South West Rocks

Transport and Movement Report

Kempsey Shire Council

23 December 2022

→ **The Power of Commitment**

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Printed date	23/12/2022 9:09:00 AM
Last saved date	23 December 2022 9:09 AM
File name	https://projectsportal.ghd.com/sites/pp01_05/swrstructureplanandt/ProjectDocs/12554964-REP_SWR-TransportandMovementDraftReport.docx
Author	S. Chapman, R. Green
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Client name	Kempsey Shire Council
Project name	SWR Structure Plan and Transport and Movement Strategy
Document title	South West Rocks | Transport and Movement Report
Revision version	Rev 0
Project number	12554964

Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S0	A	R. Green	S. Chapman		A. Fletcher		06/12/21
S0	B	R. Green	S. Chapman E. Jackson		A. Fletcher		02/06/22
S0	C	R. Green	S. Chapman		A. Fletcher		02/11/22
S0	0	R. Green G.Bughao	S. Chapman		A. Fletcher		23/12/22

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Executive summary

GHD was engaged by Kempsey Shire Council to undertake Structure Planning for South West Rocks. As an important input to the Structure Plan, a Transport and Movement Analysis was required.

This report documents the transport and movement considerations for the region, providing a basis for the road hierarchy, recommended road network improvements and inform the Structure Plan in relation to transport issues and opportunities.

South West Rocks is a locality defined by its natural characteristics. The area is experiencing growth and development pressure due to an increasingly popular 'commuter' lifestyle, demand for coastal land and modern tourism.

From a strategic perspective, management of transport, movement, development and land use is underpinned by key themes including safety, sustainability, connectedness, accessibility, long term strategic planning, adaptability and integration of the built and natural environments.

The current road hierarchy is based on broad regional classifications. The traffic profiles of the key local roads reflect the land use which they provide access to, with roads servicing residential areas generally having a more typical commuter influenced profile with AM and PM peaks, and roads servicing recreational areas generally having a single peak in the AM. Peak times are also influenced by the scheduling of events, and as such may differ from their typical times during events.

Active transport infrastructure is limited. Freight movements in South West Rocks are limited by the oversize/over mass restrictions on heavy vehicle movements in the local network. Future infrastructure and operations upgrades in South West Rocks will need to consider emerging trends with respect to alternative modes of transport, especially those that support efficient use of public assets with growing use of the area.

Vehicle ownership and historic traffic growth data was found to align with forecast population growth of a linear average of 2.5% per annum which has been used to conservatively estimate future traffic scenarios, along with information from a number of areas that have been identified in master-plans for future residential growth. Traffic modelling undertaken indicates sufficient capacity within the network to cater to growing traffic volumes, largely due to redundancy or routes within the network.

Future road network improvements have been proposed as part of the Transport and Movement Report which generally seek to review opportunities to:

– Identify core function of road network sections with respect to movement of various modes and place functions
– Support increased activity, permeability and active transport connections
– Support safe and fit for purpose transport infrastructure, targeting growth to 'for purpose' corridors
– Support network wide resilience over time

This report is subject to, and must be read in conjunction with, the limitations set out in Section 1.3 and the assumptions and qualifications contained throughout the Report.

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1. Introduction

GHD was engaged by Kempsey Shire Council to undertake Structure Planning for South West Rocks. As an important input to the Structure Plan, a Transport and Movement analysis was required to document the basis for the South West Rocks road hierarchy and inform the Structure Plan.

The Transport and Movement analysis informs the development of a road hierarchy framework which will allow determination of future infrastructure requirements and prioritisation of improvement works for South West Rocks. Development and implementation of a road hierarchy will allow the transport network to continue to service a growing community and guide upgrades and development for positive outcomes.

1.1 Purpose of this report

The purpose of this report is to document transport assessment of the network to enable for a multi-modal approach to making decisions that affect the transport network and provide understanding of the long-term vision for the broader network, allowing pre-emptive planning decision to be made.

1.2 Study area

South West Rocks is a locality on the coast of New South Wales between Port Macquarie and Coffs Harbour, comprised of the town centre of South West Rocks and the villages of New Entrance, Arakoon and Jerseyville. These contain a mixture of old and new, combining the original seaside holiday town and the newer modern developments that have resulted from the onset of modern tourism and a trend towards a 'commuter' lifestyle. The area also includes sites of natural significance including Arakoon and Hat Head National Parks.

The study area includes the town centre of South West Rocks and the villages of New Entrance, Arakoon and Jerseyville. The extent of the study area is shown in Figure 1.1.

Figure 1.1 Study area

Imagery obtained from Department of Customer Service © 2020

1.3 Scope and limitations

This report has been prepared by GHD for Kempsey Shire Council and may only be used and relied on by Kempsey Shire Council for the purpose agreed between GHD and Kempsey Shire Council as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Kempsey Shire Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

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1.4 Assumptions

This report has been prepared based on the following assumptions:

- Traffic data provided by Council (refer Section 3.2) accurately represent existing conditions of the road network in the study area and provide indicative performance of the network.
- Average travel time per direction (refer
-) is representative of typical conditions per direction, regardless of the volume of data available for calculation of the average.
- Journey to work data (refer Sections 3.6 and 3.8.1) obtained from the Australian Bureau of Statistics accurately represent commuting mode choice in the study area.
- Crash data (refer Section 3.7) sourced from Transport for New South Wales (TfNSW) provides an accurate record of incidents in the existing road network in the study area.
- Population forecasts (refer Section 4.1) obtained from id. informed decisions provide a reasonable representation of future growth.
- Traffic modelling results included within this report are subject to the assumptions and limitations documented within the Model Calibration and Validation Report.

1.5 Reference documents

The following documents have been referenced in the preparation of this report:

- Kempsey Local Growth Management Strategy 2012
- Kempsey and South West Rocks Industrial Land Review 2004
- Ageing Well in NSW: Action Plan 2021-2022
- Council Managed Crown Land Plan of Management 2021
- Kempsey Shire Council Disability Inclusion Action Plan 2017-2021
- Kempsey Shire Biodiversity Strategy 2021

- Horizon 2030: Macleay Valley Economic and Tourism Strategy 2019
- Kempsey Shire Bike Plan 2018 (Bike Plan)
- Kempsey Coastal Zone Management Plan 2016
- South West Rocks Local Community Plan 2009
- Future Macleay – Growth & Character – Local Strategic Planning Statement 2020
- Local Character and Place Guideline 2019
- Local Housing Strategy Guideline 2018
- Lower Macleay Flood Study 2019
- Macleay Valley 2036 Community Strategic Plan
- Macleay Valley Coast Destination Management Plan 2019-2029
- Macleay Valley Community Infrastructure Strategy 2020
- Macleay Valley Sports Strategy 2017
- North Coast 2036 Regional Plan
- North Coast Settlement Planning Guidelines 2019
- NSW Homelessness Strategy 2018-2023
- Plan of Management for Community Land 2017
- Plan of Management Horseshoe Bay Reserve South West Rocks 2014
- Practitioner's Guide to Movement and Place 2020
- Pedestrian Access and Mobility Plan
- Kempsey Shire Rural Residential Land Release Strategy 2014
- SWR Development
- SWR Development Planning Proposals Major Projects
- South West Rocks Open Space Strategy Planning Studies 2004
- Macleay Valley Community Infrastructure Strategy 2020
- 40 km/h High Pedestrian Activity Area Guidelines 2002
- Kempsey Shire Development Control Plan 2013
- Local Community Plan 2009 – South West Rocks
- Macleay River Estuary – Coastal Zone Management Plan 2012
- Traffic Modelling Guidelines 2013
- Kempsey Shire Pedestrian Access and Mobility Plan 2016 (PAMP)
- Lower Macleay Floodplain Risk Management Plan as it is finalised
- TfNSW Movement and Place Framework 2022
- Kempsey Shire Council, Development Design Specification D1 – Geometric Road Design
- Saltwater precinct traffic impact assessments
- Local growth maps provided by Council
- Development Application data provided by Council
- Traffic data provided by Council
- Austroads Guide to Traffic Management Part 3: Transport Study and Analysis Methods 2020
- Highway Capacity Manual 2000
- Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling 2021
- Transport for London Modelling Guidelines, TfL Traffic Manager and Network Performance Best Practice 2020

1.6 Report structure

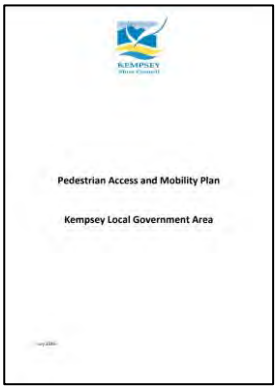
The report is comprised of the following sections:

- **Section 1 – Introduction**: provides an overview of the project objectives and context of the report in the project.
- **Section 2 – Strategic context**: provides the strategic context of South West Rocks with respect to state and local policies as well as the local place context and road hierarchy.
- **Section 3 – Existing conditions review**: provides a review of existing transport in South West Rocks for all modes including freight, public transport, active transport and private vehicle travel.
- **Section 4 – Future transport**: provides a preliminary assessment of future transport demands in South West Rocks to inform future projections for performance assessments and future requirements.
- **Section 5 – Network performance**: quantifies the current and projected performance of the network based on measures analysis undertaken.
- **Section 6 – Road hierarchy**: provides a review of the current hierarchy and recommendations for the proposed hierarchy.
- **Section 7 – Road Network Improvement Strategy**: will summarise the transport and movement analysis outcomes and proposed improvements for consideration.

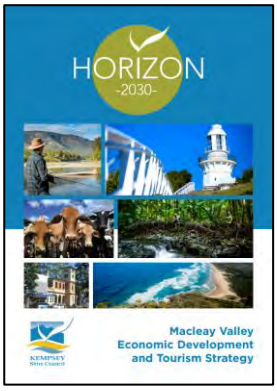
2. Strategic context

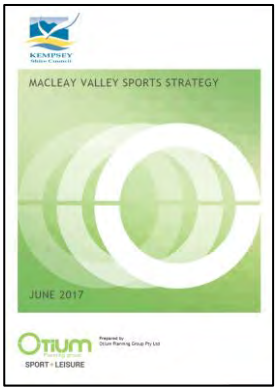
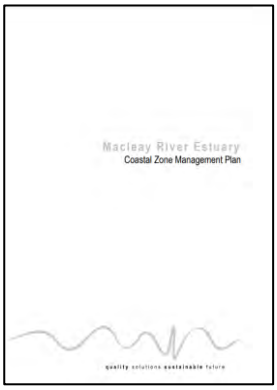
The transport provision in South West Rocks is underpinned by strategy and policy at a state, shire and local area level. Relevant documentation is reviewed in Section 2.1. The place and road hierarchy contexts are reviewed in Sections 2.2 and 2.3 respectively.

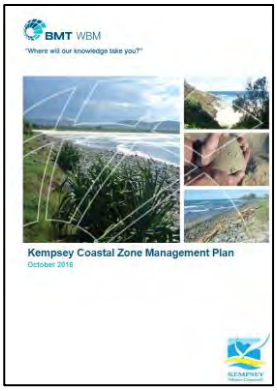
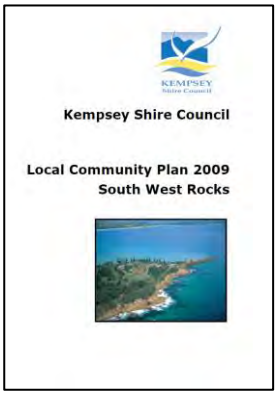
2.1 Literature review

Strategic / Policy publication	Context
State level documents	
40km/h High Pedestrian Activity Area Guidelines **Author:** Roads and Traffic Authority **Year:** 2002 Link	The *40km/h High Pedestrian Activity Guidelines* prepared by the Roads and Traffic Authority (now within Transport for New South Wales) provides guidance, primarily for Council and state officers, for identifying and implementing 40 km/h speed limits in high volume pedestrian areas. It identifies the contribution of vehicle speed to pedestrian injuries and fatalities, identifies steps in implementing 40 km/h speed zones and details possible treatment options.
Shire level documents	
Pedestrian Access and Mobility Plan **Author:** Kempsey Shire Council **Year:** 2016  Link	Kempsey Shire Council developed and adopted a *Pedestrian Access and Mobility Plan* in 2016, which outlines the proposed policies and treatments for pedestrian facilities within the Shire. This is a review and expansion of the previous *Pedestrian Access and Mobility Plan* adopted in 2003. The Plan is aimed at encouraging incorporation of planned improvements into long term and annual budgets, supporting suitable grant funding applications, and incorporating pedestrian mobility and access into other actions and plans. The Plan characterises the area in terms of the existing conditions and future pedestrian needs. Consultation with the community and review of crash data, policies, design guidelines and standards were undertaken to inform route selection, prioritisation, pedestrian movement and crossing facilities, and constraints and opportunities. A schedule of proposed treatments is included, which presents the location, treatment description, priority and cost of the proposed treatments. The Plan also identifies potential funding sources for the treatments and recommends that progress is assessed annually and a review of the Plan undertaken five year after its adoption. The schedule of proposed treatments for South West Rocks includes numerous treatments such as pedestrian refuges, pram ramps, shared paths, footpaths, warning signs, bridges and kerb blisters for over 50 locations.

Strategic / Policy publication	Context
Kempsey Shire Bike Plan **Author:** GHD **Year:** 2018 Link	In 2018 GHD prepared the *Kempsey Shire Bike Plan*, identifying an approach to developing and managing cycling infrastructure in the Shire. High-level objectives of the Plan include: – Facilitation and encouragement of cycling through integration of consistent and continuous cyclist networks. – Facilitation and encouragement of safe and convenient accessibility through linking cyclist concentrations to networks. – Highlight areas that restrict safe and convenient access through identification of clusters and patterns of cyclist crashes. – Integration and development of cyclist routes forming part of the wider connected network. – Providing links to and between Planning Instruments. Previous planning and strategic context were reviewed, community and stakeholder consultation was conducted and the existing cyclist network was audited. Based on this, the issues, constraints and opportunities for cyclist movement and access in major population centres in the Shire were identified. The Plan provides an overview of best practice standards applicable to the treatment of cyclist facilities, proposed cycle improvements aimed at cyclist safety, amenity and access improvements, and priorities for cycle improvements. The Plan recommends numerous pedestrian and cyclist improvements such as on and off-road cyclist routes, bike racks, water stations, and consideration of the needs of cyclists in ongoing maintenance and construction programs including off-road concrete shared paths on several sections of Gregory Street and an off-road concrete shared path between Hill Street and Short Street in South West Rocks.
Macleay Valley Community Infrastructure Strategy **Author:** Kempsey Shire Council **Year:** 2020 Link	In 2020, Kempsey Shire Council prepared a 20-year *Macleay Valley Community Infrastructure Strategy* to provide guidance on managing and planning community infrastructure in Kempsey Shire to respond to the role and characteristics of the diverse townships, local values, demographic profile and community needs. The purpose of the Strategy is to provide Council with a basis for investment in new and upgrades to facilities, and in decommissioning of redundant assets and those that have exceeded their operational life spans. The development of the Strategy was informed by feedback from stakeholders and the community collected through interviews, online surveys and workshops. This framework applies a rate of provision, that is a number of facilities by population range, to community infrastructure categories. The framework was applied to community buildings and open spaces and sporting facilities. Community buildings were found to be in abundance, with no significant gaps in the network, and it was identified that upgrade and expansion of some of these facilities will be required in the future. Open spaces and sporting facilities were also found to be in abundance, however there was found to be significant variation in the quality and usability of such spaces. In order to guide future community infrastructure planning, management and delivery, community infrastructure principles were developed as part of the Strategy. These are evidence-based decisions, ongoing asset management, accessible for all, diverse and place-based, multi-functional and adaptable, and safe. The Strategy then presents actions, possible funding sources, Council's role, and project timing and duration for the following themes: – A connected and inclusive community – Beautiful spaces – Healthy and active community – Policy and planning The connected and inclusive community and policy and planning themes have actions directly related to transport. As part of the connected and inclusive community theme, one of the actions presented is investigation of alternative means of providing access to community infrastructure to residents without access to a car. The policy and planning theme includes a continual improvement of the management of community facilities action.

Strategic / Policy publication	Context
	To assist in the delivery of the Strategy, an assessment framework is presented comprising of four stages; review community facility/facilities, determine Council's initial position, consult the community, and decide next steps. While the Strategy provides recommendations for 20 years, the likely requirement for further investigations and engagement was identified, and it is recommended that the status of actions from the Strategy be reviewed biannually.
Horizon 2030: Macleay Valley Economic Development and Tourism Strategy **Author:** SC Lennon & Associates **Year:** 2019  Link	The *Horizon 2030: Macleay Valley Economic Development and Tourism Strategy* details Council's vision for future economic development to support the creation of a vibrant lifestyle destination where the natural environment, investment, business and industry prosper harmoniously. The Strategy presents an action plan comprising of 62 actions. These actions have been informed by Council's economic development planning principles and the economic development and tourism vision. They are grouped under the following three themes: – Support the development of the Macleay Valley as a location for smart and sustainable agribusiness – Support the development of the Macleay Valley as an enterprising business and country lifestyle destination for investment, learning and employment – Support the development of the Macleay Valley as a premier regional visitor destination Ten of the actions are presented as part of an initial tourism and economic development work plan. One of these actions is the progression of priority actions to develop natural visitor attractions and drive growth in high-yield environmentally sustainable tourism, which will have an effect on the transport network in terms of facilitation of and accommodating such development and growth. The implementation of the Plan is to be carried out by Council and other Kempsey Shire economic development and tourism stakeholders in collaboration with State and Federal Governments, business chambers, private investors, peak industry bodies and progress associations. The Plan is to be monitored annually and an interim review and update is anticipated to be required in 2024.
Kempsey Development Control Plan 2013 **Author:** Kempsey Shire Council **Year:** 2013 Link	The *Kempsey Development Control Plan* contains the land use management statutory framework for the Kempsey Shire local government area. The Plan has 29 objectives, which are separated into general, strategic, infrastructure, urban form and design, heritage and natural environment categories. As part of the infrastructure category, one of the objectives is the ensure the community's traffic and transport needs are catered for effectively and safely in the immediate and long term. The Plan contains detailed guidelines that illustrate the controls that apply to particular types of development, and development in particular areas. These include general developments, residential developments, caravan parks, bed and breakfast accommodation, tourist facilities, urban areas, rural and environmental areas, and villages. Included in these guidelines are considerations of traffic and transport requirements and effects of developments. The Plan specifies development requirements for the purpose of ensuring that unacceptable adverse impacts on neighbouring properties, the environment or cost to the community do not result from a development.

Strategic / Policy publication	Context
Macleay Valley Sports Strategy **Author:** Otium Planning Group **Year:** 2017  Link	In 2017 Otium Planning Group prepared the *Macleay Valley Sports Strategy* for the Kempsey Shire local government area in consultation with local sporting bodies and other stakeholders. The purpose of the Strategy was to outline Council's role in local sport, define the working relationship and establish communication between Council and sporting organisations, identify key issues and establish strategies for dealing with these issues in the immediate and longer term. The Strategy sets out the information used in its formation, the strategic framework outlining the structure and approach used by Council to deal with sport related issues and identifying the methods and system that Council will use to determine sport related provision priorities for a five-to-10-year period, and an assessment and action plan. The assessment and action plan produces a series of programs comprised of specific actions with one-to-four-year timeframes, which are intended to be reviewed and updated annually. In South West Rocks, identified actions include the development of a new sportsground close to the existing site, development of the South West Rocks Sports Complex into a district facility, office, training and meeting facilities at the South West Rocks Surf Club, and various upgrades to the South West Rocks Country Club and tennis courts.
Macleay River Estuary – Coastal Zone Management Plan **Author:** GeoLINK **Year:** 2012  Link	In 2012 GeoLINK prepared a *Coastal Zone Management Plan* for the Macleay River estuary to detail priority actions and strategies to address important community and environmental issues associated with improving the Macleay River estuary's management and health. The Plan includes 30 strategies and associated actions including justification, the responsible organisation / agency, timeframe, specific tasks, estimated costs and potential funding sources. Eight high priority actions for improving the Macleay River estuary's health and management were identified for implementation in the Plan's initial five years, which were estimated to require an approximate investment of $2.1 million, of the total $8 million estimated investment required for all 30 strategies. The key priorities of the plan for these five years were: – Improved management of floodgates and drains – Improvements to floodplain wetlands – Improvements to fishery productivity in the estuary – Improved boating facilities – Strategies to reconnect riverside townships with the Macleay River – Addressing antimony and arsenic contamination within the estuary and floodplain – Planning for sea level rise on the low-lying floodplain – Implementing bank erosion works at key locations – Improving the condition of the riparian corridor Actions to be completed in South West Rocks include upgrade of existing boating facilities at Matty Flat and Back Creek, and investigation of opportunities to improve or establish pedestrian and cycle linkages between the Macleay River Estuary and South West Rocks.

Strategic / Policy publication	Context
Kempsey Coastal Zone Management Plan **Author:** BMT WBM **Year:** 2016  Link	The *Kempsey Coastal Zone Management Plan* was developed through the NSW Coastal Management Framework. A technical assessment of coastal processes and related hazards, and a risk, values and options assessment presented in the *Kempsey Coastline Coastal Zone Management Study* (2014) was used to underpin the Plan. The Plan includes 19 actions for implementation over a five-to-10-year period to manage coastal hazards, including investigation of options for addressing foreshore erosion issues as required along the rock works near the South West Rocks Surf Club and facilitation of discussion with stakeholders to review management arrangements and maintenance dredging for Back Creek in South West Rocks.
Local level documents	
Local Community Plan 2009 – South West Rocks **Author:** Kempsey Shire Council **Year:** 2009  Link	In 2009, Kempsey Shire Council developed the *Local Community Plan - South West Rocks* aimed at developing relationships with the community, problem solving and identifying improvement actions. Community workshop and feedback sessions were held to establish the community visions for the area, which included: – Aged care and services – Green planning – Medical services – Public transport – Youth – Planning – Local government consultation – Community services and facilities – Law and order – Economic development – Infrastructure – Local improvements Based on the community feedback and in alignment with these visions, the Plan was developed to include actions, their priority and Council's role in their implementation. The priority assigned to each of the actions was either low (to be commenced within four years), medium (to be commenced within two years) or high (to be commenced within a year). These actions were planned to have been completed between 2009 and 2012. Actions associated with the green planning vision included acceptance of a limit on future development (high priority). Actions associated with the public transport vision included promotion and advocacy for more community transport and small buses with three round trips to Kempsey per day linked with trains and coaches (high priority), and investigation of transport options and a needs analysis (low priority). Actions associated with the planning vision included master planning incorporating Saltwater precinct and provision of car, caravan and boat parking in or near the town centre (high priority). Actions associated with the infrastructure vision included enhancement of the existing Matty Flat boat launching facilities (high priority), more footpaths and cycleways, increased street lighting, provision of a pedestrian crossing on Gregory Street, a footbridge across Front Creek close to the Country Club, and Back Creek improvements including a cycleway (low priority).

