NORTHERN CONNECT

Strategic Assessment of Housing and Transport Infrastructure Needs in Melbourne North Growth Corridor

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In the course of our preparation of this report, projections have been prepared on the basis of assumptions and methodology which have been described in the report. It is possible that some of the assumptions underlying the projections may change. Nevertheless, the professional judgement of the members of Northern Connect have been applied in making these assumptions, such that they constitute an understandable basis for estimates and projections. Beyond this, to the extent that the assumptions do not materialise, the estimates and projections of achievable results may vary.

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Acknowledgement of Country

Northern Connect acknowledges all Aboriginal and Torres Strait Islander peoples and recognises their ongoing strength and resilience despite the past and present impacts of colonisation and dispossession. We acknowledge the important role that Aboriginal and Torres Strait Islander young people play as leaders in their communities and across Victoria.

Aboriginal and Torres Strait Islander peoples represent the world's oldest living culture. We celebrate and respect this continuing culture and strive to empower Aboriginal and Torres Strait Islander young people as they draw on the strength of their community, families and culture to build a bright future.

Executive Summary

Project Background

Australia is in the grip of a housing crisis, with demand for affordable, well-located housing outpacing supply. This challenge is particularly acute in Melbourne's fast-growing North Growth Corridor, a major urban expansion area located 20 to 60 kilometres north of the CBD. This project examines whether projected population and housing growth in the North Growth Corridor is supported by current and planned transport infrastructure, and what further investment is needed. The project is structured around three key themes:

Objective One: Population and Housing Growth

This analysis evaluates annual population growth (AAPG), annual dwelling growth (AADG), and the proportion of occupied residences (AOR) to prioritise suburbs within the corridor. Using a weighted ranking method across these metrics, the 12 suburbs within the corridor were assessed, with Donnybrook, Beveridge, Mickleham, and Wollert identified as high-priority due to their strong population and dwelling growth coupled with lower occupancy rates. The population within the North Growth Corridor is projected to increase from 249,920 people in 2021 to 594,910 by 2046, an increase of around 344,910 people. Beveridge, Donnybrook, Wollert, and Mickleham are expected to account for approximately 83% of this growth, with increases of 107,884, 72,536, 63,324, and 43,316 people respectively.

Objective Two: Transport Infrastructure Capacity and Adequacy

This analysis assesses the capacity and demand of major roads and public transport services within the North Growth Corridor. Of the 13 major roads assessed, 10 are projected to be inadequate to accommodate an annual traffic growth rate of 5.14% by 2046. Current travel time efficiency ratio (TTER) also indicates congestion, with Donnybrook, Beveridge, Mickleham, and Wollert recording TTER values of around 1.4, meaning every 10 minutes of off-peak travel requires an additional 4 minutes during peak periods. While public transport options (e.g., V/Line rail, Metro trains, and PTV buses) provide connections to and from Southern Cross Station in the CBD, residents often rely on feeder buses to access train services on the Seymour V/Line, Craigieburn Metro, or Mernda Metro lines. Capacity constraints, limited service frequency, and poor network connectivity remain key challenges. This issue is especially pronounced in Beveridge, where public transport travel times are 1.5 to 2.5 times longer than by car during peak periods.

Objective Three: Transport Infrastructure Gaps and Investment Priorities

This analysis utilises a new methodology, the Liveability Scorecard Framework, to identify and quantify transport infrastructure gaps across the North Growth Corridor and compares transport infrastructure projects in one of the high-growth hotspots, Beveridge. This analysis has highlighted three primary investment priorities: the delivery of high-capacity north–south road corridor with short-term upgrades to the Hume Freeway; the electrification and extension of the Metro train network to Beveridge and Donnybrook, accompanied by a comprehensive redesign of the PTV bus network to enhance feeder services and intermodal connectivity; and the development of the east–west arterial grid and establishment of a well-connected bus interchange that links key segments of the North Growth Corridor in all directions: North, South, East, and West.

Future Works with Artificial Intelligence

Artificial intelligence presents significant opportunities to enhance the quality, consistency and timeliness of housing and transport infrastructure planning across Australia. By automating data collection from diverse sources, standardising inconsistent datasets, and enabling dynamic, real-time forecasting, AI can support a more accurate and responsive understanding of future infrastructure demand.

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About Northern Connect

Hua Qian Ang

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Senior Lecturer

A Chartered Mechanical Engineer, founder of EPIC Engineering Comic, and an award-winning educator and researcher at RMIT, Dr Ang advocates for free, accessible engineering education globally by combining engineering with visual storytelling. Her research focuses on light alloys and additive manufacturing. Dr Ang currently serves on committees for Engineers Australia and Engineers Without Borders, actively supporting community-driven engineering initiatives. Her work has gained widespread media recognition for its innovation and impact.

Inhae Jung

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Senior Bridge Engineer

A Chartered Professional Engineer, Inhae has broad experience in civil infrastructure across consulting and construction in Australia and New Zealand. Her projects include highways, bridges, a windfarm, and the West Gate Tunnel. She has contributed to both large and small-scale developments, handling project management, quality control, structural design, coordination, and construction supervision. Inhae has strong engineering design skills and communicates effectively with stakeholders and teams.

Josie Kleinitz

BEng(Hons), CPEng, NER, APEC Engineer IntPE(Aus)

Associate Engineer

An accomplished Associate Civil Engineer and Project Manager with over 10 years of experience in project delivery and design. A Monash University honours graduate, her expertise spans site engineering, superintendency, and civil infrastructure design, specialising in hydraulics and hydrology. Josie excels in managing complex, multi-disciplinary projects, leading design teams, and delivering value-driven solutions. She is passionate about working closely with clients to achieve successful project outcomes.

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A Chartered Mechanical Engineer with over a decade of experience across mining, waste management, and water infrastructure. Holding an Honours degree in Mechanical Engineering, Vinh specialises in mechanical design, systems integration, and multidisciplinary project management. He is known for delivering complex, high-impact projects with a focus on safety, sustainability, and innovation. He is passionate about engineering excellence and mentoring emerging professionals in the field.

Northern Connect is a multidisciplinary team with expertise across academia, consulting, and infrastructure delivery. Our collective background in transport engineering, planning, research and graphic design enables us to undertake robust data analysis while remaining attuned to the practical realities of project delivery. We align strategic vision with operational implementation, ensuring that our recommendations are both evidence-based and grounded in practice. We also communicate complex findings through well-designed infographics, enhancing accessibility and engagement. In doing so, we provide Infrastructure Australia with insights that are rigorous, actionable, and tailored to the Australian infrastructure context.

Project Partners

This project is undertaken as part of Consult Australia's 2025 Future Leader Program, a national initiative designed for emerging leaders in the design, advisory, and engineering consulting sectors.

This project is guided by a brief and data sources provided by Infrastructure Australia, the Australian Government's independent advisor on infrastructure investment planning and prioritisation. The findings of this project align with Infrastructure Australia's priority focus areas and provide essential evidence to support informed decision-making in Commonwealth infrastructure investments.

This project is supported by mentorship from David Collett of BG&E. A Civil Engineer with over 36 years of experience across consulting and construction, David has led major infrastructure projects in transport, energy, water, and urban development. His international portfolio includes the Dublin Light Rail, Royalla Solar Farm, and Saigon Container Terminal. Renowned for successfully turning around complex or distressed projects, he consistently delivers results. David joined BG&E in August 2024 and currently serves as State Director, leading operations across Victoria and South Australia.

1.0 Project Background

Australia is experiencing a systemic housing crisis, characterised by a widening gap between the demand for housing and the availability of suitable supply [1]. Safe, secure, and affordable housing is becoming increasingly inaccessible for many Australians, which has significant implications for individual wellbeing, social cohesion, and the nation's economic performance. This imbalance is intensifying affordability pressures and placing growing demands on infrastructure and essential services. Australia's housing crisis is being driven by three interrelated challenges, as illustrated in Fig. 1.

(1) Rising demand. Australia's population increased by 487,000 people between September 2023 and September 2024, reflecting an annual growth rate of 1.8%. Victoria accounted for 146,000 of these new residents, recording a growth rate of 2.1%, second only to Western Australia [2]. Melbourne absorbed 142,600 of Victoria's population increase during the same period, that is a 2.7% increase [3]. This growth is being driven by natural birth and sustained levels of overseas and interstate migration.

(2) Insufficient Housing Supply. In 2023, the Victorian Government committed to delivering 800,000 new homes by 2034, which requires the completion of at least 80,000 homes each year. However, in 2023 only 56,435 dwellings were completed across Victoria, with a modest increase to 60,220 in 2024 [4, 5]. This falls well short of the annual target. The strain on housing supply is also reflected in the rental market. In July 2025, the national residential rental vacancy rate fell to 1.2%, leaving only 37,863 rental properties available across Australia. In Melbourne, the vacancy rate increased slightly to 1.8%, equating to 9,325 available residential rental properties [6]. Despite this increase, the rate remains significantly below the standard healthy benchmark of 3-4%. These statistics further confirm that the shortage of available and affordable housing is a critical issue across Australia, particularly in urban centres like Melbourne.

(3) Barriers to housing delivery. The capacity of the residential construction sector is approaching its limits, and future forecasts suggest a likely slowdown in building activity. This is due to a combination of compounding challenges, including labour shortages, supply chain disruptions, delays in planning and approvals, and a lack of enabling infrastructure in key growth areas [4]. These constraints are further hindering the timely delivery of housing in locations with good access to employment, education and public transport.

Collectively, these dynamics are driving up housing costs, reducing affordability and limiting access to suitable housing, particularly for low- and middle-income households. Without timely and coordinated policy responses, the housing crisis is likely to worsen, increasing pressure on government systems and the broader economy.

Therefore, in order to assist Infrastructure Australia in enabling infrastructure to support housing growth and mitigate Australia's housing crisis, this project aims to identify:

(1) priority, high-growth locations for significant new housing supply

(2) capacity and adequacy of transport infrastructure, and to assess the challenges in high-growth locations where a lack of enabling transport infrastructure impedes the timely delivery of new housing

(3) gaps between current and planned transport infrastructure capacity, and areas where investments may be needed to support future housing growth and population needs

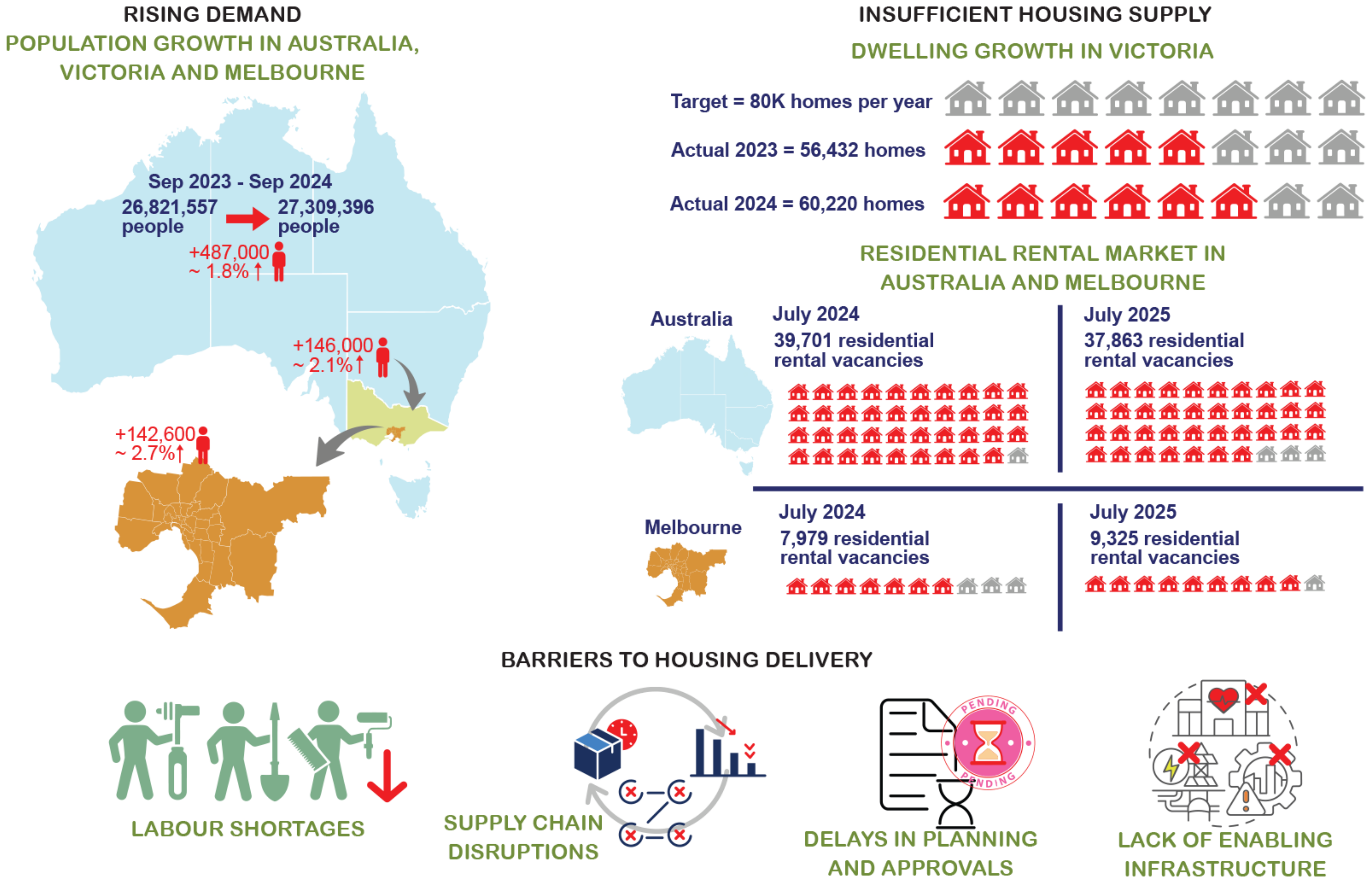


Fig. 1. Key challenges driving Australia’s housing crisis.

1.1 National Response

In recognition of the escalating housing crisis, the Australian Government has initiated a coordinated national response aimed at increasing housing supply and improving affordability outcomes. Central to this effort is the **National Housing Accord** [7], established in 2022, which marks a significant step toward unified national housing policy.

The Accord brings together the Australian Government, state and territory governments, local councils, institutional investors, and the residential construction sector, and sets an aspirational target to deliver 1.2 million new, well-located homes across Australia over the five-year period from June 2024 to June 2029. This target aims to expand housing supply in areas with access to jobs, services, and infrastructure, while also promoting collaboration across all levels of government and the private sector. To support progress toward this goal, National Cabinet endorsed $3.5 billion in Commonwealth funding, allocated to states, territories, and local governments.

However, early forecasts indicate that the national target is unlikely to be met [8]. Current projections estimate that approximately 938,000 dwellings will be completed over the Accord period, falling significantly short of the 1.2 million target by 21.8%, Fig. 2. Scenario analysis suggests that even under optimistic economic conditions, the target will not be achieved. No state or territory is currently forecast to meet the share of the national housing target implied by its population. Furthermore, when accounting for expected demolitions, the net increase in housing supply is projected to be only 825,000 dwellings over the Accord period [9].

This shortfall highlights the scale of the challenge and reinforces the need for more effective planning coordination and targeted investment in infrastructure to support population and housing growth.

Fig. 2. Projected dwelling completions compared to the national target during the National Housing Accord period (2024–2029).

"The right to housing is more than simply a right to shelter. It is a right to have somewhere to live that is adequate"
– Australian Human Rights Commission

Adequate housing includes security, access to essential services, affordability, safety, accessibility for marginalised groups, and respect for cultural identity, while being located near vital resources.

1.2 Melbourne Growth Corridor Plans

Melbourne's population is projected to grow from 5 million in 2024 to surpass 9 million by 2050, as discussed at the M2050 Summit on 9 May 2025 [10]. This growth will place increasing pressure on the city's economy, housing, education, transport, open space, health services, and community infrastructure.

To respond proactively to these anticipated demands, the Victorian Planning Authority has developed the Melbourne Growth Corridor Plan. This is a comprehensive, long-term strategic framework aimed at managing urban expansion in designated areas beyond the current metropolitan boundary [11].

The plan identifies four key growth corridors: the North, West, South East, and North West (also known as the Sunbury Growth Corridor), each strategically selected to accommodate significant future residential and employment growth. Fig. 3 shows the locations of these four growth corridors within Metropolitan Melbourne. These Growth Corridor Plans function as high-level, integrated land use and transport strategies, guiding the coordinated delivery of housing, employment opportunities, transport infrastructure, town centres, and open spaces to support Melbourne's growing population.

Effective strategic planning within these corridors is critical to ensuring that emerging communities are supported by a diverse and affordable housing supply, accessible local employment opportunities, high-quality community services, sustainable and integrated transport networks, a healthy and resilient natural environment, enhanced urban amenity, and a clearly defined sense of local identity.

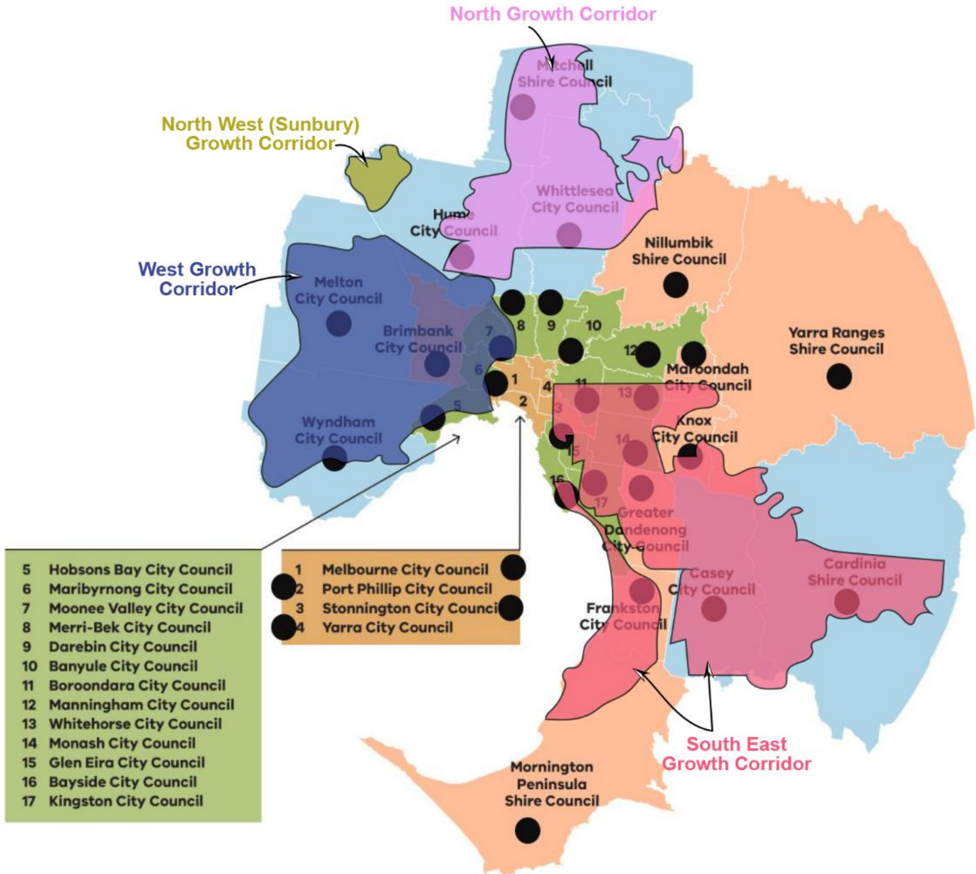


Fig. 3. Map of Metropolitan Melbourne showing the four growth corridors, adapted from [12].

1.3 Project Focus Area – North Growth Corridor

This project focuses on the North Growth Corridor because it is Melbourne's most important international and interstate gateway [11], as illustrated in Fig. 4. This key distinction sets it apart from the West, South East, and North West (Sunbury) growth corridors. It is the only corridor that connects directly to major national and international transport infrastructure, providing it with a unique strategic advantage.

The North Growth Corridor includes Melbourne Airport, which connects Victoria to the rest of Australia and the world, and the Hume Freeway, a vital 840km inter-city highway linking Sydney and Melbourne. It is also the planned site of the Beveridge Interstate Freight Terminal (BIFT), which will serve as a major freight hub, facilitating efficient transfer between road and rail. Additionally, the Inland Rail project, a new 1,600km freight rail line currently under construction, will connect Melbourne to Brisbane via regional Victoria, New South Wales, and Queensland, significantly improving freight movement between Melbourne, Sydney, and Brisbane.

Future transport infrastructure, such as the Outer Metropolitan Ring/E6, a proposed 100km transport corridor, will further enhance connectivity by establishing new road and rail links between Melbourne's north and west. This will improve access for freight transport, workers, and residents.

The North Growth Corridor also includes several new industrial precincts in Mickleham, Wollert, and along Donnybrook Road. These areas are experiencing significant growth and are expected to support employment in advanced manufacturing, logistics, and the emerging knowledge economy.

The North Growth Corridor spans three local government areas (LGAs) and 12 suburbs, as shown in Table 1, providing ample space for both residential development and employment-generating land uses.

Table 1. LGAs and suburbs in the North Growth Corridor.

Local Government Area (LGA)	Suburb
Hume	Gladstone Park
	*Melbourne Airport (Tullamarine)
	Broadmeadows
	Roxburgh Park
	Craigieburn
	Mickleham
Whittlesea	Epping
	South Morang
	Mernda
	Wollert
	Donnybrook
Mitchell Shire	Beveridge

**Includes Melbourne Airport and the wider Tullamarine area*

While the North Growth Corridor already plays a nationally significant role in freight and manufacturing, it is also developing new capabilities in technology and innovation. Its direct access to national and international transport networks, combined with strong industrial and economic potential, makes it an ideal location to support and guide Melbourne's future population and employment growth.

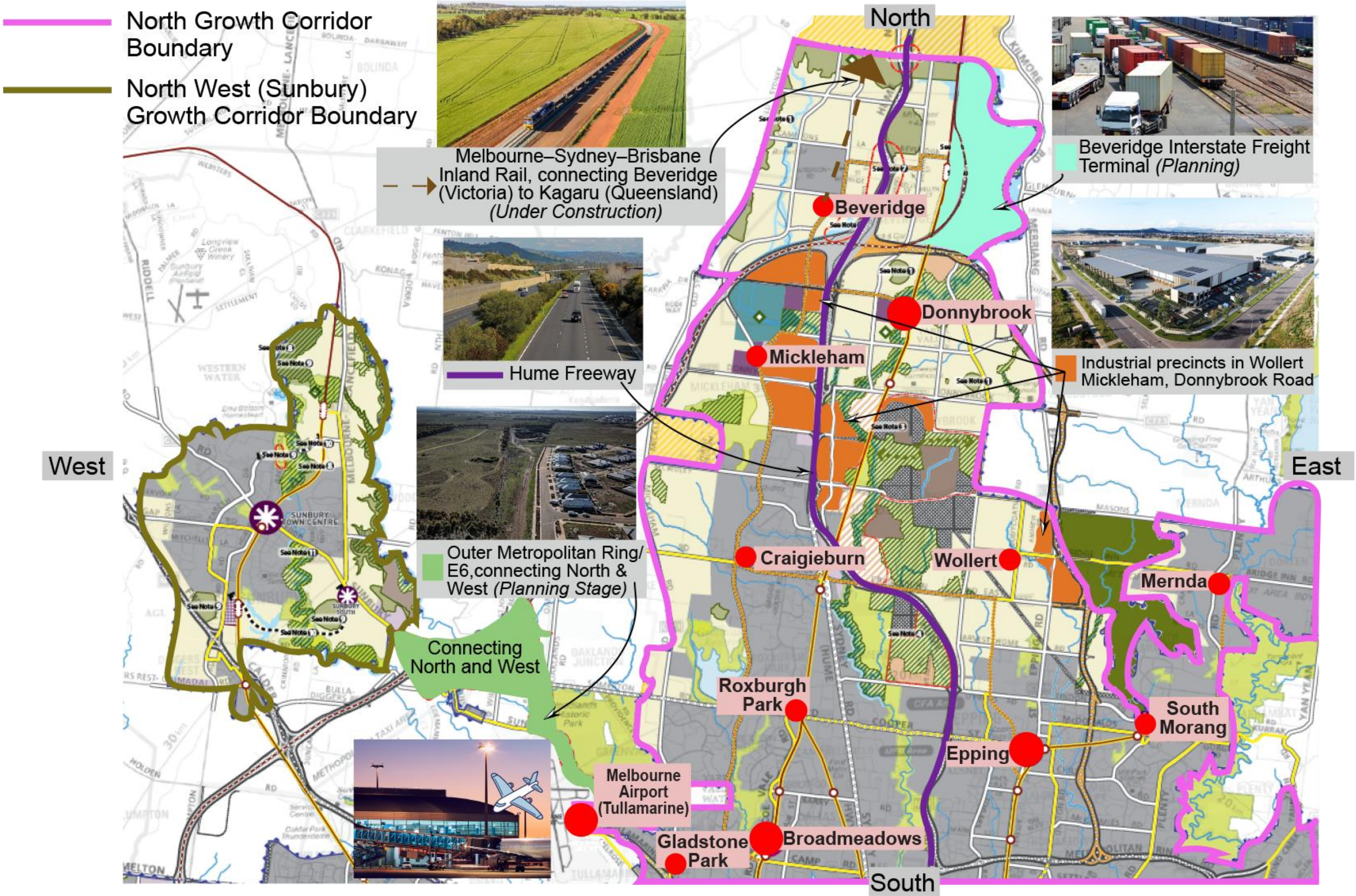


Fig. 4. North Growth Corridor and its key infrastructure, adapted from [11].

1.4 Project Objectives and Structure

Northern Connect provides guidance for planning and delivering transport infrastructure that supports population and housing growth, improves liveability, and aligns with long-term national priorities.

