Glen Eira City Council

Carnegie Activity Centre

Transport Study

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Executive Summary

Glen Eira City Council (GECC) is developing a Built Form Framework (BFF) for the Carnegie Activity Centre (CAC) in consultation with Lat37 Studios. The BFF will inform a new set of planning controls to guide development outcomes in the CAC, including building heights and setbacks, as well as overall objectives, strategies and principles for urban design and the public realm.

Arup was engaged by GECC to investigate the existing transport conditions in Carnegie and the implications of the BFF, with this report documenting the key findings and recommendations. This study is an opportunity to identify ways to create positive changes in the transport network that align the future of Carnegie with policy ambitions and community expectations.

Situational Analysis

A situational analysis of Carnegie has critically reviewed the existing transport policy context, trends shaping urban transport, precinct accessibility by all modes, and travel behaviour in the area. This culminated in the identification of a number of strengths, weaknesses, opportunities & threats to the CAC:

Strengths	Weaknesses
• A highly accessible precinct with good public transport options, viable for transit-oriented development. • A vibrant precinct with midday and night-time activity, highlighting the benefits of a place-based approach to street planning and design. • Great access to the Djerring Trail for regional cycling connections. • Distinct land use mix that would be complemented by increased resident population, which may reduce the travel needs and creating other economic benefits.	• Very poor conditions for people cycling along Neerim Road and Koornang Road. • Laneways are narrow, discontinuous and shared between various users, leading to low amenity walking environments that may create challenges for accommodating redevelopment. • Current statutory car parking requirements are poorly aligned with the local context and likely market demand for car parking in new developments. • On-street parking on Koornang Road is a relatively inefficient use of public space. • The road network and car parking are approaching capacity across peak periods and utilisation remains high across the day, with limited opportunities to increase network capacity. • Poor safety record at adjacent arterial intersections to central Carnegie.

Opportunities	Threats
• A secondary circulation either side of Koornang Road offers alternative access opportunity for new developments. • The existing laneway network provides a basis for potential expansion to enhance permeability and create a more three-dimensional activity centre, rather than simply a 'high street'. • Prior to COVID-19, a rise in public transport trips and decrease in vehicle trips suggests significant potential for mode shift. • Public transport use in the CAC is high, and car ownership is lower than Greater Melbourne, suggesting locally specific parking controls for new developments should be pursued, particularly for residential uses.	• New development may compromise the realisation of a longer-term fine-grained laneway network. • The legal status and existing use rights for access via privately owned laneways either side of Koornang Road is uncertain. • Creation of additional or wider laneways may be challenging, and potential lot consolidation creates added uncertainty. • Flexible working and evolving travel demand patterns due to COVID creates a general challenge for policy-makers and planners to anticipate a 'new normal'. • Evidence suggests COVID has spurred a renewed car dependence, creating challenges to achieving mode shift in the 'new normal'. • Circulating traffic at peak times caused by search for parking vacancies may be undermining the walkability and attractiveness of Koornang Road.

Future Development and Transport Demand

The BFF sets out allowable building heights, open space, active frontages and other urban design principles to guide the development of the CAC. SGS Economics and Planning (SGS) has estimated the potential take-up of land for retail, commercial and residential development, by 2036, summarised in the table below.

Forecast Land Use Change in Carnegie

Scenario	No. of Dwellings	Retail & Retail Services (m^2 GFA)	Commercial (m^2 GFA)
Existing	2,502	52,400	20,500
2036	5,048	64,500	25,100
% Change	***+102%***	***+23%***	***+22%***

Source: SGS Economics and Planning.

Naturally, if unmanaged; increases in development activity can place additional pressure on existing transport infrastructure. This pressure can be managed through interventions detailed in this report, which include various network mitigation recommendations, however, it also requires a degree of social and cultural acceptance in alignment with global trends of how cities need to manage urban change; by embracing active and public transport, and by supporting sustainable models of development that co-locate population density, jobs and services.

The key issue sought to be understood within this report is the potential traffic capacity implications associated with increased development in the CAC. The increase in travel demands have been estimated, measured in additional peak hour trips, by each transport mode, to 2036. While the demand assessment is not intended as a detailed traffic model of a 'post-development' scenario (which would require more detailed inputs and data collection), it provides an understanding of the scale of change and pressure-points at the local level.

Three demand scenarios were considered, as a way of dealing with the future uncertainty over travel demand and changing mobility patterns:

- **Scenario 1: Business as usual:** This scenario adopts standard industry benchmarks and empirical travel behaviour data sets collected prior to the COVID-19 pandemic.

- **Scenario 2**: **Policy target mode share:** This scenario seeks to understand the potential shift in trips to more sustainable modes, by assuming that the outcome by 2036 is more aligned with the GECC policy goal of a 50:50 car and non-car mode share.

- **Scenario 3**: **Impact Covid-19:** This scenario seeks to understand a hypothetical 'COVID-normal' or post-COVID scenario, characterised by an increase in car use, higher rates of work-from-home, and public transport hesitancy.

Comparison of peak hour trips for each demand scenario

Mode	Scenario 1 Business as Usual	Scenario 2 Target Mode Share	Scenario 3 Impact of Covid-19
Car	1,480	1,100	1,190
Bicycle	100	140	100
Walk	740	950	820
Public Transport	420	550	270
Total	**2,740**	**2,740**	**2,380**

The alternatives to a 'business as usual' future show that the number of car trips could reduce from around 1,480 to 1,100 vehicle trips in a peak hour. In order to understand the traffic implications under a worst case scenario, the 'Business As Usual' demands have been used to assess traffic impacts at the precinct level via key access roads.

Transport Response and Recommendations

The overarching findings of this study are as follows:

- Development controls that allow increased co-location of population density, jobs and services, in a high-accessibility location; inherently provide broader benefits in terms of more sustainable travel patterns, as well as community health and wellbeing through better transport choice.
- Carnegie has significant potential for a continued shift toward public transport and more sustainable, transit-oriented land use, given its high accessibility and proximity to radial public transport.
- The existing road network and car parking is at or near capacity, and there is a need to encourage public transport, walking and cycling to manage travel demand.
- There is an opportunity to develop a Parking Overlay (or similar) to support reduced traffic generation, offset the traffic pressures of development and support a transition toward more sustainable patterns of development. GECC should update the existing parking policy to mitigate traffic in the rear laneways by allowing low-car and no-car development for properties fronting Koornang Rd.
- Future development will place pressure on local access capacity of the road network. An access strategy is needed that will support and guide long term development outcomes while balancing and preserving street amenity.
- The scope for major increases to road capacity is limited. Given the finite capacity of the road network, a degree of peak spreading and displacement of non-local trips on the network is expected. The possible exception is the Urban Renewal Precinct which may be afforded access to Dandenong Road. Notwithstanding, some options are available to manage amenity, safety, and circulation.

- Development intensity allowed by the BFF, particularly in the Urban Renewal Precinct, needs a connected system of laneways. Some changes to improve laneway capacity and amenity can be planned for, to support the desired level of growth and development.

The specific recommendations for the network are outlined in the figure and table below.

Summary of Recommendations and Access Strategy

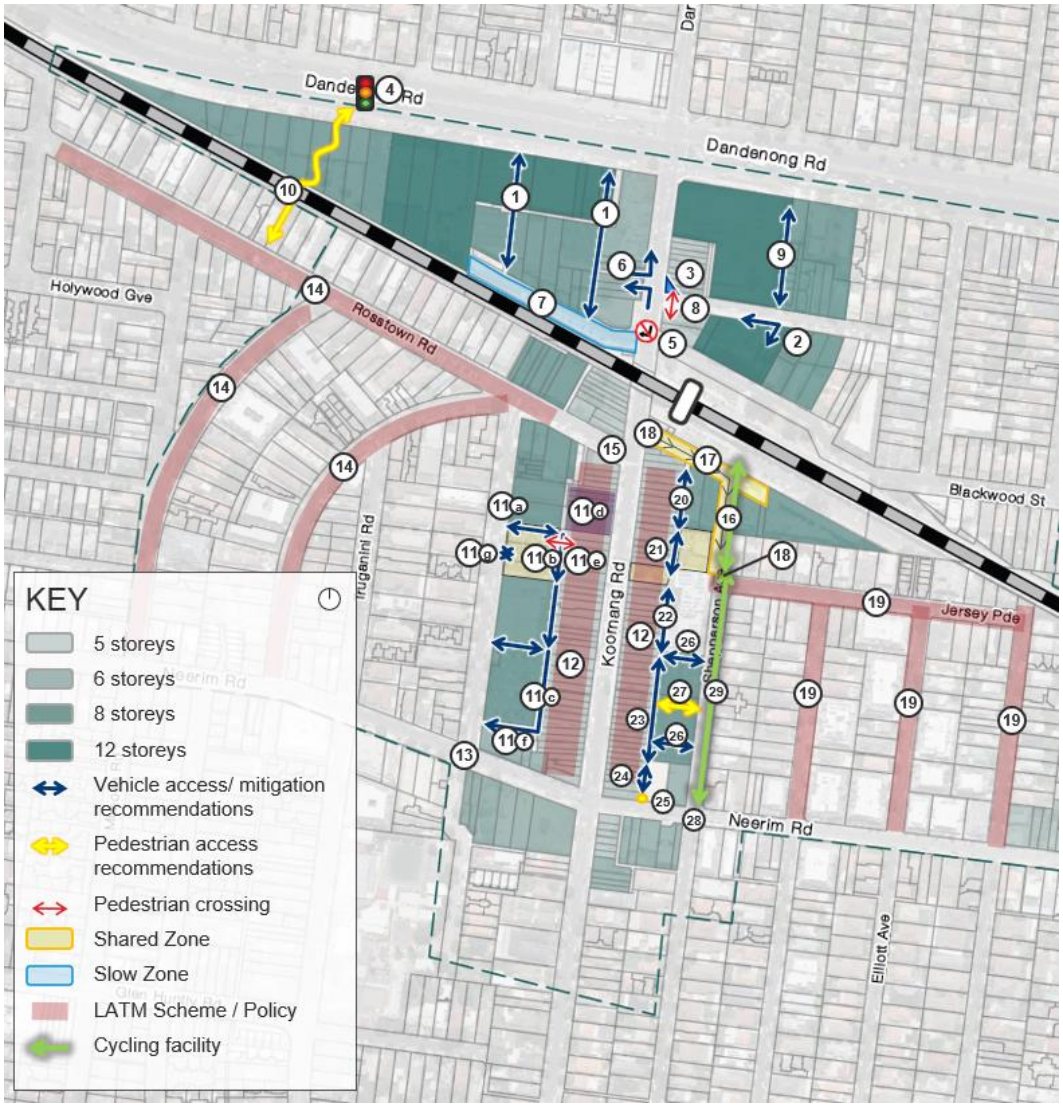

Table of recommendations

ID	Description
1	Interconnected north-south laneways between Egan Street and Dandenong Rd.
2	Focus new development access to Arawatta Street.
3	Building splays to ground floor level to improve intersection layout and address existing pedestrian safety issues.
4	Investigate feasibility of long-term signals along Dandenong Road as well as interim treatments to support short term safety and amenity. Any signals would ideally be aligned with, or connected to, a new internal road or laneway connection in the Urban Renewal Precinct.
5	Investigate potential right-turn bans from Koornang Rd.
6	Potential restriction to left-in/left-out at Koornang Rd / Laneway access.
7	Slow road environment along Egan Street to prioritise pedestrians, on-street dining and street greening
8	Improved pedestrian crossing at Arawatta St.
9	Maintain north-south through-site links to Dandenong Road upon development.
10	Work with developers to provide public access between Dandenong Road, the Djerring Trail, and Rosstown Road via future open space.
11	Interim and ultimate access strategy to facilitate laneway access to staged development west of Koornang Road.
12	Parking policy to support low traffic generating developments.
13	Minor upgrades to the intersection layout at Neerim Road/Kokaribb Road.
14	Local Area Traffic Management scheme.
15	Potential lane storage upgrade to enhance intersection operations.
16	One-way Shared Zone on Morton Avenue-Shepparson Avenue, including a contraflow bike lane on Shepparson Avenue between Jersey Parade and Morton Avenue (providing a connection to the Djerring Trail).
17	Implement a shared zone along Morton Avenue
18	Transition zones to show a change in priority between transport modes.
19	Local Area Traffic Management scheme.
20-24	Retain existing laneways with minor upgrades in conjunction with development.
25	Close the existing laneway connection to Neerim Road, retaining the land as a Pedestrian Link.
26	East-west Shared Lanes as part of future development.
27	East-west Pedestrian Link from Shepparson Avenue and linking to Koornang Road via existing laneways.
28	Minor upgrades to the intersection layout at Neerim Road/Shepparson Avenue
29	Investigate improved cycling connections on Shepparson Avenue between Neerim Road through to the Djerring Trail.
CP	Continue the use of permit only schemes in local streets where parking from the activity centre is likely to overspill. To protect local amenity – as outlined in the Glen Eira Parking Policy.
CP	Review existing car parking policy and update to consider supporting car parking below statutory requirements in Carnegie, as well allowing low-car and no-car

	development for properties fronting Koornang Rd to mitigates traffic impacts to rear laneways.
CP	Council should consider its position on requiring a reduced car parking provision, or a capped provision as part of a policy-led initiative, particularly for 'shop-top' residential development along Koornang Road.
CP	Pursue a tactical approach to incremental removal of on-street parking over time at key sites such as at intersections, to facilitate public realm improvements, including pro-active supporting measures to manage the remaining supply of parking.
CP	Investigate a parking pricing scheme as a way of offsetting peak parking demand and encouraging a shift to other modes, or to less busy times of day.
CP	Proposals to transform the existing at grade car parking to open space incorporate a reprovision of a similar supply.
PT	Consider GECC's position in advocating for or supporting recent marked-led proposals for a rapid transit corridor (trackless tram) along the Dandenong Road corridor between Caulfield and Monash National Employment and Innovation Cluster.
ST	Investigation opportunities to promote sustainable forms of transport such as supporting the rollout of an e-micromobility trials, reviewing the adequacy of public bicycle parking rails, and ways of improving broader north-south accessibility to Carnegie Station by bike to support bicycle park 'n' ride.

Key:
(CP) Car Parking
(PT) Public Transport
(ST) Sustainable Transport

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Abbreviations

ABS	Australian Bureau of Statistics
BFF	Built Form Framework
BOH	Back-of-house
CAC	Carnegie Activity Centre
CBD	Central Business District
DoT	Department of Transport
EOTF	End of Trip Facility
GECC	Glen Eira City Council
ITS	Integrated Transport Strategy
M&P	Movement and Place
MSS	Municipal Strategic Statement
PPF	Planning Policy Framework
PPTN	Principal Public Transport Network
SA2	Statistical Area Level 2
SCC	Strategic Cycling Corridor
VISTA	Victorian Integrated Survey of Travel and Activity
vpd	Vehicles per day
vph	Vehicles per hour
VPP	Victoria Planning Provisions

1 Introduction

1.1 Background

Glen Eira City Council (GECC) is developing a Built Form Framework (BFF) for the Carnegie Activity Centre (CAC) in consultation with Lat37 Studios. Arup was engaged by GECC to investigate the transport implications of the Carnegie BFF and provide an appropriate response to support future development associated with the revised Carnegie Structure Plan.

It is understood that the BFF will inform a new set of planning controls to guide development outcomes in the CAC, including building heights and setbacks, as well as overall objectives, strategies and principles for urban design and the public realm. To support the implementation of the BFF, it is understood that the Carnegie Structure Plan 2018-2031 will also be updated to support a planning scheme amendment.

The future development of the CAC will lead to changes in transport demands for all modes, and the extent of change needs to be understood, along with the challenges in managing the transport network to support this growth. It also presents an opportunity to improve the transport network by creating positive change and align the future of Carnegie with local, state and national government policy ambitions and community expectations.

1.2 Purpose of this report

The purpose of this report is to determine the transport requirements and recommendations that could support future development in the CAC. Specifically, this study has been prepared to:

- Develop an understanding of Carnegie's unique transport and land use context both now, and into the future;
- Identify and review the potential transport impacts of the BFF;
- Identify a suite of sustainable and innovative transport responses to address issues and opportunities arising out of the expected long-term changes;
- Investigate policy opportunities to shape the way people travel;
- Review the justification for potential transport interventions by providing evidence to support decision making; and
- Consider the feasibility of the use of laneways to facilitate access to new developments.

1.3 Methodology

Arup have adopted the following methodology for undertaking the study, covered over two stages:

- **Part One: Situational Analysis (Chapters 1-3).** In parallel with the BFF being developed, the existing transport context was reviewed, identifying a number of strengths, weaknesses, opportunities and threats associated with travel behaviour, urban transport trends, and the built environment.
- **Part Two: Assessment and Response (Chapters 4-10).** Transport implications of future development in the CAC were assessed and along with the situational analysis, have culminated in a number of recommendations to support future development of the CAC.

1.4 Assumptions and limitations

The scope of this study has been impacted by COVID-19 restrictions across 2020 that have impacted travel demands and behaviours, as well as the ability to collect primary data on traffic and car parking conditions. The following tasks have not been possible in preparation for this study: collecting updated car parking demand and occupancy data, obtaining traffic counts to understand current traffic volumes and performance of the local network, as well as existing transport demand generation.

For the purpose of this report, GECC has provided Arup with historical data collected over the past 5 years which has been drawn upon as evidence. Specific limitations to the use of historical data have been provided where required in the relevant sections of this report. Where available, other data sources have been used to supplement the analysis as shown in Table 1.

Table 1 – Data sets used in this study

Data Source	Time / Date	Use
Aerial photography	Approx. 1pm 23 February 2019	Used as a comparison against 2017 data parking inventory and demand survey. Review of overspill car parking demands into residential zone.
TomTom GPS Trace Data	Weekday average for May 2019	Used to understand basic metrics of network performance and congestion on major roads in the activity centre.
SCATS traffic signal volume detector data	15 and 16 May 2019	Used to understand peak hour and daily traffic flows on Koornang Rd and Neerim Rd, providing a 'pre-covid' baseline against which the net increase in traffic demands can be measured.

The long-term effects on travel behaviour associated with the COVID-19 pandemic are only beginning to be understood and remain a key source of uncertainty in understanding the future transport requirements. The approach that has been adopted considers a range of scenarios for assessment in recognition of this uncertainty.

Beyond this, the COVID-19 pandemic may impact the trajectory of underlying growth and development forecasts themselves, increasing the level of uncertainty. In this regard, this report relies on the inputs and assumptions of forecasting by SGS (that includes some consideration of the evolving influence of COVID-19). These estimates remain coarse and cover 'sub-precincts' rather than individual parcels. Despite the above limitations, the assessments provided in this report are still considered adequate for estimated changes in network demands at this phase of planning.

1.5 Reference documents

In preparing this report, reference has been made to the following:

- SGS existing and future land use forecasts provided via email 16 March 2022
- Lat37 Studios proposed building heights, open space and other urban design principles to inform the Built Form Framework provided via email 29 June 2022.
- Glen Eira Transformative Concepts Review (Onemilegrid, 2017).
- Glen Eira Street Design Guide 2021 briefing material (Glen Eira City Council, 2021).
- Transport Analysis and Forecasting Discussion Paper (MR Cagney, 2017).
- Parking Analysis for Bentleigh, Carnegie and Elsternwick draft Structure Plans (Glen Eira City Council, October 2017).
- Australian Bureau of Statistics Census data, as listed within this report.
- Victorian Integrated Survey of Travel and Activity (Department of Transport).
- Other State and Local Government policies and strategies as listed within this report.

1.6 Study area

The study area is shown in Figure 1, capturing the BFF study area plus key adjacencies, focusing only on the commercial and mixed-use areas of the CAC including the land in the Public Use Zone owned by Council. As outlined by the project brief, the study area provided consists of that proposed as part of the new structure plan. As depicted, the Transport Study boundary consists of two sections, a northern section covering roughly 48ha of the CAC along Koornang Road and Neerim Road, and a smaller southern section covering roughly 4ha of land along Koornang Road and Truganini Road close to Koornang Park.

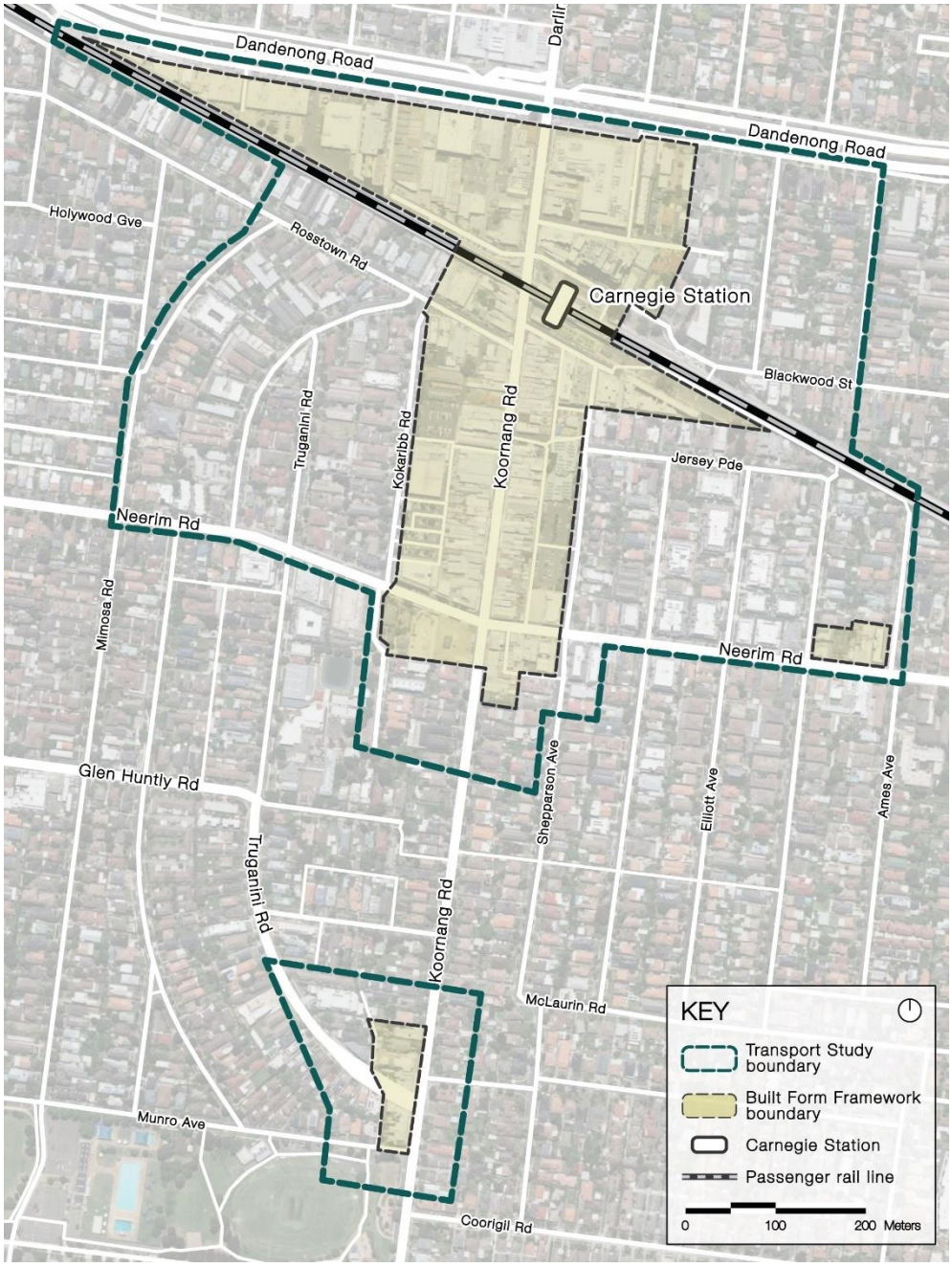


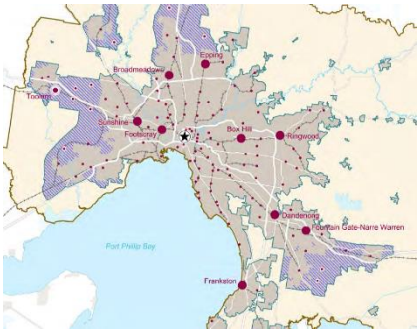
Figure 1 – Transport Study and Built Form Framework study area

2 Transport policy context

A literature review of the existing state and local policy documents has been carried out to confirm the relationships between Carnegie and the broader transport context, both in terms of the planning and governance. The purpose of this review is to ensure that any future strategies and objectives for Carnegie are aligned to both the overarching State policy, as well as having determining alignment with Glen Eira's existing commitments.

2.1 State government planning and policy

Plan Melbourne 2017-2050



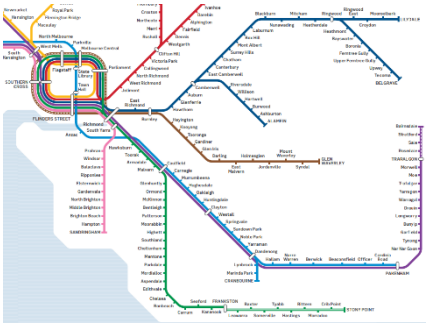
The 35-year plan for Melbourne is a Victorian Government planning document and implementation plan that outlines the key principles, outcomes, directions and policies to accommodate the State's future population and employment growth. Carnegie Activity Centre is identified in the Plan as a Major Activity Centre. Key actions from the plan have recently been completed in the study area, including the Carnegie level crossing removal with elevated rail.

Relevant ambitions for the area identified in Plan Melbourne:

- Support the development of a network of Activity Centres linked by transport.
- Contribute to accommodating a growth of 125,000 new dwellings in the established area of the Inner South East by 2051.
- To create a city of 20-minute neighbourhoods by integrating transport and land use, supported by local public transport, safe cycling networks and walkability.
- Encourage medium and high-density development in Major Activity Centres.
- Integrate place-making practices into road-space management, including a shift in current road space allocation by increasing off-street carparking and reducing on-street provisions to improve cyclist safety and increase space for dedicated public transport corridors.
- Improve neighbourhoods, particularly transit-oriented developments, to enable walking and cycling as a part of daily life.

Strategic Cycling Corridors have been identified in alignment with the Victorian Cycling Strategy (discussed below), to provide viable and direct links and support cycling for commuting.

Growing Our Rail Network 2018-2025



Outlining the funded investments across the State over the next 7 years, the network plan shows the future operating configuration for the rail network following the opening of the Metro Tunnel in 2025.

These changes include:

- Level crossing removals (Carnegie complete).
- 65% high-capacity metro trains running turn-up-&-go services, Cranbourne/ Pakenham to Sunbury.

The network plan is anticipated to have flow on impacts for the study area, increasing capacity via Carnegie Station and increasing the potential for visitors, activation and regional connection.

A number of possible future investments for beyond 2025 identified in the network plan will also have an impact on the future-planning for the Carnegie area, including fast rail to regional Victoria and the Cranbourne line duplication.

Victorian Cycling Strategy 2018-2028

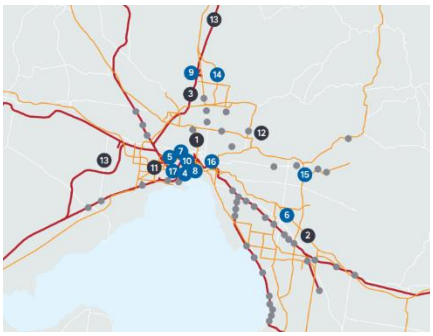
The Victorian Cycling Strategy 2019-2028 sets out a vision for the future of cycling in the state and a plan to deliver it, by:

- Investing in a safer, lower-stress, better-connecting network, prioritising strategic cycling corridors; and
- Making cycling a more inclusive experience.

As a Major Activity Centre, the approach to cycling in the CAC is important in Victoria reaching this cycling vision. The Strategy sets out the importance of local councils, such as the GECC, developing and managing their own municipal bicycle networks to facilitate direct and convenient connections to the Principal Bicycle Network (PBN), while also integrating their cycling network with stations and major public transport interchanges, addressing gaps in strategic cycling corridors, increasing the participation of underrepresented groups and planning for emerging technologies.

An initiative of the strategy is the definition of a number of Strategic Cycling Corridors (SCC), a collection of dedicated recreational cycling links connecting key centres. The Djerring Rail, a corridor making up part of the SCC network, currently passes through the study area alongside the Cranbourne Line, providing a highly utilised regional cycling link.

Delivering the Goods: Victorian Freight Plan



The Victorian Freight Plan sets the short, medium and long-term priorities for the Victorian freight and logistic system to accommodate unprecedented growth in freight volumes. The Cranborne Line is identified as a Principal Freight Network and passes through the northern section of the site and contains Carnegie Station. Besides the Cranborne Line, there are no other major freight connections in the study area.

Initiatives for the study area included in the Plan, such as the improvement of the Cranborne Line level-crossing removals, have already been implemented.

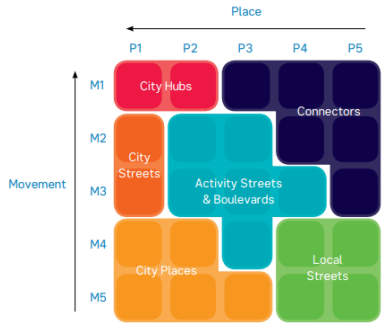
Victoria's Infrastructure Strategy 2021-2051

Victoria's Infrastructure Strategy responds to recent events, policy changes and strategies and summarises the states infrastructure needs over the next 30 years to support economic productivity, social equity, connectedness and ecological impact.

The strategy poses a number of strategies around the theme of ***managing urban change*** that are relevant to Carnegie:

- **Integrate land use and infrastructure planning** by sequentially delivering required infrastructure and services to support and encourage development in centres that can accommodate growth. Particularly for the CAC, where urban development, growth and future infrastructure meet, the collaboration of governments and agencies in the integrated planning process will be critical in achieving common objectives for urban efficiency, sustainability and equity.
- **Create thriving urban places** by supporting more homes in priority established places, using value-capture mechanisms to deliver very low-income housing, developing an interconnected open space network, partnering with local governments to fund pedestrian infrastructure, reallocate road space and fund transport accessibility.
- **Steer changes in travel behaviour** by introducing discounts and reducing bus and tram fares, reforming parking pricing at major public transport hubs, incorporating congestion pricing, while introducing levies and demand-responsive pricing for on-street parking.
- **Adapt infrastructure for modern needs** by rapidly renewing old public housing, requiring accessible buildings and upgrading public hospital infrastructure.

Movement and Place in Victoria, Department of Transport



The Movement and Place (M&P) Framework was developed by the DoT 'to assist in conducting effective integrated transport planning'. It is a decision-making framework and tool-set for network planning, management and design of roads and streets for movement, place, environment and safety outcomes.

M&P thinking stems from the recognition that streets perform multiple functions. Not only do streets move people from one place to another, they also serve as places and destinations in their own right for people to arrive and stay. The M&P framework provides four modules in the approach to street design: classifying the network, defining network performance, developing options, and assessment.

For areas such as Carnegie, the framework can help Councils to bring together the variety of competing factors and demands for locally managed streets and help classify the M&P vision to aid decision-making, as well as providing design guidance for future transport solutions. The framework can also help in communicating the vision for a street.

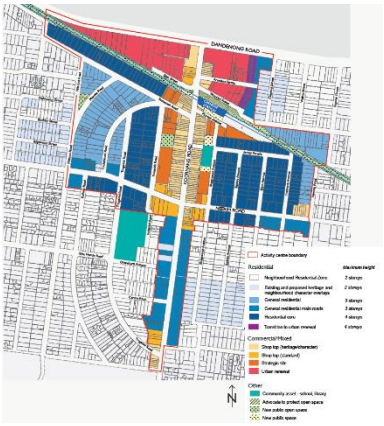
In order to align with the State transport policy framework, GECC has developed M&P classifications for the Carnegie Activity Centre, which are reproduced in Appendix A. These are currently being refined with the Department of Transport (DoT) and are subject to changes following yearly reviews of the role of the network and land uses.

Implication of State Policy Context

The CAC is well positioned as a Major Activity Centre to deliver on a number of the State's goals outlined in strategic documents, particularly Plan Melbourne, Victorian Cycling Strategy and M&P Framework. The CAC is well placed to capitalise on its location to public transport, potential of Koornang Road as a vibrant high street and key connections to strategic active transport corridors. Movement & Place provides a framework for strategic transport and land use planning and has been deployed as part of this study to develop a strategies/objectives and potential interventions that could be complementary to the Structure Plan.

2.2 Local government planning and policy

Carnegie Activity Centre Structure Plan – 2018-2031



The Carnegie Activity Centre Structure Plan was adopted in 2018, outlining the vision for the centre's built form, land use, renewal and movement network. Defined by the Structure Plan, the GECC continues to highlight the importance of maintaining a strong reflection between built form and land use, seeking improvements to the integration of bus services with the recently upgraded rail station, improving connections for people cycling and increasing the supply of off-street car parking to residents and visitors. To ensure this, the plan focusses on a number of statutory measures, including:

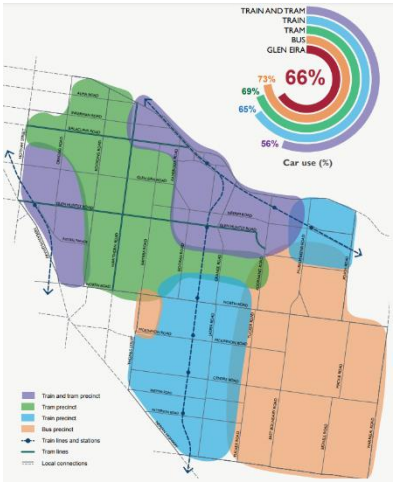
- Review land use zoning to support appropriate housing development in the housing opportunity precinct, realisation of the urban renewal precinct and support commercial activity.
- Implement building design guidance to ensure increased amenity, adequate transition between building types and developer contributions.
- Investigate the provision of a car parking overlay or parking precinct plan.
- Review public open space and provide design guidance to ensure greater protection to public spaces from adjoining developments.

The Structure Plan also highlights the development aspirations of three key sites, including the Kokaribb Road car park supermarket redevelopment (a Council-owned site), Shepparson Avenue market building development and urban renewal proposed in the northern section of the Activity Centre, north of the passenger rail line. Key elements include:

- Introduction of built form (building height) controls for future development.
- Retain as many on-street parking spaces as possible.
- Ensure vehicle access to the rear of Koornang Road shops.

In August 2020, the GECC exhibited a planning scheme amendment (C184) to implement new zoning and built form controls, however it was abandoned in March 2021.

Glen Eira Integrated Transport Strategy



The Glen Eira Integrated Transport Strategy (ITS) was adopted by Council in 2018 and sets out a 15-year priority plan for transport, providing strategic direction for future structure plans, policies and strategies. It is a key document in defining the future vision for the municipality. The overall goal of the ITS is to strive for a reduction in car use to 50% of all trips by 2031.

Under the framework, the CAC is highlighted as a precinct with excellent access to train and tram public transport, with potential for significant improvements to active transport infrastructure along Koornang Road and Shepparson Avenue for commuting and access means. Key themes that were prioritised for the CAC include:

- Construction of separated, continuous, safe bike paths on Koornang Road (south of Neerim Road) and Shepparson Avenue (north of Neerim Road).
- Pedestrian priority at all side street intersections along Koornang Road, Glen Huntly Road and near the tram termination on Truganini Road.
- Investigate shared zones to improve the pedestrian network.
- Improving traffic signals to prioritise pedestrians.
- Advocate for premium cycling infrastructure along the Cranbourne and Pakenham Line.

Glen Eira Parking Policy

The Glen Eira Parking Policy was endorsed in 2020, and outlines Council's approach to equitably addressing increased access and parking demand as a result of increased development. The overarching goal of the parking policy is for parking to reflect achieving a 50:50 mode share shift across Glen Eira.

The policy follows a place-based approach for neighbourhoods, activity centres and corridors, with a particular focus on on-street parking. The top five priorities for on-street vehicle parking that the planning for the CAC should respond to include:

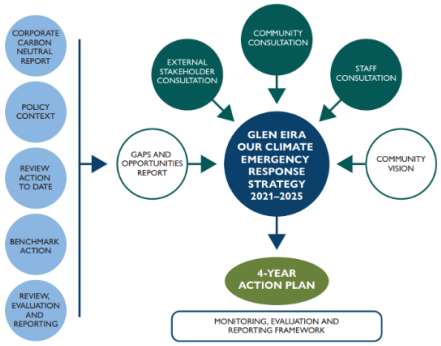
- Widen footpaths to increase safety awareness and cater for a rise in footpath activity.
- Prioritise tram/ bus stops, including taxi/ rideshare pick-up and drop-off parking.
- On-street medium-term parking bays for people with disabilities.
- Short-term parking for pick-up/ drop-off.
- Improve safety for all road users, providing access for emergency vehicles, waste collection and street cleaning.

For off-street vehicle parking, the parking policy defers to established guidance of Clause 52.06 of the Victoria Planning Provisions (VPP), which provides minimum parking rates while allowing a reduction to these based on decision guidelines. A local rate is applicable for student housing, where the minimum number of spaces is specified in a schedule to the Parking Overlay, to better reflect the reduced car ownership pattern of students. It is understood that the Department of Environment, Land, Water & Planning (DELWP) are currently in the process of reviewing Clause 52.06, subsequent to its discussion paper 'Reforming the Victoria Planning Provisions' (October 2017). As part of the Parking Policy, Council notes that it will consider the introduction of a Parking Contribution Overlay in its major activity centres to facilitate shared parking.

