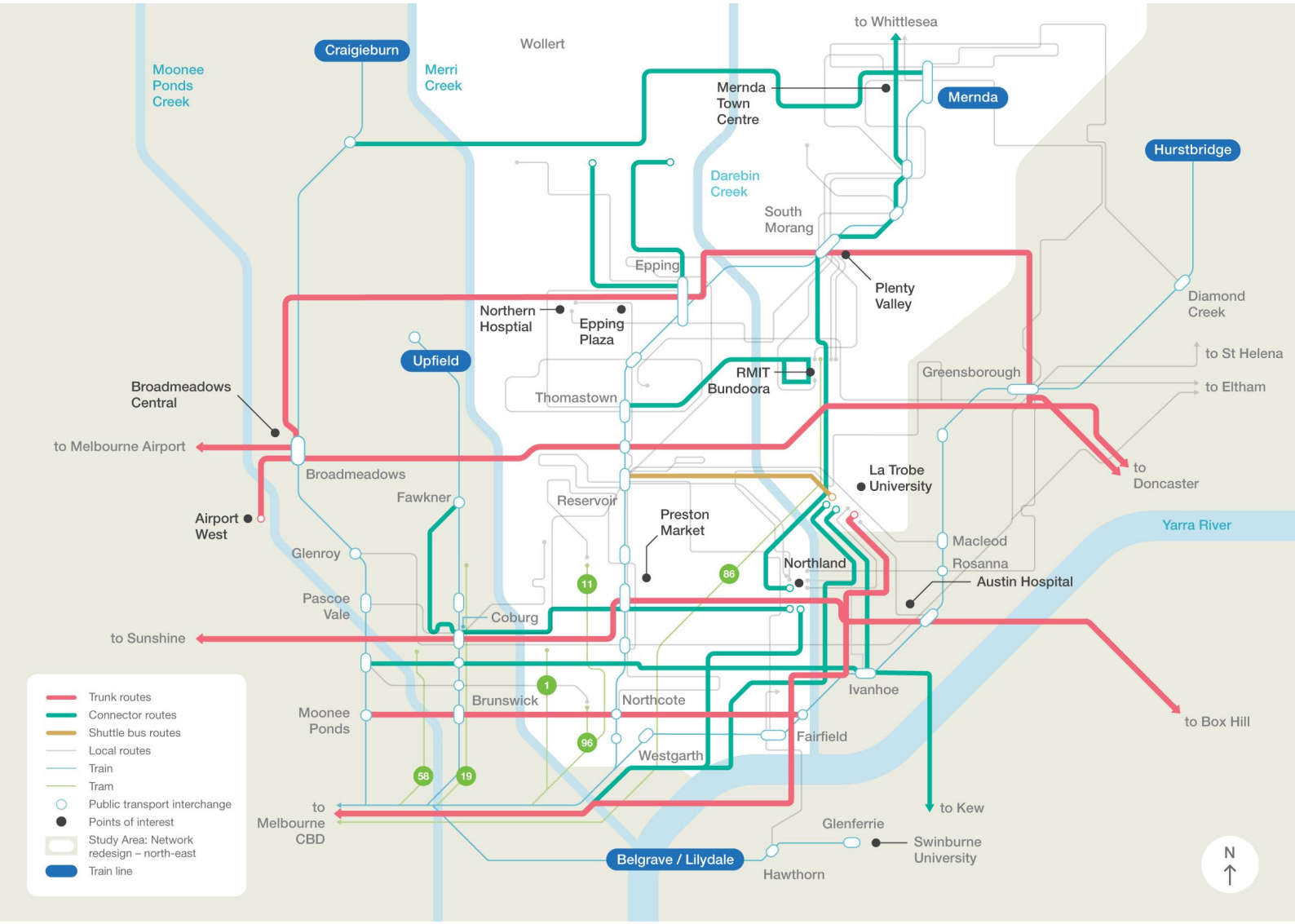
Source: Infrastructure Victoria analysis of WSP bus reform modelling.

Optimising bus routes in Melbourne's north-east

We followed this approach in developing an example of an optimised bus network in Melbourne's north-east, across Darebin and Whittlesea, to demonstrate what could be achieved across wider Melbourne. Our modelling shows that many destinations could be better served using the existing bus fleet and with the same level of operational expenditure.[108] The outcome was a network of more direct high frequency routes, as well as several local routes performing a coverage function, as shown in Figure 13. The optimised network tests bus route redesigns, like a new La Trobe University shuttle servicing both Reservoir and Macleod stations, strengthened east-west connections around Mernda, Epping and Greensborough and consolidated winding routes into a selection of higher frequency connector and local routes.

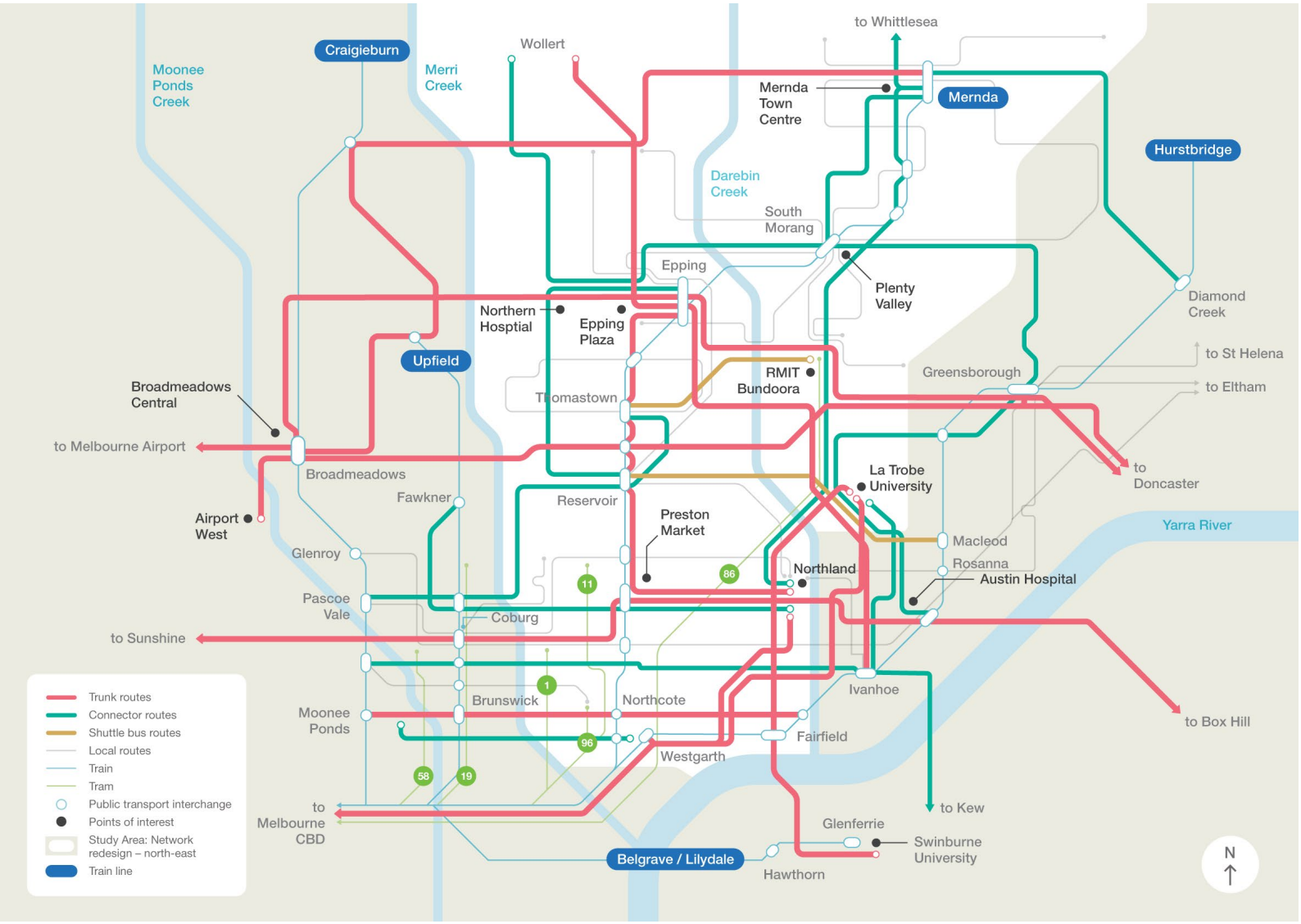
While our optimised network also increases the proportion of trunk (red) and connector (teal) bus services as a result of fewer but direct routes, they are operating at reduced frequency to remain within the existing operating budget. We also tested the combined impact of higher frequencies for the optimised north-east network in the full scale reform – scenario 4. These results are discussed in the Greater returns from a package of investments section.

Figure 12: Existing bus network in Melbourne's north-east



Only existing routes relevant to the study area are shown. Source: Infrastructure Victoria.

Figure 13: Optimised bus network in Melbourne's north-east

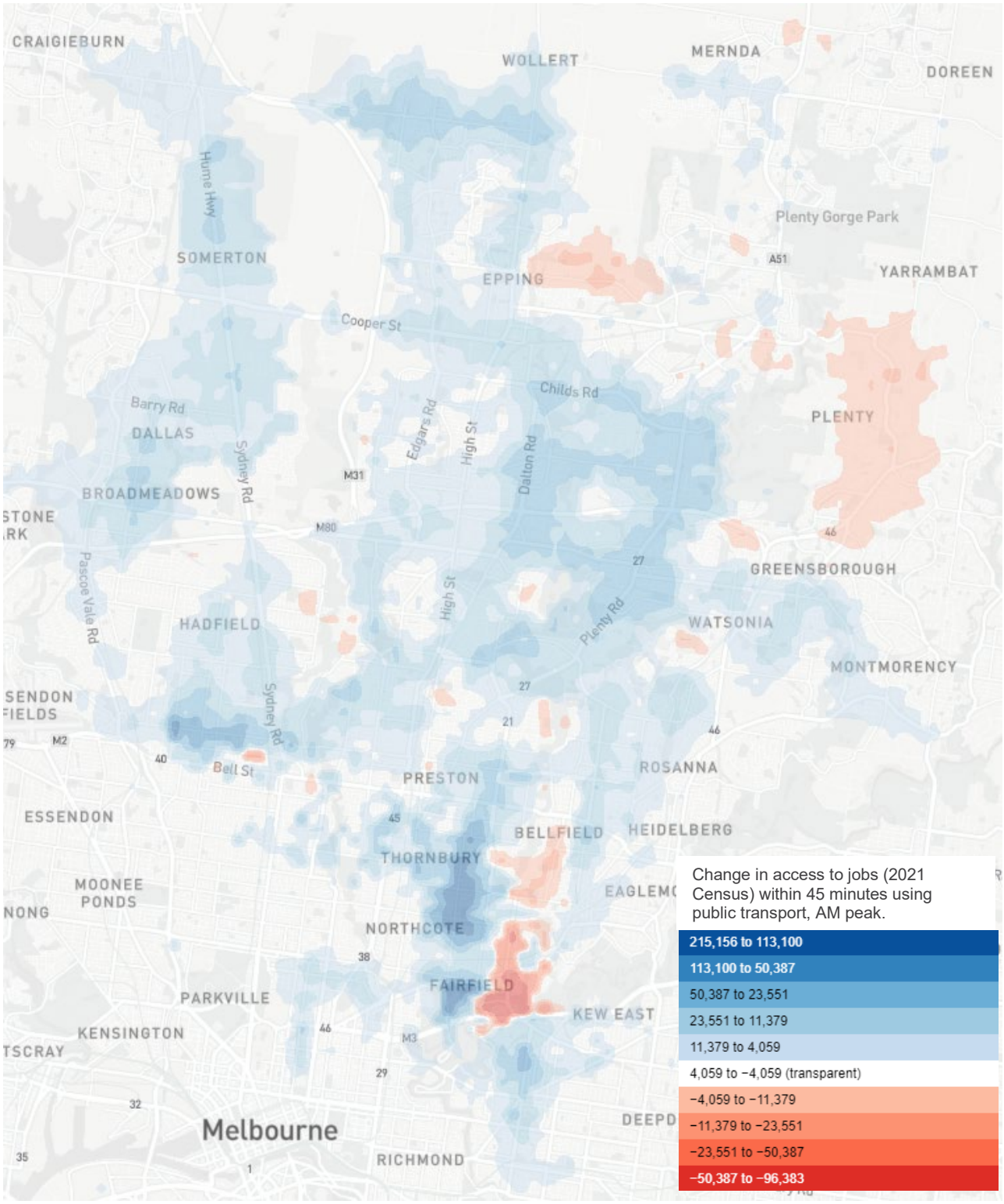


Network maps are for Infrastructure Victoria scenario testing purposes only and do not represent any current or future network designs from the Department of Transport and Planning. Only routes relevant to the study area are shown. Source: Infrastructure Victoria.

Optimising Melbourne's bus network in the north-east would result in an estimated $110 to $160 million of time saving benefits to public transport users over the 20 years after implementation. With slightly more people taking buses and fewer people driving, road congestion would also be reduced resulting in a further $300 to $550 million of time saving benefits to road users over 20 years. This is considerable given bus services in this scenario were reconfigured at no additional cost, other than a small amount of capital expenditure to adjust bus stop signage and route labels. Our analysis also shows that investing in higher frequencies (Recommendation 1) and adding in bus priority measures (Recommendation 5) can maximise the benefits from an optimised network (see section *Greater returns from a package of investments*).

This optimised network delivers widespread benefits, including improving access to employment as shown in Figure 14. Areas highlighted in blue have access to more jobs as a result of an optimised bus network. The modelled scenario benefits residents living in suburbs like Preston and Mill Park with increased access to up to an additional 23,500 jobs within a 45-minute travel time by public transport. Residents in parts of Northcote and Thornbury gain even greater access with up to 215,100 additional jobs within a 45-minute travel time. Increased access to employment means that workers' and their skills can be better matched to jobs, which can then lead to overall productivity benefits.[109] Access to areas that offer employment also indicate locations where Victorians can access services and infrastructure including activity centres.[110]

Figure 14. Route reform leads to increased access to jobs for almost all of the study area



Source: Infrastructure Victoria analysis using Conveyal accessibility tool.

However, Figure 14 also shows that further optimisation of our modelled network in this scenario would be needed. Small sections of suburbs like Alphington and the eastern part of Epping and Plenty experience reduced access to jobs (shown in red). If the optimised network were to be implemented, we would encourage engagement with local communities and the use of network planning tools to iteratively test network designs and help identify and address any negative impacts of proposed changes to existing bus services. Additional funding may be required for more targeted local routes or community transport operations (see Recommendation 4) in areas where coverage is vital.

Identifying suitable routes to reshape into a faster, more direct bus network

Melbourne's buses operate as part of an integrated public transport network. Over a third of bus journeys involve a connecting train, and 10% a connection to other buses.[111] When buses connect with trains, they can vastly expand the number of destinations accessible to travellers. However, the way that buses and trains are planned is different.

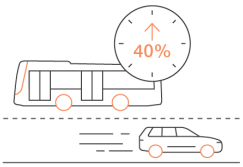
Victoria's *2012 Network development plan – metropolitan rail* lists several service principles to guide the development of rail infrastructure and service provision across metropolitan Melbourne.[112] These principles were designed to improve the overall customer experience, including frequency targets of trains every 10 minutes on trunk lines, maximum standing times in trains of 25 minutes from key stations, consistent stopping patterns, and better coordination with regional services. These principles guided network planners to design reliable and high quality rail services. There are no equivalent publicly available standards for the bus user experience as part of *Victoria's bus plan*.[113]

As future phases of *Victoria's bus plan* are developed, the Victorian Government should consider using key criteria to help elevate buses in performing a mass transit role. Service principles to guide bus network planning could include:

Service provision: change the current provision targets to incorporate both service location and frequency.

For example:

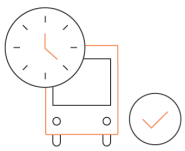
- 80% of population across metropolitan Melbourne within 800 metres of a frequent public transport service of no less than every 20 minutes.
- Weekend and public holiday service frequency no less than a typical weekday inter-peak timetable.
- Trunk and connector bus routes with operating hours of at least 6am to 11pm.



Fast and frequent services to key destinations: compare travel time competitiveness between private vehicles and public transport.

For example:

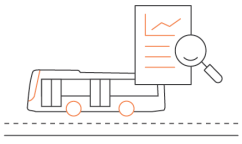
- Travel time by public transport from any location in Melbourne to any key activity centre is no more than 40% longer than an equivalent car journey. This can be achieved through investment in higher frequencies and public transport priority treatments (see Recommendation 5).



Improved reliability: set criteria for when public transport priority measures should be explored to minimise excessive delays.

For example:

- Public transport priority measures should be implemented along key public transport corridors where over 10% of delay is due to road congestion or delay from traffic signals.



Ongoing service reviews: set targets for when bus networks should be reviewed and criteria for how low performing services are identified and addressed.

For example:

- Productivity of fixed bus routes should be reviewed annually and services operating at less than 10 boardings per service hour are improved or route redesign considered (see Recommendation 2).

See endnotes section for all references associated with the above infographic.[114]

Recommendation 3

Extend operating hours to match passenger demand and improve timetable integration

Begin extending operating hours of bus services across Melbourne, especially to activity centres like Chadstone and Northland on weekends.

Progressively deliver ongoing timetable improvements to improve the user experience for bus passengers, including the integration of bus timetables with other connecting public transport services and the rollout of rapid running services.

Current operating hours do not meet passenger needs

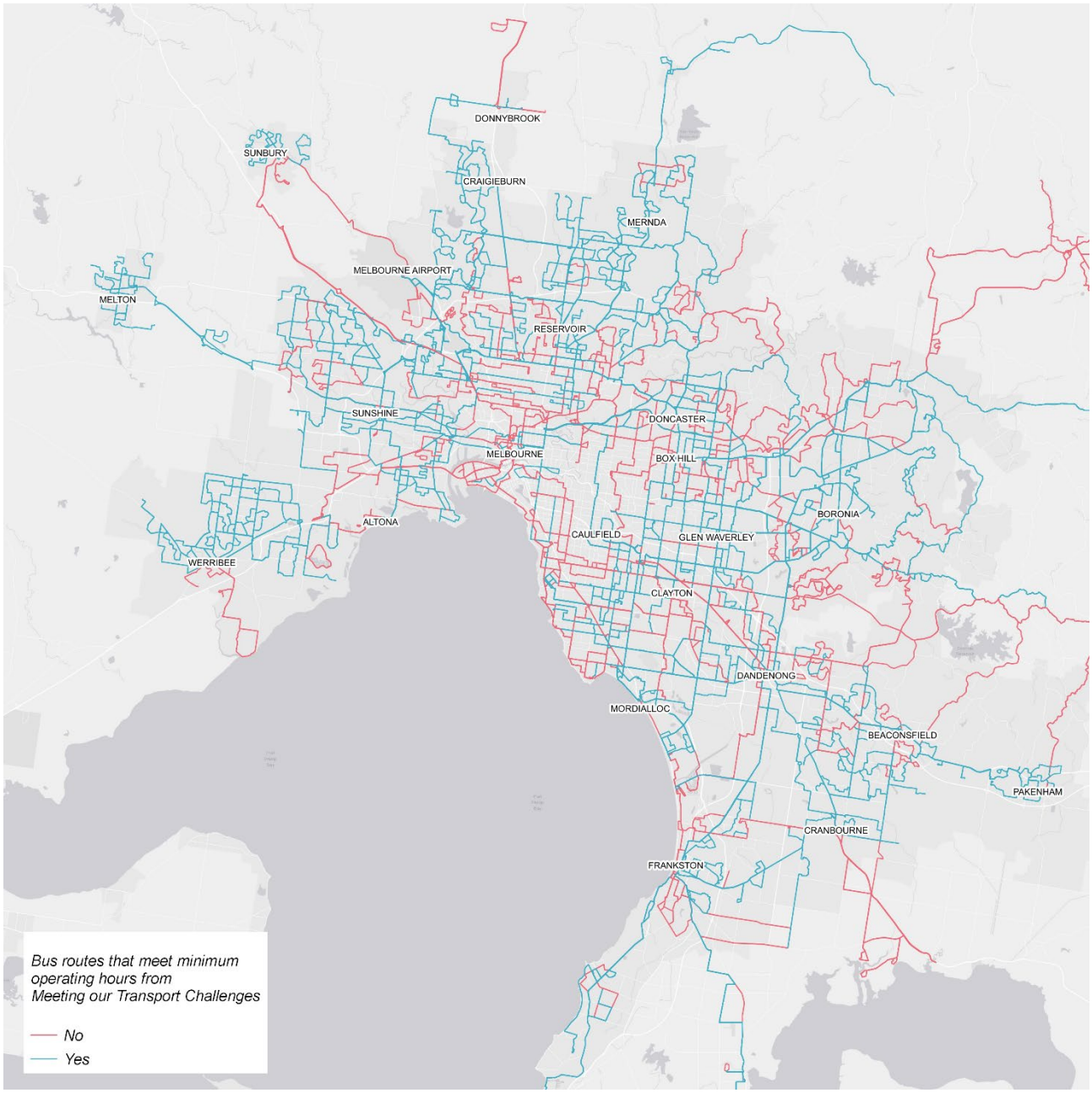
Many of Melbourne's bus routes still do not meet minimum service levels which were introduced almost 2 decades ago. Our analysis shows that just under two thirds of bus routes (62%) meet weekday minimum service levels, operating from at least 6am to 9pm on weekdays.[115] Similarly, under two thirds of bus routes (61%) operate between at least the hours of 9am to 9pm on Sundays.[116] Both weekday and weekend targets were set as part of the Victorian Government's 2006 *Meeting our transport challenges* strategy.[117] While this was a step in the right direction, our community research shows that Melburnians prefer buses to operate for longer hours than originally specified in *Meeting our transport challenges*.[118]

Many bus timetables are also outdated and have not changed much since services were first introduced on the network.[119] Years of slow progress on bus reform has also resulted in a mismatch between existing land uses and service provision. [120] The bus network has not kept up with the changes across Melbourne's suburban activity centres such as extended retail operating hours and more compact housing and mixed-use developments.[121]

As shown in Figure 15, bus services right across Melbourne have limited operating hours. Limited hours of operation dissuade potential travellers from using bus services. Extended hours are important for users of the network who travel outside of the traditional weekday peak times such as retail, healthcare and shift workers. If travellers cannot get home after making their trip on public transport because services stop early, they may use alternative modes (like private vehicles) or avoid making their trip altogether. Previous rounds of bus reform which followed the 2006 *Meeting our transport challenges* strategy showed that expanding operating hours into the evening grew patronage by around 10%.[122]

Victoria's night-time economy is also one of the largest in Australia, employing over 230,000 people.[123] Melbourne's Night Bus network consists of 21 routes which run a 24 hour weekend service, in addition to another 13 dedicated services which run after midnight on weekends.[124]

Figure 15: Bus routes that meet the *Meeting our transport challenges* minimum operating hours



Note that analysis has only considered surveyed routes (those for which timetable data has been published through GTFS).
Source: Infrastructure Victoria analysis of PTV timetable data for 2022.