The ultimate research question guiding this project is:

How do population and housing growth projections for the North Growth Corridor align with the capacity of transport infrastructure, and what additional infrastructure and investment are required to support this growth?

To answer this research question, the project is structured around three core objectives:

Objective One: To identify and quantify population and housing growth in the North Growth Corridor through data analysis and spatial mapping, with a focus on highlighting high-priority areas for future housing development.

Objective Two: To develop a comprehensive understanding of the capacity and adequacy of current and planned transport infrastructure, based on projected population and housing growth, using a data-driven approach. This objective is limited to major roads and high-capacity public transport, including rail/train and rapid bus networks.

Objective Three: To develop and apply a methodology for quantifying transport infrastructure gaps and identifying investment priorities, while considering both current and planned transport infrastructure.

The project flow chart is shown in Fig. 5.

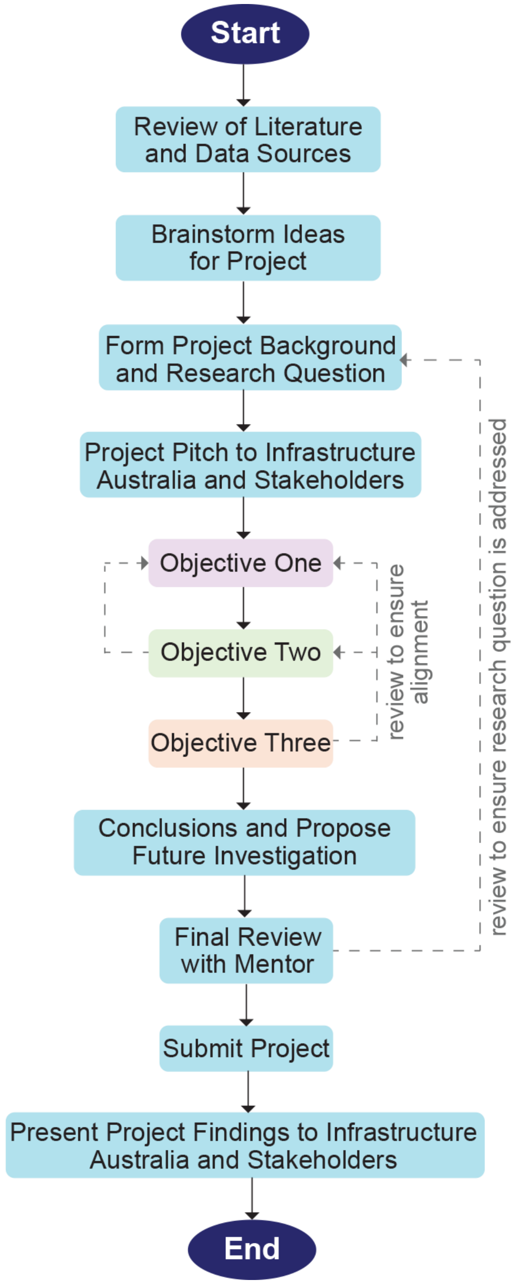
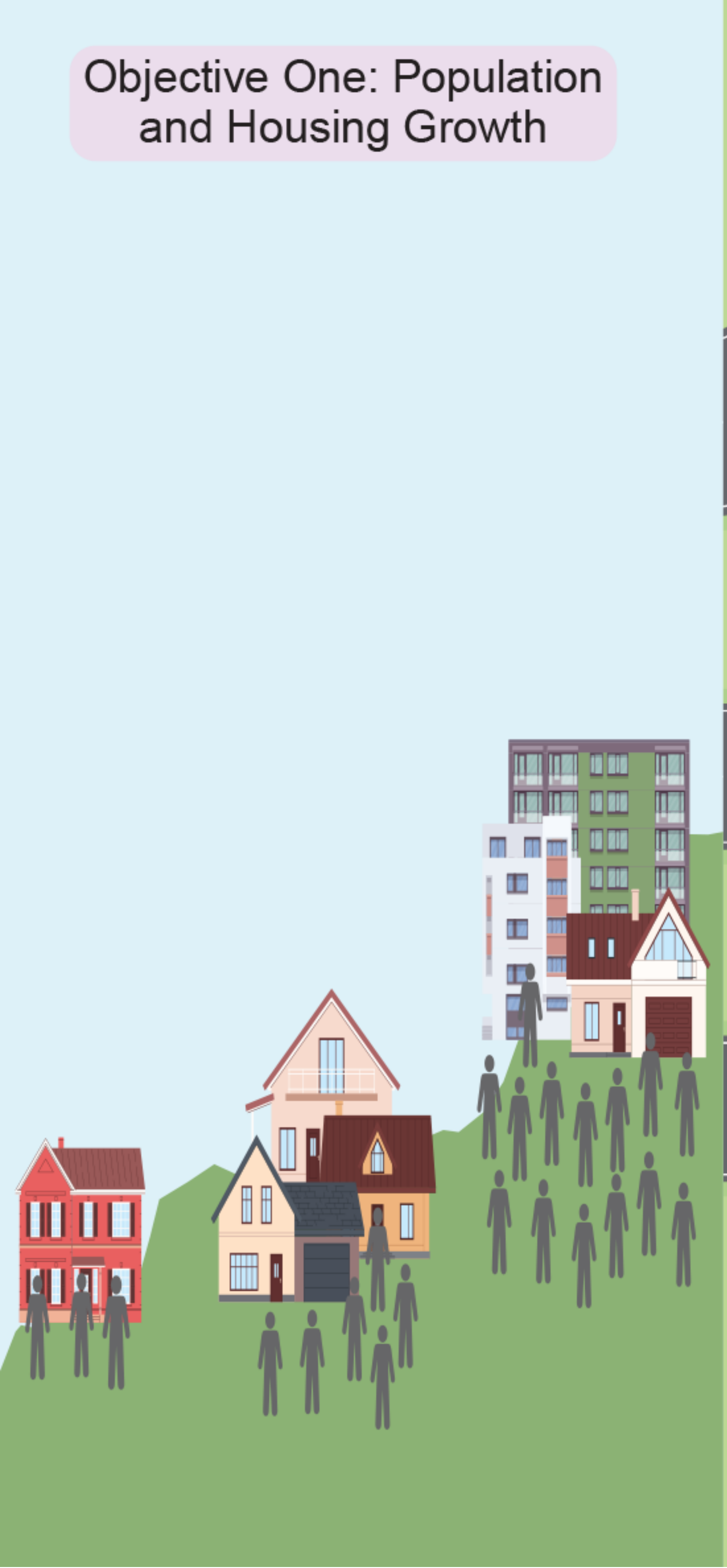
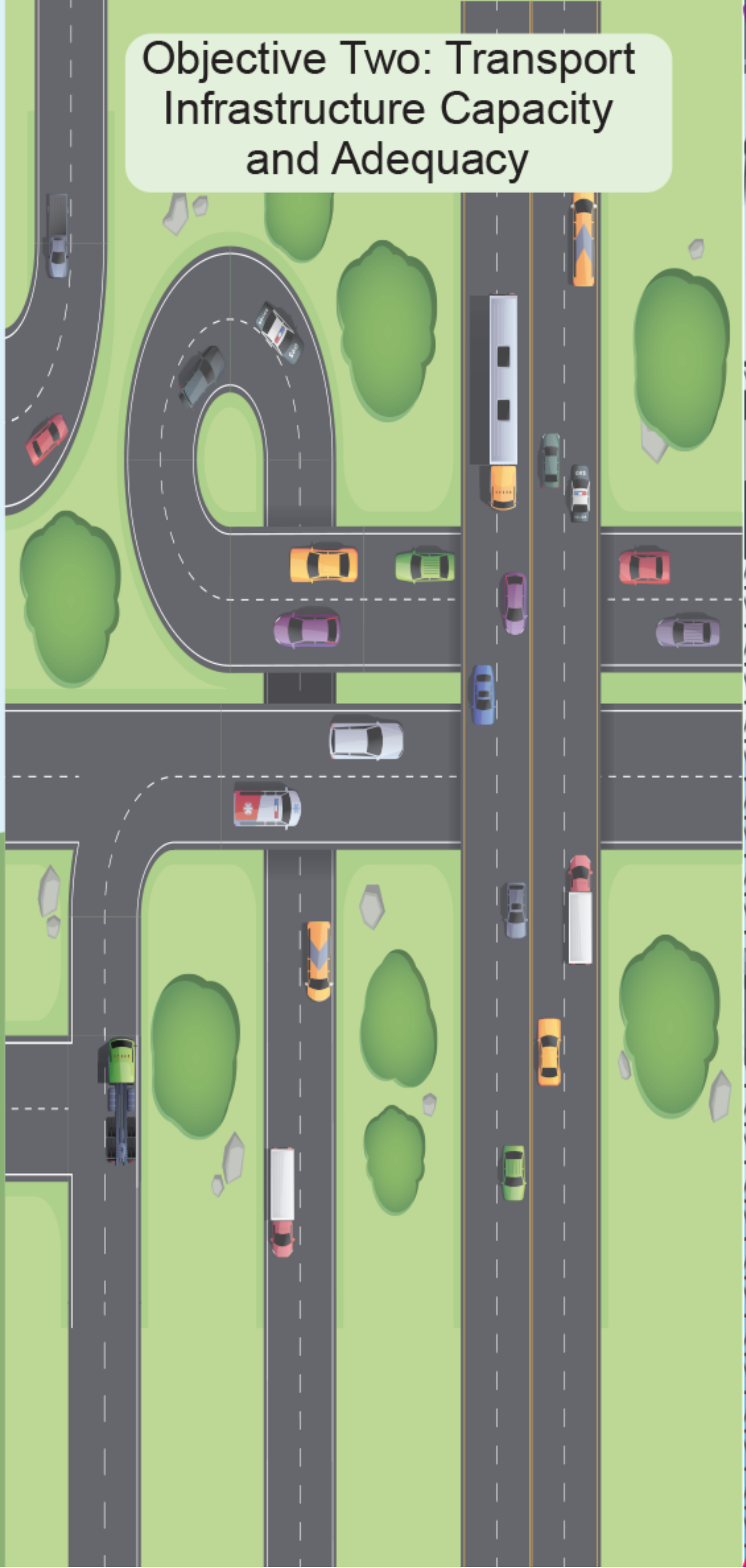


Fig. 5. Project flow chart.


Objective One: Population and Housing Growth


Objective Two: Transport Infrastructure Capacity and Adequacy


Objective Three: Transport Infrastructure Gaps and Investment Priorities

2.0 Objective One: Population and Housing Growth

As an international and interstate gateway, the North Growth Corridor is one of the fastest-growing areas in Melbourne, playing a key role in meeting the city's increasing population and housing demand. Objective One aims to identify where this growth is occurring and to measure the scale of expected increases in population and housing relative to other growth corridors across Melbourne.

To develop the following series of projection graphs, a range of reliable and publicly available data sources have been reviewed and cross-checked for accuracy and consistency. These include data from the National Forecasting Program [13], the Victoria State Government [14], local government areas [15], and the Australian Bureau of Statistics [16].

Projections are published for every 5-year horizon, from 2021 through to 2046, except for population growth projections by age group, for which data is only available up to 2036.

For population projections, values for the 2021 base year are derived from the estimated resident population for 30 June 2021, as provided by the Australian Bureau of Statistics. These values differ from, and are typically higher than, Census counts, as they account for populations missed by the Census and those overseas on Census night. As a result, the estimated resident population is generally considered a more accurate measure of population size than Census counts. For dwelling and household projections, values for the 2021 base year are based on the results of the 2021 Census.

All future-year values for population, dwelling, and household are projected based on the 2021 base year using the cohort-component model [17] for population and the propensity method [18] for dwelling and household, as described by the Australian Bureau of Statistics [19, 20]. In some instances, published data may be from a different year; in such cases, estimates are derived through interpolation.

These projections are also driven by the following demographic and migration-related assumptions:

Fertility: The total fertility rate in Victoria is assumed to remain around 1.5, representing the average number of children a Victorian woman would have over her lifetime.

Mortality: Life expectancy in Victoria is projected to continue increasing, supported by advances in healthcare and reductions in premature deaths. By 2056, it is expected to reach 86 years for males and 89 years for females.

Overseas Migration: Victoria attracts significant numbers of overseas migrants. From 2026 onwards, net overseas migration to Victoria is projected to remain between 82,000 and 84,000 people annually.

Interstate Migration: Patterns of interstate migration have varied over time, with Victoria experiencing both net gains and net losses of interstate migrants. Net interstate migration is assumed to be positive from 2023 to 2024, reaching a steady net gain of 5,100 people per year from 2027 to 2028 through to the end of the projection period.

Impact during COVID: Although COVID-related deaths and changes in migration patterns were significant during the pandemic, they are assumed to be insufficient to substantially alter the long-term population trends.


2021
2046

2.1 Population Growth Projections by Local Government Area

Fig. 6 presents the population growth projections by LGA, comparing growth across different growth corridors up to 2046. See Table A.1 in Appendix for complete dataset. Note the following when interpreting Fig. 6:

(1) Sunbury, though located within the City of Hume, is part of the North West Growth Corridor; as such, its population projection is subtracted from the total for Hume.
(2) Some LGAs include suburbs outside the designated growth corridors (e.g., Bundoora is part of the City of Whittlesea but not in the North Growth Corridor). As a result, the data may not fully reflect the total growth within the corridor, but it provides an idea of overall growth patterns.
(3) Certain LGAs within the South East Growth Corridor are excluded due to the unavailability of data.

To calculate the average annual population growth, AAPG (%), shown in Fig. 6, the annual population change, r_i (%), for each consecutive 5-year period, i, (e.g., 2021-2026, 2026-2031, 2031-2036, etc.) is first calculated using Eq. (1):

$$r_i\ (\%) = \frac{\left[\frac{Population_{end} - Population_{\ start}}{Population_{\ start}}\right] x100}{5} \qquad \text{Eq. (1)}$$

Then, AAPG (%) is calculated as the average of all r_i values using Eq. (2):

$$AAPG\ (\%) = \frac{1}{n}\sum_{i=1}^{n} r_i \qquad \text{Eq. (2)}$$

Where n is the number of 5-year periods (e.g., from 2021 to 2046, n = 5).

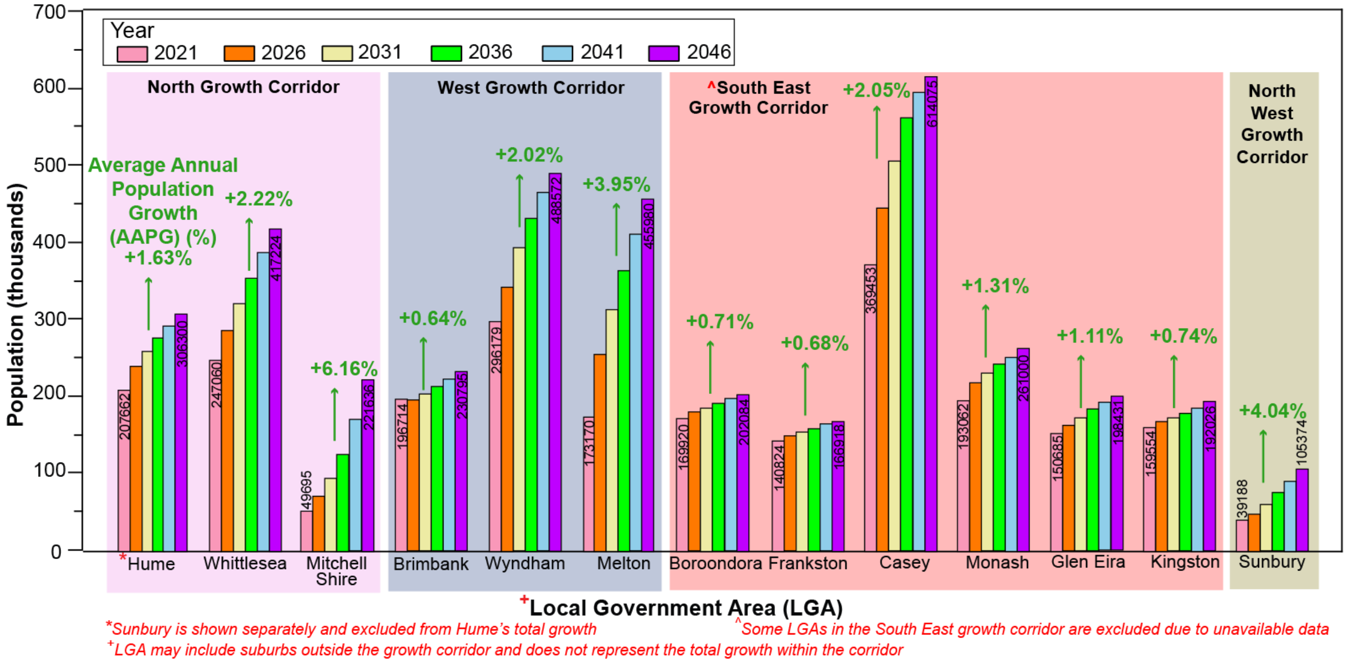


Fig. 6. Population growth projections by LGA, reanalysed from [13-16].

This method captures changes in population over time and provides a more accurate measure than calculating a single average over the entire period from 2021 to 2046.

It is observed that although Hume, Whittlesea, and Mitchell Shire do not have populations as large as Casey (projected to reach ~600K by 2046), they exhibit comparatively higher AAPG than most LGAs in the West and South East Growth Corridors: 1.63% in Hume, 2.22% in Whittlesea, with 6.16% in Mitchell Shire being the highest among all LGAs analysed. This suggests that, despite their relatively smaller populations, Hume, Whittlesea, and Mitchell Shire are expanding rapidly in proportion to their size and may require proactive planning to manage this growth. These observations align with broader trends indicating that the North Growth Corridor is emerging as a major focus area for future population and housing development, with Sunbury, despite its small population, also experiencing rapid growth, recording an AAPG of 4.04%.

2.2 Population Growth Projections by Suburb

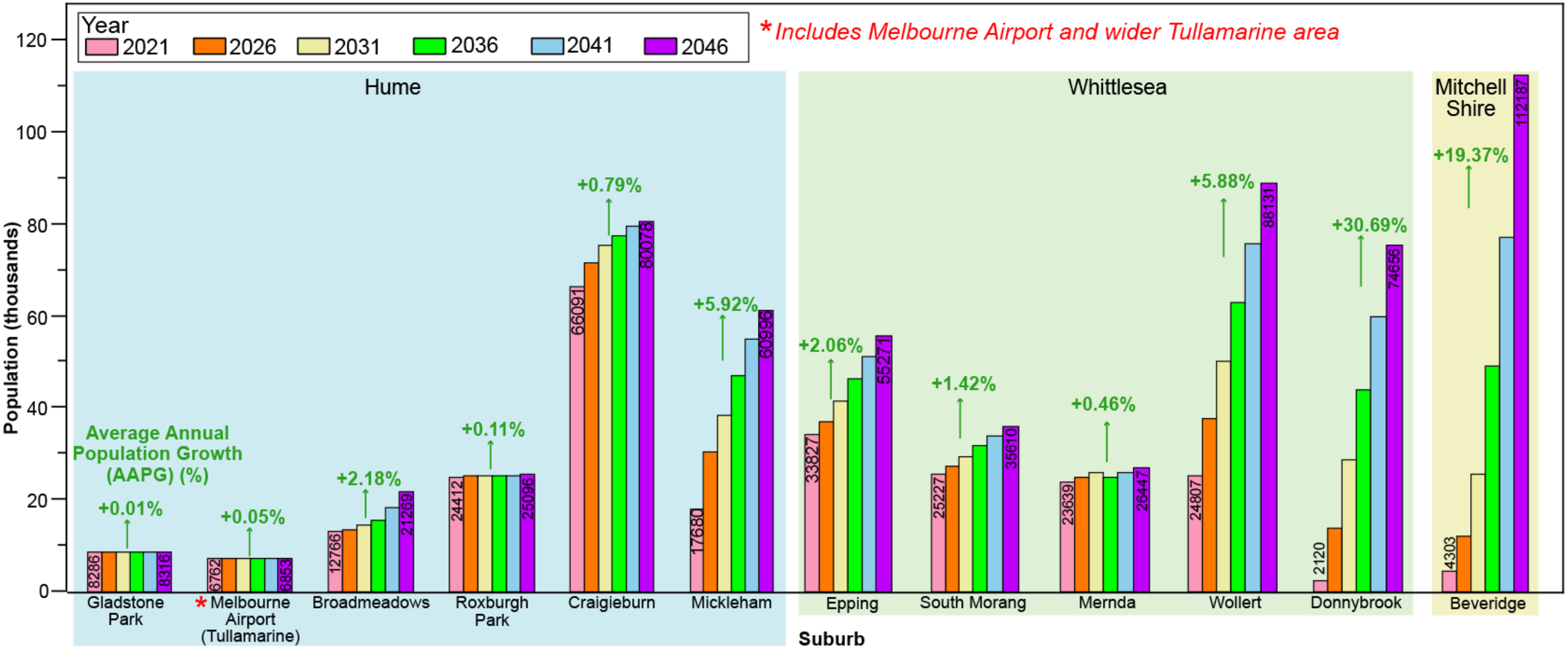


Fig. 7. Population growth projections by suburb, reanalysed from [13-15]. See Table A.2 in the Appendix for complete dataset.

Fig. 7 presents suburb-level projections to provide a better understanding of population growth within the North Growth Corridor. Donnybrook has the highest AAPG among all suburbs in the North Growth Corridor, at 30.69%, followed by Beveridge (19.37%), Mickleham (5.92%), and Wollert (5.88%). Between 2021 and 2046, the population of Donnybrook is forecast to increase by 72,536 people, accounting for ~21% of the total projected population growth in the North Growth Corridor. In comparison, Beveridge is expected to grow by 107,884 people over the same period, representing ~31% of the corridor's total population increase by 2046. These statistics highlight the development pressure emerging in specific suburbs, particularly Donnybrook and Beveridge, which are transitioning from relatively undeveloped areas into major population centres. Such rapid growth underscores the need for coordinated infrastructure planning and timely service provision to support these expanding communities.

Fig. 8 presents a colour-coded map of population growth projections (in number of persons) from 2021 to 2046. The map illustrates both the scale of growth in each suburb and the variation in growth patterns across the North Growth Corridor. Notably, growth is concentrated in the northern part of the corridor, with Beveridge experiencing the highest population increase, followed by Donnybrook, Wollert, and Mickleham. The population growth hotspot is enclosed within the dashed line on the map, highlighting areas expected to accommodate the largest increases in residents.

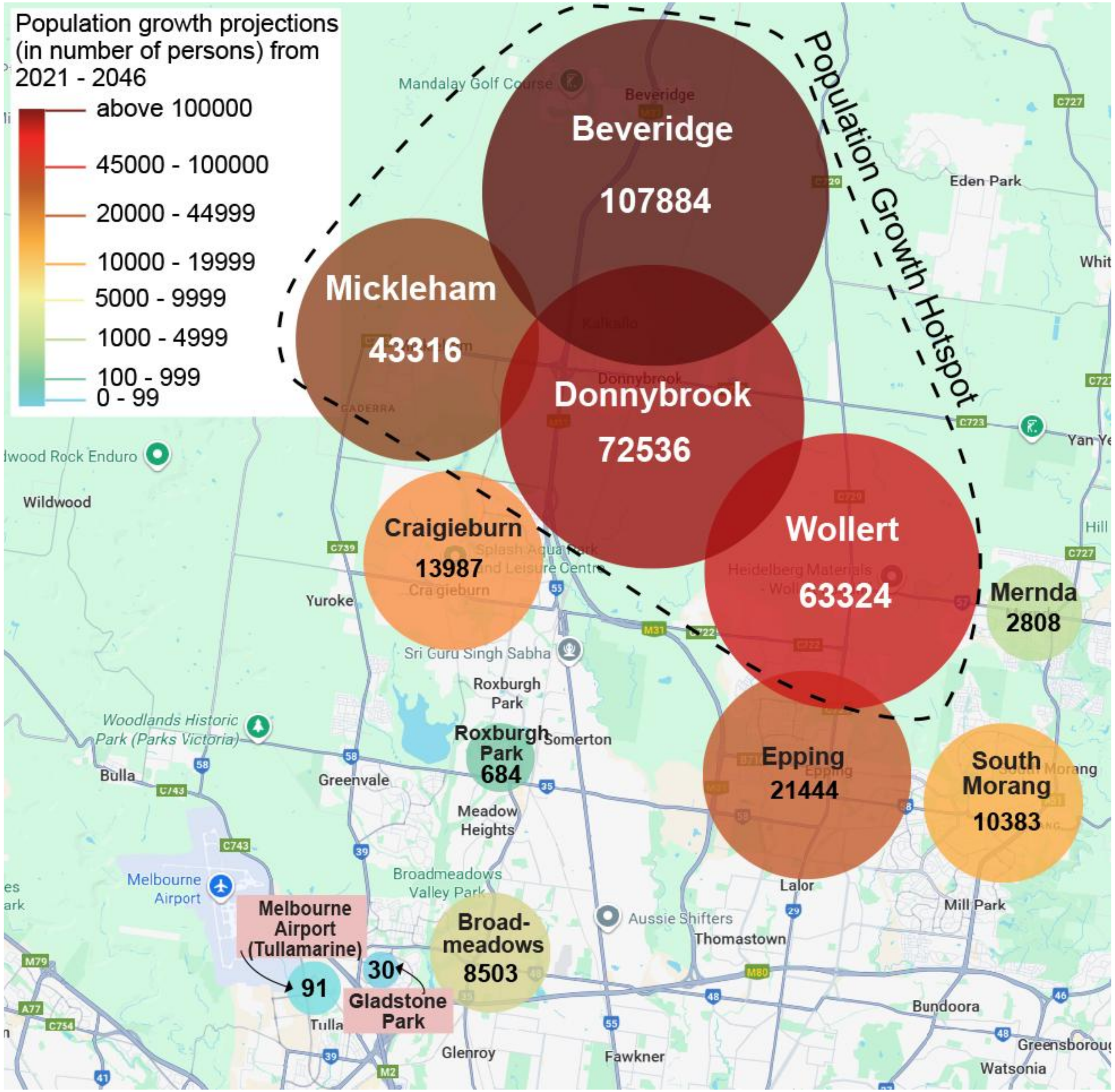


Fig. 8. Population growth patterns (in number of persons) in the North Growth Corridor from 2021 to 2046.