The policy takes a more nuanced approach to bike parking, recognising that the current requirements under the VPP Clause 52.34 is insufficient in meeting current bicycle ownership levels and aspirations of the Council's mode share split, while also being cognisant of growing uptake in e-bikes and heavier cargo bikes. The policy proposes that:

- Bike parking is to be provided at the rate of 1 space per dwelling.
- Visitor bike parking is to be provided at the rate of 1 space for every 4 dwellings.
- Charging spots for e-bikes and floor-mounted racks to accommodate all types of bicycles is to be provided at the rate of 1 bicycle parking space for every 4 dwellings.

Climate Emergency Response Strategy 2021-2025
Dhumbali Wurrungi-Biik Parbin-Ata



The GECC adopted a Climate Emergency Response Strategy in May 2020 to support the community in taking climate action and advocate and partner with governments to drive stronger action. The strategy highlights the following goals:

- Climate change action is embedded in everything that GECC does.
- The community is active and mobilised on climate action.
- Council-owned buildings and infrastructure are resilient and safe.
- The community is protected from the worst impacts of climate change.
- Net-zero Council emissions by 2025 and net-zero community emission by 2030.

From a transport perspective, the strategy highlights the GECC's commitment to mitigate emissions caused by the transport sector. A key challenge will be to develop plans, policies and provide support to the community to reduce the use of internal combustion engine vehicles and switch to active, public and electric transport modes.

2.2.1 Glen Eira Planning Scheme

The Glen Eira Planning Scheme sets out the local response to the Planning Policy Framework (PPF), highlighting the Council's strategic vision for a wide range of challenges such as integrated land use and transport planning, provisions for walking and cycling, the principal public transport network and management of car parking.

The ***Glen Eira Municipal Strategic Statement (MSS)*** in Clause 21.03 set out the broader land use vision for Glen Eira:

- Allow sustainable redevelopment that balances current and future population needs.
- Ensure integrated neighbourhood planning of Glen Eira's suburbs.
- Carnegie is an 'urban village', that will propose a complementary mix of smaller scale office and service uses so that the centre becomes more of a community focus, having a range of community facilities and activities, mix of housing and local employment, linked to other suburban centres by public transport.

Clause 21.12 sets out the key transport strategies to support the vision, including:

- Encourage new development adjacent to local roads, which is appropriate to neighbourhood amenity and the volumes of traffic able to be accommodated.
- Encourage increased use of public transport through the improvement of facilities and environment surrounding stations and tram stops.
- Encourage the co-location and sharing of car parking facilities where appropriate.
- Encourage the provision of safe and attractive aspects to rear car parks.

In practice, key points from the planning scheme in relation to the CAC include:

- New developments in the CAC are required to provide a suitable measure of car and bike parking in accordance with Clause 52.06 and 52.34.
- The majority of the study area is located within the Principal Public Transport Network (PPTN) and therefore new developments are based upon Column B carparking rates of Clause 52.06. The Planning Scheme allows for further reductions for these rates based upon its decision guidelines, which considers amongst other things empirical data and the accessibility of non-car transport options.
- The only exception is for the Community Centre/Library in accordance with the Public Use Zone, where any redevelopment of the centre must provide a minimum of 61 car spaces, while accommodating shared carparking for surrounding uses.
- Broader policy is also provided to support the development of student housing within 'Zone 2 – Housing Diversity Areas', where the number of car parking spaces is reduced commensurate with the reduced car ownership of students, and the strategic location of proposed student housing close to high quality public transport.
- An existing Design and Development Overlay exists in Schedule 9 to Clause 43.02 and may be updated following this study. Relevant policy for access and parking in developments states that access from side streets or rear laneways is preferred.

Implication of Local Policy Context

Local planning documents and strategies outline a strong ambition for a shift in behaviour to a less car-oriented approach to development and growth within the CAC through action on mode shift, improvements to the movement network for other modes, integrated land use planning and climate change. However, in practice the planning scheme currently lacks support for sustainable modes coupled with traditional requirements for carparking that do not reflect a reduction in vehicle mode share.

3 Situational analysis

The existing built form ranges from low density residential in the outskirts of the precinct, to medium-high density mixed-use along Koornang Road between Dandenong Road and Neerim Road. In 2016, the Carnegie 'SA2' Statistical Area, which covers the CAC and surrounding residential areas, was home to over 19,000 residents, growing a total of 3,500 people over the prior decade. The majority of land is currently zoned 'Commercial 1 Zone' or 'Mixed-Use Zone' with pockets of land surrounding the rail corridor and carparks being in a 'Public Use Zone'. Residential pockets of the CAC are zoned as 'Residential Growth Zone' and 'Neighbourhood Residential Zone'. The CAC's existing land use zoning and key destinations is shown in Figure 2.

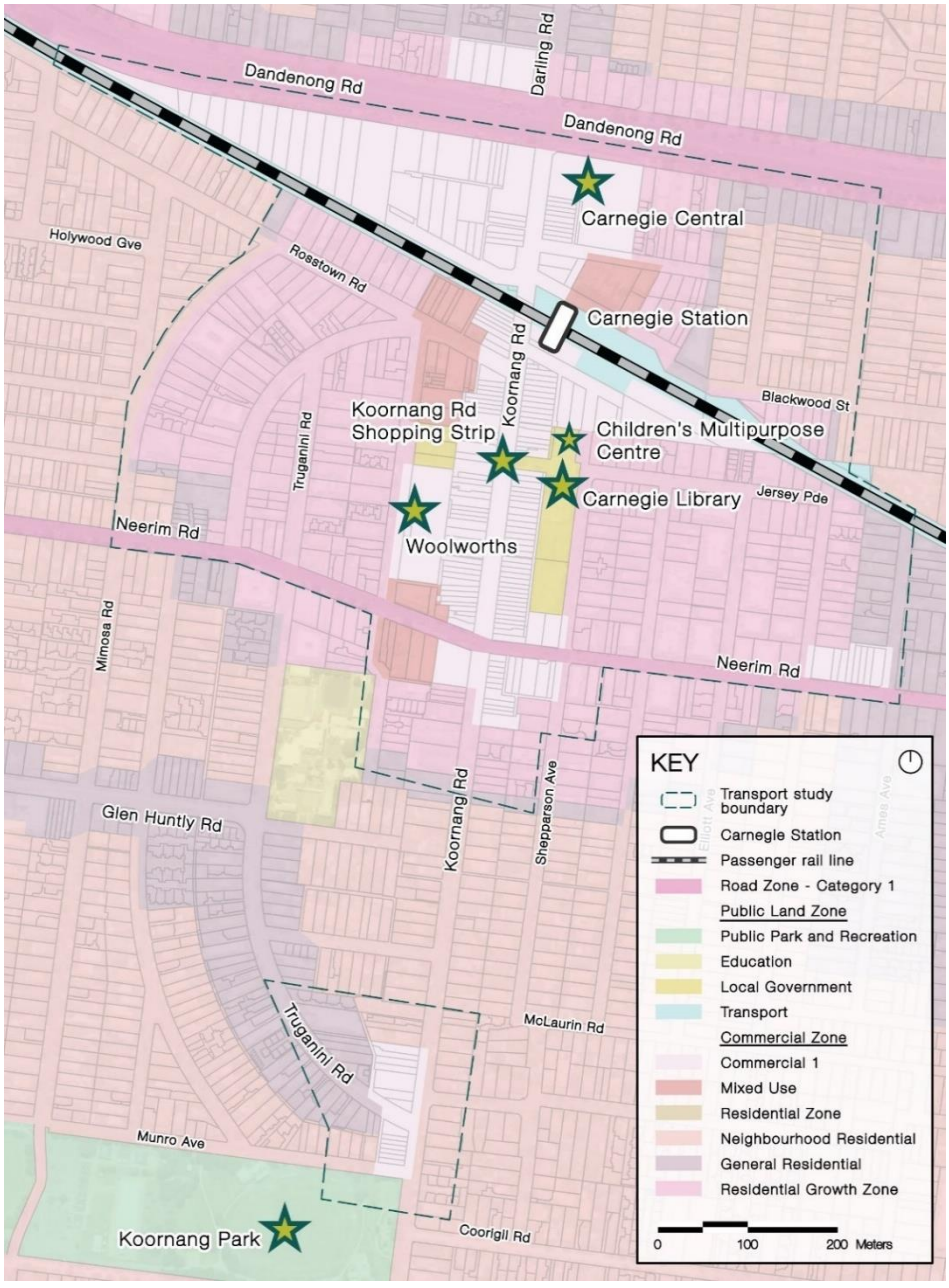


Figure 2 – Existing land use and planning zones

3.1 Policy drivers & trends shaping urban transport

Urban transport and movement networks must accommodate evolving patterns of demand and travel expectations. Some of the trends that are causing this shift are described below including the opportunities and challenges they present for travel at the local level.

3.1.1 Rising costs & congestion associated with automobile use

Rising vehicle ownership costs and increasing traffic congestion are affecting the convenience and attractiveness of private car use in cities. Prior to the COVID-19 pandemic, evidence was also emerging of a shift in modal preferences among young people, associated with concern for personal health, new mobility technologies and a reducing association of private vehicle ownership with status[1].

In Victoria, the evidence supports this, with per capita vehicle travel and motor vehicle registration declining in 2018-19 compared to 2017-18[2]. Similarly, motor vehicle licensing is declining, with almost a 10% decrease in licensing 2012-13 compared to 2000-01[3]. Research attributes this drop-off in Victoria to changes to licensing conditions, as well as reduced reliance among young people on the private car.

While stay-at-home orders associated with the COVID-19 pandemic have caused intermittent dampening of urban congestion levels, evidence suggests that is has also spurred a renewed car dependence. In Victoria, slower travel times were recorded on major arterials roads after lockdown, compared to the same time in 2019[4]. Causes of the urban traffic rebound are likely to include public transport hesitancy linked to virus transmission risk, a renewed dependence among young people on the private car as their life course alters in response to restricted international travel opportunities[5].

In addition to the impact that congestion has on transport preferences, it also affects economic productivity. The Bureau of Transport, Infrastructure and Regional Economics estimated the cost to Melbourne's economy could be as high as $4.6 billion, as of 2016. Infrastructure Victoria recommends an array of measures designed to encourage travel choices that benefit all users of the transport network, including incentives for public transport travel and reform of parking pricing[6]. Improved walkability can also be a key strategy to address urban congestion, while also delivering health, economic and safety benefits to transport users and local economies disrupted travel attitudes[7]. Improved cycling infrastructure can have a similar transformative impact in encouraging people of all ages and all abilities to cycle for a wider variety of trip types. While research undertaken for the Victorian Cycling Strategy suggests that many people are interested in cycling, major barriers to its uptake include stress arising from interactions with motor vehicles and concern over safety. This is often brought on by high variability in quality of infrastructure, limited protected cycle corridors and lack of continuous cycleways.

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[1] Arup 2016, *Cities Alive: Towards a Walking World*.
[2] Bureau of Infrastructure and Transport Research Economics (BITRE) 2020, Australian Infrastructure Statistics Yearbook 2020.
3 Delbosc, A. (2015, January 5). Why are young Australians turning their back on the car? Retrieved from The Conversation.
[4] Infrastructure Victoria 2021, Transporting Melbourne's Recovery.
[5] Delbosc, A., & McCarthy, L. (2021). Pushed back, pulled forward: Exploring the impact of COVID-9 on young adults' life plans and future mobility. *Transport Policy*, 43 - 51
[6] Infrastructure Victoria 2021, Victoria's infrastructure strategy 2021-2051.
[7] Arup 2016, *Cities Alive: Towards a Walking World*.

3.1.2 Urban resilience and sustainability

Global emissions need to halve by 2030 to mitigate climate change, a call which the GECC has recognized with its declaration of a climate emergency. For transport, GECC has reflected this commitment through aspirations towards a 50% sustainable mode share target. A significant share of emissions are a product of daily life, including using transportation to access jobs and activities. Individual mobility is a key contributor to transport emissions, responsibility for which is shared between governments and their communities. Local governments can take action to reduce emissions from transport through integrated land use planning which reduces the need to travel, while also providing options for sustainable modes.

A recent report by Arup and C40 Cities identifies a suite of neighbourhood planning initiatives that can contribute to people-centred, prosperous and sustainable cities[8]. For Carnegie, initiatives around lifecycle emissions assessments for construction and net-zero operational emissions for new buildings are proactive measures to being mindful of emissions reduction and contribution during a period of increased new development. Carnegie can also set itself up to capitalise on its access to public transport and potential for walkability by employing complete neighbourhood approaches such as compact, mixed-use environments, active frontages, adaptable spaces for multiple uses throughout the day and promoting the development on a human scale, encouraging walking and more increased local activity, avoiding long trips.

At the same time, the need for energy resilience, and calls for tighter air quality conditions is increasing interest in electric vehicles (EVs) to deliver part of the solution to addressing transport-related environmental impacts[9]. Electric automobiles are available commercially and have already enjoyed uptake as fleet vehicles and for private use. The Victorian and Federal Governments' net zero targets are likely to see the uptake of EVs accelerate. Victoria has also begun trials of zero-emission (electric) bus; and has committed to exclusively purchase zero emission buses from 2025. Much of the charging needs of EVs are anticipated to be met with home and workplace charging, however public charging infrastructure is needed to alleviate range anxiety[10]. While policies and regulation is expected to be driven by private organisations and the Federal Government, planning action is required at a local level to be ready for increased rollout and preparing new developments in order to avoid retrofit costs.

3.1.3 COVID-19

The COVID-19 public health crisis has disrupted travel in numerous ways. At the individual level, daily travel has been severely restricted by stay-at-home orders. This has resulted in the substitution of trips for virtual activity participation, most notably, working from home. Research from Monash University suggests that working from home will increase approximately 75% from a low base of 2% in 2016, to 4% post-pandemic[11]. Infrastructure Victoria has identified policies that support flexible working, including working from home and flexible hours, as a key means of alleviating pressure on the public transport. Prior to the pandemic, public transport catered to approximately 200,000 daily commute trips.

[8] C40 and Arup 2021, Green and Thriving Neighbourhoods.
[9] Arup 2020, Zero Emissions Bus Forum: Discussion Paper
[10] Infrastructure Victoria
[11] Currie, G., Aston, L. & Jain, T. 2020 Covid-19 Long Term Travel Impacts Study, *Public Transport Research Group*, Monash University.

Flexible work arrangements can play a role in spreading the peak travel demand and facilitating safe travel on public transport as Victoria transitions to COVID normal. Facilitating public transport trips is also critical for mitigating the private car 'rebound' that has already seen increased congestion levels across Melbourne. The ability to work flexibly is not available to workers in all industries. A challenge for policy-makers and planners is accommodating flexible work while also ensuring that those who do not have the option to work flexibly can continue to travel safely and efficiently.

The COVID-19 pandemic also has adversely affected the mental wellbeing of many Australians and put many under economic hardship[12]. The conversion of parking to accommodate other uses (parklets, kerb outstands, etc.) and modification of streets to facilitate safe opportunities to meet, exercise or dine outdoors is a key strategy for facilitating social and economic participation under COVID normal. Doing so at a local scale is also key. As such, COVID-19 has provided further impetus for placemaking and street-space reallocation for active transport.

3.1.4 Smart cities and future mobility

Innovations in data capture and processing are making it possible to tap into a range of sensing devices. This includes personal devices such as smart phones and activity trackers, GPS trackers delivery real time information about road network performance and vehicle location, as well as sensors in public spaces. Such information can be used to understand travel demand patterns and identify network reliability issues. It therefore serves as an important evidence base to develop operational strategies that improve network performance, reduce crowding and inform appropriate infrastructure upgrades. Digital participating tools are also opening up new ways for the government to engage the public in consultation. This can be useful for gathering feedback on new developments, and is equally important for understanding the nuanced barriers that may affect participation in the transport network among diverse users.

Data and tools are also improving the journey experience for transport users. App technology can be harnessed to seamlessly integrate transport modes and provide real-time updates. This can overcome what many perceive to be a barrier to higher uptake of shared modes which is uncertainty around travel time[13]. Similarly, smart parking technology, paired with wayfinding can alleviate congestion associated with cruising for car parks. Dynamic road lanes can also respond to time of day changes in demand.

New technologies are also disrupting the way people travel by providing new modes and opportunities for ridesharing. Micro-mobility, such as e-bikes and scooters, are becoming more diverse, compact and accessible to people living with limited mobility. They are also increasingly becoming a more viable option for last-mile connections to public transport. This is driving an increased need to provide secure and accessible parking as well as end of trip facilities (EOTF) at public transport interchanges and major destinations.

[12] Australian Institute of Health and Welfare. (2021, July 20). COVID-19 impact on mental health. Retrieved from Mental health services in Australia: https://www.aihw.gov.au/reports/mental-health-services/mental-health-services-in-australia/report-contents/mental-health-impact-of-covid-19

[13] Watkins K. 2021, *Advances in transit customer information*, in Currie, G.(Ed.) 2012, Handbook of Public Transport Research

Micro-mobility-based restaurant delivery and courier services have surged in popularity amid the COVID-19 pandemic. However, this surge brings with it concerns for road safety among drivers and other road users, and demands reconsideration of the road network as a workplace. Local council must increasingly accommodate delivery vehicle parking as well as safe locations for drivers to rest. This could be a considerable challenge for the City of Glen Eira along Koornang Road.

New technology is enabling vehicles to become increasingly automated. This trend is likely to continue, toward a future in which vehicles become effectively self-driving. Vehicle automation is expected to increase the speed and capacity on roads. This in turn will change expectations about proximity, possibly encouraging workers to choose residences that are further from their workplace and thereby contribute to urban sprawl. It is anticipated that in this future, changes in parking management will be needed at the local level, as parking demand at destinations is alleviated.

Local council has a role to play in updating regulations and planning for a future in which a proportion of inner-city road space and car parking will be repurposed for productive uses. This may reduce parking demands within Carnegie over the longer term. Uncertainty will remain regarding the extent to which this reduction can occur. The reallocation of demand also depends on making Carnegie more attractive for walking, cycling, public transport and car share to influence the willingness of the community to depart from the car ownership paradigm[14]. For the purpose of the Carnegie Structure Plan, a relatively modest shift is expected as a result of future mobility technologies, however one that should be accommodated by a step change in long term planning.

3.2 Precinct accessibility

Carnegie is characterised by abundant retail and employment opportunities, supported by a strong walk-up catchment for residents and good public transport connections across Melbourne. Plan Melbourne has identified Carnegie as a Major Activity Centre: a strategic location for continued development to accommodate population growth. Major Activity Centre status recognises the potential of a location to provide efficient access to opportunities. This is achieved through mixed-use, moderate densities and good transport connections that reduce the need for travel and provide options for accessing activities by modes that have the smallest impact on the overall transport network.

[14] Infrastructure Victoria 2018, Advice on automated and zero emissions vehicles infrastructure

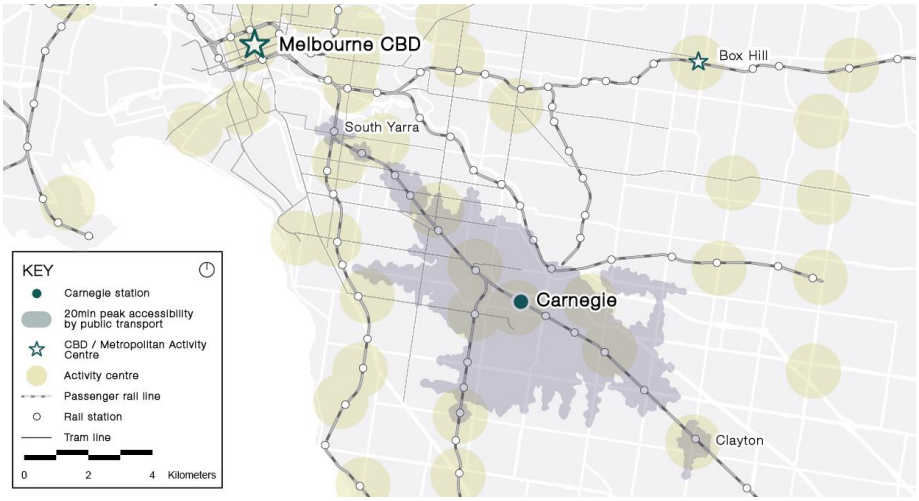


Figure 3 – 20-minute peak public transport accessibility from Carnegie Station

As Carnegie's population grows, opportunities to access work, leisure, food and other retail should also be facilitated by means of high quality active and public transport within and beyond the precinct. The ease and attractiveness of travel by non-automobile modes will determine the continued share of trips by each mode, and in turn, the ease with which people can travel to and from the precinct. Therefore, Council should investigate interventions that:

- Make the pedestrian environment more direct, comfortable and safe;
- Create an engaging on-street environment through active frontage and installations;
- Provide opportunities for people of all ages and abilities to move freely within the precinct;
- Give priority to people cycling and create a safe and inclusive cycling environment; and
- Improve the legibility of public transport connections and the ease of transfer between modes.

The State Government has invested in increasing the capacity of rail services along the Dandenong corridor on which Carnegie is located. This creates additional capacity for commute-focused trips to the Melbourne CBD, as well as outbound to National Employment and Innovation Clusters in Monash and Dandenong. Council should also continue to advocate for improvements to public transport services that facilitate a broader range of trip purposes and connect Carnegie with the rest of Melbourne. This includes existing bus services, as well as opportunities for new public transport infrastructure such as light rail servicing the Dandenong Road arterial corridor.

Land use zoning is another important tool in continuing to allow higher density living and co-location of complementary land uses, to maximise accessibility in Carnegie. Ensuring an appropriate mix of activities minimises the distances people must travel to meet their daily needs and participate in work and social activities. As well as reducing the volume of travel, the co-location of residential and non-residential land uses reduces reliance on the private car for travel.

Harnessing the levers of urban design, density and land use mix, while continuing to provide high quality public transport, is key to making efficient use of limited space in Carnegie. Providing attractive options to travel by low-impact modes will ensure that the

largest possible share of residents and visitors choose them. This in turn will mitigate growth in demand for already scarce carparking and road space; and is considered essential for accommodating Carnegie's growing population. To investigate these impacts, mode shift testing has been completed to investigate changes in travel mode demand (Section 5 and 6), with potential initiatives recommended to support changes in travel behaviour and sustainable development.

3.3 Existing travel patterns

3.3.1 Mode share trends

ABS Journey to Work (Carnegie residents)

There is a demonstrated correlation between residential proximity to public transport options and higher uptake, particularly in relation to heavy rail and this can be observed in Carnegie. Figure 4 shows the proportion of train use for work journeys in conjunction with any other mode. As can be seen, there is already a very high uptake of public transport from residents within the CAC, and particularly in comparison with other centres along the Pakenham Line. This suggests that there is a greater potential for mode shift and associated behaviour controls such as parking management in Carnegie than elsewhere in the region.

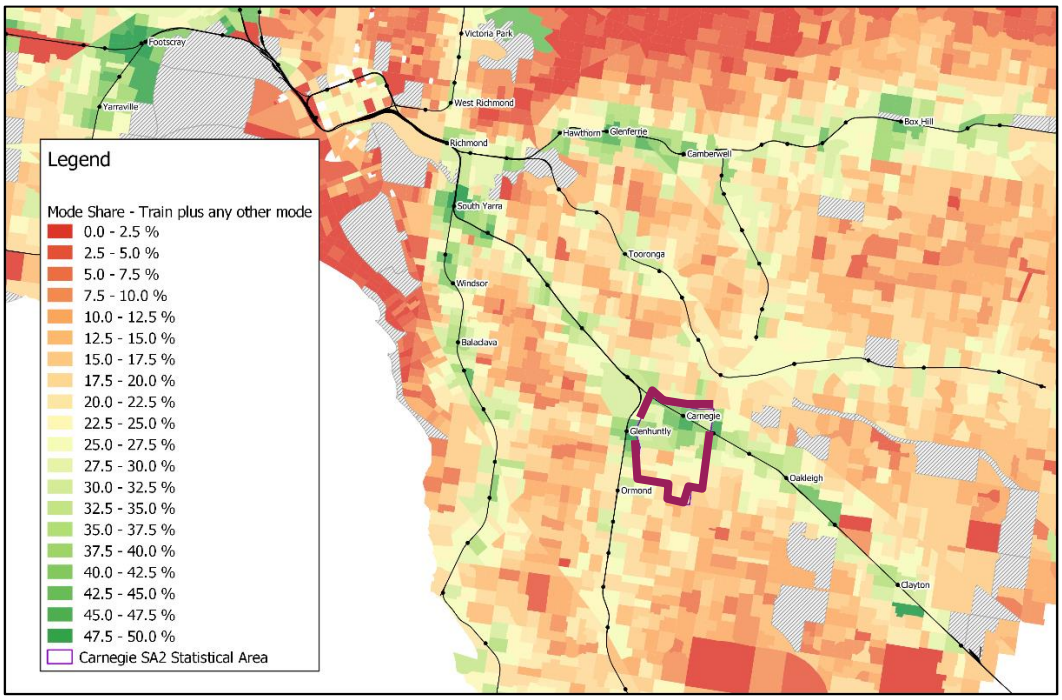


Figure 4 – ABS Journey to Work via Public Transport (Carnegie residents). Excludes 'worked at home'.

When aggregated to the 2016 Carnegie 'SA2' Statistical Area, 33% of work trips are made by public transport, with 58% by car (either driver or passenger), and 5% either walked or cycled, while 4% worked at home. Car use has decreased over time, down from 67% in 2006.

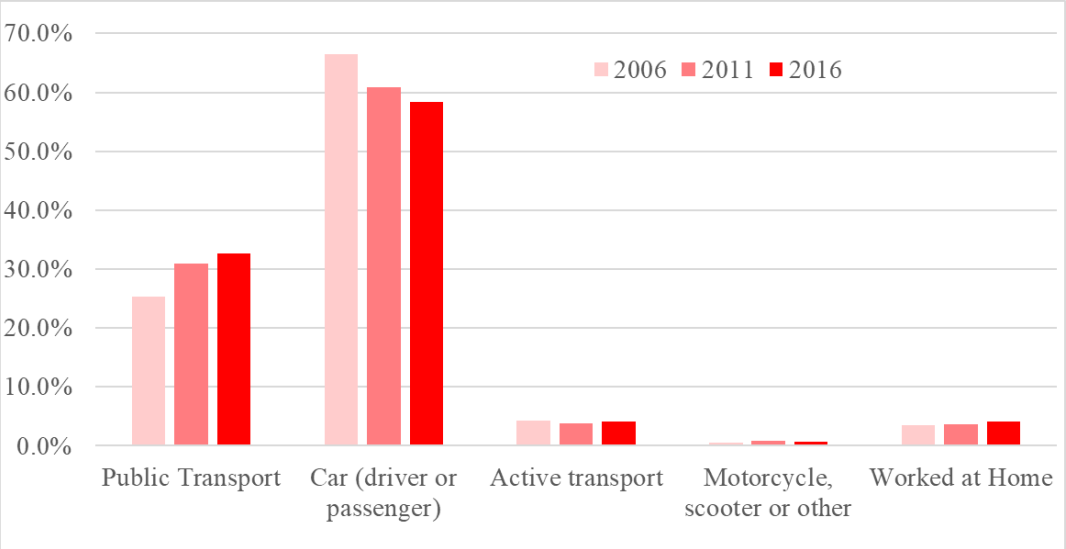


Figure 5 – ABS Method of Travel to Work of Carnegie SA2 residents (2006 to 2016)

ABS Journey to Work (Carnegie employees)

On the contrary, travel patterns of employees that work in Carnegie, while recognising this can reflect transport networks of neighbouring regions, can also suggest the levels and performance of access to Carnegie via different modes. In addition, these patterns can give an inclination of future access modes and direction of travel to the activity centre, highlighting popular routes into Carnegie.

In the order of 3,400 people responded as working in the Carnegie 'SA2' Statistical Area on census day in 2016. Of this, the majority of which (25%) also lived in Carnegie, with other key origins in Malvern to the north (3%), Murrumbeena to the east (3%) and Ormond-Glen Huntly to the southwest (3%). Vehicles make up the majority of trips made to Carnegie for work, with 71% of people arriving by car, 10% via public transport and 8% by foot or bike. Table 2 shows a breakdown of arrival method to work from 2011 to 2016. As shown, car use has decreased, while arrival by public transport, particularly by train, has increased significantly from 5% to 9%, suggesting a mode shift from cars to public transport.

Table 2 – ABS Method of Travel to Work Mode Share, for Carnegie SA2 as the destination workplace

Method of travel to work	2011	2016
Bus	1%	1%
Train	5%	9%
Tram	0%	0%
Car (either driver or passenger)	75%	71%
Bicycle	1%	1%
Walk	6%	7%
Motorcycle, scooter or other	1%	1%
Worked at Home	10%	9%

Victorian Integrated Survey of Travel and Activity (VISTA)

When considering the full range of trip types, there is a far greater reflection of the number of local trips, and in particular those made by foot. Guidance on the overall mode share of trips made by Carnegie residents has been sourced from the VISTA data set collected by the Victorian Government. VISTA randomly selects households to complete a travel diary for a single specified day. Based on a survey of 384 households in the Carnegie SA2 area between 2015-2018, the split by mode is shown in Figure 6.

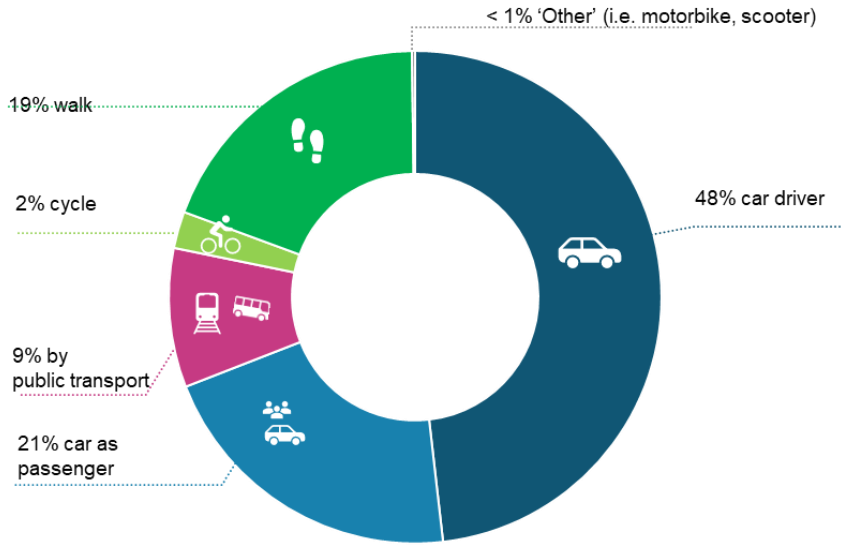


Figure 6 – Mode Share for All Trips (Carnegie residents)

It is acknowledged that the 'SA2' statistical area is larger than the Activity Centre itself, and there may be a small increase in public transport mode share locally around the station, as similarly evidenced by Figure 4.

Trip generation rates

The VISTA data also provide insights into the number of trips made across the day, showing that on average, a household generates 7 trips per day. Typically, around 10% of trips are made during the peak hour. Coupling this data with the mode split data each household generates in the order of 0.4 car trips in a peak hour.

Key findings

Based on the above data, it is evident that there is significant potential for a continued shift toward public transport and more sustainable, transit-oriented land use, particularly given the rich access to public transport. This travel data also provides a 'business as usual' baseline for assessing the transport impacts of further development, as set out in Section 5.

Carnegie Shopping Strip Visitors

The transport access modes used by visitors are distinct to the patterns of residents. A 'Shopping Strip Survey' completed by Glen Eira City Council in 2017 shows that 47% arrived on foot, which is more than the 36% that arrived by car, or the 17% that arrived by public transport or bicycle.

3.3.2 Car ownership and parking demand

Analysis of ABS car ownership data has been carried out by dwelling structure and dwelling size (no. of bedrooms), to provide an understanding of current demands relative to the prevailing planning policy requirements of Clause 52.06 of the Glen Eira Planning Scheme. The analysis has considered townhouses, flats and apartment dwelling types and excludes detached dwellings. This data set is expected to be more representative of the type of urban infill growth that could be facilitated through the Built Form Framework.

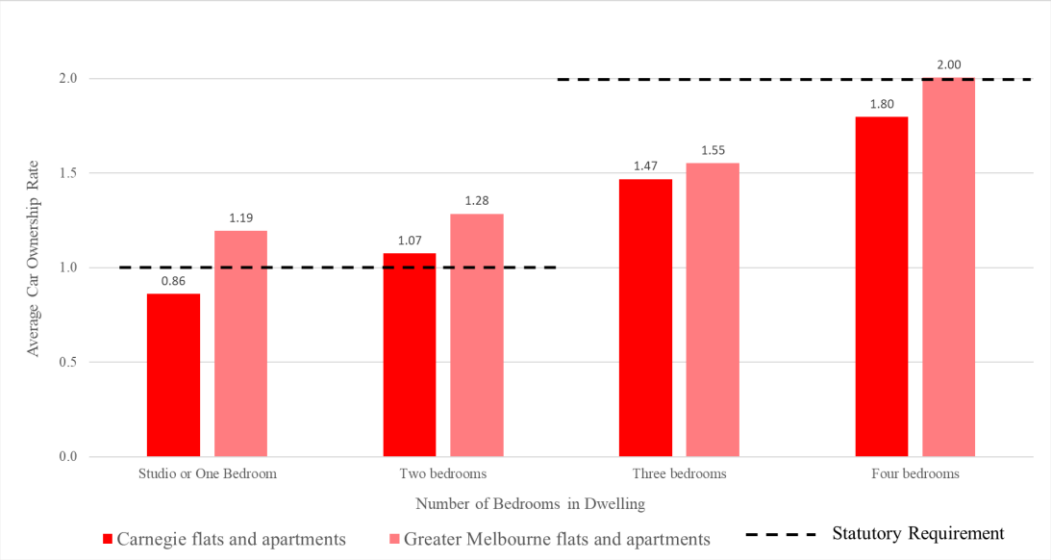


Figure 7 – Average car ownership rates in Carnegie

Key findings

Carnegie car ownership levels are lower than Greater Melbourne, which is to be expected based on the urban context and its accessibility. On average, existing ownership rates suggests that requiring all developments to comply with statutory requirements of the Planning Scheme would result in an over-provision of car parking. Recommendations on the approach for car parking and the suitability of a Parking Overlay are provided within Section 8 of this report.

3.4 Existing active transport network

Figure 8 shows the existing infrastructure supporting active transport, in addition to existing policy aspirations already defined through the GECC ITS. The area is serviced by a well-connected footpath and informal laneway network, however, lacks a direct cycling network, particularly evident in connecting key east-west cycling routes by north-south cycling infrastructure. In addition, the quality of infrastructure varies considerably within the study area, with particularly constrained cycling infrastructure along established corridors such as Neerim Road.

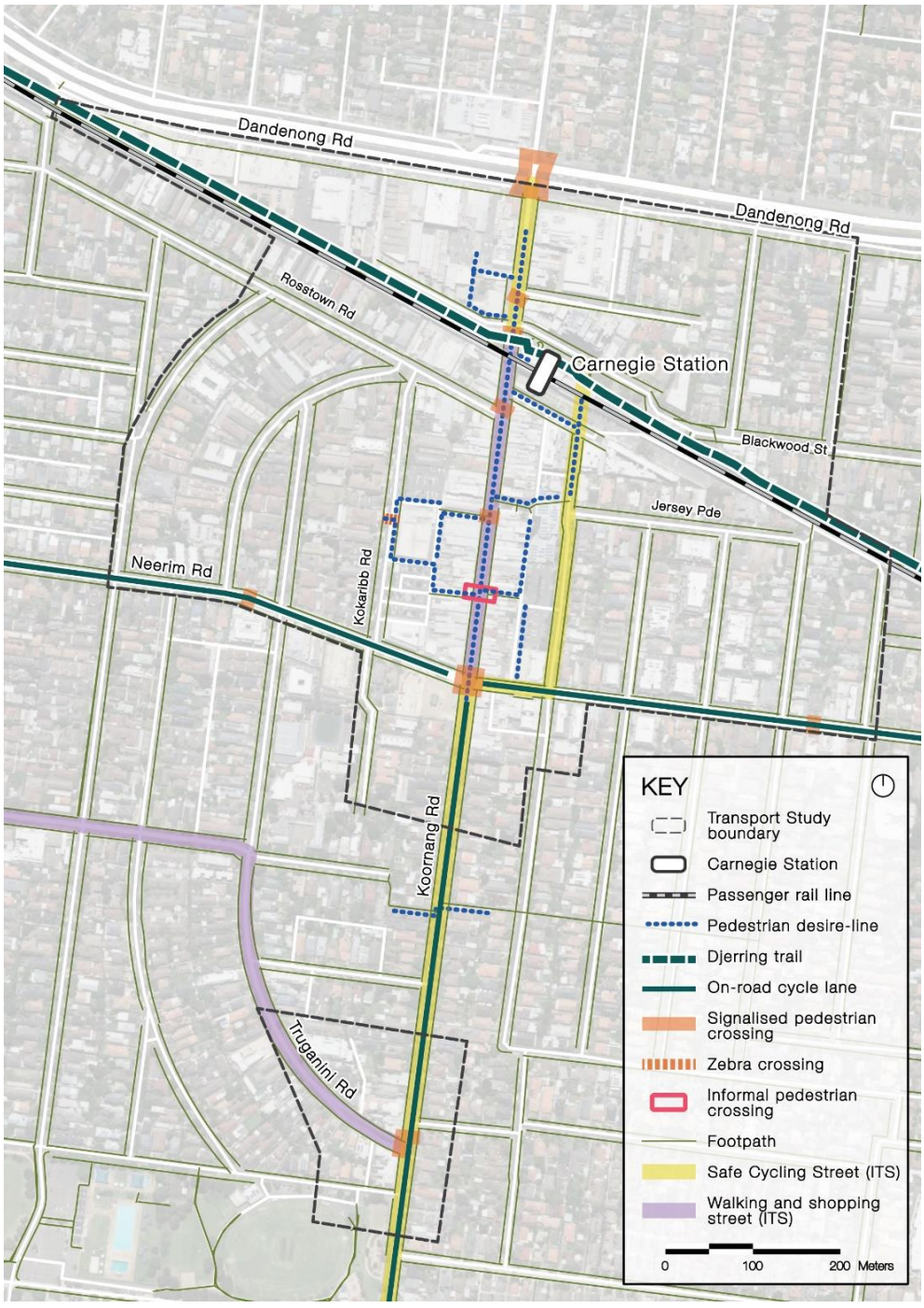


Figure 8 – Existing active transport network

3.4.1 Walkability

The CAC has a reasonable level walkability, with footpaths, pedestrian crossings, a mix of urban laneways and relatively low speed environment and small intersection footprints. Both signalised and informal pedestrian crossings at mid-block along Koornang Road and Neerim Road afford reasonable connectivity, including east-west laneway connections between Koornang Road and off-street carparks.