2.2 Place context

In order to analyse the movement and place function of a street, the New South Wales Government have a Movement and Place Framework, in which street environments are defined according to their place qualities and movement functions (see Figure 2.1). This Framework identifies four street environments: main roads, main streets, local streets, and civic spaces. Place can be measured in terms of place intensity, which refers to the level or potential level of human activity in a location, where the greatest, or potential greatest, human activity results in the highest place intensity. Classification of place can help to clarify the existing and desired characterises of a street, and therefore inform and identify the issues and opportunities within a network. The context of road user needs and the complex nature of the transport network should be considered in the assessment of the place context of each individual street which often defines the transport needs.

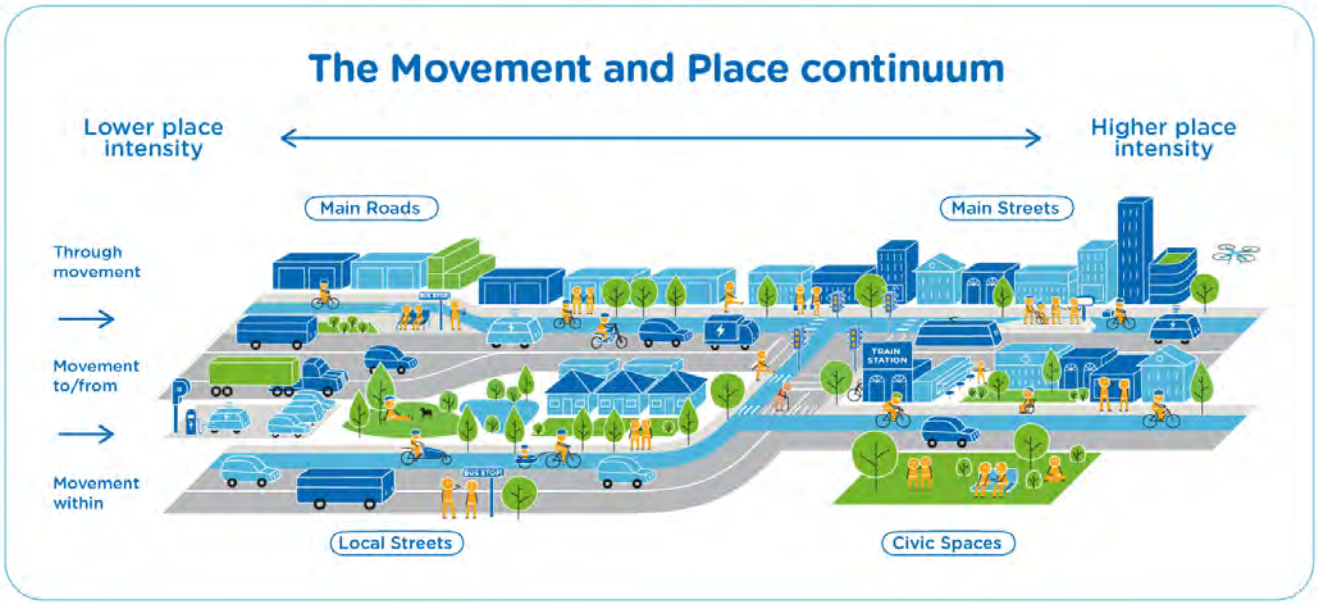


Figure 2.1 The Movement and Place continuum

Imagery obtained from Future Transport Strategy 2056 (TfNSW, 2022), accessed June 2022

Coastal and waterfront communities have a distinctive sense of place created by their history. The coastal village character combined with the surrounding natural environment on the coast and hinterland are what defines South West Rocks as a great place to live and as a tourist destination. The locality is defined by two distinct characters. The original (older) village with Livingstone Street at its core is defined by the ocean, foreshore reserve, heritage sites and landmark trees while the surrounding village contains a mixture of the old and new with new development mixed in with the original character buildings. The newer 'modern' village is separated from the old village by a vegetated buffer and forms the entrance to South West Rocks. The growing onset of modern tourism and a trend towards a 'commuter' lifestyle has seen the township grow with the small single storey cottages and accommodation houses making way for more modern mixed-use two storey developments. Coastal population growth continues to apply strong pressure on coastal land by increasing the need for both housing and land-use demands. Many coastal and waterfront communities have found that conventional development patterns threaten the assets that are highly valued and contribute to the character of a place.

Resilience to natural hazards, such as storms and storm surges, sea-level rise, and shoreline erosion, is inextricably linked to the siting and design of development, as well as to the built and green infrastructure that supports it. It is important that the characteristics that make South West Rocks distinctive are maintained, enhanced and protected.

The *Kempsey Local Environment Plan 2013* makes local environmental planning provisions for land in Kempsey. As part of this, land use zones are included which determine permitted or prohibited development. The land zoning map for the study area is shown in Figure 2.2. A large portion of the study area, particularly in the east and south, are in environmental protection zones (orange) which would attract primarily recreational trips. The towns of South West Rocks, Arakoon, New Entrance are primarily zoned as residential (pink / red) and would be expected to attract commuter trips. Along the northwest coast and foreshore areas of the study area and in South West Rocks there are areas zoned as recreation (green) which are likely to attract recreational trips concentrated during the weekend and during school holidays. In South West Rocks there are some business and industrial zoned areas (blue / purple) which would attract shopping and heavy vehicle trips.

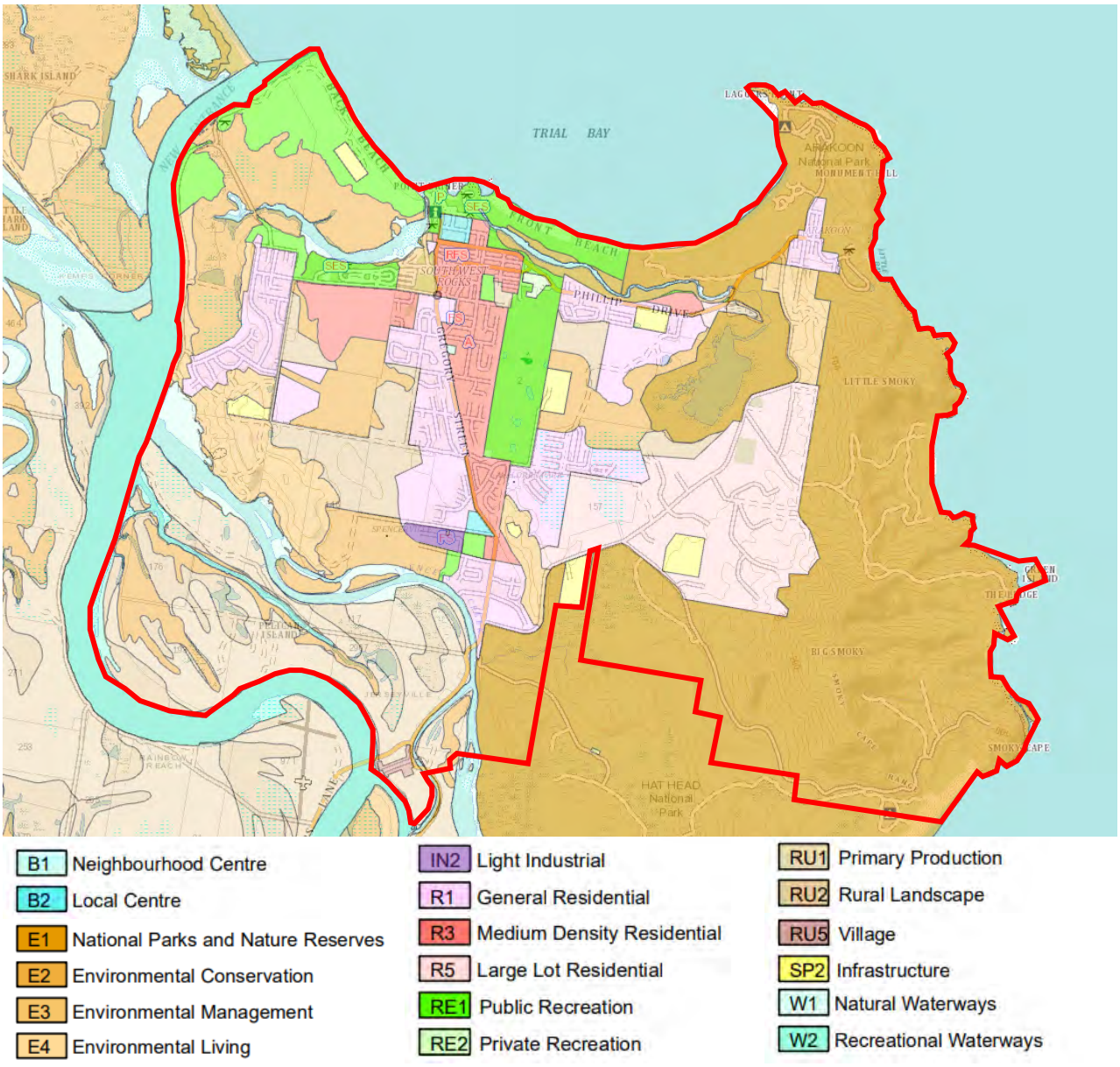


Figure 2.2 Study area zoning

Base imagery obtained from ePlanning Spatial Viewer (Department of Customer Service, 2020), accessed November 2021

It is noted that on 1 December 2022 business and industrial zones will be replaced by the new employment zones under the Standard Instrument (Local Environmental Plans) Order 2006.

2.3 Road hierarchy

Roads in the South West Rocks transport network are currently classified as either regional or local roads. According to the *Schedule of Classified Roads and Unclassified Regional Roads* (RMS, 2017), regional roads are those performing an intermediate function between council controlled local roads and the main arterial network of state roads. Within the study area there are three regional roads; Gregory Street, Plummers Lane and South West Rocks Road, which form the main access routes within, to and from the study area. The remainder of the roads in the study area are classified as local roads. All regional and local roads in the study area are managed and financed by Council, with some State financial assistance provided for the maintenance of regional roads.

A road hierarchy is a framework in which roads are classified based primarily on the need for connectivity between places. The strategic function of individual roads and their wider network relationships are outlined in a road hierarchy. This allows the function of roads to be matched with surrounding land use to ensure that the reasonable access needs of land use are met while maximising safety and network efficiency and minimising amenity conflicts between land use and road use.

From a planning and governance perspective, a road hierarchy can provide a strategic framework in the context of which planning and management of the road network can be conducted. Road authorities can use the hierarchy to guide decisions about operation planning and maintenance of the road network and infrastructure. It can:

– Assist management planning
– Assist land use development
– Guide traffic management decisions, including on issues of road safety, transport efficiency, traffic calming and amenity
– Provide direction for road network planning

Consistent development standards can be established based on each road category's use and surrounding environment. This allows state, regional and local benefits to be maximised through the direction of investments. Additionally, major traffic flows can be directed to appropriate infrastructure though the choice of priority and function assigned to duplicate and parallel routes. Operating performance levels can also be determined based on a road hierarchy to define network wide maintenance intervention levels.

It is appropriate for a road hierarchy to be accompanied by a complementary road network improvement strategy, which details specific works the road authority should take to implement and maintain the objectives of the hierarchy. Priorities for funding should be set out in the short, medium and long term, and updated regularly as new issues and opportunities arise to maintain its relevancy to the real-world situation. It would also be appropriate to review the effectiveness of the overall road hierarchy at regular intervals, although not as regularly as the review of prioritised actions.

The general objective of the road hierarchy should be to provide the basis for the planning, development and maintenance of the network to ensure it meets the ongoing needs of the area. Such needs relate to the movement of people and goods for community, business, tourism and industry purposes. Key issues include accessibility for residents, workers and visitors, travel to, from and within the area and the efficiency with which freight can be moved and with which other business travel can be completed. These issues all contribute to the general wellbeing of an area in terms of social, economic and environmental measures.

A road hierarchy should support the broader strategic goals that Council and the State Government have for the area, and specific objectives and recommendations should be aligned to relevant higher level strategic documents. The hierarchy should also be relatively high level, in that it should address the broad needs of the study area without delving into specific detail of potential projects or treatments. However, there will be specific situations, particularly around key activity centres, where particular localised action might be recommended.

In addition to statutory classifications, design classifications are used to ensure that a road is designed to appropriately serve its intended functions. The predominant function of a road should be clear to motorists from its design. Design classifications currently used by Council include access place / cul-de-sac, local street, collector road, distributor and arterial. Details of the design requirements for these roads are provided in Council's Development Design Specification D1 – Geometric Road Design (Urban and Rural) 2001.

2.4 Summary

The current documented strategic context of transport, movement, land use and development in South West Rocks is contained in various State, Shire and local level strategic documents, as summarised in Section 2.1. The strategic context of transport in South West Rocks includes key themes of accessibility, safety, adaptability, connectedness, long term strategic planning, sustainability and the harmonious integration of the natural and built environments.

South West Rocks is a place defined by its natural environment, in particular its coast and hinterland. It is a community comprised of two distinct villages, an older one along the foreshore and a newer one forming the entrance to the community. The community has been growing due to a 'commuter' lifestyle trend and modern tourism, and pressure has been put and is expected to remain on coastal land through the demand for housing and other land uses.

The current road hierarchy in South West Rocks is based on broad regional classifications which do not encompass the nuances and address the needs of the road network in a local context. An update to the road hierarchy would allow the coordination of road function and surrounding land use to maximise efficiency and safety and minimise road and land use conflicts. Such a hierarchy for the transport network could provide definition and guidance to assist South West Rocks in managing the increasing demands of growth and resilience to natural hazards in accordance with the area's strategic objectives while maintaining, protecting and enhancing the highly valued characteristics of the community. A recommended framework is provided in Section 6.

3. Existing conditions review

A review of the existing transport network conditions has been undertaken based on automatic traffic count (ATC) data, turning count, queue length and travel time data. The data provided for analysis is summarised as follows.
ATC data was provided for the following roads and years:

- Arakoon Road (2014, 2016)
- Belle O'Connor Street (2021)
- Buchanan Drive (2016)
- Gregory Street (2014, 2016, 2018, 2020, 2021)
- Horseshoe Bay Headland Entrance (2018)
- Lawson Street (2016)
- Lighthouse Road (2016)
- Marlin Drive (2015)
- New Entrance Road (2020)
- Phillip Drive (2012, 2015, 2021)
- Steve Eagleton Drive (2021)

Peak turning movement count data was provided for the following intersections and years:

- Lighthouse Road / Arakoon Road (2021)
- Russell Street / Phillip Drive (2021)
- Gregory Street / Steve Eagleton Drive / Belle O'Connor Street (2022)
- Gregory Street / Gordon Young Drive (2021)
- Gordon Young Drive / Gilbert Cory Street / Rudder Street (2021)
- Gregory street / Landsborough Street (2021)
- Gregory Street / McIntyre Street (2021)
- Plummers Lane / South West Rocks Road (2021)
- Gregory Street / Arthur Street (2022)
- Mitchell Street / Arthur Street (2021)
- Landsborough Street / Memorial Avenue (2021)
- Landsborough Street / McIntyre Street / Phillip Drive (2021)
- Simpson Street / Gregory Street (2022)
- Gregory Street / Arakoon Road (2022)

Peak queue length data was provided for the following intersections and times:

- Russell Street / Phillip Drive (2021)
- Gregory Street / Steve Eagleton Drive / Belle O'Connor Street (2022)
- Gregory Street / Gordon Young Drive (2021)
- Gordon Young Drive / Gilbert Cory Street / Rudder Street (2021)
- Gregory street / Landsborough Street (2021)
- Gregory Street / McIntyre Street (2021)
- Plummers Lane / South West Rocks Road (2021)
- Gregory Street / Arthur Street (2022)
- Mitchell Street / Arthur Street (2021)
- Landsborough Street / Memorial Avenue (2021)
- Landsborough Street / McIntyre Street / Phillip Drive (2021)
- Simpson Street / Gregory Street (2022)
- Gregory Street / Arakoon Road (2022)

Travel time data collected in 2022 was provided for the following roads:

- Gregory Street
- Livingstone Street / Memorial Avenue
- Landsborough Street / Phillip Drive / Wilson Street
- Arakoon Road / Russell Street
- Simpson Street / Mitchell Street / Landsborough Street
- Gordon Young Drive
- Gilbert Cory Street
- Marlin Drive
- Ocean Street
- Rudder Street

3.1 Transport network

Key roads within the transport network are shown in Figure 3.1 and summarised in the following sections. In Figure 3.1, the number associated with each road refers to the section in which the road is discussed.

Figure 3.1 Key roads

Base imagery obtained from Google Maps, accessed November 2021

3.1.1 Regional roads

3.1.1.1 Gregory Street

Gregory Street is a regional road connecting South West Rocks Road in the south with Livingstone Street in the north. Acting as the main spine in South West Rocks, it is a sealed two-lane two-way partially divided road with a posted speed limit of 50 km/h along most of its length. There is a school zone adjacent to South West Rocks Public School which has a posted speed limit of 40 km/h during certain times on school days. Within this school zone there is a zebra crossing. There is also a 40 km/h high pedestrian activity area on the northern section of Gregory Street between Landsborough Street and the foreshore.

Kerb and guttering and street lighting is provided along most of Gregory Street's length. Footpaths are provided in various locations, primarily in built up areas. There are some gaps in the network of footpaths on Gregory Street, generally in locations without access to residential or commercial properties from the street and therefore with lower expected pedestrian volumes. There are some sections which include on-street parallel parking lanes and a small section at the northern end of the street where there is on-street angled parking. Some traffic calming measures including pavement markings and kerb bulbing are present along the high pedestrian area and adjacent to the South West Rocks Residential Care Facility.

Gregory Street forms part of the route for the two bus services, with a number of bus stops along its length. A Cavanaugh Bus & Coach Pty Ltd wheelchair accessible service connecting South West Rocks, New Entrance and Arakoon operates along Gregory Street on weekdays. A Busways North Coast Pty Ltd service connecting South West Rocks with Kempsey via Smithtown and Frederickton operates on Gregory Street on weekdays and Saturdays.

3.1.1.2 Plummers Lane

Plummers Lane is a regional rural road serving an arterial connector function connecting Macleay Valley Way, Clybucca in the southwest with South West Rocks Road, Jerseyville in the northeast. It is a sealed two-lane two-way undivided road with a posted speed limit of 80 km/h. Plummers Lane acts as a connection between Macleay Valley Way, Clybucca, Rainbow Reach and the study area, as well as providing access to residential and rural properties. Street lighting is provided at some intersections.

3.1.1.3 South West Rocks Road

South West Rocks Road connects Washington Street, East Kempsey in the southwest with Gregory Street, South West Rocks in the northeast via Gladstone and Jerseyville. It is a regional road between Gregory Street and Plummers Lane, and between Smithtown Road and Washington Street, and is unclassified between Plummers Lane and Smithtown Road. It is a sealed two-lane two-way undivided rural arterial road with posted speed limits of 80 km/h and 60 km/h for 1.5 km on approach to Gregory Street and through Gladstone. South West Rocks Road acts as a connection between East Kempsey, Gladstone and the study area, as well as providing access to residential and rural properties and to Hat Head via Hat Head Road. Street lighting is provided at intersections in Gladstone and with Hat Head Road, Riverside Drive and Plummers Lane.

3.1.2 Local roads

3.1.2.1 Arakoon Road

Arakoon Road is a local road between the towns of South West Rocks and Arakoon, providing access to various residential properties and local roads including Cabbage Tree Lane, Gap Beach Road, Bullocks Quarry Road, Rivendell Road, Rocks View Crescent, Cockatoo Place and Carron Close. Additionally, Arakoon Road provides access to Smoky Cape Lighthouse via Lighthouse Road. It is a sealed two-lane two-way undivided road with a posted speed limit of 80 km/h. No kerb, gutter or street lighting are provided on Arakoon Road. At its southwest end, Arakoon Road connects to Gregory Street via a T-junction where Gregory Street has priority. At its northeast end Arakoon Road continues as Russell Street, a local road connecting to Phillip Drive via a T-junction where Phillip Drive has priority and providing access to several residential properties.

3.1.2.2 Belle O'Connor Street

Belle O'Connor Street is a local road providing access primarily to residential properties. It is a sealed two-lane two-way divided road with a posted speed limit of 50 km/h. It provides access to limited retail, various residential properties and local roads including Peter Mark Circuit, Dennis Crescent, Burrawong Drive and Athena Parade. Kerb and guttering and street lighting are provided. A footpath is provided on the southern side of the road. At its western end, Belle O'Conner Street connects to Gregory Street and Steve Eagleton Drive via a roundabout.

3.1.2.3 Gordon Young Drive

Gordon Young Drive is a local road between Gregory Street in the east and Rudder Street and Gilbert Cory Street in the west. It is a sealed two-lane two-way undivided road with a posted speed limit of 50 km/h. Gordon Young Drive primarily acts as a connection between the primarily residential area in the west and central South West Rocks, and provides access to some residential properties, local road Roy Sanders Street, retirement and holiday homes and the South West Rocks Creek boat ramp.

Street lighting and a footpath on the southern side are provided. A Cavanaugh Bus & Coach Pty Ltd wheelchair accessible service connecting the primarily residential area in the west and central South West Rocks operates along Gordon Young Drive on weekdays.

3.1.2.4 Landsborough Street

Landsborough Street is a sealed two-lane two-way undivided road with a default speed limit of 50 km/h. It provides access to various residential properties, businesses and Brighton Park. Kerb and guttering and street lighting are provided along its length with the exception of the section adjacent to Brighton Park. On street parallel parking is permitted along most of its length, with central median and some angle parking space provided at its western end. At its western end Landsborough Street connects to Gregory Street via a T-junction where Gregory Street has priority. At its eastern end Landsborough Street connects to Phillip Drive and McIntyre Street via a roundabout.

3.1.2.5 Lighthouse Road

Lighthouse Road is a local road providing access to Smoky Cape Lighthouse from Arakoon Road. It is a sealed two-lane two-way undivided road with a posted speed limit of 80 km/h. In addition to providing access to the Smoky Cape Lighthouse, Lighthouse Road also provides access to several residential properties via local road Wonga Place, Arakoon cemetery, several recreational walking and camping tracks and Captain Cook lookout.

At the end of the Lighthouse Road where it culminates at Smoky Cape Lighthouse, on street parking is provided. No on-street parking is provided at other locations along its length. At its northwest end, Lighthouse Road connects to Arakoon Road via a T-junction where Arakoon Road has priority.

3.1.2.6 Marlin Drive

Marlin Drive is a local road between New Entrance Road in the west and Gilbert Cory Street in the east. It is a two-lane two-way road with a default speed limit of 50 km/h. Marlin Drive provides access to various residential properties and local roads including Riverview Place, Grandview Place, Salmon Circuit, Dilberang Close and Ocean Street.