2.3 Population Growth Projections by Age Group

Fig. 9 shows the projected age structure of the population in the North Growth Corridor from 2021 to 2036. The population is categorised into three age groups to highlight differing infrastructure and service needs:

Age group 5 to 24 years (school-aged/ university students): Mickleham is projected to experience the most significant growth, increasing from 6,120 people in 2021 to 20,949 in 2036, a total increase of 14,829 people. This is followed by Beveridge, projected to grow from 1,307 to 14,496, a total increase of 13,189 people.

Age group 25 to 69 years (working-age adults): Beveridge records the largest projected growth, rising from 2,524 people in 2021 to 31,464 in 2036, an increase of 28,940 people. Donnybrook follows closely, increasing from 1,979 to 24,621, an increase of 22,642 people.

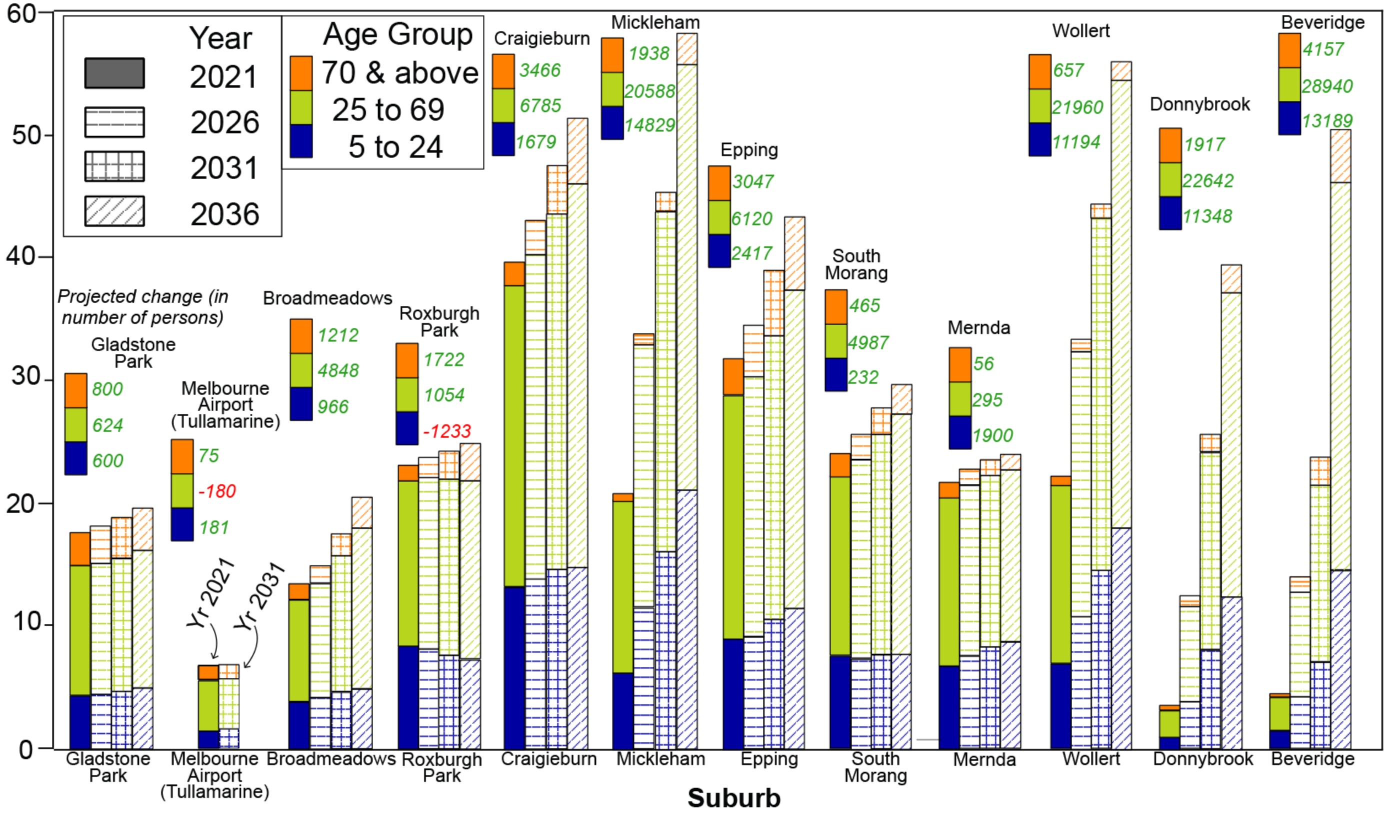


Fig. 9. Population growth projections by age group, reanalysed from [13-16]. See Table A.3 in the Appendix for the complete dataset.

Age group 70 years and above (older adults and retirees): Beveridge again shows the most substantial growth, with an increase from 73 people in 2021 to 4,230 in 2036, a rise of 4,157 people.

Beveridge, Donnybrook, Mickleham and Wollert show strong growth across all age groups, highlighting the need for targeted infrastructure planning in these suburbs to meet varying age-specific needs. For example, growth in **school-aged/university students**, who often rely on public transport, will require investment in frequent, reliable services, including bus routes and connections to education hubs.

The growing **working-age population**, who mostly commute by car, requires expanded road capacity and upgraded arterial connections to accommodate increased traffic volumes and improve access to employment hubs. Express bus services and future rail extensions should also be considered to reduce congestion and offer travel alternatives. Meanwhile, rapid growth of the **ageing population** increases demand for age-friendly transport infrastructure, including accessible bus stops, low-floor vehicles, and transport services that support access to social, recreational, and community activities, helping to maintain mobility and social inclusion for older residents.

2.4 Housing Growth Projections by Local Government Area

Fig. 10 shows two important datasets used to assess future housing capacity across different growth corridors to 2046.

Dwelling growth projections: The first dataset (coloured bars) shows the projected number of new dwellings to be built. Dwellings in this report refer to permanent structural residences, such as houses, flats, and townhouses, but exclude temporary dwellings (e.g., tents, caravans) and non-private dwellings (e.g., hotels, hospitals). These projections are derived from population forecasts and historical trends in dwelling construction.

Using the same approach as the AAPG calculation, the average annual dwelling growth, AADG (%), is calculated by first determining the annual % change in dwellings for each five-year period (e.g., 2021–2026, 2026–2031, and so on), and then taking the average of those values.

Comparing AADG with AAPG in Table 2 provides insight into whether housing supply is sufficient to meet the growth in population. If AADG is lower than AAPG, it suggests that dwellings are being delivered more slowly than population growth, potentially leading to housing shortages. Conversely, if AADG consistently exceeds AAPG over time, it may indicate an oversupply of housing, resulting in underutilisation.

Household growth projections: The second dataset (grey bars) shows the projected number of occupied dwellings. These projections are derived from population forecasts and changes in living arrangements, such as average household size (for example, if the average household size decreases, the number of households will increase).

Besides AAPG and AADG, average occupancy rate, AOR (%) is another key metric. It refers to the proportion of total dwellings that are expected to be occupied, helping to distinguish between the total dwelling stock and the number of dwellings in active use. AOR is calculated using Eq. (3):

$$AOR\ (\%) = \frac{1}{n}\sum_{i=1}^{n}\left(\frac{Households_i}{Dwellings_i}x100\right) \quad \text{Eq. (3)}$$

Where n = 6 representing the base year (2021) and five projection years: 2026, 2031, 2036, 2041, and 2046. $Households_i$ is the projected number of occupied dwellings (households) in year i, and $Dwellings_i$ is the projected total number of occupied and unoccupied dwellings in year i.

Table 2. Comparison of AAPG and AADG by local government area.

Local Government Area	Average Annual Population Growth, AAPG (%)	Average Annual Dwelling Growth, AADG (%)
North Growth Corridor		
*Hume	1.63	1.74
Whittlesea	2.22	2.43
Mitchell Shire	6.16	6.12
West Growth Corridor		
Brimbank	0.64	0.93
Wyndham	2.02	2.37
Melton	3.95	4.36
South East Growth Corridor		
Boroondara	0.71	0.71
Frankston	0.68	0.83
Casey	2.05	2.14
Monash	1.31	0.98
Glen Eira	1.11	1.03
Kingston	0.74	0.79
North West Growth Corridor		
Sunbury	4.04	4.46

**(Hume=Hume Total-Sunbury)*

From Table 2, it is observed that Mitchell Shire, Monash, and Glen Eira have higher AAPG than AADG. This indicates that population growth in these LGAs is outpacing the delivery of new dwellings, which may lead to increased pressure on the existing housing stock, reduced housing availability, and potential upward pressure on housing prices if the supply gap continues.

From Fig. 10, it is observed that Frankston and Casey, located in the South East Growth Corridor, have the highest AOR, both above 97%, indicating strong resident retention and potentially high liveability in these LGAs. In contrast, Hume, Whittlesea, and Mitchell Shire in the North Growth Corridor show lower AOR, below 94%, which are comparatively lower than most LGAs in other growth corridors.

The weak resident retention may be attributed to the rapid pace of development in the North Growth Corridor, where infrastructure and services may not yet fully support the growing population.

As the North Growth Corridor continues to evolve, improving access to essential amenities, transport networks, and employment hubs will be critical to attracting residents and boosting occupancy rates. Monitoring AOR alongside population growth rate (AAPG) and dwelling growth rate (AADG) can help identify where investment is needed to convert housing supply into actively occupied homes.

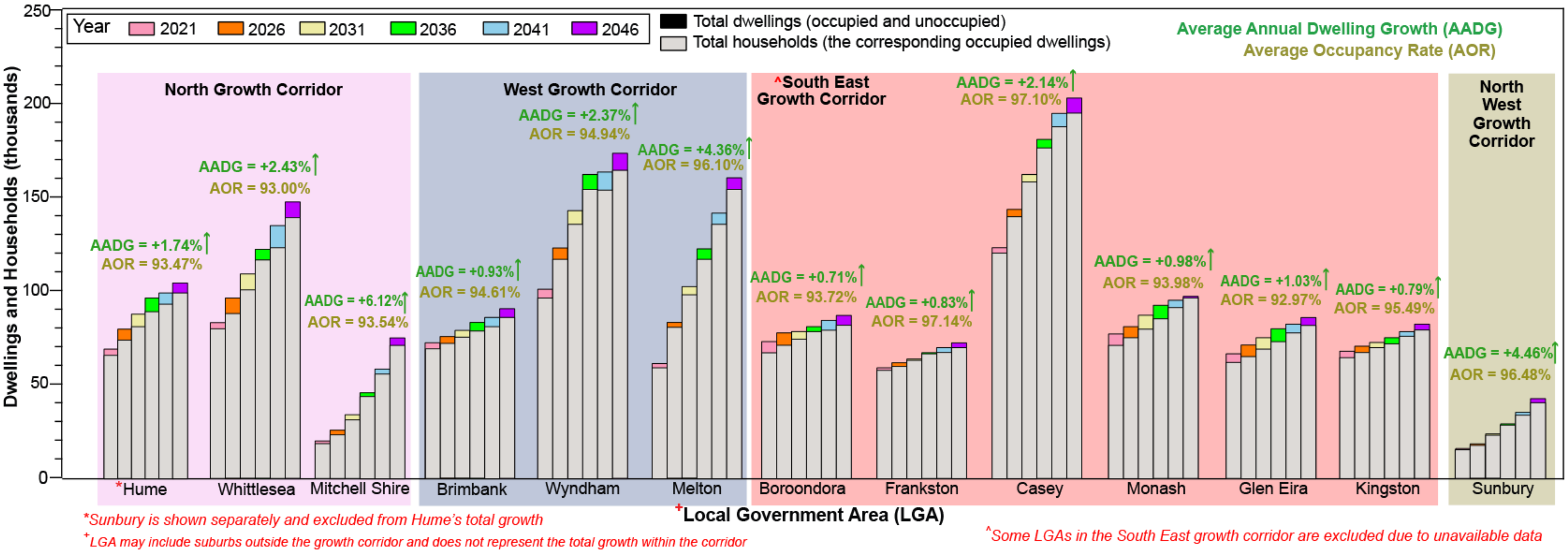


Fig. 10. Dwelling and household growth projections by LGA, reanalysed from [13-16]. Refer to Table A.4 in the Appendix for the complete dataset.

2.5 Housing Growth Projections by Suburb

Fig. 11 shows the projected dwelling and household growth by suburb, alongside the AADG and AOR. Three key findings emerge:

(1) Beveridge records the highest AADG at 20.42%, followed closely by Donnybrook (20.23%), Wollert (6.13%), and Mickleham (5.82%). These trends align with the patterns observed in Fig. 8, where these suburbs are situated within the identified population growth hotspot. This correlation supports the rationale for their elevated dwelling growth rates.

(2) Beveridge, Donnybrook, Wollert and Mickleham exhibit slightly lower resident retention, as reflected by their AOR, ranging between 92% and 94%. In comparison, other suburbs within the North Growth Corridor demonstrate higher AOR, ranging from 94% to 97%, with the exception of Melbourne Airport (Tullamarine), which has an AOR of 93%.

(3) A comparison of AAPG and AADG in Table 3 reveals that both Mickleham and Donnybrook have an AADG lower than their respective AAPG, indicating that the rate of housing supply is insufficient to meet the pace of population growth. The discrepancy is particularly significant in Donnybrook, where the AADG (20.23%) is approximately 10% lower than the AAPG (30.69%). This may result in increased housing demand pressure in the short to medium term.

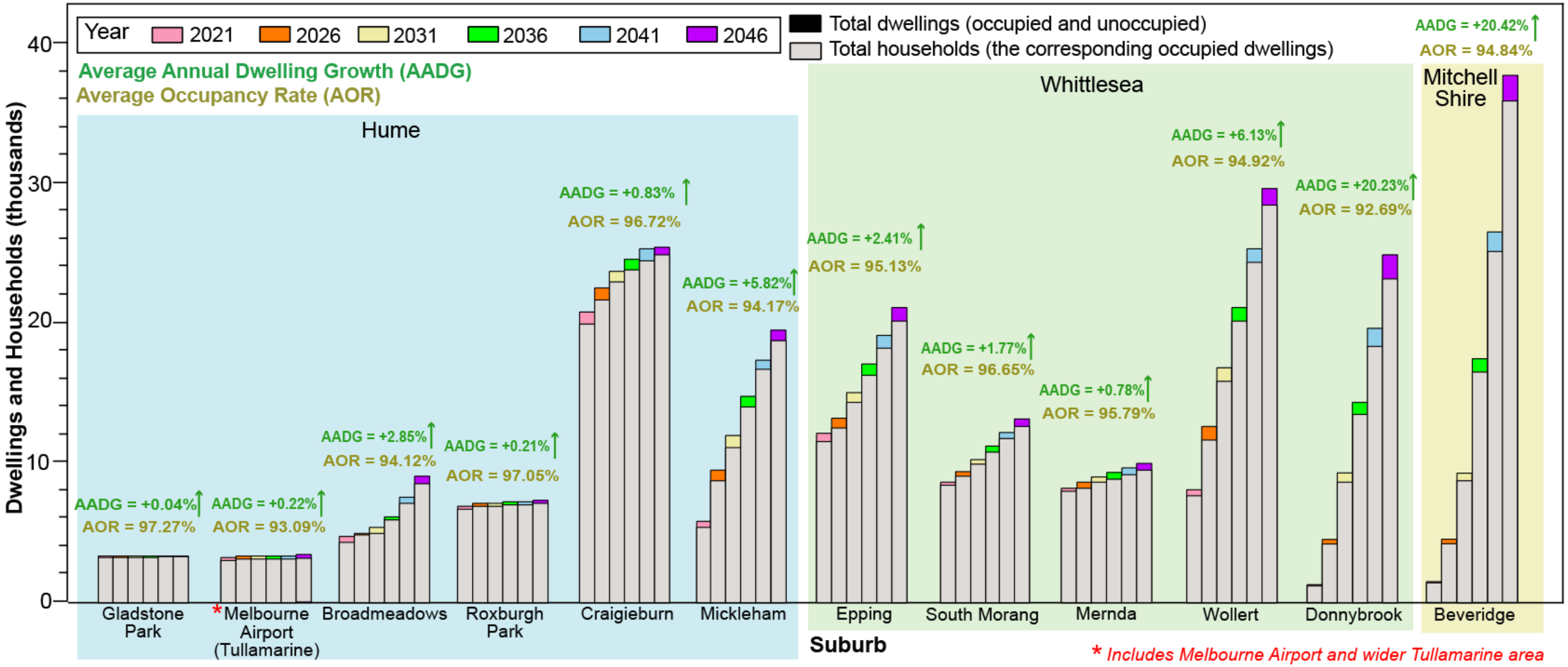


Fig. 11. Dwelling and household growth projections by suburb, reanalysed from [13-15]. Refer to Table A.5 in the Appendix for the complete dataset.

Table 3. Comparison of AAPG and AADG by suburb.

Suburb	Average Annual Population Growth, AAPG (%)	Average Annual Dwelling Growth, AADG (%)
Hume		
Gladstone Park	0.01	0.04
*Melbourne Airport (Tullamarine)	0.05	0.22
Broadmeadows	2.18	2.85
Roxburgh Park	0.11	0.21
Craigieburn	0.79	0.83
Mickleham	5.92	5.82
Whittlesea		
Epping	2.06	2.41
South Morang	1.42	1.77
Mernda	0.46	0.78
Wollert	5.88	6.13
Donnybrook	30.69	20.23
Mitchell Shire		
Beveridge	19.37	20.42

**Includes Melbourne Airport and wider Tullamarine area*

Fig. 12 illustrates the housing growth patterns (in number of new dwellings) in the North Growth Corridor by 2046. The dwelling growth hotspot closely aligns with the population growth hotspot in Fig. 8, suggesting that areas with the most significant population increases are also seeing the largest housing supply expansions.

Beveridge is projected to add the largest number of new dwellings by 2046, with a total of 36,268, followed by Donnybrook (23,598), Wollert (21,590), and Mickleham (13,704). These rapidly growing suburbs may place additional pressure on local infrastructure, particularly in the early stages of development, if infrastructure investments do not keep pace with the rapid housing expansion.

Note that Melbourne Airport (Tullamarine) has a significantly higher AADG of 0.22% compared to its AAPG of only 0.05%, with a projected increase of 175 new dwellings, while only 91 additional persons are expected by 2046 (compare with Fig. 8). This disparity suggests that the area may be experiencing an oversupply of housing relative to population growth.

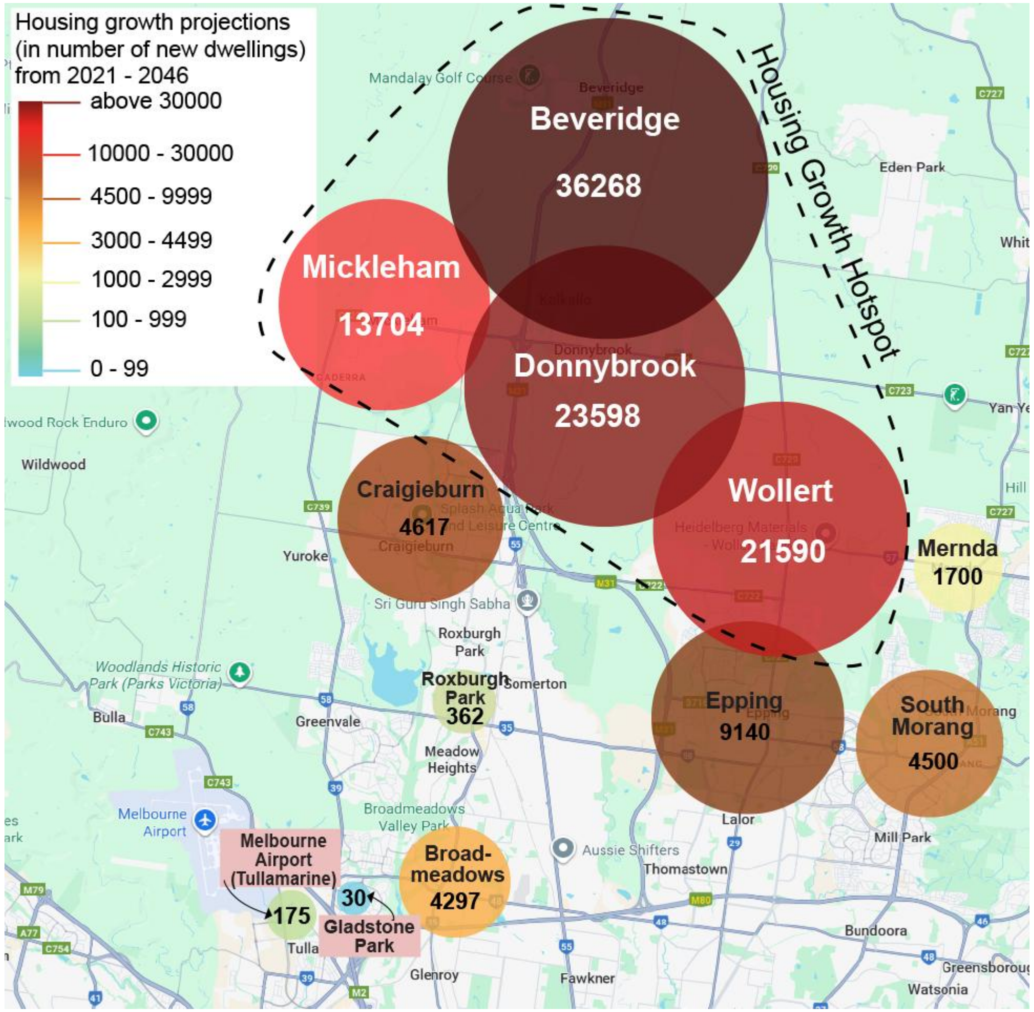


Fig. 12. Housing growth patterns (in number of new dwellings) in the North Growth Corridor from 2021 to 2046.

2.6 Suburb Prioritisation using Weighted Rank Method

To identify high-priority, high-growth locations requiring infrastructure planning, a weighted rank method, shown in Table 4, is used to assess and prioritise 12 suburbs in the North Growth Corridor. These suburbs are ranked from 1 (highest priority) to 12 (lowest priority), based on their performance across three quantifiable metrics:

Average Annual Population Growth (AAPG): Measures the annual rate of population growth in each suburb.

Average Annual Dwelling Growth (AADG): Measures the annual rate at which new dwellings are added.

Average Occupancy Rate (AOR): Measures the proportion of occupied dwellings, indicating the likelihood of resident retention.

Given the project's primary focus is to enable transport infrastructure that supports housing growth and mitigates Australia's housing crisis, AADG is assigned the highest weighting of 40% (0.4), as it directly measures the rate of housing expansion. AAPG and AOR are each assigned a weighting of 30% (0.3), reflecting their equal importance in understanding population growth and residential stability.

For both AAPG and AADG, suburbs are ranked in descending order, with rank 1 assigned to the suburb with the highest growth rate. For example, Donnybrook, which has the highest AAPG at 30.69%, receives rank 1. It ranks second in AADG, receiving rank 2. A higher growth rate signifies a greater need for infrastructure support, and hence a higher priority.

For AOR, suburbs are ranked in ascending order, with rank 1 assigned to the suburb with the lowest occupancy rate. A lower AOR indicates a higher likelihood of residents moving out, suggesting lower retention rates and a need for improved infrastructure planning, and hence a higher priority.

The total weighted score, T, for each suburb is calculated by combining the individual metric ranks according to their respective weightings, using Eq. (4):

$$T = (R_{AAPG} \: X \: w_{AAPG}) + (R_{AADG} \: X \: w_{AADG}) + (R_{AOR} \: X \: w_{AOR}) \qquad \text{Eq. (4)}$$

Where R is rank and w is weight. The suburb with the lowest total weighted score, T, is identified as the highest priority location for infrastructure planning to support housing growth.

Table 4. Weighted rank method for identifying high-priority locations for infrastructure planning.

	Metric						Total Weighted Score, T	Rank (1=highest priority, 12=lowest priority)
Weight	$w_{AAPG} = 0.3$		$w_{AADG} = 0.4$		$w_{AOR} = 0.3$			
Suburb	Average Annual Population Growth, AAPG (%), values taken from Fig. 7	Rank, R_{AAPG}	Average Annual Dwelling Growth, AADG (%), values taken from Fig. 11	Rank, R_{AADG}	Average Occupancy Rate, AOR (%), values taken from Fig. 11	Rank, R_{AOR}		
Gladstone Park	0.01	12	0.04	12	97.27	12	12	12
*Melbourne Airport (Tullamarine)	0.05	11	0.22	10	93.09	2	7.9	8
Broadmeadows	2.18	5	2.85	5	94.12	3	4.4	5
Roxburgh Park	0.11	10	0.21	11	97.05	11	10.7	11
Craigieburn	0.79	8	0.83	8	96.72	10	8.6	9
Mickleham	5.92	3	5.82	4	94.17	4	3.7	3
Epping	2.06	6	2.41	6	95.13	7	6.3	6
South Morang	1.42	7	1.77	7	96.65	9	7.6	7
Mernda	0.46	9	0.78	9	95.79	8	8.7	10
Wollert	5.88	4	6.13	3	94.92	6	4.2	4
Donnybrook	30.69	1	20.23	2	92.69	1	1.4	1
Beveridge	19.37	2	20.42	1	94.84	5	2.5	2

**Includes Melbourne Airport and the wider Tullamarine area*

From Table 4, the order of priority, from highest to lowest, is as follows: Donnybrook, Beveridge, Mickleham, Wollert, Broadmeadows, Epping, South Morang, Melbourne Airport (Tullamarine), Craigieburn, Mernda, Roxburgh Park, and Gladstone Park.