Key observations influencing walkability are:

- The low-speed environment of Koornang Road (40kph 7am-12am, 50kph other times) offers a reasonably safe walking environment, although relatively high traffic volumes can also limit the east-west crossing opportunities during busy times.
- Moderate speed environment (60kph), high traffic volumes, limited pedestrian crossings and no median treatment on Neerim Road produces a barrier for north-south pedestrian movement.
- Current east-west laneways between carparks and the Koornang Road shopping strip lack amenity, activation and are particularly narrow. Some pockets of the activity centre would benefit from increased permeability of the laneway network.
- Rear access laneways provide access to carparks, back of house facilities, loading zones and pedestrian connections through to Koornang Road shopping street and are therefore highly utilised by all modes, creating an informal shared environment between pedestrians, private vehicles and heavy vehicles.

To maximise the CAC's walkability potential and accommodate growth in line with the ambitions of the ITS, the future network must respond to these particular challenges, particularly along the identified 'Walking and Shopping Streets'. Potential interventions to support these challenges have been provided later in this report.

3.4.2 Cycling network

The existing cycling network in the CAC is east-west focused, offering the Djerring Trail, a dedicated shared path and Strategic Cycling Corridor along the Cranborne Line, and on-road cycle lanes on Neerim Road. In contrast, the north-south connectivity is fragmented, offering limited cycling infrastructure between the two east-west corridors or beyond, linking the CAC through to Bentleigh and Darling.

Strava Travel Heatmap data is shown in Figure 9. Strava is a recreational exercise application, so movement patterns are reflective of recreational cycling which may comprise a user base of more confident cyclists. However, the data is still highly useful as it provides important insights about travel patterns and preferences, typically highlighting routes of the network that are of the highest quality for cycling.

Key observations from the desktop study and available data are:

- Cycling infrastructure on Koornang Road and Neerim Road is insufficient for some user groups. Bicycle lanes are signed on Neerim Road between Koornang Road and Shepparson Avenue, however, require cyclists to ride on the road to pass parked vehicles due to their narrow width. They are also discontinuous at intersections.
- Anecdotal evidence suggests that Koornang Road is relatively well utilised by confident cyclists, due to limited north-south infrastructure on parallel streets. The section through the activity centre is line marked as an edge of traffic lane that seeks

to delineate the car-door opening area, however reportedly been mistaken as a poorly designed bicycle lane. The shoulder also creates pinch points at signalised crossings along Koornang Road.

- While Shepparson Avenue identified as a GECC north-south cycling connection, limited infrastructure is available at present. Coupled with a less direct north-south route, there is low utilisation of the street for cycling, with cyclists finding alternative routes more aligned with north-south cycling desire-lines.
- Carnegie Station offers high quality amenities for people cycling to access the station including 12 bike racks, lockers, and a secure Parkiteer bike cage for 29 bikes.

The CAC has potential to provide cycling connections to strategic corridors and support the ambition of reaching a 50:50 mode share. Legibility of the cycling network, its safety and the lack of separated infrastructure are a concern as these features discourage cycling as a viable mode of transport. Potential interventions to support greater uptake have been provided in Section 7.

Figure 9 – Strava Travel Heatmap – Cycling route utilisation

Key findings

The current provision of pedestrian and cycling infrastructure on Koornang Road and Neerim Road is poor. The secondary connections and laneway network is discontinuous and does not offer an attractive walking environment. However, there is great potential for the CAC to encourage greater walkability and access to cycling, for both to local destinations and for access to public transport. Potential initiatives are suggested in Section 7 of this report.

3.5 Existing public transport network

Figure 10 shows the existing public transport service currently servicing the study area. As shown, the CAC has a relatively competitive accessibility to public transport to other activity centres of its size in Melbourne, mixing a variety of rail, tram and bus options for residents. A summary of public transport services is provided in Table 3.

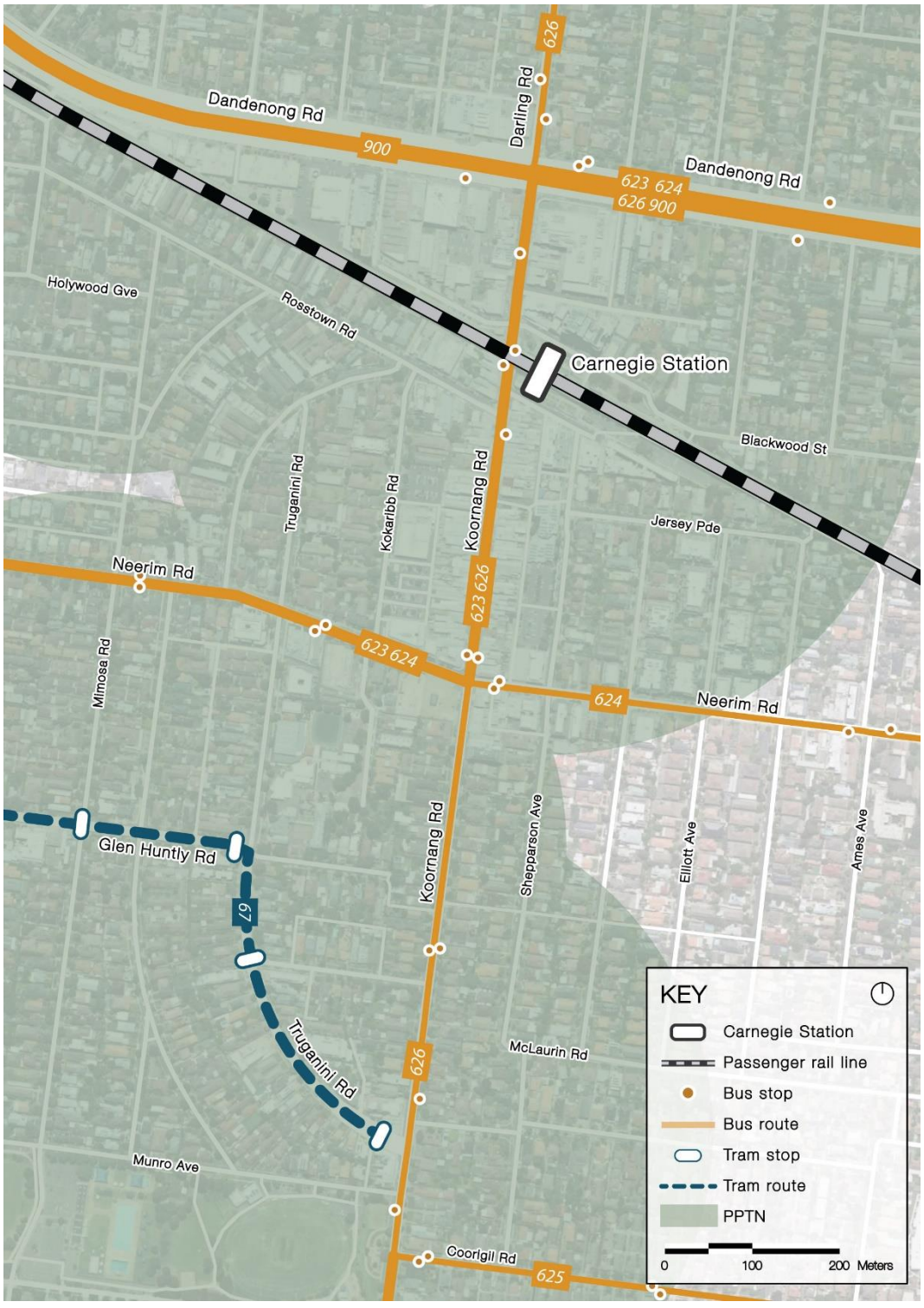


Figure 10 – Existing public transport network

Table 3 – Existing public transport provisions

Service	Route number	Route description	Frequencies
Train	Cranbourne and Pakenham Lines		Weekday: 12 trains per hour peak / 6 trains per hour interpeak Weekend: 12 trains per hour peak / 6 trains per hour interpeak Public Holiday: 12 trains per hour peak / 6 trains per hour interpeak
Bus	623	St Kilda via Mount Waverley and Chadstone and Carnegie	Weekday: 2 buses per hour peak / 2 buses per hour interpeak Weekend: 1 bus per hour all day Public Holiday: 1 bus per hour all day
	624	Kew – Oakleigh via Caulfield and Carnegie and Darling	Weekday: 4-6 buses per hour peak / 4-6 buses per hour interpeak Weekend: 1 bus per hour all day Public Holiday: 1 bus per hour all day
	626	Middle Brighton – Chadstone via McKinnon and Carnegie	Weekday: 2 buses per hour peak / 2 buses per hour interpeak Weekend: 1 bus per hour all day Public Holiday: 1 bus per hour all day
	900	Stud Park Shopping Centre – Caulfield via Monash University and Chadstone (Smartbus)	Weekday: 6 buses per hour peak / 4 buses per hour interpeak Weekend: 2 buses per hour all day Public Holiday: 2-3 buses per hour all day
Tram	67	Melbourne University – Carnegie	Weekday: 3-6 trams per hour peak / 3-6 trams per hour interpeak Weekend: 4 trams per hour all day Public Holiday: 4 trams per hour all day

3.5.1 Carnegie station

Carnegie Station is the primary public transport gateway of the CAC to the rest of Melbourne. Operating on the Cranborne Line, rail services provide northwest connections to the Melbourne CBD and southeast connections to Dandenong and onwards to Cranbourne and Pakenham. The station provides mixed-mode facilities for arrivals, featuring embayed bus stops within a short distance to the station entry, bike storage and end-of-trip facilities and accessible access for pedestrians. Situated roughly in the centre of the activity centre, the station is within walking distance to a majority of destinations and offers a direct connection to the Djerring Trail, offering strategic cycling connections to the wider metropolitan area.

3.5.2 Buses

Four bus routes currently service the CAC, facilitating north-south journeys along Koornang Road and east-west journeys along Neerim Road and Dandenong Road. These routes connect the CAC with the key catchments and destinations westbound to Brighton and St Kilda, eastbound to Chadstone and Monash University, northbound to Darling and southbound to Bentleigh.

While acting primarily as feeder services for Carnegie Station, the three uniformly spaced location of bus stops along Koornang Road benefits local businesses and proposed developments with good access to buses. The majority of bus stops however, exclusive of those provided at the station, are relatively limited in promoting buses as an attractive access mode to the area due to minimal universal access and amenity features such as benches or shelter.

3.5.3 Trams

The southern catchment of the CAC is also serviced by the 67-tram service, operating between Carnegie and Melbourne University via Glen Huntly Road and St Kilda Road. The tram terminus is located on Truganini Road, offering an end of the line stop with accessible measures and amenity.

Key findings

The CAC is highly accessible by public transport with a variety of options to reach local and surrounding destinations. With numerous local bus services along the main shopping strip, high access to tram and train and high-quality provisions for transfer and multi-modal trips, the CAC has high potential for transit-oriented development and justification for policies targeted at mode shift.

3.6 Existing road network

The CAC is serviced by a number of arterial and local roads with strategic importance as summarised in Table 4.

Table 4 – Existing road network

Road name	Description	Speed limit
VicRoads managed roads		
Dandenong Road	Six-lane dual carriageway with parallel service roads, bus queue jumps at intersections.	80kph
Neerim Road	Two-lane arterial, on-street parallel carparking on both sides of the road, on-street cycle lanes on both sides of the road.	60kph
GECC managed roads		
Koornang Road	Two-lane major road, on-street parallel carparking on both sides of the road, on-street cycle lanes on both sides of the road.	40kph within CAC (7am-12am), 50kph at other times, 50kph in areas outside the CAC
Truganini Road	Four-lane major road, median-running tram tracks, on-street parallel carparking on both sides of the road (south of Glen Huntly Road) Two-lane local road, on-street parallel carparking on both sides of the road (between Neerim Road and Glen Huntly Road)	60kph, 40kph between Neerim Road and Glen Huntly Road
Kokaribb Road	Two-lane local road, on-street parallel carparking on both sides of the road	40kph (south of Neerim Road adjacent to Primary School) Unposted (50kph) north of Neerim Road
Shepparson Avenue	Two-lane local road, on-street parallel carparking on both sides of the road	Unposted (50kph)
Morton Avenue	Two-lane local road, on-street parallel carparking on both sides of the road	Unposted (50kph)
Jersey Parade	Two-lane local road, on-street parallel carparking on both sides of the road	Unposted (50kph)
Egan Street	Two-lane local road, on-street parallel and perpendicular carparking	Unposted (50kph)
Dandenong Road Service Road	One-lane, one-way service road, on-street parallel and 45-degree angle carparking	50kph

3.6.1 Traffic volumes and performance

Recent SCATS traffic signal volume data has been extracted from the DoT open data portal for Koornang Road/ Neerim Road and Koornang Road/ Rosstown Road intersections for a typical weekday (16 May 2019). While limitations of this data exist, it can assist in building an understanding of existing volumes at key network intersections and what increases in volumes could mean for road network performance.

Figure 11 and Figure 12 illustrate the rolling hour traffic volumes for both intersections.

Table 5 sets out the daily traffic volumes on Neerim Road (western/ eastern approach) and Koornang Road (northern/ southern approach). Figure 11 and Figure 12 illustrate the rolling hour traffic volumes for both intersections.

Table 5 – Daily traffic volumes (Source: SCATS – 16 May 2019)

Road	**Neerim Road**		**Koornang Road**	
Vehicles per day (vpd)	Westbound	Eastbound	Northbound	Southbound
	5,855	5,402	7,663	7,948
Total	11,257		15,611	

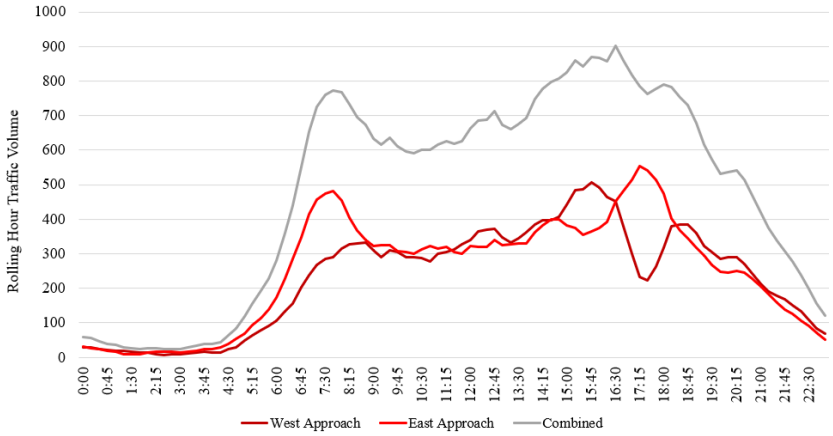


Figure 11 – Neerim Rd rolling hour traffic volumes (Source: SCATS – 16 May 2019)

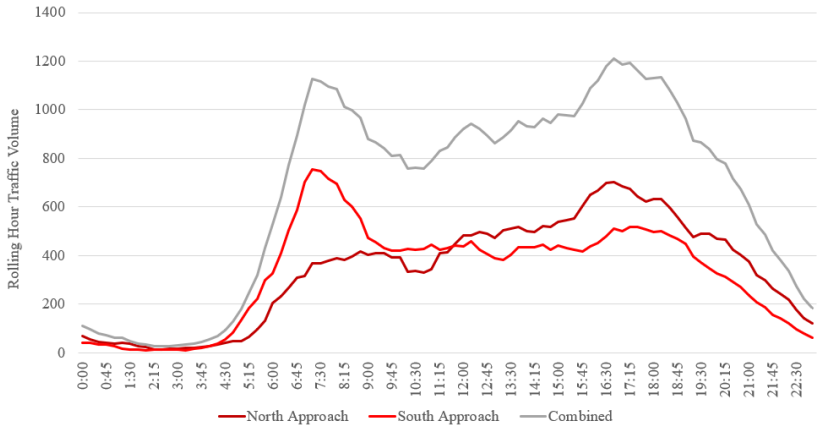


Figure 12 – Koornang Rd rolling hour traffic volumes (Source: SCATS – 16 May 2019)

As shown, demand is relatively consistent throughout the day, with two notable peak periods of demand in between 7-9am, and the critical afternoon peak between 4-6pm. At their highest, Neerim Road and Koornang Road reach hourly one-way volumes of up to 550 vehicles per hour (vph) and 800 vph respectively.

As two-lane major roads adjacent to parking lanes under 'interrupted flow', indicative maximum capacities of Neerim Road and Koornang Road are in the order of 900 vph (Austroads Guide to Traffic Management Part 3 – Transport Studies and Analysis methods, p.64). However, traffic flows are expected to be most heavily constrained by intersection capacity. For example, the capacity of Koornang Road during peak times is influenced by the boundary constraints at Dandenong Road , which prioritises east-west signal green time on the preferred traffic route.

The above data suggests that Koornang Road is verging on its typical capacity and particularly when considering the effect of parking, pedestrian movements and other similar side-friction factors which will further limit the movement capacity. It is expected that the capacity of Koornang to accommodate future car-based travel demands during peak hours would be limited. This may have a positive influence on the uptake of more non-car modes, as the utility of car use diminishes in comparison to more sustainable modes. Potential demand management and network interventions address network capacity challenges are provided in Section 6 and 6.8.

Existing weekend volumes

In addition to considerations of existing weekday traffic volumes, weekend volumes have also been extracted from SCATS data for a typical weekend day (18 May 2019).

Figure 13 and Figure 14 provide a comparison between a typical weekday and weekend, showing fluctuation in demand throughout the day. While weekend volumes are relatively consistent throughout the day, the Thursday PM peak is generally the critical time period. This supports the selection of the PM peak as the critical scenario for the transport demand assessment in Section 6.

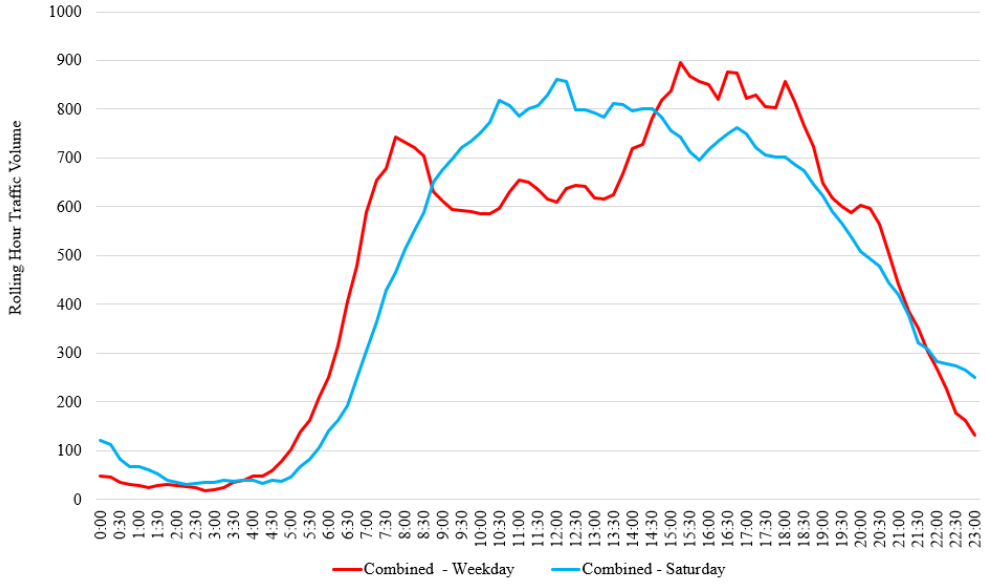


Figure 13 - Neerim Road weekday against weekend rolling hour traffic volumes (both directions) (Source: SCATS – 16-18 May 2019)

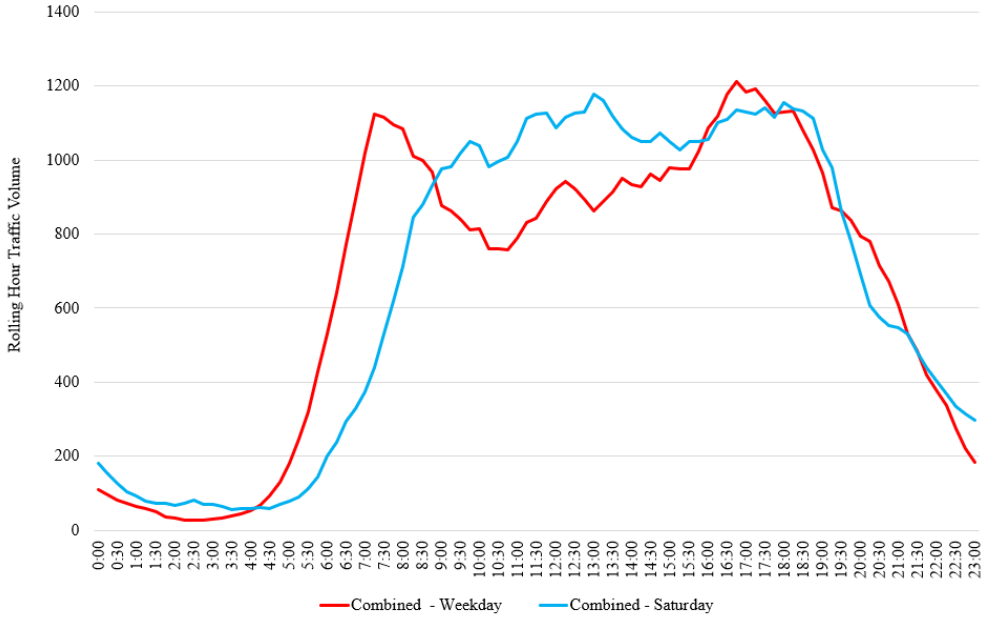


Figure 14 – Koornang Road weekday/ weekend rolling hour traffic volumes (both directions) (Source: SCATS – 16-18 May 2019)

Network performance

A high-level assessment of congestion and travel time has been undertaken for key roads in the CAC using data extracted from TomTom Traffic Stats across the month of May 2019 to understand the performance of the network under the demands outlined above.

Figure 15 shows the average travel time for vehicles travelling on Koornang Road and Neerim Road within the study area throughout the day. Data has been extracted for Koornang Road vehicles travelling between the Koornang Road/ Dandenong Road intersection and Koornang Park (1.2km), and for Neerim Road vehicles travelling between Ames Avenue and Mimosa Road (900m).

As shown, travel times on both roads have noticeable peaks, particularly on Koornang Road, throughout the day. These peaks generally correspond with morning, afternoon and evening periods, likely generated by AM and PM work trips, school pick-up/ drop-off and night-time activities within the CAC.

Travel times on Koornang Road increase throughout the day, with consistently longer northbound travel times than southbound. Travel times on Neerim Road are relatively consistent throughout the day, particularly for westbound vehicles, experiencing little variability in travel time outside of the peaks. Eastbound vehicles experience a significant travel time increase of over a minute between 5pm-7pm, consistent with the spike in travel time experienced on Koornang Road, suggesting wider impacts from congestion/ delays on the Koornang shopping strip associated with evening activity.

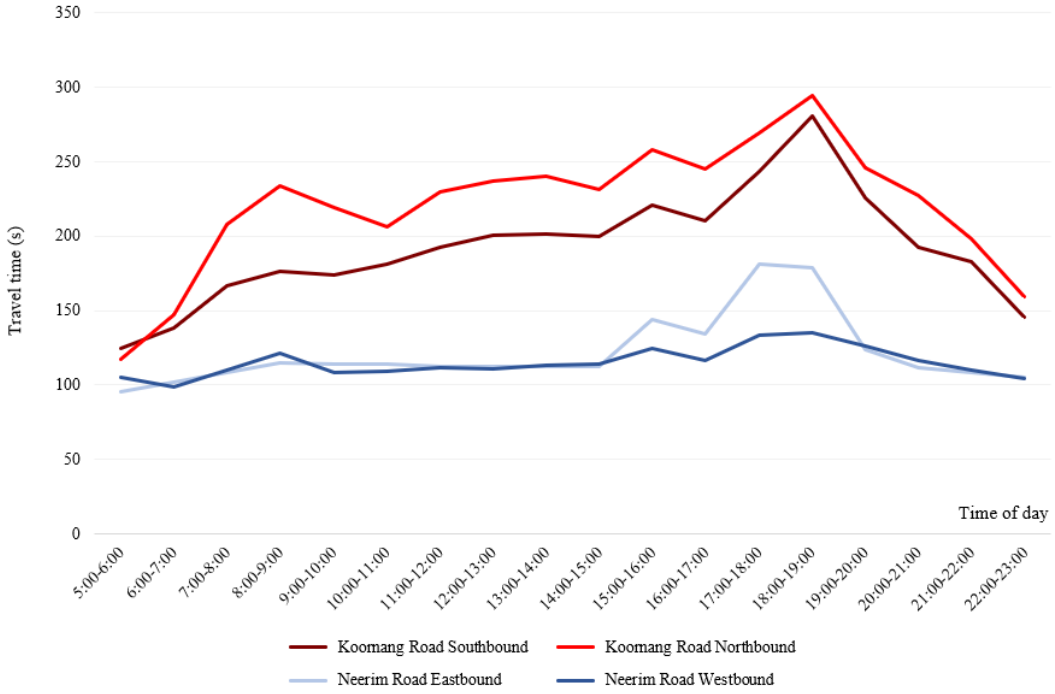


Figure 15 – Average travel time on Koornang Road and Neerim Road (Source: TomTom Traffic Stats, May 2019)

Figure 16 shows a heatmap of traffic speeds in the study area during the interpeak and evening peak hours as extracted for the same period from TomTom Traffic Stats. This allows insight into the differences in performance throughout the day along particular routes on the network. As shown, traffic speeds on Koornang Road between Dandenong Road and Neerim Road are most impacted throughout the day with average speeds dropping below 20kph between 6-7pm. Neerim Road, between Koornang Road and Truganini Road also experiences a localised decrease in traffic speed, corresponding with increased travel times during the evening peak as highlighted previously.

These findings don't necessarily mean that the road network is experiencing an unsuitable level of congestion, as reductions in travel speed may be partially attributed to pedestrian crossings and slower driving behaviours on high activity streets within the CAC.

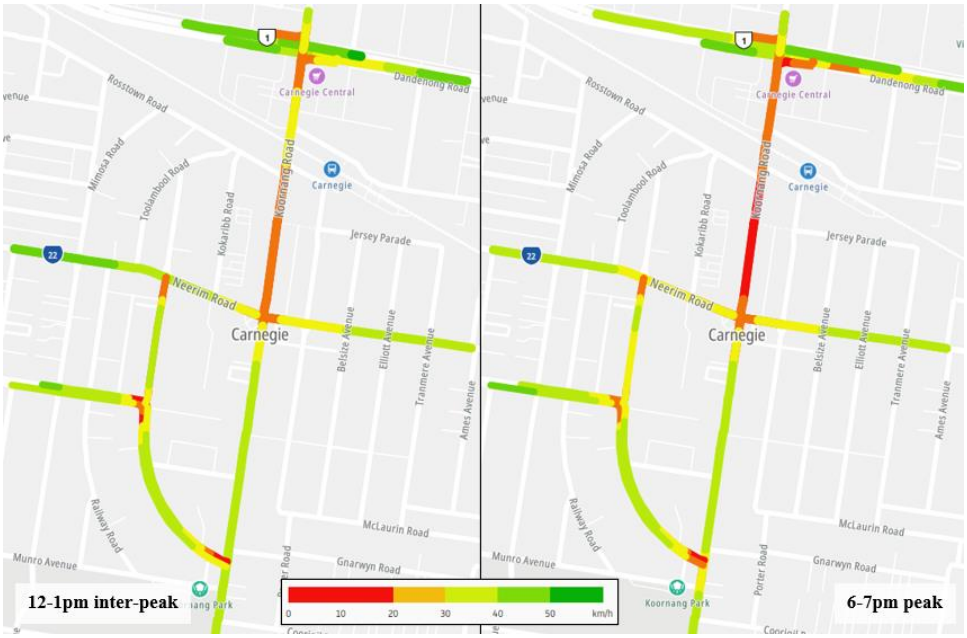


Figure 16 – Traffic speed heatmap during the inter-peak and night-time peak (Source: TomTom Traffic Stats, May 2019)

Key findings

Council maintains the majority of the road network within the CAC, creating an opportunity to plan a vision for these streets. While traffic volumes, travel times and traffic speeds do not necessarily suggest roads are operating above capacity, demands on Koornang Road are nearing capacity and are likely contributing to network delays and further challenges may arise if left unmanaged. Given the uncertain timeframe for realisation of the growth forecast, it is difficult to anticipate when the network will reach tipping point, and travel behaviour may already be adapting as the network becomes less convenient during peak times. Any major interventions may need to be reassessed when there is further clarity on development aspirations, and when additional data collection and traffic studies to calibrate the capacity of existing intersections can be carried out. Notwithstanding, potential interventions to are provided in Section 6.

3.6.2 Crash data

While most crashes occurring on the transport network involve vehicles, the overall safety of the CAC is not just in regard to vehicles but of all users, including people walking and cycling. Over the recently recorded six-year period, dating from 1 January 2015 to 31 December 2020, a total of 73 crashes have been recorded in the CAC with the majority located on or north of Neerim Road (Figure 17). Of these, a total of 29 (40%) crashes resulted in serious injuries or death, while 20 (27%) crashes involved collisions between vehicles and a pedestrian or cyclist.

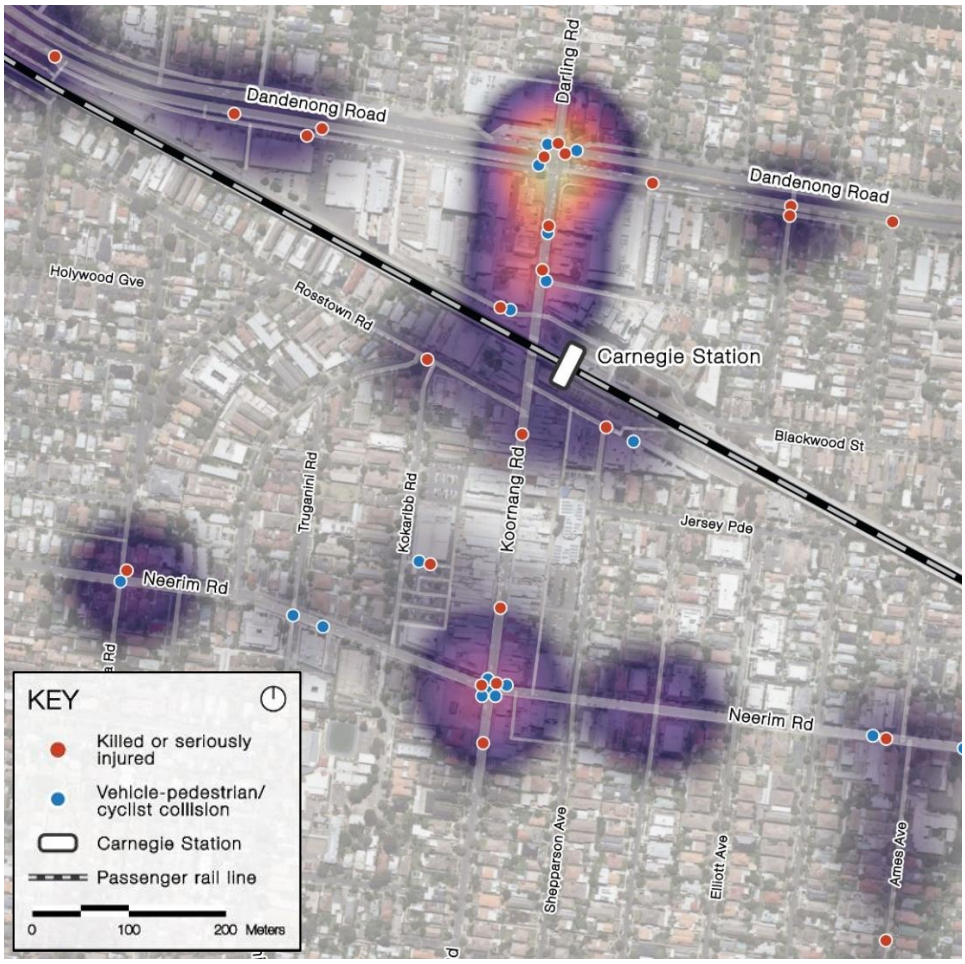


Figure 17 – Crash stats 2015-2020 hotspots

As shown, crashes involving people walking and cycling have occurred where there are concentrations of these users, primarily at pedestrian crossings on Neerim Road and north of Carnegie Station on Koornang Road. The Koornang Road/ Neerim Road intersection is a hotspot for these incidents as well, experiencing one major incident a year impacting 2 or more pedestrians at a time, usually by a turning vehicle.

There is also a high concentration of crashes of all types, including those involving pedestrians and cyclists, on the adjacent arterial road of Dandenong Road and major intersection with Koornang Road, having adverse impacts on the walkability and perception of safety accessing the CAC.

More generally, 73% of crashes within the CAC have occurred during the day, with 27% of crashes occurring at night and dawn/ dusk. Of those that occurred after dark, 85% of crashes were the result of driving under the influence of alcohol at midblock locations.

3.6.3 Laneways

The CAC features a network of urban laneways facilitating access for pedestrians, private vehicles and service vehicles to streets and community spaces, off-street parking facilities and back-of-house (BOH) areas. These laneways operate provide an informally shared environment for various modes, creating challenges for priority, capacity and safety, particularly for those near major land uses such as supermarkets and carparks.

Laneways in the CAC have been divided into four major precincts as shown in Figure 18 and summarised below. For the purpose of understanding their potential future uses, laneways have also been classified as:

- **public laneways**: those listed on Council's road register or that exist on a specific Council-owned land parcel that is publicly accessible.
- **private laneways:** those that are publicly accessible, but which appear to exist on private property or common areas that are not known to be owned by Council.

Car parking aisles have generally not been included as 'laneways', although some 'circulation roadways' adjacent to parking areas in the central precinct are included.

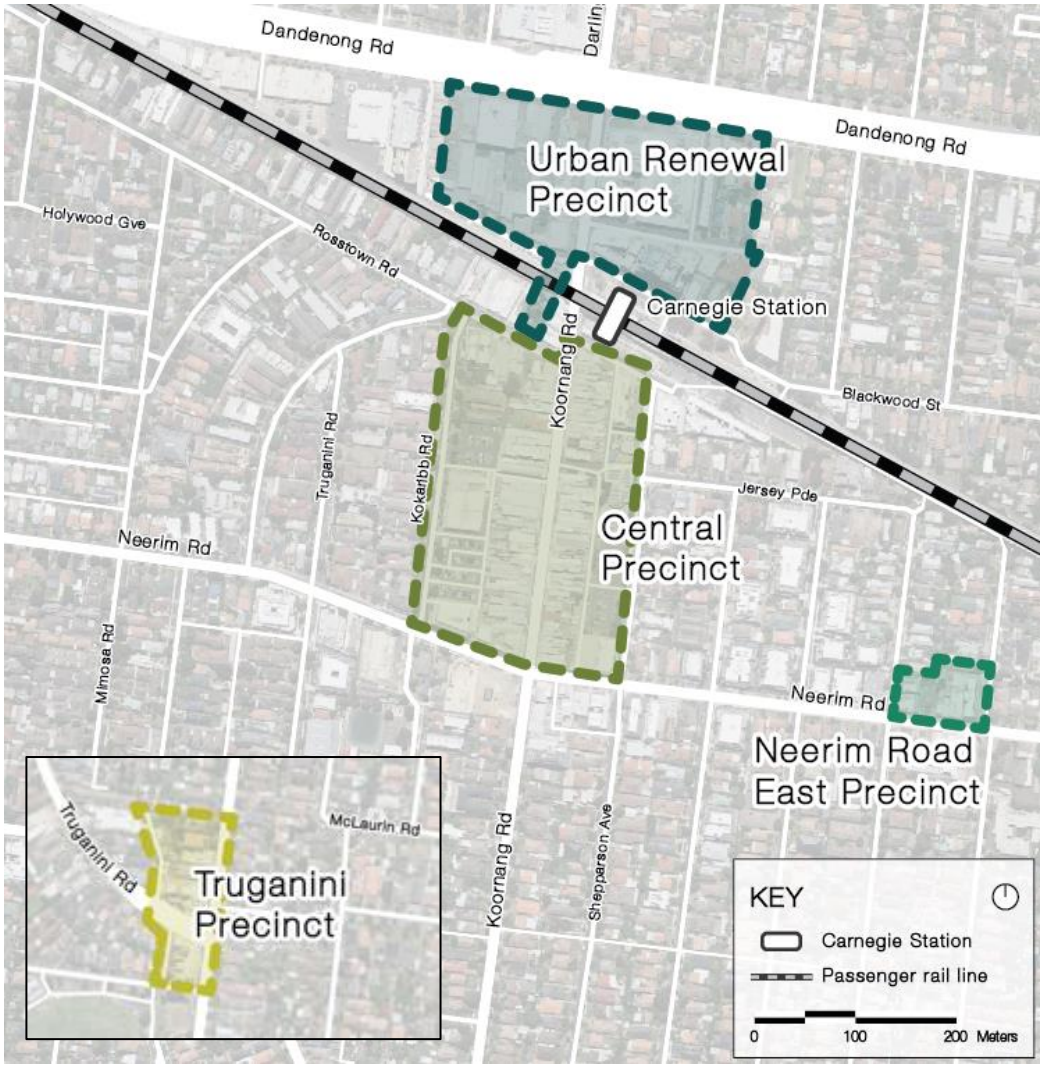


Figure 18 – Laneway precincts

Urban renewal precinct

Laneways within the urban renewal precinct are shown in Figure 19, noting those on the GECC roads register as being maintained by Council. Details are provided in Table 6.