Kerb and guttering and street lighting are provided and on street parallel parking is permitted on both sides of the street. A footpath is provided on one side of the road along some of the section between New Entrance Road and Riverview Place. At its western end Marlin Drive connects with New Entrance Road via a T-junction where New Entrance Road has priority. At its eastern end Marlin Drive connects to Gilbert Cory Street via a T-junction where Gilbert Cory Street has priority. A Cavanaugh Bus & Coach Pty Ltd wheelchair accessible service connecting New Entrance and South West Rocks operates along a small section of Marlin Drive on weekdays.

3.1.2.7 New Entrance Road

New Entrance Road is a local road between a jetty and parking area south of Marlin Drive and Quarry Street, primarily along the foreshore of the Macleay River in New Entrance. It is a sealed two-lane two-way undivided road with posted speed limits of 70 km/h and 50 km/h for 400 m on approach to Marlin Drive and Quarry Street. There is a short section where the road reduces to a one-lane two-way bridge over South West Rocks Creek, where northbound traffic has priority. Various boat ramps and jetties can be accessed from New Entrance Road, as well as the Riverside Tavern.

Kerb and guttering and a footpath are provided between Marlin Drive and the Riverside Tavern. At its southern end New Entrance Road connects to Marlin Drive via a T-junction where New Entrance Road has priority. At its other end New Entrance Road connects to Quarry Street via a staggered give way junction with Kevin Hogan Place where Quarry Street has priority.

3.1.2.8 Phillip Drive

Phillip Drive is a local road that starts at its roundabout with Landsborough Street and McIntyre Street in South West Rocks and ends at Wilson Street in Arakoon. It is a sealed two-way two-lane undivided road with posted speed limits of 50 km/h and 60 km/h. Phillip Drive acts as a connection between South West Rocks and Arakoon, and provides access to residential properties, accommodation, retail, recreational and tourist facilities and local roads including Sportmans Way, Francis Harris Close, Les Gilligan Place, Wongarl Avenue, Hillier Parade, Waianbar Avenue, Trial Street, Grey Street and Russell Street.

Kerb and guttering, street lighting, permitted on-street parallel parking and limited footpaths are provided on some sections of Phillip Drive, primarily along its western section in South West Rocks. At its western end, Phillip Drive connects to Landsborough Street and McIntyre Street via a roundabout. At its eastern end Phillip Drive continues as Wilson Street, a local road providing access to several residential properties in Arakoon. A Cavanaugh Bus & Coach Pty Ltd wheelchair accessible service connecting South West Rocks and Arakoon operates along Phillip Drive on weekdays.

3.1.2.9 Steve Eagleton Drive

Steve Eagleton Drive is a local road providing access to various residential properties and the South West Rocks Community Health Centre. It is a sealed two-lane two-way partially divided road with a default speed limit of 50 km/h. Steve Eagleton Drive provides access to local roads including Trevor Judd Avenue, Mertens Place and Yulgilbar Place. Kerb and guttering, street lighting and a footpath on the southern side of the road is provided and on street parallel parking is permitted along the majority of its length. At its eastern end, Steve Eagleton Drive connects to Gregory Street and Belle O'Connor Street via a roundabout.

3.1.2.10 Mitchell Street

Mitchell Street is a local road between Paragon Avenue in the north and Simpson Street in the south. It is a sealed two-lane two-way undivided road with a default speed limit of 50 km/h between Simpson Street and Landsborough Street and a speed limit of 40 km/h north of Landsborough Street. Mitchell Street provides access to local roads including Arthur Street, Flinders Street, Marriot Street, Hill Street, Pacific Street, McIntyre Street, Bayview Street and Landsborough Street. Kerb and guttering and a footpath on its western side are provided for the majority of its length. At its southern end, Mitchell Street connects to Simpson Street at a T-junction where Mitchell Street has priority. At its northern end Mitchell Street continues as Paragon Avenue, a local road providing access to shops and accommodation in the South West Rocks town centre.

3.1.2.11 Arthur Street

Arthur Street is a local road providing access to various residential properties. It is a sealed two-lane two-way undivided road with a default speed limit of 50 km/h. Arthur Street provides access to local roads include Colonial Crescent, Lawson Street, Bruce Field Street, Wentworth Avenue, Sturt Street, Mitchell Street and Athol Elliot Place. Kerb and guttering is provided along its length and on street parallel parking is permitted along the majority of its length. At approximately halfway along its length, Arthur Street intersects with Gregory Street at a give way intersection where Gregory Street has priority. At its eastern end Arthur Street continues as Cook Drive, a local road providing access to residential properties and local roads including The Quay and Oxley Place.

3.1.2.12 McIntyre Street

McIntyre Street is a local road between Gregory Street in the west and Landsborough Street and Phillip Drive in the east in the South West Rocks town centre. It is a sealed two-lane two-way undivided road with a default speed limit of 50 km/h. McIntyre Street provides access to residential properties and some accommodation. Kerb and guttering is provided along its length and on-street parallel parking is permitted along the majority of its length. At the eastern end, McIntyre Street connects to Landsborough Street and Phillip Drive via a roundabout, and at its western end connects to Gregory Street via a T-junction where Gregory Street has priority.

3.2 Vehicular traffic

3.2.1 Peak hour traffic volumes

Peak hour traffic volumes from daily profiles provided by Council for Gregory Street, Phillip Drive, Horseshoe Bay Headland Entrance, Belle O'Connor Street, Marlin Drive, New Entrance Road and Steve Eagleton Drive for the most recent survey year are summarised in Table 3.1. Gregory Street had the highest peak hour volumes both on weekday and weekends, consistent with its role as the main spine in South West Rocks. Horseshoe Bay Headland Entrance and Belle O'Connor Street both had similar peak hour volumes on weekdays with greater differences on weekends. Of these two roads, Belle O'Connor Street had the lowest weekend peak volumes, likely as it does not attract recreational trips. Marlin Drive, New Entrance Road and Steve Eagleton Drive had the lowest weekday and weekend peak hour volumes. These roads provide access to fewer properties or recreational activities than the other roads for which data is available.

Table 3.1 Peak hour traffic volumes

Location	Survey Year	AM Peak Volume (veh/h)		PM Peak Volume (veh/h)	
		Weekday	Weekend	Weekday	Weekend
Gregory Street	2021	603	541	598	528
Phillip Drive	2021	280	316	294	283
Horseshoe Bay Headland Entrance	2018	130	180	120	155
Belle O'Connor Street	2021	128	120	120	103
Marlin Drive	2015	80	95	78	75
New Entrance Road	2020	59	83	56	71
Steve Eagleton Drive	2021	67	53	59	44

3.2.2 Daily traffic profiles

Daily traffic profiles, representing data per hour, were provided by Council for Gregory Street, Phillip Drive, Horseshoe Bay Headland Entrance, Belle O'Connor Street, Marlin Drive, New Entrance Road, and Steve Eagleton Drive. The daily traffic profiles for the most recent years at each of these count sites are provided in Figure 3.2, Figure 3.4 and Appendix B.

The majority of the traffic profiles show either a fairly constant peak throughout the day or a more pronounced peak in the middle of the day.

The traffic profiles for Gregory Street are provided in Section 3.2.2.1 with similar profiles observed for Belle O'Connor Street, Marlin Drive and Steve Eagleton Drive provided in Appendix B. These profiles have similar characteristics, with two distinct peaks of similar magnitude in the AM and PM in the weekday profiles, and weekend profiles with significant AM peaks. This suggests that these roads may be utilised for commuter trips during the week, however the AM peaks are later than is typical of such commuter trips. The weekday volumes are generally higher than the weekend volumes on these roads, with the exception of Marlin Drive, which has a significant weekend AM peak, likely due to the access it provides to New Entrance Road and the Macleay River foreshore.

The traffic profiles for Phillip Drive are provided in Section 3.2.2.2 with similar profiles observed at Horseshoe Bay Headland Entrance and New Entrance Road provided in Appendix B. Weekday and weekend peaks are evident in the middle of the day, with weekend volumes generally greater than the weekday volumes. These profiles do not have significant and separate AM and PM peaks, with the exception of the weekday profile on Phillip Drive. These traffic profiles are consistent with the nature of these roads, showing increased activity during the weekend, due to the access they provide to recreational areas and facilities.

3.2.2.1 Gregory Street

The daily traffic profile for Gregory Street, which acts as the main traffic carrying spine in South West Rocks, is provided in Figure 3.2. The weekday profile has two smooth peaks of similar magnitude; an AM peak between 8:00 AM and 9:00 AM and a PM peak between 3:00 PM and 4:00 PM. The volumes between these peaks are not significantly below the peak volumes, resulting in an almost constant peak throughout the day which indicates that commuter trips are not significantly more dominant than other trips. The weekend profile has a single peak between 11:00 AM and 12:00 PM, which is lower than the weekday peak volumes.

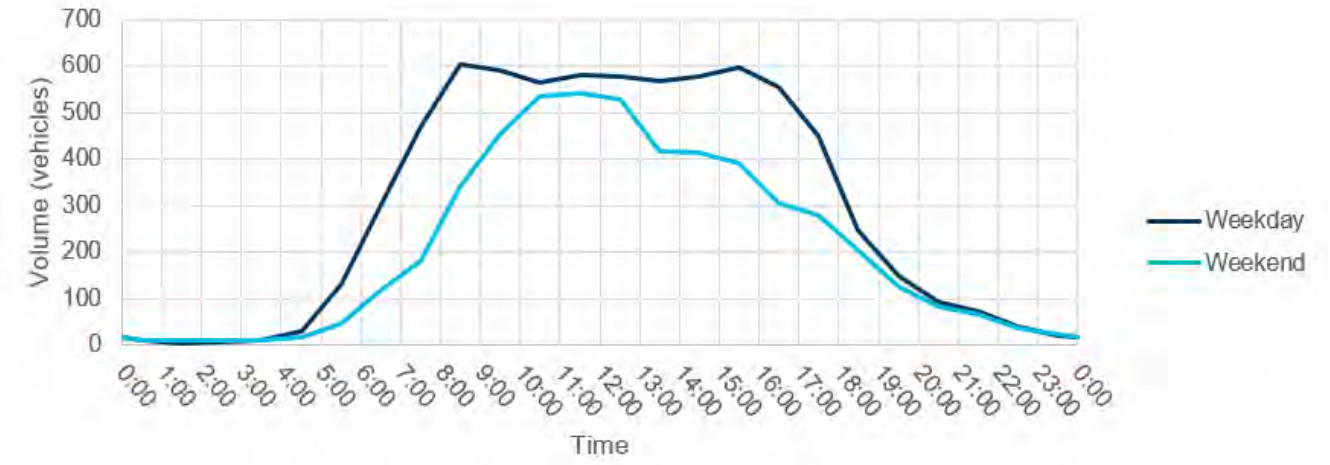


Figure 3.2 Gregory Street daily traffic profile 2021

This profile is representative of the traffic on Gregory Street 62 m south of Spencers Creek Road but is not necessarily representative of the whole corridor. As Gregory Street extends through South West Rocks, it serves several purposes based on the surrounding land use and location. At its northern end, Gregory Street is a high pedestrian area providing access to the town centre and beachfront area. At its southern end Gregory Street performs more of an arterial road function, funnelling all traffic into and out of the study area. In between, Gregory Street provides access to residential developments, local roads and shopping precincts. As such, the traffic profile, while not experiencing dramatic variations, is not constant along its length. This is illustrated in Figure 3.3, which shows the average daily traffic at various points along Gregory Street in 2021.

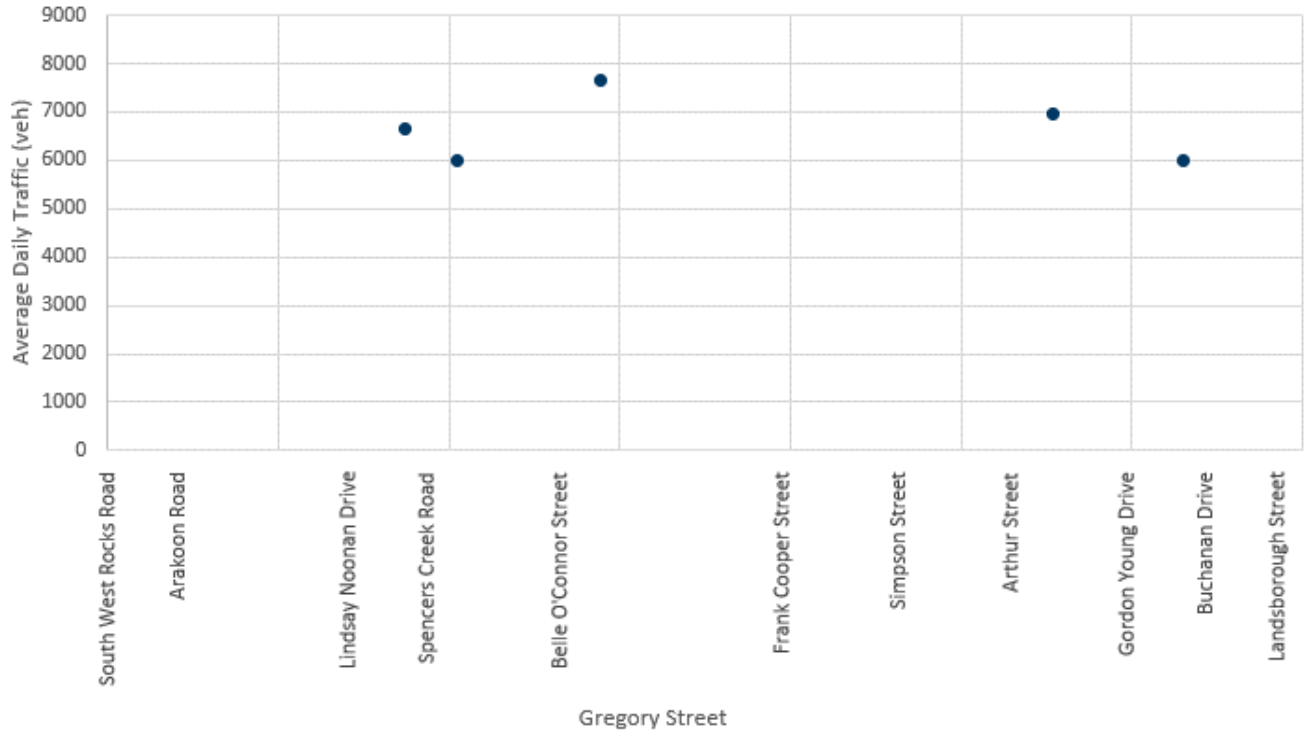


Figure 3.3 2021 average daily traffic on Gregory Street

3.2.2.2 Phillip Drive

The daily profile for Phillip Drive, which acts as a primary connection between South West Rocks and Arakoon and provides access to various residential and recreational areas and facilities, is shown in Figure 3.4. The weekday profile has an AM peak between 11:00 AM and 12:00 PM, and a PM peak between 12:00 PM and 1:00 PM followed by a smaller secondary PM peak between 2:00 PM and 3:00 PM. The weekday profile is smoother with a more sustained peak throughout the middle of the day, smaller than the weekend peaks.

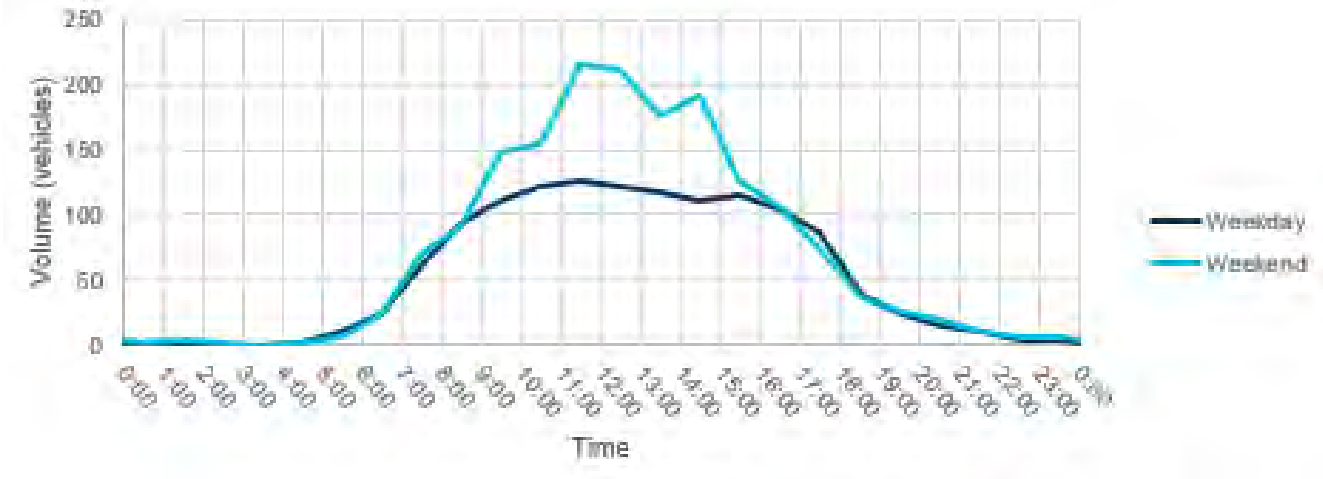


Figure 3.4 Phillip Drive daily traffic profile 2015

3.2.3 Daily traffic data

Average daily traffic (ADT), average weekday traffic (AWDT) and average weekend daily traffic (AWET) data was provided by Council for Arakoon Road, Belle O'Connor Street, Buchanan Drive, Gregory Street, Horseshoe Bay Headland Entrance, Lawson Street, Lighthouse Road, Marlin Drive, New Entrance Road, Phillip Drive and Steve Eagleton Drive. Values of each of these for the most recent survey year in each location are provided in Table 3.2.

The highest values of ADT, AWDT and AWET were observed on Gregory Street. Arakoon Road, Horseshoe Bay Headland Entrance, Lighthouse Road and New Entrance Road were all observed to have greater AWETs than AWDTs, indicating that their use for recreational trips on weekends is greater than their function as commuter routes on weekdays.

Table 3.2 Average daily, weekday and weekend traffic volumes

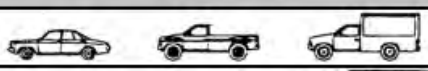
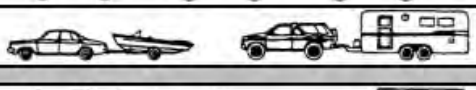
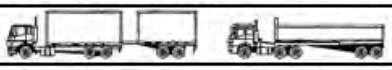
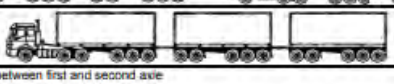
Location	Survey Year	ADT	AWDT	AWET
Gregory Street	2021	6645	7247	5140
Phillip Drive	2021	3134	3220	2918
Buchanan Drive	2016	1575	1652	1381
Horseshoe Bay Headland Entrance	2018	1339	1259	1538
Belle O'Connor Street	2021	1326	1424	1087
Arakoon Road	2016	1090	1094	1980
Marlin Drive	2015	887	901	850
Steve Eagleton Drive	2021	644	727	481
New Entrance Road	2020	593	543	718
Lighthouse Road	2016	283	237	399
Lawson Street	2016	182	194	152

3.2.4 Vehicle class profile

Vehicle class profile data was provided by Council for Arakoon Road, Belle O'Connor Street, Buchanan Drive, Gregory Street, Horseshoe Bay Headland Entrance, Lawson Street, Lighthouse Road, New Entrance Road and Steve Eagleton Drive. Class breakdowns of vehicles travelling along these roads are provided in Figure 3.6 and Appendix C.

Vehicle classes are defined according to the Austroads Vehicle Classification System, which is shown in Figure 3.5.

AUSTROADS Vehicle Classification System

Level 1 Length (indicative) Type	Level 2 Axles and Axle Groups Axles	Groups	Level 3 Vehicle Type Typical Description	AUSTROADS Classification Class	Parameters	Typical Configuration
			LIGHT VEHICLES			
Short up to 5.5m		1 or 2	**Short** Sedan, Wagon, 4WD, Utility, Light Van, Bicycle, Motorcycle, etc	1	d(1) ≤ 3.2m and axles = 2	
Medium 5.5m to 14.5m	3, 4 or 5	3	**Short - Towing** Trailer, Caravan, Boat, etc	2	groups = 3 d(1) ≥ 2.1m, d(1) ≤ 3.2m, d(2) ≥ 2.1m and axles = 3, 4 or 5	
			HEAVY VEHICLES			
	2	2	**Two Axle Truck or Bus**	3	d(1) > 3.2m and axles = 2	
	3	2	**Three Axle Truck or Bus**	4	axles = 3 and groups = 2	
	> 3	2	**Four Axle Truck**	5	axles > 3 and groups = 2	
Long 11.5m to 19.0m	3	3	**Three Axle Articulated** Three axle articulated vehicle, or Rigid vehicle and trailer	6	d(1) > 3.2m, axles = 3 and groups = 3	
	4	> 2	**Four Axle Articulated** Four axle articulated vehicle, or Rigid vehicle and trailer	7	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2m axles = 4 and groups > 2	
	5	> 2	**Five Axle Articulated** Five axle articulated vehicle, or Rigid vehicle and trailer	8	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2m axles = 5 and groups > 2	
	≥ 6	> 2	**Six Axle Articulated** Six axle articulated vehicle, or Rigid vehicle and trailer	9	axles = 6 and groups > 2 or axles > 6 and groups = 3	
Medium Combination 17.5m to 36.5m	> 6	4	**B Double** B Double, or Heavy truck and trailer	10	groups = 4 and axles > 6	
	> 6	5 or 6	**Double Road Train** Double road train, or Medium articulated vehicle and one dog trailer (M.A.D.)	11	groups = 5 or 6 and axles > 6	
Large Combination Over 33.0m	> 6	> 6	**Triple Road Train** Triple road train, or Heavy truck and three trailers	12	groups > 6 and axles > 6	

Definitions: Group: Axle group, where adjacent axles are less than 2.1m apart
Groups: Number of axle groups
Axles: Number of axles (maximum axle spacing of 10.0m)

d(1): Distance between first and second axle
d(2): Distance between second and third axle

Figure 3.5 Austroads vehicle classification system

Imagery obtained from Government of South Australia Department for Infrastructure and Transport (Austroads, 1994), accessed August 2022

The majority of vehicle class data was provided according to ARX, which is a modification of the Austroads vehicle classification. From this data, vehicles have been aggregated into light, medium, heavy, bicycle / motorcycle (or bicycle and motorcycle separately), or unclassifiable categories. It should be noted that the Austroads vehicle classification determines that vehicle of Class 3 and above as heavy vehicles, which encompasses the medium and heavy categories in Figure 3.6 and Appendix C.

On all surveyed roads light vehicles represent the largest proportion (between 0.74 and 0.95) of all vehicle classes. The majority of heavy vehicles according to the Austroads classification were two, three or four axle trucks or buses.

The vehicle class profile for Gregory Street, which acts as the main traffic carrying spine in South West Rocks, is provided in Figure 3.6.