Travel patterns post the COVID-19 pandemic suggest that weekend and off-peak weekday public transport services are key to supporting many shopping and social trips.[125] We found high levels of untapped demand for buses on weekends – should those trips be supported through longer operating hours.[126] Our community research identified that respondents preferred bus service operational hours of 6am to 11pm for both weekdays and weekends, although frequency and journey time were more important factors for current bus users (see Recommendations 1 and 2). We estimate that the additional operating expenditure required to boost operating hours to these levels would be an additional $65 to $95 million per year.[127]

Route 800, one of Melbourne's busiest buses without a Sunday service

The Route 800 bus operates in Melbourne's south-east, a direct connection between central Dandenong and Chadstone Shopping Centre running along Princes Highway.

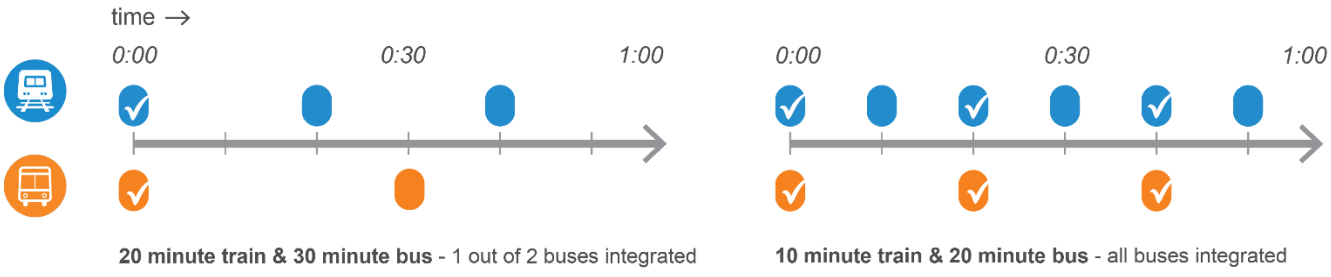
Route 800's limited operating hours have not changed for over 30 years and it is now one of Melbourne's busiest bus routes without a Sunday service.[128] Saturday frequency is also low with buses running every 60 minutes. The service is an example of where bus operating hours are mismatched to the surrounding land uses.

Major activity centres are at each end of the route, including Chadstone Shopping Centre and Dandenong Market. Residents and community advocates have been calling on the Victorian Government to upgrade service levels, making Route 800 into a convenient 7 day service.[129]

Timetables can better connect buses to other public transport services

The Victorian Government can improve people's experience of using Melbourne's buses through improved timetables. Our analysis of public transport timetable data identifies many opportunities for buses to better integrate with trains, especially on weekends. For example, many stations along the Mernda line could be better integrated with connecting bus services. Connector buses arriving every 10 to 20 minutes would integrate with the Mernda line trains operating every 20 minutes. As shown in Figure 16, poor harmonisation between bus services can mean only one of every four buses per hour meeting a connecting train.

Figure 16: Examples of harmonisation between train and bus over 60 minutes



Source: Infrastructure Victoria, 2022.

Bus services that intersect with multiple train lines, like in Melbourne's inner north, can be a challenge for network planners when trying to harmonise all buses with trains. This issue is minimised with increased investment in bus frequencies (see Recommendation 2) and rapid running services.

Rapid running services deliver faster journey times

Rapid running is a method of operating where services no longer slow down or wait at bus stops and timing points if they're running ahead of schedule.[130] Timetables list the frequency of services, for example, 'every 10 minutes', rather than departure times. In addition to more direct routes as part of a network redesign (see Recommendation 2), rapid running services are another way of reducing journey times to benefit passengers.

The Victorian Government has been trialling rapid running along selected high frequency bus routes like Route 246 which connects Clifton Hill to Elsternwick via Hoddle Street, similar to how many high frequency tram routes have been operating in Melbourne.[131] Many of Melbourne's bus timetables factor in congestion to ensure buses can adhere to a schedule on slow running days and include timing points where buses wait until it is time to depart on quieter days. Rapid running removes excessive idling at timing points, a common source of frustration for passengers.[132]

> "
>
> '…you have a schedule that wastes time when you don't need it, and is unable to control the system when you do need it.'

Simon Berrebi, quoted in *Better buses better cities (2019),* Steven Higashide.

Rapid running is a useful tool in improving the productivity of Melbourne's bus network through faster journey times and improved customer experience.

Higher frequency trunk routes that operate at least every 10 minutes, like many of Melbourne's SmartBus routes during the peak, provide an opportunity to roll out rapid running for more services. Low frequency routes are not suitable for rapid running. Improved access to real-time information (see Recommendation 7) can complement rapid running services, ensuring that travellers have a clear view on how far away the next service is.

Recommendation 4

Strengthen the role of community transport

In the next year, work with the community transport sector to identify service gaps and coordinate services for users unable to access the primary bus network. Then, provide dedicated funding for community transport providers to help cover service gaps and assist in the maintenance and modernisation of community transport fleets and user experience.

The Victorian Government needs to support communities where people may be experiencing limited mobility, whether due to health, social or geographic reasons. Increased support for community transport providers through dedicated funding would help the government to continue delivering important transport services that play a social role, while also delivering fast and efficient mass transit bus services in parallel.

Bus reforms which prioritise frequency, speed and direct routes require trade-offs which reduce transport coverage and can require users to travel further to reach their service.[133] This has a disproportionate effect on Victorians who lack access to a car and require more specialised transportation.[134] Accessing public transport services can be challenging for some Victorians due to physical disability, mental health and communication constraints. These challenges are exacerbated by the Victorian Government's delays to meet the legislated requirement to make public transport accessible for people with mobility restrictions (see section on Funding public transport accessibility).[135]

The Victorian Government is currently meeting some of the transport needs of these groups through local bus routes and FlexiRide services. Many Victorians are also being supported by community transport providers who offer door-to-door transport as well as additional social support and assistance.[136] Community transport has a health and social service role that is essential for providing independent mobility, social trips and infrastructure access. For example, community transport providers often connect users to their local medical centre and reduce the risk of illness or the need for acute care.[137]

Community transport: a simple definition for a complex problem

Community transport acts as an essential social and community service, providing affordable and specialised transport for vulnerable people.[138] Service providers are highly diverse, depending on the needs of their customers and the mobility gaps experienced. Community transport is often used to support:[139]

- people living in remote/low service provision areas without access to a car
- seniors over the age of 65
- people with mobility impairments.

Image source: Link community transport

Victoria's bus plan identifies that community transport plays an important role in complementing Victoria's bus network for specialised journeys.[140] However, it is not included within the plan's bus route categories that are intended to guide network reform and service planning. These categories include similar local and

specialised services including demand-responsive transport and school buses. The plan does not provide strategic guidance for the community transport sector's future role in supporting Victorians that are not served well by public transport.

Community transport can provide a safety net during route optimisation (see Recommendation 2). Any community transport program can be monitored over time and potentially upgraded with delivery of a more efficient new local bus route.

Existing community transport services in Victoria are made less efficient by complex funding pathways and decentralised ownership. They receive Commonwealth and Victorian government funding through various health and regional transport programs. Significant funding comes from the Commonwealth Home Support Program and the National Disability Insurance Scheme (NDIS).[141] These programs put in place restrictive eligibility requirements that can create unmet and unmeasured demand from ineligible groups.[142] A lack of coordinated investment from the Victorian Government prevents the integration and formal recognition of community transport in strategic transport planning. It also prevents the Victorian Government from having an informed understanding of service gaps and where future investment would be most valuable. Improved partnership with the community transport sector provides an opportunity for the Victorian Government to identify the locations and needs of Victorians that may currently be experiencing a specialised transport need.

Community transport in NSW

Community transport receives more direct funding in other Australian states like New South Wales. In the 2022-2023 budget the NSW Government provided $96 million to collectively fund the Home and Community Care Program and Community Transport Program.[143] This allows them to service a wider catchment of transport disadvantaged groups.

The NSW Government funds community transport for individuals who are transport disadvantaged owing to physical, social, cultural and/or geographic factors.[144] This fund allows a wider range of households to access community transport services including to culturally and linguistically diverse (CALD) groups users with language barriers.[145] The NSW government's transport portal also helps coordinate and direct users to community transport services through an information page and directory of providers.[146]

Image source: Markus Winkler on Unsplash.

The Victorian Government is currently partnering with VicTas Community Transport Association, the peak body for community transport in Victoria, to better understand the service coverage, delivery models, funding streams and new technologies across Victoria.[147] This work is due to be completed in mid-2024 and should help identify opportunities to support a more efficient and sustainable community transport sector. This partnership should be supported through ongoing data sharing with community transport providers to monitor and evaluate Victoria's investment and the benefits of transport interventions to improve accessibility and social equity.

The community transport sector's productivity and customer-facing information could be improved by Victorian Government support in standardising digital technology like booking systems and real-time

information.[148] Technological improvements in Australia's community transport network are being unevenly adopted by independent providers.[149]

Some Victorians that are currently eligible for community transport are unaware of their transport options and struggle to navigate the system.[150] A shared public platform helps users journey plan, book, and pay for services from different community transport providers to suit individual contexts and needs.[151] For example, Via Transit has partnered with American cities like Green Bay and Seattle to provide an integrated app for multiple on-demand transport services. Their technology allows users to request additional mobility or disability support.[152] Better data also means that the government and community transport providers can be dynamic with service provision and demonstrate efficient use of bus funding.

Buses in the fast lane

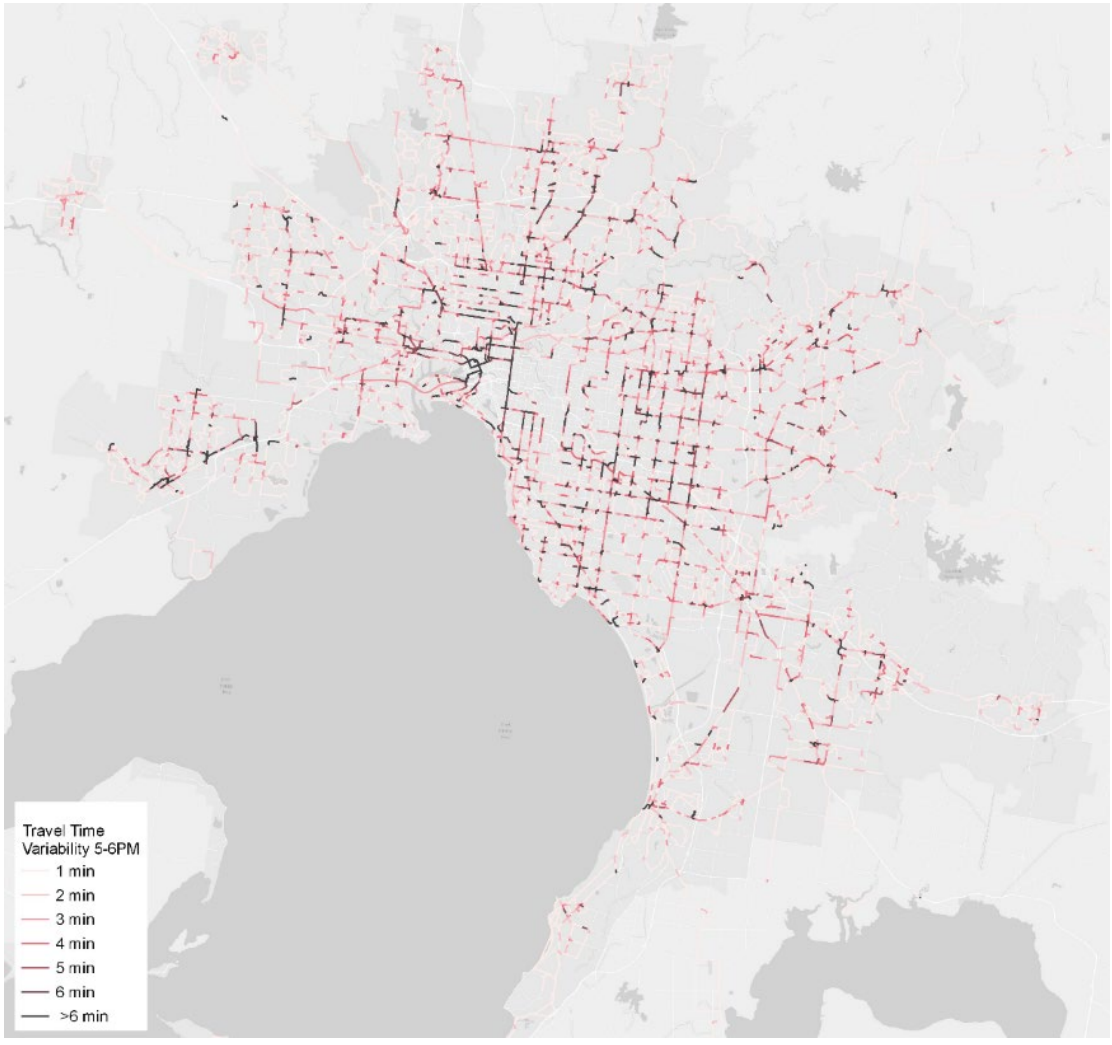
Buses don't need to be slow – there are many ways to speed them up and deliver faster journey times for Melburnians.

Melbourne has approximately 52 kilometres of dedicated bus lanes.[153] Most of Melbourne's buses share the road with general traffic, limiting the speed buses can travel, and leading to highly variable travel times. Late and unreliable bus services can also lead to missed transfer connections and a general lack of trust by travellers using the network.

Congestion is also a growing problem, with our modelling showing that the number of congested kilometres that vehicles are stuck in on Melbourne roads will increase by 46% between 2026 and 2036. Without action, travel times on Melbourne's buses will continue to deteriorate, with impacts on travel time reliability and traveller confidence.

As shown in Figure 17, many bus routes that currently operate in inner and middle suburbs of Melbourne are impacted by heavy congestion. These include routes running along Hoddle Street and Bell Street, and around activity centres in Werribee, Footscray, Heidelberg and Ringwood.

Figure 17: Bus travel time variability during weekday evening peak



Source: Infrastructure Victoria analysis of Department of Transport and Planning 2019-20 bus data. Variability measured in minutes per kilometre.

Recommendation 5

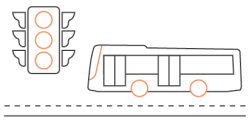
Speed up buses through on-road priority and smarter technology

In the next 5 years, implement a suite of bus priority measures across the network to improve bus travel speeds and network reliability.

Through a targeted review of congestion and bus delays across Melbourne, explore on-road priority measures like new bus lanes, traffic signal improvements and queue jumps at intersections. Prioritise delivery in inner and middle parts of Melbourne along high frequency routes and around busy activity centres like Footscray, Glen Waverley, Box Hill and precincts like Fishermans Bend.

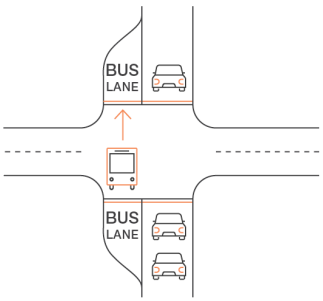
Bus priority measures provide travel time benefits and improve the reliability of bus services. These measures have increased patronage in Australian cities.[154] The Victorian Government should implement bus priority measures like dedicated bus lanes and improved traffic signalling to maximise use of the bus network.

There are many different measures used by transport planners to give buses priority on the network.



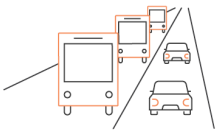
Improved signal operations

Improved signal operations for bus services can be a discrete and effective bus priority measure. Traffic signals are typically timed for cars, not buses. In Minneapolis, signal priority changes, along with better detection of approaching buses, reduced bus travel times by up to 15%.



Dedicated bus lanes

Dedicated lanes shield buses from traffic congestion. When implemented along congested roads and busy bus corridors, dedicated bus lanes can deliver fast and reliable journey times. In Sydney, dedicated bus lanes combined with signal priority have delivered travel time savings for B-Line passengers of 14%, and reduced travel time variability by 20%.



Bus queue jumps

Bus queue jumps allow buses to skip general traffic queues at intersections. When matched with improved signal operation, bus queue jumps can speed up bus travel times. In San Francisco, queue jumps reduced travel times of up to 50% at some locations. They are a useful measure if space is limited or a full-length bus lane is impractical.

See endnotes section for all references associated with the above infographic.[155]

The benefits from bus priority are multiplied when combined with many of the other bus reform recommendations outlined in this report (see section *Greater returns from a package of investments*). Although higher frequencies or longer operating hours may achieve short-term patronage gains, bus priority is the key to ensuring ongoing investment in bus reform does not get stuck in the slow lane.

Our modelling suggests that introducing 260 kilometres of bus lanes in Melbourne can increase bus boardings by 10% in 2036.

The bus lanes we tested in bus priority corridors – scenario 2 are shown in Figure 18, including reallocation of 110 kilometres of existing traffic lanes and 150 kilometres of widening road space or using existing public transport priority. Our selected locations for bus lanes were identified as potential corridors for measuring the benefits of faster and more reliable buses. We estimate that the benefits to current and future bus passengers of these lanes at around $670 to $920 million over the next 20 years, flowing from improved journey time and travel time reliability, through less congested bus roads and fewer buses running late. Costs would vary depending on the location and type of bus priority implemented. These range from under $1 million for a small-scale conversion of existing lanes to a bus lane to $200 million for bus lanes involving road widening.

Figure 18: Testing bus lanes across Melbourne

Source: Infrastructure Victoria.

Planning is also vital to the success of bus priority measures. The right type of bus priority requires careful analysis of local context and how bus priority supports strategic transport plans like Victoria's Principal Public Transport Network (PPTN). Bus lanes with low frequency bus services running along them may be perceived as a waste of valuable road space and can frustrate motorists.[156]

Lessons can be drawn from Melbourne's own experience with implementing Stud Road bus lanes in the outer east. Despite introduction of new bus lanes in 2009, the infrastructure was never backed up with higher frequency services, leaving bus lanes appearing 'empty'. Frustration from motorists ultimately ended in many priority lanes being removed and returned back to general traffic. However, results from Infrastructure Victoria's community research show that the majority of respondents rated a scenario of converting road lanes into bus lanes for busy bus routes between 'somewhat' and 'completely acceptable'. Frequent bus users were more accepting of this change while regular drivers were less inclined to accept a conversion of general traffic lanes into bus lanes (one in 3 regular drivers rated this as acceptable).[157]

The Victorian Government's Smarter Roads program is rolling out improvements to modernise the road network (see Smarter Roads case study). Through harnessing technology like travel time sensors, vehicle detectors and traffic light optimisation, arterial roads in Melbourne's west have experienced up to a 15% reduction in travel times during peak hours.[158] The program also includes trialling new technology that extends green time at intersections to allow buses, which might otherwise be delayed, to pass through efficiently.

The Principal Freight Network is a framework which identifies and protects Victoria's major road (and rail) freight routes and places.[159] Over 180 kilometres of the Principal Freight Network and the PPTN overlap, especially along state-owned arterial roads. Taking a Smarter Roads technology approach to improving traffic flow can benefit both bus services and support high capacity freight movements, increasing productivity for both goods and people.

As an extension of the Smarter Roads approach, the Victorian Government should dedicate resources to monitor, identify and deliver a continuous program of bus priority improvements over the next five years. Bus priority measures should be designed around improving travel speeds for bus passengers and improving network reliability. The program should coordinate with other road projects and upgrades to minimise disruption to the network.

Case study

Smarter Roads – transforming the management of busy suburban roads for all users

The Smarter Roads program began in mid-2020 with $340 million of committed funding to reduce delays associated with future increases in road traffic and deliver long-term congestion relief.[160]

The program has deployed a wide range of technologies including over 700 live traffic monitoring cameras, 120 in-ground vehicle detectors, 42 live travel signs displaying real-time information, 260 travel time sensors, as well as new pedestrian crossing technology and the review of over 850 traffic light sequences.[161] The first phase of the program reviewed every arterial road across Smarter Roads zones in Melbourne's west, east, and south-east, delivering a more efficient network and better responses to incidents. Phase 2 has already commenced reviewing the remaining 4 zones and will be completed by mid-2027.[162]

Examples of Smarter Roads benefits include traffic light optimisation along Clyde Road in Berwick resulting in 43% better travel times despite a 4.8% increase in traffic over the same time.[163] At selected intersections along Wellington Road, pedestrians benefit from 14-second time savings as well as more green time for motorists allowing 153 additional vehicles per hour to flow through in the morning peak.[164]

The Smarter Roads program has helped both cars and buses. During peak hour, Smarter Roads improvements have reduced delays by up to 22% on Balcombe Road in Melbourne's south-east, improving bus reliability. On Webb Street, Narre Warren, traffic light cycle times reduced from an average of 130 seconds to 96 seconds, resulting in up to approximately 30 second reduction in delay for each bus travelling through.[165]

The program is trialling TRANSnet technology which detects trams and buses approaching signalised intersections, and can provide additional green time for public transport vehicles which have fallen behind schedule.

The program is also making pedestrian crossings safer, smarter and more reliable by installing dynamic pedestrian detectors (DPDs) and 'puffin crossings'.[166] DPDs detect the number of pedestrians at a crossing in real time and can extend the crossing time to allow for more pedestrians to cross. Puffin crossings have sensors to detect pedestrians as they cross the road, keeping traffic lights red for vehicles until all pedestrians have cleared.

These results from the Smarter Roads program demonstrate the benefits from smarter technology and continuous optimisation of Melbourne's transport network. The Victorian Government should build in a stronger emphasis for buses and pedestrian access to services as part of future phases of the Smarter Roads program.

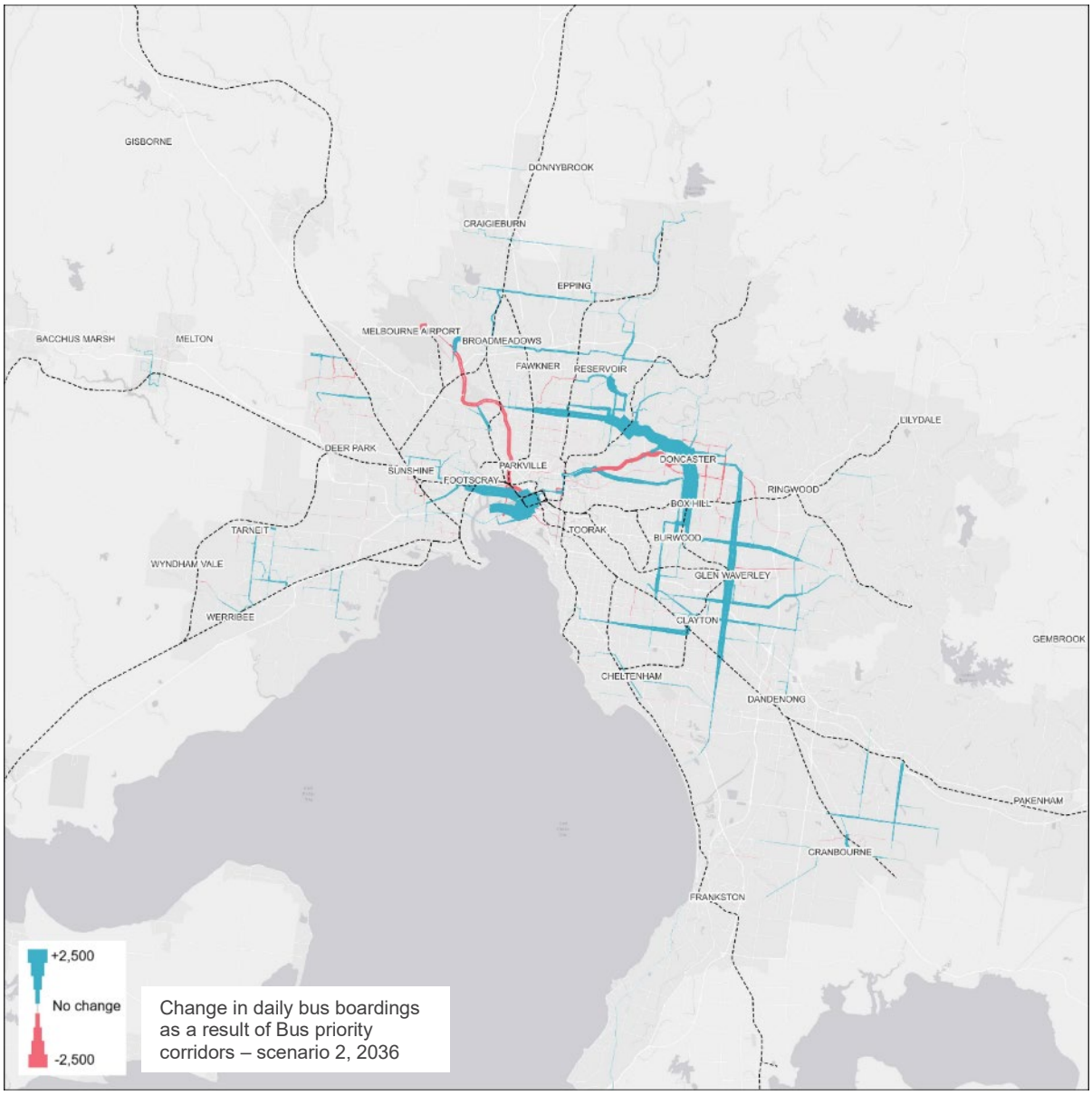
Below: Taking a Smarter Roads technology approach to improving traffic flow can benefit both bus services and support high capacity freight movements, increasing productivity for both goods and people. Source: Will Fox on Unsplash.