Figure 19 – Urban renewal precinct, status of laneways in GECC roads register

Table 6 – Urban renewal precinct laneway summary

ID	Name	Primary function	Secondary function/s	Circulation	Approx. Width (m)
1	Internal east-west	Carpark circulation / service access	Access to external road network	Two-way	3m ROW [1]
2	Internal north-south	Carpark circulation	Access to external road network	Two-way	3m ROW [1]
3	Egan Street access	Bottle shop drive-thru egress	Carpark egress to Egan Street	Two-way	3m ROW [1]
4	Koornang Road access	Carpark access	Service vehicle BOH access	Two-way	3m ROW [1]
5	Carnegie Central loading bay access	Service access	Service vehicle BOH access	Two-way	3m ROW [2]
6	Rosstown Road access	Driveway	N/A	Two-way	3.5m
7	Dandenong Road service road access	Private driveway	N/A	Varies	Varies
8	Carnegie Central carpark access/ egress	Car park circulation	N/A	Two-way	6.5m

[1] Additional car parking aisle width exists outside the ROW, providing a total width in the order of 5.5-6m

As shown, laneways generally facilitate access but are also used by pedestrians accessing Koornang Road and Carnegie Station from car parking areas. While the width of laneways may be appropriate for current needs; the environment is uninviting of other activities such as pedestrian access and improvements would be desirable to support increased use and activation as further development is realised. Some single width sections may not be suitable for accommodating two-way flow depending on future development generated traffic volumes to/from these laneways.

Central Precinct

Laneways within the central precinct are shown in Figure 20, noting those laneways that appear in the GECC roads register as a Council maintained laneway. Details are provided in. Table 7.

Figure 20 – Central precinct laneways

Table 7 – Central precinct laneway summary

ID	Name	Primary function	Secondary function/s	Vehicle circulation	Approx. Width (m)
1	Morton Avenue access	Service vehicle BOH access	Bin placement and collection	Two way	4.5m (N) 3m (S)
2	Shepparson Avenue internal north-south	Carpark access	Loading zone, service vehicle BOH access	Two-way (one vehicle in each direction with limited passing opportunities)	3m ROW [1]
3	Koornang Road-Shepparson Avenue	Pedestrian access between carpark and Koornang Road	N/A	None (pedestrian only)	<1.5m
4	Neerim Road access	Service vehicle BOH access	Carpark access	Two-way	3.2m
5	Rosstown Road access	Service vehicle BOH access	N/A	Two-way	2.5-3m
6	Kokaribb Road access North	Carpark access	Service vehicle BOH access (as per endorsed planning permit)	Two-way	6m
7	Koornang Road-Kokaribb Road arcade north	Through-site link	N/A	None (pedestrian only)	Not available
8	Kokaribb Road internal north-south (adjacent Woolworths site)	Loading zone, service vehicle BOH access	Bin placement and collection, carpark access	One-way southbound	3.5-8m
9	Kokaribb Road internal north-south aisles	Carpark circulation aisles	Exit route for service vehicles/ freight	Two way	4.5m
10	Koornang Road-Kokaribb Road arcade south	Pedestrian access between carpark and Koornang Road	Pedestrian access to internal shops and businesses	Exclusive pedestrian right of way	4.5-5m
11	Kokaribb Road access South (partly Council/ private land)	Carpark access	Access to off-street car park at 77 Koornang Road	Two-way	6m

[1] Additional carriageway width exists outside the ROW, increasing available width to 6m in the northern section and 4m in the southern section

As shown, laneways facilitate a number of uses, primarily being east-west access for pedestrians between land uses along and either side of Koornang Road and for vehicle access to off-street carparks. Laneways also facilitate service vehicle access for informal BOH operations such as waste collection and loading, which lead to the placement of bins, unloaded cargo and general clutter. Not only does the informal use of BOH operations impact amenity but the accumulation of clutter impacts safety, discourages pedestrian use and impacts overall walkability of the CAC.

Key findings

Council maintained laneways are discontinuous and much of the fine-grained network is outside Council control, or may be impacted by existing lease agreements or activities included on approved planning permits, reducing the potential for improvements to laneway connectivity. The variety of existing uses including carpark access and circulation, bin storage, loading and other informal BOH operations are a challenge to staged improvement and for servicing traffic access to new developments. Some laneways are very narrow, with limited capacity to serve major development demand, which may lead to safety and amenity challenges. As part of future planning and development, there are opportunities to increase permeability and deliver public through-site links for pedestrians. Recommendations for the future of laneways in Carnegie are provided in Section 6 and 7.

3.6.4 Car parking

The existing supply of car parking in the CAC has been shown in Figure 21 across four zones. Data sources used and an in-depth analysis for each precinct is detailed in Appendix B.

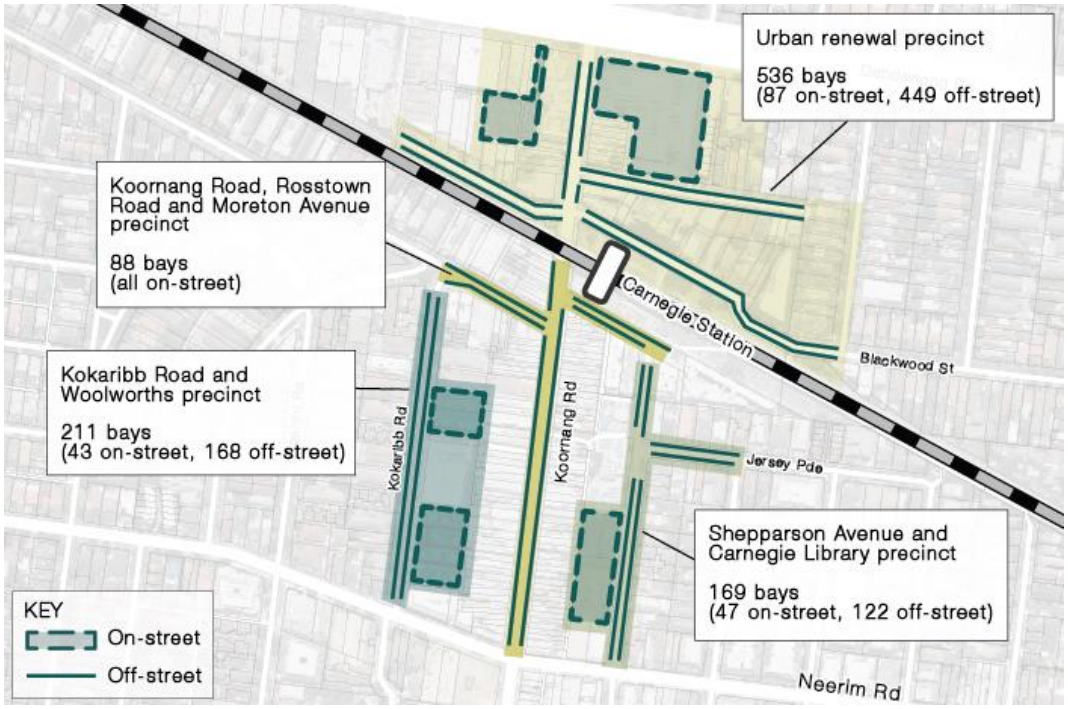


Figure 21 – Existing CAC parking supply and location

An appreciation of the 'normal' condition of parking has been undertaken through interrogation of previous studies and associated data collection provided by the GECC as summarised in Table 8.

Table 8 – Summary of supplied carparking data

Source	Available data
75A-75B Koornang Road Traffic Impact Assessment, Ratio Consultants, 2020	Supply and utilisation data for: Friday 28 July, 2017, 11am – 11pm Saturday 29 July, 2017, 11am – 11pm
Transport Analysis and Forecasting Discussion Paper, MRCagney, 2017	Supply and utilisation data for: Thursday 27 July, 2017, 8am – 10pm Saturday 29 July, 2017, 9am – 2pm
GECC Parking Analysis, GECC, 2017	Supply and utilisation data for: Tuesday 25 July, 2017, 8am – 10pm Saturday 29 July, 2017, 9am – 2pm
Spot counts and observations from aerial imagery	Off-street carparking supply for: Thursday 19 December, 2019, 3:01pm Saturday 23 February, 2019, 1:10pm

An analysis of the existing supply and utilisation of carparking has been undertaken for each zone using available data and is shown in Table 9.

Table 9 – Existing CAC parking supply and utilisation

Precinct	Supply	Peak occupancy		Utilisation		
		Lunch time (12pm)	Dinner time (7pm)	Lunch time (12pm)	Dinner time (7pm)	Afternoon (4pm)
Urban Renewal	536 bays total 87 on-street 449 off-street	488	515	91% (Saturday 29 July 2017)	96% (Saturday 29 July 2017)	59% (Friday 28 July 2017)
Koornang Road, Rosstown Road and Morton Avenue	88 bays total All on-street	76	81	86% (Saturday 29 July 2017)	92% (Saturday 29 July 2017)	60% (Saturday 29 July 2017)
Kokaribb Road and Woolworths	211 bays total 43 on-street 168 off-street	186	192	88% (Saturday 29 July 2017)	91% (Friday 28 July 2017)	71% (Friday 28 July 2017)
Shepparson Avenue and Carnegie Library	169 bays total 47 on-street 122 off-street	150	149	89% (Friday 28 July 2017)	88% (Friday 28 July 2017)	63% (Saturday 29 July 2017)
Total	1,004 bays	900	937	90%	93%	62%
Availability (surplus/ shortfall)		+104	+67			

As shown, the CAC currently provides a total of 1,004 public on and off-street parking bays. Parking demand peaks at 12pm and in the day and again at 7pm at night, where total utilisation throughout the area reached 90% and 93% respectively.

These levels of parking demand are nearing the theoretical capacity limit of a public car parking area. High levels of utilisation (i.e. around >85%) particularly with on-street parking, can lead to an increase in circulating traffic. Parking precincts are rarely 100% occupied due to the mismatch in time and space between one vehicle leaving and another vehicle finding a vacancy.

While parking demands remain high for the majority of the day on both Fridays and Saturdays, carparking utilisation reduces to 62% during the late afternoon (4pm), and drops significantly overnight to below 50%. There is limited data available to understand overspill carparking onto surrounding residential streets, which may be relied upon by visitors due to the limited parking capacity within the core precinct.

With parking demand concentrated in two peak times and remaining high throughout the day, there will be a need for improved access to public and active transport modes within the CAC to accommodate growth.

There are currently no provisions of public EV charging infrastructure within the CAC, potentially reducing the ability of capturing more sustainable transport modes and vehicle use given increasing uptake of EV and other forms of micro-mobility.

3.7 SWOT summary

Strengths

- Carnegie is a highly accessible precinct with good public transport options, making it a viable location for transit-oriented and transit-adjacent development.
- It is a vibrant precinct with midday and night-time activity making Carnegie a logical candidate for place-based approach to street planning and design.
- Great access to the Djerring Trail offering strategic cycling connections to nearby activity centres.
- The CAC has distinct land use pattern with a clear peak visitation times, and a strong understanding of ‘place’. A greater residential population may complement its current activity profile, leading an overall reduction in the need for travel and other economic benefits.

Weaknesses

- There are poor conditions for cyclists, and particularly those that are less confident, along Neerim Road and Koornang Road. Existing conditions are not reflective of current travel patterns and desire-lines, nor their strategic intent as commuter and recreational cycling links.
- Laneways are discontinuous and shared between pedestrians, vehicles and informal BOH operations, leading to low amenity walking environments for pedestrians and may create challenges for staged improvements and redevelopments. In some instances, the spacing of laneways limits the directness of connectivity, increasing walking distances.
- Some laneways are very narrow, with limited capacity to serve major redevelopment upgrades and additional demand.
- Current statutory planning requirements for car parking are poorly aligned with the local context and likely market demand for private car parking in new developments.
- On-street parking on Koornang Road is a relatively inefficient use of public space considering the nearby off-street parking.
- The road network and car parking are approaching capacity across peak periods and utilisation remains high across the day, with limited opportunities to increase network capacity.
- There are currently no public provisions for electric charging infrastructure in the centre, potentially limiting the uptake and awareness of the benefits of electric mobility.

Opportunities

- The secondary circulation network either side of Koornang Road offers an alternative access opportunity for any new developments adjacent Koornang Road, allowing walkability to be preserved and enhanced.
- An existing laneway network provide a basis for potential expansion to enhance permeability and create a more three-dimensional activity centre, rather than simply a ‘high street’.

- Prior to COVID-19, a rise in public transport trips and decrease in private vehicle trips suggests significant potential for continued shift away from car-centric urban form, providing opportunities for more liveable streets.
- Existing car ownership levels are lower than Greater Melbourne, suggesting a more context-specific approach to car parking controls in new developments could result in a reduction in car parking supply and overall greater mode shift.
- Public transport use in the CAC is very high compared with other areas that are less well served by heavy rail access, suggesting the potential for mode shift and lower on-site parking rates could be supported in new developments.
- Net zero targets are likely to increase uptake of EV and future mobility and there is potential to capitalise on the support for initiatives in the CAC.
- Increased use of micro-mobility and emerging forms of transport technology open up opportunities to accommodate new forms of last-mile connections with nuanced EOTF and secure storage/ parking solutions.

Threats

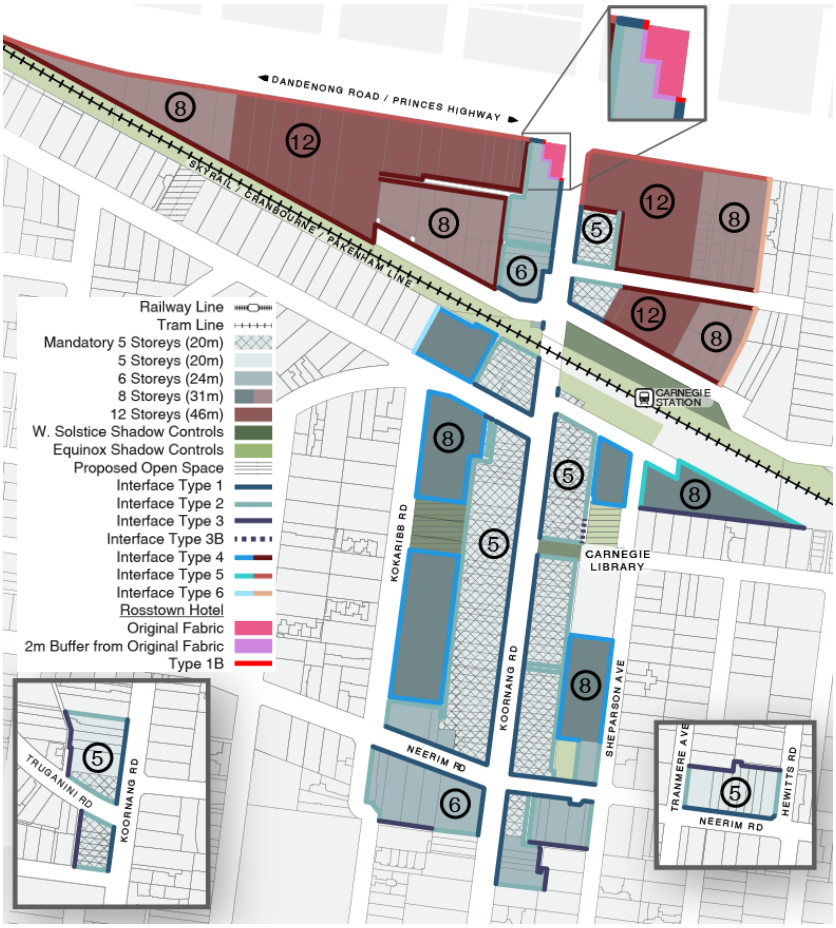
- New development may compromise the ability to deliver a future laneway network that is permeable for east-west connections to Koornang Road.
- Future proofing for the creation of additional or wider laneways may be challenging. For example, short term development may have sufficient capacity, but in turn – could constrain longer term development capacity. Equally, an ‘ideal’ laneway network would probably involve an extent of lot consolidation that is outside of Council control.
- Poor safety record at adjacent arterial intersections to central Carnegie are an ongoing concern for community safety and wellbeing.
- Flexible working and evolving travel demand patterns due to COVID creates a challenge for policy-makers and planners to anticipate a ‘new normal’. It will be important to ensure that those who do not have the option to work flexibly can continue to travel safely and efficiently.
- There is evidence that stay-at-home orders due to COVID have spurred a renewed car dependence and may impact the previous trends of higher public transport uptake in the short and medium term.
- Increased operation of delivery drivers at all times of the day creates challenges to safety, demands and concern for the road network as a place of work.
- Circulating traffic at peak times caused by search for parking vacancies may be undermining the walkability and attractiveness of Koornang Road.

4 Built form framework

4.1 Future land use

A Built Form Framework for Carnegie has been prepared that sets out proposed building heights, open space, and other urban design principles to guide the development of the activity centre. An excerpt is shown in Figure 22.

Figure 22 – Built Form Framework (Building Envelopes and Proposed Open Space)



As part of a review of employment land needs for the major activity centres, SGS Economics and Planning (SGS) has estimated the potential take-up of land for retail, commercial and residential development, by 2036, summarised in Table 10. For the purpose of this assessment, a broad definition of retail has been adopted to cover both terms of 'retail' and 'retail services' provided by SGS.

Table 10 - Forecast Land Use Change in Carnegie

Scenario	No. of Dwellings	Retail & Retail Services (m^2 GFA)	Commercial (m^2 GFA)
Existing	2,502	52,400	20,500
2036	5,048	64,500	25,100
% Change	***+102%***	***+23%***	***+22%***

Source: SGS Economics and Planning, March 2022.

The SGS forecast land use change for residential has been adopted as per the sub-precinct level inputs provided, while retail/commercial land use growth in the activity centre has been proportionately allocated to each sub-precinct within the CAC based on overall land area. This provides a high-level basis for estimating transport demands, noting the limitations in Section 5.2. An overview of the sub-precincts is provided in Figure 23 with the estimated land use change summarised in Table 11.

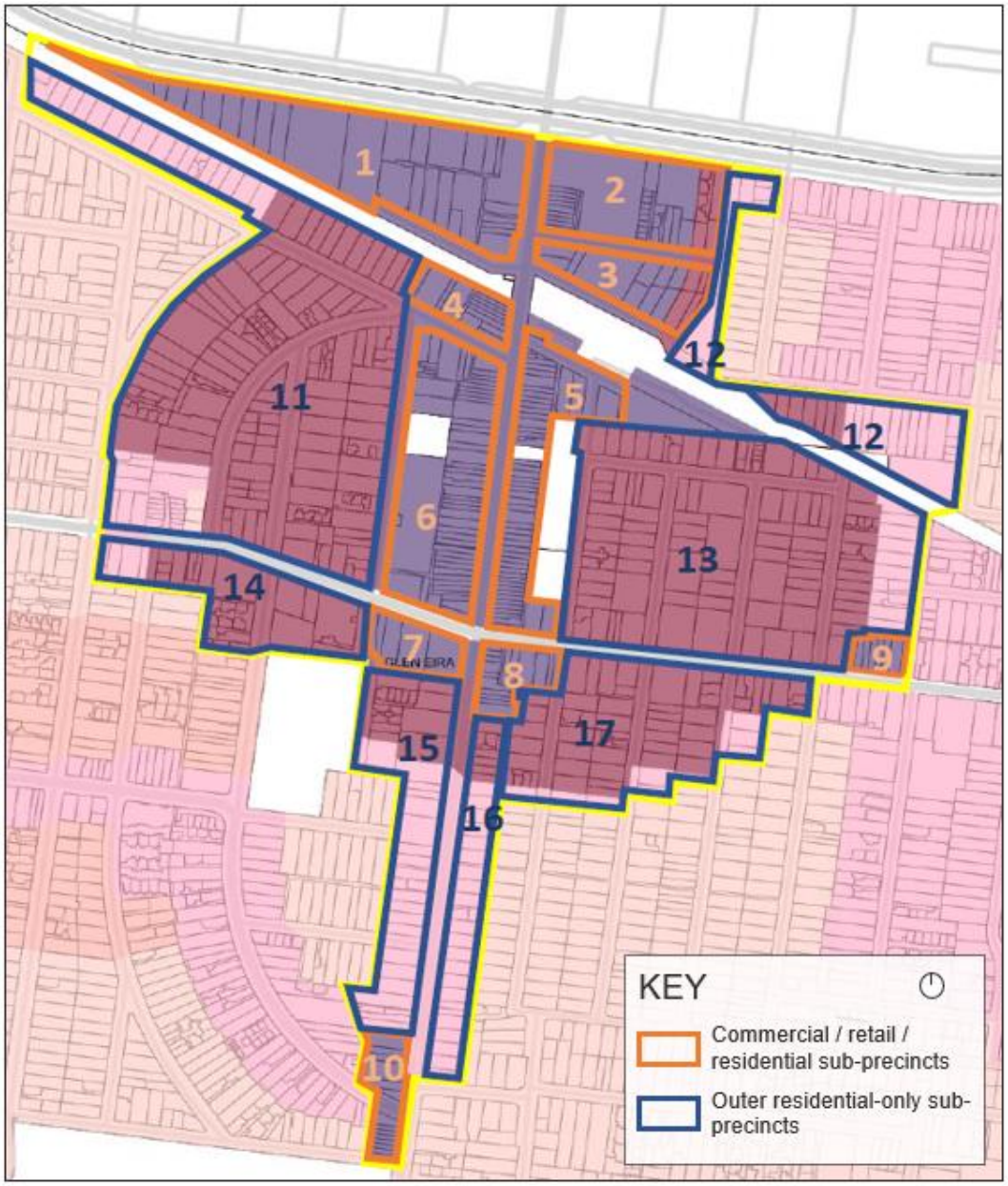


Figure 23 – Carnegie sub-precinct map

Table 11 – Forecast growth 2021-2036 by sub-precinct

Sub-Precinct	Additional apartments	Additional townhouses/ units	Retail growth (m^2)	Commercial growth (m^2)
1	518	0	2,887	1,098
2	129	0	1,870	711
3	54	0	987	375
4	17	0	500	190
5	110	0	1,788	680
6	225	0	2,426	922
7	21	0	508	193
8	37	0	440	167
9	19	0	267	101
10	28	2	427	162
11	414	14	-	-
12	37	6	-	-
13	511	8	-	-
14	47	0	-	-
15	93	23	-	-
16	73	25	-	-
17	213	1	-	-
Total	**2,546**	**79**	**12,100**	**4,600**

The information above shows that there could be substantial demand for commercial/retail floor area as well as medium and high-density housing in Carnegie. It is noted that limited information has been available to understand the existing land uses in detail within each of the sub-precincts, but the overall scale of change is highlighted in Table 10.

Development controls in Carnegie that allow an increased degree of co-located population density, jobs and services, in a high-accessibility location; inherently provide broader benefits for Melbourne. This comes in the form of more sustainable travel patterns, and improved community health and wellbeing through better transport choice. Although it is also evident that this places an increased pressure on local infrastructure in established areas. These pressures can be managed through the recommendations proposed in Sections 6 and 7 of this report, but also requires a degree of social and cultural acceptance in alignment with global trends of how cities need to manage urban change. The following section provides an assessment of transport demands generated by land use changes outlined above.

5 Transport demand

Having established the estimated land use changes, this section defines the estimated increase in travel demand across a range of scenarios. Potential increased development within the CAC has been assessed based on the BFF and land use projections undertaken by Lat37 and SGS Economics and Planning respectively.

5.1 Approach

The assessment takes the net change in floor area by 'sub-precinct' (refer Figure 23) and applies trip generation rates to calculate the increase in transport demands to/from and within the activity centre by 2036.

The 2036 horizon is considered appropriate as it generally spans the horizon adopted for the Carnegie Structure Plan. Beyond this timeframe, the level of certainty is reduced and limits the usefulness of this type of assessment.

The purpose is to understand the potential scale of change in transport demands, measured in peak hour trips, generated by potential development in Carnegie over the medium term. It is intended to guide development principles and policy recommendations for the transport network and public realm.

The assessment is not intended to serve as a detailed traffic modelling of future development as this would require more specific input information relating to the type of proposed development for specific properties. This level of analysis would be more appropriate during subsequent stages of the planning process as specific development proposals are defined.

However, it remains important to understand the scale of change in travel demand and the potential implications for the transport network. In this regard, the adopted approach estimates the transport demand generated by each 'sub-precinct' and provides a high-level indication of the potential need for interventions, either by improving access to sustainable and efficient transport modes, or by way of policy changes. A key issue is also the carrying capacity of laneways, where this assessment helps to contextualise the potential need for widening to improve capacity and amenity in response to the development intent, which is further discussed in Section 6.8.

5.2 Methodology, inputs and assumptions

The methodology for assessing transport demand, along with any key inputs/assumptions is noted as follows:

- The net increase in residential dwellings is taken as an input from estimates by SGS, already broken down by sub-precinct (refer Figure 23 for map of sub-precincts).
- The net increase in retail and commercial development floor area for the entire Carnegie activity centre is taken as an input from estimates by SGS. This growth has then been distributed proportionately to the land area assumed to be developable within each 'sub-precinct' zoned for commercial development (i.e. 1-10 only). It is noted that the potential for different building heights is of little consequence to this assumption, as the growth forecast derived by the SGS modelling assumes retail and commercial floor areas to be on the ground or first floor only.

The limitations and risks with the abovementioned inputs include:

- Land use assumptions do not take into account any building setbacks or widening for laneways. These are assumed to be incorporated within the SGS assumption that 70% of ground floor area is land use.
- The analysis assumes the same land use mix in all areas and therefore does not account for any clustering of development of land use types.
- Trip generation rates have been compiled for the three key land use types, using a variety of sources including historical travel behaviour data (ABS, VISTA), traffic generation rates, and industry benchmarks. No attempts have been made to account for potential trips with both origin and destination within the activity centre that may be double counted.
- Public car parking demands have been estimated, by first calibrating the existing activity centre car parking demand rate per 100m^2 and applying the same rate into the future with the addition of residential visitor car parking.

5.3 Scenario development

The increase in transport demands from the development in Carnegie has been assessed in three scenarios. A scenario-based approach presents a way of dealing with future uncertainty over travel demand and changing mobility patterns over time, as well as allowing us to assess the role of a range of potential policy levers in shaping transport outcomes, consistent with the broader strategic intent of GECC.

The three scenarios are defined as follows:

- **Scenario 1: Business as usual**: This scenario adopts standard industry benchmarks and empirical travel behaviour data sets collected prior to the COVID-19 pandemic. It assumes that the pre-COVID mode share and travel demands remain, but does not consider the long term trajectories in the trends of downwards car own ownership, increasing public transport usage, and increased uptake of active transport. It also assumes that car parking is provided at a similar rate as existing.
- **Scenario 2: Policy target mode share**: This scenario seeks to understand the potential shift in trips to more sustainable modes, by assuming that the outcome by 2036 is more aligned with the policy goal of a 50:50 car and non-car mode share,

associated with the general downwards trend of car ownership, increasing public transport, and reduced car ownership.

- **Scenario 3: Impact Covid-19**: This scenario seeks to understand a hypothetical 'COVID-normal' or post-COVID scenario, characterised by an increase in car use, higher rates of work-from-home, and public transport hesitancy.

The assumptions and key findings from each scenario are detailed below.

5.3.1 Scenario 1: Business-As-Usual (BAU)

The BAU transport demand scenario takes guidance from a range of historical travel behaviour data sets for Carnegie (ABS, VISTA and GECC shopping strip mode share surveys as outlined in Section 3.3) as well as industry benchmarks such as the NSW Roads and Maritime Services Guide to Traffic Generating Developments. Where trip generation rates are unavailable for non-car modes, the number of trips for walking, cycling and public transport has been scaled relative to car trips based on the existing mode split (see 'trip factor' – number of non-car trips for every 1 car trip).

Evidence for the BAU mode share and trip generation assumptions for each land use are summarised as follows:

Commercial

- **Mode Share:** The assumed mode is based on ABS mode share data for work trips to the Carnegie Activity Centre, as shown in Table 2 (with 'Work from Home' excluded).
- **Traffic generation:** A rate of 1.5trips/100 m^2 is adopted based on the accessibility of Carnegie to public transport, and has been benchmarked against the following:
  - The RTA Guide to Traffic Generating Developments, which notes a rate of 2 trips/100m^2 GFA in the evening peak hour.
  - The RMS Guide to Traffic Generating Developments Updated traffic surveys (2013) provides data from an additional 10 survey sites showing 1.6 and 1.2 trips/hr in the AM and PM peaks respectively.

  It is noted that any capping on car parking provision within new developments would present a significant opportunity to reduce these rates (reflected in part under Scenario 2).

Retail

- **Mode Share**: Based on interpretation of resident VISTA data (Figure 6) and VISTA data dashboard[15] for all of Melbourne – which shows mode used by trip purpose (walk-only represents 14% and 26% for shopping and social/recreational trips respectively). A higher share of walk only trips has been assumed for Carnegie, supported by the high accessibility of Carnegie and strip shop survey data collected by GECC (refer 3.3.1).
- **Trip generation**: Retail trip generation is supported by the RTA Guide to Traffic Generating Developments Updated Traffic Surveys including rates for:
  - Restaurant: 5 vph/100m^2
  - Shopping centre (mixed retail): Up to 4.6vph/100m^2 for >30,000m^2

15 https://public.tableau.com/app/profile/vista/viz/VISTA-Trips-timeseriesAccess/Trips-methodoftravel

Residential

- **Mode Share**: Based on VISTA historical mode share for Carnegie residents as shown in Figure 6.
- **Trip generation**: Total trip generation (by any mode) has been calibrated to the RMS Guide to Traffic Generating Developments Updated surveys (2013) which shows in the order of 0.6 trips/hr per apartment. Mode shares are then applied to determine the traffic generation rate of 0.3 car trips/dwelling.

The BAU traffic generation rates and mode split assumptions are shown in Table 12. It is noted that these volumes are two-way, with each 'trip' constituting either as an arrival or a departure.

Table 12 – Trip generation rate and mode split assumptions

Land Use	Parameter	Mode				
		Car driver [1]	Car passenger	Bicycle	Walk	Public transport
Commercial	Average peak hour traffic generation rate	1.5 car trips/100m2				
	Mode share	71%	8%	2%	8%	12%
	Trip factor	1.00	0	0.02	0.11	0.17
Retail	Average peak hour traffic generation rate	5 car trips/100m2				
	Mode share	38%	20%	3%	28%	12%
	Trip factor	1.00	0	0.08	0.73	0.32
Residential	Average peak hour traffic generation rate	0.3 car trips / dwelling				
	Mode share	55%	8%	3%	19%	15%
	Trip factor	1.00	0	0.05	0.35	0.27

[1] Rate for car driver trips is assumed to include ride-sharing, with car passenger trips set to zero.

By applying the trip generation rates and mode split assumptions to the net increase in floor areas, the business-as-usual transport demands have been calculated in Table 13.

Table 13 – Scenario 1: BAU net increase in peak trips by 2036

Sub-Precinct	Car (trips / hour) [1]	Bicycle (trips / hour)	Walk (trips / hour)	Public transport (trips / hour)
1	320	20	160	90
2	140	10	90	40
3	70	10	40	20
4	30	<5	20	10
5	130	10	80	40
6	200	20	120	60
7	40	<5	20	10
8	40	<5	20	10
9	20	<5	10	10
10	30	<5	20	10
11	130	10	50	40
12	10	<5	10	<5
13	160	10	50	40
14	20	<5	10	<5
15	40	<5	10	10
16	30	<5	10	10
17	70	<5	20	20
Total	**1,480**	**100**	**740**	**420**

[1] Car trips are based on car driver mode shares and are assumed to include passenger trips.

Key findings from the above are that:

- While private vehicle is the dominant mode, the significant walk-up demand combined with public transport usage results in the share of car trips comprising around 53% if all trips.
- More than 420 new public transport trips will be generated, highlighting the importance of quality integration between destinations and the station.
- Based on current mode share data, cycling demand will continue to be modest. Regardless, there is still a need to safely accommodate last-mile connections for these users. Space could be needed to park a significant number of bicycles for non-residential uses, with around 70 of the 100 peak hour trips being related to retail or commercial activity.
- In the order of 530 new vehicle trips could be generated in the Urban Renewal Precinct (sub precincts 1, 2 and 3). In the absence of redevelopment east of Koornang Road, this may be concentrated on the western side of Koornang Road. The existing network of narrow laneways is unlikely to be appropriate for this scale of traffic demand without some interventions.

- Residential zones flanking the activity centre (sub-precincts 13, 17) will experience minor growth in traffic demands to/from these streets and are not cause for concern. The likely volume of traffic using local residential streets to access sub-precincts 4, 5 and 6 is also expected to be relatively low. Despite the low impact in traffic volumes, traffic speeds should be monitored to ensure non-local traffic does not compromise safety or amenity in these areas.

5.3.2 Scenario 2: Policy Target Mode Share

The Glen Eira *Integrated Transport Strategy 2018 – 2031* strives for a 50:50 mode split between car and non-car trips by 2031 as illustrated in Figure 24. The implied shift from 64% to 50% car trips represents a decrease in the use of private vehicles, to around 75% of current levels.

Given the target applies for the whole municipality, and that there is natural variation in mode shares for different trips types for moving to/from and through the activity centre, the GECC 'non-car' percentages do not directly reconcile against the BAU mode share assumptions shown in Table 13. As such, in order to reflect the policy target, Scenario 2 applies a traffic generation rate of only 75% of the BAU rate, shifting these car trips to other modes (walking, cycling and public transport). This scenario is used as a proxy to reflect other policy initiatives that could be considered within Carnegie, such as reduced car parking rates for new developments.

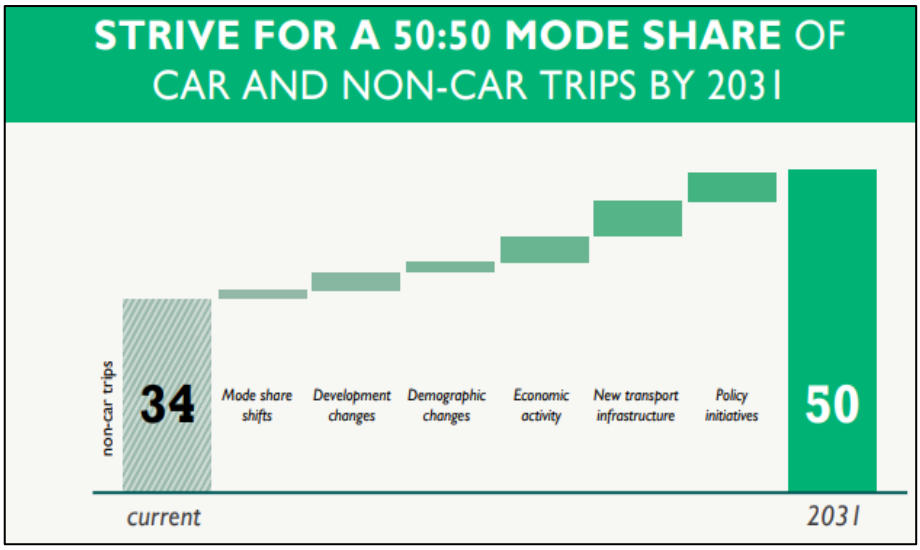


Figure 24 – Glen Eira Integrated Transport Strategy Mode Share Targets

Table 14 – Peak trips for demand Scenario 2 and comparison to BAU

Mode	Scenario 1 Business as Usual	Scenario 2 Target Mode Share
Car	1,480	1,100
Bicycle	100	140
Walk	740	950
Public Transport	420	550
Total	**2,740**	**2,740**

Key findings from the above are that:

- Application of the GECC target would reduce private car trips from around 1,480vehicles/hour to around 1,110 vehicles per hour.
- More than 220 additional walking trips and 40 new cycling trips would be created in an hour, highlighting the importance of walkability and rideability of the centre and the need for supportive infrastructure.

5.3.3 Scenario 3: Impact of Covid-19

Research from Monash University suggests that in post-COVID conditions, the share of commuting by car will increase by around 5%, while the share of commuting by public transport will decline by 6%[16]. Other modes such as walking, and cycling are also expected to increase slightly (approximately +1%).

Stated preference surveys also suggest that peak hour trips generated will reduce with up to 1 day per week being worked from home (for those with remote working capabilities), equating to in the order of 25% reduction in peak trip generation in post-COVID. Taking into consideration approximately 62.6% of the residents Carnegie work in remote workable jobs and 85% of the residents in Carnegie are employed (extracted from Census Data 2016), this equates to approximately 13% reduction in trip generation due increase in number of people working from home in post-COVID conditions.