The focus of Objective Two will be on assessing the capacity and adequacy of current and planned transport infrastructure in the North Growth Corridor, with particular attention to the top four high-priority suburbs, Donnybrook, Beveridge, Mickleham, and Wollert, which are situated within the identified high-growth hotspot in Figs. 8 and 12.

Objective One: Reflection

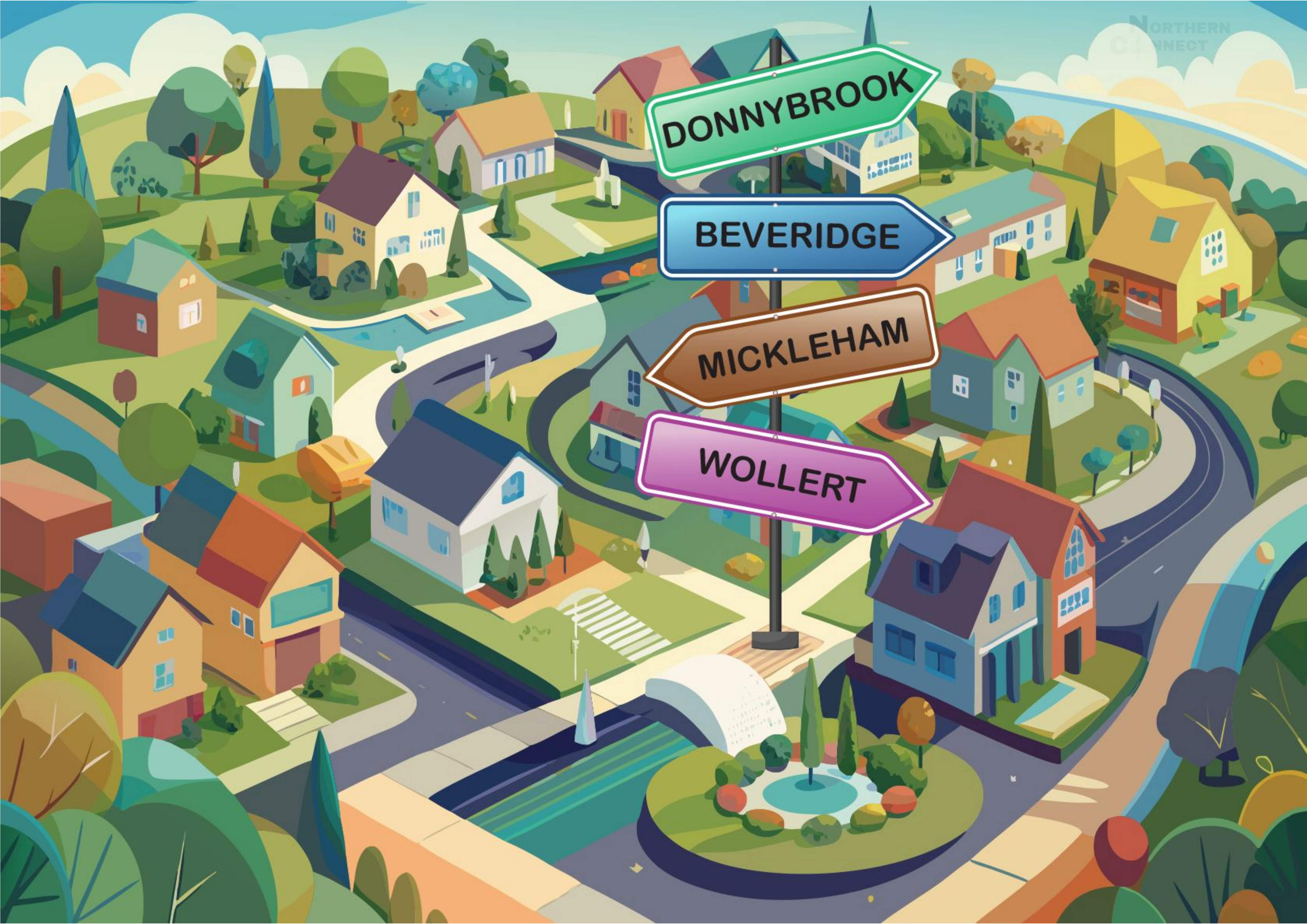
Population and Housing Growth Projections: The population and housing growth projections have been analysed at both the LGA and suburb levels. The data utilised are sourced from four key datasets [13-16]. These projections offer valuable insights into areas poised for significant growth, enabling targeted investment in high-growth hotspots such as Donnybrook, Beveridge, Mickleham, and Wollert.

Data Gaps and Limitations: While the available data on population growth and housing supply provide a solid foundation for assessing housing needs, several key gaps and limitations remain. Firstly, these projections are all based on a 2021 base year, forecasting future trends without accounting for more recent developments. Secondly, in some instances, data collected across different LGAs are inconsistently formatted or use varying projection years, and estimates are derived through interpolation. This variability could affect the accuracy and reliability of the projections.

Future Data Improvements: To improve the accuracy of housing growth assessments, incorporating real-time data on housing transactions and construction activity is crucial. Housing transaction data, such as recent sales volume, median rent, and sale prices, would provide valuable insights into market activity and housing affordability. This is essential for understanding the challenges faced by potential buyers and renters, particularly younger generations entering the housing market for the first time. Real-time data on construction activity, such as new building starts and completions, would shed light on the pace of housing supply expansion. Additionally, data on housing stock, including the total available housing supply and rental vacancy rates, would offer a clearer and more timely picture of market dynamics and housing availability. These data are all critical for tracking shifts in demand, but they are not included in the current report.

Another important consideration is the accessibility of population and housing data. While these data are available, they are often difficult to access and siloed across different council reports or private sector sources. Improving the accessibility and transparency of these data, for example through a centralised database or standardised reporting format, such as adopting consistent projection years, would make it easier for stakeholders to conduct more comprehensive analyses.

Addressing these gaps, particularly in terms of data accuracy, timeliness, and accessibility, would significantly enhance the ability to forecast population and housing growth more reliably and inform more effective policy decisions in the future.


DONNYBROOK
BEVERIDGE
MICKLEHAM
WOLLERT

3.0 Objective Two: Transport Infrastructure Capacity and Adequacy

The North Growth Corridor encompasses an area located approximately 20 to 60 kilometres north of Melbourne Central Business District (CBD). This corridor has been identified as an international and interstate gateway and is expected to accommodate substantial population and housing growth over the coming decades. As shown in Objective One, the population within the corridor is projected to grow from approximately 249,920 people in 2021 to 594,910 people by 2046, representing an increase of approximately 138%. Similarly, housing stock is projected to grow from 83,316 dwellings in 2021 to 203,297 dwellings by 2046, an increase of approximately 144% over the 25-year period.

This rapid population and housing growth is placing increasing pressure on the region's existing transport infrastructure. The road network servicing the corridor is primarily anchored by the Hume Freeway (M31), supported by a limited number of arterial roads. Public transport access remains constrained, with the Seymour V/Line service functioning as the primary rail connection for residents in high-growth hotspots such as Beveridge, Mickleham, and Donnybrook. As these suburbs undergo accelerated residential development, increasing numbers of residents are now heavily reliant on the regional rail network, which was not originally designed to accommodate metropolitan commuting patterns at such intensity.

In the more established parts of the corridor, such as Craigieburn, Broadmeadows, South Morang and Mernda, residents benefit from access to Metro train lines that offer more frequent services, as well as rapid bus networks that provide essential connections between residential areas, local activity centres, and transport interchanges. However, capacity constraints, service frequency, and network connectivity remain key challenges, particularly during peak travel periods, and may not be able to accommodate the corridor's anticipated growth if left unaddressed.

As population and housing density continue to increase within the corridor, the demand for reliable, high-capacity transport options will intensify. To ensure timely investment and informed planning decisions, Objective Two aims to assess the capacity and adequacy of existing and planned transport infrastructure within the North Growth Corridor, using a data-driven approach by examining three types of evidence:

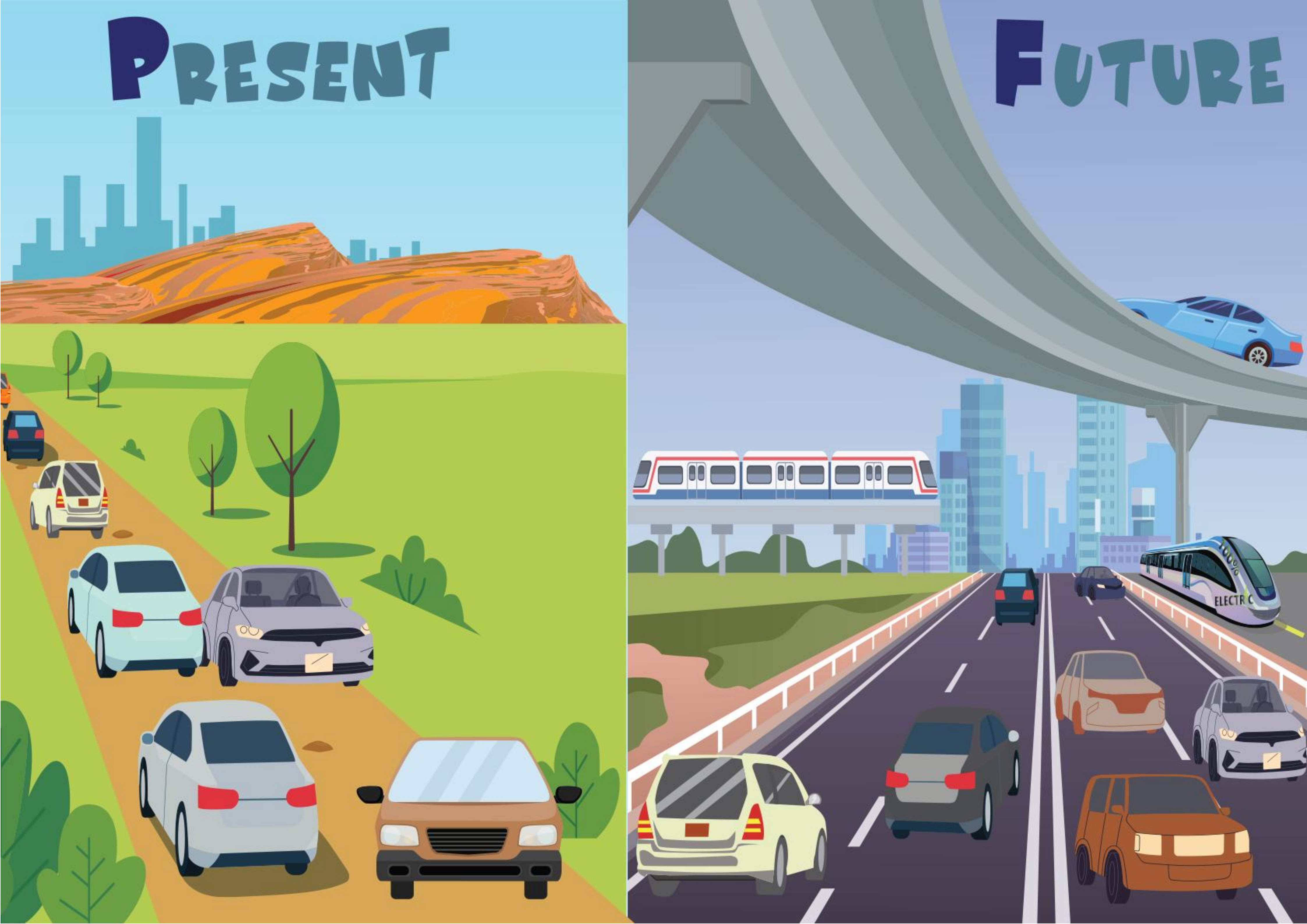
Supply-side measures, such as the capacity of roads and public transport services (e.g., number of road lanes, standing/seating capacity on rails/trains and buses),

Demand-side measures, including the usage of the network (e.g., traffic volumes, passenger numbers),

Performance and outcome indicators, which reflect how well the system is functioning (e.g., congestion, travel time efficiency ratio, overcrowding).

The scope of Objective Two is limited to major roads (including freeways and arterial roads) and high-capacity public transport systems, such as rail/train and rapid bus networks. Other forms of local or commercial transport infrastructure, including local council roads servicing residential areas, active transport modes (walking and cycling), ports and airports are considered out of scope, though their influence on broader network performance may be referenced where relevant.

The findings from Objective Two will provide an evidence base for identifying infrastructure gaps and informing the investment priorities outlined in Objective Three.


Present
Future

3.1 Major Roads

All major road connections between the North Growth Corridor and Melbourne CBD are shown in Fig. 13. Under Victoria's road classification system [21], 'M' roads are high-capacity freeways designed for fast, long-distance travel. 'A' roads serve a similar function but typically carry less traffic and are built to lower design standards. 'C' roads are secondary arterials that connect suburbs to the broader road network, while Metropolitan Routes (MRs) are major arterial roads that support intra-metropolitan travel, linking residential areas to major activity centres.

To assess whether these roads can accommodate the corridor's growing population and increasing transport demand, their physical conditions and characteristics are shown in Fig. 14. Their **capacity** (based on the number of lanes in each direction) and their annual average daily traffic data for the year 2020 ($AADT_{past}$), along with projections for 2031 and 2046 ($AADT_{future}$), are summarised in Table 5.

Capacity: According to capacity analysis by Austroads [22], a single-lane road can accommodate ~1,500 to 2,400 passenger cars per hour (pc/h) in each direction. When heavy vehicles are included, this capacity typically reduces to around 1,800 vehicles per hour (v/h). The capacity of multi-lane roads is more complex and depends on several factors, including lane configuration, the number of access and exit points, lane width (particularly of inner lanes that do not interfere with exit lanes), speed limits, and the proportion of heavy vehicles. However, for simplicity, based on this publication [23], a two-lane road can generally accommodate around 2,000 v/h, a three-lane road up to 3,600 v/h, and a four-lane road up to 6,000 v/h. These capacity estimates are used as benchmarks in Table 5 for comparison with the corresponding AADT.

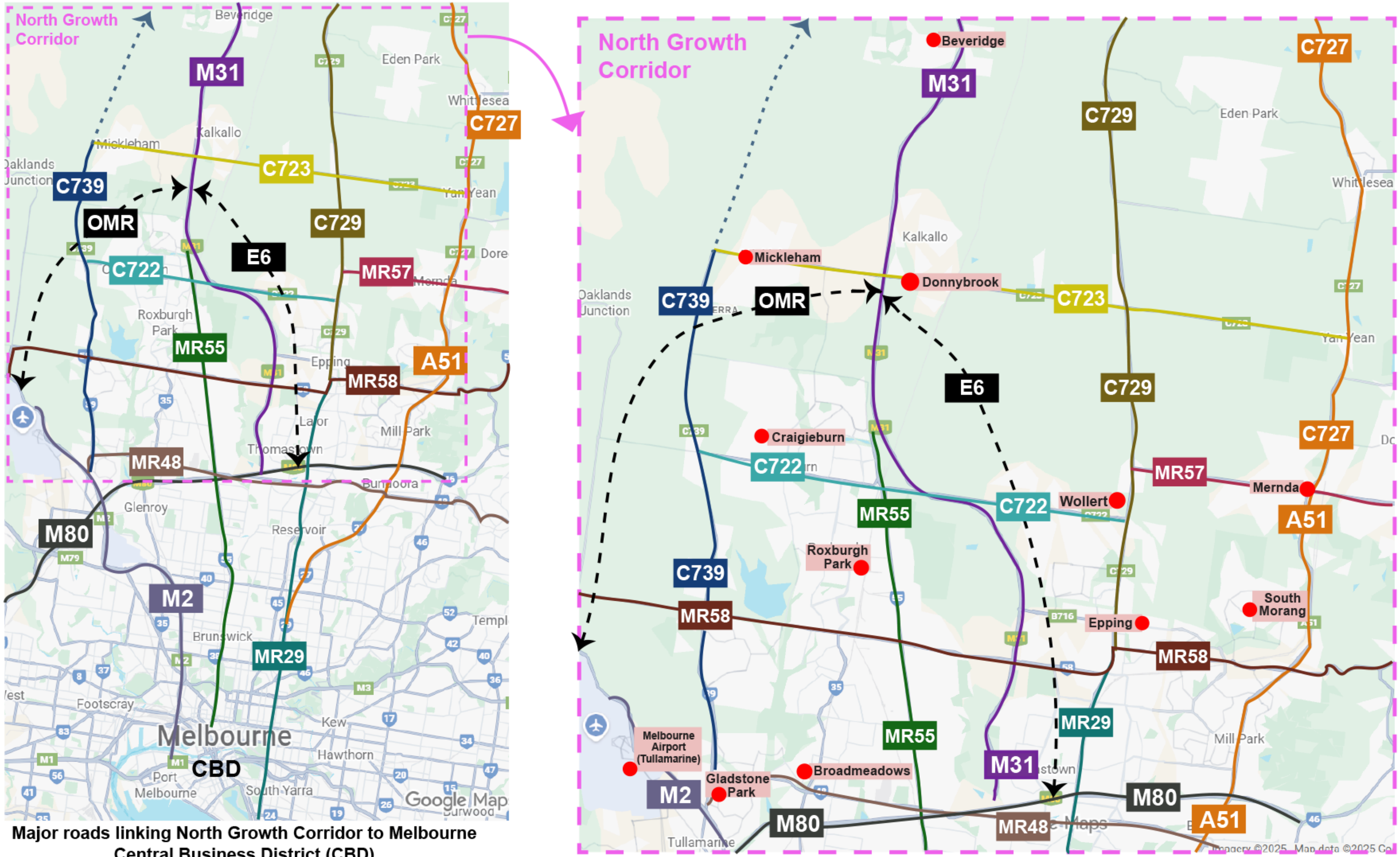
$AADT_{past}$: AADT, the annual average daily traffic is the average volume of vehicle traffic on a specific road segment over a 24-hour period, calculated by dividing the total annual traffic volume by 365 days. The past AADT values presented in Table 5 are sourced from VicRoads traffic volume database [24] for the year 2020.

$AADT_{future}$: According to the traffic data computation method published by the Federal Highway Administration [25], Eq. (5) can be used to forecast future AADT:

$$AADT_{future} = AADT_{past} \ x \ (1 + AACR)^n \qquad \text{Eq. (5)}$$

Where n represents the number of forecast years. $AACR$ is the annual average change rate, or traffic growth rate. AACR is the average of all change rates, where each change rate is calculated as the ratio of AADT in the most recent year to that of a previous year. However, due to the unavailability of AADT data for years other than 2020 in [24], AACR could not be computed directly. As a simplification, an AACR value of 0.012 is adopted for Eq. (5), based on a report from the Australian Financial Review (August 2025) [26], which stated that Melbourne recorded the weakest annual traffic growth nationally, an increase of just 1.2% between 2024 and 2025.

In Table 5, if $AADT_{future}$ (**projected demand**) exceeds the road's **capacity**, high traffic congestion is expected in the future, and the road is considered inadequate. When the volume of vehicles using the road surpasses what the road can efficiently handle, it leads to slower travel speeds and increased delays. Persistent congestion can also contribute to higher vehicle emissions and decreased road safety.



Major roads linking North Growth Corridor to Melbourne Central Business District (CBD)

- Hume Freeway M31
- Mickleham Road C739
- Donnybrook Road C723
- Epping-Kilmore Road C729
- Plenty Road (Bundoora to Mernda: A51, Mernda to Whittlesea C727)
- Craigieburn Road C722
- Metro Route 58 MR58
- Metro Route 57 MR57
- Metro Route 55 (Sydney Road) MR55
- Metro Route 48 MR48
- Metro Route 29 (Hoddle Highway) MR29
- Western/Metropolitan Ring Road M80
- Tullamarine Freeway M2
- Outer Metropolitan Ring (OMR)/E6 (Planning), construction might commence in 2030s, or later
- Old Sydney Road (upgrade commences soon)

Fig. 13. Major road connections between the North Growth Corridor and the Melbourne CBD.

Fig. 14. Physical conditions and characteristics of major roads shown in Fig. 13. Individual road photos are sourced from Google Maps [27], while road characteristics are taken from Expressway [28].

Table 5. Road capacity based on lane configuration, with past annual average daily traffic (AADT) data and projections for 2031 and 2046 using 1.2% traffic growth rate.

Major roads, refer to Fig. 13	No. of lanes per direction, refer to Fig. 14	Capacity (v/h), by no. of lanes refer to [22, 23]	$AADT_{past}$ for year 2020, data taken from [24]		$AADT_{future} = AADT_{past}\ x\ (1+0.012)^n$		Is $AADT_{future}$ > Capacity ? (Yes=Congestion, No=OK, Adequate)
					$AADT_{2031}$ where n=11	$AADT_{2046}$ where n=26	
			v/day	v/h	v/h	v/h	
M31	2	2,000	17,000	708	808	966	OK, Adequate
			46,000	1,917	2,185	2,614	Yes, Congestion
C739	1	1,800	3,500	146	166	199	OK, Adequate
	3	3,600	20,000	833	950	1,136	OK, Adequate
C723	1	1,800	3,900	163	185	222	OK, Adequate
	2	2,000	4,800	200	228	273	OK, Adequate
C729	1	1,800	2,900	121	138	165	OK, Adequate
			19,000	792	903	1,080	OK, Adequate
C727	1	1,800	20,000	833	950	1,136	OK, Adequate
A51	2	2,000	36,000	1,500	1,710	2,045	OK for 2031, Congestion for 2046
C722	1	1,800	7,200	300	342	409	OK, Adequate
	2	2,000	17,000	708	808	966	OK, Adequate
MR58	1	1,800	8,300	345	394	472	OK, Adequate
			20,000	833	950	1,136	OK, Adequate
MR57	1	1,800	6,300	263	299	358	OK, Adequate
MR55	2	2,000	30,000	1,250	1,425	1,705	OK, Adequate
MR29	2	2,000	30,000	1,250	1,425	1,705	OK, Adequate
			48,000	2,000	2,280	2,727	Yes, Congestion
M80	3	3,600	48,000	2,000	2,280	2,727	OK, Adequate
	4	6,000	81,000	3,375	3,848	4,602	OK, Adequate
M2	3	3,600	48,000	2,000	2,280	2,727	OK, Adequate
	4	6,000	88,000	3,667	4,181	5,000	OK, Adequate
MR48	1	1,800	12,000	500	570	682	OK, Adequate
	2	2,000	30,000	1,250	1,425	1,705	OK, Adequate

Caution is advised when interpreting Table 5:

1) Past AADT data obtained from [24] may vary across different road segments. For example, the Hume Freeway (M31) records ~27,000 vehicles per day (~1,125 v/h) between Sydney Road and Donnybrook Road, increasing to ~30,000 vehicles per day (~1,250 v/h) between Cooper Street and Craigieburn Road. As a result, both the lowest and highest AADT values for a given road may be included.

2) Lane configurations also vary across certain roads due to widening. For example, Mickleham Road (C739) begins at the intersection with Donnybrook Road and Old Sydney Road, continuing south as a one-lane road per direction until the intersection with Craigieburn Road, where it expands to three lanes per direction due to ongoing upgrades.

3) Future demand projections are calculated based on Eq. (5), which uses the traffic growth rate, AACR. AACR is more reliable when derived from traffic data spanning multiple preceding years, as this reduces the impact of short-term fluctuations. However, in this case, only a single-year traffic growth rate of 1.2% between 2024 and 2025, as reported in [26], has been applied due to unavailability of data from other years.

4) Ongoing road expansion has been accounted for in Table 5, including all additional lanes resulting from current upgrades.

As shown in Table 5, the Hume Freeway (M31) includes segments with varying traffic volumes, ranging from 708 to 1,917 vehicles per hour in 2020. Applying a traffic growth rate of 1.2%, segments with higher volumes will exceed the capacity of a two-lane road (2,000 vehicles per hour) by 2031, rendering them inadequate for the projected traffic demand.

For Plenty Road (A51), the traffic volume in 2020 was approximately 1,500 vehicles per hour. Using the same growth rate, the projected traffic volume increases to 1,710 vehicles per hour by 2031 and 2,045 vehicles per hour by 2046. As A51 is currently a two-lane road, it is expected to operate within capacity in 2031, but will likely exceed its capacity by 2046.

Similarly, certain segments of Metropolitan Route MR29 with already high traffic volumes are also projected to exceed capacity by 2031 if no upgrades are made.

1.2% Traffic Growth Rate: An Underestimate?

It is believed that the 1.2% traffic growth rate may be an underestimation. This rate applies to the entire Metropolitan Melbourne, where some areas, being well-developed, exhibit lower growth rates. Consequently, the 1.2% traffic growth rate is likely skewed by these lower growth areas, thus not accurately reflecting the higher growth potential in emerging regions, like the North Growth Corridor. North Growth Corridor is undergoing rapid development, with an average dwelling growth rate of 5.14%. This value can be calculated by averaging all AADG values in Appendix Table A.5.

Assuming one new dwelling corresponds to one additional vehicle, the traffic growth rate could be as high as 5.14% for the entire North Growth Corridor. This provides a more realistic estimate of traffic growth, as residents in the North Growth Corridor are more likely to use the major roads (Fig. 13) within the corridor. To assess whether these major roads can still accommodate traffic growth within the North Growth Corridor, Table 6 presents the projected traffic volumes based on the traffic growth rate of 5.14%.

Authors' Note: Our findings on road adequacy align with the traffic modelling report from Metropolitan Planning Authority [29]. Although their report was published in 2014, it includes 2046 traffic projections for the Craigieburn Employment Precinct North, located within the North Growth Corridor, and identifies peak-period congestion points consistent with our analysis in Table 6.

NORTHERN CONNECT

Table 6. Projected traffic volumes for 2031 and 2046, based on a 5.14% traffic growth rate. See Table 5 for $AADT_{past}$ data.