Bus lanes are best paired with high frequency routes

Our modelling shows that patronage response is strongest when bus lanes are paired with high frequency routes like trunk routes that connect suburbs to key transport nodes, employment and shopping centres. Overall changes in bus patronage in our bus priority corridors – scenario 2 are shown in Figure 19.

Almost all of these additional boardings come from a mode shift away from using private vehicles. Daily private vehicle trips in the model reduced by over 20,000 in 2026 and over 26,000 by 2036. This also reduced the daily vehicle kilometres travelled by car by 623,000 kilometres in 2026 and 774,000 kilometres in 2036.

Figure 19: Not all bus lanes are created equal. Patronage gains as a result of bus lanes are highest in inner and middle parts of Melbourne and along high frequency routes



Source: Infrastructure Victoria analysis of WSP bus reform modelling.

For bus lanes implemented in inner and middle ring suburbs like Footscray, bus lanes along high frequency trunk routes showed increased patronage of 110%. In Glen Waverley, bus lanes increased trunk route boardings by 67%. Key road corridors with new bus lanes tested include Station Street in Box Hill (92% additional patronage) and Bell Street (68% additional patronage) which support the orbital 903 SmartBus route.

Better buses to support urban renewal precincts

Australia's largest urban renewal project, Fishermans Bend, is expected to be home to 80,000 residents and provide employment for up to 80,000 people by 2050.[167] While the strategic framework for the precinct assumes the delivery of future tram connections, our modelling shows the tram line would reach peak period capacity by the mid-2030s.[168]

Bordered by the Yarra River to the north, improved bus connections to Fishermans Bend are a vital short to medium-term solution in achieving transport connectivity between the precinct and the rest of Melbourne.

The Victorian Government has already begun significant investment in high frequency services for Fishermans Bend.[169] Our modelling shows that pairing these services with bus lanes in some of the most congested sections would help to maximise the travel time benefits and improve trip reliability for decades to come. Bus lanes along Lorimer Street in Fishermans Bend increased patronage on existing routes in our modelling by over 110%.

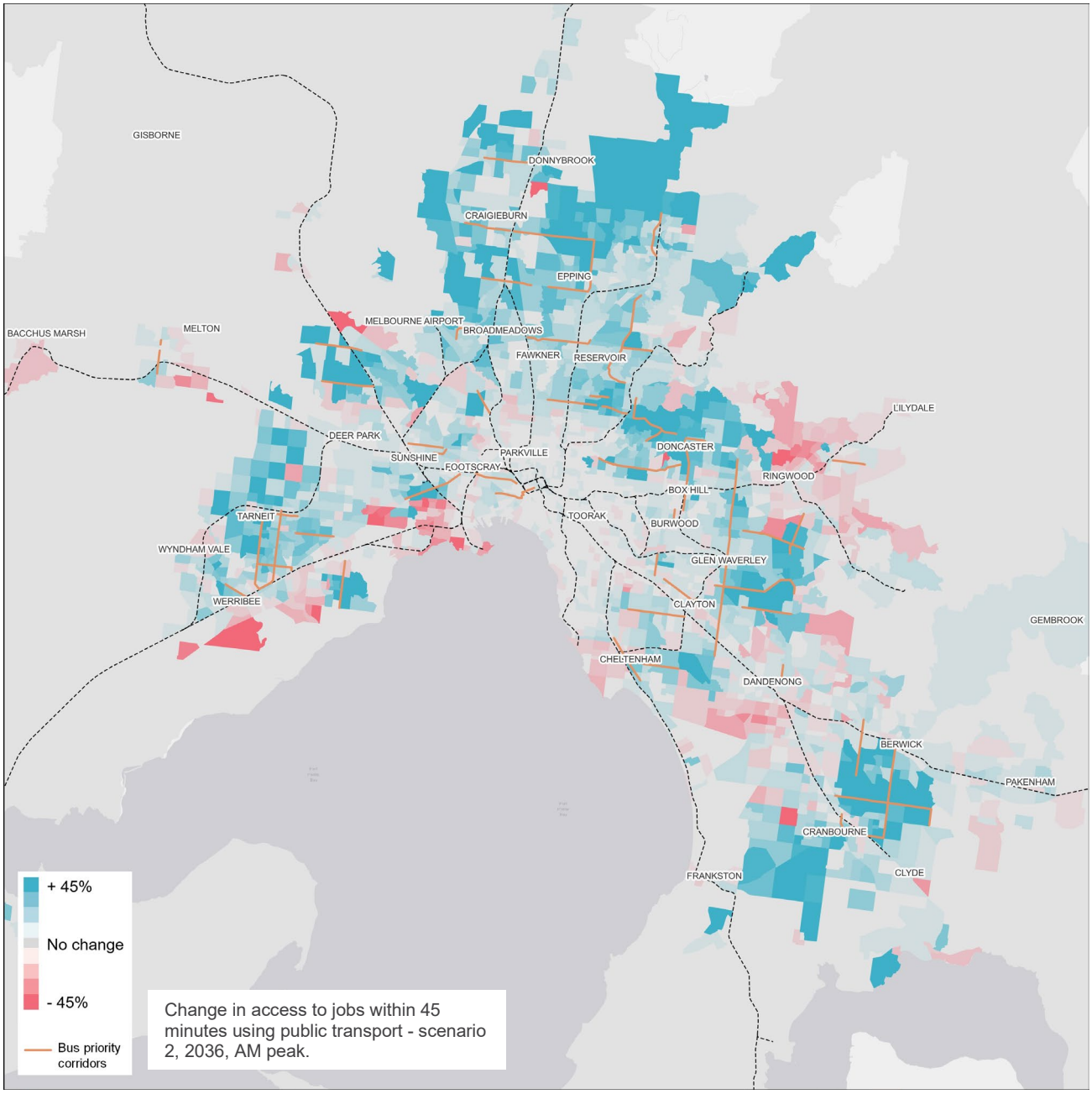
Image source: Victorian Government

Bus priority means faster journeys and more access to jobs and services

Bus priority makes travelling by bus quicker, increasing its appeal to potential passengers. Bus priority measures offer travel time saving benefits to bus passengers during busy peak periods. This includes weekends, especially near high activity areas like shopping centres.

Bus priority can also improve access to employment for many Melburnians, as shown in Figure 20. By 2036, the average Melburnian could access over 30,000 additional jobs (4% uplift) as a result of the bus lanes tested in scenario 2. Bus lanes also mean that education precincts like La Trobe University in the north-east and Monash University in the south-east also benefit from faster journeys for their staff and students.

Figure 20: Bus priority improves access to jobs



Percentage change in access to jobs by public transport within 45 minutes during the morning peak. Source: Infrastructure Victoria analysis of WSP bus reform modelling.

Detailed assessment of bus priority location is required to ensure value for money

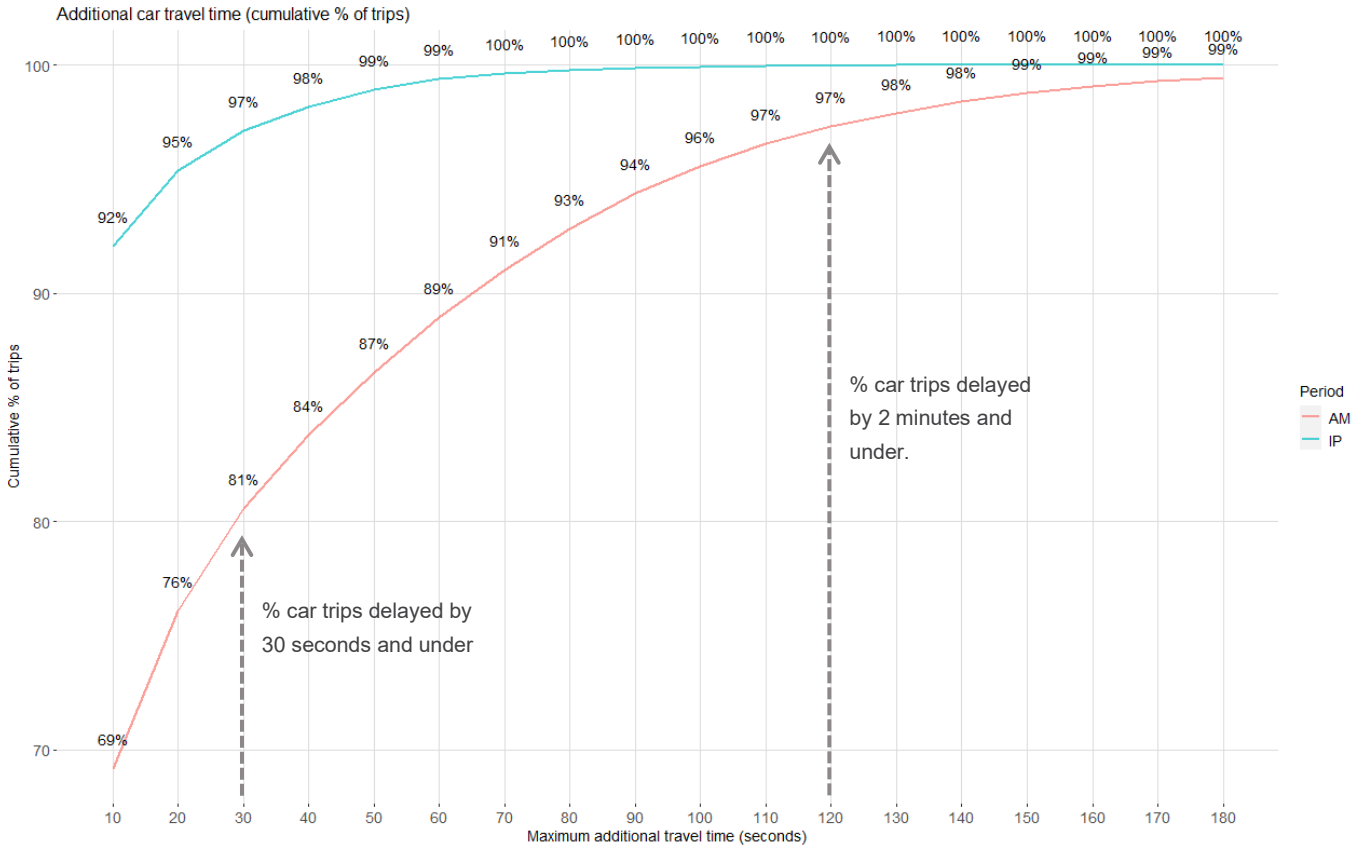
Although we only undertook a strategic economic assessment, a detailed business case assessment of individual bus priority corridors can ensure that Victorians get the most value out of any investment in bus priority lanes. Some bus priority corridors in our strategic assessment performed well, while others were less effective in attracting patronage. Carefully selecting the appropriate bus priority measures can ensure good value for money.

Our modelled bus lanes resulted in an increase in overall road congestion of 2% across the network in 2036. However, this is made up of a relatively small impact on individual motorists with 81% of peak trips experiencing a delay of 30 seconds and under, and 97% of trips experiencing a delay 2 minutes and under, despite converting some existing traffic lanes to bus priority lanes, as illustrated in Figure 21.

Our modelling shows that even without any changes to bus lanes, Melbourne's congestion increases by 14 times this amount due to population growth forecast between 2026 and 2036. In addition to travel time benefits, the value of social mobility and reduced risks of social exclusion resulting from increased bus trips has been estimated at about $550 to $760 million over this period.

Full scale reform, as outlined in the following section of this report, demonstrates that the exact same network of bus lanes would actually reduce road congestion when combined with other bus reform measures like improved frequencies, and an optimised network of faster and more direct routes.

Figure 21: Modelled bus lanes had a relatively small impact on individual motorists, increasing travel times by under 30 seconds for most car trips



Source: Infrastructure Victoria analysis of WSP bus reform modelling.

The measured delays are partly due to some limitations of the modelling, which does not account for motorists who would shift their trip time away from the busy peak period to the quieter shoulder peak periods. Our modelling also could not consider changes to improved traffic signal technology which can help to reduce congestion and provide some levels of bus priority with no or minimal impact on other road users (see Smarter Roads case study).

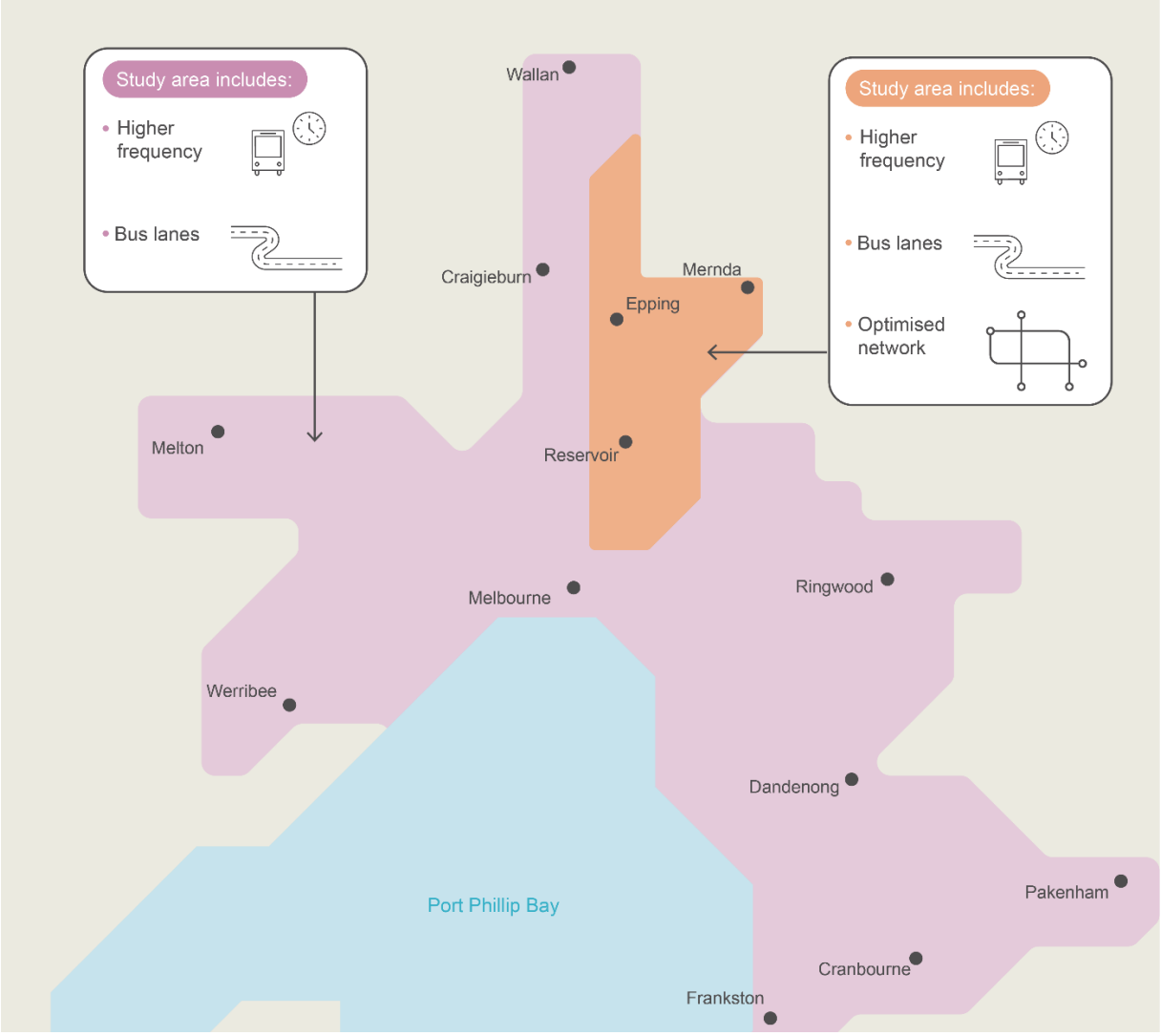
Greater returns from a package of investments

Implementation advice: the Victorian Government should invest in a significant and coordinated program of improvements in buses to maximise benefits

A combined suite of improvements is needed to get the most value for money from Melbourne's bus network. Improving Melbourne's buses through faster, more direct routes needs to be supported by complementary and sustained investment in higher frequency services, longer operating hours and bus priority measures.

We found that comprehensive reform of bus services to include higher frequencies, more direct routes and bus priority measures overwhelmingly delivers the strongest benefit of all tested scenarios.[170] To test this idea of packaging up bus reform, we modelled an optimised bus network pilot area in Melbourne's north-east (Recommendation 2) and overlayed higher frequencies (Recommendation 1) and bus lanes (Recommendation 5). For the remaining areas of Melbourne, we tested the benefits of high frequency routes paired with bus lanes.

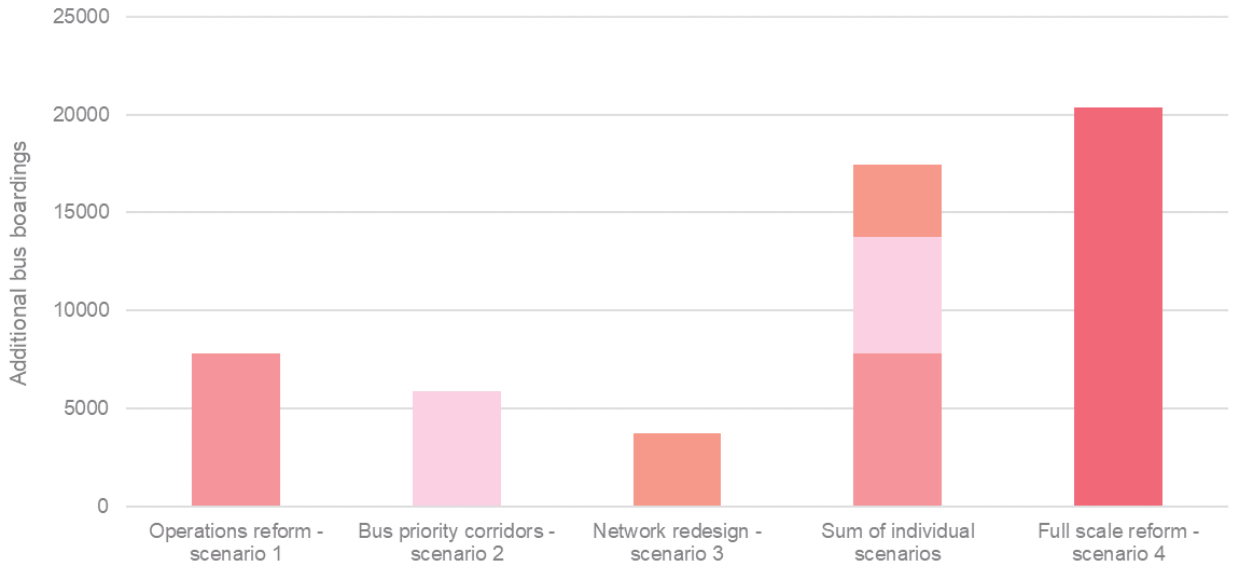
Figure 22: Overview of full scale reform – scenario 4



Source: Infrastructure Victoria.

Our full scale reform modelling scenario with all reforms packaged up together resulted in a 62% increase in boardings within the Darebin and Whittlesea pilot area, and an overall 164,000 extra daily bus boardings across Melbourne by 2036. This is equivalent to 2,500 full standard sized Melbourne buses.[171] Combining the optimised network with higher frequencies and bus priority resulted in greater bus boardings than the sum of each individual reform alone, as shown in Figure 23.

Figure 23: The benefits of full scale bus reform in Darebin and Whittlesea



Source: Infrastructure Victoria analysis of WSP bus reform modelling.

Although the rollout of bus lanes reduces traffic capacity along some road corridors, the total number of congested vehicle kilometres reduces in 2036 for full scale reform (scenario 4) when compared to the base case. Better conditions on Melbourne's roads lead to faster travel times by car for residents in many of Melbourne's outer and growth areas resulting in a net car travel time reduction in Wyndham Vale, Craigieburn and Cranbourne – a total time saving of over 2,500 hours for these regions in the morning peak period.

Our full scale reform scenario is estimated to deliver a total of $2.4 to $3.3 billion worth of travel time saving benefits to public transport users over the next 20 years after implementation. Full scale reform of Melbourne's bus network allows people to take trips they were otherwise excluded from making. This is estimated to lead to around 20 million more public transport trips per year, resulting in $1.4 to $1.9 billion of social mobility benefits over the 20 years after implementation. Full scale reform also led to a considerable amount of mode shift to public transport in our modelling. This shift meant more people walking as part of a public transport trip, leading to $220 to $300 million of health benefits over 20 years. These figures are likely to increase significantly if the network was optimised across Melbourne, rather than just in the Darebin and Whittlesea study area.

Operating costs behind the full scale reform scenario are similar to those from higher frequencies in Recommendation 1, costing $430 to $520 million per year to operate. Capital expenditure in this scenario will largely come from construction of additional bus priority, with individual bus lanes costing from under $1 million to $200 million, depending on the location and scale of treatment (as discussed in Recommendation 5).

Value of mobility and social inclusion

Social exclusion occurs when someone experiences problems which stop them fully participating in society. Individuals may experience multiple overlapping problems, such as unemployment, poor health and inadequate education.

Through 443 face-to-face interviews in Melbourne, researchers found that the number of personal trips that people undertake are significantly associated with the risk of being socially excluded.[172] The more trips that are made per day, the lower the risk of social exclusion. The research also concluded that the value of each additional public transport trip is estimated to be $4.80 (2006 dollars) and one additional car trip worth $3.50 (2006 dollars).