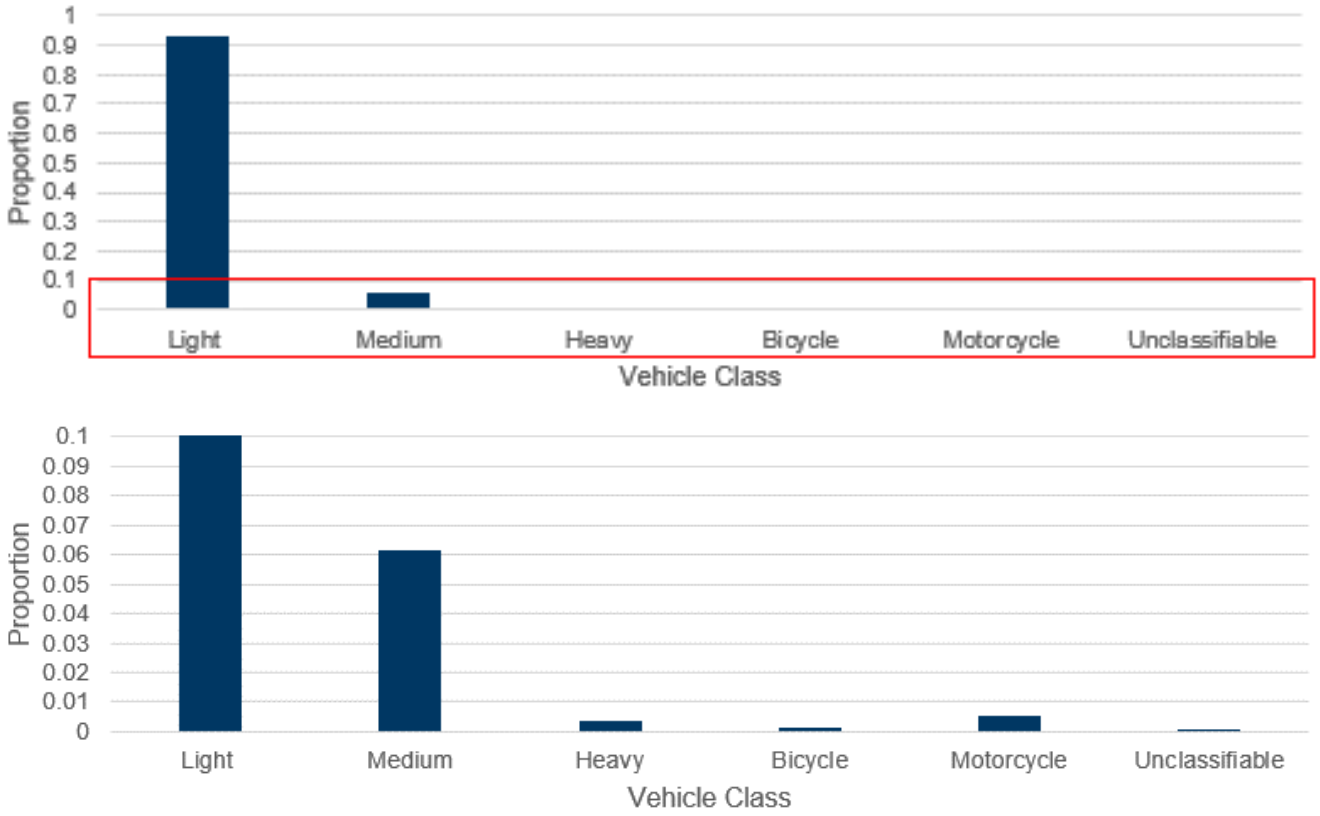


Figure 3.6 Vehicle class proportion on Gregory Street 2021

Vehicle class profile data for Gregory Street, 120 m north of Belle O'Connor Street in March 2021

The vehicle class profiles for Arakoon Road, Buchanan Drive, Lawson Street, and Lighthouse Road are provided in Appendix C. On these roads light vehicles represent the largest proportion by far (between 0.92 and 0.95), followed by medium vehicles (between 0.04 and 0.07), bicycles / motorcycles (between 0.02 and 0.03) and heavy vehicles (<0.01) respectively.

Belle O'Connor Street and Steve Eagleton Drive have similar vehicle class profiles, reflecting their similar location and function providing access primarily to residential properties. On each of these roads light vehicles represent the largest proportion, though a smaller proportion (0.86 and 0.74 respectively) than that of the surrounding network for which such data is available. The medium vehicle proportions were very similar on these roads, representing 0.13 and 0.12 respectively. In both cases, heavy vehicles, bicycles, motorcycles and unclassifiable vehicles represented similar proportions, with these classifications accounting for proportions of around 0.01 on Belle O'Connor Street and around 0.04 on Steve Eagleton Drive. The vehicle class profiles for these roads are provided in Appendix C.

Horseshoe Bay Headland Entrance and New Entrance Road have similar vehicle class profiles, as provided in Appendix C. Each have large proportions of light vehicles (0.93 and 0.91 respectively), followed by small proportions of medium vehicles (0.07 and 0.09 respectively) and very small proportions of heavy vehicles (<0.01). Neither have any bicycles, motorcycles or unclassifiable vehicles recorded. This reflects the similar nature of these roads, as they provide access primarily to the foreshore / beach and associated recreational facilities.

Vehicle class data was not provided for Marlin Drive or Phillip Drive. The proportion of heavy vehicles has been estimated for these locations. The nearest location to Marlin Drive where data on the proportion of heavy vehicles has been provided is New Entrance Road, which was observed as having 9% heavy vehicles. Due to the proximity of the New Entrance Road and Marlin Drive traffic count locations, and the similar traffic volumes at these locations, Marlin Drive is assumed to have a heavy vehicle proportion of 9%.

The nearest location to Phillip Drive where data on the proportion of heavy vehicles has been provided is Horseshoe Bay Headland Entrance, which was observed as having a heavy vehicle proportion of 7%. Due to the proximity of the Horseshoe Bay Headland Entrance and Phillip Drive traffic count locations, Phillip Drive is assumed to have a heavy vehicle proportion of 7%. As Phillip Drive was observed to have more than double the volume of traffic observed at Horseshoe Bay Headland Entrance, this assumption is considered conservative.

3.2.4.1 Heavy vehicles proportions at intersections

The locations of surveyed intersections, and midblock portions with heavy vehicle proportion data can be seen in Figure 3.7. Heavy vehicle proportion data provided were provided by the Council for the following midblock locations: Arakoon Road, Belle O'Connor Street, Buchanan Drive, Gregory Street, Horseshoe Bay Headland Entrance, Lawson Street, Lighthouse Road, New Entrance Road and Steve Eagleton Drive.

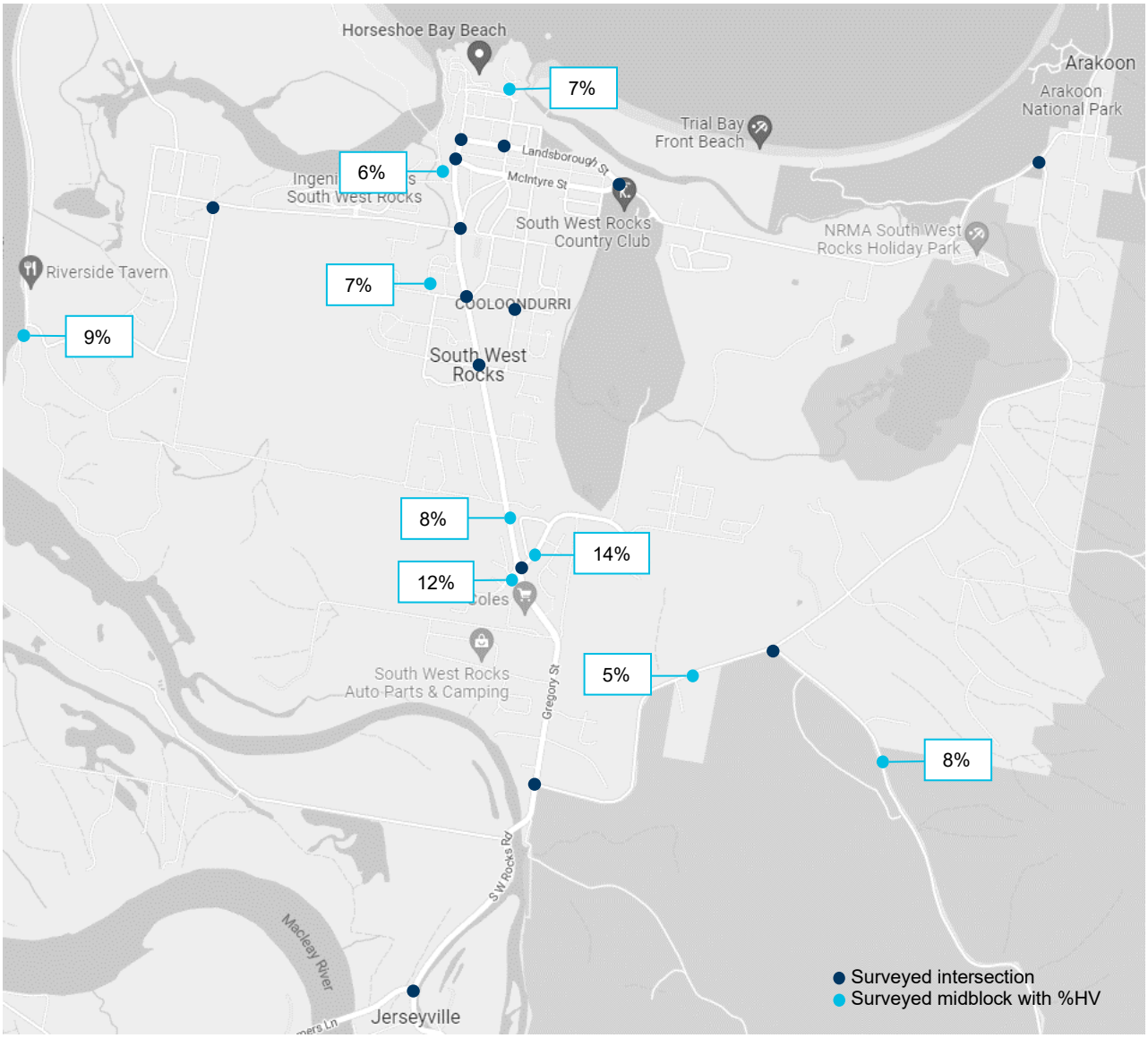


Figure 3.7 Surveyed intersections and midblock locations with heavy vehicle proportion data
Base imagery obtained from Google Maps, accessed April 2022

3.2.5 Traffic speeds

Average and 85th percentile traffic speed data was provided by Council for Arakoon Road, Belle O'Connor Street, Buchanan Drive, Gregory Street, Horseshoe Bay Headland Entrance, Lawson Street, Lighthouse Road, Marlin Drive, New Entrance Road, Phillip Drive and Steve Eagleton Drive. The speed data for the most recent survey year in each location is summarised in Table 3.3.

The weekday and weekend average speeds were fairly consistent in each of the locations, differing by up to 2 km/h in each location.

Table 3.3 Traffic speed data (km/h)

Location	Survey Year	85th Percentile	Average	Weekday 85th Percentile	Weekday Average	Weekend 85th Percentile	Weekend Average
Arakoon Road	2016	79	69	79	69	80	70
Belle O'Connor Street	2021	39	34	39	33	39	34
Buchanan Drive	2016	42	34	42	34	43	36
Gregory Street	2021	56	51	-	-	-	-
Horseshoe Bay Headland Entrance	2018	19	16	-	-	-	-
Lawson Street	2016	33	27	33	27	33	28
Lighthouse Road	2016	67	58	67	57	68	58
Marlin Drive	2015	53	45	-	-	-	-
New Entrance Road	2020	30	24	-	-	-	-
Phillip Drive	2021	52	46	-	-	-	-
Steve Eagleton Drive	2021	33	27	33	27	33	26

In addition, 85th percentile and average daily speed profile data was provided by Council for Belle O'Connor Street, Gregory Street and Steve Eagleton Drive. The speed data was obtained from tube count data and as such is point speed data rather than the average speed for each road. The speeds on Belle O'Connor Street, Gregory Street and Steve Eagleton Drive would likely vary slightly block to block depending on environmental factors such as on-street parking, side roads / intersections and surrounding land use.

The daily speed profiles for Belle O'Connor Street 25 m north-east of Gregory Street in 2021 are presented in Figure 3.8. It is observed that the speed profile is generally even across the day, with the greatest variation overnight. The 85th percentile speed was observed to be generally between 5 km/h and 12 km/h below the speed limit of 50 km/h.

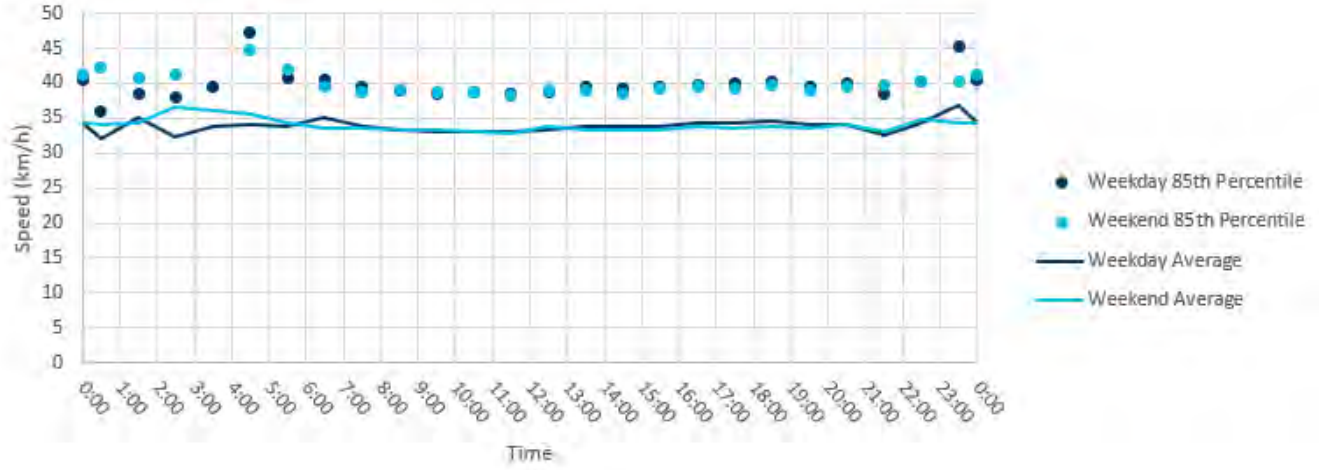


Figure 3.8 Belle O'Connor Street daily speed profiles 2021

One data between 3:00 and 4:00 AM on the weekend has been removed.

The daily speed profiles for Gregory Street 120 m north of Belle O'Connor Street in 2021 are presented in Figure 3.9. It is observed that the speed profile is generally even across the day, with a small peak between 3:00 AM and 4:00 AM on the weekend. The 85th percentile speed was observed to be between 3 km/h and 24 km/h greater than the speed limit of 50 km/h. The average speed was observed to be between 2 km/h below and 10 km/h above the speed limit. The profiles indicate a trend of motorists not complying with the speed limit at this point on the corridor.

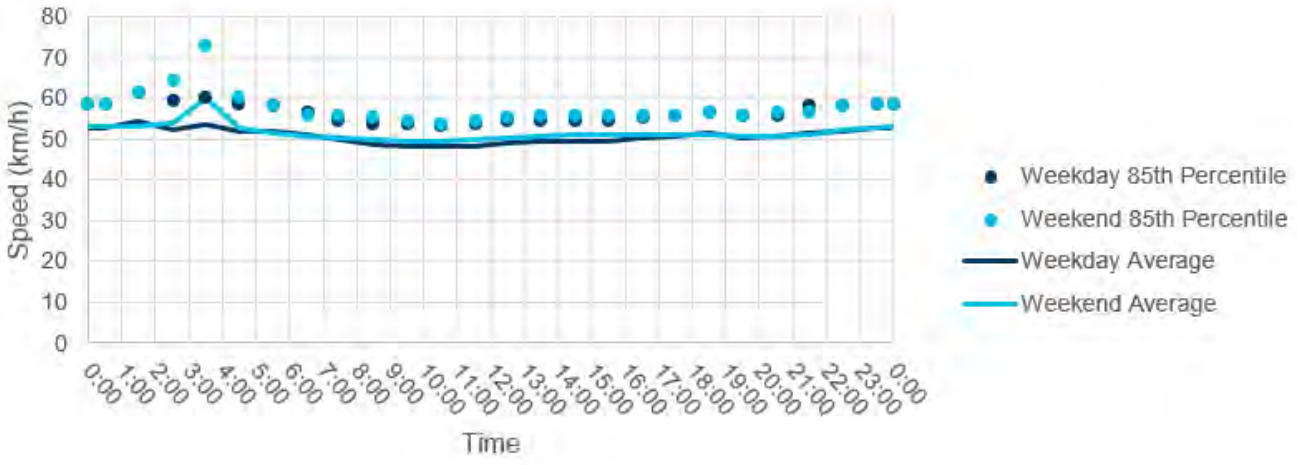


Figure 3.9 Gregory Street daily speed profiles 2021

Daily speed profile data for Gregory Street, 120 m north of Belle O'Connor Street in March 2021

The daily speed profiles for Steve Eagleton Drive 29 m west of Gregory Street in 2021 are presented in Figure 3.10. It is observed that the speed profile is somewhat even across the day, with the exception of the period between 12:00 AM and 6:00 AM. The 85th percentile speed was observed to be generally between 15 km/h and 20 km/h below the speed limit of 50 km/h. Given the proximity of the measurement location to the intersection with Gregory Street and Belle O'Connor Street and the median strip at this point, it is possible that these geometric constraints are contributing to speeds being significantly below the speed limit.

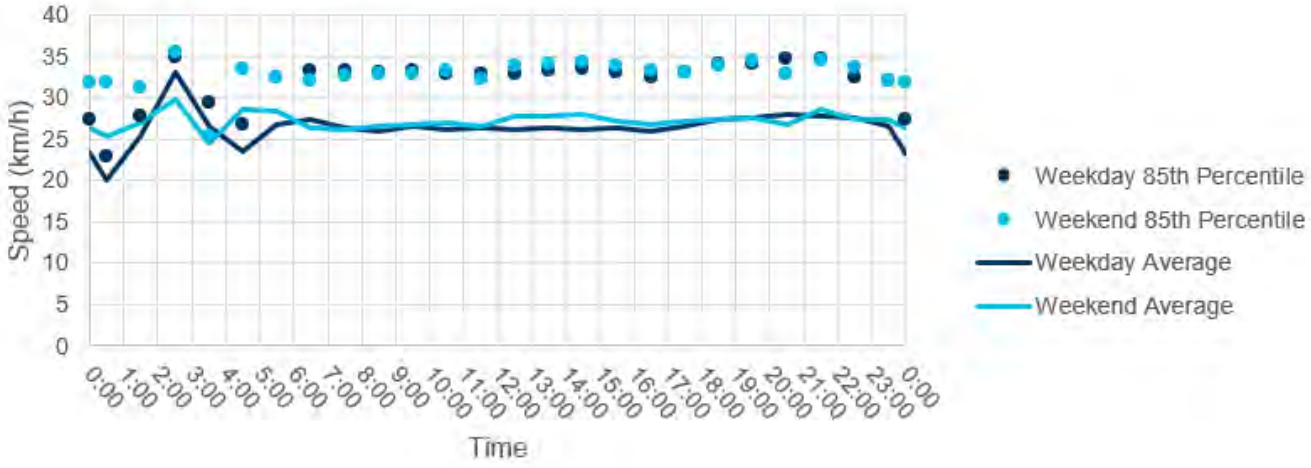


Figure 3.10 Steve Eagleton Drive daily speed profiles 2021

3.2.6 Travel times

Travel time data was provided by Council for Gregory Street, Livingstone Street / Memorial Avenue, Landsborough Street / Phillip Drive / Wilson Street, Arakoon Road / Russell Street, Simpson Street / Mitchell Street / Landsborough Street, Gordon Young Drive, Gilbert Cory Street, Marlin Drive, Ocean Street / Rudder Street, and Rudder Street. Travel times were measured intersection to intersection and do not include travel times through intersections at start and finish points. Measurements were undertaken over a three week period during mid-week days. Complete travel time data is provided in Appendix D, and the routes on which travel time was measured are shown in Figure 3.11.

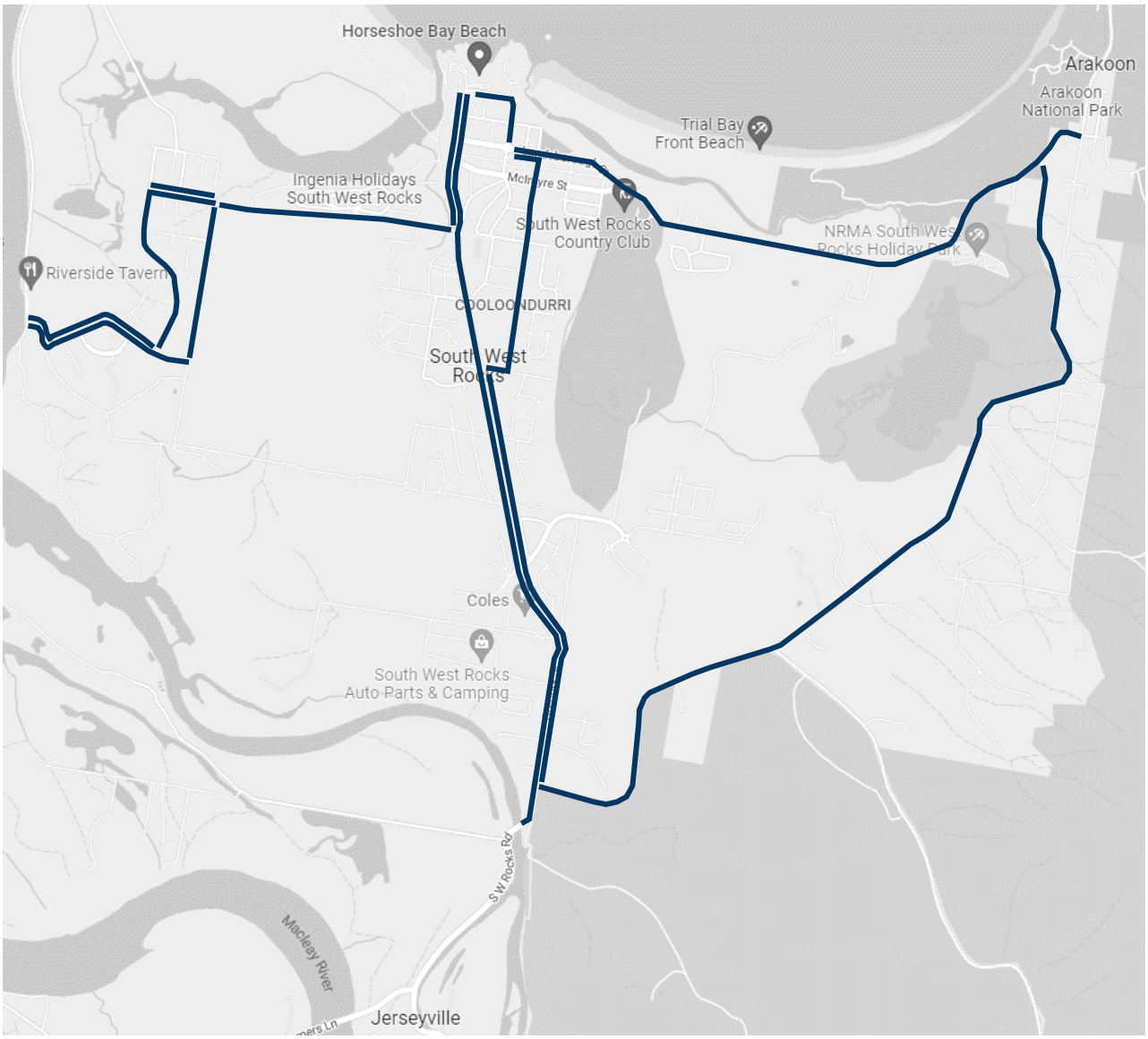


Figure 3.11 Travel time routes

Base imagery obtained from Google Maps, accessed April 2022

Average travel time data is summarised by direction in Table 3.4. It is observed that average travel times on any single route do not differ significantly by direction. The greatest difference observed is on Gregory Street between Arakoon Road and Simpson Street, where the southbound travel time was 16 seconds longer than the northbound travel time. Assuming this data is representative of typical conditions in the study area, the average travel time observed, the speed limit, road conditions and the length of each route indicate that in general there may be some but not significant congestion affecting travel time on key routes.