Table 15 – Comparison of peak trips for each demand scenario

Mode	Scenario 1 Business as Usual	Scenario 2 Target Mode Share	Scenario 3 Impact of Covid-19
Car	1,480	1,100	1190
Bicycle	100	140	100
Walk	740	950	820
Public Transport	420	550	270
Total	**2,740**	**2,740**	**2,380**

The findings from Scenario 3 show that:

- The marginal increase in preference for commuting by driving does not lead to an increase in overall vehicle trips in the peak hours, as this is expected to be offset by the increase of working from home. The impact of Covid tells a similar story as the GECC Target Mode Share scenario, just with fewer public transport journeys.
- Overall, there are around 360 fewer trips generated during the peak hour, predominately relating to avoided work trips. These may be replaced with some increases in incidental local walking trips, as people replace their commute time with other localised activities.

[16] Currie, G., Aston, L. & Jain, T. 2020 Covid-19 Long Term Travel Impacts Study, *Public Transport Research Group*, Monash University.

5.3.4 Scenario conclusion

While there are clear differences in the travel demand generated under each scenario, the alternatives to a 'business as usual' future show that the number of car trips would reduce from around 1,480 to around 1,100 vehicles in a peak hour.

For the purposes of presenting a worst-case assessment of the impact on the network, the Scenario 1: BAU demands have been further interrogated at the 'sub-precinct' level in Section 6 with potential network mitigation considered.

While the GECC 50/50 mode split target would reduce the demands on the transport network, the scale of incremental change from BAU is less significant when considered across the CAC. On this basis, it is expected that the findings under Scenario 1 would apply at a similar (albeit, reduced scale) for Scenario 2.

6 Access strategy and traffic assessment

The forecast land use change and associated transport demand will provide both challenges and opportunities for preserving or enhancing access to the CAC. This section investigates these issues including:

- **Section 6.1** provides overarching access strategy principles for the Activity Centre.
- **Section 6.2** illustrates a strategic assessment of the relative increase in transport demand at the precinct-wide scale, considering the post-development traffic demands at main corridors of Neerim Road and Koornang road. Strategies around the role of sustainable and public transport are presented as a way of managing this growth.
- **Sections 6.3 to 6.6** presents a high-level traffic assessment of four precincts, based on an overall access strategy that contemplates how access to future developments might be provided, and then estimates the impact of the additional traffic demands distributed to each frontage road. This culminates in recommendations for network mitigation to support the development of each precinct, noting that the actual traffic generation and distribution will be influenced by potential lot consolidation, the extent of creation of internal roads, and location of access points, with further studies ultimately being required.
- **Section 6.7** provides an overall summary of the transport network mitigations to be considered in supporting long term growth and development of the activity centre.
- **Section 6.7** provides specific consideration to the use of laneways in accommodating development generated transport demands.

6.1 Access strategy principles

The role of good design cannot be understated in its contribution to a desirable and liveable activity centre. Good access management design is no exception. It is a fundamental consideration for the success of the CAC and is required to guide development outcomes that positively contribute to the sustainable travel goals that have been established through the policy review.

While the access strategy is context specific and is explored for each of the precincts in subsequent sections, there are a number of overarching principles that apply for the CAC. These are informed by the policy context that encourages enhanced walking, cycling and public transport along with best practice access management as defined in Austroads Guide to Traffic Management Part 5: Road Management.

Key access strategy principles include:

- **Enhance pedestrian comfort:** Avoid any new vehicle crossovers along pedestrian priority streets and in particular, key retail areas such as Koornang Road to provide for safety and comfort for people walking.
- **Active transport permeability:** Encourage and facilitate an increased degree of permeability between buildings, as well as-through-site links within major developments to allow connection within the precinct for people walking and cycling.
- **Protect active frontages:** Providing safe and attractive building entrances for all transport modes, responding to the built form hierarchy of frontages. Rear-lot vehicle access should be sought wherever possible, with pedestrian access from the primary

active frontages, and separate access to end-of-trip facilities located on ground floor level.

- **Enhance and rationalise vehicle access:** Develop a statutory planning framework to plan for widening and/or introduction of passing areas along laneways at the time of development, in cases where laneways are anticipated to accommodate significant post-development traffic volumes. Require major developments to provide on-site waste collection and loading areas where relevant.
- **Improve network efficiency and safety:** Reduce conflict points along movement corridors such as Neerim Road and Koornang Road and consider speed reductions across the CAC. This will assist in reducing potential inefficiencies and other community costs such as safety risks, increased delays, and road capacity constraints.

6.2 Strategic transport demand assessment

In order to assess the transport and access requirements for the specific precincts within the CAC, it is necessary to understand the transport demands at a strategic level.

The 'business as usual' traffic demands from Section 5.3.1 have been assigned onto the network in broad terms to understand the potential traffic impact at key locations of Neerim Road and Koornang Road. The directionality of trips to/from each sub-precinct has been based on a generalised pattern of development, considering a combination of existing and potential future access connections. A separate assessment, considering the number of trips generated to/from each sub-precinct is provided in Section 6.3 to Section 6.6

At a strategic level, the net increase in traffic volumes under a worst case 'BAU' scenario, relative to the existing traffic conditions has been reviewed at key locations on Koornang Road and Neerim Road.

A high-level assessment was carried out by mapping out the expected directional distribution of each sub-precinct traffic to key locations on Neerim Rd and Koornang Rd, suggesting that in the order of 20-30% of all new trips generated would pass through the locations shown in Figure 25, equating to in the order 300-400vph in the peak.

By way of comparison to the existing traffic volume data provided in Section 3.6.1, this represents:

- A net increase in peak hour link-flows in the order +30-45% on Neerim Road. Post development traffic demands would be up to 1,300vph.
- A net increase in link-flows in the order +25-35% on Koornang Road. Post development traffic demand would be up to 1,600vph.

It is acknowledged that the 'post-development' traffic estimates presented above do not include background increases in through-traffic. With the scale of development forecast, the increases in non-local traffic demand are likely to be displaced onto other parts of the network or be absorbed as peak spreading. Increasingly, longer trips through capacity constrained inner and middle-ring suburbs are expected to be taken up by other modes, or competing routes, which is suspected to be the case in Carnegie.

Figure 25 Estimated Increase in Approach Flows

As outlined in Section 3.6.1, Neerim Road and Koornang Road are key access routes for the precinct and the estimated demand would place further pressure on network performance. Koornang Road in particular has limited capacity. These additional demands would likely result in volumes greater than their theoretical capacity (as per (Austroads Guide to Traffic Management Part 3 – Transport Studies and Analysis methods, p.64), inducing lower speeds, increased peak spreading and some impacts on journey time reliability for travel to the CAC by car. This highlights the need for precinct measures that will improve access for people walking, cycling and using public transport. Sustainable and public transport strategies are discussed in Section 6.2 below. These capacity limitations of the precinct are also relevant in informing the recommendations in relation to car parking which are outlined in Section 8.3 noting that the level of car parking supply is an available lever in reducing the car parking demand.

6.2.1 Travel demand management

In a spatially constrained urban environment where it is difficult, impractical, and sometimes undesirable to accommodate increases car-based growth on major roads; this drives the need to manage travel demand through active and public transport, which are complementary to land use outcomes.

Sustainable transport

Increasing the ease of uptake for more sustainable forms of transport has great potential to alleviate some of the traffic capacity issues that may otherwise result from the forecast level of growth. This is not a massive shift, but an incremental step change in building upon existing travel patterns and transport trends and is clearly supported by the various state and local transport policies such as Plan Melbourne (i.e. 20-minute city). The CAC has a strong public transport base, with availability of diverse destinations within walking distance.

The following plans and strategies are recommended to be pursued by GECC to promote sustainable transport within the CAC and mitigate the need for costly and impractical upgrades to the road network:

- Investigate the rollout of an e-micromobility (i.e. Lime e-scooter and e-bikes, etc.) trial in partnership with private business, including an e-mobility parking hub to increase awareness of sustainable travel benefits and options within the centre.
- Review the adequacy of public bicycle parking rails and identify any areas for additional bicycle rails or parklets for future funding or other opportunities that could be delivered as part of future developments.
- Improve the north-south accessibility of Carnegie Station by bike to support bicycle park ‘n’ ride through the identification of interventions discussed in this report and previous GECC strategies.

Public transport advocacy

Advocacy, promotion and local planning to support State public transport initiatives may accommodate increased development in Carnegie and ensure strategic success of the Structure Plan. GECC should consider its position in advocating for a recent marked-led proposal for a rapid transit corridor (trackless tram) to be delivered along the Dandenong Road corridor between Caulfield and Monash. This could include advocating for improved integration the northern extent of the activity centre as part of any future project to be delivered, enhancing links with Carnegie Station and the Urban Renewal Precinct.

Other local public realm and street initiatives to improve public transport amenity and access are discussed in Section 7.

6.3 Urban Renewal Precinct

The Urban Renewal Precinct could cater for up to an additional 700 dwellings and in the order or 7,900m^2 of retail/ commercial with up to 8-12 storeys of development by 2036.

The Urban Renewal Precinct is somewhat unique. It has a higher growth potential and may be conducive to lot consolidation prior to development. The access strategy set out below assumes existing boundaries and constraints remain; however alternative solutions with more substantial change could also be pursued as part of a master-planned development, supported by its own Development Plan.

6.3.1 Access strategy

There are a number of key challenges for the Urban Renewal Precinct.

Western Precinct Challenges

Vehicle access to development west of Koornang Road is proposed via the extension of existing internal laneway networks, in addition to direct access from Dandenong Road service road. Under this scenario, the following challenges are identified:

- There are a large number of existing crossovers on the north side of Egan St. For properties fronting Egan St, the only alternate access is via a rear laneway and connections to Koornang Road or back to Egan St. Laneway connectivity via Dandenong Road currently exists, however would not necessarily be maintained in perpetuity. It does not appear to be a public road, rather access is accommodated via 1084 Dandenong Road.
- While recent level crossing removals have greatly improved accessibly under the rail viaduct, the continuous row of private properties still create a major barrier to north-south pedestrian and cycling movements.
- Given Dandenong Road offers a major connection to surrounding activity centres, it is expected that a high volume of vehicles will access/egress under this scenario, leading to an increased number of vehicles on the preferred shared zone outcome for Egan Street.
- The existing laneway connection south of the Rosstown Hotel intersects Koornang Road at a location that is poorly integrated with the Koornang Road/Arawatta St signals.

Eastern Precinct Challenges

On the east of Koornang Road, vehicles will be required to access development sites via Koornang Road, Arawatta Street and Woorayl Street with no new direct access from Dandenong Road. East of Koornang Road the following challenges are identified:

- Traffic access to potential future developments via Arawatta Street may create additional challenges due to existing width constraints and high traffic volumes from commercial land uses.
- Current north-south through-site connections are held in private land and may not be available in perpetuity.

Given the location of Carnegie Central car park, a high volume of traffic currently uses Arawatta Street for access, however it is not expected that an influx in traffic on these streets due to the development will have a major impact on operation.

Recommended Access Strategy

Table 16 provides a recommended access strategy for the Urban Renewal Precinct, which is illustrated in Figure 26.

Table 16 - Access strategy recommendations for the Urban Renewal Precinct

Map Ref.	Access Strategy
1	Support the developments to maintain access arrangements to the north-south service lane connecting to the Dandenong Rd service road, to offer a link between Dandenong Road and Egan Street, relieving the reliance on access from the Egan Street/Koornang Rd intersection.
2	Improvements to the active transport network, particularly the provision of north-south pedestrian crossings on Arawatta Street and Woorayl Street, should be investigated to support encourage mode shift.
3	Maintain a north-south through-site links including a potential shared lane between Dandenong Road and Arawatta Street as part of future development.
4	Support the flexible creation of new through-site connectivity between Dandenong Road, the Djerring Trail, and Rosstown Road via future open space held by Council. This would overcome the barrier to pedestrian and cycling movements between Dandenong Rd, the Djerring Trail and Carnegie that is created by continuous property boundaries on either side.
5	Plan for the gradual restriction of Koornang Road/Laneway RO121 (south of Rosstown Hotel) to be left-in/left-out due to the proximity to the Arawatta St signalised intersection causing potential issues for right turn traffic, as well as mitigating conflicts with pedestrians walking along Koornang Rd.
6	Investigate feasibility of a long-term signalised intersection to Dandenong Road to replace the existing unsignalised turning facilities, as well as investigating interim treatments to support short term safety and amenity of the service road. Traffic signals may require the intersection to be shifted west. The signals would benefit from being aligned with, or connected to, a new internal road or laneway connection in the west, t may require lot consolidation to facilitate.
General	Require any new or widened laneways to provide corner splays at changes of direction, to facilitate access to developments further afield. Appropriate space for two-way flow in shared lanes to allow safe passing for vehicles, and provide suitable space for walking.
	Potential flaring of laneways intersections to accommodate service vehicles, and ensure suitable sight distance to oncoming traffic.

Figure 26 – Urban Renewal Precinct public realm recommendations

6.3.2 Traffic demand assessment

Figure 27 shows the estimated traffic distribution in the Urban Renewal Precinct.

Figure 27 – Additional peak hour trips generated by the Urban Renewal Precinct by 2036

Figure 27 shows that:

- Around 120vph, or approximately two vehicle movements per minute, could be generated onto Egan Street by 2036, assuming ‘sub-precinct 1’ demands are split evenly to the north and south. Depending on the existing traffic volumes (not collected for this assessment due to Covid-19), there is a risk that the post-development traffic volumes on Egan St could undermine amenity of the street. This highlights the importance of enhancing connectivity toward Dandenong Road, allowing more direct access to arterial network and allowing an enhanced outcome for Egan St, which may be supported by signals at Dandenong Rd.
- At the Egan Street/Koornang Road intersection, the increase in traffic demands entering from the north via Dandenong Road may prove a challenge for managing the capacity of uncontrolled right turn movements at the cross-intersection, particularly

given the proximity of the signals to the north. These trips could equally occur via the service road for Dandenong Road. The right turn out of Egan Street, may experience increased delays, and capacity of this intersection would likely rely on gaps created by the existing pedestrian crossing and signals to either side.

- The overall increase of 120vph via Dandenong Road service road access points may lead to increasing delays and difficulty finding a gap to enter/exit, due to high volumes along Dandenong Road. Ultimately, new signals may be required to improve safety by controlling these movements in accommodating the level of development allowed for by the BFF height controls.
- A total of 140vph are shown generated to/from the east side of Koornang Road. These trips are likely to be spread between both Woorayl St and Arawatta St, depending on the extent of lot consolidation in Sub-precinct 3 (noting that existing land parcels have a single frontage). It would be preferable that future development seeks access from the Arawatta St, where traffic movements can be managed at the existing traffic signals. However, there is a need to improve the existing layout, particularly on the north-east and south-east corners, to manage pedestrian and vehicle conflicts (refer to Figure 28).
- Around 60vph to/from the west side of Koornang Road (nominally adjacent the Rosstown Hotel), would present up to 1 vehicle per minute crossing the pedestrian path in an activated retail area. As a result, initiatives to limit traffic to/from this intersection and maintain pedestrian safety/amenity at this location should be considered.

Figure 28 - Poor relationship between buildings and the intersection at Koornang Rd / Arawatta St signals

Recommendations

The recommended network mitigations for the Urban Renewal Precinct are as follows:

- Require new developments to achieve interconnected north-south laneways to allow through-connections to/from Dandenong Rd service road (refer Section 6.3.1 for details). This would maximise traffic distribution opportunity to Dandenong Road to improve network resilience and flexibility of access.
- Encourage development to/from sub-precinct 3 to be focused to/from Arawatta Street. This would avoid uncontrolled movements at the unsignalised cross-intersection at Koornang Road / Egan St / Woorayl St intersection. Council would typically require a minimum 3m x 3m splay.
- Provide increased building setback (i.e. triangular splay to ground floor level) as part of any future development on all corner sites (in accordance with heritage requirements).This would aim improve pedestrian circulation and mitigate pedestrian safety issues cause by a lack of sight distance.
- Investigate feasibility of long-term signals along Dandenong Road as well as interim treatments to support short term safety and amenity. Any signals would ideally be aligned with, or connected to, a new internal road or laneway connection in the Urban Renewal Precinct.
- Monitor traffic demands over time, with a long-term view to banning the right-turns into Egan Street from Koornang Road, to preserve pedestrian amenity and avoid turning vehicles from having a disproportionate impact on through-traffic performance.
- Create a slow road environment along Egan Street to prioritise pedestrians, on-street dining and street greening. This will manage the balance of pedestrian vs. vehicle demands moving between new developments and the Koornang Road precinct.
- Maintain north-south through-site links including a potential shared lane between Dandenong Road and Arawatta Street as part of future development.

6.4 Kokaribb Precinct

The precinct between Kokaribb Road and Koornang Road could be developed up to 8 storeys, catering for up to an additional 225 dwellings and approximately 3,300m^2 of retail/ commercial land uses by 2036. The BFF also highlights the potential for a new open space, north of the existing Woolworths supermarket within the existing Council carpark.

6.4.1 Access strategy

In accommodating the new open space, the Built Form Framework contemplates the closure of east-west vehicle access from Kokaribb Road (north of Woolworths) in order to provide an activated area and an attractive route to/from the Koornang Road shopping strip.

Two staging scenarios (Interim and Ultimate) have been contemplated as part of the access strategy, due to the following challenges:

- The east-west parking access from Kokaribb Road (immediately north of Woolworths) serves as truck access to the leased Woolworths supermarket loading areas (adjacent to the eastern boundary of the supermarket). Access to this existing area for loading operations forms part of the endorsed planning permit, and as such is expected to need to be maintained.
- In addition, this access also provides a connection to the north-south laneway between at the rear of Koornang Road properties, which despite not being on the Council register of public roads, appears to be relied upon for BOH operations (loading/waste collection), and implying there are existing use rights.
- There are properties along Koornang Road, including some with existing crossovers to Koornang Road, that do not have any alternative rear access options. This is important because of the desire to avoid vehicle crossovers, to protect active frontages.

Based on the above, the following Interim and Ultimate staging scenarios have been considered.

Kokaribb precinct access strategy: Interim Scenario

The interim scenario assumes:

- Conversion of the existing Council carpark north of the Woolworths site to an open space.

Existing Woolworths operations (adjacent to the eastern boundary of the supermarket) are maintained.

Table 17 provides a recommended access strategy for the Kokaribb Precinct under an Interim Scenario, as illustrated in Figure 29.

Table 17 - Access strategy recommendations for the Kokaribb Precinct (Interim)

Map Ref.	Access Strategy
1	Retain the east-west access from Kokaribb Road (north of Woolworths) to provide access for trucks and service/ waste collection vehicles only to the Woolworths supermarket loading area and Koornang Road property BOH areas.
2	Retain the laneway between Koornang Road and Koornang Road properties with one-way southbound operation. Ongoing discussions with Woolworths and neighbouring landowners are required to optimise access to the existing Woolworths loading area and BOH areas.
3	Retain existing carpark circulation (south of Woolworths) and share laneways with trucks and service/ waste collection vehicles.

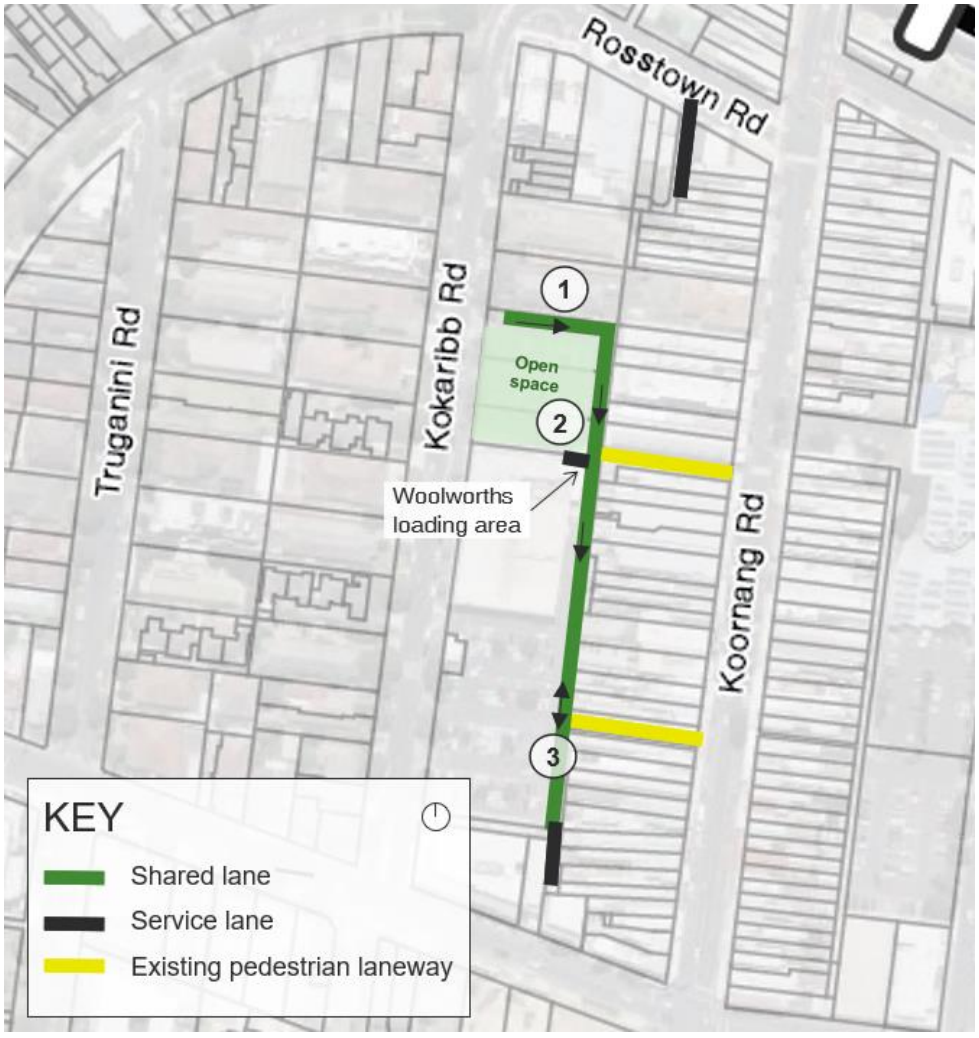


Figure 29 – Kokaribb Precinct public realm recommendations (Interim Scenario)

Kokaribb precinct access strategy: Ultimate Scenario

The ultimate scenario assumes:

- Conversion of the existing Council carpark north of the Woolworths site to an open space.
- Major redevelopment between Kokaribb Road and Koornang Road.

Table 18 provides a recommended access strategy for the Kokaribb Precinct under an Ultimate Scenario, as shown in Figure 30.

Table 18 - Access strategy recommendations for the Kokaribb Precinct (Ultimate)

Map Ref.	Access Strategy
1	Investigate the implications for prospective developers in obtaining planning permits, if no access to Koornang Road or the rear laneways are available.
2	Investigate pedestrian crossing facilities connecting through to the Koornang Road shopping strip for movements across the north-south laneway to/from the open space.
3	Creation of an east-west shared lanes for circulation and access to the new development, limited to primarily vehicle access and small vehicles. This link is nominally shown in the location of the existing connection south of Woolworths.
4	Consider a single access point to development near the existing Woolworths site from Kokaribb Road, for larger vehicles, and/or any major commercial car park entrances.

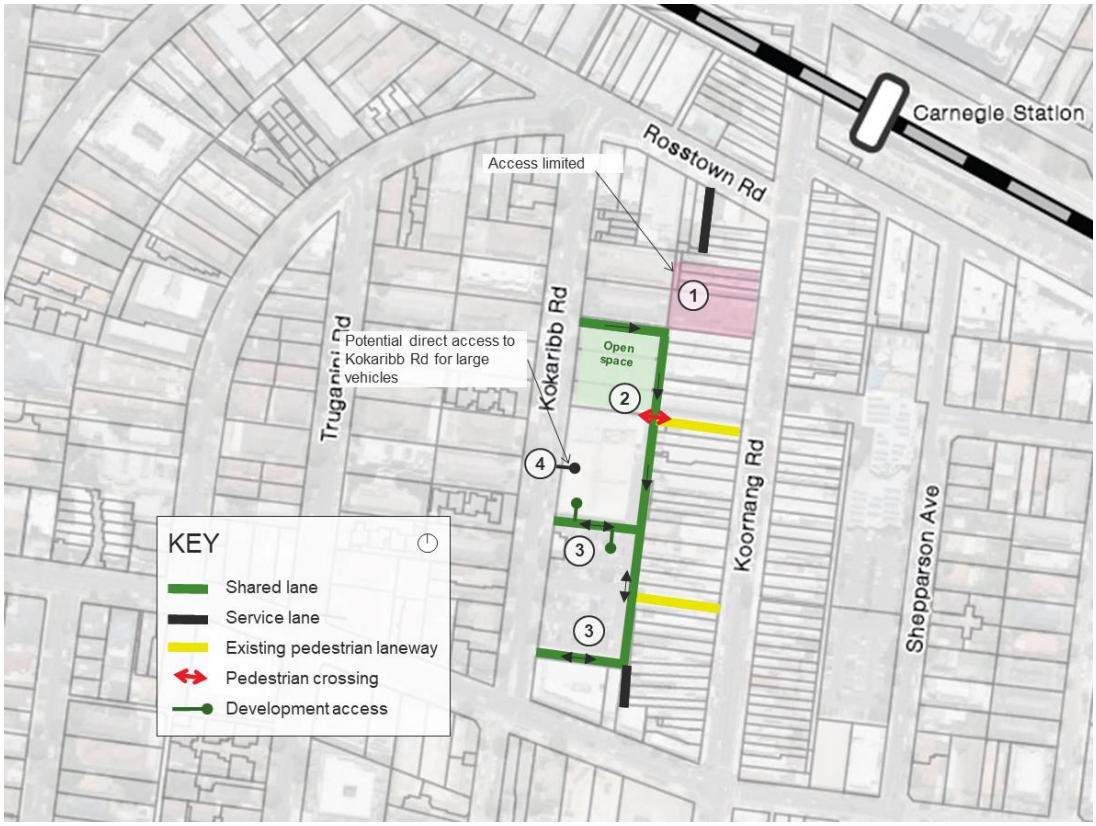


Figure 30 - Kokaribb Precinct public realm recommendations (Ultimate Scenario)

6.4.2 Traffic demand assessment

Figure 31 shows the estimated traffic distribution in the sub-precincts west of Koornang Road, and north of Neerim Road.

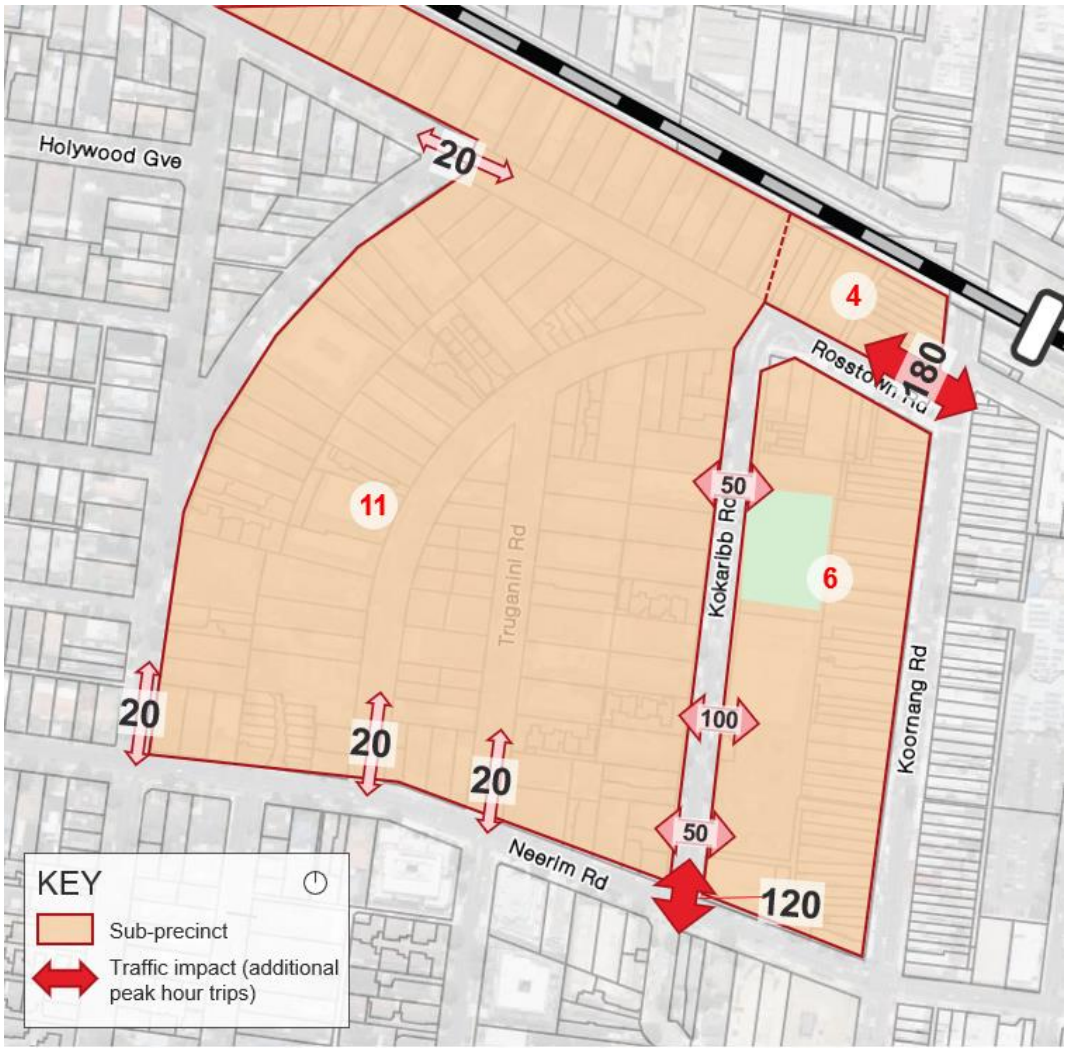


Figure 31 – Additional peak hour trips generated by the Kokaribb Precinct by 2036

Figure 31 shows that:

- Around 200vph are estimated to access sub-precinct 6 to/from Kokaribb Road, split amongst up to three access connections. The existing north-south laneway connections through sub-precinct 6 are either one-way (southbound) or two-way parking aisles. The future traffic demands will likely exceed the capacity of a single lane, a two-way laneway presenting challenges for new development access. The future access strategy seeks to simplify this arrangement by reinforcing a one-way north to south system, to assist resolving traffic capacity issues.
- The increase of around 120vph generated via the Neerim Road / Kokaribb Rd intersection may warrant minor upgrades to the intersection layout to improve safety and operation, such as keep clear line marking, pedestrian thresholds on Kokaribb Rd to reinforce pedestrian priority, or removal of car parking to improve the ability for through-traffic to bypass turning vehicles. The intersection also warrants treatment to incorporate safer cycling movements to address crash statistics information in section

3.6.2. A high-level intersection assessment shows that when assessed in isolation, the intersection has capacity for some 400 vehicles entering/exiting Kokaribb Rd, allowing for approximately 2% growth in through traffic on Neerim Road to 2036. However, capacity is very sensitive to driver gap acceptance criteria, particularly for right-turners exiting from the north approach. Gap conditions are heavily impacted by the relationship with upstream signalised intersections, which create gaps in traffic on Neerim Rd but also may constrain intersection capacity when queued, and these conditions will change over time. Once COVID conditions are stable, more detailed traffic data collection and assessment could be carried out to provide certainty on the extent of spare capacity.

- A small increase in traffic demands is estimated on local residential streets such as Truganini Road, Rosstown Road, Toolambool Rd, and Mimosa Rd. There is also a risk that these roads may experience higher levels of circulating traffic associated with parking vacancy search, or roads such as Toolambool Rd may be used as an alternative to travelling along Neerim Rd-Koornang Rd.
- The peak hour increase of 180vph at the Koornang Rd / Rosstown Rd intersection may marginally reduce intersection performance during peak times; however, is not expected to fundamentally compromise the safety or operation of the network. By way of comparison SCATS detector data, it can be inferred that Rosstown Rd leg carries in the order of 400 to 500vph, in which case the additional development traffic would represent a +35-40% increase. A high-level intersection assessment (isolated SIDRA model) suggests that this intersection is not currently a constraint on broader road system capacity. However, there may be downstream capacity constraints that impact this intersection (i.e. blocking back through the intersection, particularly in the PM peak northbound, as shown by the TomTom data in Section 3.6.1).

Recommendations

The recommended network mitigations for the Kokaribb Precinct are as follows:

- GECC should update the existing parking policy to mitigate traffic in the rear laneways, allowing low-car and no-car development for properties fronting Koornang Rd. This would help to mitigate congestion, maximise safety, and mitigate against poor amenity outcomes associated with excessive traffic in the local area. For further discussion on car parking policy, refer to Section 8.
- Investigate minor upgrades to the intersection layout at Neerim Road/Kokaribb Road. The aim would be to improve the safety and operation of right-turn movements. There is limited scope to provide more capacity without traffic signals, which may provide problematic due to the close intersection spacing to Koornang Rd.
- Develop a Local Area Traffic Management scheme for the residential growth zones to the west of Kokaribb Rd. This would aim to limit the negative perceptions of increased traffic volumes, and enhance the sense of safety and liveability, which might otherwise be impacted by a redistribution of traffic onto local streets due to increased delays at the Neerim Rd/Kokaribb Rd intersection.
- Monitor the performance of the Koornang Rd/Rosstown Road intersection. Depending on the performance of the west approach, the left turn storage could be extended by introducing part-time clearways on the north side of Rosstown Road. The aim would be to prevent lane blockages than could otherwise undermine intersection efficiency.

6.5 Shepparson Precinct

The existing area to the west of Shepparson Avenue and south of Carnegie Library is proposed to accommodate development up to 8 storeys, with the area north of Carnegie Library identified as an area for future community use / open space.

6.5.1 Access strategy

Vehicle access will be provided along the existing north-south laneway between Morton Road and Neerim Road. Currently, this laneway serves a number of uses such as vehicle access to the existing carpark, BOH access to Koornang Road properties for service vehicles and waste collection, access to residential and mixed-use developments north of the library, including pedestrian access between the Koornang Road shopping strip and the carpark. Multiple competing uses have created challenges associated with informal waste collection, service vehicle and carpark circulation, and pedestrian crossovers, which have led to a poor outcome for users.

Table 19 summarises the access strategy for the Shepparson Precinct, as illustrated in Figure 32.

Table 19 - Access strategy recommendations for the Shepparson Precinct

Map Ref.	Access Strategy
1	Upgrade the existing two-way laneway that connects to Morton Avenue as a Shared Lane. Given the narrow cross section (approx. 4.5m), encourage new development to provide localised widening to 5.5m to improve passing ability.
2	Subject to a review of traffic generation at the time of any proposed developments served from this laneway, retain a single width laneway as a Shared Lane north of the existing open space. This would maintain 'filtered permeability' allowing only pedestrians to travel through the bollards and across the library forecourt. The open space that provides a forecourt to the library would be retained, and vehicle access vehicle access discontinuous to the south.
3	Retain a two-way laneway (6m+ carriageway) as a Shared Lane, south of the open space only. Preservation of the full two-way carriageway width appears to rely on the western curtilage of the Carnegie library site.
4	Retain a two-way laneway by widening into the Council car parks. Any widening would be more easily accommodate to the east at the time of development of Councils at grade parking areas.
5	Retain a single width, two-way shared lane, subject to future post-development traffic volumes not exceeding 30vph.
6	Close the existing laneway connection to Neerim Road to vehicles, creating a Pedestrian Lane. This section of laneway appears to sit on private land however it creates a pedestrian safety issues due to the blind corners (no pedestrian visibility splays are provided).
7	Retain two east-west Shared Lanes. These would provide opportunities for activation, allow side-entrances to future development reducing the need for direct crossovers to Shepparson St, and deliver a fine-grained network. These could be rationalised to suit development aspirations, or combined with #8 below if appropriately integrated into a potential future Development Plan.
8	Provide an east-west pedestrian link to be aligned with the current through-site link to Koornang Road.

Figure 32 – Shepparson Precinct public realm recommendations

6.5.2 Traffic demand assessment

Figure 33 shows the estimated traffic distribution in the sub-precincts east of Koornang Road, and north of Neerim Road.