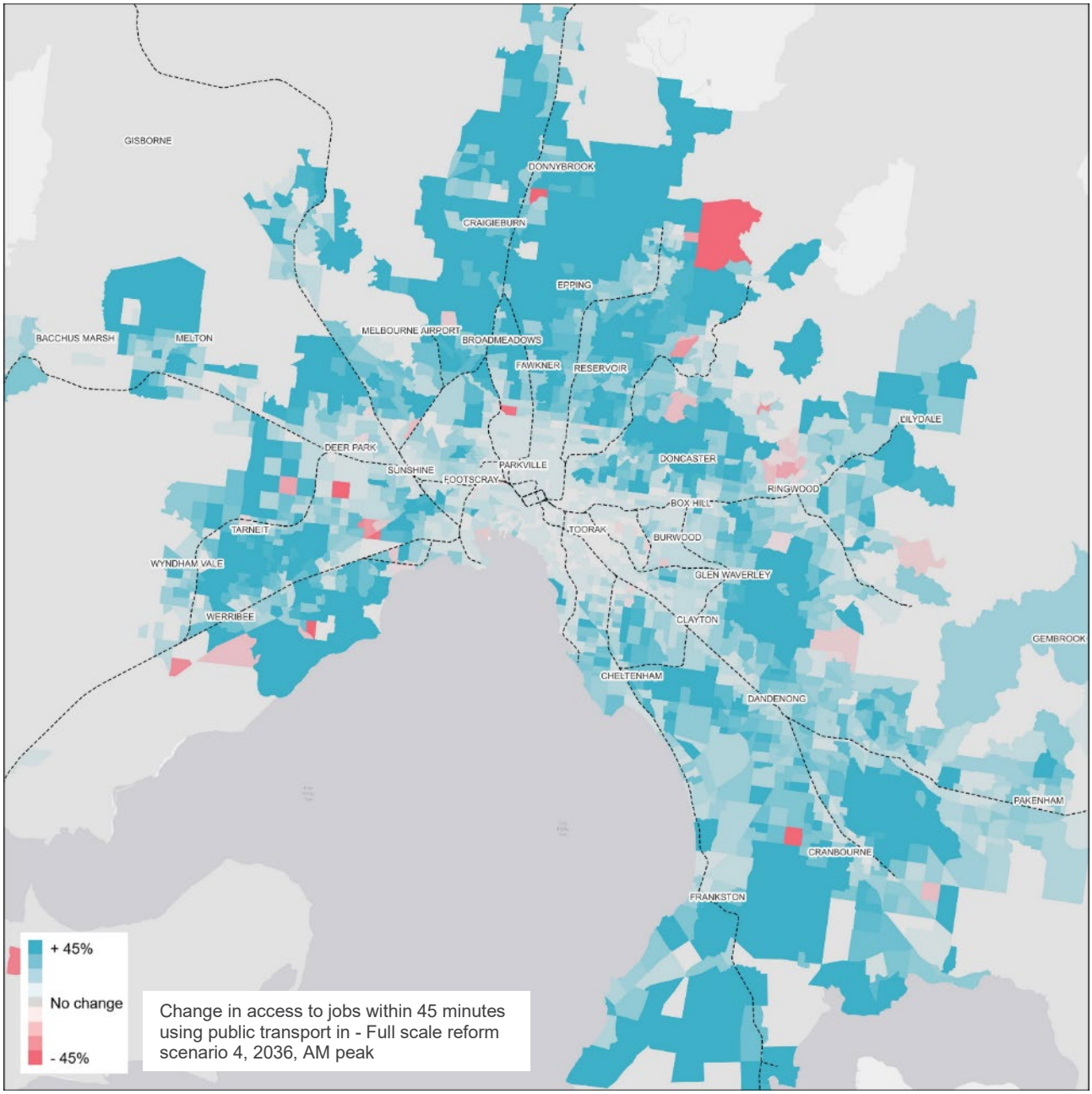
The Victorian Integrated Transport Model only 'switches' a person's trip between public transport and car as a result of changes to the transport network. As a result of our modelled bus reform scenarios and improved bus services, many people shift their car trips to bus trips. By applying the estimated value of additional trips with the model's simulated number of additional bus trips (as a result of switching from cars), we are able to value the benefits of mobility and social inclusion for each bus reform scenario.

The number of private vehicle trips on Melbourne's roads also reduces by over 63,000 every day, more than to the total daily number of vehicles that travel through the Domain Tunnel.[173]

Full scale reform increases the number of jobs accessible by public transport within 45 minutes by over 45% for many residents in middle ring and outer areas, as shown in Figure 24. Better access to jobs by public transport means that fewer Melburnians are forced into car ownership, delivering an estimated $1.8 to $2.5 billion in economic benefits over the 20 years after implementation.

The Victorian Government can maximise the benefits of its investment in comprehensive bus reform through a sustained, but spatially targeted approach. Our modelling applied widespread uplift in bus service quality across the city. Instead, government should approach reform through rolling out sequenced improvements in targeted areas of Melbourne to match the scale of reform required and diverse needs of local communities.

Figure 24: Full scale reform improves access to jobs across Melbourne for public transport users in 2036



Source: Infrastructure Victoria analysis of WSP bus reform modelling.

Case study

Maximising the opportunity of Melbourne's new zero emissions bus fleet

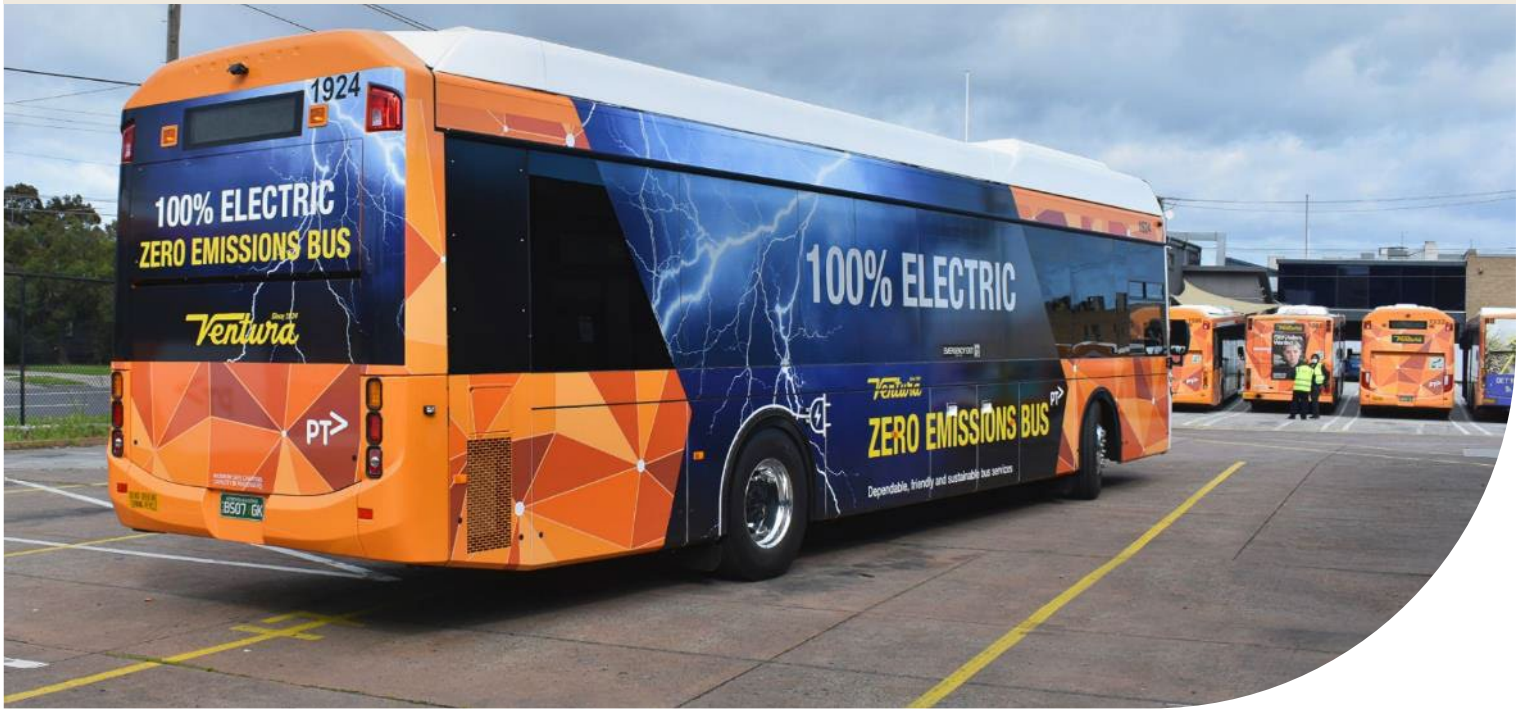
Zero emissions buses present a unique opportunity to rebrand Melbourne's buses by providing a smoother, quieter and more environmentally sustainable experience. The Victorian Government has committed to transition the entire diesel bus fleet to zero emissions buses from 2025.[174] The *Zero emission bus transition* consultation paper was released in September 2023, detailing the government's proposed approach and seeking feedback from industry and stakeholders.[175]

The Victorian Government should maximise this opportunity by pairing the transition with other bus reforms, like faster and more frequent services and route optimisation. A zero emissions bus that is stuck in congestion, slow or indirect is not making the most out of a new modern asset.

The Victorian Government trialled a similar approach to branding through the introduction of the SmartBus service in 2002. New SmartBus services with distinctive silver and orange branding were supported by new infrastructure like bus lanes, high frequency weekday and weekend timetables, and real-time passenger information displays.[176] Many SmartBus services in their first year of operation recorded 20% or more growth in boardings.[177]

A zero emissions bus fleet will mean zero tailpipe emissions, improved local air quality, reduced noise and other environmental outcomes near large depots and interchanges, and contribute to job creation and upskill of existing workforces.[178]

Image source: Ventura Bus Lines.



Reshape bus travel across Melbourne

Recommendation 6

Plan and deliver bus rapid transit across Melbourne

In the next 5 years, undertake detailed assessment, reserve land corridors and begin delivery of bus rapid transit corridors across Melbourne. Prioritise delivery of bus rapid transit routes that serve major activity centres, beginning with outer and growth area suburbs like Point Cook, Caroline Springs, Braybrook, Broadmeadows, Clayton and Rowville.

Bus rapid transit is a powerful tool in reimagining mass transit across Melbourne. Most bus rapid transit systems can carry over 30,000 people every hour along dedicated transport corridors.[179] Bus rapid transit systems provide a much higher level of service than Melbourne's existing SmartBus network as they use large buses that run along dedicated lanes and stop at metro-like stations with platforms, real-time information displays, and shelter and seating.

Australian cities like Sydney, Brisbane and Adelaide have embraced bus rapid transit-like services, increasing access to jobs and boosting bus patronage (see case study, Bus rapid transit in Australian cities). The Victorian Government can reshape travel across Melbourne's suburbs with a new network of bus rapid transit corridors. Bus rapid transit can provide a level of service equivalent to Melbourne's trams for areas that currently do not have a tram.

Many of Melbourne's established outer suburbs and growth areas lie beyond or between a reasonable reach of high capacity tram or train lines. With reliance on slow, indirect routes, communities often have poor perceptions of buses, fuelled by a bus network which is increasingly contributing to transport disadvantage and inequity.[180] Bus rapid transit can play a unique role in connecting these communities with jobs and services through high quality, direct and fast public transport connections. Importantly, bus rapid transit infrastructure can usually be delivered at a fraction of the cost of a tram and rail network.[181]

Upon completion, the North East Link Eastern Busway will be Melbourne's first bus rapid transit corridor, delivering completely dedicated bus services and infrastructure between Doncaster and inner Melbourne.[182] Our modelling shows that there is potential for Melbourne to plan for the next step, creating a high speed bus rapid transport network across the city, contributing to over 83,000 new bus boardings in 2036.

We estimate that bus rapid transit has the potential to return around $2.60 for every dollar invested in a new network, including benefits from public transport user travel time savings and land value uplift around new bus rapid transit stations.

New bus rapid transit systems in cities like Los Angeles, Miami and Vancouver have delivered patronage gains along corridors of between 30 and 85%. These are often new public transport trips, rather than diverting existing trips from other types of public transport. [183]

Our modelling shows that delivery of bus rapid transit is an opportunity to revolutionise traditional approaches to infrastructure planning. The Victorian Government has an opportunity to radically reshape how Melburnians access jobs, services, activity centres and train stations. This means strategically planning and reserving land, and beginning delivery of bus rapid transit corridors across Melbourne.

Case study

Bus rapid transit in Australian cities

Bus rapid transit has played an important role in the transport systems of Adelaide, Brisbane and Sydney. Adelaide's O-Bahn, Brisbane's Busways and Sydney's T-Way provide dedicated infrastructure for high frequency buses. This supports faster journey times, encourages growth in public transport patronage, improves land values, and supports the growing transport needs for more compact cities.

Adelaide's O-Bahn was first opened in 1986, with an extension taking it further into Adelaide's centre in 2017.[184] This 15 kilometre busway takes passengers from Adelaide's north-west into the city centre, completing the full trip in 19 minutes, a journey which took around 30 minutes prior to the busway being built. Around 31,000 trips are made every weekday, although the busway has capacity for up to 18,000 passengers an hour.[185]

Brisbane's South East Busway was introduced in 2000 and expanded in 2014. Buses only share 400 metres of the entire 32 kilometre route with general traffic, servicing Brisbane's inner and middle suburbs.[186] Following introduction, trip times for buses were cut down by over 50%, resulting in buses being around 9 to 12 minutes faster than an equivalent car trip into the central city.[187] Patronage grew along the busway 60% faster than the rest of Brisbane's public transport network. A survey also found that 40% of users had shifted away from driving and 13% previously did not make the trip at all.

Brisbane is currently adding to its bus rapid transit system with Brisbane Metro. Stage 1 is expected to be complete by late 2024. Electric buses will run along the network with turn up and go services, and operations for 24 hours on weekends.[188] The system will utilise the pre-existing Brisbane South East Busway and Northern Busway, as well as new pieces of infrastructure which join the two busways.[189]

Sydney's Liverpool-Paramatta T-way was introduced in 2003 and operates along 20 kilometres of separated bus rapid transit infrastructure, and 10 kilometres of bus lanes.[190] The T80 route runs along the length of the Liverpool-Paramatta T-way and services 36 stations spaced about every 800 metres.[191] The service runs every 5-15 minutes during the day and every 30 minutes at night, [192] with other routes also running along portions of the T-way. Over 2.2 million trips are made annually on route T80 alone, making it one of Sydney's most popular routes.[193]

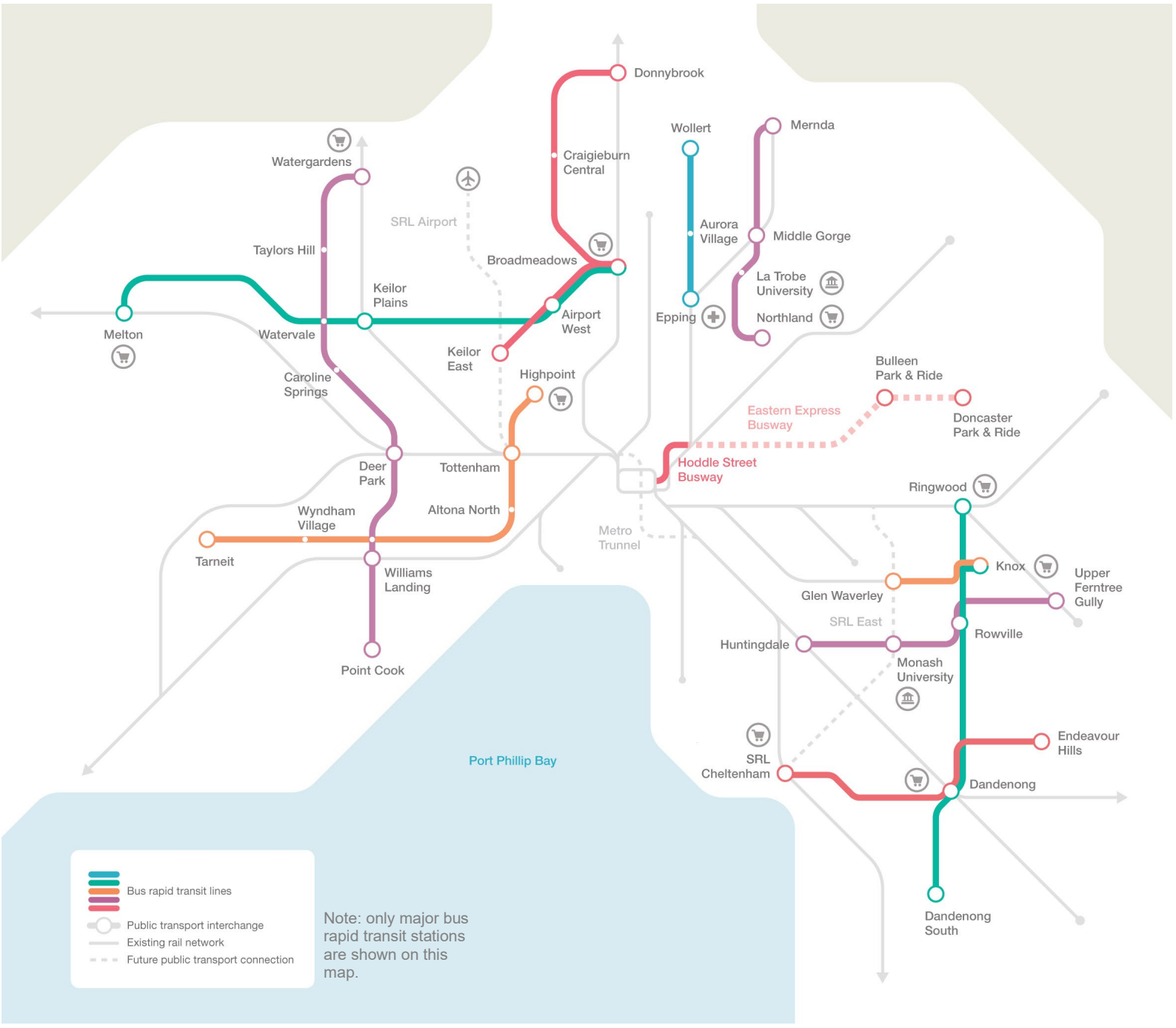
Below: Brisbane South East Busway. Source: Unsplash.

A network of bus rapid transit routes for Melbourne

We tested how Melburnians would respond to 10 new bus rapid transport corridors, as well as a 2.1 kilometre busway connecting the city to the future Eastern Busway being delivered as part of the North East Link project. Our modelling of an illustrative bus rapid transit network provided a premium, higher capacity public transport connection between major activity centres, train stations and development fronts across Melbourne.

We selected corridors and connections between destinations across Melbourne based on design principles such as addressing transport gaps, providing competitive public transport travel times and maximising other public transport connections and interchange opportunities. These routes were modelled to help demonstrate what could be achieved in Melbourne through bus rapid transit, not to determine the selection and alignment of any future route. Our illustrative bus rapid transit network uses larger articulated zero emissions buses, running every 5 minutes during the peak and every 10 minutes at other times.[194] The entire BRT network shown in Figure 25 has an estimated capital cost of $3.4 to $4.0 billion (in 2023 dollars) and would cost $150 to $180 million per year to operate, with an estimated $2.60 in benefits for every dollar invested.

Figure 25: We tested 10 bus rapid transit routes and a 2.1 kilometre Hoddle Street busway



Our modelling shows strong demand for the new bus rapid transit network, as shown in Table 3 and Figure 26, with most routes attracting more passengers per service than any other existing bus service in Melbourne. If people switch to using the bus rapid transit system, we estimate that passengers would benefit about $1.5 to $2.1 billion in travel time savings from shorter public transport journey times over the next 20 years.

Notable examples of bus rapid transit routes modelled in the west include Tarneit to Maribyrnong, Point Cook to Watergardens, and Melton to Broadmeadows, each with above 11,000 new daily boardings. In Melbourne's north, the Craigieburn to Broadmeadows corridor could provide a fast and direct connection for residents west of the rail line, resulting in almost 9,000 new daily boardings by 2036. In the east, the connection between Huntingdale and Upper Ferntree Gully through Rowville could attract 9,300 new daily boardings in 2036. This suggests an untapped demand for a high speed public transport offering in these areas.

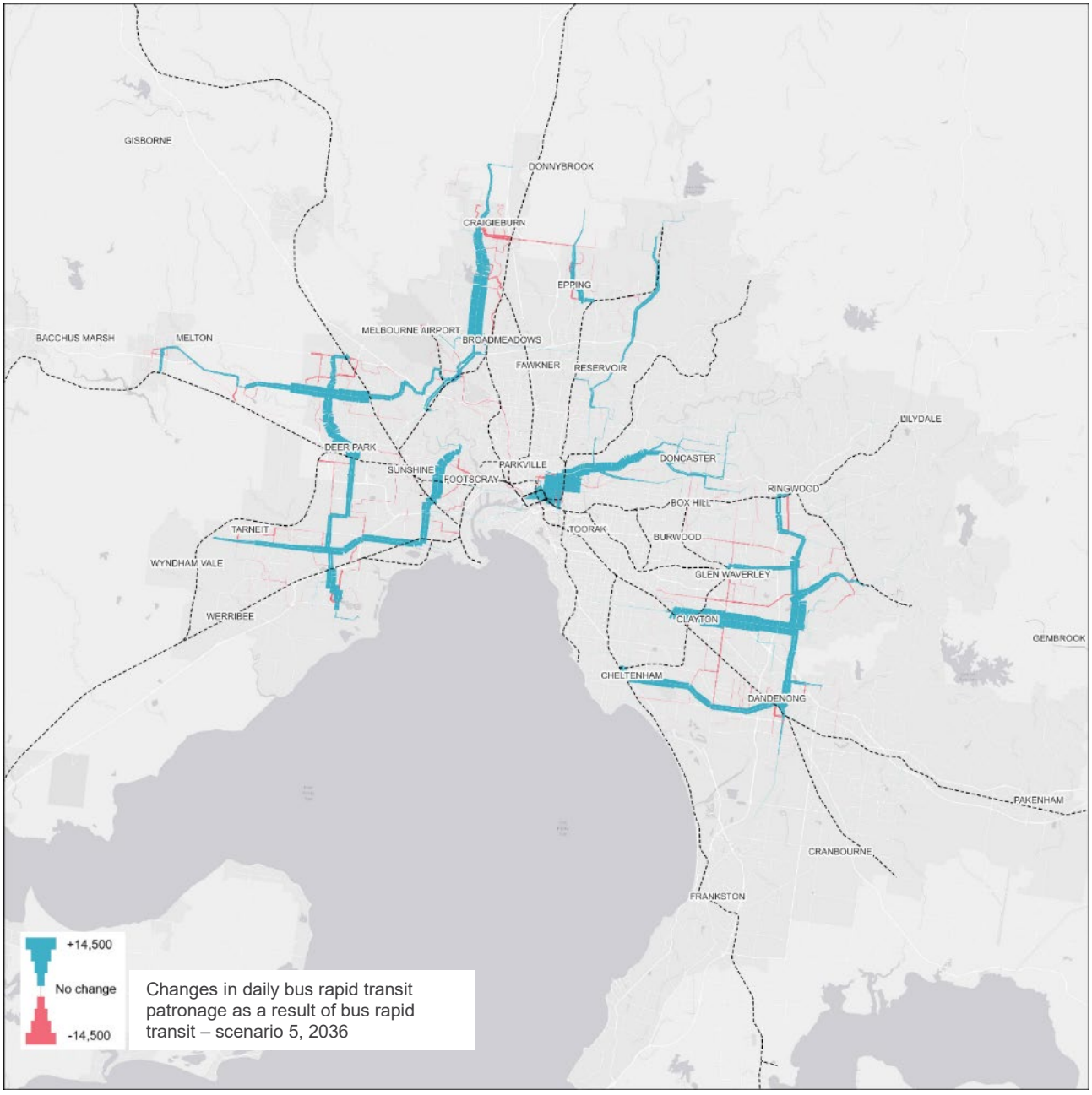
Table 3. Bus rapid transit boardings by route

Bus rapid transit route	Total daily boardings, 2036
Tarneit – Maribyrnong	11,500
Melton – Broadmeadows	11,400
Point Cook – Watergardens	17,600
Keilor East – Donnybrook	8,900
Wollert – Epping	2,400
Mernda – Northland	3,100
Dandenong South – Ringwood	8,600
Glen Waverley – Knox City	2,800
Huntingdale – Upper Ferntree Gully	9,300
Endeavour Hill – Southland	7,600
Hoddle Street Busway*	57,200
Total boardings (excluding Hoddle Street Busway)	***83,100***

See WSP scenarios modelling report for further details. Total figure includes rounding. *Total daily boardings of all bus services that would use the Hoddle Street Busway in 2036.