Major roads	No. of lanes per direction	Capacity (v/h), by no. of lanes [22, 23]	$AADT_{future} = AADT_{past} \times (1 + 0.0514)^n$		Is $AADT_{future}$ > Capacity ? (Yes=Congestion, No=OK, Adequate)
			$AADT_{2031}$ where n=11	$AADT_{2046}$ where n=26	
			v/h	v/h	
M31	2	2,000	1,229	2,607	OK for 2031, Congestion for 2046
			3,327	7,055	Yes, Congestion
C739	1	1,800	253	537	OK, Adequate
	3	3,600	1,446	3,068	OK, Adequate
C723	1	1,800	282	598	OK, Adequate
	2	2,000	347	736	OK, Adequate
C729	1	1,800	210	445	OK, Adequate
			1,374	2,914	OK for 2031, Congestion for 2046
C727	1	1,800	1,446	3,068	OK for 2031, Congestion for 2046
A51	2	2,000	2,603	5,522	Yes, Congestion
C722	1	1,800	521	1,104	OK, Adequate
	2	2,000	1,229	2,607	OK for 2031, Congestion for 2046
MR58	1	1,800	600	1,273	OK, Adequate
			1,446	3,068	OK for 2031, Congestion for 2046
MR57	1	1,800	456	966	OK, Adequate
MR55	2	2,000	2,169	4,601	Yes, Congestion
MR29	2	2,000	2,169	4,601	Yes, Congestion
			3,471	7,362	Yes, Congestion
M80	3	3,600	3,471	7,362	OK for 2031, Congestion for 2046
	4	6,000	5,858	12,423	OK for 2031, Congestion for 2046
M2	3	3,600	3,471	7,362	OK for 2031, Congestion for 2046
	4	6,000	6,364	13,497	Yes, Congestion
MR48	1	1,800	868	1,841	OK for 2031, Congestion for 2046
	2	2,000	2,169	4,601	Yes, Congestion

M31: Segments with lower traffic volume need at least three lanes (per direction), while segments with higher traffic volume need more than four lanes to meet projected traffic demand by 2046.
Unplanned, Require Expansion

C729: Segments with higher traffic volume need at least three lanes (per direction) by 2046.
Expansion underway, may meet demand

C727 needs at least three lanes (per direction), while A51 needs at least three lanes by 2031 and four lanes by 2046.
Unplanned, Require Expansion

C722: Segments with higher traffic volume need at least three lanes (per direction) by 2046.
Expansion underway, may meet demand

MR58: Segments with higher traffic volume need at least three lanes (per direction) by 2046.
Expansion underway, may meet demand

MR55 needs at least four lanes (per direction) by 2046.
Unplanned, Require Expansion

MR29: Segments with lower traffic need at least four lanes, while segments with higher traffic volume need more than four lanes by 2046.
Unplanned, Require Expansion

M80 needs more than four lanes (per direction) by 2046.
Expansion underway, may meet demand

M2 needs more than four lanes (per direction) by 2046.
Unplanned, Require Expansion

MR48: Segments with lower traffic need at least two lanes (per direction), while segments with higher traffic volume need at least four lanes by 2046.
Unplanned, Require Expansion

3.2 Travel Time by Car via Major Roads

After assessing the adequacy of major roads through to 2046, it is also important to understand the current travel time by car to/from Melbourne CBD via these roads. This provides insight into network performance and motorist experience, particularly during peak periods.

Fig. 15 presents travel times between suburbs in the North Growth Corridor and Southern Cross Station in the CBD, arranged from the nearest suburb, Gladstone Park (~21 km), to the farthest, Beveridge (~69 km). Southern Cross Station is used as reference point as it is Australia's largest public transport hub, offering connections to interstate, regional and suburban trains, coaches, airports, and tram lines.

Travel times are analysed across three time periods:

Period 1: Weekdays, 7:00–8:00 am: peak inbound, off-peak outbound. According to the Department of Transport and Planning [30], traffic volumes in the counter-peak direction are typically less than one-third of the peak-direction flow.

Period 2: Weekdays, 4:00–5:00 pm: peak outbound, off-peak inbound.

Period 3: Weekends, 12:00–1:00 am: off-peak in both directions.

Live travel times were collected daily during these periods via Google Maps [27] and are subject to daily variation. Average travel times are calculated, with sample standard deviations included to indicate variability.

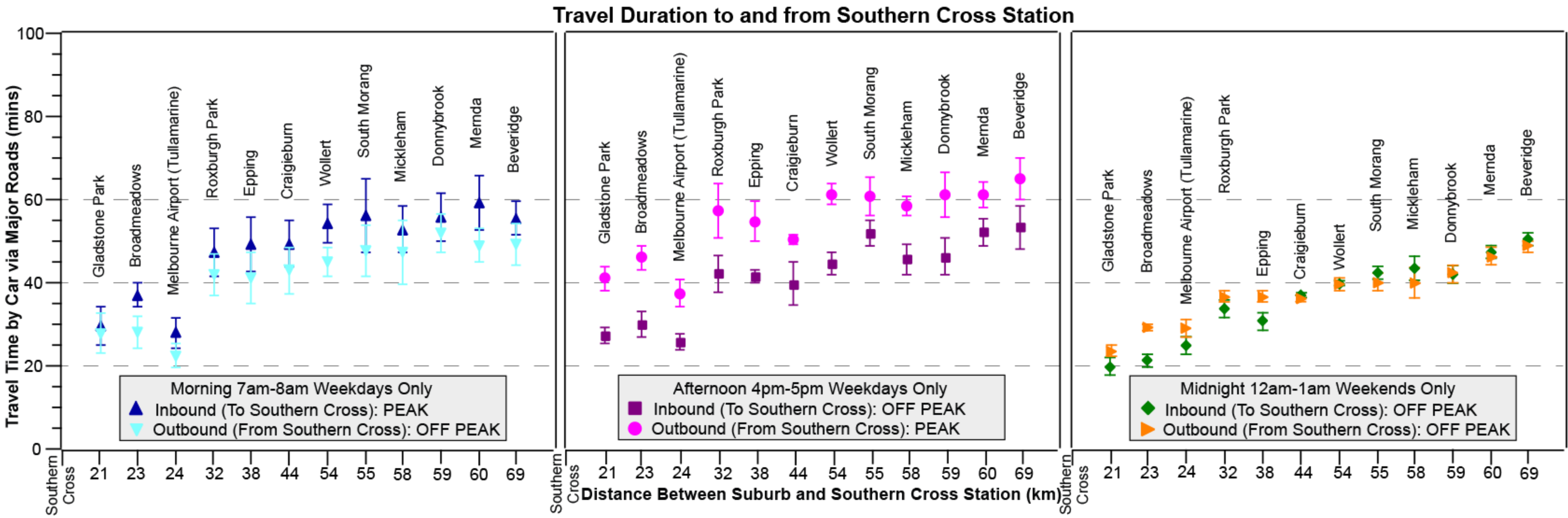


Fig. 15. Travel duration by car via major roads to and from Southern Cross Station. See Table A.6 in the Appendix for the complete dataset.

NORTHERN CONNECT

As shown in Fig. 15, weekend off-peak travel times exhibit smaller standard deviations, indicating more stable and consistent traffic conditions. If weekend off-peak travel times are considered representative of ideal conditions, then the travel time efficiency ratio (TTER) can be calculated using Eq. (6). TTER values are presented in Table 7.

$$Travel\ Time\ Efficiency\ Ratio = \frac{Peak\ Travel\ Time}{Weekend\ Off-Peak\ Travel\ Time} \quad \text{Eq. (6)}$$

Table 7. TTER estimates during peak periods.

Suburb (Nearest to Farthest from Southern Cross)	Weekend Off-Peak Travel Time (Avg) – To/From Southern Cross (mins)	Peak Travel Time (Avg)		Travel Time Efficiency Ratio (TTER)
		7–8am Inbound (mins)	4–5pm Outbound (mins)	
Gladstone Park	21	30	41	1.39 – 1.93
Broadmeadows	25	37	46	1.49 – 1.86
*Melbourne Airport (Tullamarine)	27	28	37	1.06 – 1.41
Roxburgh Park	35	47	57	1.36 – 1.65
Epping	33	49	55	1.48 – 1.65
Craigieburn	36	49	50	1.37 – 1.40
Wollert	39	54	61	1.38 – 1.56
South Morang	41	56	61	1.37 – 1.49
Mickleham	41	53	58	1.28 – 1.42
Donnybrook	42	56	61	1.34 – 1.47
Mernda	46	59	61	1.28 – 1.32
Beveridge	49	55	65	1.13 – 1.33

**Melbourne Airport and wider Tullamarine area*

According to the Department of Transportation [31], TTER, also commonly known as the Travel Time Index (TTI), is defined as the ratio of travel time during the peak period to the time required to complete the same trip under free-flow conditions. In this analysis, weekend off-peak travel times are used instead of relying on free-flow conditions that assume an idealised free-flow speed (e.g., 80 km/h) under uncongested conditions.

This approach is more realistic because motorists travel on different roads when going to/from Southern Cross. For example, the map in Fig. 13 shows that a trip from Beveridge to Southern Cross in Melbourne CBD typically involves using M31, M80, and M2, each with different speed limits (see Fig. 14). Therefore, using off-peak travel times as a benchmark in this context is a more practical measure:

1) It naturally captures real-world delays, such as traffic signals, and intersections, stop signs
2) It reflects the baseline operational conditions of the network under minimal congestion
3) It avoids reliance on theoretical assumptions about idealised speeds under free-flow conditions, which may not be consistently applicable across different roads

A higher TTER indicates longer travel times and, consequently, reduced travel efficiency. Among the suburbs analysed, Gladstone Park and Broadmeadows exhibit relatively high TTER values, suggesting greater levels of peak-hour congestion. High-growth hotspots such as Donnybrook, Beveridge, Mickleham, and Wollert report TTER values ~1.4, meaning every 10 minutes of off-peak travel requires an additional 4 minutes during peak periods.

Authors' Note: The TTER values in Table 7 are indicative estimates only, intended to support an initial understanding of conditions during the AM and PM peaks. Factors such as seasonal variation and traffic incidents are not considered. For a more accurate identification and understanding of bottlenecks, a detailed study using road/segment-level travel time is recommended.

Public Transport in North Growth Corridor

3.3 Public Transport

In addition to major roads, public transport, though limited, is available within the North Growth Corridor to facilitate access to the Melbourne CBD. Three primary modes of public transport serve the corridor: V/Line regional rail, Metro trains, and PTV bus services. Fig. 16 illustrates the connectivity of these three modes, and typical routes between the 12 suburbs under investigation and Southern Cross Station in CBD. Three distinct segments are observed:

Segment A (Beveridge, Mickleham, Donnybrook): Residents take bus 511 or 525 to connect with Seymour V/Line service.

Segment B (Craigieburn, Roxburgh Park, Tullamarine, Gladstone Park, Broadmeadows): Residents take bus 525, 544 or 477 to connect with Craigieburn Metro train line.

Segment C (Wollert, Epping, South Morang, Mernda): Residents take bus 356 or 577 to connect with Mernda Metro train line.

These routes were determined using Google Maps [27], prioritising the fastest option with fewest transfers. Note that alternative routes may exist depending on real-time service conditions and individual travel preferences.

Currently, there is no public transport service directly connecting Melbourne Airport to Southern Cross Station or the broader Melbourne CBD. The only available option is the privately operated SkyBus City Express service, which charges fixed commercial fares independent of the public transport fare system.

Fig. 16. Public transport modes within the North Growth Corridor.

Table 8 summarises the **capacity** and **projected demand** for V/Line rail, Metro trains, and PTV buses in 2031 and 2036 across the three segments shown in Fig. 16. For a detailed breakdown of data in Table 8, see Appendix Table A.7.

The analysis focuses on two peak periods, as defined by public transport website [32]: weekdays inbound (to Southern Cross) from 7:00 to 9:00 am, and weekdays outbound (from Southern Cross) from 4:00 to 6:00 pm. If projected demand exceeds capacity, the public transport may be unable to adequately accommodate passengers, resulting in overcrowding and reduced service quality.

Capacity estimates are calculated using publicly available data from the respective transport websites:

V/Line Rail [32]: Seymour service uses VLocity (222 seats per three-car set) and Sprinter trains (87 seats per car). Although standing capacity is not specified, V/Line generally provides very limited standing space.

Metro Trains [33]: Craigieburn line uses X'Trapolis 2.0 model (1,241 total capacity: 443 seated, 798 standing), while the Mernda line uses X'Trapolis 100 model (794 total capacity: 528 seated, 266 standing).

PTV Buses [34]: While capacity depends on vehicle model, size and configuration, a standard single-deck bus typically carries around 55 passengers.

Total capacity is estimated by multiplying vehicle capacity by the number of services during the two peak periods.

Future demand is projected using population data by age group (see Section 2.3 in Objective One and Fig. 9). Studies show that ~32–38% of school-aged students [35, 36] and ~4.4–4.9% of working-age adults [16, 37] use public transport for school and work commutes, respectively.

Based on this, it is assumed that during the two peak periods:

- 30% of school-aged and 5% of working-age populations will use the Seymour V/Line rail and Metro trains.

As Fig. 16 shows, buses in the North Growth Corridor primarily serve as feeders to/from train stations. Therefore:

- only 1% of the population is assumed to use buses, as most passengers are likely to drive and park their cars at the train stations, due to short travel distances and the infrequent bus services.

It is also assumed that older adults and retirees (age group 70 and above) do not use public transport during these two peak periods.

The projected demand in Table 8 is calculated by segments. For example, in Segment A: 1% of school-aged and working-age populations in Beveridge are assumed to take Bus 511, 1% of school-aged and working-age populations in Mickleham are assumed to take Bus 525, and 30% of school-aged and 5% of working-age populations across Beveridge, Mickleham, and Donnybrook are assumed to use the Seymour V/Line during the analysed peak periods.

The same methodology is applied to estimate demand for Segments B and C, based on the population counts of the respective suburbs.

Authors' Note: The percentages of the population assumed to use public transport are based on existing literature and reflect generalised travel behaviour patterns. Percentages may vary by suburb and evolve over time. While percentages are indicative and used for modelling purposes only, the methodology of comparing capacity (based on service frequency and vehicle size) with projected demand (based on population by age group) remains a robust approach for identifying potential service gaps.

Table 8. Public transport capacity and projected demand during weekdays' peak periods in Years 2031 and 2036. **For a detailed breakdown of these data, see Appendix Table A.7.**

Service	Capacity		Projected Demand (Peak Periods)		Is Demand > Capacity ? (Yes=Overcrowding, No=OK, Adequate)
	AM Peak Inbound 7–9am (To Southern Cross)	**PM Peak Outbound 4–6pm** (From Southern Cross)	**Yr 2031**	**Yr 2036**	
Segment A (Beveridge, Mickleham, Donnybrook)					
Seymour V/Line	1,236	1,314	12,128	18,853	Yes, Overcrowding
Bus 511	55	55	212	460	Yes, Overcrowding
Bus 525	165	220	437	555	Yes, Overcrowding
Segment B (Craigieburn, Roxburgh Park, Tullamarine, Gladstone Park, Broadmeadows)					
Craigieburn Metro Line	17,374	21,097	13,177	12,858	OK, Adequate, but some passengers will need to stand
Bus 525	275	385	433	459	Yes, Overcrowding
Bus 544	275	220	218	214	OK, Adequate
Bus 477	330	330	206	159	OK, Adequate
Segment C (Wollert, Epping, South Morang, Mernda)					
Mernda Metro Line	12,704	11,910	16,304	18,420	Yes, Overcrowding
Bus 356	330	330	429	543	Yes, Overcrowding
Bus 577	385	220	334	373	OK for morning peak inbound, but not adequate for afternoon peak outbound

Authors' Note: Our findings from Table 8 are consistent with the transport modelling report [38], which projects that the Seymour, Craigieburn, and Mernda lines will experience high passenger volumes by 2031. An additional 6,000 passengers are forecast for Seymour line, and 10,000 for the Craigieburn and Mernda lines during the same peak periods. Elevated boarding levels in these outer suburbs will significantly contribute to overall line usage, increasing the risk of crowding as services approach Southern Cross Station in CBD.

The Seymour V/Line, as a regional service, is not adequate for metropolitan commuting. Councils plan to extend the Craigieburn line [39], including new stations at Beveridge and Cloverton. This will provide vital suburban connections to Donnybrook and beyond, reduce reliance on buses, and improve access to the CBD.

Segment A: Planning and expansion underway, may meet demand

Due to conservative assumptions (30% of school-aged and 5% of working-age populations using trains), Craigieburn services are projected to be adequate for 2031 and 2036. Despite only 1% of these populations being forecast to use buses, capacity constraints are still anticipated for bus 525, highlighting the need for increased feeder bus service frequency during peak periods. The proposed Melbourne Airport Rail, which will connect Melbourne Airport (Tullamarine) with the CBD, may also help alleviate pressure on the Craigieburn line by serving a portion of the Tullamarine population.

Segment B: Require ongoing monitoring, increase bus service frequency and expansion underway for Melbourne Airport Rail, may meet demand

Both metro train and bus services are projected to be insufficient to meet future demand. Mernda train capacity and feeder bus frequencies will need to increase to accommodate this growth.

Segment C: Require planning and expansion

3.4 Travel Time by Public Transport

Fig. 17 shows the estimated public transport travel times between suburbs and Southern Cross Station during weekdays AM (inbound) and PM (outbound) peak periods. Travel times are disaggregated into rail/train, bus, and transfer (interchange) components. These times are sourced from Google Maps journey planner and are indicative only, as actual travel durations may vary depending on services (express or normal), transfer conditions, and individual journey choices.

In most suburbs, access to rail/train network requires a feeder bus service. Generally, bus timetables are well-coordinated with rail and train schedules, resulting in transfer times of under 15 minutes for the majority of connections. However, during the PM peak, outbound travel from Southern Cross Station to Beveridge presents a challenge. Due to the limited frequency of Bus 511 departing Donnybrook Station, passengers arriving from Southern Cross are unable to make the connection in time. As a result, many are required to transfer at Craigieburn Station, where the waiting time for Bus 511 can extend to 88 minutes, rendering this a poor travel option. While alternative public transport options do exist for Beveridge residents, these are constrained by infrequent services and multiple interchanges. Consequently, total travel time for many journeys exceeds two hours.

Table 9 compares travel times by car with those by public transport during these peak periods. The travel time ratio is defined as public transport travel time divided by the corresponding car travel time. A ratio of 1.0 indicates equivalent travel durations. It is generally assumed that when the travel time ratio is less than 1.5 (e.g., a 10-minute car journey taking 15 minutes by public transport), public transport becomes a more viable and attractive option for users. Conversely, when the ratio exceeds 1.5, car travel is typically preferred.

Among the high-growth hotspots, Wollert, Mickleham, and Donnybrook are relatively well-serviced by public transport (travel time ratio less than 1.5), offering feasible connections to and from Southern Cross in CBD. However, improvements in service frequency will be required to meet the demands of the growing population in these suburbs; otherwise, overcrowding issues (projected in Table 8) may arise. In contrast, Beveridge currently lacks adequate public transport coverage, and investment is required to ensure residents have access to efficient, reliable, and timely transport options.

Table 9. Comparison of peak period travel times (mins) by car and public transport.

Suburb (Nearest to Farthest from Southern Cross)	**AM Peak Inbound 7–9am** (To Southern Cross)			**PM Peak Outbound 4–6pm** (From Southern Cross)		
	By Car	By Public Transport	Travel Time Ratio	By Car	By Public Transport	Travel Time Ratio
Gladstone Park	30	73	2.4	41	61	1.5
Broadmeadows	37	41	1.1	46	30	0.6
*Melbourne Airport (Tullamarine)	28	71	2.5	37	53	1.4
Roxburgh Park	47	64	1.3	57	55	1.0
Epping	49	68	1.4	55	68	1.2
Craigieburn	49	81	1.6	50	60	1.2
Wollert	54	65	1.2	61	76	1.2
South Morang	56	50	0.9	61	51	0.8
Mickleham	53	76	1.4	58	66	1.1
Donnybrook	56	49	0.9	61	48	0.8
Mernda	59	58	1.0	61	60	1.0
Beveridge	55	85	1.5	65	163	2.5

**Melbourne Airport and wider Tullamarine area*

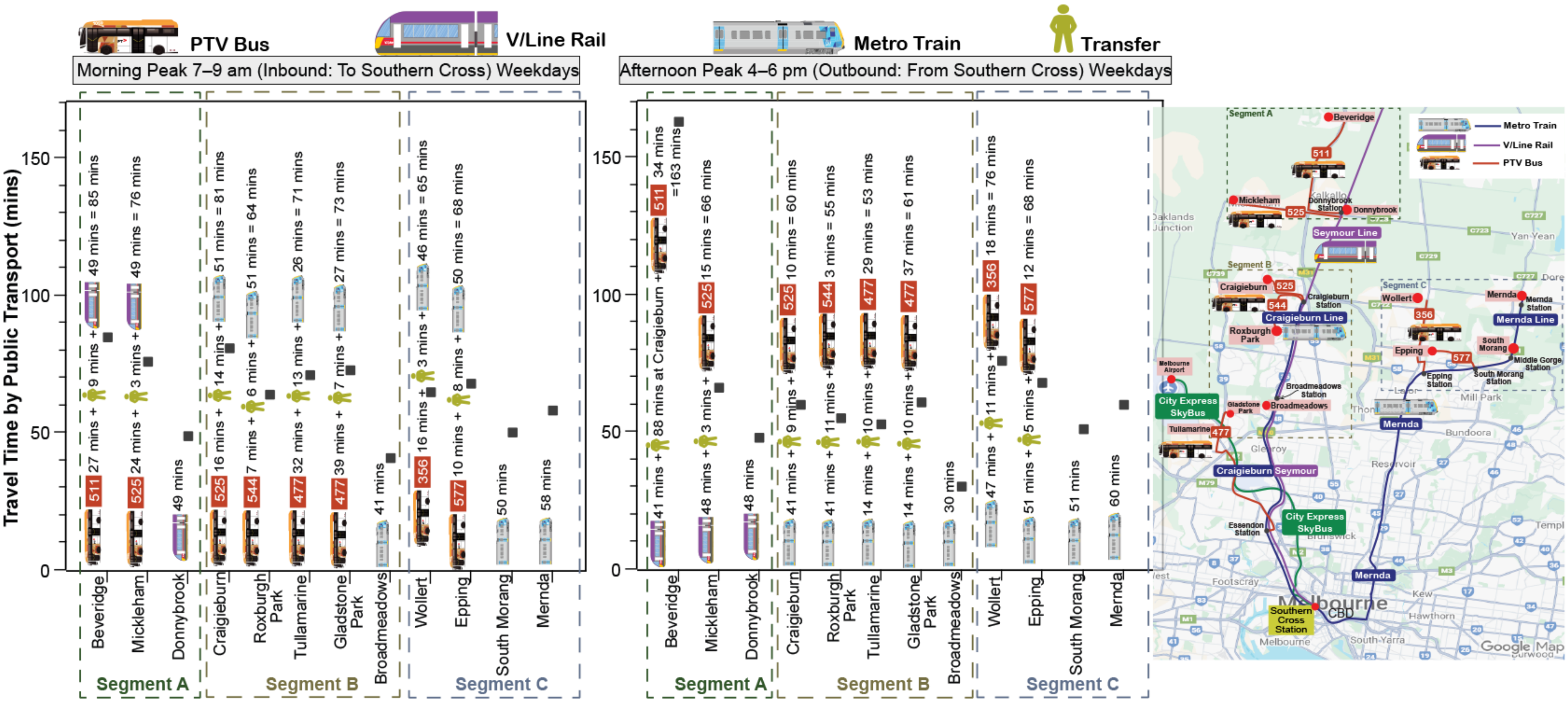


Fig. 17. Travel duration by public transport to and from Southern Cross Station, with inset showing the route map from Fig. 16 for easy reference.

3.5 Transport Infrastructure Challenges in High-Growth Hotspots

Following the broader assessment of transport infrastructure across the North Growth Corridor, this section provides a focused summary of the four high-growth hotspots: Donnybrook, Beveridge, Mickleham, and Wollert.

Major Roads (Refer to Fig. 13; Tables 6 and 7)

Donnybrook and Mickleham: Primary access is via the Hume Freeway M31, supplemented by arterial routes C729, C739, and C723. Traffic projections, based on an annual growth rate of 5.14%, indicate that the M31 will experience significant congestion by 2031, with C729 expected to reach capacity by 2046. M31 will require future expansion, while C729 is already undergoing capacity upgrade works. These works include the construction of additional lanes and bicycle lanes, as well as the installation of new traffic signals.

Beveridge: Access is predominantly provided via M31, with Old Sydney Road serving as an alternative diversion route. However, this road remains largely undeveloped and is currently unsuitable for high traffic volumes. In response, the Federal Government has committed $45 million towards sealing and upgrading Old Sydney Road [40]. Construction is expected to commence in the near future.

Wollert: Wollert is served by C722 and C729, both of which are forecast to face capacity constraints by 2046. Road widening and upgrade works are planned and already in progress to align with projected demand.

The current travel time by car via these major roads to Southern Cross in the CBD is suboptimal, with a reported TTER value of ~1.4. This indicates that every 10 minutes of off-peak travel requires an additional 4 minutes during peak periods.

Outer Metropolitan Ring (OMR)/E6: This remains in the planning phase, with construction potentially commencing in the 2030s or later. The OMR/E6 is a 100km long high-speed transport corridor intended to alleviate congestion in Melbourne's North and West Growth Corridors by diverting freight and inter-suburban traffic away from arterial roads and major freeways such as the M31 and Tullamarine Freeway. Once completed, the OMR/E6 is expected to significantly ease congestion in for these suburbs.