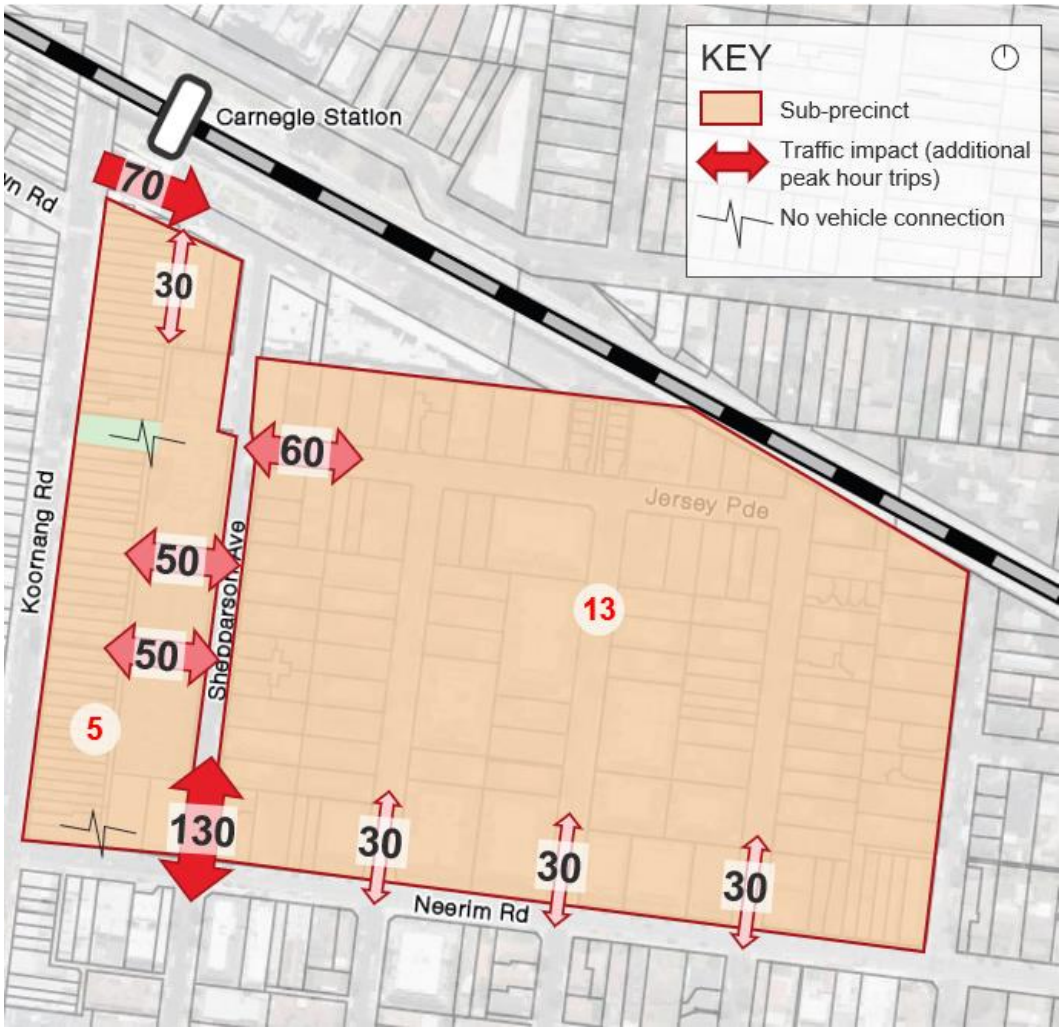


Figure 33 –Additional peak hour trips generated by the Shepparson Precinct by 2036

Figure 33 shows that:

- An increase of around 130vph is generated via the Neerim Road / Shepparson Ave intersection. A further increase in exiting traffic could be expected following the conversion of Morton Avenue to a one-way system in the eastbound direction, with traffic redistributing towards the south end of Shepparson Avenue to exit the precinct. This is likely to warrant upgrades to the intersection layout to improve safety and operation given the proximity to the Koornang Rd/Neerim Rd signals. Some congestion at the Shepparson Avenue intersection may cause vehicles to circulate via other local residential streets to the east, which could be managed through a local area traffic management scheme. Once COVID conditions are stable, more detailed traffic data collection and detailed modelling could be carried out to provide certainty on the extent of spare capacity at this intersection.

- The increase of around 70vph at Koornang Rd/Morton St would be supported by one-way operation eastbound along Morton Street, which is currently being investigated as part of broader plans for Carnegie. Most vehicles are expected to arrive from Dandenong Road as left-turn entries, reducing the potential for capacity issues.
- Around 60vph are expected to utilise Jersey Parade, equating to in the order of 1 vehicle per minute during peak hours.

Recommendations

The recommended network mitigations for the Shepparson Precinct are as follows:

- Similar to the Kokaribb precinct, GECC should update the existing parking policy to mitigate traffic in the rear laneways, allowing low-car and no-car development for properties fronting Koornang Rd. This would help to mitigate congestion, maximise safety, and mitigate against poor amenity outcomes associated with excessive traffic in the local area. For further discussion on car parking policy, refer to Section 8.
- The design of any one-way system on Morton Avenue-Shepparson Avenue would be suitable to operate eastbound and southbound and with extents limited to the section north of Jersey Parade. A contraflow bike lane on Shepparson Avenue should be included between Jersey Parade and Morton Avenue (and provide a connection to the Djerring Trail).
- Investigate improved cycling connections on Shepparson Ave between Neerim Road through to the Djerring Trail.
- Investigate minor upgrades to the intersection layout at Neerim Road/Shepparson Avenue. The aim would be to improve the safety and operation of right-turn movements, however there is limited scope to provide more capacity without traffic signals, which may provide problematic due to the close intersection spacing to Koornang Rd.
- Investigate Local Area Traffic Management scheme for Jersey Parade and surrounding streets. This would aim to limit the negative perceptions of increased traffic volumes, and enhance the sense of safety and liveability, which might otherwise be impacted by a redistribution of traffic onto local streets due to increased delays at the Neerim Rd/Shepparson Avenue intersection.

6.6 South of Neerim Road

The precinct south of Neerim Road will predominately be residential apartments and townhouses with elements of commercial and retail near the intersection of Neerim Road and Koornang Road. The scale of development at this southern extent of the CAC is much reduced in comparison with the remainder of the precinct at a maximum of 5-6 storeys.

6.6.1 Access strategy

The access strategy seeks to utilise the existing street network to distribute the residential demand. Localised access for the retail and commercial zones is assumed to gain access from Neerim Road, which is appropriate considering the relatively minor increase in side-road traffic.

6.6.2 Traffic demand assessment

Figure 33 shows the estimated traffic distribution in the sub-precincts east of Koornang Road, and north of Neerim Road. Traffic volumes are generally very minor and would not be expected to impact the operation of the existing road network. It is noted that sub-precinct 7 has an approved permit application, and traffic generation will vary from the information shown.

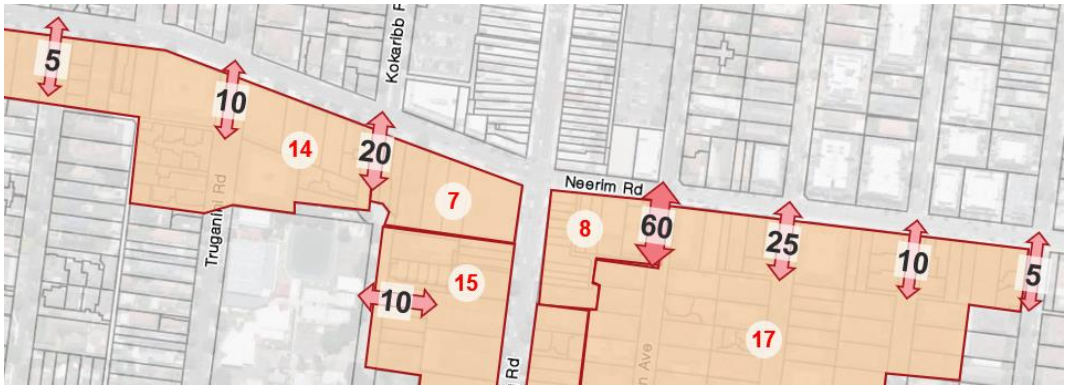


Figure 34 –Additional peak hour trips generated from the south of Neerim Road by 2036

6.7 Access strategy & traffic mitigation summary

The approach to this transport study has been to develop strategic access principles (Section 6.1), and subsequently apply them to each precinct. A traffic assessment has then identified a suite of mitigations to support the growth and development of the activity centre.

The traffic assessment has adopted a 'business-as-usual' scenario. While various road network constraints are noted in terms of accommodating an this more conservative (on the high side) estimate of traffic impact, it is unlikely that lower car use assumptions would fully eliminate the need for mitigation. The recommended mitigations are summarised below in Figure 35.

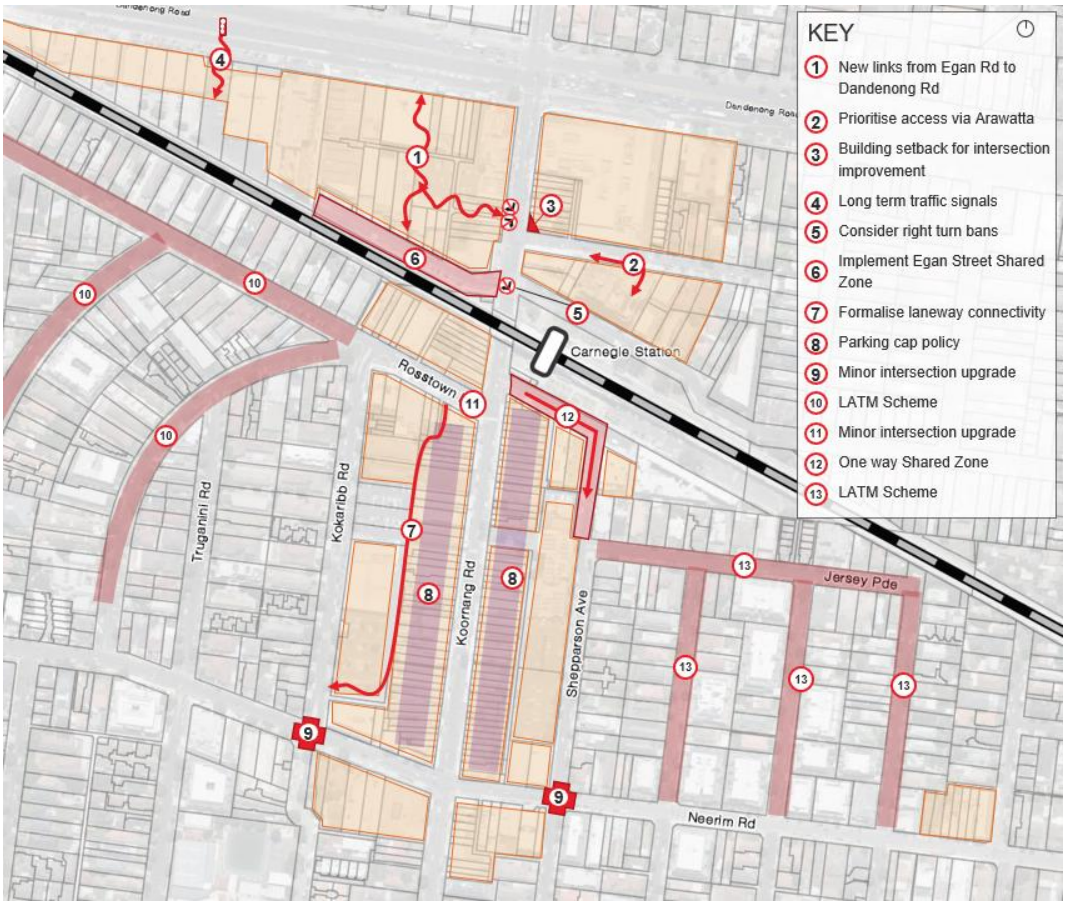


Figure 35 – Network Mitigation Summary

Conclusion

Carnegie can accommodate the 15-year growth forecast through a combination of road network mitigation initiatives and travel demand management (including initiatives such as reduced parking provision in residential development). Mitigation does not necessarily mean providing additional road capacity. In some instances, ensuring safety, regulating speeds and controlling movements will provide a suitable outcome during peak periods. Like most urban centres, congestion itself may result in some peak spreading as the transport network 'self-regulates'. Some displacement of non-local trips will occur, and travel patterns will adapt more broadly. A focus on active transport, public transport measures will support the above.

6.8 Use of laneways

A key issue for the Carnegie Structure Plan is the ability of existing laneways to support new development, while also contributing to liveability and a walkability of the street network. There is a clear priority for active frontages and maintaining a high amenity pedestrian environment along Koornang Road, thereby necessitating rear-lot access. Most existing laneways are narrow and may constrain servicing and development options, with some not providing an appropriate level interconnectedness with the broader network.

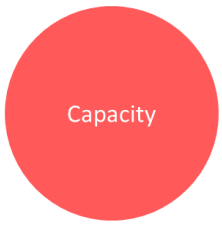
The future network of laneways and required widths may change depending on any lot-consolidation, and as such will remain uncertain until the subsequent stages of planning and development. This presents challenges for providing definitive recommendations for change, as these are dependent on staging of delivery and potentially obtaining additional land.

Notwithstanding, the challenge for the Structure Plan and associated planning scheme amendment to provide a balance of clarity and flexibility in accommodating future development aspirations. The cost of doing nothing is that poor long-term planning for laneways risks compromising outcomes for land use yield, operational efficiency, serviceability, amenity and safety. The assessments presented in Section 6 demonstrate that many even with a fine-grained network, the existing narrow laneways will be insufficient to accommodate the longer-term forecast traffic demands, without intervention. GECC will need to determine the appropriate extent of regulation. While not within the core scope of this study, it is understood that options could include investigate the following options:

- developing requirements as part of a Design and Development Overlay (i.e. including mandatory ground floor setbacks),
- a Public Acquisition Overlay,
- allowing for increased laneway width within existing Council-owned land,
- preparing a Development Contributions Plan, or
- voluntary agreements.

6.8.1 Planning principles for urban laneways

The appropriateness of using existing laneways to support increased development in Carnegie should be guided by the principles of operational **capacity**, **amenity & serviceability**, and **safety**. These principles and the desired attributes of urban laneways associates with each are discussed below, for the purpose of providing context to what best-practice might look like for the implementation of the Structure Plan.



- Carrying capacity should be viewed in the context of the adjoining land uses. Note the 'operational capacity' (i.e. the capacity traffic systems) can differ from 'environmental capacity' (i.e. amenity based capacity).
- Operational capacity is a function of laneway design, including:
  - Ability for vehicles to pass one another
  - Ability for pedestrians able to pass vehicles
  - Ability for pedestrians to pass each other, or pass in groups.
  - Boundary conditions i.e. intersecting roads / adjoining site access points.
- Capacity should also be viewed in the context of what happens in a 'failure' state. For example, if vehicles meet in a narrow laneway – can vehicle still negotiate around one another, for example could the exiting from a property yield by partially retreating into a site?

- Provides space to dwell (adjacent activated frontages).
- Quality pavement surfaces.
- Positive visual aesthetic.
- Limited exposure to bad odour.
- Lighting conditions.
- Some traffic capacity thresholds are based on environmental amenity based (noise, aesthetic, perceived safety etc.)
- Suitably sized for service vehicle needs (i.e. waste vehicle, delivery vehicles?)

- Good active or passive surveillances (relationship with building frontages).
- Good visibility at entrances/exits, to facilitation negotiated priority.
- Driver speeds become self-managed as a result of the laneway environmental.
- Safe separation of pedestrians from loading and waste collection activities.
- Permeable network to limit entrapment risk.
- Priority can either be 'negotiated' between road users in a low speed environment, or allocated by traffic control systems.
- Mitigation devices such as convex mirrors, hazard signage, flashing beacons should only be used in a retrofit situation where there are fixed constraints.

It is important to recognise that a given laneway may not meet all criteria, and trade-offs may be required depending on the specific context.

6.8.2 The need for traffic capacity mitigation

There are no hard and fast traffic volume capacity thresholds that, when viewed in isolation, would mandate widening or other mitigating interventions to accommodate development. Notwithstanding the above, some industry guidance are discussed below which have been used to support the recommended widening of laneways documented in subsequent sections of this report:

Victoria Planning Provisions

In seeking guidance on capacity thresholds, common traffic engineering practice in Victoria is makes reference Clause 56 of the VPP – Access and Mobility Management.

In interpreting this guidance, the intended use case of the policy should be acknowledged; Clause 56 is targeted toward planning applications for low density residential subdivision. It was not intended to be used as prescriptive guidance to be retrospectively applied to laneways within urbanised, mixed use Activity Centres.

Clause 56 represents a notion of contemporary urban planning that has prevailed since the mid-1900s and adopts streets in a 'tree-like' rather than a 'grid-like' pattern observed in earlier colonial settlements of inner Melbourne. As such, there is an implied objective of preserving notions of 'amenity' that relate to low density neighbourhoods. A tree-like form had been stated as desirable for enhancing pedestrian safety near the home, by reducing through-traffic and perceived or real threats to environment or liveability.

On the above basis, the Planning Scheme capacity guidance is provided as follows:

- **Access Lane**: 5.5m wide shared zone and no dedicated footpaths = 300 vehicles per day (vpd).
- **Access Place**: 5.5m wide shared zone plus a dedicated footpath if serving more than 5 dwellings = 300 to 1,000vpd.

A typical rule of thumb is that 10% of daily trips are made during the peak hour. On that basis, the peak hour capacity of an access lane or access place could vary from 30-100vph as an amenity-based threshold.

Australian Standards

The Australian Standards for Off-Street Car Parking provides guidance on the triggers for the provision of a passing area, for instances where an access driveway or connecting circulation roadway is not wide enough for simultaneous two-way flow. It states that:

> *"As a guide, 30 or more movements in a peak hour (in and out combined) would usually require provision for two vehicles to pass on the driveway, i.e. a minimum width of 5.5m. On long driveways, passing opportunities should be provided at least every 30m."*

Clearly, the Australian Standards guidance is particularly relevant for two-way laneways. These guiding principles used in determining the 30vph threshold would not apply to a laneway with one-way operation.

Could parking supply be capped to match the available traffic capacity of laneways?

In theory, the overall change in car parking supply could be limited in such a way that the capacity of the road network is not exceeded. Some key considerations that complicate this concept include the following:

- There are viable alternatives: Some degree of capacity improvement at the local level (i.e. laneways) is feasible, whether led by Council through planning controls or by the development sector. It follows from the above, that a parking minimisation strategy is a choice. While it may be a valid choice, it nevertheless means that it must be a 'policy led' consideration, rather than being dictated by analysis of the existing conditions.
- Other external factors may 'self-regulate' a system that is at capacity. For example, car trips could be spread to the shoulder periods. Similarly, while there is limited evidence, there is industry recognition that car parking supply does not necessarily correlate proportionately with car use during peak hours in urban activity centres, particularly for residential developments.
- A parking minimisation strategy may require a decision on which land uses require more car parking than others. Carnegie lends itself to lower parking rates for residential uses, due to greater accessibility to jobs in the CBD and South East via public transport, as well as access to local services and hospitality in walking distance. Anecdotally, retail visitors to the centre may be less flexible for substituting car trips with other modes. To the contrary, retail/commercial visitor parking which is not allocated and would be particularly difficult to regulate in a narrow laneway environment, with no redundancy for managing circulating traffic when parking becomes full. This could undermine the original intent.

Based on the above, while there are general benefits in reducing car parking requirements to support laneway functionality (further discussion in Section 8), a prescriptive 'parking cap' or forcing rates below reasonable levels of market demand will be difficult to accurately predict and particularly without additional detail on the nature of the proposed development. A parking cap would need to be a policy-led decision, rather than being justified as the only response required to manage traffic issues within the laneway network.

6.8.3 Laneway typologies

The laneways of Carnegie have been classified as a shared lane, a service lane, or a pedestrian lane for the purpose of the Structure Plan. These typologies are based on user-needs and can be generally mapped against their level of prioritisation of traffic movement and pedestrian space, as shown in Figure 36. Examples are provided of a potential cross-sectional profile; however, these are not exhaustive or prescriptive. Site specific factors including the nature of abutting development and development staging will influence deliverability. Table 20 also provides the recommended user provisions and governance for each laneway typology.

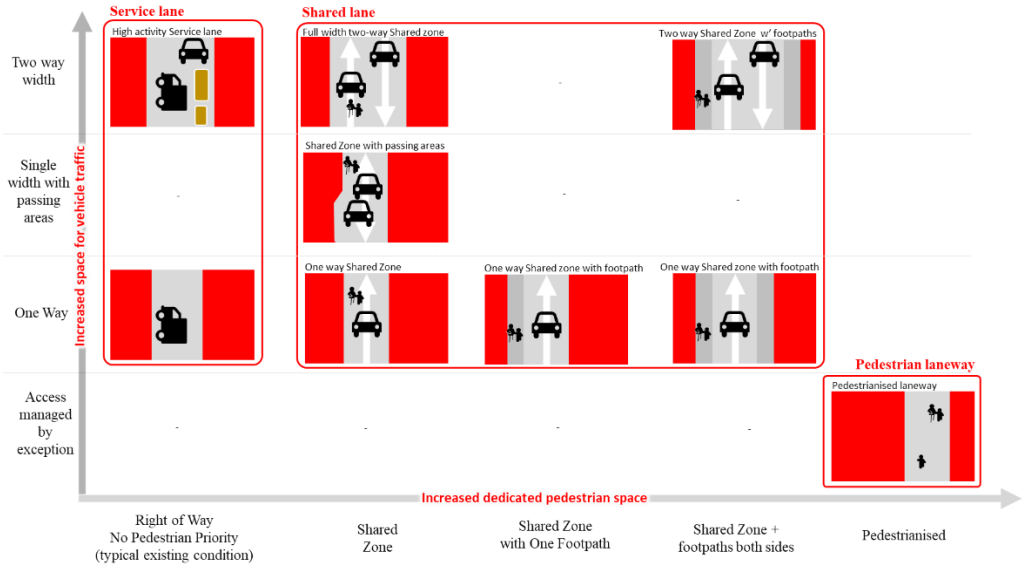


Figure 36 – Laneway typologies mapped against user needs

Table 20 – Proposed laneway typologies and description

Typology	Recommended user provisions	Recommended governance
Service laneway	Consistent width, carriageway with low-speed and low volume environment. May have direct access to back of house operational areas. Limited access via secondary pedestrian entrances to buildings. Limited through-movement functions. May be used as a primary access to/from smaller car parking areas.	Public or private
Shared laneway	Signposted as a shared zone unless provided with a separate footpath. Direct access to pedestrian entrances	Must be publicly accessible. Either private or public ownership. May include land with statutory controls to ensure access (i.e. access easement or similar)
Pedestrian laneway	High pedestrian traffic areas connecting activity nodes. Terminal treatments to prevent or manage vehicle access to authorised vehicles only. May include through-site links through common areas, subject to controls on hours of availability.	Must be publicly accessible. Either private or public ownership. May include land with statutory controls to ensure access (i.e. access easement or similar)

Potential strategies/objectives and recommended interventions for each laneway classification are provided as follows. It is noted that specific location-based interventions are also included in Section 6 as part of the access strategy for each sub-precinct.

Service Laneway

Strategies & Objectives

- Require new development or change of use to internalise informal waste/logistics storage functions internally within buildings, rather than being accomodated directly onto the laneway.
- Waste and logistics management plans should be provided for new developments.
- Minimise reversing manouvres onto laneways, and ensure adeqaute sight distances are achieved.

Interventions

- Work with the community to manage any informal usage of public roads for storage.

Shared Laneway

Strategies & Objectives

- Enable activatation onto laneways with land use that have a visitation element, such as café or retail space.
- Require major developments to facilitate on-site loading and waste collection.
- For smaller developments that may seek servicing directly from a laneway, these activities should be regulated such that waste collection and loading/deliveries occurs outside of peak hours.
- Enhance existing laneways to improve traffic capacity, serviceability, safety and amenity to support new development.

Interventions

- At the time of redevelopment, implement statutory planning controls to transition to wider laneways, provide interconnection to existing laneways and/ or increase individual setbacks onto the lane to allow for wider areas for cars to circulate.
- Install 10kph shared zone signage.
- Implement high quality paving treatments to enhance visual amenity.
- Provide lighting and encourage designs that deliver passive surveillance to pedestrian laneways.

Pedestrian Laneway

Strategies & Objectives

- Investigate the provision of additional pedestrian laneway connections via new developments.
- Consider introducing a policy that encourages development to provide through-site links.

Interventions

- Utilise removable bollards to manage any infrequent vehicular access requirements.
- Provide lighting encourage designs that deliver passive surveillance to pedestrian laneways.

Further to the above, the application of the laneway typologies and to the new or modified laneways proposed is shown in Figure 37. While there may be changes to these example cross sections as part of subsequent stages of planning and design, the basic rationale behind the adopted cross sections is as follows:

- The north-south laneway though the Shepparson precinct is designated as a shared zone. This would provide a more seamless integration between the laneway network

and the proposed shared zone on Morton Avenue, as a desire line between station and precinct. It also offers a more efficient layout due to the constraints including land availability and geometric constraints of manoeuvring to/from site entrances, if kerbs were to be provided.

- Similar to the above, the north-south laneway west in the Kokaribb precinct is designated as a shared zone.
- East-west laneways in the core precinct are proposed to have a footpath on at least one side, as this may provide a useful curtilage around buildings at side-loaded vehicle and pedestrian entry points, and may also offer an improved pedestrian environment should there be activated ground floor uses etc.
- Shared lanes should be deployed north-south (formally designated as a Shared Zone at the appropriate time).

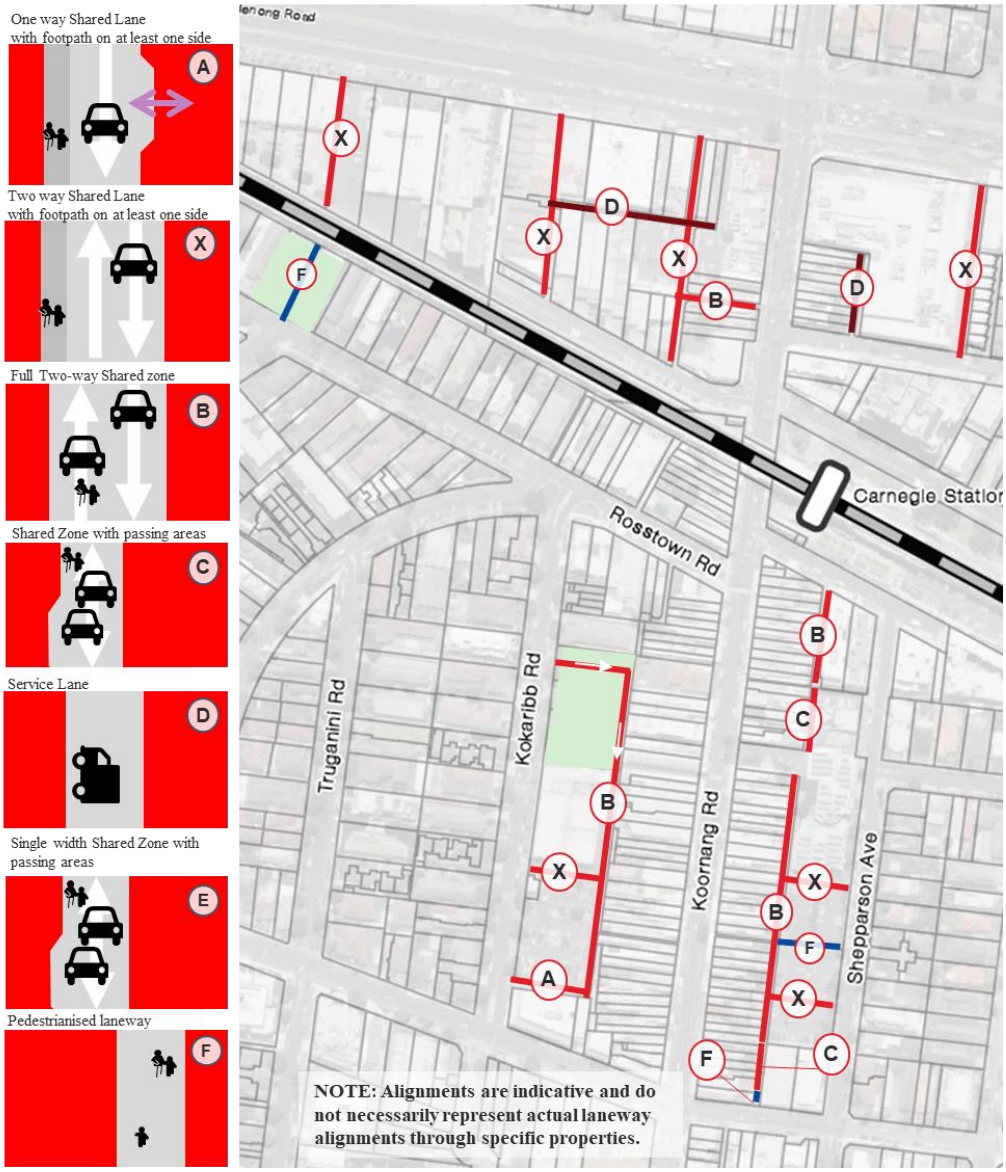


Figure 37 – Application of Laneway Typologies to New or Modified Laneways

7 Movement and Place assessment

7.1 Movement & Place vision for Carnegie streets

While Section 6 provided recommendations in response to the transport demands allowed under the BFF, the streets of Carnegie serve numerous functions beyond providing a space for the movement of people and goods. They create places through which we visit, stay, work and live.

An assessment using the Movement and Place framework has been applied to key streets within Carnegie. This aims to recognise the complementary role that existing streets will play in realising the aspiration of the Built Form Framework, recognising the competing demands for road space and the trade-offs that are ultimately required in managing changing urban environments. The following assessment explores ideas and opportunities that could assist in managing this change, to align the long-term plan for streets of Carnegie with the relevant state and local government policy objectives.

As outlined in Section 2.1, the M&P Framework is the DoT recognised approach to planning and designing roads streets. Principles of the framework have been applied to maximise consistency with State Government policy, and to help define a vision for unique 'street types' in Carnegie. Under the vision for each street, a set of strategies/objectives and potential interventions have been developed, seeking to balance an increasing transport demand on each link while supporting adjacent development and place-based aspirations of the BFF.

For the purpose of this assessment, the core principles of the framework have been applied, with a primary focus on Urban Road and Street Design Guide initiatives. Initially, the existing and aspirational classification of each of the streets has been agreed with GECC using the Movement (M1 to M5) and Place (P1 to P5) classifications outlined in Figure 38.

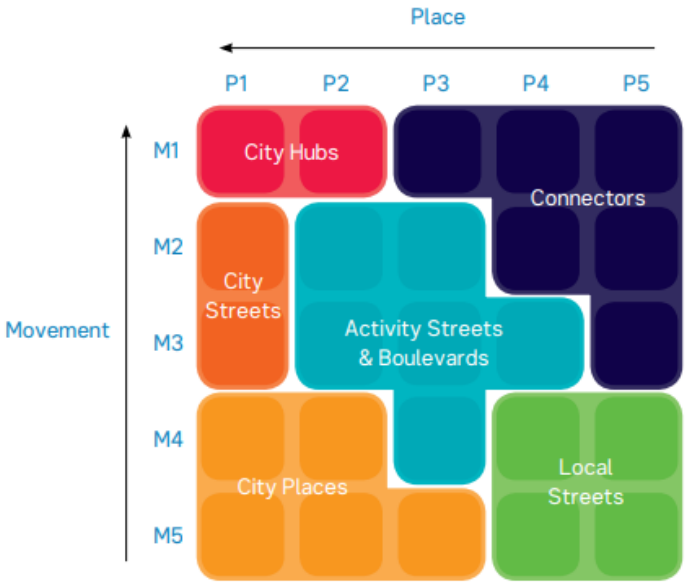


Figure 38 – Movement and Place Street Families

It should be noted that the M&P classifications within Carnegie are currently under review with the DoT and will be subject to regular updates. Based on the M and P classifications, the 'Street Types' are shown in Figure 39 and are described in detail in Figure 40.

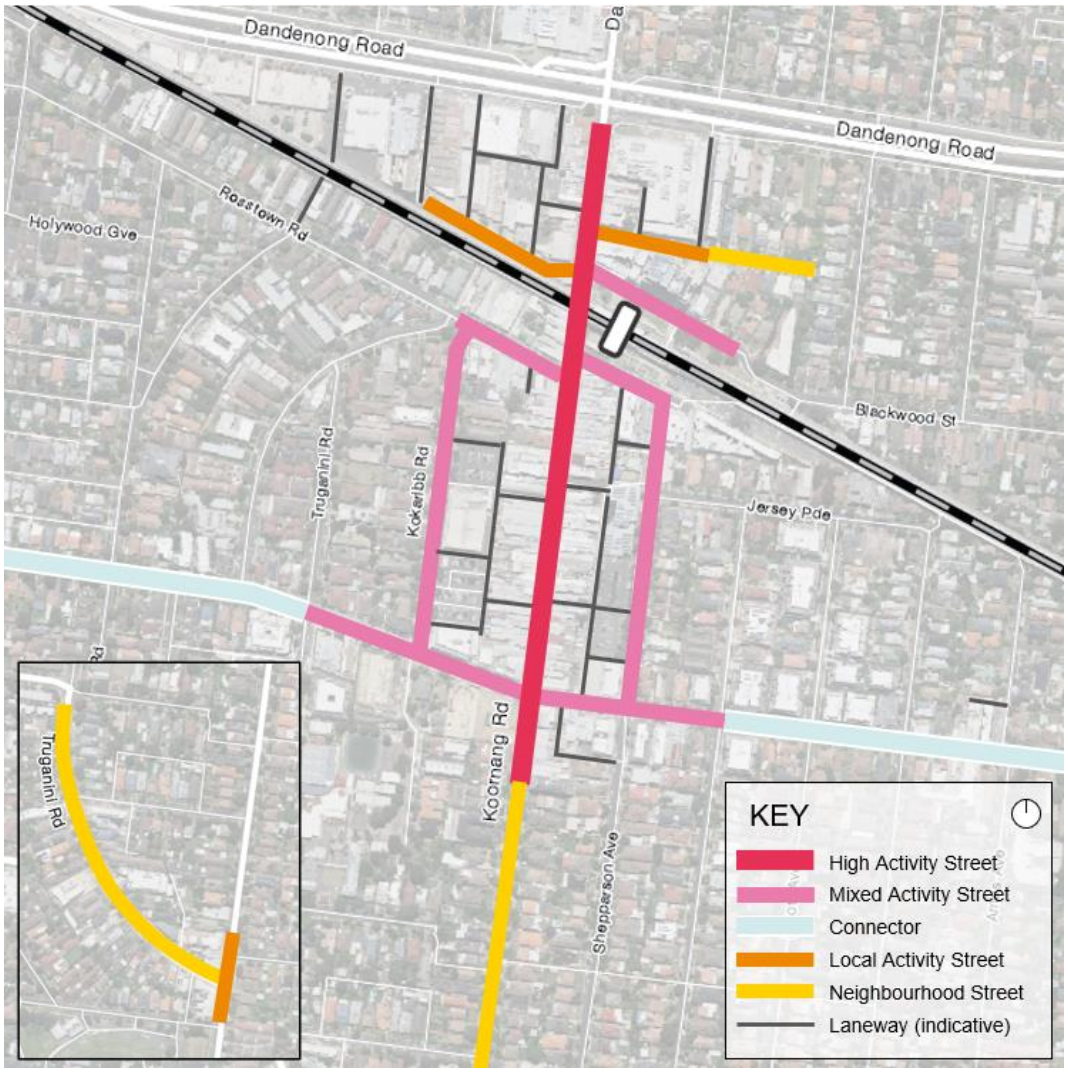


Figure 39 – Movement & Place Vision: Carnegie Street Types

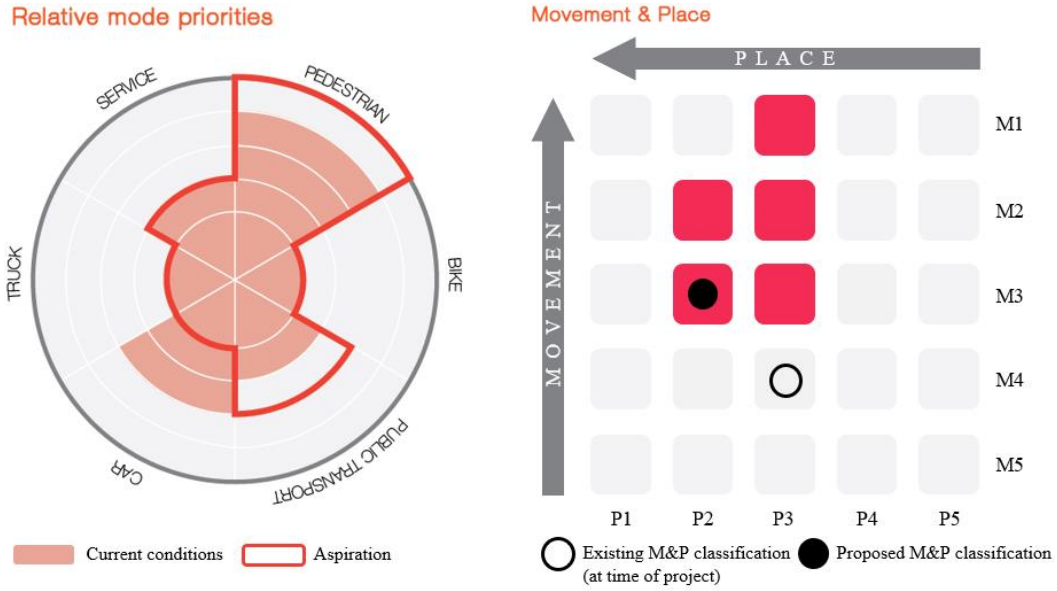
Figure 40 - Movement and Place Street Classifications for Carnegie

Using the Street Types above, each street has been reviewed against the M&P 'target' aspiration for each transport mode, to identify any gaps. The gaps analysis has informed a set of strategies and potential interventions that could complement the aspirations of the BFF.

The potential interventions listed below will require further review and investigation prior to implementation. They may also evolve over to time, to suit the changing needs of the activity centre.

7.2 Koornang Road

Koornang Road currently serves a major role as the main thoroughfare of the CAC and shopping strip, while providing a link between Dandenong Road and North Road and local access to residential land uses south of Neerim Road. The vision for Koornang Road, as it traverses the study area within the CAC, is to increase pedestrian priority and capitalise on the existing public transport provisions by improving amenity. The movement classification for general traffic (cars) is currently low (GT4), and while some service vehicles use existing loading zones on Koornang Road, they can also access properties via laneways accessed from a circulation network to the east and west.