On Gregory Street, Simpson Street / Mitchell Street / Landsborough Street, and Ocean Street / Rudder Street three northbound travel time measurements were taken, and one southbound was taken. On Gordon Young Drive and Marlin Drive between Gilbert Cory Street and New Entrance Road three westbound travel time measurements were taken, and one eastbound was taken. On the remaining routes, two travel time measurements were taken in each direction. Where only one measurement is available for a direction, it is not possible to identify and exclude any potential outlying travel time data.

Table 3.4 Average travel time by direction

Street	Start	Finish	Direction	Average Travel Time
Gregory Street	South West Rocks Road	Livingstone Street	Northbound	5 m 0 s
	Livingstone Street	South West Rocks Road	Southbound	5 m 12 s
	Arakoon Road	Simpson Street	Northbound	3 m 1 s
	Simpson Street	Arakoon Road	Southbound	3 m 17 s
	Gordon Young Drive	Livingstone Street	Northbound	1 m 14 s
	Livingstone Street	Gordon Young Drive	Southbound	1 m 11 s
Livingstone Street / Memorial Avenue	Gregory Street	Landsborough Street	Eastbound	1 m 14 s
	Landsborough Street	Gregory Street	Westbound	1 m 13 s
Landsborough Street / Phillip Drive / Wilson Street	Memorial Avenue	Cardwell Street	Eastbound	4 m 53 s
	Cardwell Street	Memorial Avenue	Westbound	4 m 54 s
Arakoon Road / Russell Street	Phillip Drive	Gregory Street	Southbound	4 m 54 s
	Gregory Street	Phillip Drive	Northbound	4 m 50 s
Simpson Street / Mitchell Street / Landsborough Street	Gregory Street	Memorial Avenue	Northbound	2 m 16 s
	Memorial Avenue	Gregory Street	Southbound	2 m 22 s
Gordon Young Drive	Gregory Street	Gilbert Cory Street	Westbound	1 m 23 s
	Gilbert Cory Street	Gregory Street	Eastbound	1 m 25 s
Gilbert Cory Street	Gordon Young Drive	Marlin Drive	Southbound	1 m 4 s
	Marlin Drive	Gordon Young Drive	Northbound	1 m 13 s
Marlin Drive	Gilbert Cory Street	New Entrance Road	Westbound	1 m 29 s
	New Entrance Road	Gilbert Cory Street	Eastbound	1 m 42 s
	New Entrance Road	Ocean Street	Eastbound	1 m 14 s
	Ocean Street	New Entrance Road	Westbound	1 m 12 s
Ocean Street / Rudder Street	Marlin Drive	Gordon Young Drive	Northbound	1 m 31 s
	Gordon Young Drive	Marlin Drive	Southbound	1 m 27 s
Rudder Street	Ocean Street	Gilbert Cory Street	Eastbound	0 m 40 s
	Gilbert Cory Street	Ocean Street	Westbound	0 m 45 s

Average travel time data is summarised by time period in Table 3.5. It is observed that for all key routes except those on Marlin Drive, travel times during the PM period are longer than during the AM period. Travel times in the PM period were recorded as exceeding AM travel times by up to 34 seconds (Arakoon Road / Russell Street). This suggests that in general more congestion may be experienced on key routes in the PM than the AM.

For each route, three travel times were measured during the AM period, and one travel time was measured during the PM period. Therefore, it is not possible to identify any potential outlying travel time data for the PM period, and it is assumed that the PM travel time data is representative of typical conditions on key routes during the PM period.

Table 3.5 Average travel time by time period

Street	Between*	Time Period	Average Travel Time
Gregory Street	South West Rocks Road and Livingstone Street	AM	4 m 56 s
		PM	5 m 23 s
	Arakoon Road and Simpson Street	AM	2 m 59 s
		PM	3 m 22 s
	Gordon Young Drive and Livingstone Street	AM	1 m 11 s
		PM	1 m 22 s
Livingstone Street / Memorial Avenue	Gregory Street and Landsborough Street	AM	1 m 13 s
		PM	1 m 15 s
Landsborough Street / Phillip Drive / Wilson Street	Memorial Avenue and Cardwell Street	AM	4 m 49 s
		PM	5 m 5 s
Arakoon Road / Russell Street	Phillip Drive and Gregory Street	AM	4 m 44 s
		PM	5 m 18 s
Simpson Street / Mitchell Street / Landsborough Street	Gregory Street and Memorial Avenue	AM	2 m 13 s
		PM	2 m 31 s
Gordon Young Drive	Gregory Street and Gilbert Cory Street	AM	1 m 22 s
		PM	1 m 28 s
Gilbert Cory Street	Gordon Young Drive and Marlin Drive	AM	1 m 8 s
		PM	1 m 11 s
Marlin Drive	Gilbert Cory Street and New Entrance Road	AM	1 m 36 s
		PM	1 m 22 s
	New Entrance Road and Ocean Street	AM	1 m 14 s
		PM	1 m 10 s
Ocean Street / Rudder Street	Marlin Drive and Gordon Young Drive	AM	1 m 26 s
		PM	1 m 42 s
Rudder Street	Ocean Street and Gilbert Cory Street	AM	0 m 39 s
		PM	0 m 52 s

**Regardless of direction*

3.2.6.1 Level of Service

The Austroads *Guide to Traffic Management Part 3: Transport Study and Analysis Methods* (AGTM03-20, 2020) describes Level of Service (LOS) for urban and suburban arterial roads with interrupted flow conditions based on the base free-flow speed (BFFS). The LOS conditions for these types of road are summarised in Table 3.6.

Table 3.6 AGTM03-20 LOS conditions for urban and suburban arterial roads with interrupted flow conditions

Level of Service	Condition
A	Travel speed exceeds 80% of the BFFS.
B	Travel speed is between 67% and 80% of the BFFS.
C	Travel speed is between 50% and 67% of the BFFS.
D	Travel speed is between 40% and 50% of the BFFS.
E	Travel speed is between 30% and 40% of the BFFS.
F	Travel speed is 30% or less of the BFFS.

For the purposes of this assessment the BFFS has been estimated as the speed limit. Gregory Street, Phillip Drive and Arakoon Road are considered to have characteristics similar to suburban arterial roads, and their average travel speed based on the travel time data (Table 3.5) have therefore been assessed against the conditions in Table 3.6 to provide an indication of LOS, as shown in Table 3.7. The assessment indicated that these roads have LOS such that vehicles travelling on them are reasonably unimpeded. Comparing this with the vehicle speed data analysis it is considered that generally although travelling at a lower speed this is more likely due to choice or conditional factors.

Table 3.7 Assumed LOS based on average travel times

Street	Between	Average Travel Speed	Assumed BFFS	LOS
Gregory Street	South West Rocks Road and Livingstone Street	43 km/h	50 km/h	A
	Arakoon Road and Simpson Street	40 km/h	50 km/h	B
	Gordon Young Drive and Livingstone Street	33 km/h	46 km/h	B
Landsborough Street / Phillip Drive / Wilson Street	Memorial Avenue and Cardwell Street	39 km/h	54 km/h	B
Arakoon Road / Russell Street	Phillip Drive and Gregory Street	57 km/h	78 km/h	B

**In calculation of the BFFS on Gregory Street between South West Rocks Road and Livingstone Street, the reduced speed limit in the school zone has been conservatively not considered.*

3.2.7 Turning movements

Turning movement data for the AM period between 7:00 AM and 9:15 AM was provided by Council for the following intersections:

- Arakoon Road / Lighthouse Road
- Phillip Drive / Russell Street
- Gregory Street / Steve Eagleton Drive / Belle O'Connor Street
- Gregory Street / Gordon Young Drive
- Gordon Young Drive / Gilbert Cory Street / Rudder Street
- Gregory Street / Landsborough Street
- Plummers Lane / South West Rocks Road
- Gregory Street / Arthur Street
- Mitchell Street / Arthur Street
- Landsborough Street / Memorial Avenue
- Landsborough Street / McIntyre Street / Phillip Drive

AM peak hour turning movements for these intersections are shown in Figure 3.12.

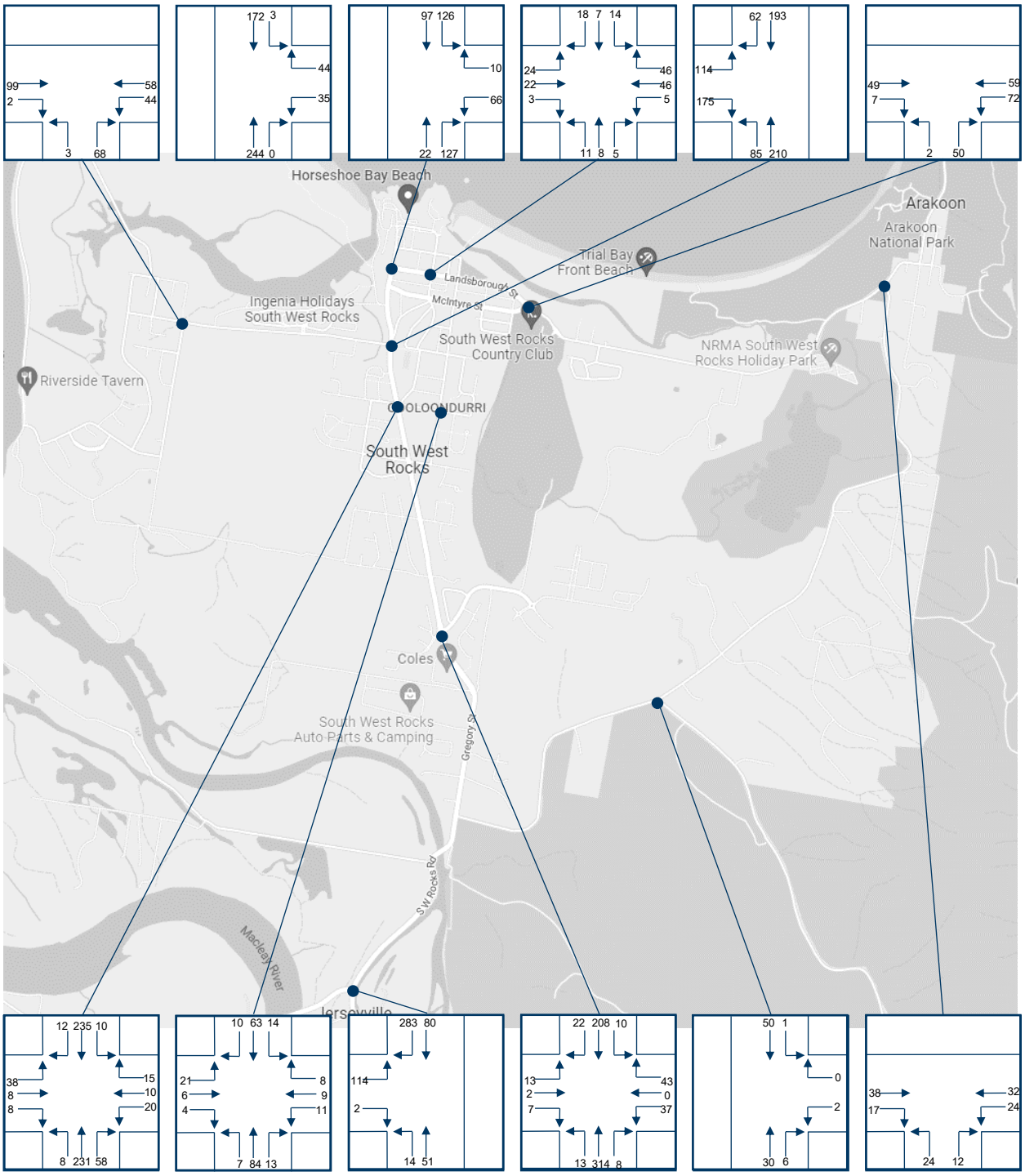


Figure 3.12 AM peak turning movements

Base imagery obtained from Google Maps, accessed April 2022

Turning movement data for the PM period between 3:30 PM and 5:30 PM was provided by Council for the following intersections:

- Phillip Drive / Russell Street
- Gregory Street / Steve Eagleton Drive / Belle O'Connor Street
- Gregory Street / Gordon Young Drive
- Landsborough Street / McIntyre Street / Phillip Drive
- Gregory Street / Simpson Street
- Gregory Street / Arakoon Road

PM peak turning movements for these intersections are shown in Figure 3.13.

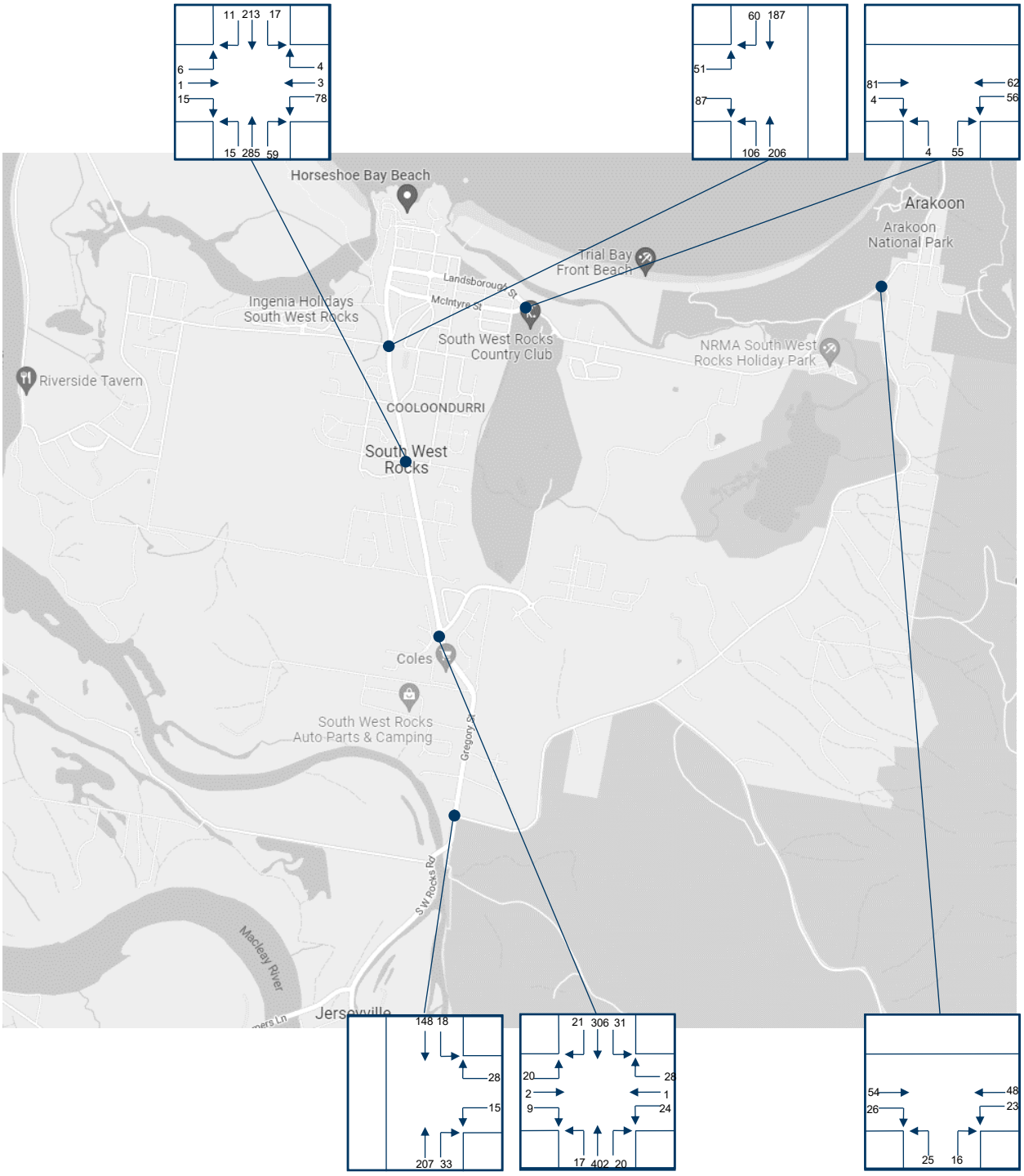


Figure 3.13 PM peak turning movements

Base imagery obtained from Google Maps, accessed April 2022

3.3 Active transport

3.3.1 Walking

Infrastructure for walking in the study area is comprised of footpaths and recreational walking trails. Footpaths are provided along the majority of Belle O'Connor Street, Gregory Street, Gordon Young Drive, Phillip Drive and the South West Rocks town centre. Outside these areas, footpaths are limited, typically not connected to the rest of the footpath network and in certain areas are in poor condition. The Austroads *Guide to Road Design Part 6A: Paths for Walking and Cycling* (AGRD6A, 2021) suggests a minimum footpath width for general low pedestrian volume areas of 1.2 m, and for high pedestrian volumes of at least 2.4 m with footpaths in the area generally indicating provision for low pedestrian volume. There are several recreational walking trails in the area, including:

- Trail Bay Gaol to Smoky Cape Campground
- Monument Hill Loop
- Gap Beach via Smoky Cape Track
- South West Rocks Beach
- Green Island Lookout Walk
- Gap Beach Circuit
- Gap Beach to Jack Perkin Walking Track
- Little Bay to Smoky Cape via Interior Tracks Beach
- South West Rocks Back Creek

The *Pedestrian Access and Mobility Plan* for the Kempsey local government area, completed by Council in 2016, proposed various improvements to the pedestrian network in South West Rocks. These are shown in Figure 3.14. The existing footpaths are primarily concentrated around the South West Rocks town centre and along Gregory Street, with a connection between South West Rocks and New Entrance via Gordon Young Drive and between South West Rocks and Arakoon via Phillip Drive. Additionally, there are some limited and disjointed existing footpaths in residential areas. Since the development of the *Pedestrian Access and Mobility Plan* (Kempsey Shire Council, 2016), some new footpaths on limited sections of Gregory Street and Steve Eagleton Drive have been constructed, but the recommendations are largely yet to be implemented.

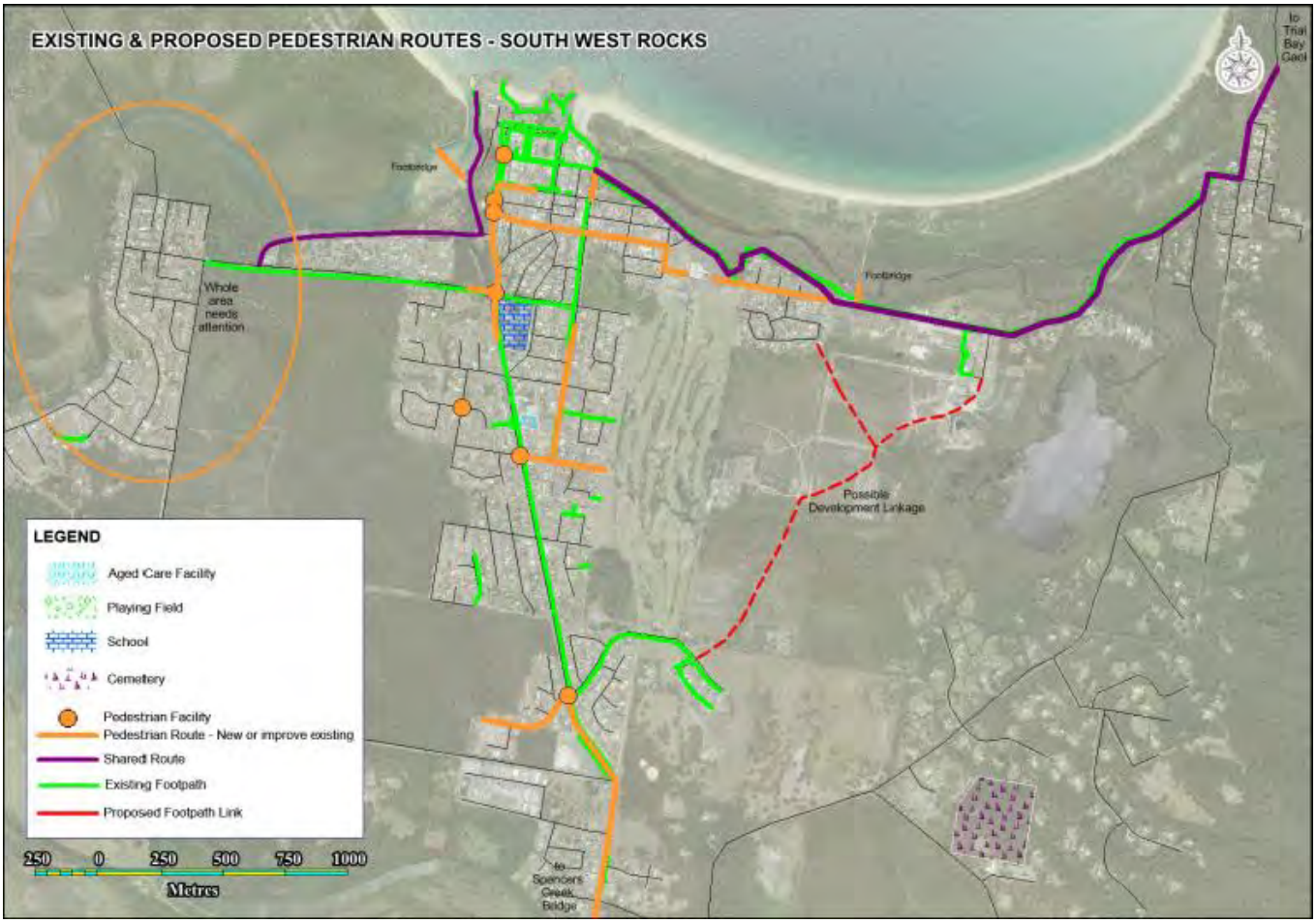


Figure 3.14 Pedestrian Access and Mobility Plan existing and proposed pedestrian routes

Imagery obtained from Pedestrian Access and Mobility Plan (Kempsey Shire Council, 2016), accessed September 2021

3.3.2 Cycling

The existing cycling infrastructure within the study area is also limited. The local urban street system makes up the majority of the cycling network, with cyclists having to share the road network with general traffic. Cyclists under the age of 12 and those supervising such cyclists are allowed to ride on the footpaths where they exist with footpaths being utilised as part of the cyclist network, however the *Kempsey Shire Bike Plan* (GHD, 2018) identified that existing footpaths are typically narrower than 2.5 m considered as the minimum width required for a shared pathway.