Public Transport (Refer to Figs. 16 and 17; Tables 8 and 9)

Donnybrook: Donnybrook is directly served by the Seymour V/Line, providing a rail connection to Southern Cross Station in under 50 minutes, ~17% faster than car travel during peak periods (around 1 hour). However, current V/Line capacity is insufficient to meet projected demand, with estimates indicating that a nine- to fourteen-fold increase in capacity will be required at Donnybrook Station by 2031 and 2036, respectively.

Mickleham and Beveridge: Public transport access is currently reliant on feeder bus services to Donnybrook Station, where passengers can transfer to the Seymour V/Line. The frequency of these feeder bus services and network coverage will need to increase to support the anticipated population growth and mitigate the risk of overcrowding and extended transfer times.

Wollert: Wollert is also connected by bus to Epping Station, linking to the Mernda Metro line. Mernda train and feeder bus services in Wollert will require increased frequency to meet projected demand. The travel time ratio for Wollert to reach Southern Cross is ~1.2, indicating that a 10-minute car journey takes around 12 minutes by public transport.

These challenges facing high-growth hotspots may be contributing to the lower average occupancy rate (AOR) (Fig. 11) and could hinder the timely delivery of new housing. This summary is illustrated in Fig. 18.

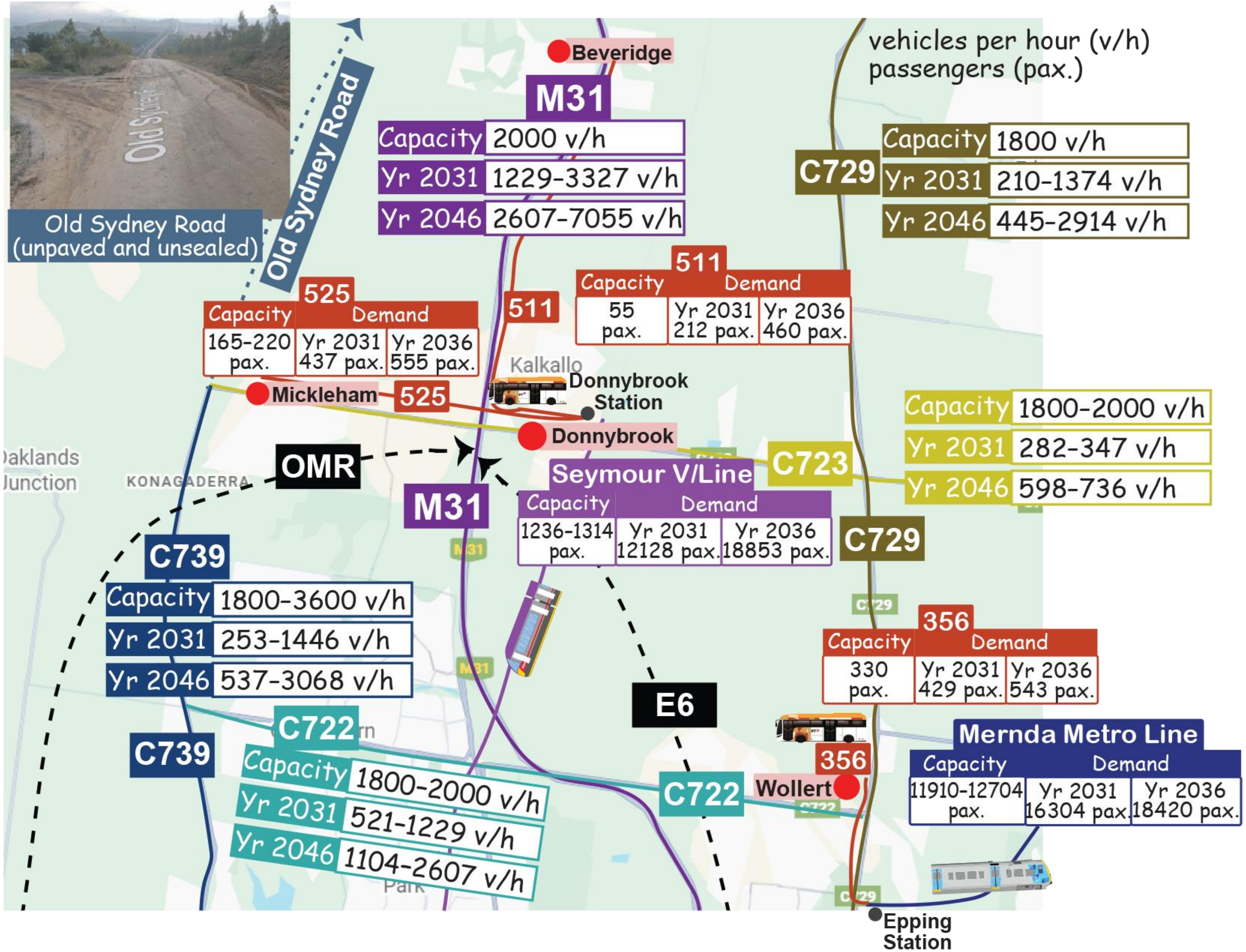


Fig. 18. Current transport infrastructure capacity and projected future demand in high-growth hotspots: Donnybrook, Beveridge, Mickleham, and Wollert.

Objective Two: Reflection

Transport Infrastructure Analysis: Capacity and demand have been analysed for major roads and public transport in the North Growth Corridor. For **major roads**, capacity is estimated based on number of lanes [22, 23], with demand forecasts for 2031 and 2046 using a simplified projection model [25]. Roads where demand exceeds capacity are considered inadequate, indicating potential congestion. For **public transport**, capacity is calculated by multiplying vehicle capacity by service frequency during peak periods, with demand projections for 2031 and 2036 based on age-segmented population data. Where demand exceeds capacity, public transport services are deemed inadequate, indicating potential overcrowding and the need for service improvements.

Data Gaps and Limitations: For **major roads**, capacity estimation is based solely on the number of lanes, without accounting for factors such as lane width, intersections, traffic signals, and speed limits, which can significantly affect actual traffic flow and capacity. Projected demand is based on a 5.14% traffic growth rate, derived from average annual dwelling growth (AADG) under the assumption that each new dwelling generates one additional vehicle. While suitable for high-level forecasting, this method does not account for variations in household car ownership, travel behaviour, mode shift, or differences between peak and off-peak demand. For **public transport**, capacity is based on current weekday services and excludes any ad hoc services. The demand estimates assume that 30% of school-aged population and 5% of working-age population use V/Line and Metro trains, and that 1% of these groups use buses during peak periods. These assumptions do not reflect potential changes in residents' travel patterns or adjustments to service frequencies over time.

Future Data Improvements: To improve the accuracy and reliability of transport capacity and demand forecasting, future efforts should prioritise the use of more granular and dynamic data sources. For example, applying the Victorian Integrated Transport Model (VITM) to account for mode preferences, travel times, and route selection would enable a more comprehensive simulation of travel patterns. Household travel surveys and behavioural studies can provide valuable insights into trip purposes and mode choices across different demographic groups, supporting better prediction of evolving mobility patterns. In addition, collecting detailed freight movement data, such as delivery schedules, vehicle types, and last-mile logistics, will strengthen traffic planning. Advancements in modelling tools should also support scenario testing of emerging travel behaviours, including increased uptake of active transport (e.g., cycling and walking) and telecommuting (working from home), to better inform future infrastructure planning and investment decisions.


PRESENT

FUTURE

4.0 Objective Three: Transport Infrastructure Gaps and Investment Priorities

The most effective way to identify transport infrastructure gaps and priorities that support or hinder housing growth is by assessing their impact on liveability. According to the report by RMIT and Australian Urban Observatory [41], multiple liveability criteria, spanning economic, environmental, health, and social factors, are used to evaluate how well an area supports safe, healthy, and connected lives for residents.

This section adapts key elements of the liveability criteria outlined in these reports [41, 42], applying them specifically to transport infrastructure. By doing so, liveability metrics can be quantified to provide a more holistic, people-centred approach to assessing transport infrastructure adequacy within the North Growth Corridor. While Objective Two focuses on traffic volumes and public transport demand to highlight capacity issues, the liveability criteria in Objective Three go further. Objective Three provides a more comprehensive understanding of how well transport networks support quality of life outcomes for residents in the North Growth Corridor. This is particularly important for rapidly growing communities, which face not only congestion but also broader challenges such as rising travel costs, car dependency, longer commutes, and social isolation when transport services fail to keep pace with growth. Fig. 19 shows a low liveability index in the North Growth Corridor in year 2021.

Incorporating liveability criteria into North Growth Corridor planning enables:

- Alignment with policy goals for sustainable and inclusive communities across all levels of government. Standardised criteria facilitate consistent benchmarking, progress tracking in growth zones, and clearer evaluation of the anticipated impact of future investments.

- Identification of infrastructure shortfalls that affect daily life. These human-centred gaps, often overlooked in traditional engineering assessments, can significantly influence growth outcomes.

- Quantification of infrastructure gaps using consistent metrics. This approach converts abstract challenges into measurable data, allowing meaningful comparisons across timeframes, regions, and impact categories.

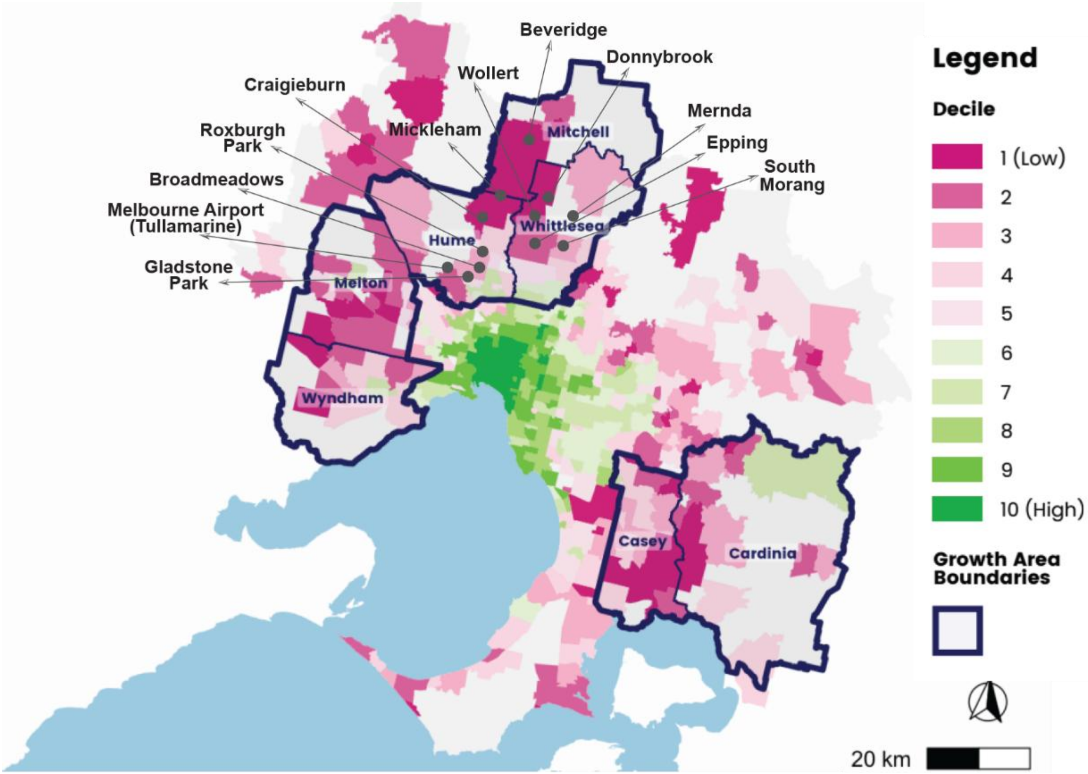


Fig. 19. Liveability Index in the North Growth Corridor in year 2021, adapted from [41].

Northern Connect

4.1 Transport Infrastructure Gaps Using a Liveability Scorecard Framework

The Liveability Index, developed by RMIT and Australian Urban Observatory [41], draws on extensive research to measure key factors influencing urban liveability, including social infrastructure, public transport, public open space, housing affordability, and local employment. While the Index includes some aspects of transport infrastructure, such as access to frequent public transport, it does not provide a comprehensive assessment of overall transport infrastructure adequacy.

To address this gap, a transport-specific Liveability Scorecard Framework has been developed to evaluate transport infrastructure performance across different geographical areas. It assesses four key criteria (Fig. 20), each measured using 2 to 5 indicators, to quantify how well transport infrastructure supports housing growth and liveable communities. A standardised scoring system (Fig. 21) rates each indicator on a scale from 0 to 5. To support consistent application, defined ranges have been established for each indicator. By comparing current performance against projected needs, the framework produces a clear assessment of infrastructure gaps.

Fig. 20. Transport Liveability Scorecard Framework.

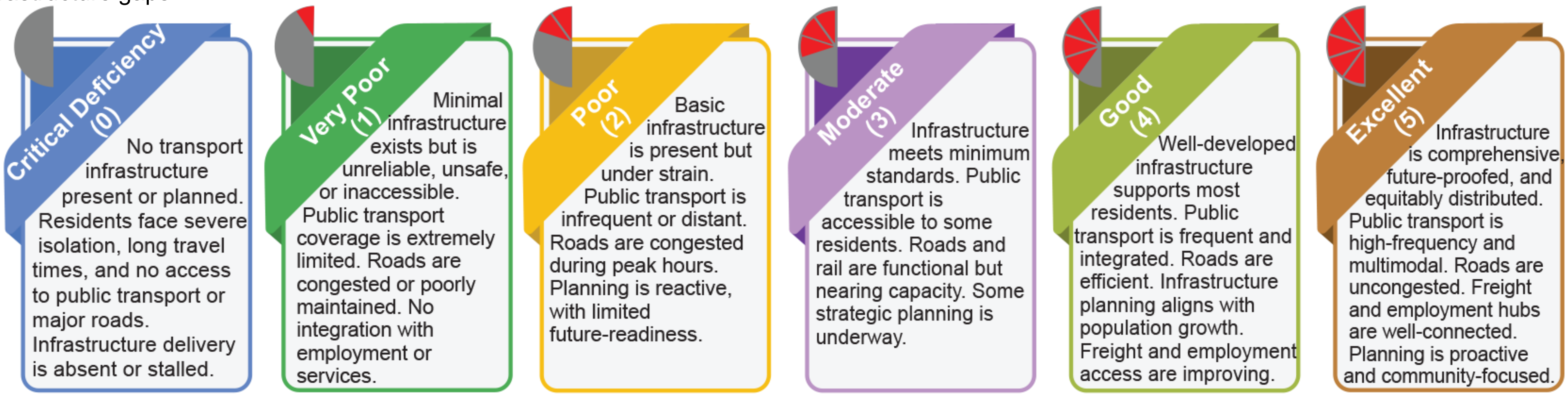


Fig. 21. Scoring guidelines for the Liveability Scorecard Framework.

Accessibility & Connectivity

Accessibility & Connectivity

This criterion assesses whether residents can easily access jobs, education, services, and social infrastructure. Key indicators are:

Percentage of dwellings within 400 metres of public transport (rail, train, bus): The proximity of homes to public transport indicates how effectively transit serves new suburbs. Closer access encourages public transport use over cars, supporting higher-density housing growth. Research shows that residents within 400 metres are more likely to benefit from public transport [41].

Private car travel time to major employment hub (CBD): Shorter car commutes indicate adequate road capacity. Longer travel times suggest congestion, which can be linked to poorer physical and mental health [43].

Public transport travel time to major employment hub (CBD): Faster commute times support housing development further from the city, whereas prolonged travel times may decrease housing demand and restrict its appeal to specific population segments.

Integration of transport modes (park-and-ride, bus-rail interchanges): Multimodal connectivity is essential in outer suburbs to extend the reach of rail/train lines and support new housing where direct transit options are limited.

Frequency and reliability of services: Frequent, on-time public transport reduces car dependency and supports sustainable growth.

Table 10 provides the comprehensive scoring guide for this criterion.

CRITERION 1

Table 10. Accessibility & Connectivity score guide.

Score	% of dwellings within 400m of public transport	Private car travel time to CBD	Public transport travel time to CBD	Integration of transport modes	Frequency and reliability of services
0	<10%	>120 mins	>120 mins	Road transport only, no interchanges present	>45 mins or <90% on time
1	10–25%	91–120 mins	91–120 mins	Only one transport mode available with no interchanges	31–45 mins or 90–92% on time
2	26–40%	60–90 mins	60–90 mins	Two modes available but no functional interchanges	26–30 mins or 93–94% on time
3	41–60%	45–59 mins	45–59 mins	Three modes are available, but interchanges are poorly designed (with long transfer times or lack coordination)	21–25 mins or 95–96% on time
4	61–80%	30–44 mins	30–44 mins	Interchanges are functional and support efficient travel to nearest employment hub	15–20 mins or 97–98% on time
5	>80%	<30 mins	<30 mins	A multimodal network (>3 modes) with seamless interchanges enabling cross-suburb travel (not just radial to CBD)	<15 mins and >98% on-time

Mobility & Commute Experience

Mobility & Commute Experience

This criterion assesses how well transport networks enable timely, reliable, and equitable access to key destinations, particularly during peak periods. Key indicators are:

Average Commute Time (Peak vs Off-Peak): A widening gap between peak and off-peak times indicates network strain during peak periods, reduced reliability, and productivity losses.

Road Congestion Levels: Measured using the Travel Time Efficiency Ratio (TTER) (Section 3.2). High congestion levels reflect inadequate road capacity relative to demand and are projected to cost Melburnians up to $10.2 billion annually by 2030 [44].

Public Transport Congestion Levels: The TTER methodology can also be applied to rail, train, and bus infrastructure to assess where capacity is insufficient to meet current or forecast demand.

Patronage Growth vs Capacity Forecasts: Monitoring patronage growth alongside capacity planning is essential for identifying infrastructure gaps. Without proactive investment, rapid increases in ridership can overwhelm existing public transport assets, leading to service deterioration.

Table 11 provides the comprehensive scoring guide for this criterion. It is important to note that Australia's urban development policy increasingly supports the concept of 30-minute cities as a benchmark for sustainable urban connectivity. This is to ensure that residents can access jobs, services, and amenities within a 30-minute travel time, regardless of the distance travelled [45]. Accordingly, scoring thresholds within this framework have been calibrated to support investment decisions aligned with this policy objective.

CRITERION 2

Table 11. Mobility & Commute Experience score guide.

Score	Average commute time	Road congestion levels	Public transport congestion levels	Patronage growth vs capacity forecasts
0	Peak >90 mins, Off-peak >75 mins. High variability (>30 min difference). Severe congestion and poor reliability.	TTER >2 Roads are severely congested.	TTER >2 Services are severely congested.	Patronage is growing rapidly (>5% annually), but no capacity upgrades are planned. Services are consistently overcrowded (>130% load factor). Infrastructure is at or beyond capacity.
1	Peak 75–90 mins, Off-peak 60–75 mins. High variability (21–30 mins). Commute is long and inconsistent.	TTER 1.81–2 Congestion causes missed connections and unreliable travel.	TTER 1.81–2 Congestion causes missed connections and unreliable travel.	Patronage growth is high (4.1–5% annually), with limited or delayed capacity upgrades. Overcrowding is frequent (121–130% load factor). Planning is reactive.
2	Peak 60–74 mins, Off-peak 45–59 mins. Moderate variability (16–20 mins). Commute is strained during peak hours.	TTER 1.61–1.8 Congestion is regular during peak hours.	TTER 1.61–1.8 Congestion is regular during peak hours.	Patronage growth is moderate (2.1–4% annually), but infrastructure is nearing capacity. Some upgrades are planned but not funded or sequenced. Load factor 111–120%.
3	Peak 45–59 mins, Off-peak 30–44 mins. Acceptable variability (11–15 mins). Infrastructure nearing capacity.	TTER 1.41–1.6 Congestion is manageable but growing.	TTER 1.41–1.6 Congestion is manageable but growing.	Patronage growth is steady (1.1–2% annually). Capacity is adequate for now, but future growth may strain the system. Upgrades are in early planning stages. Load factor 100–110%.
4	Peak 30–44 mins, Off-peak 20–29 mins. Low variability (5–10 mins). Commute is efficient and reliable.	TTER 1.21–1.4 Congestion is minimal and predictable.	TTER 1.21–1.4 Congestion is minimal and predictable.	Patronage growth is modest (0–1% annually). Capacity upgrades are funded and sequenced to meet future demand. Load factor 85–99%.
5	Peak <30 mins, Off-peak <20 mins. Minimal variability (<5 mins). Commute is short, consistent, and well-supported by infrastructure.	TTER 1–1.2 Roads are free-flowing and resilient to peak demand.	TTER 1–1.2 Services are free-flowing and resilient to peak demand.	Patronage growth is aligned with proactive capacity planning. Infrastructure is future-proofed for 2031–2046 projections. Load factor <85%. Services are frequent, reliable, and scalable.

Economic Development & Employment Access

Economic Development & Employment Access

This criterion assesses transport links to jobs and economic opportunity. Well-connected growth corridors attract employers, shorten commute distances, and improve work-life balance. Key indicators are:

Percentage of residents with access to local employment within 30 minutes: This measures the proportion of the population able to reach employment within 30 minutes, reflecting how well housing supply is integrated with employment hubs. It supports local economic development and reduces the burden of long commutes [46].

Impact on business and industrial precincts: Efficient transport links are essential for attracting industries to growth corridors and sustaining the economic growth of new and emerging communities [47].

Table 12 provides the comprehensive scoring guide for this criterion.

Table 12. Economic Development & Employment Access score guide.

Score	% of residents with access to local employment within 30 minutes	Impact on business and industrial precincts
0	<10% of residents can access local employment within 30 mins.	<10% of workplaces are within 400m of frequent public transport. No viable access for workers via public transport.
1	10–25% of residents can access local employment within 30 mins	10–25% coverage. Very limited access: services are infrequent or poorly aligned with work hours.
2	26–40% of residents can access local employment within 30 mins	26–40% coverage. Some access exists, but many workplaces remain disconnected from frequent services.
3	41–60% of residents can access local employment within 30 mins	41–60% coverage. Public transport is available and moderately frequent. Coverage is improving but not comprehensive.
4	61–80% of residents can access local employment within 30 mins	61–80% coverage. Most workplaces are within walking distance of frequent public transport. Services support typical work hours.
5	>80% of residents can access local employment within 30 mins	>80% coverage. Nearly all workplaces are well-served by frequent public transport. Public transport is a viable and preferred commuting option for workers.

CRITERION 3

Resilience & Future Readiness

Resilience & Future Readiness

This criterion assesses whether transport infrastructure is keeping pace with housing growth and whether the system is prepared to withstand future pressures, minimising potential impacts on the economy and quality of life [48]. Key indicators are:

Capacity to absorb future population growth (2031–2046 projections): Evaluates whether existing or planned infrastructure can accommodate forecast demand without negatively impacting communities [49].

Planned upgrades and infrastructure sequencing: Evaluates whether transport investments are appropriately timed to align with new housing delivery, ensuring that roads and transit services are available as communities grow [50].

Alignment with strategic plans and projects: Evaluates how well local land use strategies and major infrastructure projects are coordinated to support housing supply and long-term liveability.

Table 13 provides the comprehensive scoring guide for this criterion.

CRITERION 4

Table 13. Resilience & Future Readiness score guide.

Score	Capacity to absorb future population growth (2031–2046 projections)	Planned upgrades and infrastructure sequencing	Alignment with strategic plans and projects
0	Projected population growth exceeds transport capacity by >50%. No infrastructure upgrades planned or funded. Severe risk of future congestion and isolation.	No upgrades planned or funded. Delivery timelines lag population growth milestones by >5 years.	No alignment. Projects conflict with all relevant strategic plans and liveability objectives.
1	Growth exceeds capacity by 31–50%. Limited upgrades planned, with delays or funding gaps. Infrastructure will be overwhelmed.	Upgrades identified but not funded/sequenced. Delivery timelines lag milestones by 3–5 years.	Minimal alignment. <25% of projects support strategic objectives and liveability objectives.
2	Growth exceeds capacity by 10–30%. Some upgrades planned but not sequenced to meet demand. Risk of strain during peak growth years.	Some upgrades planned, but funding/sequencing incomplete. Timelines lag milestones by 1–3 years.	Partial alignment. 25–49% of projects support strategic objectives and liveability objectives.
3	Growth and capacity are roughly aligned (±10%). Planning is underway, but infrastructure may be stressed without timely delivery.	Upgrades planned and partially funded. Timelines align with milestones (within ±1 year of projected need).	Moderate alignment. 50–74% of projects support strategic objectives and liveability objectives.
4	Capacity exceeds projected growth by 11–30%. Infrastructure upgrades are funded and sequenced. Network is resilient to expected demand.	All upgrades funded and sequenced. Timelines lead milestones by 1–3 years (infrastructure ready before demand).	Strong alignment. 75–89% of projects support strategic objectives and liveability objectives.
5	Capacity exceeds projected growth by >30%. Infrastructure is future-proofed for 2031–2046. Planning is proactive, integrated, and scalable.	Upgrades fully funded, sequenced, and future proofed. Timelines lead milestones by >3 years (well ahead of demand).	Full alignment. ≥90% of projects directly support and deliver on strategic objectives and liveability objectives.

4.1.1 Liveability Scorecard: North Growth Corridor

This Liveability Scorecard Framework enables consistent, transparent, and evidence-based comparison across suburbs and projects. Gaps and opportunities are identified by asking, *"What is preventing this suburb or project from achieving a higher score?"* Recording these insights during assessment reveals recurring issues.

In this section, the North Growth Corridor is assessed using the liveability scorecard. Findings from projected population and housing growth (Objective 1) and transport infrastructure trajectories (Objective 2) were analysed against the Liveability Scorecard Framework to generate the final scores. The corridor's overall score of 2.08 out of 5 indicates poor to moderate transport infrastructure performance relative to recent housing growth, as shown in Table 14. To produce a visual representation, the data from Table 14 have been plotted and are presented in Fig. 22.