Strategies & Objectives

- Pedestrian experience along and across is the priority.
- Provides safe, convenient and pronounced pedestrian crossings and links to laneways.
- Active frontages are supported by high foot traffic, with places to sit, stay and enjoy Carnegie.
- No new vehicle crossovers are introduced and the significance of existing crossovers are limited or made redundant and shifted to rear laneways.

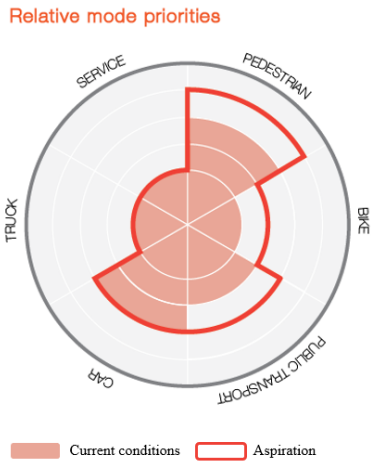
Interventions

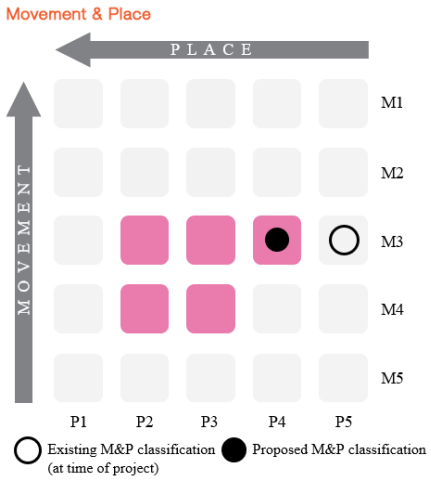
- Advocate for reduced speeds, improved pedestrian crossings at side streets with raised thresholds, intersection upgrades, particularly at Neerim Road and Dandenong Road, and additional street trees to increase pedestrian amenity.
- Car parking should be managed and provided so it does not adversely impact active frontages, encourages high-turnover and consolidated to consider the installation of parklets for dining/ greening.
- Remove buffer between on-street parking and traffic lanes and introduce a painted median that encourages slower speeds and a higher sense of pedestrian priority.
- Investigate feasibility of protected or buffered bicycle lanes south of Neerim Road.
- Improve bus stop amenity with lighting, wayfinding and embayments for buses.

7.3 Neerim Road

Neerim Road currently serves a strategic role as a moderately important movement conduit east-west through the municipality. It serves the role of a 'Connector' more broadly, yet there is no change in the streetscape as it becomes more of an Activity Street within the CAC where place value becomes more significant.

There is a performance gap for Neerim Road reaching its aspiration as an Activity Street. Particular performance issues include its poor safety record and a lack of cycling facilities. There are limited measures to ensure safety of pedestrians and cyclists within the corridor, particularly around Koornang Road, to address these issues appropriately. Measures are recommended that assist in safely balancing demands for pedestrians and cyclists within the available road space, while facilitating access to shops and services for all modes to elevate the place function of the street to align with desired performance.





Strategies & Objectives

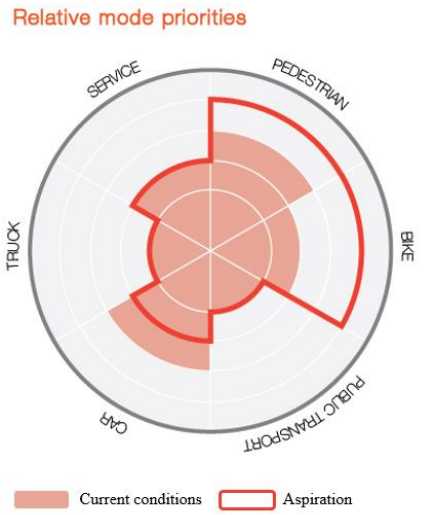
- Facilitate a safe and coherant east-west cycling route between Shepparson Avenue and Koornang Road.
- Provide a safe entry point to the Koornang Road shopping strip.
- Provide vehicular access to future development without reliance on Koornang Road.

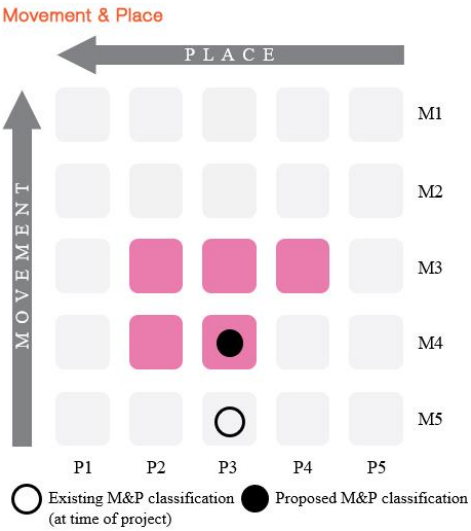
Interventions

- Investigate reallocation of road space on Neerim Road (at a minimum between Koornang Road and Shepparson Avenue) to introduce widened buffered or protected cycle lanes.
- Improve pedestrian crossings at side streets by providing threshold treatments or refuge islands to narrow crossing distances.
- Introduce signalling improvements to protect pedestrian/cyclist movements during crossing phases at the Neerim Road/ Koornang Road intersection to increase safety.
- As a short term solution, consider installing bicycle lanterns to allow cyclists to legally use the existing pedestrian crossings, given the high-stress on-road cycling environment.
- Monitor intersection performance and safety at Shepparson Avenue and Kokarrib Road over time, and consider intersection upgrades or right-turn bans in/out if required.

7.4 Shepparson Avenue

In its current condition, Shepparson Road currently facilitates access for vehicles from Neerim Road to the car park between Shepparson Avenue and the Koornang Road shopping strip. As such, the road is well serviced for vehicles but lacks aspects of place to meet its ambition as a key walking and cycling link for accessing Carnegie Station, supporting cycling connections through to the Djerring Trail.





Strategies & Objectives

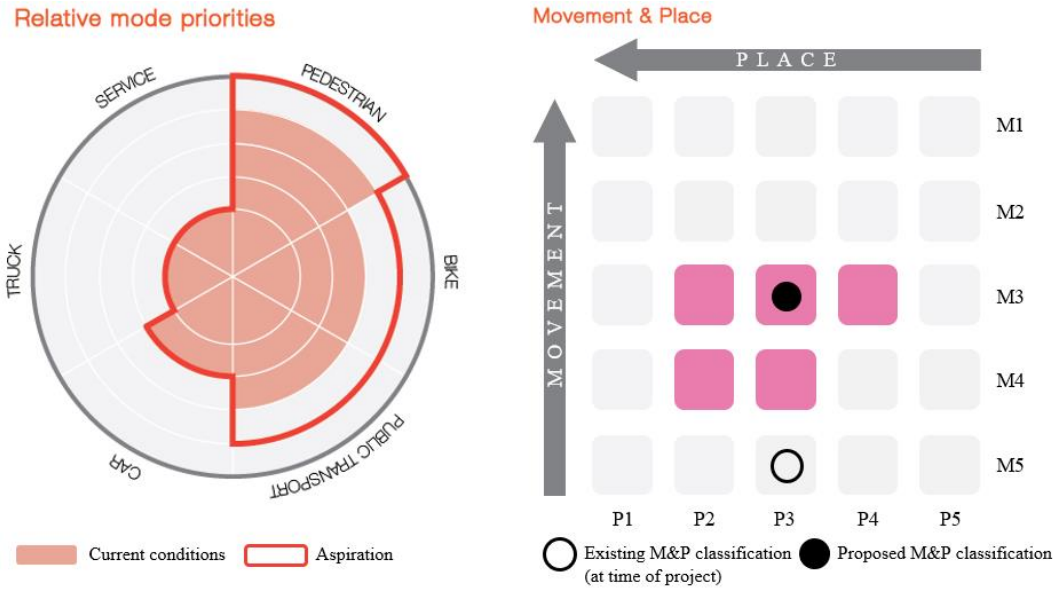
- Provide a north-south cycling link between Carnegie Station/the Djerring Trail and the broader network.
- Support future development by enhancing walking and connections to the Koornang Road shopping strip.
- Provide a streetscape that feels part of the activity centre and provides secondary circulation both across and along its length to bridge the residential interfaces to the east.

Interventions

- Investigate the consolidation of on-street parking, widening of footpaths and separated cycle lanes on the western side of the street to support urban design and multi-modal initiatives, while aligning to the desire line to/from Carnegie Station.
- Investigate crossing facilities to improve the link between on-street bike lanes on Neerim Road and Shepparson Avenue.

7.5 Truganini Road (south of Glen Huntly Road)

Truganini Road, south of Glen Huntly Road, currently has a key focus on public transport, accomodating the 67 tram terminus. Amenity for walking and cycling is relatively poor in this location compared to other streets with similar relative mode priorities, due to narrow footpaths and the absence of bike lanes, despite being a strategic east-west connection. The vision for Truganini Road is to improve connections to the 67 tram terminus while also increasing access to future public realm changes at the Truganini Road/ Koornang Road intersection.



Strategies & Objectives

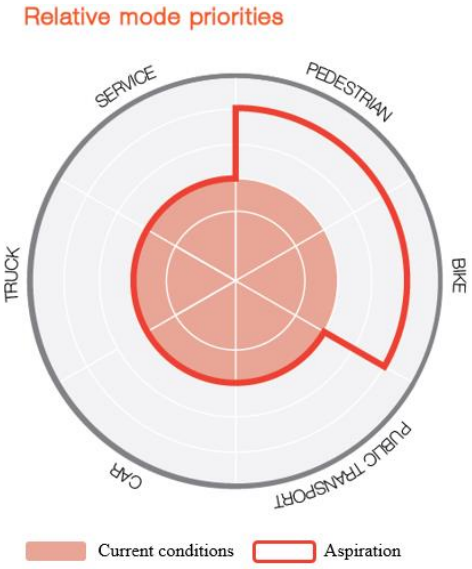
- Provides high quality connections for public transport users to the tram terminus to enhance regional travel.
- Accessibility to the local centre from surrounding residential areas is increased by bike and foot to support increased development.

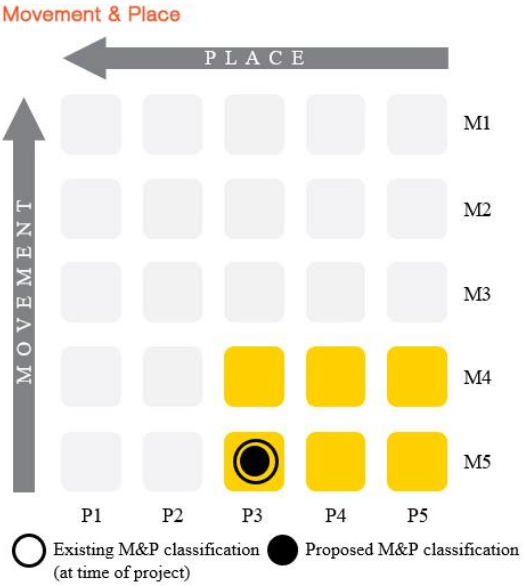
Interventions

- Extend kerbs and widen footpaths on both sides of the street and widen existing on-street bike lanes and continue along the entire street.
- Investigate formalising pedestrian access from the northern side of the tram platform to improve safety, or restrict access at this end.
- Provide amenity improvements to the tram terminus by increasing sheltered space, introducing lighting, providing more seating and improved wayfinding.
- Introduce lighting along the length of the street to improve the walking and cycling environment.

7.6 Egan Street

Egan Street is a no-through-road and provides a low movement function in comparison to the surrounding network, yet has potential to build upon existing active land uses and connections to public use areas underneath the Cranbourne/ Pakenham Line viaduct. The proposed 'Neighbourhood Street' aligns with the street's movement and place classification, and proposals to convert the street to provide a slow road environment could enhance performance, particularly for people walking and cycling.





Strategies & Objectives

- High activity frontages that encourage people to stay and reclaim the street.
- Provides vibrant connections between the Urban Renewal precinct and Carnegie Station, acting as a gateway to the CAC.
- Additional vehicle crossovers to/from the Urban Renewal Precinct are avoided and presence is minimised.

Interventions

- Implement regulated shared zone signage and reduce speeds to 10kph.
- De-clutter the street by introducing flush kerbs and reduced linemarking.
- Introduce a contrasted paving treatment and lighting technique to the surrounding road network to show visual cues of changing priority.
- Introduce a transition zone treatment at the Koornang Road entrance such as a narrowed entry/exit and traffic calming measures.
- Use street furniture to encourage people to dwell.
- Introduce bike parking in close proximity to active frontages and public use area.

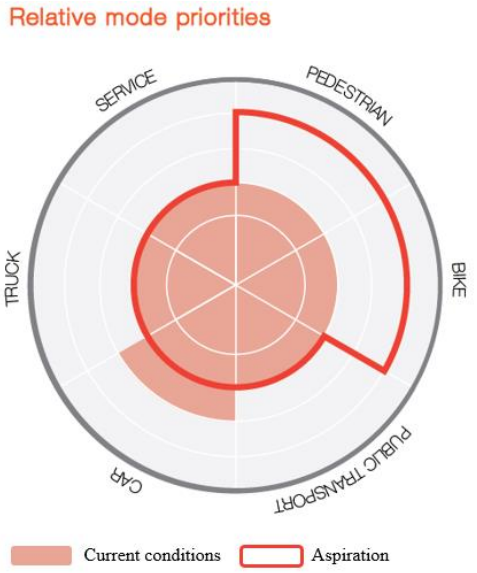
A streetscape reconfiguration has been considered along Egan Street, with opportunities to create a slow road environment and prioritise pedestrians, on street dining and street greening.

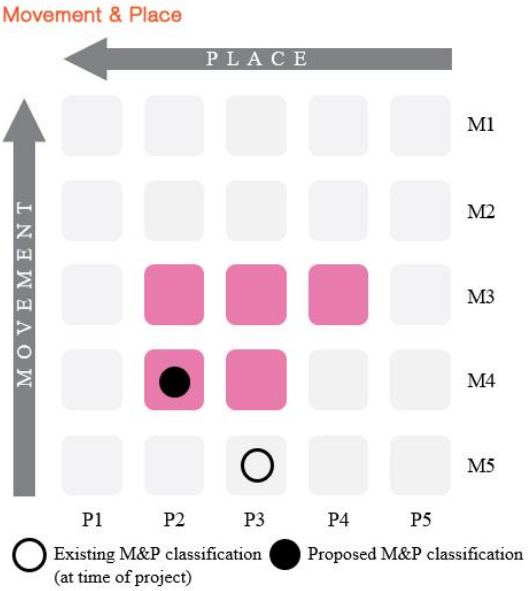
Future development of the Urban Renewal Precinct has the potential to increase vehicle and active transport demands both along and across Egan Street, on desire lines connecting between the development precinct, the Djerring Trail, and the Koornang Road shopping strip.

With the potential for the precinct to transition away from its current industrial/ commercial feel, there is an opportunity to provide a more generous pedestrian zone along the north side of Egan Street. An increase from the current narrow footpath, made possible by the intermittent removal of some on-street parking to support on-street activity such as al-fresco seating. A new road surface could be considered to make the look and feel of the carriageway significantly different to surrounding roads, with kerb outstands to introduce subtle variations in the road alignment. A pedestrian priority street might alleviate the visual dominance of the adjacent rail overpass, and provide a stronger visual connection between developments on the north and the community uses and shared spaces underneath the viaduct.

7.7 Morton Avenue

Morton Avenue serves a similar role to Egan Street in connecting commuters to Carnegie Station, while in addition, providing short-term pick-up/drop-off parking, service vehicle access to the BOH areas of Koornang Road properties and shop fronts on the street's southern side. Morton Avenue also acts as a secondary circulation route from Koornang Road to Shepparson Avenue, allowing access to at-grade carparking opportunities and wider access to Neerim Road. Alike Egan Street, Morton Avenue is proposed for potential conversion to a shared zone, increasing the place significance of the street at a gateway to the CAC for visitors from Carnegie Station to activity centre destinations, while improving cyclist connections from/to the Djerring Trail SCC. Under shared zone operation, the street is also proposed to operate under a one-way eastbound (discussed further in Section 7.7.1), balancing the demands for vehicles from Koornang Road through to Shepparson Avenue and maintain this movement connection.





Strategies & Objectives

- High activity frontages that encourage people to stay and reclaim the street.
- Provides inviting, human-scale connections between the Koornang Shopping Strip and Carnegie Station
- Presence of vehicle crossovers is minimised.

Interventions

- Implement regulated shared zone signage and reduce speeds to 10kph.
- De-clutter the street by introducing flush kerbs and reduced linemarking.
- Retain pick-up/drop-off station parking on the northern side of the road to both increase activation and as a traffic calming measure.
- Introduce a contrasted paving treatment and lighting technique to the surrounding road network to show visual cues of changing priority.
- Introduce a transition zone treatment at the Koornang Road entrance and Shepparson Road exit such as a narrowed entry/exit and traffic calming measures.
- Use street furniture to encourage people to dwell.
- Introduce bike parking in close proximity to active frontages and station entry.

7.7.1 Morton Avenue shared zone

Similar to Egan Street, a key element of the BFF is the introduction of a shared zone along Morton Avenue which has been investigated in further detail.

In the 2018 Glen Eira ITS, a possible improvement to the experience of the walking and shopping streets of the CAC was to investigate potential road closures and shared zones in key locations. In the 2018 Structure Plan, converting Morton Avenue to a one-way shared zone was considered. This would incorporate an eastbound only shared zone, with widening of footpaths and reduction of on-street parking. The opportunity exists to improve the pedestrian network and support activate frontages on the south side of the street, as well as enhancing access across to Carnegie Station to/ from the south.

Following a review of the options for an east or westbound-only shared zone, Arup has considered that a one-way eastbound operation of Morton Avenue is likely to provide the best outcome for amenity improvements and vehicle circulation. An indicative representation of the potential cross section of Morton Avenue has been provided in Figure 41 and Figure 42.

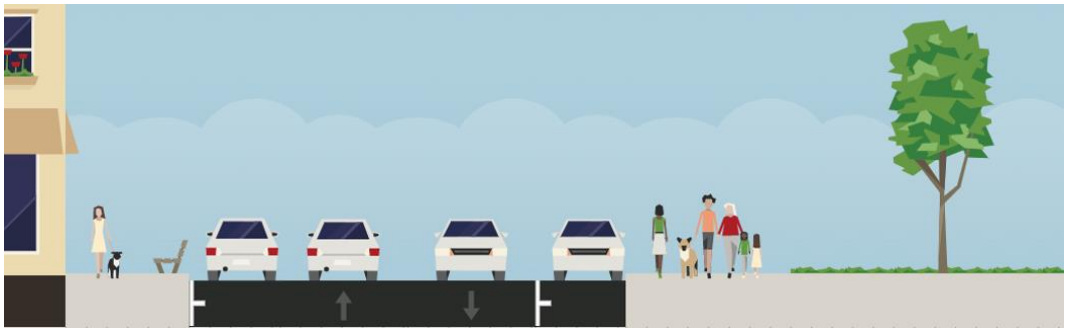


Figure 41 – Existing Morton Avenue cross section (made with Streetmix)

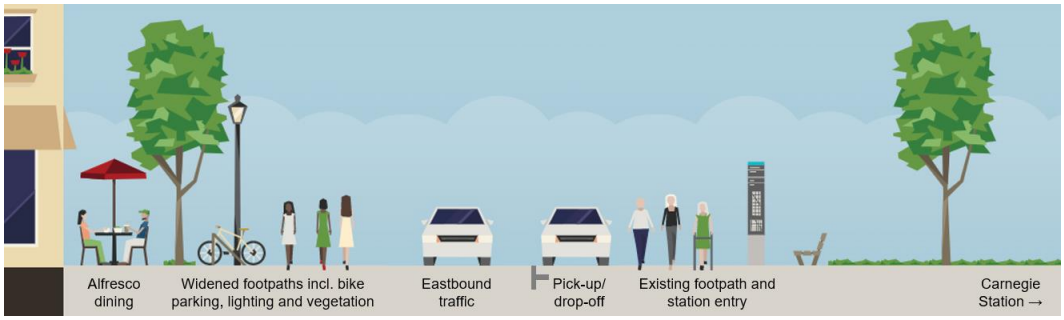


Figure 42 – Indicative Morton Avenue shared zone cross section (made with Streetmix)

Key considerations for the shared zone include:

- Transition zones (points between the surrounding road network and the shared zone) should be well defined to provide a visual cue to motorists showing a change in priority between transport modes. This can be achieved by introducing a narrowed entry and exit, a raised streetscape, concise warning signage and/ or a formal pedestrian crossing such as a zebra or wombat crossing, encouraging drivers to slow down.
- Local Area Traffic Management may be required to disincentivise through traffic from ‘rat-running’ between Koornang Road and Neerim Road.

Key considerations around the choice of traffic flow have been considered. The benefits of eastbound flow are as follows:

- Eastbound flow would allow the westbound traffic lane to accommodate footpath widening on the southern side of the street, improving both the active transport amenity but also providing greater potential for frontage activation for local businesses.
- Given a one-way southbound laneway is proposed between Morton Avenue to Neerim Road, eastbound traffic on Morton Avenue will allow a more direct route for vehicles from Dandenong Road to access development sites, the carpark and key land uses such as the Carnegie Library, while also reducing demand on Koornang Road.
- Eastbound operation will also allow existing short-stay parking bays on the northern side of the street to be retained, which are currently being used as pick-up/drop-off bays for Carnegie Station.

The potential challenges and trade-offs in going with an eastbound flow include:

- The one-way operation of the street will need to consider appropriate turnbacks for northbound vehicles on Shepparson Avenue, discouraging vehicle entry into the shared zone.

8 Car parking assessment

8.1 Existing activity centre car parking rate

The ratio of existing car parking demands to existing floor areas within the core Koornang Road precinct have been used to understand the rate of car parking demand, per 100m^2 of retail/commercial floor area. The purpose of this exercise is to understand, all else being equal, what a 'business as usual' provision of parking would result from the forecast in development.

The following metrics of peak parking demand have been considered:

- **Core Precinct Only:** The peak rate of demand for ***public*** car parking (on-street and off-street) within the core precinct only, assuming that drivers are able to park close by to their end destination. This may be prone to underestimating the actual rate of demand; since high occupancy parking conditions may cause some motorists to park further away from their end destination. A conservative element of this calculation is that it assumes no residential car parking generated in the core precinct (in reality, there is likely a small component of residential demand particularly on Kokaribb Rd and Shepparson Ave).
- **Core Precinct + Overspill:** The peak rate of overall car parking demand (public + private), including adjacent residential streets expected to carry some overspill parking demand during peak times. An estimate of private car parking demands has also been developed, by reviewing the back-of-house area parking demands from aerial photography during the Saturday lunch-time peak. Private basement/ground floor car parks within buildings have not been included, however these are relatively limited within the core precinct.

A summary of this calculation is provided in Table 21, with the relevant parking areas and sub-precinct floor areas shown in Figure 43.

Table 21 – Core Precinct Car Parking Rates

Car Parking Demand Metric	Car Parking Measure	Existing Commercial & Retail Floor Area	Car Parking Demand	Parking Demand Rate
Core Precinct Only	Public Car Parking Demand within Commercial and Mixed Use Zones	30,319m^2	422 veh	1.4 spaces/100m^2
Core Precinct + Overspill	***Lower bound estimate*** Total Car Parking Demand [1]		591 veh	1.9 spaces/100m^2
	Upper bound estimate Total Car Parking Demand [2]		717 veh	2.4 spaces/100m^2

[1] Lower bound estimate of overspill parking demand at which equates to approximately 30% of the Saturday lunch-time demand, within the areas shown in Figure 43.

[2] Upper bound estimated of overspill parking demand which estimated at 80% of the demand in Figure 43, and factored up by 10% to reflect a Saturday night-time peak.

Based on the preceding analysis, it is estimated that the activity centre is currently generating a peak car parking demand at a rate in the order of **1.9 to 2.4 car parking spaces per 100m^2** of non-residential floor area.

Figure 43 – Existing Activity Centre Floor Area and Public Car Parking Areas

The car parking demand rate is expected to be relatively unaffected by public transport park and ride demand, given that the historical data set was collected during the construction of the Carnegie level crossing removal. However, the limitations of the methodology above are as follows:

- Parking overspill to surrounding residential areas has been estimated from aerial photography taken on a Saturday (pre-COVID) at the lunch time peak for the lower bound estimate, and factored up for the Saturday night time peak upper bound estimate based on sample data provided in Appendix B.
- The use of the station carpark after-hours has not been included. It is noted that the station car park was closed at the time of car parking demand surveys used as an input to this study. It is possible that this parking area is used by visitors to the CAC during very busy night-time peaks for parking overspill.

The derived rate of 1.9 to 2.4 spaces per 100m^2 represents a 'blended' rate of a number of land uses including but not limited to retail, restaurant and supermarkets. Further surveys and studies of empirical data sources should be carried out before the aforementioned rate is relied upon to inform a formal car parking policy for Carnegie.

For reference, the statutory car parking rates for the relevant land use terms included under retail and commercial are noted below (via Clause 52.06 – Column B):

- Supermarkets require 5 spaces to each 100m^2 of leasable floor area.
- Retail (shop) requires 3.5 spaces per 100m^2 of leasable floor area.
- Food and Drinks Premises, Restaurant require 3.5 spaces per 100m^2 of leasable floor area; and
- Commercial (Office) require 3 spaces per 100m^2 Net Floor Area (NFA).

The 'blended' rate derived from existing data suggests that the activity centre generates car parking at a lower rate than the statutory car parking rates require. An assessment of the 'business as usual' future car parking demands is presented in Section 8.2, and adopts a mid-range car parking demand rate of ***2.2spaces/100m^2*** between the lower and upper bounds. Recommendations on parking management are subsequently provided in Section 8.3.

8.2 Future car parking demands

An estimate of the 'Business As Usual' scenario car parking demand has been undertaken using retail/commercial floor area growth and housing projections provided by SGS, with inputs/assumptions outlined in Sections 4.1 and 5.2.

For retail and commercial uses, a mid-range estimate of car parking demand of ***2.2 spaces/100m^2*** between the lower and upper bounds has been adopted as outlined in Section 8.2. As such, this assumes that future developments make effective use of the existing Planning Scheme 'decision guidelines' and seek a parking provision in line with existing levels of demand.

For residential car parking, the empirical car ownership data from Section 3.3.2 has been used; which while lower than the statutory parking requirement of 1 space per dwelling, remains broadly similar at 0.89 per one bedroom apartment and 1.07 per 2-bedroom apartment.

A typical residential visitor peak parking demand in the order 0.1 visitor spaces per dwelling has been assumed. While the relevant statutory car parking requirement is zero, the actual demand still exists, and therefore has been included in the assessment.

The total peak car parking demand within the CAC, under a business-as-usual scenario is summarised in Table 22.

Table 22 – Business-as-usual increase in car parking demand

Sub-precinct	Commercial / Retail		Residential		
	Floor area increase (m^2)	Commercial/ Retail Parking Demand	Additional Dwellings [1]	Resident Parking Demand	Residential Visitor Parking Demand
1	3,985	90	518	460	50
2	2,581	60	129	20	10
3	1,363	30	54	10	10
4	689	20	17	<5	<5
5	2,468	50	110	20	10
6	3,349	70	225	40	20
7	701	20	21	<5	<5
8	608	10	0	10	<5
9	368	10	19	<5	<5
10	589	10	28	<5	<5
11	0	0	414	70	40
12	0	0	37	10	<5
13	0	0	511	80	50
14	0	0	47	10	<5
15	0	0	93	20	10
16	0	0	73	20	10
17	0	0	213	30	20
Total	**16,700**	**370**	**2,509**	**820**	**265**

[1] Includes an assumed dwelling mix of 16/80/4% of 1bdr/2bdr/3bdr+ apartments provided from SGS housing model.

Note: Car parking demand rounded to the nearest 10, and a minimum of 5

The parking demand assessment shows that in the order of 1,450 additional parked vehicles could be generated by new development at current rates, including 370 for retail/commercial uses and around 1,060 associated with residential uses. A breakdown by precinct is shown in Figure 44, assuming all parking is 'self-contained' in each precinct.

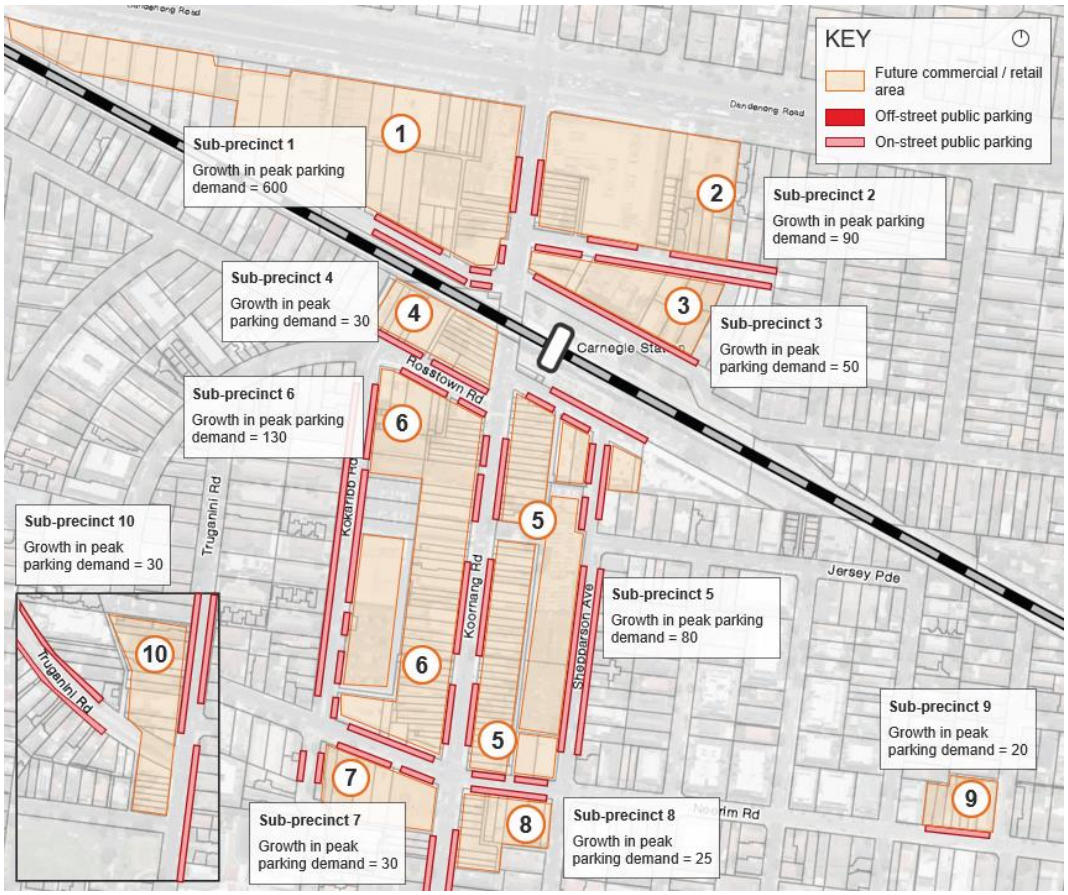


Figure 44 – Estimated Increase in Peak Car Parking Demand by 2036

8.3 Car parking recommendations

By comparison against the car parking data summarised in 3.6.4, which shows a spare capacity of some 67 spaces during the evening, there is limited capacity to absorb the additional car parking demands without generating significant overspill demand into surround streets.

The extent to which the increase in car parking demand of some 1,450 parking spaces is provided within private off-street car parking areas or public shared car parking will be influenced by a range of factors, including:

- Local policy and planning decisions, including potential new guidance on parking rates for new development (including potential reduced parking requirements for constraints traffic environments).
- Council decisions on the future of its existing public car parking areas.
- Parking management decisions (using restrictions to control outcomes).

- Developer led activity and understanding of market expectations (i.e. degree of reduction sought from statutory parking requirements), and interactions with the broader planning system (i.e. interventions via VCAT or Panel).

8.3.1 Car parking rates for new development

The use of minimum parking rates that are common for all settings across Victoria have become increasingly misaligned with the travel demand management objectives employed in a number of inner urban activity centres. In comparison, some jurisdictions offer maximum rates, or reduced minimums as a policy 'lever' to exert downwards pressure on traffic demand, align with sustainability objectives, and as mitigation against exacerbating existing traffic capacity or amenity issues. Carnegie is no exception to the above with available evidence suggesting that empirical rate of parking demand is already lower than the relevant statutory minimums. Reduced car parking rates are considered appropriate for the commercial core of Carnegie.

Recommended approach to parking policy development

A number of options are available to GECC in developing parking policy guidance and the following recommendations are provided:

- A comprehensive study of empirical data sources would be required to determine appropriate rates, with a Car Parking Demand Model prepared based on updated and expanded parking data collection to detail the specific parking rates that would be appropriate to each land use.
- Develop guidelines that establish and promote reduced car parking provision rates for new developments in Carnegie. This could offer 'informal' criteria for reduced parking provision without the administrative and legislative burden of a Planning Scheme Amendment. As an example, a similar approach has been adopted within the City of Port Phillip, with its Sustainable Transport Policy and Parking Rates.
- Review parking restrictions surrounding proposed major developments with reduced car parking rates, to ensure occupants can't simply rely on nearby unrestricted parking areas.
- Encourage new developments to include adaptable re-use concepts into the design of any at-grade or above-ground car parking areas, allowing for future retrofit to usable floor area. For example, this would discourage sloped floor car parking areas.
- In parallel with new development or the removal of existing at-grade parking areas, pro-actively manage the remaining car parking areas to protect sensitive user groups and provide equitable access to parking. This could be via a Parking Management Plan for Carnegie, including consultation to identify the acceptance of introducing paid car parking areas to spread demand to other modes of off-peak times. As an example, Hastings in New Zealand took the initiative of surveying the public on whether they thought parking should be funded through Council rates or on a 'user pays' basis. Priced parking was introduced in line with community preferences.
- Continue the use of 'permit only' schemes in local streets where parking from the activity centre is likely to overspill and to protect local amenity, to align with the Glen Eira Parking Policy.
- Invest in edge of market parking technologies, such as ground/ mounted sensors, to communicate real-time information to drivers in both on-street and off-street parking

facilities, allowing drivers to make more informed decisions, reduce circulation times and fuel consumption.

A number of the above considerations, if pursued, should be rolled into a Car Parking Strategy for the Activity Centre incorporating key initiatives such as the Car Parking Demand Model and Parking Management Plan, along with any relevant consultation activities.

Should a Parking Overlay be pursued?

Under the existing operation of the VPP, the most widely accepted tool to manage and enable local variations to car parking requirements is through the implementation of a Parking Overlay via Planning Scheme Amendment. The existing Glen Eira Parking Policy notes already acknowledges that *'Council will consider the introduction of a Parking Contribution Overlay in its major activity centres to facilitate shared parking'*.

It has been observed that some Councils have not opted into this pathway due to the Parking Overlay and associated documents being particularly onerous and costly to prepare[17]. Notwithstanding, this remains a viable option for GECC. The practicality of this pathway would be enhanced if GECC were to pursue the introduction of a Parking Overlay across a number of its activity centres, not just Carnegie.

Other forms of parking plans, policy advocacy and management devices may assist to manage parking in the short-term, while the viability of a Parking Overlay is in consideration.

Justification for reduced car parking provision

There is clear evidence in support of reduced car parking provision rates for new development, for example reduced minimums, or no prescriptive requirement (i.e. letting the market decide). Key points include:

- Carnegie is positioned as a mixed-use activity centre along a high frequency passenger rail network, making it an excellent location for low-car or no-car housing (refer discussion on Figure 4). There may be an untapped potential for future populations that would 'self-select' this type of housing, should it be available.
- Evidence suggests that in some housing typologies, existing parking demands are already lower than the existing statutory requirements.
- There is alignment to the endorsed Glen Eira Parking Policy, which supports consideration of lower car parking rates on active frontages or active laneways where the Glen Eira Planning Scheme or an adopted structure plan identifies an active frontage or active laneway with no reasonable alternative access (refer Table 3.5.3 of the Glen Eira Parking Policy).
- Evidence suggests that; if the forecast scale of development is realised under a business-as-usual approach, there would be some exacerbated traffic capacity issues that may require additional mitigation. Supporting the development market in a transition to downwards pressure on parking supply can reduce the traffic generating capacity of developments and take pressure off the criticality of these issues (for example, the need to widen laneways).

[17] Victorian Auditor-General's Office Report: Managing Victoria's Planning System for Land Use and Development (22 March 2017)

- Policy mechanisms that support a reduced car use, a major greenhouse gas emitter, are well aligned with other GECC commitments on climate change and sustainability.

In some areas, this approach could be taken further toward a more aggressive prescriptive 'parking cap' policy of forcing rates below market demand to manage traffic impacts, however this could be challenged. This would need to be a policy-led decision, rather than being justified as a required to manage traffic issues, given that some mitigation of laneway capacity is also feasible.

Potential benefits of precinct-specific parking policy guidance

The development of parking policy guidance could provide the following benefits for Carnegie:

- Encourage a market led approach that matches supply and demand for parking in new developments, which may increase affordability and diversity in housing stock or commercial spaces.
- Opportunities to limit poor amenity and urban design outcomes associated with frequency of building openings at rear laneways behind Koornang Road.
- Opportunities to reduce the extent of widening of existing laneways that may otherwise be needed to support development access or passing areas along narrow laneways.
- Provides certainty for developers and in turn supports economic growth, through greater confidence and lower risk of failed development proposals. In turn, the community more broadly may benefit from increased economic agglomeration effects or improved access to services.
- Potential for improved building design outcomes as a result of a lesser burden in the number of spaces to be delivered within a fixed building enveloped.
- Opportunity to align development outcomes with a whole-of-precinct approach to car parking management. This could allow for strategically located car parking, greater efficiency through the sharing of a pooled resource, and more equitable use of public assets through parking pricing mechanisms.
- An opportunity to develop strategies that support a managed transition from existing at-grade car parking areas to higher value uses.