The *Kempsey Shire Bike Plan,* completed for Council by GHD in 2018, proposed various improvements to the cycling network within and to / from South West Rocks. These are shown in Figure 3.15 and Figure 3.16. Intertown links comprising of a minimum of sealed shoulders of appropriate width were proposed to connect South West Rocks with Arakoon via Arakoon Road, Smoky Lighthouse via Lighthouse Road and Smithtown / Gladstone via South West Rocks Road. Various improvements in South West Rocks were also proposed.

Off road cycleways were proposed on the southern section of Gregory Street between Arakoon Road and Spencers Creek Road, on Meehan Close and the western edge of the South West Rocks Country Club golf course, on Trial Bay Gaol Access Road and to connect Point Briner with the Macleay River Foreshore via Buchanan Drive, Fig Tree Lane, Gilbert Cory Street, Marlin Drive and New Entrance Road. On road cycleways were proposed on the northern section of New Entrance Road and the western section of Gordon Young Drive. Based on available imagery, it appears that none of these proposed links or cycleways have been implemented.

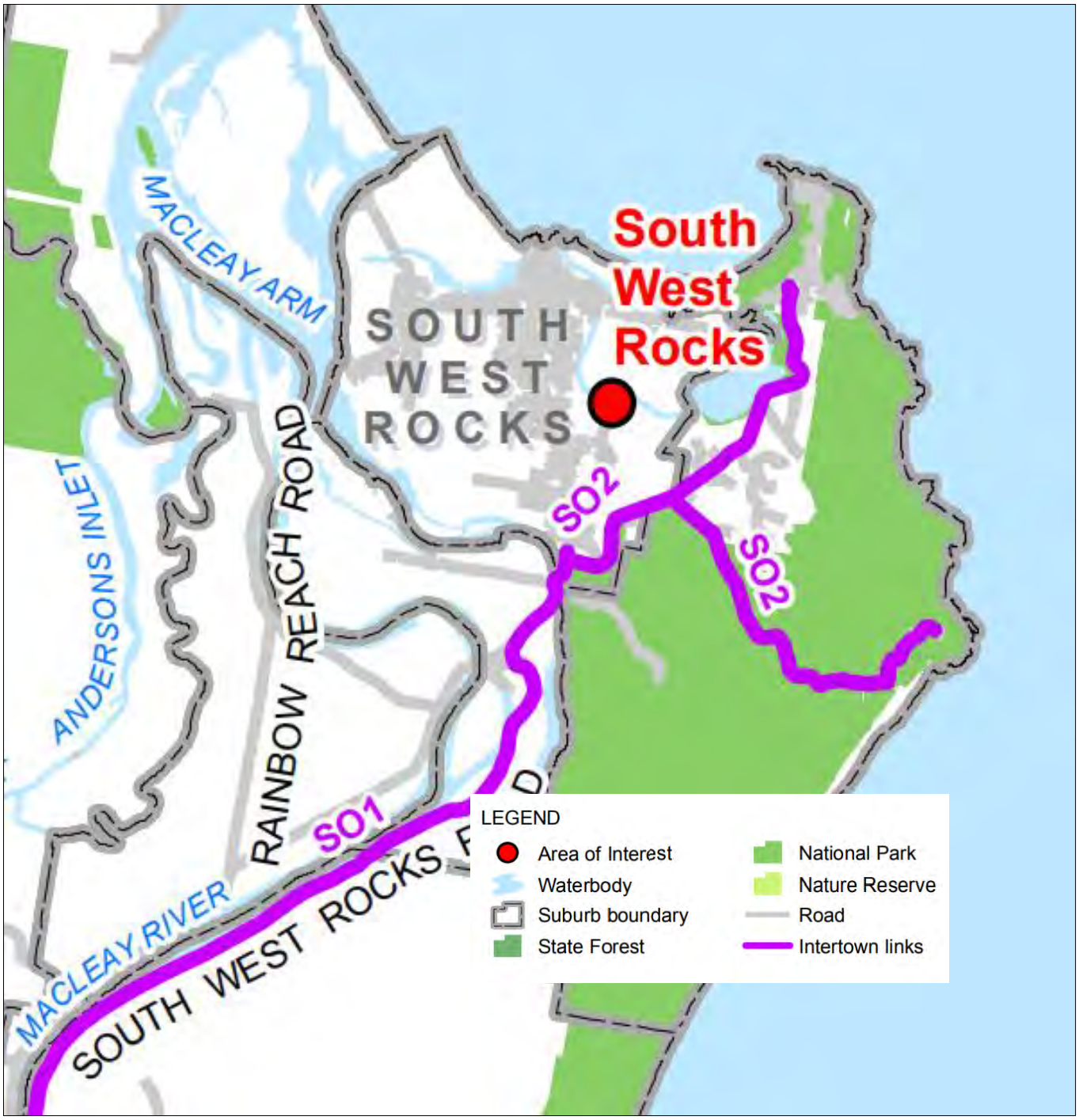


Figure 3.15 Kempsey Shire Bike Plan proposed intertown links

Imagery obtained from Kempsey Shire Bike Plan (GHD, 2018), accessed September 2021

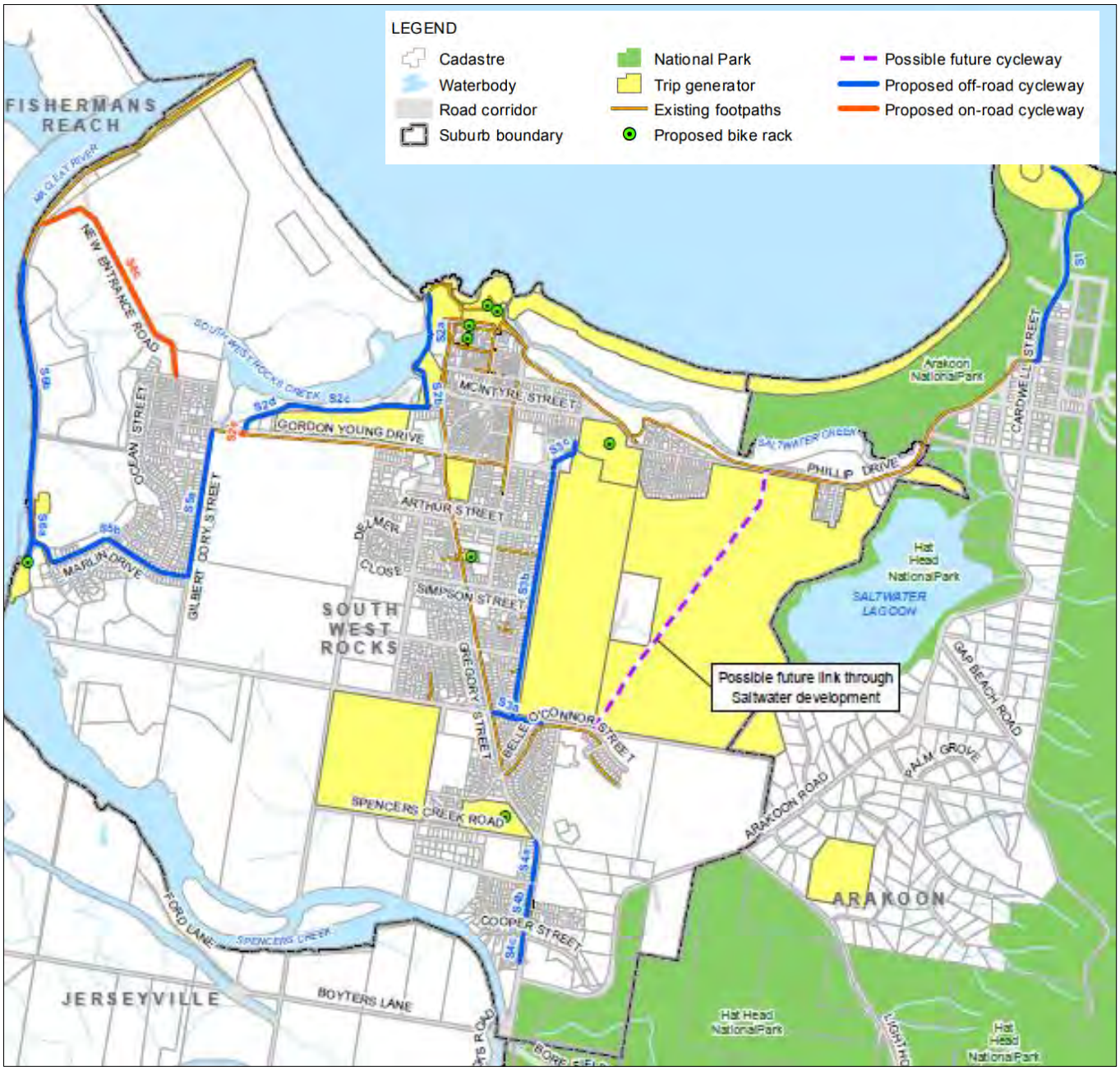


Figure 3.16 Proposed improvements in South West Rocks

Imagery obtained from Kempsey Shire Bike Plan (GHD, 2018), accessed September 2021

3.4 Public transport

Public transport available in the study area comprises of bus and taxi services. Cavanagh Bus & Coach Pty Ltd operate a wheelchair accessible service (348) in the study area on weekdays, which operates on two routes; one servicing New Entrance and South West Rocks, and the other servicing Arakoon and South West Rocks. Both of these routes operate three services in the morning and one service in the mid-afternoon. Busways North Coast Pty Ltd operate a service (350) which connects South West Rocks with Kempsey via Smithtown and Frederickton. It operates on weekdays four times per day during school terms and three times per day during school holidays, and two times on Saturday mornings. Route maps for the 348 and 350 services are shown in Figure 3.17. No buses operate in the area on Sundays or public holidays.

Figure 3.17 Cavanaugh Bus & Coach Pty Ltd 348 bus routes (left) and Busways 350 bus route (right)

Imagery obtained from Cavanaugh Bus & Coach Pty Ltd and Busways North Coast Pty Ltd, accessed September 2021

Taxi services are available and operate from the town centre.

3.5 Freight

3.5.1 Restricted access vehicle networks

There are no General Mass Limit (GML), Concessional Mass Limit (CML) or Higher Mass Limit (HML) networks within the study area. Higher Mass / Dimension Vehicles are required to have route access permits issued by the National Heavy Vehicle Regulator. These permits include Road Manager (Council) conditions drafted to ensure safe and functional access for each approved route.

The Controlled Access Bus (CAB) network is the network available for CABs which comply with the National Class 3 Controlled Access Bus Notice Exemption Notice 2019 (No. 1). It is subject to sign-posted restrictions and is based on a maximum vehicle width of 2.5 m. The CAB network in the study area is shown in Figure 3.18.

Figure 3.18 South West Rocks CAB network

Imagery obtained from Restricted Access Vehicles Map (Transport for NSW, 2021), accessed October 2021

3.5.2 Industry and business locations

Within the study area, there is one area zoned industrial, and three areas zoned business that generate and attract heavy vehicle movements. In order to consider the routes taken by heavy vehicles and the need for heavy vehicles to be on certain roads within the network, the location of heavy vehicle attraction and generation sites were identified. Figure 3.19 illustrates areas zoned as industrial and business under the *Kempsey Local Environmental Plan 2013*.

The industrial zone in the study area is classified as light industrial. Light industrial zones are those which provide light industrial and warehouse land uses which do not interfere with adjacent residential areas or neighbourhood amenity. This zone is expected to generate and attract heavy vehicle movements.

The northern most and southern most business zones in the study area are classified as local centres. Local centres are those which provide services including business, retail, entertainment and community to a wider catchment than the neighbourhood centres. The small business zone in the centre of the study area is classified as a neighbourhood centre. Neighbourhood centres are those which provide services which may include retail, business, community and residential uses to a small-scale neighbourhood. These zones are expected to generate and attract some heavy vehicle movements, though less than the industrial zone.

Ongoing land use developments include the subdivision of greenfield sites are expected to attract heavy vehicle movements during their development stages.

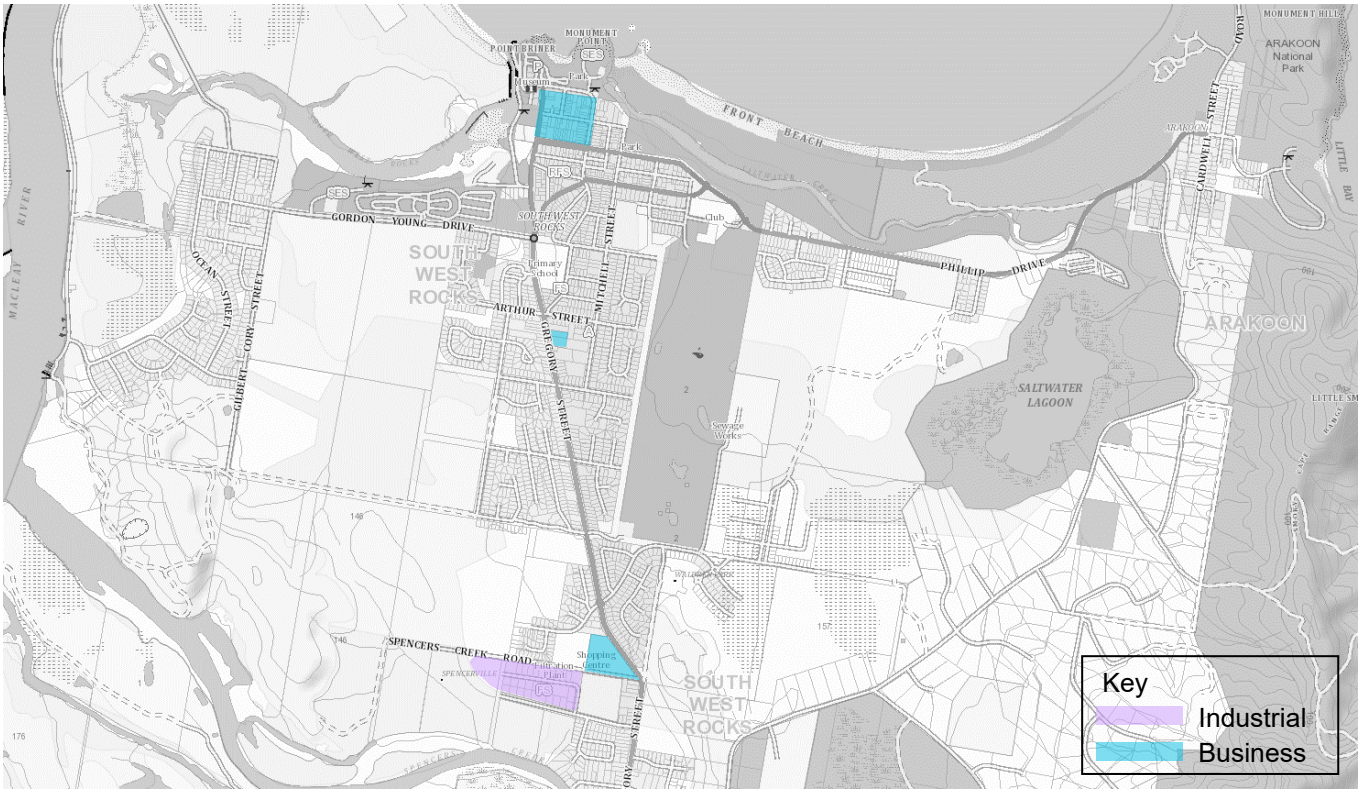


Figure 3.19 Industry and business locations within the study area

Base imagery obtained from NSW Government Planning Portal, accessed October 2021

3.6 Demand (journey to work)

Journey to work data from the 2021 census was obtained (see Table 3.8) from the Australian Bureau of Statistics for the South West Rocks, Arakoon and Jerseyville state suburbs, which are shown in Figure 3.20.

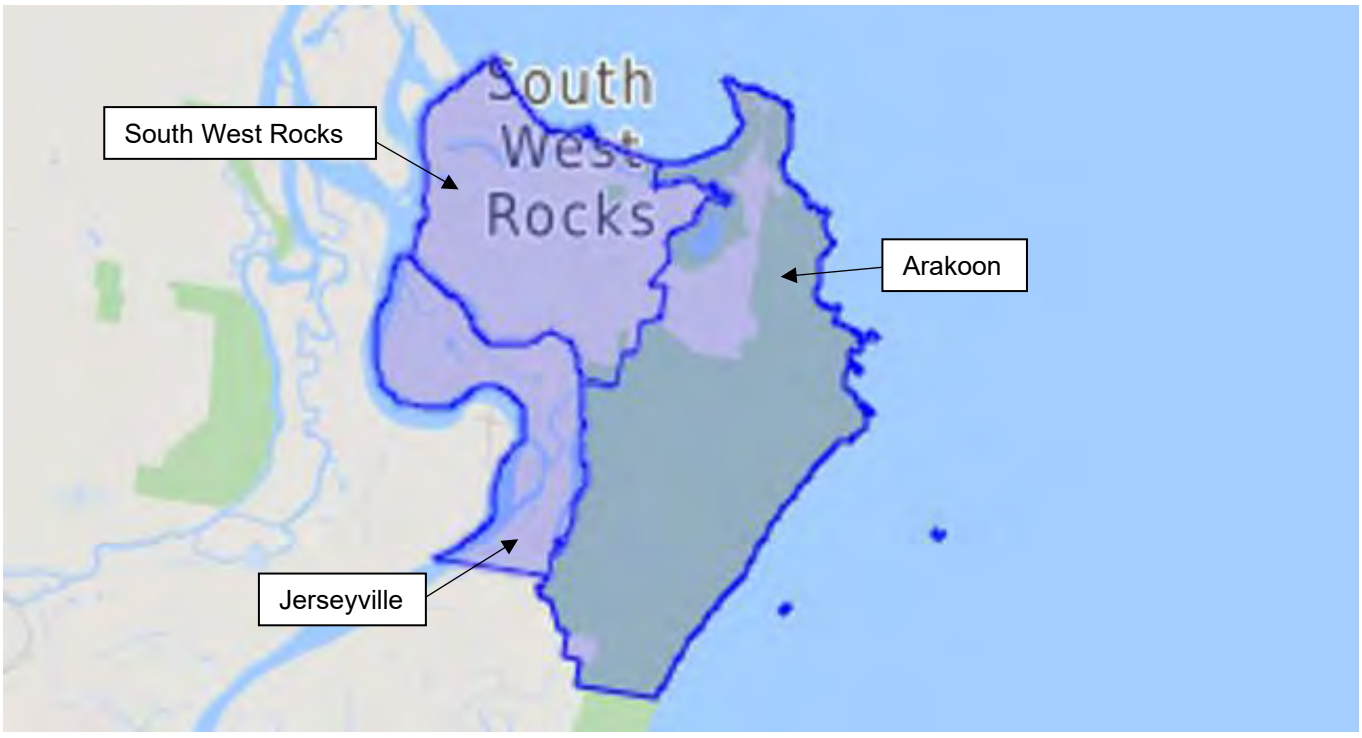


Figure 3.20 Australian Bureau of Statistics state suburbs

Base imagery obtained from the Australian Bureau of Statistics, accessed September 2021

The data in Table 3.8 indicates a heavy reliance on cars, with the vast majority of commuting trips completed by car, either as a driver or passenger (78%). This reliance is most prominent in South West Rocks (80%) and slightly less prominent in Arakoon (69%). Single occupancy vehicle (car, as driver) account for approximately 72% of journey to work trips. Other than commuting by car, working at home and walking only were the next most prevalent types of journeys to work, accounting for 14% and 5% respectively. Working at home made up a significantly higher proportion in Arakoon (23%) and Jerseyville (20%) compared to South West Rocks (13%). South West Rocks and Jerseyville share the same percentage of 6% in walking to work journey type, while Arakoon has 0% share which is likely a result of the lack of employment opportunities and limited pedestrian infrastructure within Arakoon. Very small numbers of journey to work by public transport and bicycle were reported, each less than making up less than 1% of the total.

Table 3.8 Journey to work data

	South West Rocks	Arakoon	Jerseyville	Total
Car, as driver	1026 (73%)	100 (65%)	33 (67%)	1159 (72%)
Car, as passenger	87 (6%)	7 (5%)	3 (6%)	97 (6%)
Walked only	81 (6%)	0 (0%)	3 (6%)	84 (5%)
Truck	14 (1%)	8 (5%)	0 (0%)	22 (1%)
Worked at home	184 (13%)	35 (23%)	10 (20%)	229 (14%)
Public transport	5 (<1%)	0 (0%)	0 (0%)	5 (<1%)
Bicycle	0 (0%)	5 (3%)	0 (0%)	5 (<1%)
Total	1397 (100%)	155 (100%)	49 (100%)	1601 (100%)

Data obtained from the Australian Bureau of Statistics, accessed December 2022

3.7 Road safety

Crash data covering the five year period 2015 to 2019 was obtained from TfNSW for the study area. Over this period there were 30 recorded crashes. Crashes involving casualties accounted for 73%, including one fatality. Off path on straight was the most prevalent crash type (27%). A heat map showing the locations of the crashes is shown in Figure 3.21. A summary of the crash data is provided in Table 3.9.

Overall, crashes on Gregory Street, either at intersections or midblock, accounted for approximately 37% of all crashes in the study area during this period. All but one of these crashes resulted in either injury or fatality. The prevalence and severity of crashes on Gregory Street indicate a pattern of unsafe driver behaviour such as driving at inappropriately high speeds, and the potential presence of road safety issues along this route. Figure 3.21 shows three areas of crash concentration as red spots. The southern most area is the intersection of Gregory Street, Belle O'Connor Street and Steve Eagleton Drive where there were two crashes resulting in moderate or serious injury. There is an area at and on the northbound approach to the Gregory Street / Arthur Street intersection, where there were two crashes also resulting in moderate or serious injury. The northern most area is at or on southbound approach to the Paragon Avenue / Prince of Wales Avenue, both of which involved pedestrians and resulted in minor or moderate injury.