Bus rapid transit routes perform well in areas of Melbourne where public transport options are currently limited or are uncompetitive with the car. In 2036, the modelled bus rapid transit network (83,100 boardings) could potentially attract more boardings than the Craigieburn line today (approximately 50,000 boardings).[195] This is also more than the total number of passengers that take a train from Flinders Street station every day (57,000 passengers).[196]

Figure 26: Bus rapid transit delivers strong patronage growth, especially in Melbourne's outer north and west



Source: Infrastructure Victoria analysis of WSP bus reform modelling.

Most trips on the bus rapid transit network we designed are from new passengers that never previously used the public transport network. The modelled bus rapid transit corridors take almost 30,000 cars off Melbourne's roads in 2036, resulting in an overall reduction of 165 million vehicle kilometres travelled every year. The benefits from greater mobility options are estimated to be around $620 to $850 million for the 20 years from implementation.

Additional benefits include health benefits of $100 to $140 million with bus rapid transit passengers walking from their homes or destinations to the bus rapid transit service, and a reduced need for some households to purchase a car (or second or third car), providing cost of living relief of $180 to $250 million.

The introduction of a bus rapid transit network in Melbourne could significantly expand access to labour markets for many industrial areas of Melbourne like Dandenong South, Tottenham, Derrimut and Laverton North.

Residents in Melbourne's west would gain the most from the modelled bus rapid transit corridors. Suburbs like Braybrook and Altona North are estimated to gain access to up to an additional 396,000 jobs within a 45-minute travel time window by public transport. This is largely due to new connections between residential areas of the inner west and employment precincts further west, like Derrimut and Truganina. In Melbourne's outer east, residents in suburbs like Knoxfield, Rowville and Keysborough could also gain access to up to an additional 121,000 jobs within a 45-minute travel time window by public transport.

Further guidance in developing an efficient and high patronage bus rapid transit network

New high quality infrastructure like a bus rapid transit system is known to increase the adjacent areas' land value (see breakout box). This land value benefit is estimated to be $8.5 to $9.5 billion for the modelled bus rapid transit routes.[197] Our modelling and economic analysis demonstrates a significant future opportunity for bus rapid transit in Melbourne.

Some bus rapid transit routes that we modelled didn't perform as strongly as others. Routes in the north-east like Mernda to Epping and Wollert to Northland (see Table 3) have comparatively lower boardings compared to routes in the west and south-east of Melbourne. Before proceeding with implementation, a more refined route-by-route assessment to optimise station locations, and the jobs, services and other social opportunities that a new route can potentially connect travellers to would be required. A detailed assessment of individual routes would also help to maximise the overall benefits from investment in a future bus rapid transit system across Melbourne.

Property value uplift from bus rapid transit

The relationship between the public transportation system and housing prices has been heavily researched. Houses located within one kilometre of a rail station have significantly higher prices than those located further away.

Research in Brisbane showed that following the introduction of Brisbane's South East Busway, the values of properties within 800 metres of its stops increased by 7%.[198] This is consistent with literature from Vancouver which has shown a 5 to 7% premium within a 20 minute walk of bus rapid transit stations.[199]

Considering the median price of properties surrounding our modelled bus rapid transit network, we estimated that house values could increase by over $55,000 and unit values could increase by nearly $40,000[200].

Our modelling shows that the boardings across the bus rapid transit network are highest at locations where bus routes stop at train stations, accounting for approximately 27% of all boardings. Bus rapid transit connections to the rail network in Melbourne's west drive the largest increase in rail travel, with daily passenger volumes on the Sunshine to Caulfield rail corridor increasing by 5% in 2036 as a result of the connections.

To test the potential of better connections to the bus rapid transit network, we also modelled a scenario where bus rapid transit routes were supported by park and ride facilities at 32 major interchanges and activity centres. While the presence of parking led to a 16% to 20% increase in bus rapid transit boardings, the Victorian Government should first consider the role that connector and local bus services could play in expanding the catchment of any future bus rapid transit network.

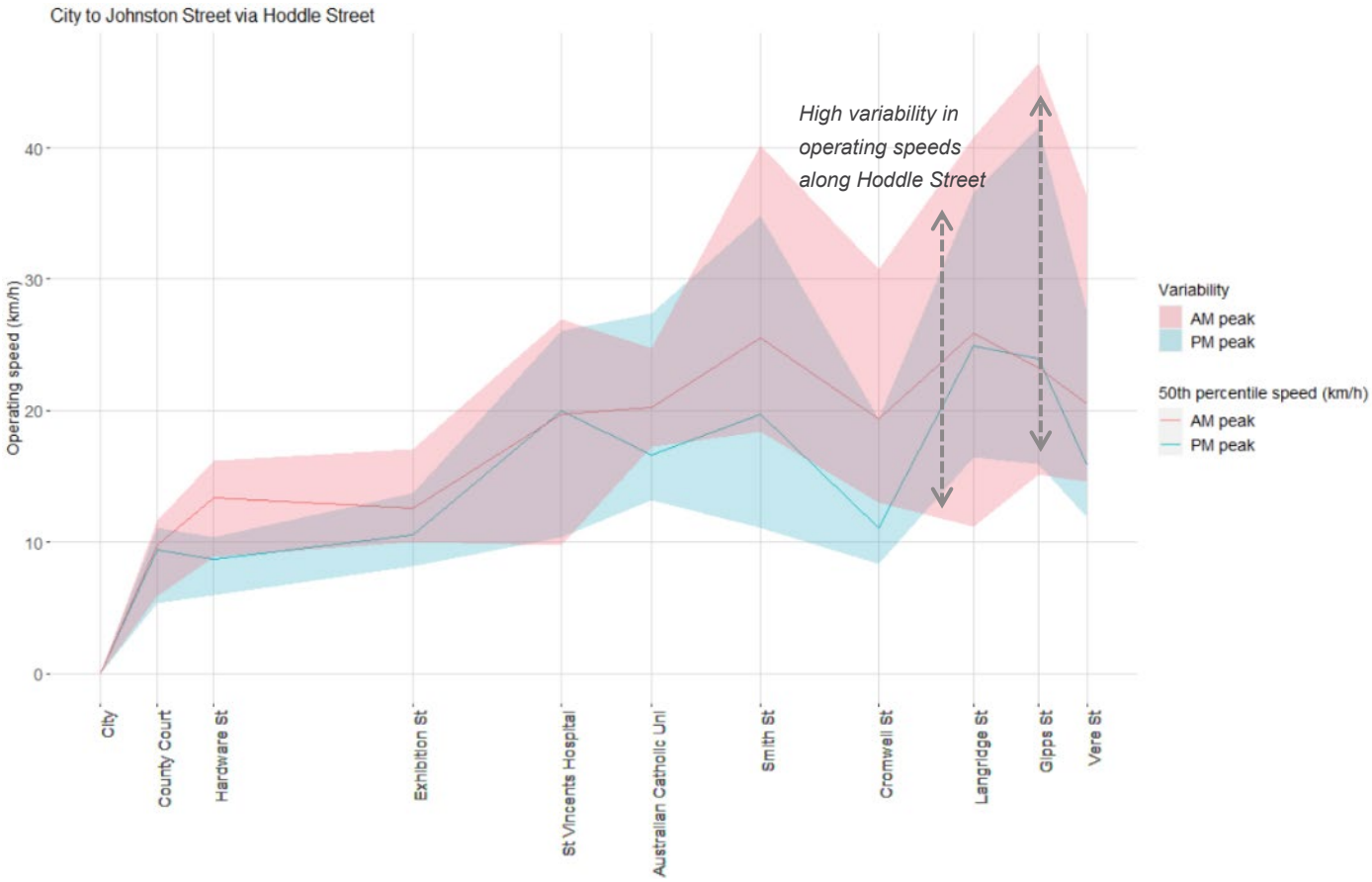
Completing Melbourne's first bus rapid transit corridor

Melbourne's future Eastern Busway (part of the North East Link project) will predominately serve high frequency Doncaster Area Rapid Transit (DART) services which were first introduced in 2010.[201] The project

is expected to improve service reliability and reduce peak hour trip times by up to 30%[202] by enabling buses to travel at 100 kilometres per hour and avoid congestion due to vehicles merging at existing on and off ramps.

However, the Eastern Busway does not fix all congestion and reliability problems for Melbourne's DART services. Figure 27 shows that many buses which will link into the Eastern Busway will get caught in congestion along inner city roads like Melbourne's Hoddle Street. The larger the shaded area, the greater the variability in travel times. Existing bus lanes along Hoddle Street are also not continuous, nor do they operate beyond a limited peak period. Average bus speeds can vary between 15 and 40 kilometres per hour depending on the day, resulting in highly variable journey times. While recent road project investments have sought to improve traffic flow on Hoddle Street, buses are still regularly delayed by obstructions like left turning and parked vehicles.[203]

Figure 27: Buses travelling along Hoddle Street are regularly delayed



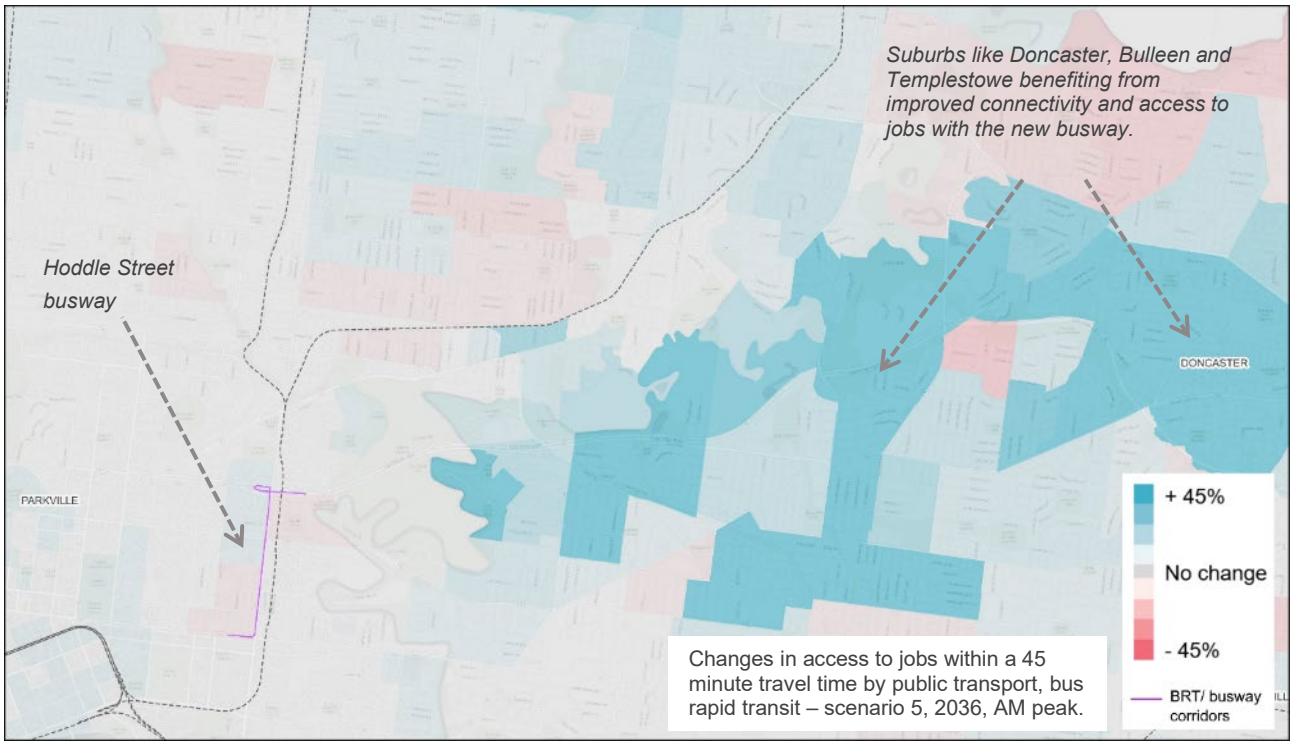
Source: Infrastructure Victoria analysis of Department of Transport and Planning bus GPS data.

As part of our bus rapid transit scenario, we modelled a new Hoddle Street busway, designed to provide a continuous and uninterrupted bus lane for all DART and Hoddle Street bus services. The busway links the Eastern Busway to existing bus lanes on Victoria Parade, providing clear separation from other traffic and a high quality, frequent bus service.[204] A detailed assessment would be required to determine the best approach to deliver dedicated bus rapid transit infrastructure for the Hoddle Street busways. This could include options like central bus lanes with dedicated bus stations, or an elevated busway structure.

Our modelling shows that adding a high quality busway along Melbourne's Hoddle Street corridor would result in improved travel times for thousands of bus travellers. Bus users would make up 1 in 5 trips along Hoddle Street during morning and evening peaks periods in 2036. The Hoddle Street busway would not only reduce conflicts between turning vehicles and stopping buses within the immediate road environment, but also provide significant access benefits to jobs and services areas beyond the immediate vicinity of the busway. As shown in Figure 28, residents in suburbs like Doncaster, Bulleen and Templestowe would

experience an increase in the number of jobs accessible by 45 minutes. This would also lead to higher bus use, with existing bus routes using the new busway experiencing patronage increases of up to 16%.

Figure 28: A Hoddle Street busway improves connectivity and access for many Manningham residents



Source: Infrastructure Victoria analysis of WSP bus reform modelling.

Creating a convenient, accessible and inclusive service

A bus journey: from the travellers' perspective

Real-time information to assist with safety and awareness of local services

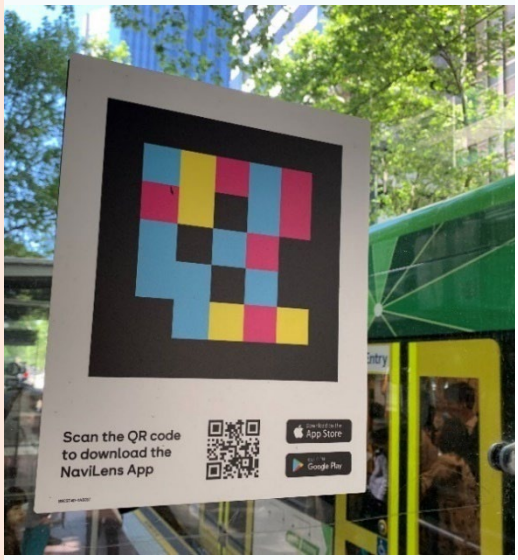
International evidence highlights real-time information and high quality wayfinding signage as being some of the most cost-effective bus improvements.[205] Without real-time information, travellers are left uncertain as to when the bus will arrive. For regular users, real-time information helps to factor in delays and disruptions.[206] Accessible public transport information in both visual and audible formats is also critical for Victorians with a disability.[207]

Boosting tram accessibility for blind and low vision passengers

Brightly coloured QR codes designed to help blind and low vision users navigate Melbourne's tram network have begun appearing across Melbourne. [208] The technology, called NaviLens, delivers audible information to travellers like routes serving their current location and real-time tram arrival information.[209]

NaviLens is being on trialled on Route 96 East Brunswick to St Kilda Beach, and will soon appear on all 100 E-Class trams.

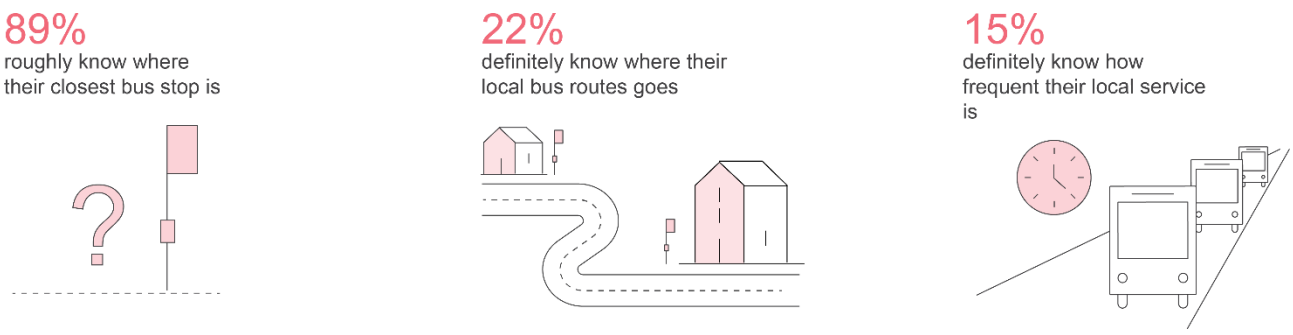
The codes have also been successfully integrated into public transport networks in cities around the world, including Singapore and New York.[210]



Melbourne's SmartBus network, launched in 2002, delivered real-time information boards at bus stops and visual and audible announcements as on-board services. [211] Apart from the SmartBus fleet and some local route services, there is no consistent information provided to bus users through high quality visual and audio alerts either at stops, or on-board services. [212] Our community research shows that real-time information should be provided through mobile apps as a priority, before rolling out similar visual and audio alerts across bus stops and all buses.[213] Researchers identify real-time information as a strategy for improving safety on and around public transport by minimising uncertainty and lengthy wait times, especially at night.[214] A significant proportion of all residents in outer suburbs (more than 60%) and almost 70% of women felt unsafe waiting or walking to and from public transport stops, compared with a third of men surveyed.[215]

Our community research highlighted that Melburnians have relatively low awareness of existing bus services.[216] Most Melburnians roughly know where their closest bus stop is (89%), however less than a quarter are aware of where their local bus goes (22%) and only 15% know how frequently their local bus comes. Real-time information is particularly useful for lower frequency services, allowing travellers to nearly halve their wait time through checking real-time information prior to commencing their journey.[217]

Figure 29: Melburnians' awareness of existing bus services – how well do you know your bus?



Source: Infrastructure Victoria bus reform community research.

Most Melburnians walk to their local bus stop

Most Melburnians who take the bus will walk to their local bus stop.[218] We identified physical access to buses and bus stop infrastructure (like available kerb and pedestrian crossings) as a significant barrier to use, especially for those with mobility challenges.[219] This journey of physically accessing the bus stop impacts the experience of users. A high quality bus service is no use if travellers cannot access the bus.

A survey and review of bus stop data undertaken by Victoria Walks found that low quality bus stop facilities and low walkability of the surrounding environment contributes to an overall negative experience of using the bus.[220] Their survey found that over 64% of bus stops had no formal crossing nearby, more than a third of stops had no ramp access within 50 metres and only 5% of bus stops on higher speed roads had pedestrian crossings at the stop.[221] Getting across a busy road where pedestrian crossings are spaced far apart can also make it challenging to access bus stops, particularly for people with limited mobility or for those pushing prams.[222] Short pedestrian green time to favour traffic throughput rather than pedestrian safety also disproportionately impacts slower walkers like elderly Victorians. [223]

Our community research highlighted that Melburnians would be prepared to walk further to get to faster and more frequent services. However, this will create increased difficulty for some older Melburnians and those with mobility challenges when reform can involve increasing walking distances.[224] These factors will become increasingly important as the proportion of Victorians aged 60 years or older expands from around 22% to 25% by 2046.[225] The following section on funding accessibility upgrades and Recommendation 4 on community transport would help to ensure that these travellers are not left behind.

Putting active transport first in new communities

It is vital that communities have suitable active transport connections to their local bus stop. This is especially important in Melbourne's growth areas where footpath infrastructure and connectivity is expanding within new residential and commercial developments.

Current precinct structure planning guidelines for growth areas set a standard for 95% of dwellings to be located within walking distance of a train station (800 meters), tram stop (600 meters) or 400 meters of a future bus route or bus capable road.[226] However, only 25% of completed growth area subdivisions are within 400 metres walking distance of a public transport stop.[227] These proximity standards do not assess the quality of the bus service, its frequency, service hours or route. Our research suggests that in some cases a greater minimum walking distance should be allowed in exchange for access to more direct and efficient bus routes.[228]

Other jurisdictions around Australia capture this nuance and have improved development codes requiring at least 90% of dwellings to have access to either a coverage route bus stop within 500 meters or a frequent service within 800 meters.[229] Residents are encouraged to use public transport through active transport factors such as street connection, high quality footpaths and co-location of multiple forms of transport.

Growth area estate design could be improved by integrating interstate examples of subdivision guidelines or voluntary programs.

- The Australian Capital Territory (ACT) residential subdivision development code sets performance-based standards for the convenient access of bus routes and stops such as wayfinding, passive surveillance, and linkages with the path network.[230] Improved active transport features facilitate independent movement for a greater diversity of people including children and people with reduced mobility.
- The Heart Foundation's *Healthy Active by Design* guidelines encourage the integration of multiple transport modes including bus routes and bike paths. They also provide guidance for network planning to create access to local destinations.[231] The guidelines also include guidance for streetscapes and infrastructure designed for all users including a range of modes and mobility needs.
- The Council Alliance for a Sustainable Built Environment's (CASBE) sustainable subdivision framework improves street connectivity by advising against cul-de-sacs, encouraging wayfinding signage and setting targets for delineated, safe and convenient active transport.[232]

Case study

Transport in growth area communities

Early public transport provision and integrated estate design in Selandra Rise

Selandra Rise in Melbourne's south-east is a good example of integrating estate design with the early provision of infrastructure.[233] Central to this demonstration project was early delivery of parks, walkable streets and public transport.[234] Bus Route 798 arrived in mid-2014 within 3 years of the first residents.[235]

Selandra Rise's improved subdivision planning and infrastructure coordination meant that residents benefitted from improved transport quality and local destinations to encourage active and sustainable travel. Residents were able to use the bus to efficiently reach Cranbourne Station (6 kilometres away) and the Selandra Rise Shopping Centre.[236] A survey of Selandra Rise residents found that 75% of their trips on the bus were to access the station and shops, the most common trip purposes were work (28%), study (24%) and shopping (24%). Research found that 20% of travellers who would not have previously made the trip did so because of route 798.[237] Residents in surrounding neighbourhoods who had been waiting for a service were also able to access the new bus route.