8.3.2 Future of the public parking supply in carnegie

On Street car parking

On street parking demands are already very high across a significant portion of the day and as a result are likely to already be generating additional traffic movement in search of a vacancies. The increasing difficulty in finding a convenient parking space may act as a deterrent for those making short driving trips, leading to changing travel choices over time and lower car use.

A reduction in on-street supply will also likely displace demands further into the surrounding residential neighbourhood, or for a broader span of the day. Accommodating overspill demands in side-streets is relatively common in activity centres. For residents, it is a small and often expected price to pay for living close to an urban centre, for which there are several benefits.

However, given the existing demand for car parking, a tactical approach will be required to support incremental removal of on-street parking areas over time, with the necessary supporting measures. In parallel with the removal of on-street car parking, it would be recommended that Council:

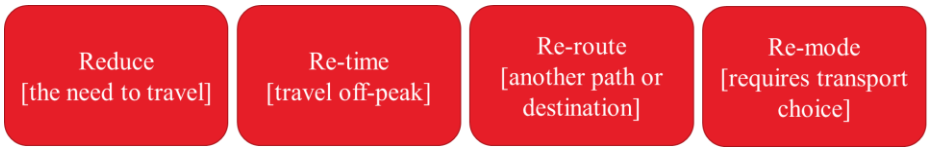
- Consider extending short-term parking restrictions into neighbouring residential streets.
- Use parking restrictions to disincentivise staff car parking. Staff trips tend to be more easily transferable to non-car modes and reducing long-stay demand may provide capacity for multiple short-stay trips.
- Investigate conversion of parallel parking to angled parking to increase supply in neighbouring residential streets.
- Council could implement 'permit only' schemes in areas where parking overspill is likely, in alignment with the existing Glen Eira Parking Policy.
- Trial changes to car parking to understand impacts, and incorporate community views on alternate use of the road space.
- Continue to invest in and advocate for active transport and public transport enhancements that provide a 'pull effect' to reduce parking demand.

Off Street car parking

The Built Form Framework proposes the conversion of two at-grade parking areas to open space.

It is clear from the existing data, that there is limited spare capacity in the commercial precinct to absorb any major displacement of demand. A review of aerial photography also indicates limited vacancy to accommodate these demands within the adjoining residential areas. It is expected that the limited spare capacity would also be absorbed by removal of on-street parking to support other public realm interventions.

Removal of this car parking supply would risk Carnegie losing competitiveness as a night time activity destination, and risks causing a drop in visitation. In terms of managing the travel demand associated with a potential capacity constrained parking situation, there are four options for the end user:



While Carnegie has excellent access to rail, the customer catchment for uses such as supermarkets and restaurant is more likely to be arriving from a radial catchment. Unlike residential trips, these trips are likely to have fewer transport choices to accommodate a 're-mode' and are therefore risks a 're-route' decision to another destination.

A parking pricing scheme may offer one way of offsetting the peak demand and encouraging a shift to other modes, or to less busy times of day. Further work would need to be carried out on the price elasticity of car parking demand in Carnegie.

On the basis of the above, it is recommended that the proposals to transform the existing at grade car parking to open space incorporate a reprovision of a similar supply. There may be future opportunities (for either Council, or the private sector) to deliver off-street

public car parks as part of commercial redevelopment sites that are strategically located within the centre.

Summary and Recommendations

The recommended car parking approach for Carnegie is as follows:

- A Car Parking Strategy should be prepared, to investigate the opportunity to reduce car parking from statutory rates in future development and a parking policy (or similar guidelines) should be implemented. This would include a Car Parking Demand Model (to determine the ideal rates), and a Car Parking Management Plan (to manage various externalities and public supply, including the detailed implementation extents of 'permit only' schemes in accordance with the Glen Eira Parking Policy).
- Reduced car parking provision, or even a capped provision, could be useful in the core precinct to exert downwards pressure on traffic demands, particularly for 'shop-top' residential development on Koornang Road.
- In the order of 1,450 additional parked vehicles could be generated by new development at current rates, including 370 for retail/commercial uses and around 1,060 associated with residential uses
- On-street parking demands are already very high across a significant portion of the day. A tactical approach will be required to support the incremental removal of on-street parking areas over time to facilitate public realm improvements, with the necessary supporting measures such as extending short-term parking restrictions, using some restrictions to disincentivise long term (staff) car parking, investigate conversion of parallel parking to angled parking, carrying out trials, and other active transport and public transport enhancements to reduce demand.
- A parking pricing scheme could be investigated as a way of offsetting peak parking demand and encouraging a shift to other modes, or to less busy times of day, depending on the price elasticity of car parking demand in Carnegie.
- It is recommended that the proposals to transform the existing at grade car parking to open space incorporate a reprovision of a similar supply.

9 Summary of recommendations

A summary of the public realm assessment and subsequent recommendations is provided in Figure 45 and listed below.

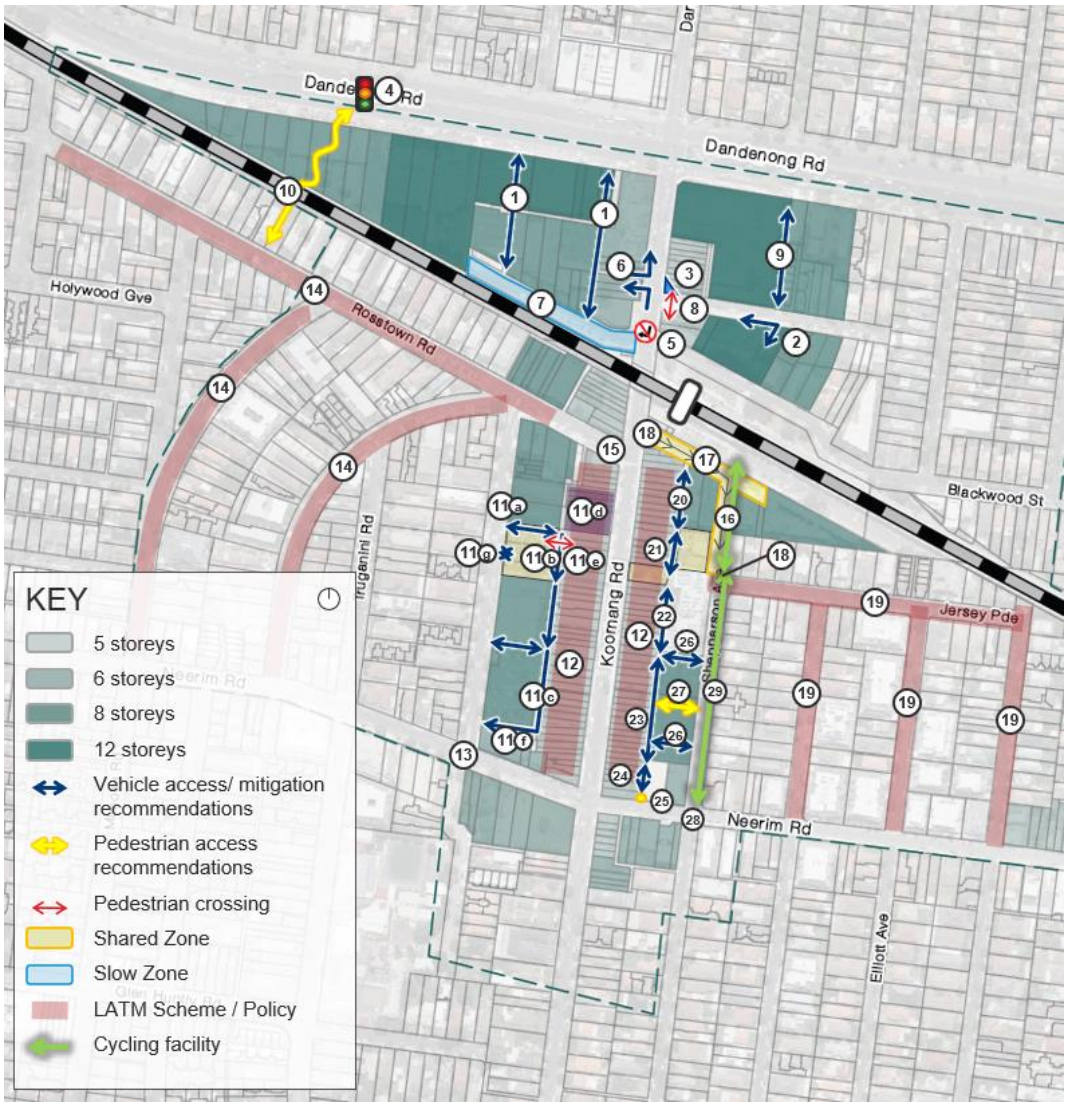


Figure 45 – Summary of recommendations

Other general recommendations include:

ID	Description	Timing
-	Require any new or widened laneways to provide corner splays at changes of direction, to facilitate access to developments further afield.	Upon development
-	Appropriate space for two-way flow in shared lanes where required to allow safe passing for vehicles, and provide suitable space for walking.	Ongoing
-	Investigate the potential flaring of laneways intersections to accommodate service vehicles and ensure suitable sight distance to oncoming traffic.	Upon development

9.1 Urban Renewal Precinct

Recommendations and timing for the Urban Renewal Precinct are as follows:

ID	Description	Timing
1	Require new developments to achieve interconnected north-south laneways to allow through-connections to/from Dandenong Rd service road (refer Section 6.3.1 for details). This would maximise traffic distribution opportunity to Dandenong Road to improve network resilience and flexibility of access.	Upon development
2	Encourage development to/from sub-precinct 3 to be focused to/from Arawatta Street. This would avoid uncontrolled movements at the unsignalised cross-intersection at Koornang Road / Egan St / Woorayl St intersection. Council would typically require a minimum 3m x 3m splay.	Ongoing
3	Provide increased building setback (i.e. triangular splay to ground floor level) as part of any future development on all corner sites (in accordance with heritage requirements)., with a particular focus on the north east corner of the Arawatta St/Koornang Rd intersection. This would aim improve pedestrian circulation and mitigate pedestrian safety issues cause by a lack of sight distance.	Upon development
4	Investigate feasibility of a long-term signalised intersection to Dandenong Road to replace the existing unsignalised turning facilities, as well as investigating interim treatments to support short term safety and amenity of the service road. Traffic signals may require the intersection to be shifted west. The signals would benefit from being aligned with, or connected to, a new internal road or laneway connection in the west, t may require lot consolidation to facilitate.	Upon development
5	Investigate the banning of the right-turns into Egan Street from Koornang Road, to preserve pedestrian amenity and avoid turning vehicles from having a disproportionate impact on through-traffic performance.	Ongoing / Long
6	Plan for the gradual restriction of Koornang Road/Laneway (south of Rosstown Hotel) to be left-in/left-out due to the proximity to the Arawatta St signalised intersection causing potential issues for right turn traffic and follow-on implications for pedestrian amenity.	Medium
7	Create a slow road environment along Egan Street to prioritise pedestrians, on-street dining and street greening. This will manage the balance of pedestrian vs. vehicle demands moving between new developments and the Koornang Road precinct.	Upon development
8	Improvements to the active transport network, particularly north-south pedestrian crossings on Arawatta Street, should be investigated.	Short
9	Maintain north-south through-site links including a potential shared lane between Dandenong Road and Arawatta Street as part of future development.	Upon development
10	Work with developers to provide public access from Rosstown Road to the Djerring Trail.	Long

9.2 Kokaribb Precinct

Recommendations for the Kokaribb Road Precinct are as follows:

ID	Description	Timing
11	Under two staging scenarios contemplated, the following access strategy recommendations are provided: **Interim (no change to existing Woolworths site)** a. Retain the east-west access from Kokaribb Road (north of Woolworths) to provide access for trucks and service/ waste collection vehicles only to the Woolworths supermarket loading area and Koornang Road property BOH areas. b. Retain the laneway between Koornang Road and Koornang Road properties with one-way southbound operation. Ongoing discussions with Woolworths and neighbouring landowners are required to optimise access to the existing Woolworths loading area and BOH areas. c. Retain existing carpark circulation (south of Woolworths). **Ultimate (with broader development)** d. Investigate the implications for prospective developers in obtaining planning permits, if no access to Koornang Road or the rear laneways are available. e. Investigate pedestrian crossing facilities connecting through to the Koornang Road shopping strip for movements across the north-south laneway to/from the open space. f. Creation of an east-west shared lanes for circulation and access to the new development, limited to primarily vehicle access and small vehicles. This link is nominally shown in the location of the existing connection south of Woolworths. g. Consider a single access point to development near the existing Woolworths site from Kokaribb Road, for larger vehicles, and/or any major commercial car park entrances.	Short – Long
12	Update the existing Glen Eira Parking Policy to allow low-car and no-car development for properties fronting Koornang Rd, to alleviate traffic impacts in the rear laneways. This will help to mitigate congestion, maximise safety, and maximise pedestrian amenity outcomes.	Short
13	Investigate minor upgrades to the intersection layout at Neerim Road/Kokaribb Road. The aim would be to improve the safety and operation of right-turn movements. There is limited scope to provide more capacity without traffic signals, which may provide problematic due to the close intersection spacing to Koornang Rd.	Short
14	Develop a Local Area Traffic Management scheme for the residential growth zones to the west of Kokaribb Rd. This would aim to limit the negative perceptions of increased traffic volumes, and enhance the sense of safety and liveability, which might otherwise be impacted by a redistribution of traffic onto local streets due to increased delays at the Neerim Rd/Kokaribb Rd intersection.	Medium
15	Monitor the performance of the Koornang Rd/Rosstown Road intersection. Depending on the performance of the west approach, the left turn storage could be extended by introducing part-time clearways on the north side of Rosstown Road. The aim would be to prevent lane blockages than could otherwise undermine intersection efficiency.	Long

9.3 Shepparson Precinct

Recommendations for the Shepparson Avenue Precinct are as follows:

ID	Description	Timing
16	The design of any one-way system on Morton Avenue-Shepparson Avenue would be suitable to operate eastbound and southbound and with extents limited to the section north of Jersey Parade. A contraflow bike lane on Shepparson Avenue should be included between Jersey Parade and Morton Avenue (and provide a connection to the Djerring Trail).	Upon development
17	Implement a shared zone along Morton Avenue	Short
18	Transition zones (points between the surrounding road network and the shared zone) should be well defined to provide a visual cue to motorists showing a change in priority between transport modes. This can be achieved by introducing a narrowed entry and exit, a raised streetscape, concise warning signage and/ or a formal pedestrian crossing such as a zebra or wombat crossing, encouraging drivers to slow down.	Upon development
19	Investigate Local Area Traffic Management scheme for Jersey Parade and surrounding streets. This would aim to limit the negative perceptions of increased traffic volumes, and enhance the sense of safety and liveability, which might otherwise be impacted by a redistribution of traffic onto local streets due to increased delays at the Neerim Rd/Shepparson Avenue intersection.	Upon development
20	Upgrade the existing two-way laneway that connects to Morton Avenue as a Shared Lane. Given the narrow cross section (approx. 4.5m), encourage new development to provide localised widening to 5.5m to improve passing ability.	Medium
21	Subject to a review of traffic generation at the time of any proposed developments served from this laneway, retain a single width laneway as a Shared Lane north of the existing open space. This would maintain 'filtered permeability' allowing only pedestrians to travel through the bollards and across the library forecourt. The open space that provides a forecourt to the library would be retained, and vehicle access vehicle access discontinuous to the south.	Short
22	Retain a two-way laneway (6m+ carriageway) as a Shared Lane. The preservation of the full two-way width appears to rely on part of the Carnegie library site.	Upon development
23	Retain a two-way laneway by widening into the Council car parks. Any widening would be more easily accommodated to the east at the time of development of Councils at grade parking areas.	Short
24	Retain a single width, two-way laneway, subject to future post-development traffic volumes not exceeding 30vph.	Upon development
25	Close the existing laneway connection to Neerim Road to vehicles, creating a Pedestrian Lane. This section of laneway appears to sit on private land however it creates a pedestrian safety issues due to the blind corners (no pedestrian visibility splays are provided).	Upon development
26	Retain two east-west Shared Lanes.	Short
27	Provide an east-west pedestrian link to be aligned with the current through-site link to Koornang Road.	Upon development

28	Investigate minor upgrades to the intersection layout at Neerim Road/Shepparson Avenue. The aim would be to improve the safety and operation of right-turn movements, however there is limited scope to provide more capacity without traffic signals, which may provide problematic due to the close intersection spacing to Koornang Rd.	Upon development
29	Investigate improved cycling connections on Shepparson Avenue between Neerim Road through to the Djerring Trail.	Short - Medium

9.4 Car parking

A summary of the recommended car parking approach for Carnegie is provided as follows:

- A Car Parking Strategy should be prepared, to investigate the opportunity to reduce car parking from statutory rates in future development and a parking policy (or similar guidelines) should be implemented. This would include a Car Parking Demand Model (to determine the ideal rates), and a Car Parking Management Plan (to manage various externalities and public supply, including the detailed implementation extents of 'permit only' schemes in accordance with the Glen Eira Parking Policy). This should include an update to the existing Glen Eira Parking Policy to allow low-car and no-car development for properties fronting Koornang Rd.
- Reduced car parking provision, or even a capped provision, could be useful in the core precinct to exert downwards pressure on traffic demands, particularly for 'shop-top' residential development on Koornang Road.
- On-street parking demands are already very high across a significant portion of the day. A tactical approach will be required to support the incremental removal of on-street parking areas over time to facilitate public realm improvements, with the necessary supporting measures such as extending short-term parking restrictions, using some restrictions to disincentivise long term (staff) car parking, investigate conversion of parallel parking to angled parking, carrying out trials, and other active transport and public transport enhancements to reduce demand.
- A parking pricing scheme could be investigated as a way of offsetting peak parking demand and encouraging a shift to other modes, or to less busy times of day, depending on the price elasticity of car parking demand in Carnegie. It is recommended that the proposals to transform the existing at grade car parking to open space incorporate a reprovision of a similar supply.

10 Conclusion

A Built Form Framework for Carnegie has been prepared that sets out proposed building heights, open space, and other urban design principles to guide development.

The development controls for Carnegie, which allow a high degree of co-located population density, jobs and services, in a high-accessibility location; inherently provide broader benefits for Melbourne and are well aligned with State Policy settings including Plan Melbourne.

Land use forecasting by SGS suggest there could be major take-up of residential growth (doubling the number of dwellings), as well as increases of retail and commercial in the order of 30 to 40%. This places an increased pressure on infrastructure – including transport infrastructure.

The analysis presented in this report has indicated that forecast traffic associated with increased development is likely to create challenges, given the existing network is likely at or near capacity. This reinforces the need to encourage public transport, active transport and other measures to manage demand.

An access strategy is also needed that will support the above approach. At the local level, some changes could be made to laneways that are capable of supporting the expected level of growth, while improving walkability and amenity. Options are also available to manage amenity, safety, and circulation at intersections. However, none of these recommendations provides a single solution and the activity centre will rely on a degree of peak spreading and displacement of non-local trips onto other parts of the network should it realise the growth projections.

Car parking is another lever to reduce pressure on traffic generation, and a Parking Overlay (or similar) should be developed to support reduced traffic generation. The assessment has shown that while increased development will likely be associated with an increased parking demand, the CAC currently generates carparking at a lower rate than the statutory carparking rates and is supported by high frequency rail, and lower car ownership rates. A Car Parking Strategy would support this initiative.

To inform Council's broader planning, the Movement and Place framework has also been used to develop a set of strategies/objectives and potential interventions for consideration, that would be complementary to the growth and development of the activity centre.

It is understood that the recommendations presented throughout this report will be considered, and a decision made on the extent to which they are incorporated into the subsequent stages of planning for Carnegie.

Appendix A

Movement & Place Network Classifications

Figure 46 – DoT Movement Classifications

Figure 47 – DoT Place Classifications

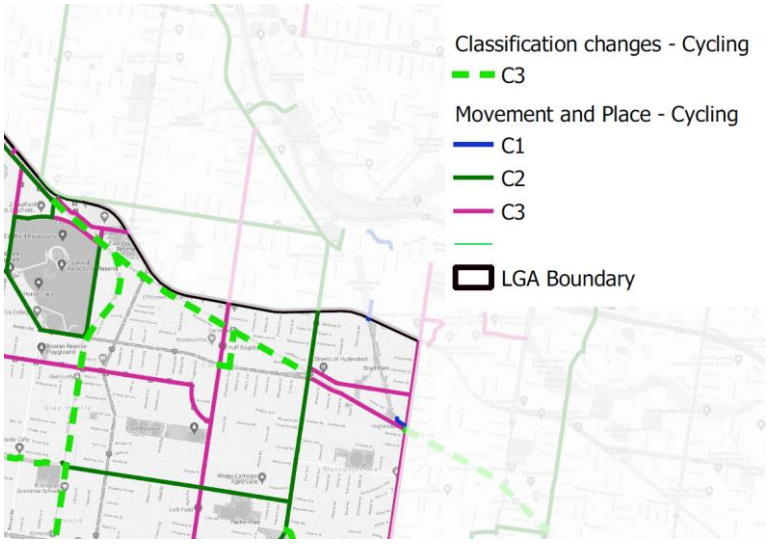


Figure 48 – GECC Cycling Classifications

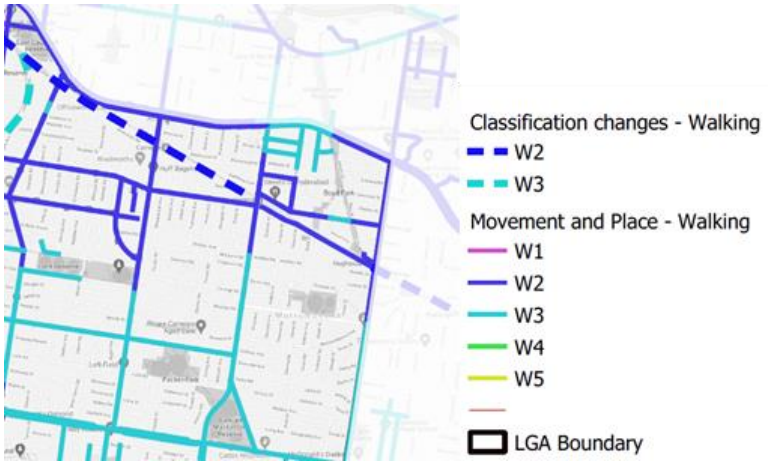


Figure 49 – GECC Walking Classifications

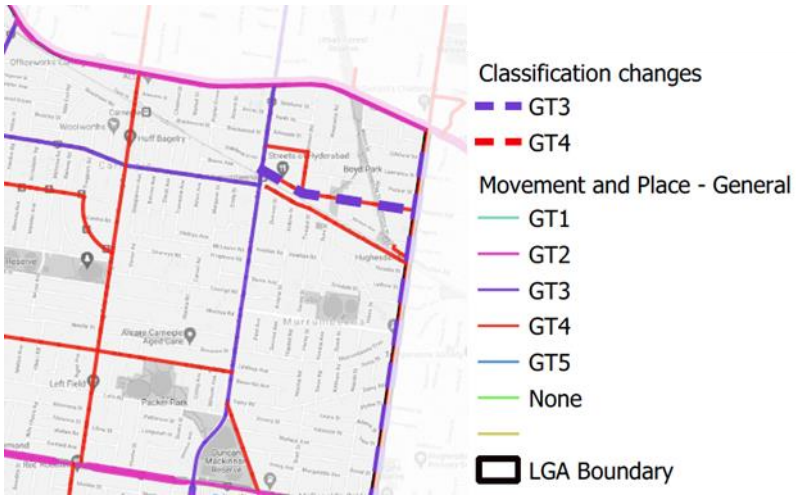


Figure 50 – GECC General Traffic Classifications

Appendix B

Car parking data

Due to the Covid-19 lockdown restrictions in-place at the time of this assessment, an assessment of the existing carparking supply and utilisation could not be undertaken. Thus, an appreciation of the 'normal' condition of parking has been undertaken through interrogation of previous studies and associated data collection provided by the GECC as summarised in Table 23.

Table 23 – Summary of supplied carparking data

Source	Available data
75A-75B Koornang Road Traffic Impact Assessment, Ratio Consultants, 2020	Supply and utilisation data for: • Friday 28 July, 2017, 11am – 11pm • Saturday 29 July, 2017, 11am – 11pm
Transport Analysis and Forecasting Discussion Paper, MRCagney, 2017	Supply and utilisation data for: • Thursday 27 July, 2017, 8am – 10pm • Saturday 29 July, 2017, 9am – 2pm
GECC Parking Analysis, GECC, 2017	Supply and utilisation data for: • Tuesday 25 July, 2017, 8am – 10pm • Saturday 29 July, 2017, 9am – 2pm
Spot counts and observations from aerial imagery in 2021	Off-street carparking supply

The current limitations of this data include:

- Lack of current-day data to understand sustained trends over time comparative to supplied data
- Supplied data contains supply and utilisation of some carparking facilities but not of others, therefore data has been shared from sources to build an overall understanding of operation.

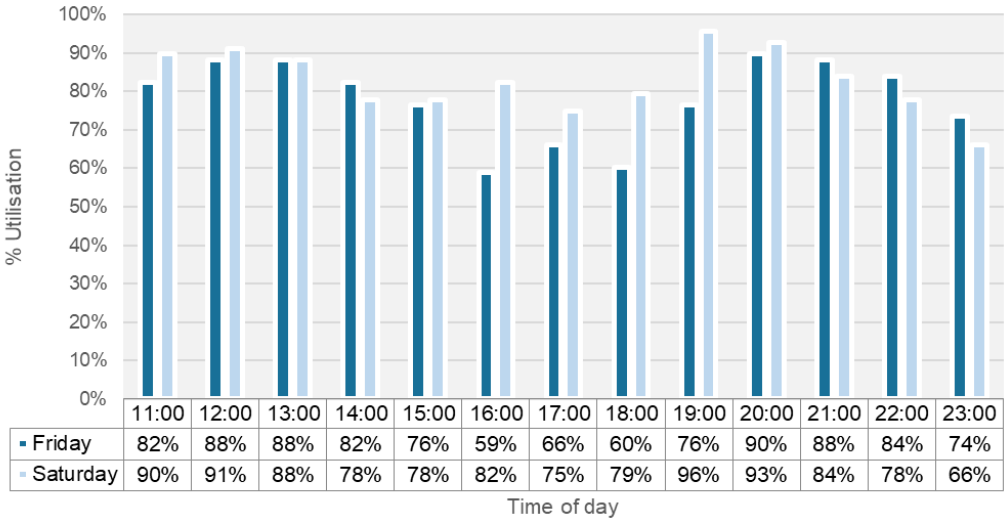
Urban renewal parking precinct

The urban renewal parking precinct is observed to have an existing supply of 536 public carparking bays shared amongst on-street and off-street parking facilities. A breakdown of the supply has been provided in Table 24.

Table 24 – Carparking supply breakdown for the urban renewal parking precinct

Facility	Supply	Source
On-street	87	*Ratio Consultants, 2020*
Off-street (Egan Street)	73	*Ratio Consultants, 2020*
Off-street (Carnegie Central)	376	*MRCagney, 2017; GECC, 2017*
Total supply	536	

Utilisation of carparking in this precinct has been provided in Figure 51 for the survey periods of Friday 28 July 2017 and Saturday 29 July 2017. Due to the data available at the time of this study, only the utilisation of on-street carparking could be provided for this precinct.



	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Friday	82%	88%	88%	82%	76%	59%	66%	60%	76%	90%	88%	84%	74%
Saturday	90%	91%	88%	78%	78%	82%	75%	79%	96%	93%	84%	78%	66%

Figure 51 – Carparking utilisation summary for the urban renewal parking precinct

Key insights include:

- The overall demand for on-street carparking at the time of assessment was moderate to high, ranging from 59% at 4pm on Friday to 96% at 7pm on Saturday.
- Two distinctive peak periods for parking have been highlighted, lunch time (82-91% utilisation) and dinner time (76-96% utilisation).
- Demand is more consistent across the day on Saturday, likely due to the more constant travel demand generated by Carnegie Central on the weekend, offering multiple services and destinations that are not dependent on time of day such as food and beverage land uses.

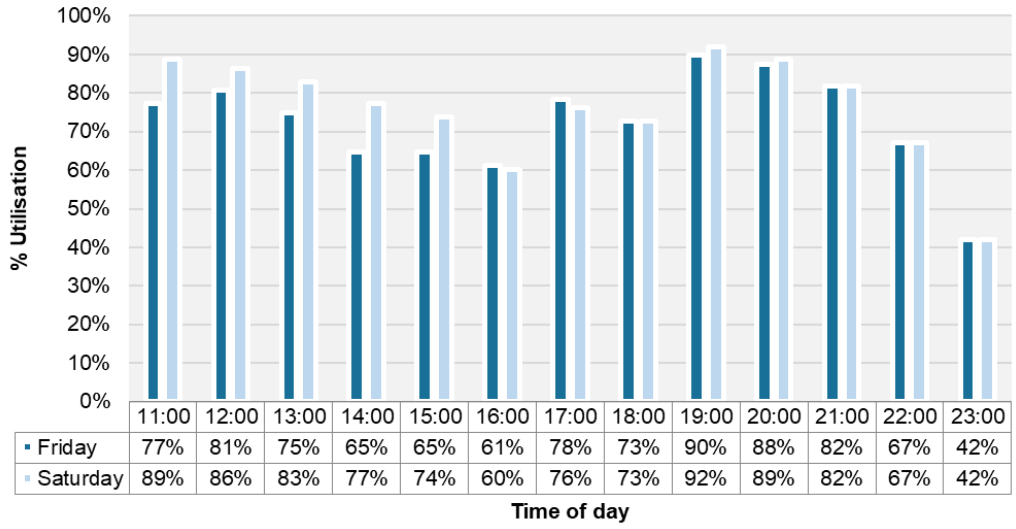
Koornang Road, Rosstown Road and Morton Avenue

The Koornang Road, Rosstown Road and Morton Avenue parking precinct is observed to have an existing supply of 88 public on-street carparking bays. A breakdown of the supply has been provided in Table .

Table 25 – Carparking supply breakdown for the Koornang Road, Rosstown Road and Morton Avenue parking precinct

Facility	Supply	Source
Koornang Road on-street	59	*Ratio Consultants, 2020*
Rosstown Road on-street	17	
Morton Avenue on-street	12	
Total supply	88	

Utilisation of carparking in this precinct has been provided in Figure 52 for the survey periods of Friday 28 July 2017 and Saturday 29 July 2017.



	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Friday	77%	81%	75%	65%	65%	61%	78%	73%	90%	88%	82%	67%	42%
Saturday	89%	86%	83%	77%	74%	60%	76%	73%	92%	89%	82%	67%	42%

Figure 52 – Carparking utilisation for the Koornang Road, Rosstown Road and Morton Ave precinct

Key insights include:

- The overall demand for on-street parking at the time of assessment was low to high, ranging from 42% 11pm on Friday and Saturday to 92% at 7pm on Saturday
- Two distinctive peak periods for parking have been highlighted, lunch time (82-91% utilisation) and dinner time (79-96% utilisation)
- Demand on Saturdays are generally higher and more consistent throughout the day, likely due to the precincts offering of leisure activities such as food and beverage and retail, often used more regularly on weekends
- Demand drops significantly after the dinner time peak, likely due to the limited number of land uses offering late-night entertainment.

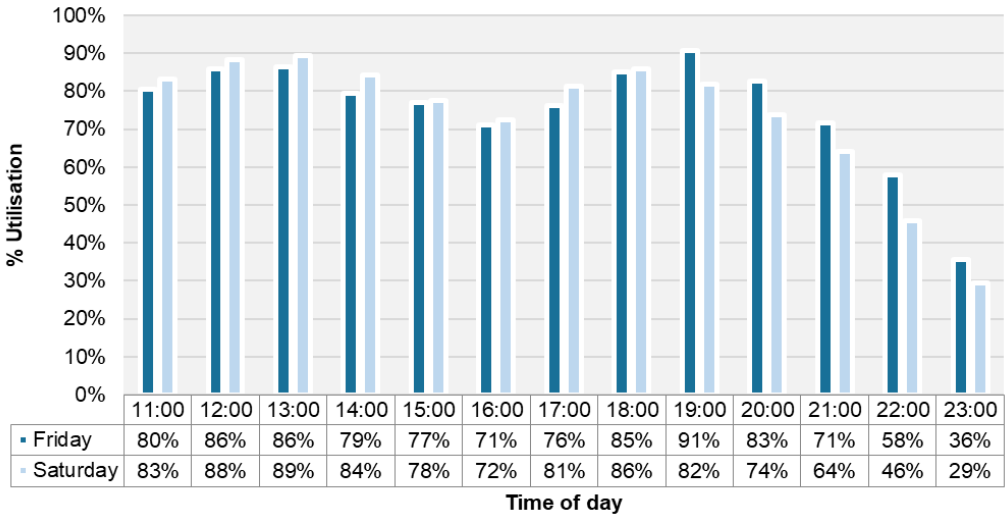
Kokaribb Road and Woolworths

The Kokaribb Road and Woolworths parking precinct is observed to have an existing supply of 211 public carparking bays shared amongst on-street and off-street parking facilities. A breakdown of the supply has been provided in Table .

Table 26 – Carparking supply breakdown for the Kokaribb Road and Woolworths parking precinct

Facility	Supply	Source
Kokaribb Road on-street	43	*Ratio Consultants, 2020*
Kokaribb Road off-street north	66	*Spot counts and observations from aerial imagery in 2021*
Kokaribb Road off-street south	102	
Total supply	211	

Utilisation of carparking in this precinct has been provided in Figure 53 for the survey periods of Friday 28 July 2017 and Saturday 29 July 2017.



	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Friday	80%	86%	86%	79%	77%	71%	76%	85%	91%	83%	71%	58%	36%
Saturday	83%	88%	89%	84%	78%	72%	81%	86%	82%	74%	64%	46%	29%

Figure 53 – Carparking utilisation for the Kokaribb Road and Woolworths precinct

Key insights include:

- The overall demand for on-street parking at the time of assessment was low to high, ranging from 29% at 11pm on Saturday to 91% at 7pm on Friday
- Two distinctive peak periods for parking have been highlighted, lunch time (80-89% utilisation) and dinner time (74-91% utilisation)
- Demand drops significantly after the dinner time peak, likely due to the limited number of land uses offering late-night entertainment and the night time closure of Woolworths shopping centre.

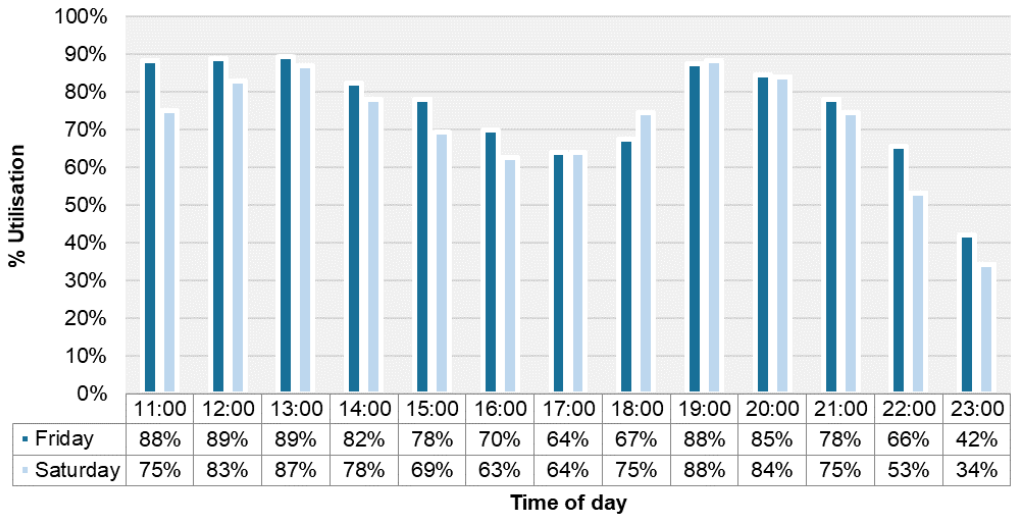
Shepparson Avenue and Carnegie Library

The Shepparson Avenue and Carnegie Library parking precinct is observed to have an existing supply of 169 public carparking bays shared amongst on-street and off-street parking facilities. A breakdown of the supply has been provided in Table .

Table 27 – Carparking supply breakdown for the Shepparson Avenue and Carnegie Library parking precinct

Facility	Supply	Source
On-street	47	Ratio Consultants, 2020
Off-street	122	Ratio Consultants, *2020* Spot counts and observations from aerial imagery in 2021
Total supply	169	

Utilisation of carparking in this precinct has been provided in Figure 54 for the survey periods of Friday 28 July 2017 and Saturday 29 July 2017.



	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Friday	88%	89%	89%	82%	78%	70%	64%	67%	88%	85%	78%	66%	42%
Saturday	75%	83%	87%	78%	69%	63%	64%	75%	88%	84%	75%	53%	34%

Figure 54 – Carparking utilisation for Shepparson Avenue and Carnegie Library precinct

Key insights include:

- The overall demand for on-street parking at the time of assessment was low to high, ranging from 34% at 11pm on Saturday to 89% 12pm and 1pm on Friday
- Two distinctive peak periods for parking have been highlighted, lunch time (75-89% utilisation) and dinner time (75-88% utilisation)
- Demand drops significantly after the dinner time peak, likely due to the limited number of land uses offering late-night entertainment.