Table 3.9 Crash data summary (2015 – 2019)

Location	Number of crashes		Crash type(s)
	Total	Casualty	
Intersection			
Arakoon Road / Cockatoo Place	1	1	Vehicles from adjacent direction (1)
Gregory Street / Arthur Street	1	1	Vehicles from adjacent direction (1)
Gregory Street / Belle O'Connor Street / Steve Eagleton Drive	2	2	Vehicles from adjacent direction (1), off path on straight (1)
Gregory Street / Landsborough Street	1	0	Off path on curve or turning (1)
Gregory Street / Lindsay Noonan Drive	1	1	Vehicles from same direction (1)
McIntyre Street / Mitchell Street	1	1	Vehicles from adjacent direction (1)
Memorial Avenue / Baldwin Street	1	0	Off path on straight (1)
Paragon Avenue / Prince of Wales Avenue	1	1	Pedestrians (1)
South West Rocks Road / Plummers Lane	1	1	Vehicles from same direction (1)
Midblock			
Arakoon Road	1	1	Off path on curve or turning (1)
Belle O'Connor Street	1	0	Manoeuvring (1)
Entrance street	1	0	Off path on straight (1)
Gregory Street	6	6	Vehicles from same direction (2), manoeuvring (2), off path on straight (2)
Lighthouse Road	2	1	Vehicles from opposing direction (1), off path on curve or turning (1)
McIntyre Street	2	1	Pedestrians (1), manoeuvring (1)
New Entrance Road	1	0	Off path on curve or turning (1)
Overshot Dam Road	1	1	Off path on straight (1)
Phillip Drive	1	1	Off path on straight (1)
Plummers Lane	1	0	Off path on straight (1)
Prince of Wales Avenue	1	1	Pedestrians (1)
South West Rocks Road	1	1	Off path on curve or turning (1)
Trial Bay Gaol Access Road	1	1	Off path on curve or turning (1)
TOTAL	**30**	**22**	

Figure 3.21 Crash heat map (2015 – 2019)

3.8 Emerging trends

3.8.1 Ridesharing, taxi and ride hailing

Ridesharing, where two or more people (who are either strangers or known to each other) utilise the same vehicle for transport, is a transport trend that has increased in momentum in recent times. It is expected that this form of travel alongside the use of taxis and ride-hailing (such as Uber) will grow as new generations begin commuting.

Four taxi providers service the study area; South West Rocks Taxi Service, Macksville Taxi Services, Kempsey Radio Taxi Network and Macleay Valley Taxis.

Ridesharing is preferred over taxis and ride-hailing as it can reduce the number of trips and costs associated with an individual. Assuming a case where taxis are the only transport mode of choice, one person trip is equal to two vehicle trips as the taxi or hailed vehicle must first travel to the pickup point before continuing on to the destination.

Data from the 2016 census indicates that taxis were not used as a means of commuting to work within the study area.

Currently data is too limited on the use of ridesharing or ride-hailing to draw conclusion on its prevalence within the study area. Within the census data these modes are likely combined into the category ‘Other’, or ‘Car, as passenger’. However, a review of car travel (as a passenger and as a driver) as well as the change in ‘Other’ as a response to the method of travelling to work, can give some indication on the change in travel trends. Car use and occupancy data from the 2016 census was obtained (see Table 3.10) for the South West Rocks, Arakoon and Jerseyville state suburbs (see Figure 3.20). The data in Table 3.10 indicates that current ride sharing and/or carpooling is minimal within the study area for commuter trips, there may be opportunity to consider higher occupancy vehicle models to support higher visitation to the area without equally increased demand.

Table 3.10 2016 car use and occupancy per day

	South West Rocks	Arakoon	Jerseyville
Car, as driver	889	100	28
Car, as passenger	76	15	3
Vehicle occupancy	1.09	1.15	1.11
Other mode	115	12	4

Data obtained from the Australian Bureau of Statistics, accessed September 2021

3.8.2 Electric and autonomous vehicles

Council endorsed at its October 2020 meeting a Long Term Renewable Energy and Water Strategy. It was noted that the opportunities and actions within the Strategy shall inform the scope of future projects where relevant.

There has been a rise in discussions and interest around emerging transport trends such as electric vehicles (EVs) and autonomous vehicles (AVs). Associated provisions will need to be considered to accommodate these trends in conjunction with anticipated development and growth within the study corridor. As with ridesharing and ride-hailing, there is currently limited data on the use of EVs and AVs to draw robust conclusions. Several jurisdictions are incorporating electric and autonomous vehicles into their 30-year plans, with some of the key considerations in these plans being:

– EV and AV uptake: There is some variability in the estimated level of uptake in EVs and AVs, depending on the level of intervention proposed (government subsidy/legislation) and the socio-economic and geographical areas considered. A report by Infrastructure Victoria (Evidence Base Report – Advice on Automated and Zero Emissions Vehicle Infrastructure, August 2018) estimates that without intervention 75% of the vehicle fleet in Victoria will be electric or hybrid electric by 2050 and 48% of vehicles by 2040 will be driverless, with major urban areas having a faster uptake than rural areas.
– Freight and mass public transport: The introduction of EVs and AVs provides opportunities in relation to improving costs and resources available for freight and mass public transport. EVs have the opportunity to reduce operating costs, whilst AVs have the potential to negate limitations associated with availability of skilled drivers, by either running unassisted, or with a less skilled ‘operator’. This means that freight and mass public transport can operate more frequently for the same cost.
– Interactions with vulnerable road users: Pedestrians and active transport will still need to be accommodated within the road network. This will necessitate paths and crossing points to provide separation between cars and people. Of note is that traffic signals will still be required if AVs are adopted, to allow the crossing of pedestrians at high volume roads.
– Safety: In general it is acknowledged that AVs will improve safety due to faster reaction times for vehicles. However, the physical limitations involved in stopping a vehicle, plus the maximum tolerable deceleration for passengers inside the vehicle, means that crashes and injuries may still occur. One major concern is pedestrians and other vulnerable road users crossing roads and emerging in front of an AV, with the vehicle having no means to avoid the collision, impacting the safety of all involved. Therefore investments in safe pedestrian and active transport infrastructure will still be required.
– State of the road network: To enable the operation of AVs, conditions and infrastructure provision within the road corridor will need to be at a minimum standard to allow for safe operation.
– Increased demand for travel: It is anticipated that the introduction of AVs and EVs will make the travel task more accessible, easier and cheaper, particularly for those in rural and low socio-economic areas. Additionally, time spent travelling in an AV can also be undertaken in conjunction with other tasks such as reading. Traditional methods of determining demand for travel, such as Elasticity of Demand and Generalised Cost Methods indicate that improvements to the accessibility, ease and costs of travel of AVs will favour personal travel over mass-transit.

– Increases in practical capacity of road network: The nature of AVs is that they will be able to reduce headways and gap acceptance through two-way communication between vehicles. However, there is a limit to the level of improvement. A reasonable headway will still be required as vehicles of different mass will have different braking potentials, therefore some space between vehicles will be needed to accommodate this. Additionally, traffic signals will still be required, particularly in urban areas, and will be a limiting factor in the potential increase in road capacity. This means that AVs are unlikely to significantly increase the number of person trips capable of being undertaken within a road network over that of mass public transport.
– Mobility as a service: With the high technological advancements associated with EVs and AVs, there is potential to charge for distance travelled or other road network usage metrics. Payment methods such as subscriptions or pay-on-use have been proposed both with advantages and disadvantages.
– Provision of sufficient fast charging stations for electric vehicles: Electric vehicles currently have a shorter potential trip length, therefore necessitating sufficient opportunities to charge the vehicles. The time taken to charge the vehicles is also of concern, with charging mid-journey needing to be completed quickly, so as not to adversely extend travel times.
– Legislation regarding the use and liability in relation to autonomous vehicles: How autonomous vehicles are allowed to operate within the road network (will they be given priority lanes, will they be allowed to drive empty, or will they need to be stored when not actively involved in a person trip) and who is responsible when an incident occurs.
– Ownership models for AVs: Several ownership models are currently being considered with both personal ownership, communal ownership, and on-demand fleet vehicles discussed. These models impact whether AV trips will replicate the travel patterns of cars, taxi/ride-hailing, or rideshares.

Summary

Emerging trends in transport indicate that car use will not reduce over the coming decades, rather growth in traffic volumes will accelerate, due to an increase in the accessibility and ease of transport. This is particularly due to the convenience of services such as ‘on demand’ transport, and the reduced operating costs provided by electric vehicles.

Whilst the estimates of the prevalence and penetration of emerging transport trends are uncertain, the assessment does highlight several key considerations:

– Planning and investing in active and sustainable modes of transport is still required.
– It is important that future traffic growth estimates do not underestimate car usage in favour of other transport modes, where the evidence supports increasing reliance on motor vehicles.
– It is important to consider how to make ridesharing or higher vehicle occupancy more accessible.
– Planning for an EV and AV future should focus on freight, mass public transport and safe interactions with pedestrians and other vulnerable road users.

Future upgrades in South West Rocks will need to consider emerging trends with respect to alternative modes of transport, especially those that realise energy savings such as electric vehicles. Emerging trends with respect to road construction and product materials that also result in energy savings will need to be considered as part of the future upgrades.

4. Future transport

4.1 Population growth

The population of South West Rocks has remained relatively stable over the past 10-15 years, however, has recently started to experience growth. South West Rocks had a population of 5,133 people at the 2016 Census and has increased to be 5,700 in 2021. The population is forecast to grow at a linear average of 2.5% per annum between 2021 and 2036, increasing to 7,812 people in 2036, as shown in Table 4.1. This represents a total increase of 37.1% over 15 years.

Table 4.1 South West Rocks population forecast

Indicator	2016	2021	2026	2031	2036
Population	5,235	5,700	6,321	7,008	7,812
Change in population (5yrs)	--	465	621	687	804
Average annual increase	--	1.8%	2.2%	2.2%	2.3%

Data obtained from .id informed decisions, accessed October 2021

The New South Wales Mid North Coast is experiencing what is now referred to as the 'COVID Boom', due to people moving from populated metropolitan areas to regional areas with access to nature and lower house prices. The recent upgrades to the Pacific Highway may be contributing to the recent influx of residents on the Mid North Coast. The upgrades have made the region more accessible by road from Brisbane and Sydney, which may increase the region's desirability as a place to live.

At the 2016 Census, the median age of the population was 57, and the proportion of the population over 60 was 45% reflecting the popularity of South West Rocks for those wanting to retire to the coast. The forecast age structure is shown in Figure 4.1.

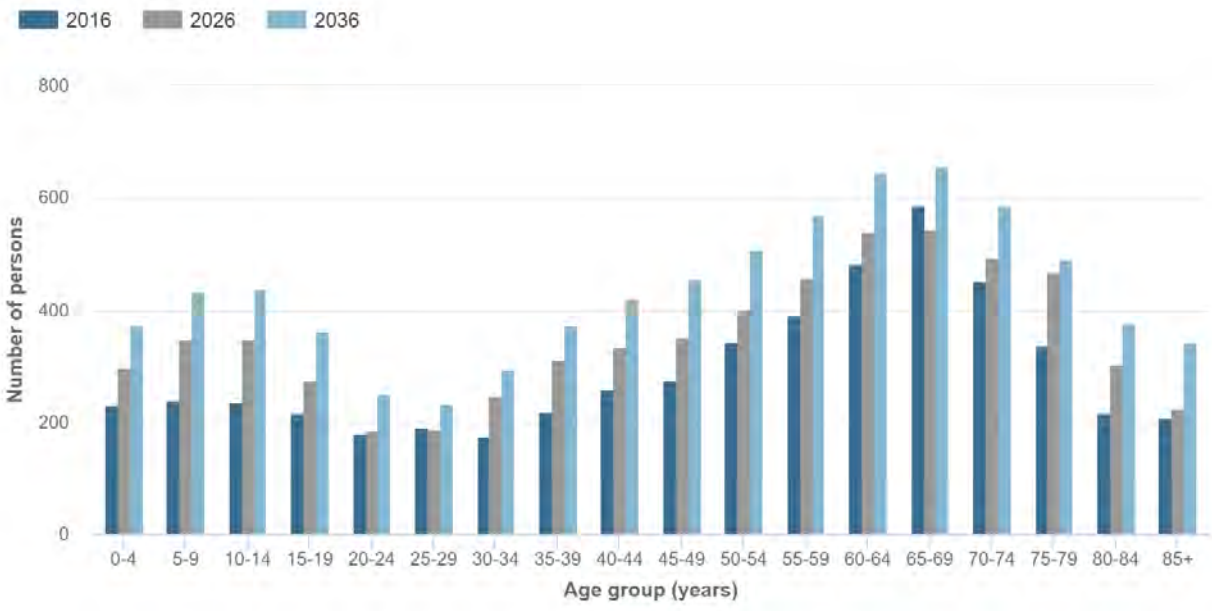


Figure 4.1 Forecast age structure for South West Rocks

Image obtained from Population and household forecasts, 2016 to 2036 (.id informed decisions, 2018), accessed October 2021

The greatest population change for South West Rocks is forecast for the period from 2032 to 2036, which is expected to have a net increase of 803 people. This will be due to net migration and natural increase (births minus deaths). Migration is also driven by housing development. The forecast annual population change is shown in Figure 4.2.

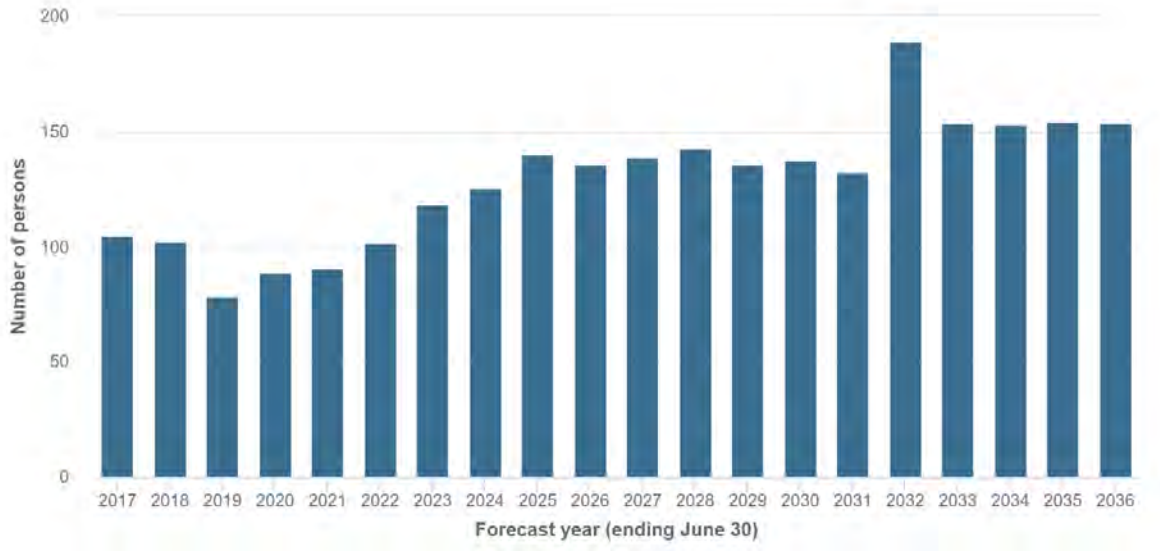


Figure 4.2 Forecast annual population change

Image obtained from Population and household forecasts, 2016 to 2036 (.id informed decisions, 2018), accessed October 2021

4.2 Vehicle ownership

Background growth was estimated with reference to demographic data for the South West Rocks, Arakoon and Jerseyville state suburbs (see Figure 3.20). A summary of the number of dwellings with one or more motor vehicles is shown in Table 4.2.

Table 4.2 Dwellings with one or more motor vehicles

Area	2016	2021
South West Rocks	1,794	2,056
Arakoon	167	181
Jerseyville	41	44
Total	2,002	2,281

Data obtained from the Australian Bureau of Statistics, accessed December 2022

Based on the information in Table 4.2, the number of dwellings with one or more motor vehicles increased at an average linear rate of 2.8% between 2016 and 2021. According to Australian Bureau of Statistics census data, during this period, the population of these areas increased by an average linear rate of 1.9%. This indicates a reasonable alignment between population growth and vehicle ownership in the study area based on the available data. Therefore, for the purposes of this analysis, the forecast population growth discussed in Section 4.1 of a linear average of 2.5% per annum is considered appropriate as a conservative estimate to apply as background traffic growth for the network.

4.3 Historic growth

Traffic data was provided for numerous locations and years throughout the network (refer Section 3). Data from Gregory Street was examined due to its importance as the major transport spine in the study area and the availability of data. Data from April 2020 was not included in growth calculations due to the restrictions in place in New South Wales as a result of the COVID-19 pandemic at that time and the correspondingly low traffic volumes. It is noted that this data is limited and collected over varying time periods so is provided as an indication only. Due to the highly seasonal nature of traffic generation in the area it is difficult to provide a clear trend in traffic growth.

Over the length of the corridor between Lindsay Noonan Drive in the south and Spencers Creek Road in the north and from data sources from the 2016 – 2021 five-year period volumes generally ranged between 6,000 vpd and 7,600 vpd. A similar degree of variability was observed in the traffic data in Section 3.2.3 where Gregory Street in 2021 was recorded to have an AADT of 6,645 vpd which was averages from 7,247 vpd on weekdays and a lower 5,140 vpd on weekends. Whilst variability occurs both seasonally and along the corridor from the traffic data available generally data recorded between key intersections along Gregory Street showed correlation year to year with generally some traffic growth (exceptions to this include data from 2020 and locations where data was recorded over different months). Historic traffic growth on the corridor provides limited insight without a continuous counter however from three sites with multiple data sets growth was observed between 0-3% representative of linear traffic growth in the order of 100 – 200 vehicles annually. Where growth was observed as 0-1% this may be resultant of the data collection periods, due to the amount of vehicles that the growth estimates refer to it is considered appropriate to conservatively estimate growth. As such the data generally correlates the conservative estimate of a linear average of 2.5% per annum.

4.4 Developments

In South West Rocks residential development is generally spread across the study area, with more concentrated development south-east of the town centre in recent years. The largest increasing household type is lone person households and this trend is set to continue over the next 20 years, while the overall average household size is expected to increase slightly.

While there has been a moderate increase in the proportion of medium density housing available in South West Rocks, the majority of houses are single detached 3–4-bedroom dwellings.

Residential development forecasts assume that the number of dwellings will increase by an average of 71 dwellings per annum to 4,519 in 2036, with the average household size rising from 2.10 to 2.14 between 2016 and 2036, as shown in Table 4.3.

Table 4.3 Forecast households and dwellings

Summary	2016	2021	2026	2031	2036
Households	2,473	2,659	2,934	3,250	3,597
Average household size	2.10	2.12	2.14	2.14	2.14
Dwellings	3,109	3,341	3,686	4,084	4,519
Dwelling occupancy rate	79.54	79.59	79.60	79.58	79.60

Data obtained from Population and household forecasts, 2016 to 2036, (.id informed decisions, 2018), accessed October 2021

The *North Coast Regional Plan 2036* has identified South West Rocks as an Urban Growth Area. The delivery of housing is a priority with the aim to deliver an appropriate supply of residential land within local growth management strategies and local plans to meet the region's projected housing needs.

Council is continuing to receive proposals for future infill and greenfield housing developments. Although South West Rocks is experiencing increasing demand for housing, development is restricted by the natural environment surrounding the locality including vegetation, coastline and natural waterways.

Urban release areas have been identified in South West Rocks for future residential development under the *Kempsey Local Environment Plan 2013*. They are used to provide planning directions for greenfield residential development areas that are to be addressed before development approvals are fully considered.

Prior to the development of any site within the urban release area, Council require a master plan to be prepared. A master plan is an overarching planning document and spatial layout which is used to structure land use and development. It is a dynamic long-term planning document that provides a conceptual layout to guide future growth and development. Areas that have been master planned for future residential growth and details of the number of lots involved in these residential subdivisions are shown in Figure 4.3.

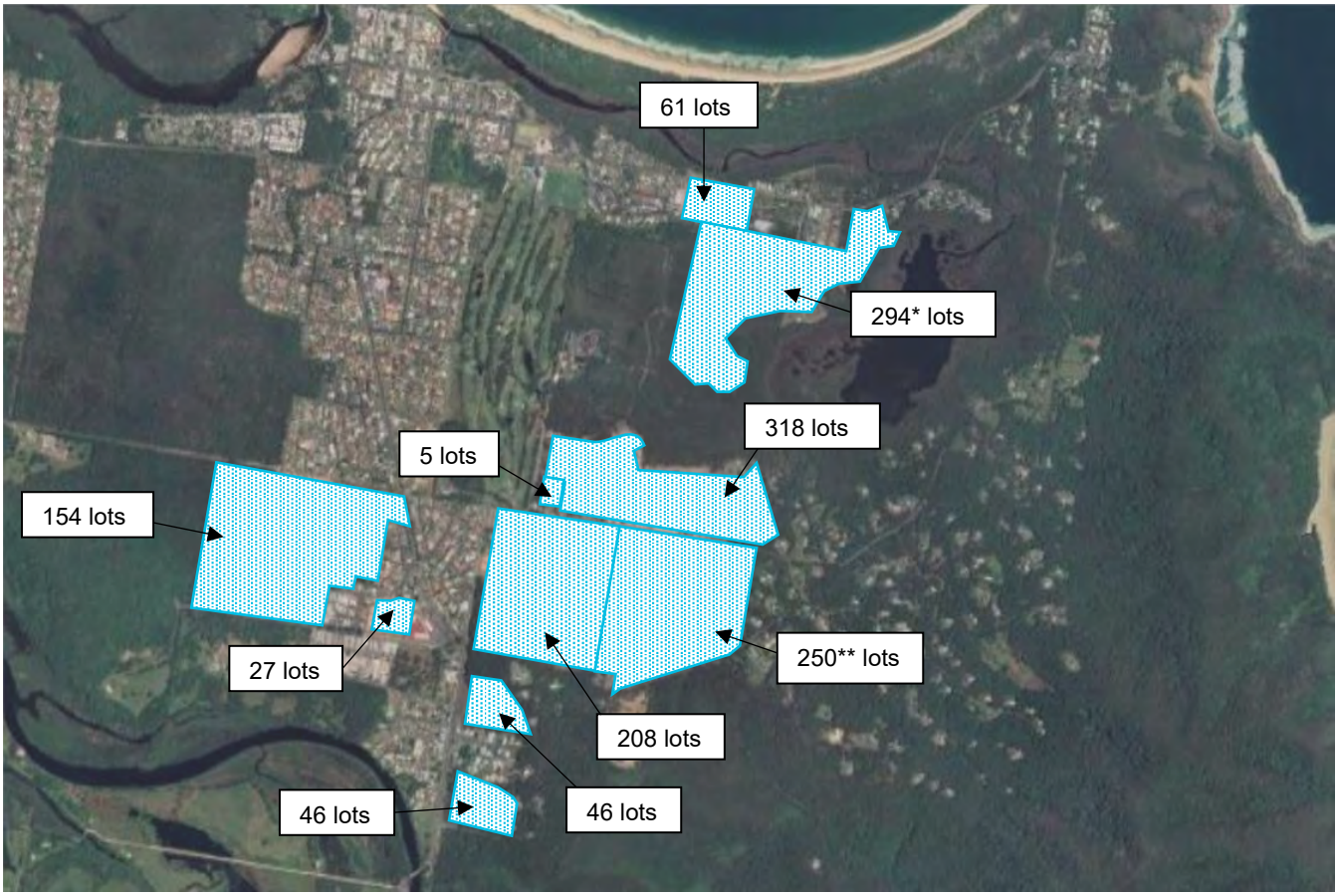


Figure 4.3 Residential subdivisions in South West Rocks

Base imagery obtained from Google Maps, accessed August 2022

**Number of lots estimated based on Appendix 2 of the Planning Proposal for Part of Lot 35 DP 1214499 'Saltwater', South West Rocks (Keiley Hunter Town Planning, 2021).*

***Number of lots estimated based on Seascape Grove, Belle O'Connor Street, South West Rocks, Stage 1 Traffic Impact Assessment (Environmental Resources Management Australia, 2006).*

The locations of areas master planned for future residential growth shown in Figure 4.3 indicate that Steve Eagleton Drive, Belle O'Connor Street and Phillip Drive will provide access to and from the majority of the master planned developments. As such, they will be key future road network elements. In addition, Gregory Street will continue to be a key road network element as the transport spine of the community.