Key Findings from the Assessment

During the assessment, several critical issues emerged. Public transport access across the North Growth Corridor is limited and uneven, contributing to road congestion and long, unreliable commutes. While established suburbs like Broadmeadows and Roxburgh Park benefit from regular services, high-growth hotspots such as Beveridge, Mickleham and Wollert lack train stations and have limited bus access. As a result, access to frequent public transport within 400 metres is well below the metropolitan benchmark.

The corridor performs relatively well on proximity to jobs, due to dispersed employment centres across Melbourne's outer suburbs, but this advantage is largely car-dependent. Future readiness is poor, with infrastructure investment lagging behind rapid population growth. In essence, the current transport network only partially supports the scale of recent housing development.

Table 14. North Growth Corridor transport liveability baseline assessment. The complete dataset is too large to include in this report. Full results in Excel format are available upon request.

Suburb	Accessibility & Connectivity	Mobility & Commute Experience	Economic Development & Employment Access	Resilience & Future Readiness	Average
Hume					
Gladstone Park	3.20	2.25	4.00	3.67	**3.28**
Tullamarine	3.20	2.25	4.00	3.33	**3.20**
Broadmeadows	4.20	3.75	4.00	4.00	**3.99**
Roxburgh Park	3.60	3.00	4.00	3.67	**3.57**
Craigieburn	2.00	1.75	3.00	3.67	**2.60**
Mickleham	1.60	2.00	1.00	1.67	**1.57**
Whittlesea					
Epping	1.40	1.25	0.50	2.33	**1.37**
South Morang	3.20	2.25	3.00	2.33	**2.70**
Mernda	2.80	1.50	2.50	3.00	**2.45**
Wollert	1.80	3.00	1.50	2.00	**2.08**
Donnybrook	2.00	1.75	2.00	1.67	**1.85**
Mitchell Shire					
Beveridge	1.00	1.75	2.00	1.00	**1.44**
North Growth Corridor	2.00	2.00	3.00	1.33	**2.08**

Rising road congestion and long commute times reflect the corridor's heavy reliance on private vehicles. The Hume Freeway and a limited arterial network are increasingly strained, with few alternative routes to absorb disruptions. With most local employment centres still developing, residents in areas like Beveridge and Donnybrook must commute out, increasing travel costs, reinforcing congestion, and highlighting the imbalance between housing and jobs. This may also contribute to lower occupancy rates compared to other growth areas.

Infrastructure resilience and future readiness are lagging behind housing growth. Although the corridor's population is projected to more than double by 2046, few major transport upgrades are operational, funded, or under construction. This timing mismatch is already straining the network, particularly in high-growth hotspots, and will worsen as new developments are occupied. While key projects are outlined in growth plans and Precinct Structure Plans, implementation is not keeping pace with demand.

Overall, the findings highlight stark internal disparities within the North Growth Corridor.

Authors' Note: When assessing the North Growth Corridor as a whole, three of the four evaluation criteria scored similarly to the average of its individual suburbs, showing only minor differences. The largest difference was in the Resilience and Future Readiness criterion. This likely occurs because evaluating resilience at the suburb level is too limited, given the nature of this measure. Factors such as the ability to accommodate future population growth, planned infrastructure upgrades, and alignment with strategic plans are better assessed at a broader corridor or regional level to fully capture their impact.

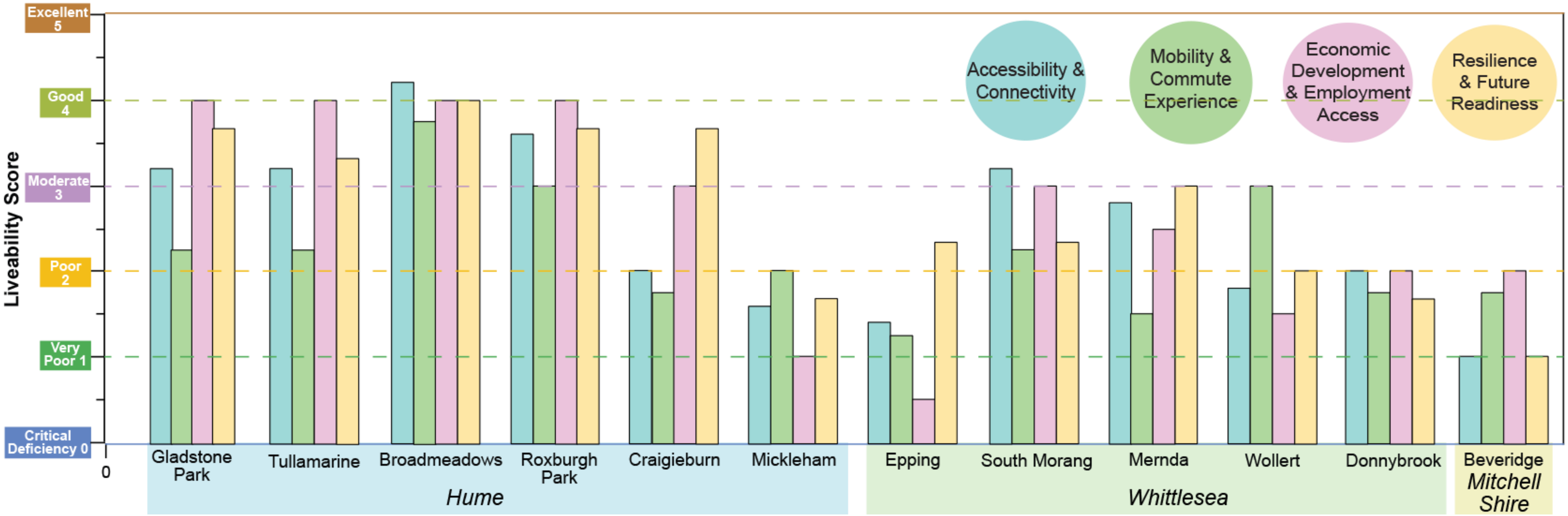


Fig. 22. Liveability scores by suburb within the North Growth Corridor.

4.1.2 Liveability Scorecard: Beveridge Infrastructure Projects

The Liveability Scorecard Framework is not limited to suburb-level assessments; it is also a versatile tool for evaluating how specific infrastructure projects are expected to influence transport-related liveability outcomes across a growth corridor. In this section, three pipeline infrastructure projects in Beveridge are assessed against the four criteria to evaluate their impact on transport liveability within the North Growth Corridor, as shown in Table 15.

Table 15. Liveability assessment of Beveridge infrastructure projects. The complete dataset is too large to include in this report. Full results in Excel format are available upon request.

Project	Accessibility & Connectivity	Mobility & Commute Experience	Economic Development & Employment Access	Resilience & Future Readiness	Average
Beveridge Baseline (from Table 14)	1.00	1.75	2.00	1.00	**1.44**
Beveridge Interstate Freight Terminal (BIFT)	1.00	1.50	2.50	1.67	**1.67**
Camerons Lane Interchange	1.40	1.50	2.50	3.00	**2.10**
Beveridge Train Station	3.20	3.00	3.00	2.67	**2.97**

As shown in Table 15, the proposed Beveridge train station and rail electrification project in the Beveridge and Lockerbie Precinct Structure Plans [51] demonstrates a significant uplift in liveability, increasing Beveridge's transport score from 1.44 to 2.97. This improvement is driven by anticipated gains in accessibility, commute times, reliability, and long-term resilience, bringing Beveridge closer in performance to more established suburbs, such as Gladstone Park and Broadmeadows.

In contrast, road-based projects like the Camerons Lane Interchange and the Beveridge Interstate Freight Terminal (BIFT) delivered more modest improvements, mainly in mobility and economic access, with limited impact on public transport or mode shift.

These assessments highlight the differentiated value of project types: public transport investments typically deliver broader, multi-criteria benefits, while road projects address more specific gaps. The Liveability Scorecard Framework enables consistent comparison across diverse project types, supporting transparent prioritisation and sequencing of infrastructure delivery.

Beveridge Interstate Freight Terminal (BIFT)
Artist's impression by the authors

4.1.3 Liveability Scorecard: South East Growth Corridor (Comparative Analysis)

To contextualise the transport infrastructure challenges in the North Growth Corridor, a comparative assessment (Table 16) was conducted with Melbourne's South East Growth Corridor, encompassing the City of Casey and Shire of Cardinia. Both corridors are experiencing rapid population growth; however, the South East Growth Corridor began urban expansion earlier and has benefited from more sustained infrastructure investment.

Table 16. Liveability comparison of North and South East Growth Corridors. The complete dataset is too large to include in this report. Full results in Excel format are available upon request.

Project	Accessibility & Connectivity	Mobility & Commute Experience	Economic Development & Employment Access	Resilience & Future Readiness	Average
North Growth Corridor (from Table 14)	2.00	2.00	3.00	1.33	**2.08**
South East Growth Corridor	2.80	2.25	2.50	3.33	**2.72**

With a rapidly growing population (Fig. 6), the South East Growth Corridor has seen significant projects such as the Monash Freeway widening, Cranbourne-Pakenham rail upgrades, and the planned Clyde extension. These investments have enhanced capacity and reliability despite ongoing congestion. In contrast, the North Growth Corridor is at an earlier development stage, with fewer major upgrades completed and a more limited transport network.

As shown in Table 16, the South East Growth Corridor outperforms the North Growth Corridor with an overall score of 2.72. Higher scores in Accessibility and Connectivity, and Resilience and Future Readiness reflect the South-East's more established infrastructure base and stronger preparedness for continued growth.

The South East Growth Corridor outperforms the North primarily due to the following:

Greater public transport coverage: Electrified rail lines and frequent bus services result in a higher proportion of households within 400 metres of public transport.

Sustained infrastructure investment: Projects such as EastLink, the Monash Freeway upgrades, and the Metro Tunnel have significantly improved network capacity and reliability in the South East. In contrast, key projects in the North, such as the Outer Metropolitan Ring (OMR)/E6, remain unfunded.

Better commute times: Train trips from Beveridge to the CBD take ~85–163 minutes, compared to ~70 minutes from Pakenham (in the Shire of Cardinia). Driving times remain congested in both corridors, reinforcing that public transport investment provides greater liveability benefits than road infrastructure alone.

Although the North scores higher on Economic Development & Employment Access, this may decline as population growth increases congestion and access to local job hubs remains poorly served by public transport. In summary, the South East Growth Corridor's higher scores reflect the long-term benefits of early, coordinated investment. The North will require proportionally greater and faster infrastructure delivery to support its rapid growth.

4.2 Investment Priorities for the North Growth Corridor

The Liveability Scorecard assessment confirms a significant and quantifiable gap between current and planned transport infrastructure and what is required to support the North Growth Corridor's projected population and housing growth. This gap is already impacting residents through long commutes, limited public transport access, and poor local connectivity. Without timely intervention, these challenges will escalate, constraining mobility, undermining liveability, and potentially suppressing housing demand in the corridor.

The assessment highlights three priority areas where infrastructure investment is most urgently needed:

North–South Road Capacity: The Hume Freeway (M31) is the North Growth Corridor's primary north–south arterial route, but it is already operating at or near capacity during peak periods. This is reflected in low Mobility and Commute Experience scores (2.00 corridor-wide and 1.75 for Beveridge and Donnybrook), highlighting worsening congestion and unreliable travel times. The key infrastructure gap is the absence of a high-capacity alternative to the Hume Freeway. Although the OMR/E6 has been identified in strategic planning, it remains unfunded and unscheduled. In the short term, targeted upgrades to the Hume Freeway, such as additional lanes or designated lanes for specific purposes , ramp metering, and intelligent traffic management, alongside significant investment in public transport (e.g., trackless tram) to encourage mode shift, are essential to prevent further decline in transport performance as the corridor continues to grow.

Mass Transit/Metro Train Services in High-Growth Hotspots: The Accessibility and Connectivity scores (2.00 for the corridor, 2.00 at Donnybrook, and just 1.00 at Beveridge) highlight a critical lack of metro-level public transport in the corridor's northern areas. The current reliance on infrequent V/Line services (typically every 40 minutes during peak periods and hourly off-peak) is inadequate. The assessment also shows fewer than 25% of dwellings are within 400 metres of frequent public transport, well below the benchmarks set by the Australian Urban Observatory [41]. This gap cannot be addressed without extending electrified Metro train services into these high-growth hotspots. New stations at Beveridge and Donnybrook serviced by high-frequency trains (at least every 30 minutes) are essential. As intermodal bus-rail connections are a recurring theme in supporting public transport uptake and reducing private vehicle use, a comprehensive overhaul of the PTV bus network is recommended, including the introduction of feeder services to new and existing stations to facilitate seamless intermodal travel.

Local and East–West Connectivity: The assessment also reveals that residents of Beveridge and Donnybrook face significant challenges travelling to nearby suburbs, such as Craigieburn and Mernda. Limited continuous east–west arterial roads and sparse local bus services force reliance on congested north–south routes or indirect back roads, creating inefficient travel patterns and congestion hotspots, especially near freeway interchanges and key intersections. Resilience and Future Readiness scores (ranging from 1.00 in Beveridge to 1.67 in Donnybrook) underscore the urgent need for a completed arterial grid, a strengthened local bus network, and a well-connected bus interchange that links key segments of the North Growth Corridor in all directions: North, South, East, and West. While some upgrades, such as the Donnybrook Road duplication and Camerons Lane Interchange, are planned, many remain in early stages or lack funding. Without timely delivery, internal accessibility will remain poor, undermining liveability, economic productivity, and housing growth targets.

These three investment priorities are illustrated in Fig. 23.

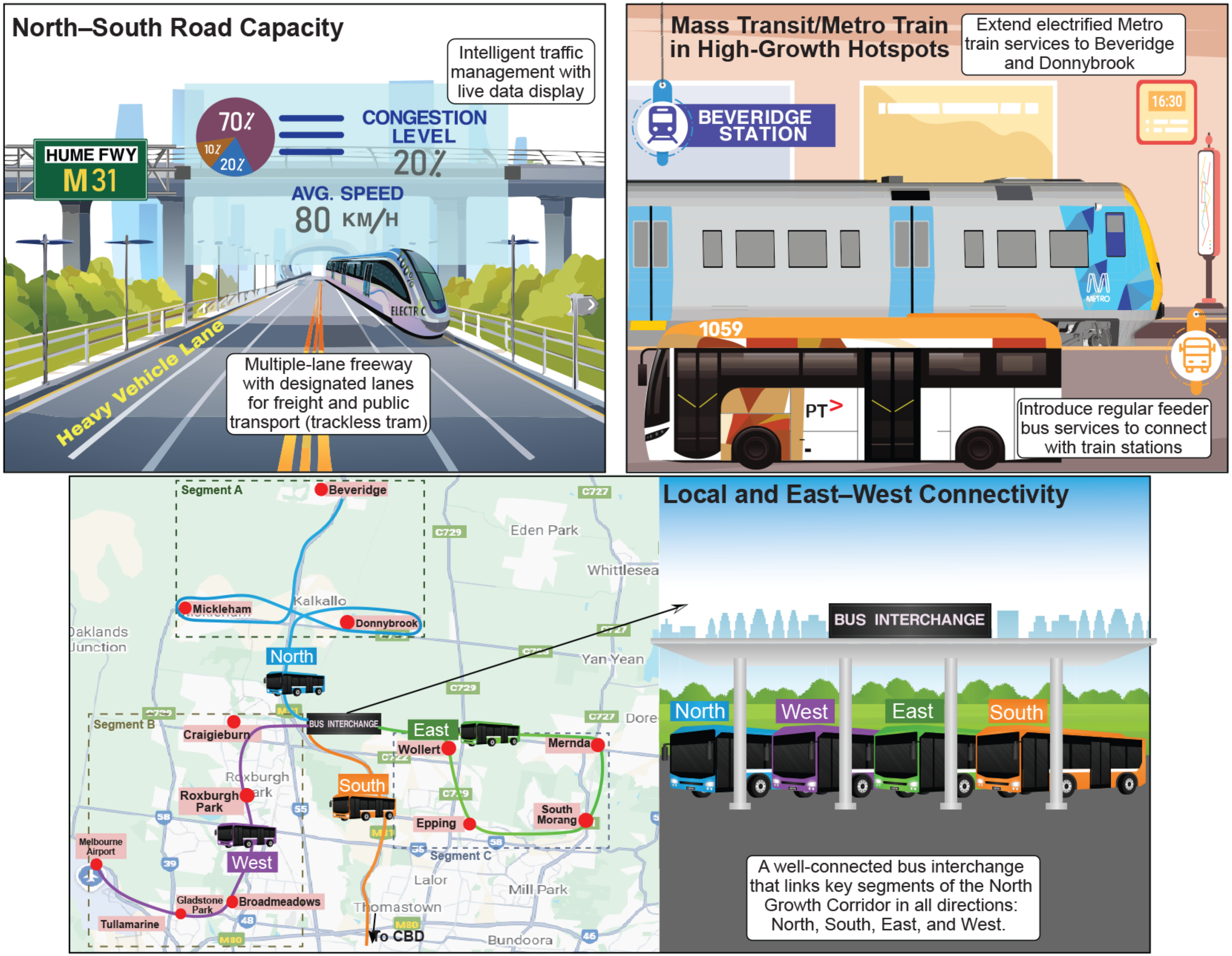


Fig. 23. The three investment priorities proposed by **Northern Connect**.

Objective Three: Reflection

Transport Gaps and Investment Priorities: A new methodology, the Liveability Scorecard Framework, has been applied to identify and quantify transport infrastructure gaps across the North Growth Corridor. Based on this assessment, three key investment priorities are proposed:

1) Delivery of the Outer Metropolitan Ring (OMR)/E6 or an equivalent high-capacity north–south road corridor in the future. In the short term, targeted upgrades to the Hume Freeway, such as additional lanes, designated lanes for heavy vehicles and trackless tram, ramp metering, and intelligent traffic management systems.

2) Electrification and extension of the Metro train network to Beveridge and Donnybrook, supported by a full redesign of the PTV bus network to enable effective feeder services and intermodal connectivity.

3) Development of the east–west arterial grid and establishment of a well-connected bus interchange that links key segments of the North Growth Corridor in all directions: North, South, East, and West. This can improve cross-corridor movement and reduce reliance on radial routes.

Data Gaps and Limitations: The transport Liveability Scorecard Framework developed for this study is a composite index incorporating both established indicators and qualitative judgements. While criteria were weighted equally to support comparability, alternative weighting approaches could yield different outcomes. The scorecard is best used as a comparative rather than absolute measure, and small differences should be interpreted with caution. Assumptions regarding project timing were based on publicly available information; however, many infrastructure upgrades remain uncommitted, introducing uncertainty into forecasts. Sensitivity to delivery timelines, such as delays to the OMR/E6, may significantly affect infrastructure gap estimates. Additionally, while this report identifies infrastructure needs, it does not assess cost, engineering feasibility, or funding constraints in detail. These factors require further analysis by relevant delivery agencies.

Future Data Improvements: Further development of the Liveability Scorecard Framework could include additional criteria to better assess the transport needs of vulnerable population groups, including low-income households, the elderly, youth, people with disabilities, and Traditional Owners, ensuring they have adequate access. Additionally, linking transport infrastructure to broader growth outcomes such as housing supply, economic development, health, and sustainability would enhance the framework's relevance. By aligning each criterion with a priority outcome for growth-area infrastructure, the methodology can better guide investments toward improvements that matter most for liveable communities and reveal gaps that a purely aggregate analysis might overlook. However, data availability, quality, and consistency remain variable and sometimes limiting. Establishing a unified data-sharing framework between Councils and the Department of Transport would improve accuracy and forecasting capability. Continuous monitoring, refinement, and the creation of a shared dashboard with key indicators and regular updates would support more adaptive and evidence-based planning as the corridor evolves.

Conclusions

Australia's ongoing housing crisis is a complex challenge shaped by rapidly increasing demand, insufficient supply, and significant barriers to timely housing delivery. The North Growth Corridor exemplifies this pressure, with population projections indicating substantial growth that will place considerable strain on existing infrastructure and services. Between 2021 and 2046, the corridor's population is expected to more than double, with key suburbs such as Beveridge, Donnybrook, Mickleham, and Wollert driving most of this expansion. This rapid growth underscores the urgent need for integrated planning approaches that align housing development with transport infrastructure capacity.

Current assessments reveal that much of the transport network within the corridor is already under strain, and this will worsen without targeted investment. The majority of major roads are forecasted to be insufficient to handle anticipated traffic volumes, leading to increased congestion and travel delays. Public transport options, while connecting residents to central Melbourne, face challenges including limited service frequency, network fragmentation, and extended travel times, particularly in fast-growing suburbs like Beveridge. These factors collectively contribute to reduced accessibility and liveability for residents, especially those dependent on public transport.

Addressing these challenges requires strategic investment guided by a robust understanding of infrastructure gaps. Using the Liveability Scorecard Framework, this study has identified three critical priorities to support the corridor's growth: the construction of a high-capacity north-south road corridor such as the Outer Metropolitan Ring (OMR)/E6 with short-term upgrades to the Hume Freeway; the electrification and extension of the Metro train network to Beveridge and Donnybrook paired with a comprehensive overhaul of the bus network to improve feeder services and facilitate seamless intermodal travel; and the establishment of an east–west arterial road grid, complemented by a well-connected bus interchange that links key segments of the North Growth Corridor in all directions: North, South, East, and West to enhance cross-corridor connectivity and reduce reliance on congested radial routes. These priorities are essential to fostering a transport system that supports sustainable population growth while enhancing community liveability.

In conclusion, the findings demonstrate that without coordinated infrastructure investment aligned with projected housing and population growth, the North Growth Corridor risks exacerbating congestion, limiting accessibility, and diminishing quality of life. A proactive, integrated approach to planning and delivery will be vital to ensuring that transport infrastructure keeps pace with development, enabling the corridor to evolve into a connected, liveable, and resilient community.

Future Works with Artificial Intelligence

As identified in Objective One, a key challenge in housing and transport planning is the continued reliance on outdated, inconsistent and fragmented data. Artificial intelligence (AI) offers practical and scalable solutions to address these issues by improving the accuracy, consistency and timeliness of infrastructure forecasting.

AI can automatically collect and integrate data from a range of sources, including the Australian Bureau of Statistics, the Department of Home Affairs, local council planning documents and public announcements. This approach ensures that data used in planning remains current, helping to reduce the lag between real-world developments and official projections. Where direct data feeds are unavailable, AI can be programmed to monitor websites and extract relevant information, such as planning proposals, infrastructure delivery schedules and housing approvals.

AI also plays a key role in standardising inconsistent datasets. It can harmonise formats, align reporting periods and fill data gaps through pattern recognition, creating a more complete and reliable evidence base for both national and regional infrastructure planning. Unlike traditional forecasting methods that rely primarily on linear trend analysis, AI models can assess multiple, interconnected factors such as employment shifts, transport accessibility and housing supply. These models can dynamically update forecasts as new data becomes available, leading to more responsive and realistic infrastructure demand projections.

In the area of transport demand modelling, AI has the potential to transform how travel patterns are understood and forecasted. Current approaches often rely on static indicators, such as travel time efficiency ratios or desktop analysis tools, which may not reflect the complexity of real-world behaviours. AI-driven models can integrate real-time traffic flows, GPS data, public transport usage and incident reports to simulate how people adjust their travel in response to infrastructure changes, congestion or policy interventions. This enables more accurate forecasting of peak spreading, route diversion and travel time reliability, which are critical factors for planning transport networks in fast-growing suburbs.

AI can also provide deeper insights into public transport usage and travel behaviour. By analysing large datasets on demographics, historical travel patterns, service quality and behavioural responses, AI can predict how changes such as increased train frequency or fare adjustments may influence mode choice. The use of mobile device data, smart ticketing systems and local travel surveys can further improve model accuracy, ensuring that infrastructure investment is better aligned with community needs and preferences.

By harnessing AI's capabilities, Infrastructure Australia and other planning bodies can significantly improve data quality, forecasting accuracy and the sophistication of transport modelling. This supports a smarter, more adaptive and evidence-based approach to infrastructure planning that meets the evolving needs of Australia's growing population.

ARTIFICIAL INTELLIGENCE IN HOUSING AND TRANSPORT INFRASTRUCTURE PLANNING

NORTHERN CONNECT

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NORTHERN CONNECT

Appendix: Datasets

Table A.1. Dataset of population growth projections by local government area.

Corridor	Local Government Area	Population Growth Projections						Total change	Average Annual Population Growth, AAPG (%)
		Yr 2021	Yr 2026	Yr 2031	Yr 2036	Yr 2041	Yr 2046		
North Growth Corridor	*Hume	207,662	239,023	257,604	274,576	291,165	306,300	98,638	1.63
	Whittlesea	247,060	285,054	320,336	352,632	384,928	417,224	170,164	2.22
	Mitchell Shire	49,695	69,600	92,576	123,801	168,482	221,636	171,941	6.16
West Growth Corridor	Brimbank	196,714	194,539	202,432	211,057	220,344	230,795	34,081	0.64
	Wyndham	296,179	342,221	391,650	431,338	463,632	488,572	192,393	2.02
	Melton	173,170	254,482	311,234	363,485	410,069	455,980	282,810	3.95
South East Growth Corridor	Boroondara	169,920	178,630	184,487	189,992	196,043	202,084	32,163	0.71
	Frankston	140,824	147,291	152,536	157,878	162,673	166,918	26,094	0.68
	Casey	369,453	444,654	505,046	559,681	593,496	614,075	244,622	2.05
	Monash	193,062	217,972	228,963	239,568	250,219	261,000	57,157	1.31
	Glen Eira	150,685	160,500	170,882	181,976	190,327	198,431	47,746	1.11
	Kingston	159,554	165,837	170,978	176,157	183,608	192,026	32,472	0.74
North West (Sunbury) Growth Corridor	Sunbury	39,188	46,361	58,777	73,944	89,874	105,374	66,186	4.04

**(Hume=Hume Total-Sunbury)*

Table A.2. Dataset of population growth projections by suburb.