Route 798 also demonstrates the value of direct routes and the proven willingness of some users to walk a greater distance. Only half of homes are within 800 metres of a bus stop, while other bus users reported willingness to walk for upwards of a kilometre to access the service.[238] The bus route was designed to allow closer proximity to the retirement home where residents may be less capable of walking long distances.[239]

Supporting active choices in Oran Park requires high quality public transport

Oran Park is a growth area suburb in Sydney that adopted the Heart Foundation's Healthy Active by Design guidance for walking and cycling networks. While it has strong active transport links and an attractive urban environment, as reported by residents, only 9% of residents took the train or bus to work in contrast to an average 23% across Sydney.[240] The development serves as a cautionary study in ensuring active transport links in new suburbs are coordinated alongside reliable and frequent bus services. Oran Park has access to 3 bus routes that are within 1 kilometre of most homes and connect to major activity centres and train stations. [241] However, these bus services only operate on an hourly frequency, resulting in a highly car-dependent community. Recent media reporting highlights Oran Park's public transport commute as one of the worst in the city, with nearly 20% of Oran Park residents travelling more than 90 minutes to work.[242]

Below: Early public transport can benefit growth areas and support more walking and cycling. Source: Shutterstock.

Funding public transport accessibility

In *Victoria's infrastructure strategy 2021–2051,* we called for better planning and funding to support transport accessibility upgrades.[243] This has implications for all public transport services across the state, including metropolitan buses.

For many Victorians with a disability, funding universal accessibility improvements for Melbourne's bus network is the difference between the freedom to travel equitably and in a dignified way, or to face exclusion and segregation in areas of community life.[244] Currently, only 65% of metropolitan bus stops are wheelchair accessible.[245] Modern vehicles that comply with disability requirements like low floor buses need to be supported by upgrades to stops and curbs to allow travellers to easily board and alight services safely.

The Victorian Government has missed the 2022 compliance targets for an accessible public transport network set as part of the *Disability Standards for Accessible Public Transport 2002 (DSAPT),* under Australian law.[246] While the scale of Melbourne's public transport network has added technical and financial constraints to upgrading legacy infrastructure, this leads to a varied travel experience for the 1.1 million Victorians (17%) with a disability.[247]

In *Victoria's infrastructure strategy 2021–2051*, we acknowledged that general government revenue will continue to be a major source of funding for public transport accessibility.[248] We identified a cost range of $1 to $1.5 billion as a lower bound estimate for required tram and bus accessibility upgrades.[249]

When accessibility upgrades are delivered only as part of major projects, or when identified by members of the community, progress can be slow. Victoria currently has no dedicated funding mechanism to identify, target and prioritise accessibility upgrades which could include pedestrian crossings, kerb ramps and footpath connections to bus stops. A dedicated and long-term funding stream, similar to the approach taken by the New South Wales Government, would help to make substantial progress towards universal accessibility. A dedicated funding mechanism could then assist the Victorian Government to consult on, prioritise and deliver infrastructure upgrades that deliver the best accessibility outcomes for communities. The Victorian Government ultimately has an obligation to meet legislated requirements and deliver an accessible transport network for the Victorian community.

New South Wales Transport Access Program

The New South Wales Transport Access Program, first introduced in 2011, targets improving access to public transport for people with a disability or limited mobility, and parents and carers with prams. This includes upgrading accessibility at train stations, interchange upgrades, wayfinding and signage, CCTV and lighting upgrades and bus shelters.[250] A $240.2 million package for capital works was delivered as part of the New South Wales 2022/23 budget, bringing the total expenditure of the program to over $2.2 billion.[251]

Prioritising and funding accessibility upgrades requires careful balance. Focusing exclusively on achieving compliance with the *Disability Standards for Accessible Public Transport 2002* legislation means potentially missing out on some high patronage locations where accessibility upgrades would significantly benefit travellers with a disability.[252]

The New South Wales Government determines the priority of upgrades based on:[253]

- current and future patronage
- the needs and demographics of customers who use the location
- whether important services such as hospitals or educational facilities are nearby
- cumulative impacts of other construction projects
- the accessibility of other nearby transport interchanges and facilities.

However, as highlighted by the Audit Office of New South Wales, this approach is not an alternative to meeting compliance obligations. To best capture value for money, the Audit Office of New South Wales also found that the New South Wales Government would need to undertake a comprehensive audit of all infrastructure to objectively measure and report on progress in achieving universal accessibility.[254]

Complementary to New South Wales's approach, our research as part of *Victoria's infrastructure strategy 2021–2051* identified that the Victorian Government could achieve value for money through setting criteria for priority upgrades, like addressing public transport facilities with high use and high projected population growth nearby.[255] Victoria's draft transport accessibility strategy 2023 also highlights the need to prioritise upgrades that will make the greatest impact, including addressing safety risks or stops and stations where current infrastructure is an absolute barrier to use.[256]

Image source: Sam Bhattacharyya on Unsplash.

Recommendation 7

Improve the bus stop and interchange experience

Over the next 5 years, plan for and fund bus user experience upgrades through real-time and accessible service information, provide safe and connected pedestrian footpaths to access bus services, and improve bus stop and interchange infrastructure. Prioritise upgrades along busy bus corridors like Lonsdale Street in inner Melbourne, and busy suburban bus interchanges like Werribee, Moonee Ponds, Box Hill and Dandenong.

Real-time information and accessible bus stops

The Victorian Government needs to improve the user experience of taking the bus, prior to travellers even setting out for their local bus stop. Without a high quality user experience, we will miss the opportunity to make buses a mode of choice for many Melburnians with more competitive transport options. This means investing in systems to enable real-time information, especially via mobile apps, and making it accessible to all Melburnians when planning out their bus journey. This includes information on planned and unplanned disruptions across the public transport network and opening up third-party access to accurate real-time data, like Google Transit, to support customer choice.

From a universal accessibility perspective, the roll out of accessible real-time information in visual and audible formats for users both waiting at bus stops and when on board the bus is vital to ensuring all Victorians have the confidence to navigate the public transport system.[257]

Getting to and from the bus stop is another part of the bus user experience and often involves crossing a busy road. To improve safety and ease of access, and encourage people to travel on buses, the Victorian Government should continue and extend the Smarter Roads program (see Smarter Roads case study) to improve signalised pedestrian crossings at bus stops and interchanges. This includes opportunities to:

- reduce wait times for pedestrians
- installing dynamic pedestrian detectors and puffin crossing sensors to ensure people have enough time to safely cross the road.

Any new bus stops along busy roads should also be placed at a signalised crossing. This includes placing bus stops close to intersections, particularly in locations where interchange is likely to occur with services along a perpendicular road.

Feeling safe while getting to and waiting for public transport, along with improved pedestrian infrastructure, also helps to support journeys that require connecting public transport services. Many of Melbourne's current bus stops and interchanges have limited connections and poor amenity, making it difficult to transfer from buses to connecting public transport services like another bus or a train.[258] Examples of bus reform from cities around the world, like Auckland, highlight the importance of bus routes integrating with the wider public transport network as this maximises connectivity between a larger number of destinations.[259]

Delivering a high quality bus stop and interchange experience

Less than 1% of all bus stops and interchanges account for more than a third of Melbourne's bus boardings.[260] This provides a clear priority for where investment in Melbourne's bus stops will deliver value for money and benefit the largest number of travellers. Bus routes are often connecting travellers to high demand locations like shopping centres, universities and major employment centres. In many of these cases, additional infrastructure beyond standard bus stop signage and benches is required to support traveller movements.

For example, there over 15 bus routes running along Lonsdale Street in the city, making it one of the busiest bus corridors in Melbourne. Narrow footpaths, inconsistent bus stop layouts and street infrastructure like signage impacts the user experience. Our analysis also shows that peak hour congestion also impacts buses travelling along Lonsdale Street with some services taking up to 3 times as long in the peak as a typical non-peak journey, travelling at an average speed of less than 10 kilometres per hour (see Recommendation 5 bus priority).[261]

Further investment is needed at major suburban bus interchanges along the Suburban Rail Loop to help address poorly connected and low amenity facilities like in Box Hill and Glen Waverley.[262] Local councils have also been calling for upgrades to safety, amenity and capacity at some of Melbourne's busiest suburban bus interchanges like Werribee, Moonee Ponds and Dandenong.[263]

Figure 30: Current bus interchange facilities at Box Hill (left) and Moonee Ponds (right)

Source: Infrastructure Victoria.

The Victorian Government should consider the following options to elevate the interchange experience:

- Major bus stops and interchanges should be upgraded, prioritising large bus interchanges and bus stops with converging high patronage services like trunk and connector route categories, delivering a rail-like experience for travellers.[264]
- Balancing design elements like locating bus interchanges in short walking distances from major destinations, providing passenger amenities like shelter and lighting, minimising impacts of bus performance (like deviations away from major roads) and high quality urban design.
- Consideration of user experience upgrades like increasing the quality of lighting, designing to maximise passive surveillance and enabling real-time information to promote greater safety for travellers.[265]
- As more services are added to Melbourne's bus network through bus reform, the right sized bus interchanges for the number of bus services will become increasingly important.

Costs for bus stop and interchange infrastructure upgrades will vary significantly based on complexity and scope. For example, a 2015 bus interchange upgrade at Huntingdale Station cost $5 million including new bus bays and drop-off facilities. This can be compared with the much larger Bulleen Park and Ride bus interchange, delivered in 2023 at a cost of $69 million (see case study).[266]

Case study

A tale of two bus interchanges

Our community research identified the vast differences in perspectives and attitudes towards using Melbourne's buses. It also highlighted the importance of the combined factors that make up a high quality bus service like frequency, journey time, trip reliability and bus stop infrastructure.[267]

Two distinct interchange examples in Melbourne demonstrate stark differences in the quality of bus service and provide an insight into the patronage response when the Victorian Government invests in creating a modern bus system, compared to when it lags behind.

The $69 million Bulleen Park and Ride in Melbourne's east was delivered in early 2023 as part of the North East Link project.[268] The premium park and ride includes parking for 370 cars, bike storage, pick-up and drop-off bays and a 5,000 square metre green roof.[269] Currently, it is served by the high frequency Doncaster Area Rapid Transit route 905 and other express city bus services. In 2019, Route 905 had 1.26 million boardings, the 15th highest patronage service in Melbourne. Route 905 remains one of Melbourne's most productive bus routes.[270] In the future, the Bulleen Park and Ride will also be integrated into the Eastern Express Busway.

On the other side of the city, the Altona North Park and Ride provides a similar type of bus connection express into the city – but with vastly less supporting infrastructure and investment in services. The interchange has low amenity with poorly maintained lighting and cracked pavements which has previously led to safety concerns.[271] It contains over 120 parking spaces and is served by Route 232, a service which runs every 20 minutes on average. Route 232 was originally introduced by The Met as 'an express service designed to serve the Western Suburbs' with the park and ride built in the 1990s near the former Paisley Station site.[272] In 2019, Route 232 had a total 253,000 boardings, just one fifth of the boardings along Route 905 in Melbourne's east. Part of the reason for low patronage can be attributed to the fact that other bus routes run in a similar area to parts of Route 232.[273] Route 232 also does not provide a competitive service, with buses regularly getting delayed on their congested journey along the West Gate Freeway. Route 232 arrived late for almost every second trip in 2018.[274]

The contrast between the Altona and Bulleen park and rides demonstrates the choice the Victorian Government has between transforming Melbourne's bus network from an underused public asset into a modern day mass transit system.

Figure 31: Bulleen (left) and Altona North (right) park and ride bus interchanges

Bulleen interchange (Source: North East Link) and Altona North interchange (Source: Infrastructure Victoria)

Recommendation 8

Substantially reduce bus fares relative to other modes

In the next three years, substantially reduce bus fares relative to other forms of public transport to encourage people to make better use of bus services, while maintaining an integrated ticketing system as part of the new ticketing contract.

The Victorian Government should consider making buses more accessible to Victorians, increase patronage, and make the most of its existing bus services through reducing bus fares. Cheaper bus fares should be introduced alongside other bus services and user experience improvements to make buses a more appealing option.

Our community research with over 4,000 people across Melbourne demonstrated that fare prices are a significant influence on how likely Melburnians would be to take the bus, suggesting that for every $1 reduction in bus fares, patronage could increase by up to 19%.[275] Despite cheaper average fares, our previous research has found that more public transport users overall help to generate similar levels of revenue under a new system.[276] Cheaper fares, alongside other fare reforms like off-peak discounts, can also attract over 56,000 new public transport users on a typical weekday.[277]

Cheaper bus fares also contribute towards the social and environmental objectives of Victoria's *Transport Integration Act*.[278] Buses are overwhelmingly used by people on lower incomes. Up to a third of bus travellers are in lower income groups.[279] Cheaper fares can improve overall efficiency of the transport network by removing over 31 million car trips from the roads every year and contribute towards Victoria's emissions reduction targets by cutting 78,000 tonnes of greenhouse gas emissions annually.[280] Overall, Victorians would be $520 million better off through more transport options, reduced crowding and congestion and better environmental outcomes.[281]

International research also shows that the shorter the trip, the greater the influence bus fares have on attracting new bus users.[282] Even frequent bus services will struggle to attract short bus trips to local shops and services if they cost the same as long distance peak train services from Melbourne's suburbs into the inner city. [283]

Melburnians have responded positively to discounted public transport fares before. In early 2023, V/Line's regional tickets were capped in line with myki charges for metropolitan travellers. [284] An additional 1.5 million V/Line trips (around 45% increase) occurred mid-2023, compared with the same period in 2022.[285] The network also experienced high levels of overcrowding, especially on weekends. Since the fare caps were implemented, additional services have been added to meet demand.[286] Unlike regional train services, most of Melbourne's bus services have the capacity to meet extra demand, and extra services can be added at relatively low cost.[287] Our analysis showed that approximately 60% of bus routes averaged less than 20 boardings per service hour. Even with projected population growth, Melbourne's bus network will still be running with just 1% of crowded service kilometres across the entire bus network.[288]

Other public transport fare reforms include off-peak fare discounts across all trains and trams. Our research shows that off-peak fare discounts have the potential to rebalance transport demand away from busier peak periods and make better use of existing public transport services.[289] As part of the new Public Transport Ticketing Agreement, Conduit Business Services will assume the operation of the current ticketing system in December 2023,[290] which includes developing an account-based ticketing (ABT) back office. Once operational, this cloud-based ABT back office will provide the Victorian Government with much greater flexibility to adjust fares in comparison to current arrangements.

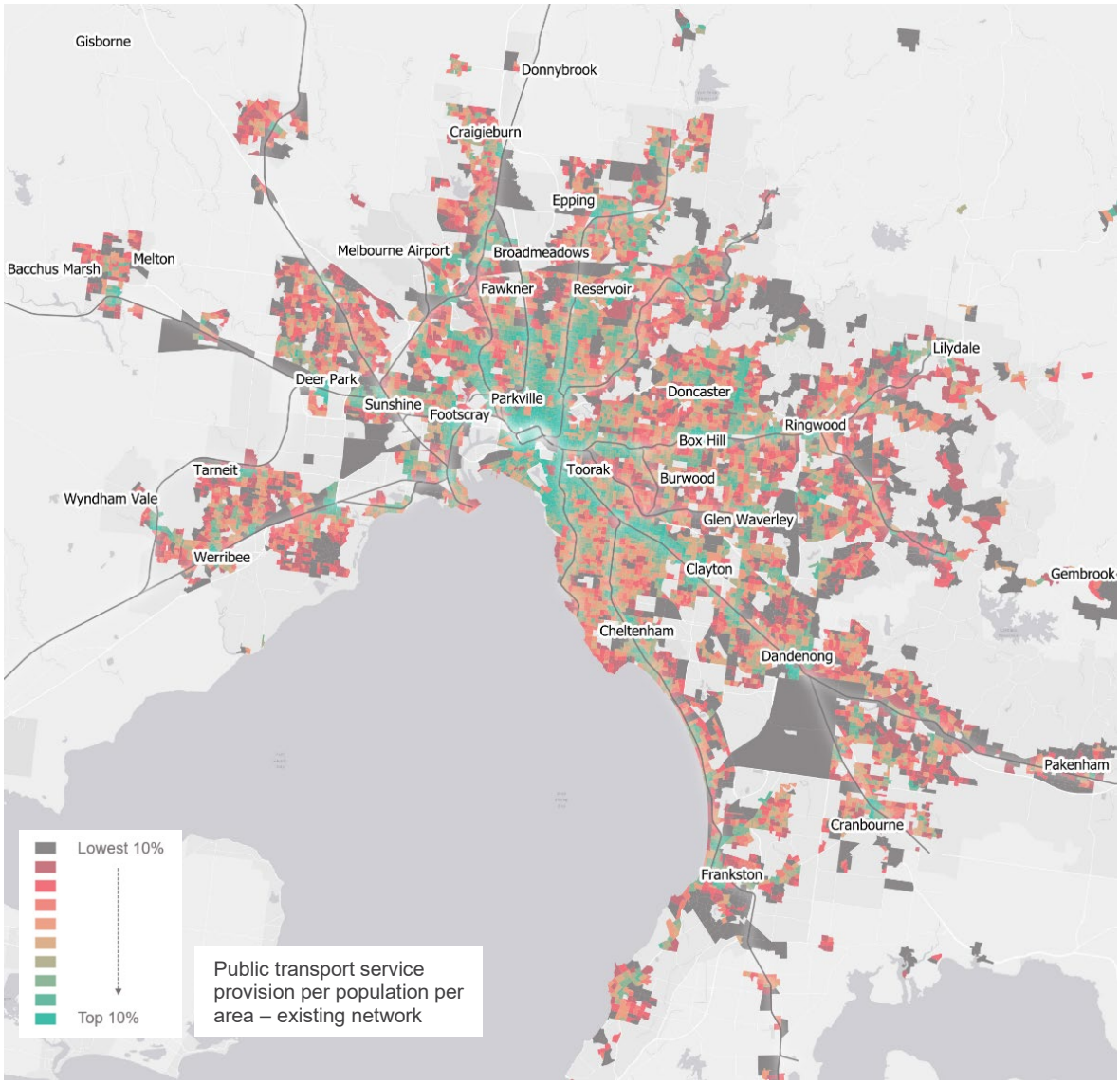
Setting strategic corridors and supporting urban growth

Public transport to support urban growth

Our analysis shows that investing in growth area and outer suburbs provides increased access to jobs and travel time savings to areas that have the most to gain. Whether it be through increased frequency, longer operating hours, bus lanes or more direct routes, growth areas like Hume and Casey need dedicated funding to support their growing transport task.

Many of these areas do not have the service levels to adequately support their current populations, let alone the 452,000 new residents expected to move in over the next decade.[291] Figure 32 shows the current supply of public transport relative to how many people live in each part of Melbourne. Many outer and new growth areas fall into the bottom 10 to 20%, highlighted in grey and red, with the lowest levels of public transport service provision across the city.

Figure 32: Outer and new growth areas face a transport undersupply compared to inner suburbs



Public transport service provision per population per area. Source: Infrastructure Victoria analysis of GTFS and population data.

The need for greater certainty and growth area bus funding

Victoria does not currently have a published transport plan, as identified in *Victoria's infrastructure strategy 2021–2051*.[292] Without a transparent transport plan, the role of buses in supporting future mass transit corridors and addressing transport challenges is not clear.[293] This makes it challenging for Victorian Government agencies, local governments and the private sector to collaborate on infrastructure and land use planning, especially in coordinating investments for growing communities.

Updating the existing Principal Public Transport Network (PPTN) strategic planning tool will be important with or without a published integrated transport plan.

Currently, public transport services in the outer and growth suburbs of Melbourne are not within walking distance for many households. This prevents their access to a reliable journey to work, socialise or even achieve daily tasks.[294]

As Infrastructure Victoria's *Our home choices* report showed, moderate income households in Melbourne have few affordable home options, so many choose to move to new growth suburbs where they are more likely to afford a detached home that meets their needs.[295] Households in Melbourne's outer and new growth areas have limited alternatives to private transport, so residents have higher than average car ownership and must cover the cost of extra fuel.[296] Compounded with the fact that the provision of services are often delayed until there is an acute and proven need for a bus, many new residents have already developed entrenched transport habits and car dependency.[297] Early bus delivery provides social benefits, supporting people that can't drive to make trips for work, study, socialising or health services.[298]

Reducing social exclusion improves individual and community wellbeing, especially for economically vulnerable groups who are already constrained by rising living costs such as fuel and mortgage repayments.[299] Mobility and trip making improves social inclusion and reduces neighbourhood disadvantage.[300] Social exclusion influences economic and social factors such as employment status, access to social support and community participation.[301]

Case study

5,500 residents with one road in and out

Buses and cars share peak hour gridlock in Cloverton Estate

Cloverton Estate is an example of residential development where the rate of infrastructure delivery has not kept up with the needs of residents moving in. Cloverton Estate is the largest master-planned community in Victoria with an intended final population of up to 30,000 residents across over 1,100 hectares.[302] The community falls within the Lockerbie Precinct Structure Plan and is an extension of the established township of Kalkallo.[303] Kalkallo is growing rapidly, with a population of only 112 in the 2016 census that increased to 5,550 by 2021.[304]

Cloverton Estate has only one arterial road connection in and out of the estate. This creates significant congestion during the morning peak with delays of up to an hour and traffic queues of over 1 kilometre long.[305] Bus Route 525 (Donnybrook to Craigieburn Station) runs through the Cloverton Estate and provides public transport access to 2 major train stations. With no dedicated bus lane, Route 525 is delayed by the road congestion within Cloverton Estate, and on surrounding arterial roads. Route 525 does not directly access most homes within the estate.[306] Households furthest from Cloverton's access to Donnybrook Road are a 40-minute walk from their closest bus stop.

The lack of essential road infrastructure to support the growing Cloverton Estate community is impacting the efficiency and speed of buses serving the area. A future Hume Freeway interchange directly adjacent to the estate will give residents access to a second major exit and facilitate more direct and efficient routes so that bus services do not have to go in and out of estates, duplicating coverage. The interchange received $6 million in funding in the 2022 state budget and is expected to open in 2026.[307] However, without competitive and high quality bus infrastructure serving the needs of the Cloverton Estate community when residents first moved in, the Victorian Government has missed a crucial opportunity to offer genuine travel choice and limit car dependence.

Below: Traffic congestion from Cloverton Estate. Source: ABC News, Peter Drought.

Recommendation 9

Update the Principal Public Transport Network

In the next year, update the Principal Public Transport Network (PPTN) to accurately align it with existing and committed future mass transit bus routes delivered through *Victoria's bus plan*. Ensure the PPTN is updated every 3 years so that it is accurately reflected in strategic land use planning across Melbourne, including helping to achieve aspirations of the new plan for Victoria.

The PPTN is a Victorian statutory land use planning tool, a key policy in Melbourne's metropolitan strategy *Plan Melbourne* and an incorporated document in the Victorian Planning Provisions.[308] The PPTN identifies areas that are or will be served by high quality transport. It includes existing and future passenger railway, existing tram routes as well as some existing bus services with high peak service frequency.[309]

The PPTN should be updated to support integrated transport planning and direct future land use and infrastructure investment. It should include a wider network of both existing and future mass transit bus routes.

The Department of Transport and Planning should also incorporate the PPTN into strategic land use planning including future precinct structure plans and the finalised land use framework plans.[310] Communicating future metropolitan bus routes will assist in guiding future housing, commercial and industrial development, and support better sequencing of infrastructure in areas less serviced by public transport. [311] The Victorian Government should improve bus efficiency in growth areas by planning for bus priority along roads marked for mass transit routes in the PPTN, and include the bus priority measures as the roads are first built.