Local Government Area	Suburb	Population Growth Projections						Total Change	Average Annual Population Growth, AAPG (%)
		Yr 2021	Yr 2026	Yr 2031	Yr 2036	Yr 2041	Yr 2046		
Hume	Gladstone Park	8,286	8,283	8,292	8,281	8,287	8,316	30	0.01
	*Melbourne Airport (Tullamarine)	6,762	6,747	6,794	6,828	6,877	6,853	91	0.05
	Broadmeadows	12,766	13,248	14,136	15,379	17,817	21,269	8,503	2.18
	Roxburgh Park	24,412	25,047	25,057	25,009	25,044	25,096	684	0.11
	Craigieburn	66,091	71,297	74,969	77,278	79,365	80,078	13,987	0.79
	Mickleham	17,680	30,091	38,096	46,742	54,616	60,996	43,316	5.92
Whittlesea	Epping	33,827	36,635	41,186	45,881	50,576	55,271	21,444	2.06
	South Morang	25,227	26,901	29,163	31,312	33,461	35,610	10,383	1.42
	Mernda	23,639	24,705	25,486	24,666	25,462	26,447	2,808	0.46
	Wollert	24,807	37,377	49,701	62,511	75,321	88,131	63,324	5.88
	Donnybrook	2,120	13,656	28,225	43,718	59,187	74,656	72,536	30.69
Mitchell Shire	Beveridge	4,303	11,696	25,171	48,688	76,623	112,187	107,884	19.37

**Includes Melbourne Airport and wider Tullamarine area*

Table A.3. Dataset of population growth projections by age group.

Local Government Area	Suburb	Age group 5 – 24 (school-aged/university students)				Total Change	% Change
		Yr 2021	Yr 2026	Yr 2031	Yr 2036		
Hume	Gladstone Park	4,172	4,303	4,561	4,772	600	14.38
	*Melbourne Airport (Tullamarine)	1,273	-	1,454	-	181	14.21
	Broadmeadows	3,721	4,019	4,417	4,687	966	25.96
	Roxburgh Park	8,306	8,053	7,545	7,073	-1,233	-14.84
	Craigieburn	13,052	13,735	14,513	14,731	1,679	12.86
	Mickleham	6,120	11,273	16,048	20,949	14,829	242.30
Whittlesea	Epping	8,942	9,031	10,439	11,359	2,417	27.03
	South Morang	7,341	7,286	7,523	7,573	232	3.16
	Mernda	6,653	7,405	8,176	8,553	1,900	28.56
	Wollert	6,793	10,710	14,324	17,987	11,194	164.79
	Donnybrook	937	3,719	7,849	12,285	11,348	1211.10
Mitchell Shire	Beveridge	1,307	4,100	6,893	14,496	13,189	1009.10

Local Government Area	Suburb	Age group 25 – 69 (Working-age adults)				Total Change	% Change
		Yr 2021	Yr 2026	Yr 2031	Yr 2036		
Hume	Gladstone Park	10,427	10,556	10,696	11,051	624	5.98
	*Melbourne Airport (Tullamarine)	4,121	-	3,941		-180	-4.37
	Broadmeadows	8,161	9,113	10,875	13,009	4,848	59.40
	Roxburgh Park	13,285	13,794	14,254	14,339	1,054	7.93
	Craigieburn	24,386	26,328	28,828	31,171	6,785	27.82
	Mickleham	14,008	21,287	27,610	34,596	20,588	146.97
Whittlesea	Epping	19,740	21,049	23,022	25,860	6,120	31.00
	South Morang	14,502	15,976	17,858	19,489	4,987	34.39
	Mernda	13,577	13,707	13,860	13,872	295	2.17
	Wollert	14,385	21,421	28,575	36,345	21,960	152.66
	Donnybrook	1,979	7,679	15,924	24,621	22,642	1144.11
Mitchell Shire	Beveridge	2,524	8,405	14,286	31,464	28,940	1146.60

Table A.3. Continued.

Local Government Area	Suburb	Age group 70 years and above (older adults and retirees)				Total Change	% Change
		Yr 2021	Yr 2026	Yr 2031	Yr 2036		
Hume	Gladstone Park	2,537	2,878	3,184	3,337	800	31.53
	*Melbourne Airport (Tullamarine)	976	-	1,051	-	75	7.68
	Broadmeadows	1,146	1,254	1,675	2,358	1,212	105.76
	Roxburgh Park	1,205	1,574	2,116	2,927	1,722	142.90
	Craigieburn	1,756	2,652	3,839	5,222	3,466	197.38
	Mickleham	449	807	1,430	2,387	1,938	431.63
Whittlesea	Epping	2,841	4,128	5,164	5,888	3,047	107.25
	South Morang	1,818	1,963	2,050	2,283	465	25.58
	Mernda	1,115	1,186	1,171	1,171	56	5.02
	Wollert	681	844	1,069	1,338	657	96.48
	Donnybrook	241	706	1,313	2,158	1,917	795.44
Mitchell Shire	Beveridge	73	1,130	2,188	4,230	4,157	5694.52

**Includes Melbourne Airport and wider Tullamarine area*

Table A.4. Dataset of dwelling and household growth projections by local government area.

Dataset	Local Government Area	Dwelling and Household Growth Projections						Total change	Average Annual Dwelling Growth, AADG (%)	Average Occupancy Rate, AOR (%)
		Yr 2021	Yr 2026	Yr 2031	Yr 2036	Yr 2041	Yr 2046			
North Growth Corridor										
Dwelling	*Hume	68,657	79,269	87,644	96,319	98,377	103,789	35,132	1.74	93.47
Household		65,009	73,662	80,631	88,865	92,687	98,370	33,361	-	
Dwelling	Whittlesea	82,993	95,769	108,669	122,319	134,806	147,293	64,300	2.43	93.00
Household		79,031	87,460	99,786	115,827	122,643	138,459	59,428	-	
Dwelling	Mitchell Shire	19,590	25,068	33,544	45,070	58,065	74,384	54,794	6.12	93.54
Household		18,009	22,979	30,922	43,153	55,011	70,677	52,668	-	
West Growth Corridor										
Dwelling	Brimbank	71,871	75,194	78,884	82,734	85,401	90,131	18,260	0.93	94.61
Household		68,469	71,141	74,603	78,208	80,529	85,047	16,578	-	
Dwelling	Wyndham	100,363	122,682	142,382	161,932	163,567	173,662	73,299	2.37	94.94
Household		95,959	116,545	135,289	153,849	154,676	164,003	68,044	-	
Dwelling	Melton	60,363	82,671	102,271	121,921	141,012	160,103	99,740	4.36	96.10
Household		58,734	79,673	97,616	116,405	135,193	153,981	95,247	-	
South East Growth Corridor										
Dwelling	Boroondara	72,924	77,012	78,211	80,902	83,851	86,801	13,877	0.71	93.72
Household		66,916	70,728	74,234	77,836	78,575	81,509	14,593	-	
Dwelling	Frankston	58,890	61,152	63,602	66,552	69,541	72,093	13,203	0.83	97.14
Household		57,058	59,557	62,481	65,693	66,649	69,057	11,999	-	
Dwelling	Casey	122,674	143,422	162,122	180,772	194,837	202,926	80,252	2.14	97.10
Household		120,253	139,639	158,107	176,296	187,337	194,830	74,577	-	
Dwelling	Monash	76,463	80,970	86,370	92,270	94,627	96,984	20,521	0.98	93.98
Household		70,685	74,616	79,295	84,656	90,732	96,807	26,122	-	
Dwelling	Glen Eira	66,235	70,589	74,839	79,089	81,755	85,071	18,836	1.03	92.97
Household		61,555	64,561	68,456	72,355	77,571	81,327	19,772	-	
Dwelling	Kingston	67,560	69,895	72,247	74,754	78,211	81,995	14,435	0.79	95.49
Household		63,714	66,577	69,009	71,589	75,035	78,843	15,129	-	
North West Growth Corridor										
Dwelling	Sunbury	15,323	18,211	23,136	28,751	34,888	41,857	26,534	4.46	96.48
Household		14,742	17,608	22,351	27,748	33,633	40,332	25,590	-	

**(Hume=Hume Total-Sunbury)*

Table A.5. Dataset of dwelling and household growth projections by suburb.

Dataset	Suburb	Dwelling and Household Growth Projections						Total change	Average Annual Dwelling Growth, AADG (%)	Average Occupancy Rate, AOR (%)
		Yr 2021	Yr 2026	Yr 2031	Yr 2036	Yr 2041	Yr 2046			
Hume										
Dwelling	Gladstone Park	3,241	3,242	3,246	3,251	3,259	3,271	30	0.04	97.27
Household		3,110	3,144	3,161	3,174	3,184	3,204	94	-	
Dwelling	*Melbourne Airport (Tullamarine)	3,146	3,181	3,216	3,251	3,286	3,321	175	0.22	93.09
Household		2,936	2,973	3,004	3,033	3,062	3,050	114	-	
Dwelling	Broadmeadows	4,626	4,878	5,281	6,091	7,457	8,923	4,297	2.85	94.12
Household		4,192	4,775	4,866	5,847	7,041	8,356	4,164	-	
Dwelling	Roxburgh Park	6,823	6,983	7,028	7,066	7,116	7,185	362	0.21	97.05
Household		6,576	6,793	6,835	6,868	6,912	6,975	399	-	
Dwelling	Craigieburn	20,737	22,385	23,611	24,444	25,193	25,354	4,617	0.83	96.72
Household		19,872	21,602	22,829	23,666	24,404	24,757	4,885	-	
Dwelling	Mickleham	5,675	9,386	11,844	14,674	17,275	19,379	13,704	5.82	94.17
Household		5,262	8,637	11,001	13,960	16,567	18,674	13,412	-	
Whittlesea										
Dwelling	Epping	11,935	13,025	14,925	16,975	19,025	21,075	9,140	2.41	95.13
Household		11,429	12,374	14,179	16,126	18,073	20,020	8,591	-	
Dwelling	South Morang	8,502	9,252	10,152	11,102	12,052	13,002	4,500	1.77	96.65
Household		8,296	8,931	9,796	10,709	11,622	12,535	4,239	-	
Dwelling	Mernda	8,091	8,491	8,891	9,191	9,491	9,791	1,700	0.78	95.79
Household		7,865	8,109	8,492	8,778	9,064	9,350	1,485	-	
Dwelling	Wollert	7,989	12,479	16,679	20,979	25,279	29,579	21,590	6.13	94.92
Household		7,594	11,580	15,712	20,040	24,267	28,395	20,801	-	
Dwelling	Donnybrook	1,168	4,441	9,122	14,262	19,514	24,766	23,598	20.23	92.69
Household		1,050	4,081	8,534	13,395	18,256	23,117	22,067	-	
Mitchell Shire										
Dwelling	Beveridge	1,383	4,400	9,176	17,331	26,407	37,651	36,268	20.42	94.84
Household		1,341	4,128	8,637	16,365	25,018	35,775	34,434	-	

**Includes Melbourne Airport and wider Tullamarine area*

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Table A.6. Dataset of travel duration by car via major roads to and from Southern Cross Station.

Distance to/from Southern Cross (approx. km)	Suburb	Time Period 1: Weekdays Morning (7–8 am)													
		Peak Inbound (To Southern Cross Station) (mins)							Off-Peak Outbound (From Southern Cross Station) (mins)						
		Mon	Tue	Wed	Thu	Fri	AVG	Sample STDEV	Mon	Tue	Wed	Thu	Fri	AVG	Sample STDEV
21	Gladstone Park	33	35	24	27	29	29.6	4.45	33	33	24	23	26	27.8	4.86
23	Broadmeadows	39	38	40	33	35	37.0	2.92	30	34	24	27	26	28.2	3.89
24	*Melbourne Airport (Tullamarine)	28	33	24	25	30	28.0	3.67	26	25	21	20	20	22.4	2.88
32	Roxburgh Park	50	54	49	39	44	47.2	5.81	42	50	37	41	39	41.8	4.96
38	Epping	49	50	59	41	47	49.2	6.49	42	50	37	34	43	41.2	6.14
44	Craigieburn	47	59	49	47	45	49.4	5.55	48	49	38	37	43	43.0	5.52
54	Wollert	50	57	60	49	55	54.2	4.65	46	50	43	41	45	45.0	3.39
55	South Morang	58	59	68	50	45	56.0	8.86	55	53	43	41	46	47.6	6.14
58	Mickleham	57	60	51	49	47	52.8	5.49	55	56	42	43	40	47.2	7.66
59	Donnybrook	55	62	61	52	49	55.8	5.63	57	56	50	46	51	52.0	4.52
60	Mernda	61	64	66	55	50	59.2	6.61	55	50	47	49	44	49.0	4.06
69	Beveridge	61	57	56	51	52	55.4	4.03	55	53	46	43	49	49.2	4.91
Distance to/from Southern Cross (approx. km)	Suburb	Time Period 2: Weekdays Afternoon (4–5 pm)													
		Off-Peak Inbound (To Southern Cross Station) (mins)							Peak Outbound (From Southern Cross Station) (mins)						
		Mon	Tue	Wed	Thu	Fri	AVG	Sample STDEV	Mon	Tue	Wed	Thu	Fri	AVG	Sample STDEV
22	Gladstone Park	27	28	26	25	30	27.2	1.92	45	40	43	38	39	41.0	2.91
23	Broadmeadows	35	31	27	29	28	30.0	3.16	50	42	47	46	45	46.0	2.91
24	*Melbourne Airport (Tullamarine)	27	28	26	25	23	25.8	1.92	38	42	38	36	33	37.4	3.28
32	Roxburgh Park	50	42	40	39	40	42.2	4.49	54	48	61	65	59	57.4	6.58
38	Epping	41	39	43	42	42	41.4	1.51	52	50	61	59	52	54.8	4.86
44	Craigieburn	48	42	37	37	35	39.8	5.26	51	49	50	52	50	50.4	1.14
54	Wollert	46	43	41	48	45	44.6	2.70	62	65	59	59	61	61.2	2.48
55	South Morang	55	47	54	52	51	51.8	3.11	57	56	66	60	65	60.8	4.54
58	Mickleham	50	45	45	40	48	45.6	3.78	60	59	55	61	57	58.4	2.40
59	Donnybrook	49	45	39	48	50	46.2	4.43	65	59	66	63	53	61.2	5.31
60	Mernda	52	50	48	56	55	52.2	3.34	62	58	66	61	59	61.2	3.11
69	Beveridge	55	59	49	47	57	53.4	5.17	67	72	66	61	59	65.0	5.14

Table A.6. Continued.

Distance to/from Southern Cross (approx. km)	Suburb	Time Period 3: Weekends Midnight (12–1 am)							
		Off-Peak Inbound (To Southern Cross Station) (mins)				Off-Peak Outbound (From Southern Cross Station) (mins)			
		Sat	Sun	AVG	Sample STDEV	Sat	Sun	AVG	Sample STDEV
22	Gladstone Park	18	21	19.5	2.12	22	24	23.0	1.41
23	Broadmeadows	20	22	21.0	1.41	29	28	28.5	0.71
24	*Melbourne Airport (Tullamarine)	26	23	24.5	2.12	27	30	28.5	2.12
32	Roxburgh Park	35	32	33.5	2.12	37	35	36.0	1.41
38	Epping	32	29	30.5	2.12	35	37	36.0	1.41
44	Craigieburn	37	36	36.5	0.71	35	36	35.5	0.71
54	Wollert	39	40	39.5	0.71	38	40	39.0	1.41
55	South Morang	43	41	42.0	1.41	41	38	39.5	2.12
58	Mickleham	41	45	43.0	2.82	42	37	39.5	3.54
59	Donnybrook	43	40	41.5	2.12	40	43	41.5	2.12
60	Mernda	46	48	47.0	1.41	44	47	45.5	2.12
69	Beveridge	51	49	50.0	1.41	47	49	48.0	1.41

**Melbourne Airport and wider Tullamarine area*

Table A.7. Segment A: Public transport capacity and projected demand during weekdays' peak periods in Years 2031 and 2036.

Segment A

Seymour V/Line service (Beveridge, Mickleham and Donnybrook)												
Capacity						**Projected Demand Peak Periods (calculated from data in Appendix Table A.3)**						Is **Demand** > **Capacity** ? (Yes=Overcrowding, No=OK, Adequate)
AM Peak Inbound 7–9am (To Southern Cross)			**PM Peak Outbound 4–6pm (From Southern Cross)**			**Yr 2031**			**Yr 2036**			
Departing Donnybrook Station	No. of Seats	Total Capacity	Departing Southern Cross	No. of Seats	Total Capacity	30% of school-aged students in *Donnybrook, Beveridge, Mickleham*	5% of working-age adults in *Donnybrook, Beveridge, Mickleham*	Total Demand	30% of school-aged students in *Donnybrook, Beveridge, Mickleham*	5% of working-age adults in *Donnybrook, Beveridge, Mickleham*	Total Demand	
7:10am	444	1,236	4:07pm	444	1,314	9,237	2,891	12,128	14,319	4,534	18,853	Yes, Overcrowding
7:50am	348		4:37pm	261								
8:18am	444		5:05pm	348								
			5:30pm	261								
PTV Bus 511 (Beveridge)												
Departing Beveridge	Capacity	Total Capacity	Departing Donnybrook Station	Capacity	Total Capacity	1% of school-aged students in *Beveridge*	1% of working-age adults in *Beveridge*	Total Demand	1% of school-aged students in *Beveridge*	1% of working-age adults in *Beveridge*	Total Demand	Yes, Overcrowding
7:14am	55	55	4:25pm	55	55	69	143	212	145	315	460	
PTV Bus 525 (Mickleham)												
Departing Mickleham	Capacity	Total Capacity	Departing Donnybrook Station	Capacity	Total Capacity	1% of school-aged students in *Mickleham*	1% of working-age adults in *Mickleham*	Total Demand	1% of school-aged students in *Mickleham*	1% of working-age adults in *Mickleham*	Total Demand	Yes, Overcrowding
7:23am	55	165	4:20pm	55	220	160	276	437	209	346	555	
7:55am	55		4:55pm	55								
8:34am	55		5:25pm	55								
			5:58pm	55								

Table A.7. Segment B: Public transport capacity and projected demand during weekdays' peak periods in Years 2031 and 2036.

Segment B	Craigieburn Metro Line (Craigieburn, Roxburgh Park, Tullamarine, Gladstone Park, Broadmeadows)												
	Capacity						**Projected Demand Peak Periods (calculated from data in Appendix Table A.3)**						Is **Demand** > **Capacity** ? (Yes=Overcrowding, No=OK, Adequate)
	AM Peak Inbound 7–9am (To Southern Cross)			**PM Peak Outbound 4–6pm (From Southern Cross)**			**Yr 2031**			**Yr 2036**			
	Departing Craigieburn Station	Capacity	Total Capacity	Departing Southern Cross	Capacity	Total Capacity	30% of school-aged students in *Craigieburn*, *Roxburgh Park*, *Gladstone Park*, *Tullamarine*, *Broadmeadows*	5% of working-age adults in *Craigieburn*, *Roxburgh Park*, *Gladstone Park*, *Tullamarine*, *Broadmeadows*	Total Demand	30% of school-aged students in *Craigieburn*, *Roxburgh Park*, *Gladstone Park*, *Broadmeadows* *(Tullamarine data n/a for 2036)*	5% of working-age adults in *Craigieburn*, *Roxburgh Park*, *Gladstone Park*, *Broadmeadows* *(Tullamarine data n/a for 2036)*	Total Demand	
	7:01am	1,241 (443 seats; 798 standing)	17,374 (6,202 seats; 11,172 standing)	4:04pm	1,241	21,097 (7,531 seats; 13,566 standing)	9,747	3,430	13,177	9,379	3,479	12,858	OK, Adequate, but some passengers will need to stand
	7:07am	1,241		4:14pm	1,241								
	7:16am	1,241		4:24pm	1,241								
	7:30am	1,241		4:34pm	1,241								
	7:39am	1,241		4:44pm	1,241								
	7:45am	1,241		4:53pm	1,241								
	7:53am	1,241		4:55pm	1,241								
	8:03am	1,241		5:02pm	1,241								
	8:17am	1,241		5:08pm	1,241								
	8:23am	1,241		5:14pm	1,241								
	8:33am	1,241		5:20pm	1,241								
	8:39am	1,241		5:24pm	1,241								
	8:46am	1,241		5:30pm	1,241								
	8:53am	1,241		5:39pm	1,241								
				5:44pm	1,241								
				5:52pm	1,241								
				6:00pm	1,241								
	PTV Bus 525 (Craigieburn)												
	Departing Craigieburn	Capacity	Total Capacity	Departing Craigieburn Station	Capacity	Total Capacity	1% of school-aged students in *Craigieburn*	1% of working-age adults in *Craigieburn*	Total Demand	1% of school-aged students in *Craigieburn*	1% of working-age adults in *Craigieburn*	Total Demand	Yes, Overcrowding
	7:15am	55	275	4:13pm	55	385	145	288	433	147	312	459	
	7:35am	55		4:38pm	55								
	7:50am	55		4:56pm	55								
	8:12am	55		5:09pm	55								
	8:29am	55		5:27pm	55								
				5:39pm	55								
				5:45pm	55								

PTV Bus 544 (Roxburgh Park)												
Departing Roxburgh Park	Capacity	Total Capacity	Departing Craigieburn Station	Capacity	Total Capacity	1% of school-aged students in *Roxburgh Park*	1% of working-age adults in *Roxburgh Park*	Total Demand	1% of school-aged students in *Roxburgh Park*	1% of working-age adults in *Roxburgh Park*	Total Demand	OK, Adequate
7:01am	55	275	4:04pm	55	220	75	143	218	71	143	214	
7:32am	55		4:34pm	55								
8:02am	55		5:04pm	55								
8:10am	55		5:34pm	55								
8:32am	55											
PTV Bus 477 (Gladstone Park and Tullamarine)												
Departing Gladstone Park	Capacity	Total Capacity	Departing Essendon Station	Capacity	Total Capacity	1% of school-aged students in *Gladstone Park, Tullamarine*	1% of working-age adults in *Gladstone Park, Tullamarine*	Total Demand	1% of school-aged students in *Gladstone Park (Tullamarine data not available for 2036)*	1% of working-age adults in *Gladstone Park (Tullamarine data not available for 2036)*	Total Demand	OK, Adequate
7:15am	55	330	4:19pm	55	330	60	146	206	48	111	159	
7:35am	55		4:39pm	55								
7:55am	55		4:59pm	55								
8:16am	55		5:18pm	55								
8:38am	55		5:38pm	55								
8:57am	55		5:59pm	55								

Table A.7. Segment C: Public transport capacity and projected demand during weekdays' peak periods in Years 2031 and 2036.

Segment C

Mernda Metro Line (Wollert, Epping, South Morang, Mernda)												
Capacity						Projected Demand Peak Periods (calculated from data in Appendix Table A.3)						Is Demand > Capacity ? (Yes=Overcrowding, No=OK, Adequate)
AM Peak Inbound 7–9am (To Southern Cross)			PM Peak Outbound 4–6pm (From Southern Cross)			Yr 2031			Yr 2036			
Departing Mernda Station	Capacity	Total Capacity	Departing Southern Cross	Capacity	Total Capacity	30% of school-aged students in *Wollert*, *Epping*, *Mernda*, *South Morang*	5% of working-age adults in *Wollert*, *Epping*, *Mernda*, *South Morang*	Total Demand	30% of school-aged students in *Wollert*, *Epping*, *Mernda*, *South Morang*	5% of working-age adults in *Wollert*, *Epping*, *Mernda*, *South Morang*	Total Demand	
7:08am	794 (528 seats; 266 standing)	12,704 (8,448 seats; 4,256 standing)	4:06pm	794	11,910 (7,920 seats; 3,990 standing)	12,139	4,166	16,304	13,642	4,778	18,420	Yes, Overcrowding
7:12am	794		4:16pm	794								
7:18am	794		4:26pm	794								
7:27am	794		4:35pm	794								
7:30am	794		4:44pm	794								
7:36am	794		4:53pm	794								
7:39am	794		5:01pm	794								
7:48am	794		5:10pm	794								
7:54am	794		5:18pm	794								
8:01am	794		5:22pm	794								
8:10am	794		5:30pm	794								
8:16am	794		5:38pm	794								
8:23am	794		5:46pm	794								
8:35am	794		5:50pm	794								
8:45am	794		5:58pm	794								
8:53am	794											
PTV Bus 356 (Wollert)												
Departing Wollert	Capacity	Total Capacity	Departing Epping Station	Capacity	Total Capacity	1% of school-aged students in *Wollert*	1% of working-age adults in *Wollert*	Total Demand	1% of school-aged students in *Wollert*	1% of working-age adults in *Wollert*	Total Demand	Yes, Overcrowding
7:05am	55	330	4:18pm	55	330	143	286	429	180	363	543	
7:25am	55		4:36pm	55								
7:45am	55		4:58pm	55								
8:03am	55		5:18pm	55								
8:21am	55		5:38pm	55								
8:41am	55		5:56pm	55								

PTV Bus 577 (Epping)												
Departing Epping	Capacity	Total Capacity	Departing South Morang Station	Capacity	Total Capacity	1% of school-aged students in *Epping*	1% of working-age adults in *Epping*	Total Demand	1% of school-aged students in *Epping*	1% of working-age adults in *Epping*	Total Demand	OK for morning peak inbound, but not adequate for afternoon peak outbound
7:08am	55	385	4:20pm	55	220	104	230	334	114	259	373	
7:17am	55		4:57pm	55								
7:37am	55		5:17pm	55								
7:57am	55		5:37pm	55								
8:17am	55											
8:36am	55											
8:50am	55											

"This project is dedicated to every Victorian still waiting for secure and affordable housing"

Written through a visual storytelling lens, this report is designed to inform, inspire, and make complex housing and transport planning accessible, relatable, and meaningful for people of all ages.

"Because good planning isn't just about infrastructure—it's about people, and the lives it can change"

Hua Qian Ang, Inhae Jung, Josie Kleinitz, Vinh Ly