The current PPTN is out of date and requires review. The PPTN does not always accurately reflect existing busy mass transit bus routes. [312] For example, the PPTN in Casey only recognises existing train stations and the immediate 400 metre catchment surrounding them, in addition to a single high patronage Route 841 bus on Cranbourne Road. It also does not provide guidance for future bus planning despite performing a similar role for future train lines.[313] There is no indication of how future mass transit routes will serve this growing community, especially on the growth front east of Casey. The service standards that qualify a bus route's inclusion in the PPTN are also unclear.[314]

With minimal use of the PPTN to signify future high quality transport routes, especially in Melbourne's growth areas, the Victorian Government is missing a key opportunity to achieve the aspirations of *Victoria's housing statement* and align with a new plan for Victoria in delivering more homes near transport.[315]

Integrated transport planning allows for the efficient coordination of transport services and land use and creates opportunities to sequence and optimise the benefits of transport investments.[316] The PPTN is intended to provide certainty to communities and land use planners, as well as supporting government decision making in future transport investment. [317] The Victorian Planning Provisions include a wide range of policy objectives relating to the PPTN, including creating compact and walkable neighbourhoods and bus priority measures along PPTN-identified corridors. [318] New developments that fall within the PPTN overlay are subject to altered planning provisions to support more compact developments and allow reduced car parking requirements due to proximity of high quality public transport options.[319] The PPTN is not currently included in the Victorian Planning Authority's precinct structure planning for growth areas. Updating the PPTN provides an opportunity to guide commercial and residential development around future transport corridors through new precinct structure plans.

The *Transport Integration Act 2010* sets an objective that the Victorian Government align the current and future transport system with land use through an integrated transport plan.[320] The Victorian Government should publish an integrated, long-term transport plan and use a new plan for Victoria to deliver more homes

near public transport.[321] This is in line with previous recommendations in Infrastructure Victoria's 30-year infrastructure strategy.

Maintaining an up-to-date PPTN will be important with or without a published integrated transport plan. This will help to coordinate land use, transport investment and future strategic planning.

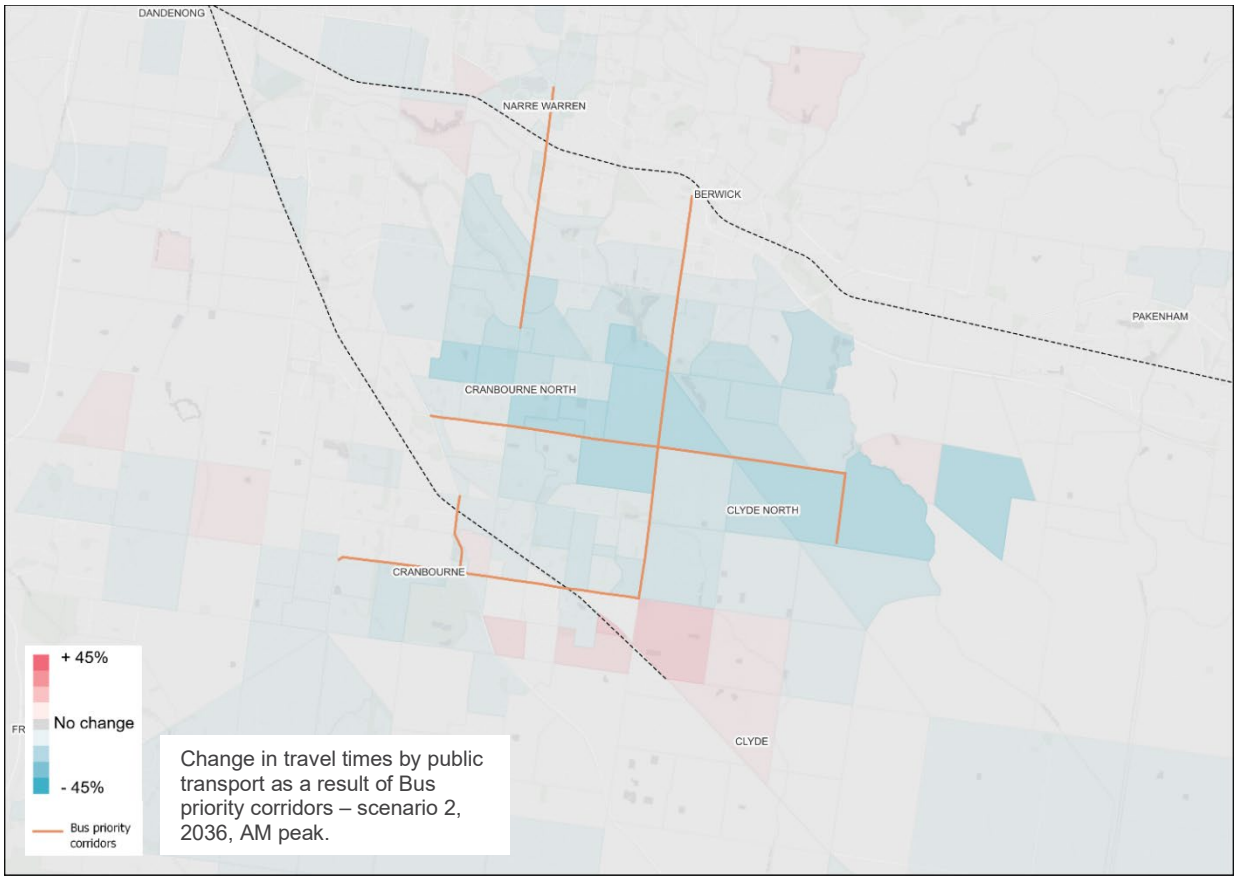
For example, subdivision codes in Canberra set objectives for bus priority measures and direct bus routes to minimise travel time and to avoid backtracking and circuitous routes. [322] Similar to how trains and trams have shaped land use in Melbourne's established suburbs, integrating an updated PPTN into precinct structure planning processes ensures that planning authorities, local government and developers all have visibility on the public transport outcomes required in a new growth area community. This would include provision for bus lanes to support future PPTN mass transit routes.

PPTN planning and priority in growth area communities

Recommendation 5 outlined the many benefits of dedicated bus lanes for Victorian communities. Bus lanes are especially useful in growth areas as they lock in future travel time benefits for growing communities and help to maintain a reliable bus service.

Engagement with stakeholders revealed that planning efficient bus routes in Melbourne's growth area can be a challenging process, especially when it involves the implementation of bus lanes. Growth area bus services are also negatively impacted by issues such as incomplete road networks, road congestion, and delays in capacity upgrades to arterial roads. Many of the outer suburban arterial roads are at or beyond capacity and cannot support public transport services as well as high private car use.[323] Our modelling of bus lanes in Melbourne's south-east achieved significant public transport travel time benefits. As shown in Figure 33, bus lanes in Casey reduce travel times by up to 20%, the largest reduction across all of Melbourne.

Figure 33: Bus lanes achieve some of the largest travel time savings and improvements in access to jobs for outer and growth area communities



Source: Infrastructure Victoria analysis of WSP bus reform modelling.

Recommendation 10

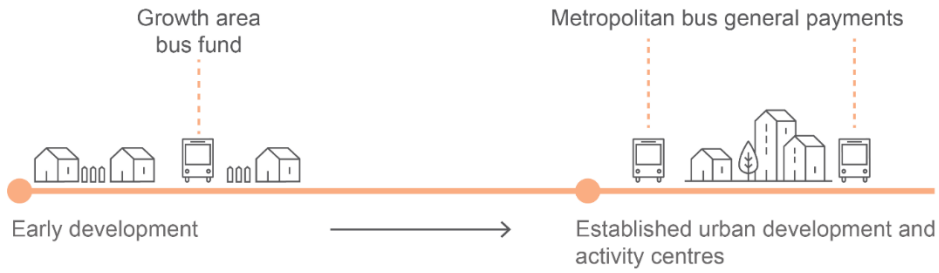
Provide funding certainty for growth area buses

In the next 2 years, establish a long-term growth area funding program dedicated to supporting the delivery of buses in Melbourne's growth areas during their early stages of development. Direct funding to priority growth suburbs that are currently underserved by the existing public transport network like Tarneit, Rockbank, Donnybrook and Clyde. Ensure that delivery of new bus services is informed by population and employment growth in these areas and is aligned with the route design in the updated Principal Public Transport Network.

The Victorian Government should address the chronic undersupply of public transport for existing growth area residents and ensure timely provision of bus services for future communities through a long-term growth funding program for Melbourne's buses.[324] Many growth areas with low public transport service provision from 2016 are still facing the same challenges close to a decade later.[325]

As an immediate priority, the growth funding program needs to be directed to funding bus routes where residents have already moved in but there are no or limited public transport services. Once travel demand builds over time and as more residents move in and town centres and businesses are established, these growth area bus services need to be upgraded to high capacity connector and trunk route services. This upgrade to bus route categories should also indicate the transition of bus service operating costs from the growth fund to general payments made for metropolitan bus services through the Department of Transport and Planning.[326] This stepped approach to developing growth area services should ultimately aim to deliver a high quality mass transit network as guided by an updated PPTN.

Figure 34: A long-term growth area funding program will support delivery of buses in Melbourne's growth areas, before transitioning to ongoing public transport funding



Source: Infrastructure Victoria.

Early delivery of bus services to meet the transport needs of a new suburb or development is fundamentally different to the traditional approach of investing in transport where sufficient demand already exists, like in established parts of Melbourne.[327] Low density areas in new growth area suburbs have lower cost recovery due to lower patronage. This is exacerbated in contexts where car dependency is already embedded.[328] Cost recovery should not be the only incentive for future investment in transport. It leads to delays in delivering much needed services.[329]

Regular and accessible public transport enables individual mobility and prevents social exclusion. These benefits are often excluded from government business cases and the cost-benefit analysis process.[330] For example, suburbs like Tarneit, Rockbank, Donnybrook and Clyde have very little service provision (refer to Figure 32). These communities would benefit from early delivery of buses through a growth area bus fund which would ultimately transition to a mass transit network to achieve the aspirations of an updated PPTN (see Recommendation 10) and new plan for Victoria. We estimate that a growth area bus fund that addressed all of Melbourne's growth areas would cost around $400 to $500 million annually if fully

implemented. This is based on the costs of a growth area bus network, similar to our illustrative network for Melbourne's south-east, rolled out across all growth areas of Melbourne. Ultimately, this process should be staged over time as growth area populations increase. While early priorities would be to provide equitable coverage and local access, the gradual delivery of more connector and trunk bus routes would then help to match growing travel demand. Importantly, staging of bus services requires a long-term view of the future mass transit bus network – something only a strategic plan like the PPTN would help to achieve.

It's important to note that these growth area communities have no trams, and limited access to trains. This means that public transport funding in growth areas almost entirely needs to be in expanding their bus networks. We illustrate what this could look like in Melbourne's south-east in the following section.

Network efficiency in growth areas

Residential development in growth areas can sometimes occur in dispersed locations that are 'out of sequence' with planned infrastructure and services, including buses.

These developments are disconnected from existing developments and infrastructure and can prevent economies of scale where a bus can conveniently access multiple communities in a short distance.[331] In these instances, there may be opportunities for co-investment towards an introductory bus service through infrastructure contributions or direct partnership with developers.[332]

In limited cases, demand-responsive services like the Victorian Government's current trial of FlexiRide may be a useful option to addressing difficult to reach developments.[333] These services can be used to test the demand for a higher frequency bus service and can change their service in response to new roads, residential development or demand for new destinations.[334]

Image source: Ventura.

Additional funding for buses in growth areas is occasionally provided through the Growth Areas Public Transport Fund.[335] This fund is supported by growth area infrastructure contributions (GAIC) and is intended for state significant transport infrastructure including bus interchanges, train stations and occasionally, bus services. Infrastructure contributions like GAIC could be used to support a dedicated growth area bus fund.

Early delivery of services is essential to establishing transport habits and providing a public transport option before households make transport decisions such as buying an additional car. However, there are growth area suburbs that have developed over the last decade that still do not have access to a frequent and reliable public transport service. For example, residents of Mount Atkinson are more than 4 kilometres from their closest bus route.[336] The arrival of new bus services in growth areas is frequently delayed and the services provided are infrequent with limited operating hours. In an analysis of 150 growth area communities, residents waited an average of 3.1 years for a bus service to arrive. In some cases, buses arrived up to 14 years after the first residents.[337]

A growth funding program for metropolitan buses directly addresses this delivery challenge and removes the tension between growth areas and established parts of Melbourne competing for the same transport funding

pool. Once the fund is established, the Victorian Government will need to closely monitor development in growth area suburbs and consider service upgrades where required. These could be based on the status of urban development, traveller demographics and scale of demand, using development thresholds like minimum population or developed hectares to indicate when upgrades should be considered.[338] The types of bus services could also be tailored to best suit each development, including demand-responsive services and shuttles to nearby rail stations and established activity centres.

Case study

Challenges for cities: sustained funding for bus services and infrastructure in new growth areas

Dedicated but ad hoc funding for New South Wales's growth area buses

Two dedicated growth area funding streams for buses in Sydney have been established to provide new bus services and infrastructure.

Between 2013 and 2015, the New South Wales Growth Bus program committed over $70 million to fund 80 new buses in Sydney's metropolitan and outer metropolitan area to respond to patronage growth.[339, 340] Bus services for growth areas in New South Wales were also supported by the Bus Head Start program.[341] This aimed to provide bus services as new homes were built, connecting new residents with major activity centres and public transport interchanges from the day they first moved in.[342]

However, funding for growth area buses has not kept pace with population growth and has failed to maintain long-term reliable services.[343] Buses introduced by the growth bus program were only granted funding for the first 2 years. This led to reduced service delivery and shortfalls in the transport budget after the initial funding period. In addition, new bus routes were not supported by an up-to-date service plan. The 2023 Bus Industry Taskforce recommended that Transport for New South Wales undertake further work to identify key corridors and priorities.[344]

Delivering public transport early in Calgary's new communities

The City of Calgary is an example of staging transport services in growing suburbs with different thresholds of residential and commercial development. The city aims to deliver transport early in new communities to build sustainable travel habits.[345] Calgary Transit's strategic transit plan, RouteAhead, provides an equivalent of Victoria's bus categories with four service levels: introductory, base, frequent and primary transit.[346] Unlike Victoria's bus categories, these levels include a clear social transit criteria for the base and introductory services.

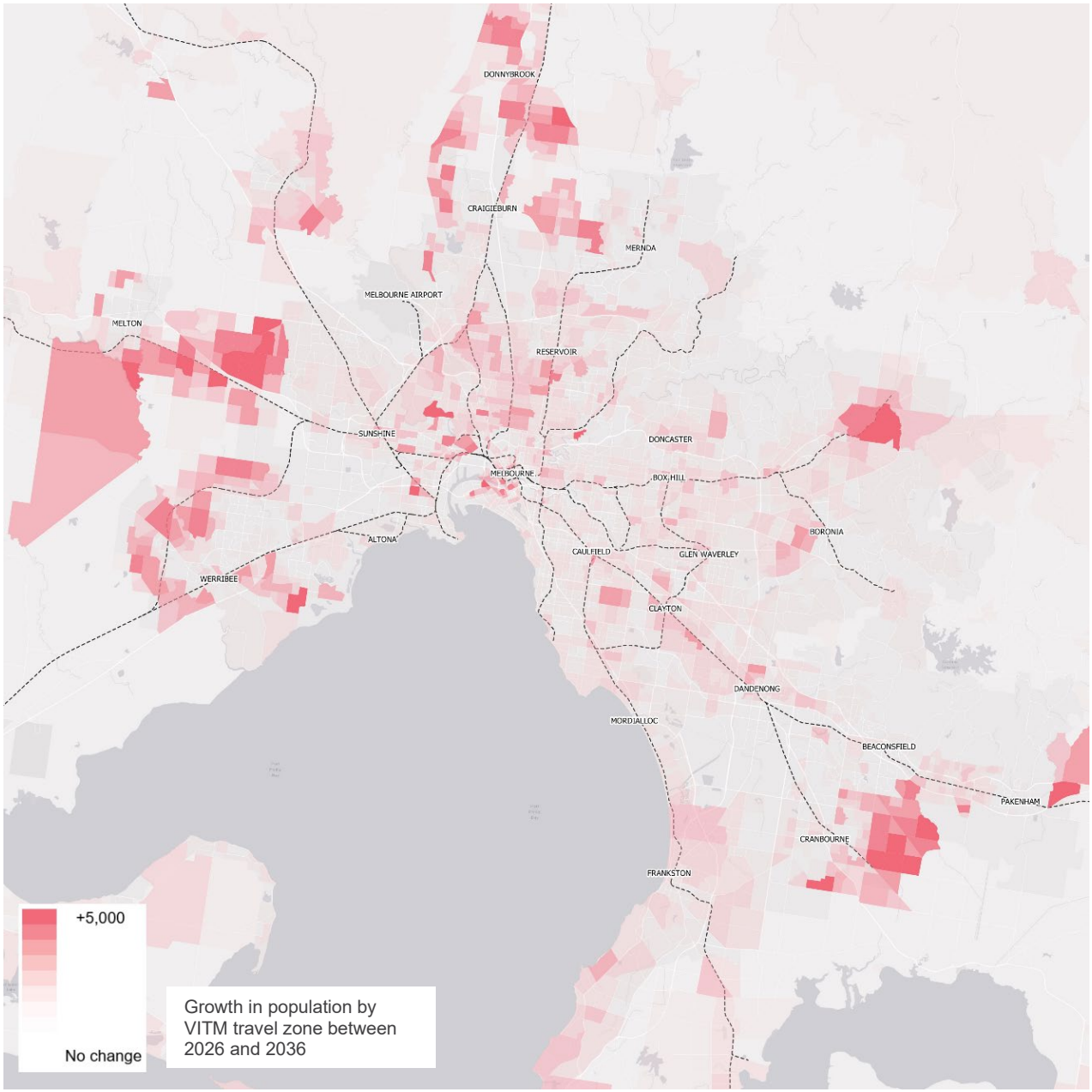
Calgary Transit determines locations for new introductory services based on network connectivity and possible demand (adequate population or job intensity). Their strategic plan suggests that new communities of 300 to 400 dwellings can support delivery of new bus services.[347] Where new communities reach sufficient population or job density and have a suitable road network to support efficient travel, funding is prioritised through the budget process, while also considering the needs of other new communities and existing routes. A typical phasing approach is followed, building in public transport capacity for growing communities. Calgary Transit's service categories also include a commitment to monitor and evaluate patronage and demand, to upgrade the service and improve frequency as needed.

Modelling a high quality growth area bus network

Funding certainty in growth area buses benefits both current and future residents

We modelled increased investment and delivery of a high quality bus network in Melbourne's south-east, illustrative of the benefits from early delivery and high quality buses that could be achieved in all of Melbourne's growth areas. Growth area bus upgrades – scenario 6 focuses on Casey and urban areas of Cardinia, delivering new high frequency trunk and connector bus routes. These areas are expected to experience the highest level of population growth in Melbourne, as shown in Figure 35. For some residents, including students and apprentices, an improved bus network means being able to access training and first jobs.[348]

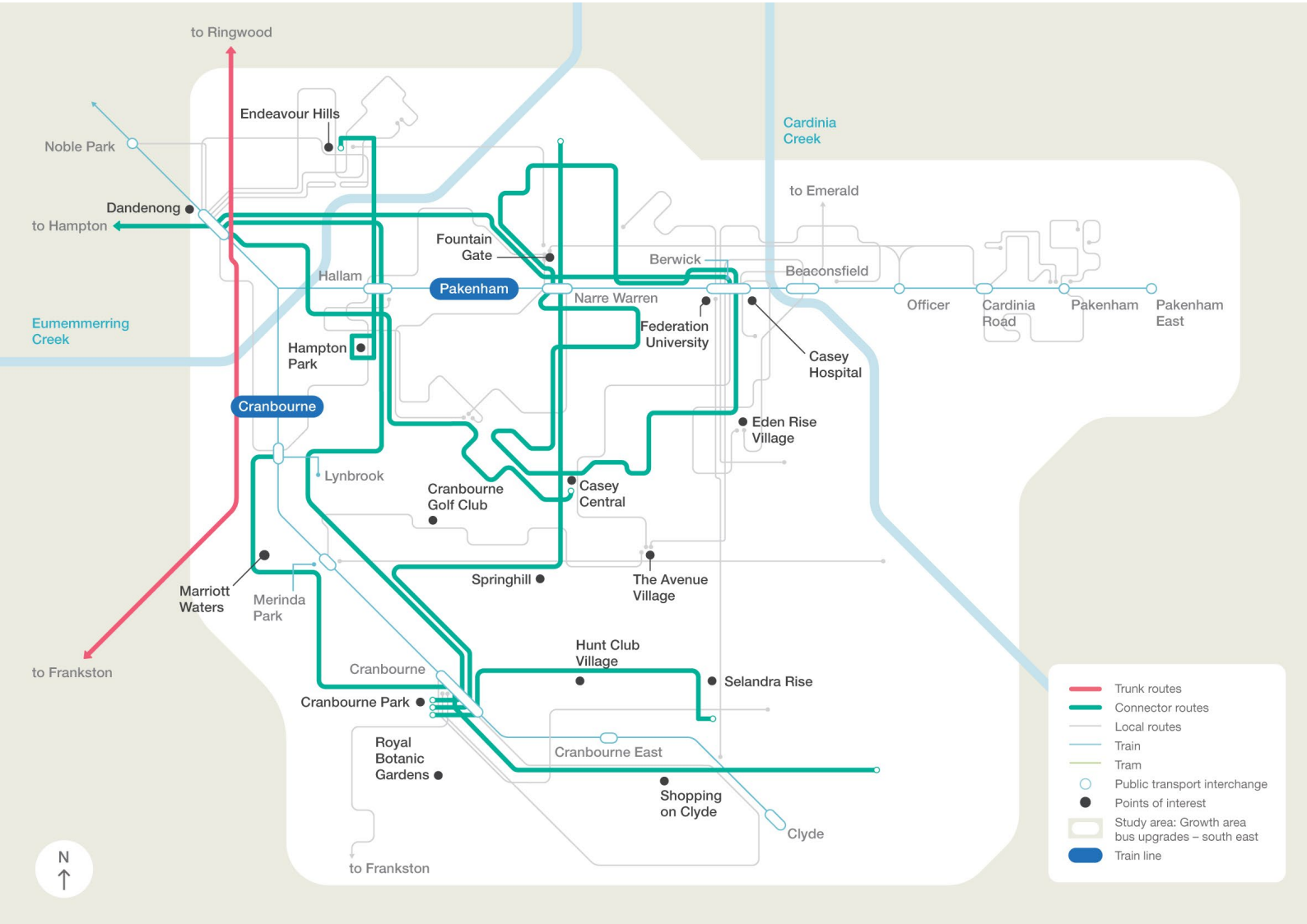
Figure 35: Casey and Cardinia are set to experience some of the strongest population growth in Melbourne by 2026 and 2036



Source: Infrastructure Victoria analysis of WSP bus reform modelling.

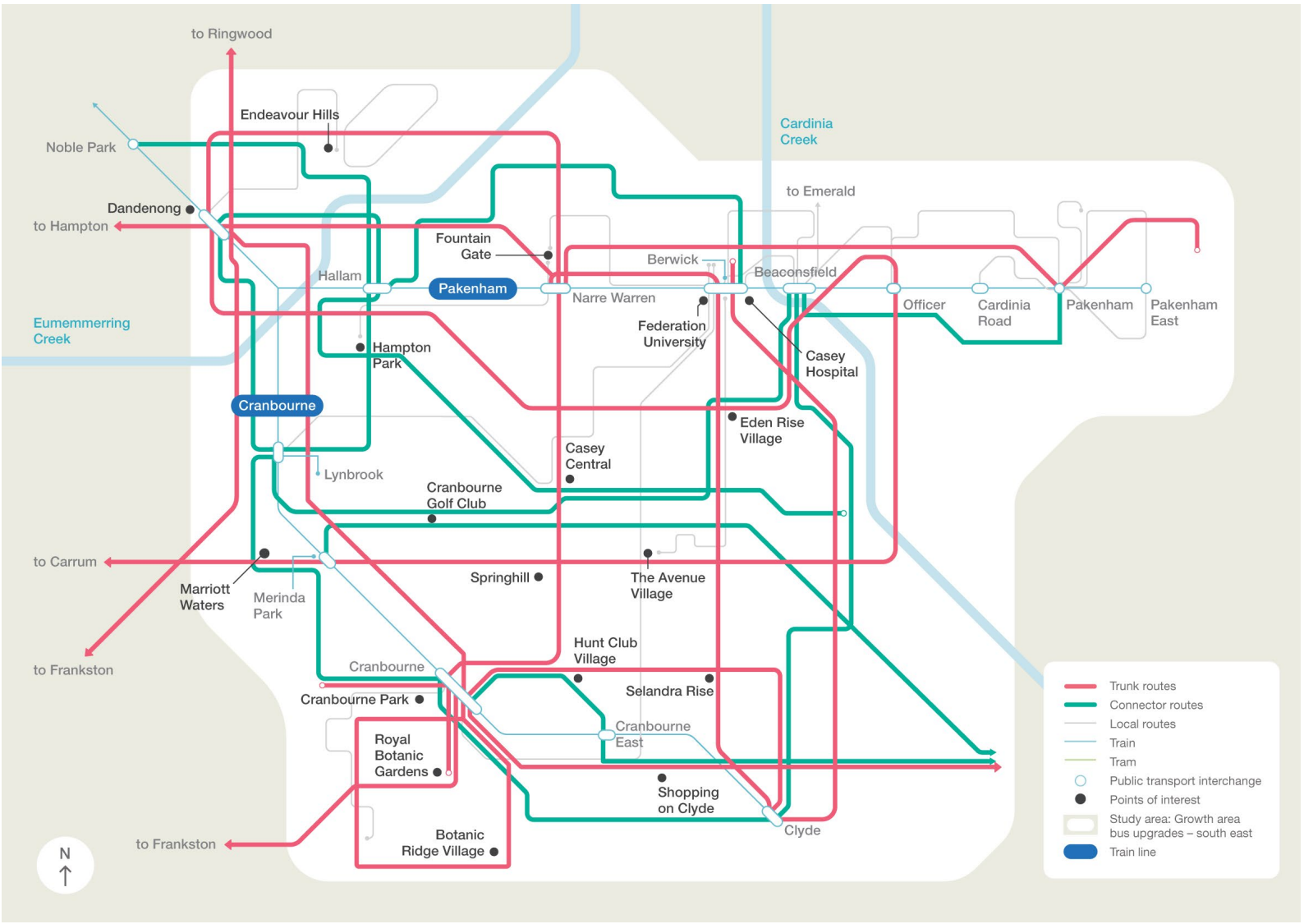
As shown in Figure 36, many existing routes in Casey and Cardinia are indirect. Current wait times are long, with only 52% of Casey residents receiving a service that comes as frequently as every 20 minutes or more on a weekday. Our modelling of the growth area bus upgrades (scenario 6) improves this so that 92% of Casey's residents would wait less than 20 minutes for a weekday public transport service. Figure 37 shows the reformed network scenario, including faster trunk route connections forming a 'turn up and go' grid network with improved connections to activity centres, industrial precincts and train stations. The reformed network significantly reduces wait times in the targeted areas of Casey and Cardinia. The number of residents in Casey who have access to a bus that comes at least every 10 minutes would increase from approximately 12% to 72% (Casey) and from 0% to 37% (Cardinia).

Figure 36: Existing bus network in Melbourne's south-east growth area



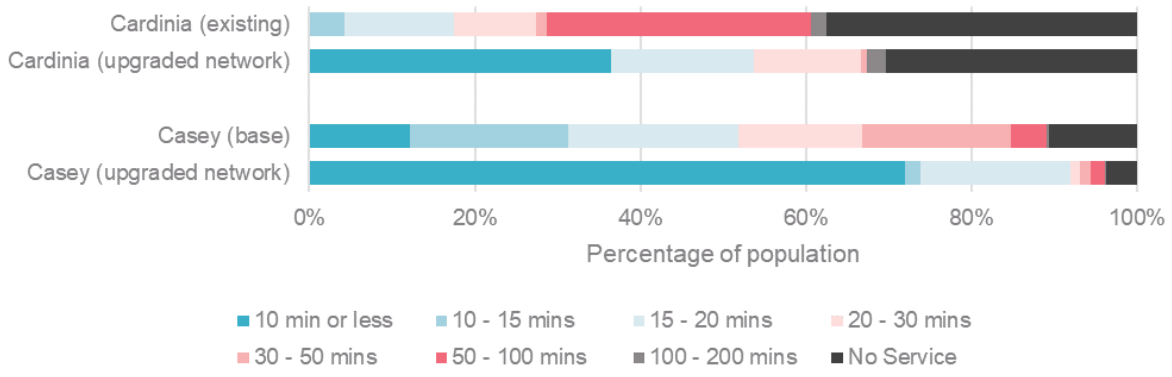
Only existing routes relevant to the study area are shown. Source: Infrastructure Victoria.

Figure 37: Illustrative reformed bus network in Melbourne's south-east growth area



Network maps are for Infrastructure Victoria scenario testing purposes only and do not represent any current or future network designs from the Department of Transport and Planning. Only routes relevant to the study area are shown. Source: Infrastructure Victoria.

Figure 38: Growth area bus upgrades – scenario 6 in Melbourne's south-east drastically reduces wait times for residents in Casey and Cardinia



Source: Average public transport wait times (6am to 8pm) by Local Government Area. Source: Infrastructure Victoria analysis of GTFS and ABS Census 2021.

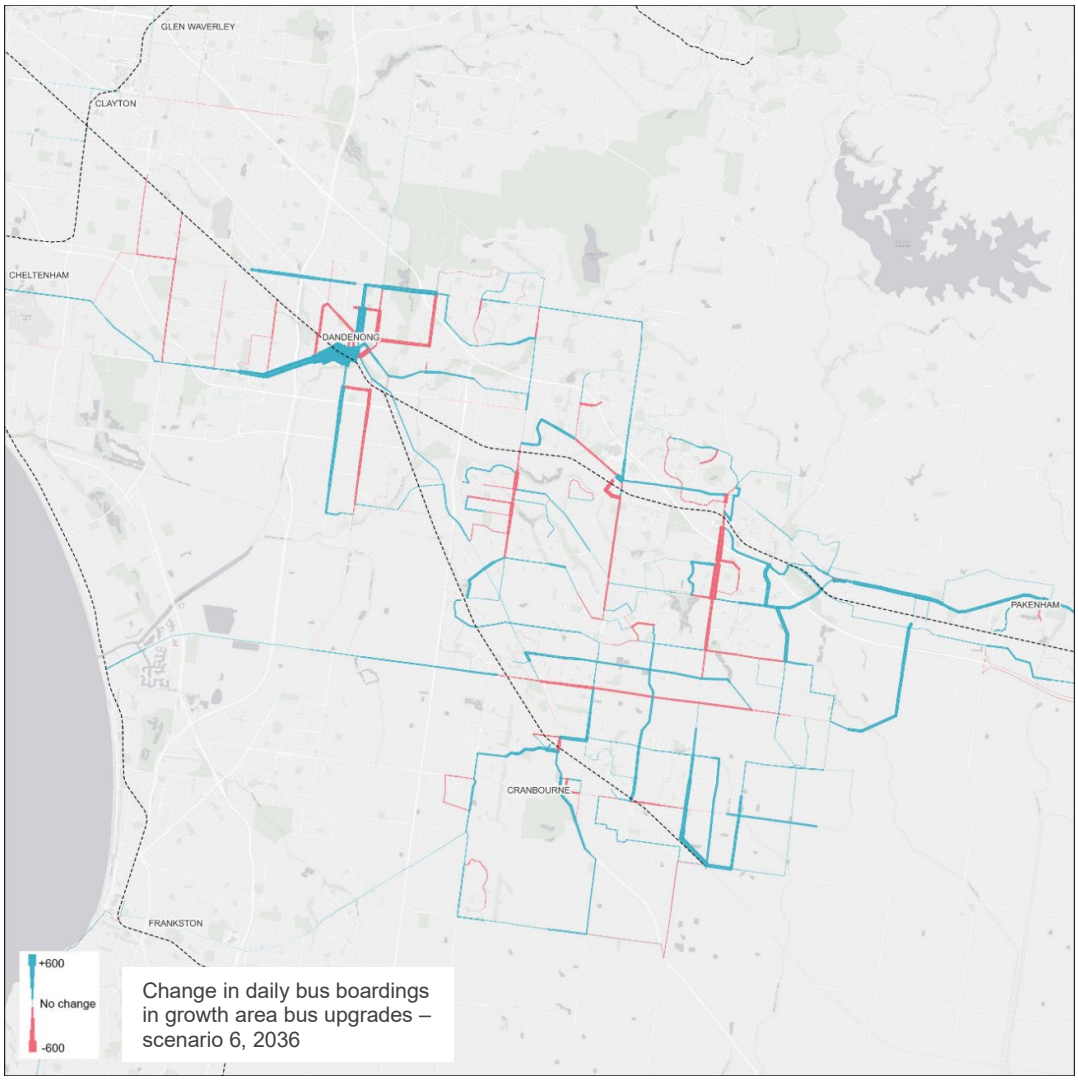
Improvements in service translates to greater access to jobs and increased bus boardings

Our scenario for Melbourne's south-east tripled the total bus service hours in the study area while the population of Casey and Cardinia increases by 22% between 2026 and 2036. The scale of investment needed to create an attractive public transport network in a dispersed growth area will always be higher than the cost of delivery in an established suburb of Melbourne.[349]

We modelled strengthened connections between Casey, Cardinia and neighbouring Greater Dandenong, boosting access to Dandenong's extensive manufacturing and industrial precincts. We also modelled improved connections between growth area estates and nearby Pakenham and Cranbourne train lines, enabling efficient transfers between bus and train.

Modelled total bus boardings increased by approximately 40% in Casey and 150% in Cardinia with improved services. New high patronage corridors could include the Princes Highway between Beaconsfield to Pakenham, bus links to a future Clyde train station, and improved bus links between Dandenong and Keysborough, as shown in Figure 39

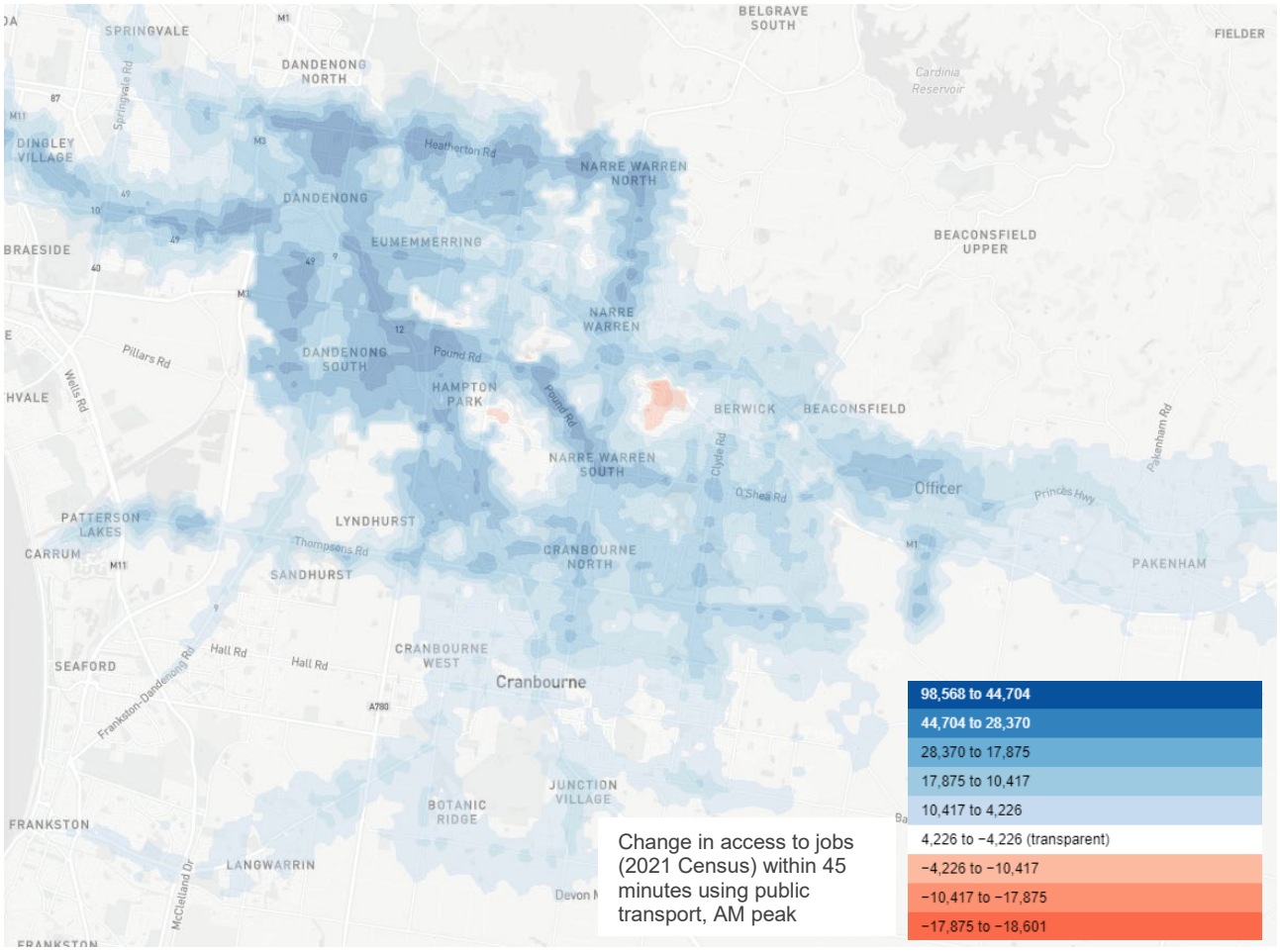
Figure 39: The upgraded growth area network attracts more boardings than the existing bus network



Source: Infrastructure Victoria analysis of WSP modelling.

Those living in suburbs like Narre Warren North, Dingley and Hampton Park benefit from an additional 98,500 jobs now accessible within a 45-minute travel time by public transport. Residents in Cranbourne North, Officer and Lyndhurst also benefit from additional access to 44,700 jobs within 45 minutes, as shown in Figure 40.

Figure 40: The upgraded growth area bus network leads to increased access to jobs for almost all of the study area



Source: Infrastructure Victoria analysis using Conveyal accessibility tool.

Balancing the cost of a new growth area network with projected population growth

Redesigning and implementing early delivery of bus services in Melbourne's south-east provided around $280 to $390 million of time saving benefits to public transport users over the next 20 years after implementation. Our research has shown that when viable public transport options are offered in growth areas, new residents choose to own fewer cars. Because of this reduction in car dependency, a further $190 to $270 million of car ownership benefits are provided by the redesigned and early delivery of bus services in Melbourne's south-east. An estimated $130 to $180 million of benefits from the value of additional mobility can also be expected over the next 20 years after implementation. The illustrative network for Melbourne's south-east is expected to cost an additional $120 to $150 million in operating expenses for 2026 and $45 to $55 million worth of capital costs (2023 dollars).

An important aspect related to the cost is that we modelled an immediate delivery of a high quality bus network in Melbourne's south-east growth area, bringing the public transport service up to a level only experienced by residents currently in established areas like Darebin and Moonee Valley. Although researchers have identified a clear lag between when residents first move in and the delivery of new bus services,[350] these bus networks should be expanded gradually to scale up in line with changes in land use.

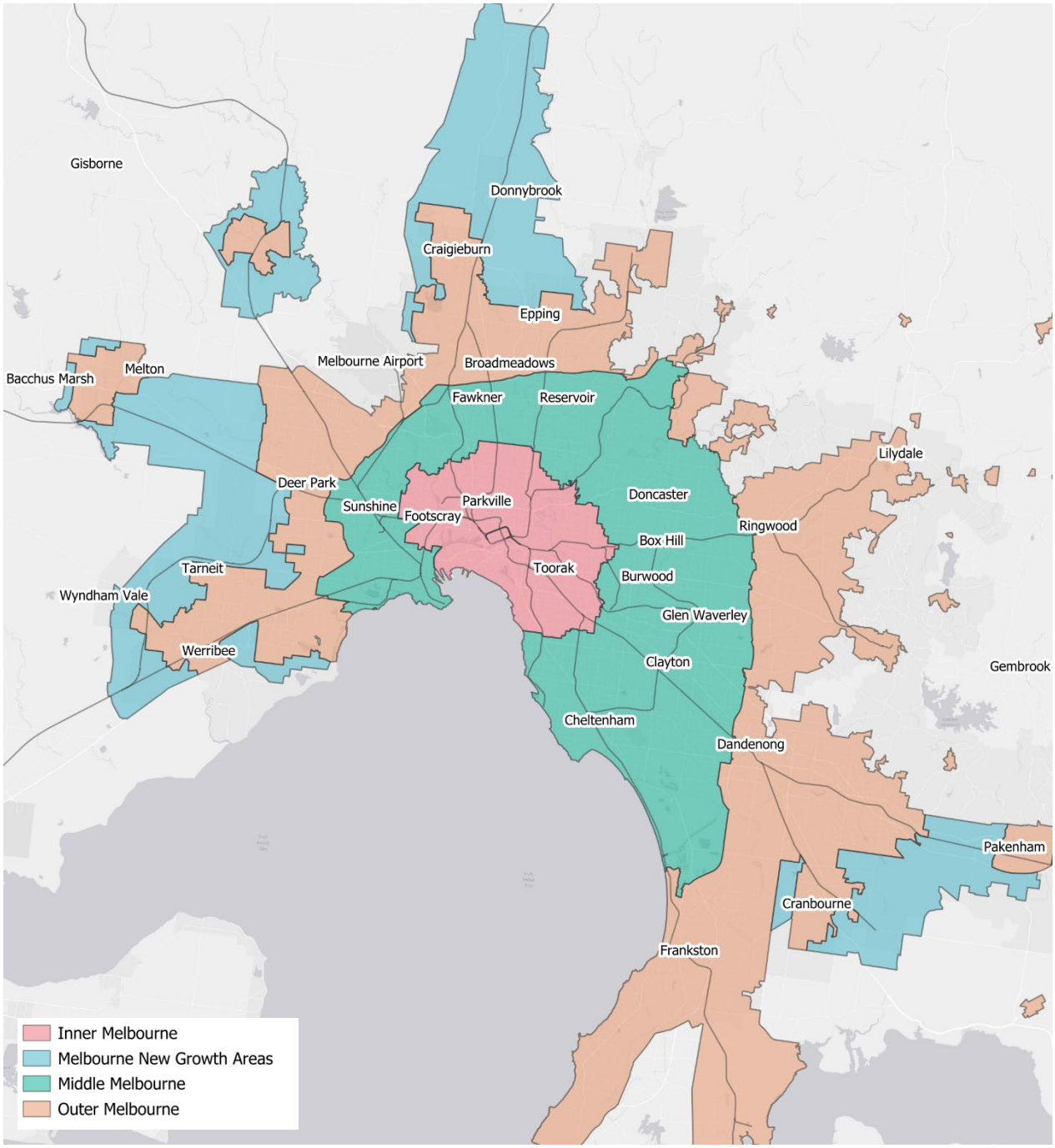
Glossary

accessibility	Accessibility is the ease with which people can reach valuable destinations. It accounts for transport availability, travel time, distance and cost. In this report, we mostly refer to people's access to jobs and services by car or by public transport.
articulated bus	A large bus with two or more rigid sections connected allowing passenger access between the sections, also referred to as a 'bendy bus'.
bus rapid transit (BRT)	Bus rapid transit (BRT) is a high quality bus-based transit system that delivers fast, comfortable, and cost-effective services at metro-level capacities. It does this through the provision of dedicated lanes, with busways and large stations, and fast and frequent operations.[351]
'close proximity' to high quality public transport	We've combined measures of how far people are from their nearest public transport stop with the frequency of the public transport service. Informed by our community research, we've defined being close to high quality public transport as either: • within 800 metres of a bus stop where the bus comes at least every 20 minutes, or within 400 metres of a bus with a wait time of longer than 20 minutes • within 800 metres of a tram stop • within 800 metres of train station.
mass transit	Mass transit is another term for public transport which primarily focuses on the high capacity movement of people within urban areas.
mobility gap	People who do not have access to a car or public transport that meets their requirements can be at risk of experiencing a mobility gap where they cannot access the jobs, services or social opportunities to fully participate in society.[352]
patronage	Patronage is a count of the number of people boarding onto public transport services like buses or trains.
patronage/mass transit vs. coverage/social transit	*Patronage* relates to how many people use public transport. The environmental, health and land use benefits of public transport are related to how many people use the service. Financial efficiency objectives, such as minimising government subsidy, are also related to patronage levels. For example, more passengers on a given bus service means a lower per passenger cost of providing the service. *Coverage* relates to the availability of services across the network. Coverage of services also relates to supporting social and economic inclusion benefits of public transport, such as access to services for people experiencing disadvantage, or who cannot drive.
productive routes	Route productivity may be measured in the number of boardings per service hour. Previous analysis conducted by Infrastructure Victoria has used a benchmark of 20 boardings per service hour as a general measure of economic viability. This benchmark factors in the benefits of taking a bus trip (improved health, reduced congestion and reduced emissions) against the costs of providing a bus service.[353] For the purposes of our modelling analysis, we have used 20 boardings per service hour as a productivity measure for mass transit bus routes. We acknowledge that economic viability is just one measure to benchmark bus services, researchers identify that buses also play an important social transit role.[354] A benchmark of 10 boardings per service hour reflects the accessibility

	benefits and social value that a bus service can offer to travellers with limited mobility alternatives.
rapid running	Rapid running means bus services have no fixed timetable and operate at a 'turn up and go' frequency, like every 10 minutes. This means buses will operate with the traffic along the route and no longer slow down or wait at bus stops if they are running ahead of schedule.[355]
transport disadvantage	Transport disadvantage relates to a wide range of factors relating to the ability to access public transport, non-friendly transport options, not being able to afford transport, or experiencing financial stress as a result of the cost of transport.[356]
trunk, connector, local routes	These are bus route categories as identified in *Victoria's bus plan*.[357] • Trunk routes are frequent and direct, serving key transport nodes and employment and shopping centres. • Connector routes provide easy connections to the rail network and local employment and shopping centres. • Local routes provide local access for passengers, targeted to provide a minimum level of service to access local shops and services.
wait times	The time travellers may spend waiting at the start of their journey for a bus service, or a connecting bus service mid-way through a journey.

Spatial analysis definitions

Figure 41: Functional Urban Areas used to define suburb locations across Melbourne.



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Published by Infrastructure Victoria
December 2023.

This document is also available in PDF and accessible HTML or Word format at www.infrastructurevictoria.com.au

ISBN 978-1-925632-96-5 (pdf/online/MS word)