4.5 Forecast vehicle trips

Traffic modelling is a useful tool to assess infrastructure before it is built as well as to assess infrastructure under various volumes. In order to consider future traffic demand conditions a best prediction is required to be made on what future traffic demands may be. Four key inputs were reviewed to predict future demand:

1. Existing demand, from traffic survey
2. Vehicle ownership (refer Section 4.2)
3. Historic growth (refer Section 4.3)
4. Development traffic generation (refer Section 3)

Traffic generation from developments discussed in Section 3 are summarised in Table 4.4. As reviewed in Section 3, there is a dominant use of private vehicles as a means of travel, with a low uptake of active transport and a very small proportion using public transport. When predicting future traffic volumes, behavioural change is difficult to estimate, however given the existing infrastructure in place, mode shifts to active and public transport aren't anticipated without changes to the network. As such the traffic generation considers trips by passenger vehicles only.

Table 4.4 Development traffic growth summary

Development	Access	Peak hour generation
Seascape Grove Stage 1	Extension of Belle O'Connor Street	177
	Belle O'Connor Street, approximately 55 m northwest of Anthea Parade	
	Belle O'Connor Street via extension of Burrawong Drive	
Seascape Grove Stage 2	Belle O'Connor Street (extension of existing)	213
	Arakoon Road, approximately 50 m west of Lighthouse Road)	
Saltwater Belle O'Connor Street	Belle O'Connor Street via new access road	270
	Phillip Drive via extension of Waianbar Avenue	
ROSARII	Cooper Street approximately 90 m east of Gregory Street (via new access roads)	40
Settlers Ridge	Extension of Steve Eagleton Drive	131
	Keith Andrews Avenue, approximately 65 m east of Rippon Place	
	Extension of Trevor Judd Avenue	
13-19 Steve Eagleton Drive	Steve Eagleton Drive, approximately 170 m southwest of Gregory Street	23
SWRUT	Phillip Drive, approximately 230 m east of Wongarl Avenue	52
18 Belle O'Connor Street	Anthea Parade, approximately 150 m east of Belle O'Connor Street	5
286-310 Gregory Street	Gregory Street, approximately 90 m north of Lindsay Noonan Drive (via new access roads)	40
	Tallowwood Place, approximately 180 m east of Gregory Street	
Saltwater Phillip Drive	Extension of Waianbar Avenue	250
	Anthea Parade via extension of Waianbar Avenue	
	Phillip Drive via new access road through SWRUT development	

Peak hour traffic generation from traffic reports provided by Council generally adopted a 0.85 trips per peak hour generation rate. Where trip generation was not provided for a development or the provided value was less than 0.85 trips per peak hour, a rate of 0.85 trips per peak hour was adopted for consistency.

4.6 Proposed link road

The feasibility of a "link road" between Belle O'Connor Street and Phillip Drive has been investigated by others as part of master planning for existing subdivision development approvals within the Saltwater precinct. These investigations commenced around 2008 and have continued as part subsequent subdivision development applications in the form of detailed traffic impact statements. The assessments undertaken to date support planning for the link road primarily to provide connectivity between the adjoining subdivision developments and secondly to function as a major distributor road within the South West Rocks Road hierarchy. The southern connections of Athena Parade and Shamrock Avenue, and the northern connection of Hillier Parade are constructed in accordance with Council geometric design standards referred to in Section 6.1.1.

The proposed link road connecting Shamrock Avenue and Hillier Parade – between Belle O'Connor Street and Phillip Drive is indicated on Figure 4.4.

Figure 4.4 Proposed link road

5. Network performance

Transport modelling has been undertaken to better understand movement within the study area. A summary of network statistics produced in the model is provided in the following sections.

5.1 Current demand

The South West Rocks Traffic Model (the model) was used as calibration to 2021 traffic conditions to undertake some assessments of performance under current demand simulated conditions. The model provides AM and PM peak periods, noting the demand profile of roads within the network varies and does not consistent follow a peak hour pattern these two periods are considered as indicative of common demand scenarios for the network.

5.1.1 Network performance statistics

Vehicle Kilometres Travelled (VKT) is a measure of the sum of the distance travelled by each vehicle in the model. Changes in VKT, with no increase in network capacity, are related to changes in demand. For this situation a change in the VKT reflects an increase in the number of vehicles travelling through the network, such as would occur due to a new development, or a decrease in the number of vehicles travelling through the network due to the diversion of traffic with an alternate road connection provided.

Vehicle Hours Travelled (VHT) is a measure of the sum of the time spent by each vehicle in the model. Changes in VHT may align with changes in VKT, but where they do not, it may indicate improved or worsening conditions.

By combining VKT and VHT it is possible to estimate the average vehicle speed for all vehicles in the study area. This provides a clear indication of the impact of a particular scenario.

Table 5.1 outlines a summary of the AM and PM network statistics under current demand. The PM peak has a higher VKT, indicating that demand is greater in the PM peak than the AM peak. The difference in VHT aligns with the difference in VKT between the AM and PM peaks, resulting in a similar average speed and indicating that conditions on the network are similar in the AM and PM peaks.

Table 5.1 Traffic model peak period current network statistics

Network Statistic	AM Peak (7:00 – 9:00 AM)	PM Peak (3:30 – 4:30 PM)
VKT (km)	5,610	6,734
VHT (hours)	96	114
Average Speed (km/h)	58.6	59.1

The average speed limit on the modelled network is 55.8 km/h. The average speeds calculated for the AM and PM peaks are slightly higher than the average speed limit, indicating that traffic generally experiences free flow conditions under current demand.

5.1.2 Delays

There are numerous definitions of delay in the context of traffic. The Highway Capacity Manual (Transportation Research Board, 2000) provides five basic delay definitions as follows:

1. **Control delay:** the delay caused by a traffic control device.
2. **Geometric delay**: the delay caused by the requirement for vehicles to reduce speed to negotiate geometric features of the road.
3. **Incident delay:** the delay caused by an incident.
4. **Traffic delay:** the delay caused by vehicles reducing speed below free flow speed due to interaction with other vehicles.
5. **Total delay**: the sum of control, geometric, incident and traffic delay.

In general, delay is measured as the difference between actual journey time and a base journey time that is generally represented by the free flow speed (Austroads *Guide to Traffic Management Part 3: Transport Study and Analysis Methods* (AGTM03-20), 2020).

Modelled Total Delay at key locations on the network are shown for each of the peak hours in Figure 5.1 and Figure 5.2. The legend for the figures is aligned to Austroads LoS criteria for unsignalised intersections from LoS A to LoS E, where LoS D is considered a target for urban environments. All observed results were LoS A.

Figure 5.1 Current AM simulated delay time (s)

Figure 5.2 Current PM simulated delay time (s)

During both the AM and PM peaks under current demand conditions, very little delay was observed. All model sections experienced delay of less than 10 seconds (LoS A).

5.1.3 Key route travel times

Travel time is a major transportation network performance indicator. It is recognised that travel time variability is an important consideration in route choice, and that it can provide information on a traffic network's congestion levels (AGTM03, 2020). Key route travel time is the actual time taken to traverse the length of a key route.

The following four key routes were identified:

– Gregory Street between Plummers Lane and Livingstone Street (approximately 4.4 km)
– Gregory Street between Frank Cooper Street and Livingstone Street (approximately 1.6 km)
– Arakoon Road / Russell Street between Gregory Street and Phillip Drive (approximately 4.6 km)
– Landsborough Street / Phillip Drive between Gregory Street and Russell Street (approximately 2.9 km)

Travel time, average speed and LOS for urban and suburban arterial roads with interrupted flow conditions were determined in both direction for each key route and are shown in Table 5.2. In the peak periods observed, travel times and speeds on key routes were observed to perform well, particularly for a peak period, and with acceptable LOS.

Table 5.2 Current key route travel times (s) and average speeds (km/h) [LOS]

Route	Direction	AM Peak		PM Peak	
		Travel Time	Average Speed [LOS*]	Travel Time	Average Speed [LOS*]
Gregory St (Plummers Ln – Livingstone St)	NB	302	52 [A]	303	52 [A]
	SB	302	52 [A]	300	52 [A]
Gregory St (Frank Cooper St – Livingstone St)	NB	117	48 [A]	116	48 [A]
	SB	115	49 [A]	113	50 [A]
Arakoon Rd / Russell St (Gregory St – Phillip Dr)	NB	211	79 [A]	210	79 [A]
	SB	212	79 [A]	210	79 [A]
Landsborough St / Phillip Dr (Gregory St – Russell St)	EB	207	51 [A]	207	51 [A]
	WB	208	50 [A]	209	50 [A]

**For the purposes of this assessment the BFFS has been estimated as the speed limit.*

Modelled travel time on these routes is shown graphically in Figure 5.3 – Figure 5.10. As shown, travel time in the AM and PM and along the length of each route in each direction is generally very consistent, aligning with understanding the vehicles are generally able to nominate travel speed (i.e. free flow conditions).

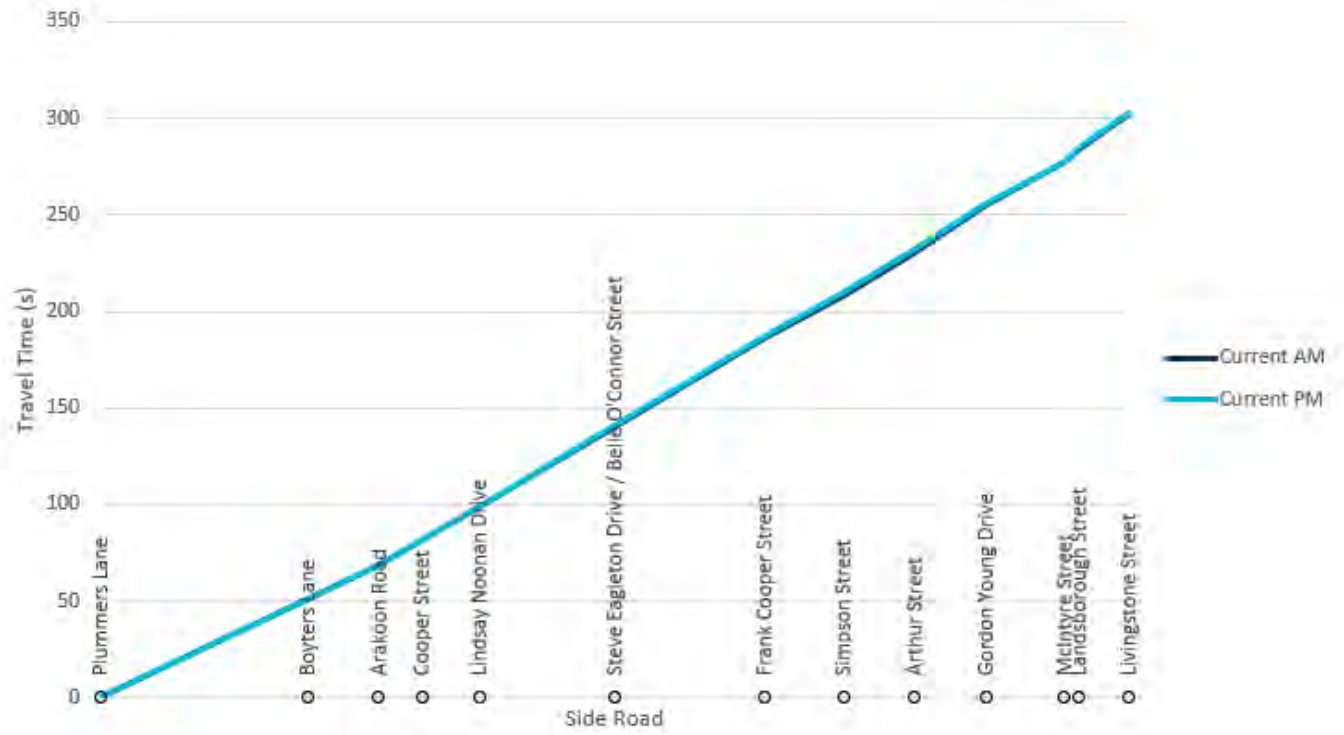


Figure 5.3 *Travel time on Gregory Street northbound between Plummers Lane and Livingstone Street*

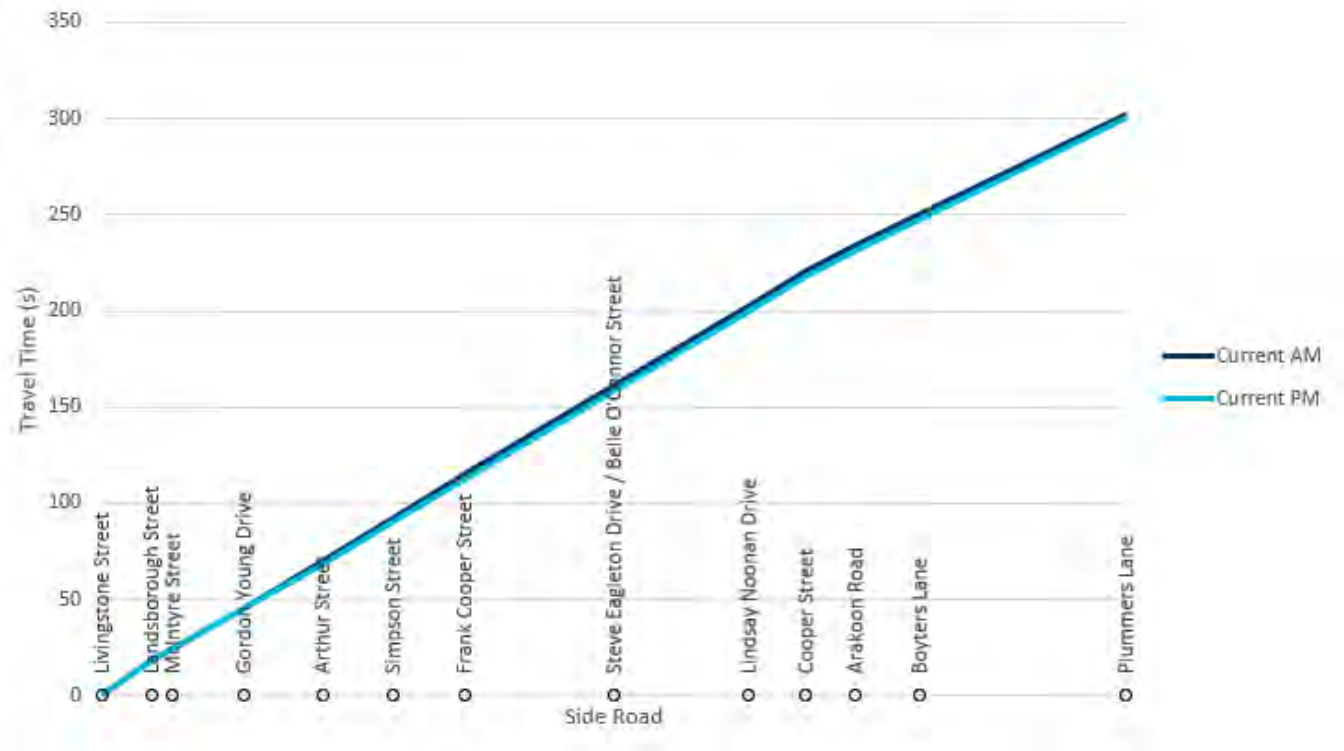


Figure 5.4 *Travel time on Gregory Street southbound between Livingstone Street and Plummers Lane*

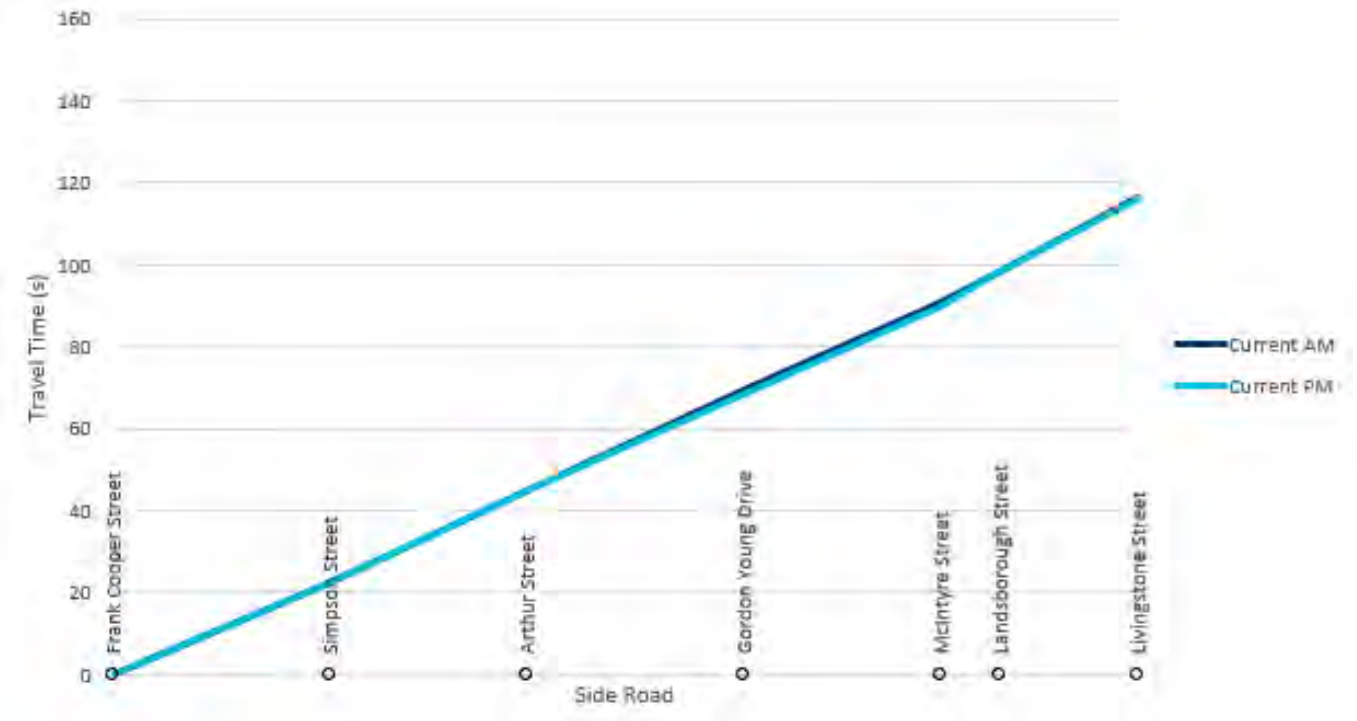


Figure 5.5 *Travel time on Gregory Street northbound between Frank Cooper Street and Livingstone Street*

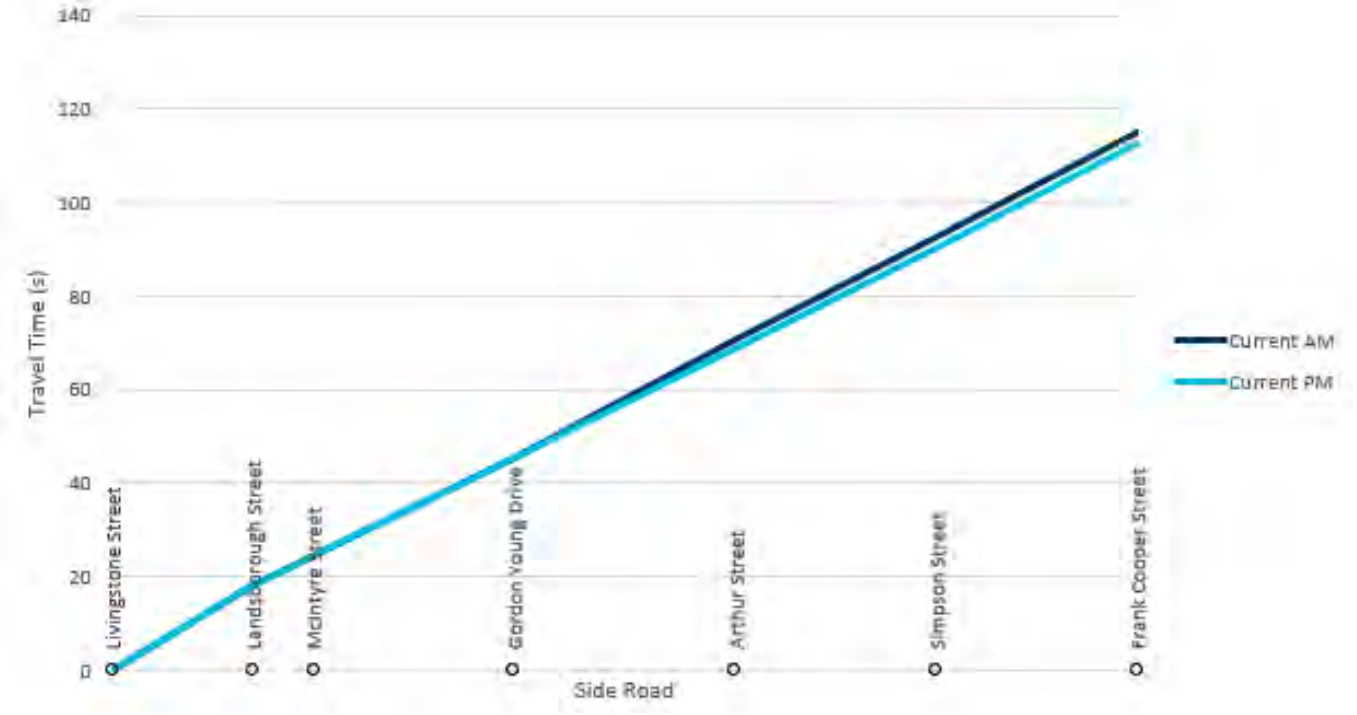


Figure 5.6 *Travel time on Gregory Street southbound between Livingstone Street and Frank Cooper Street*

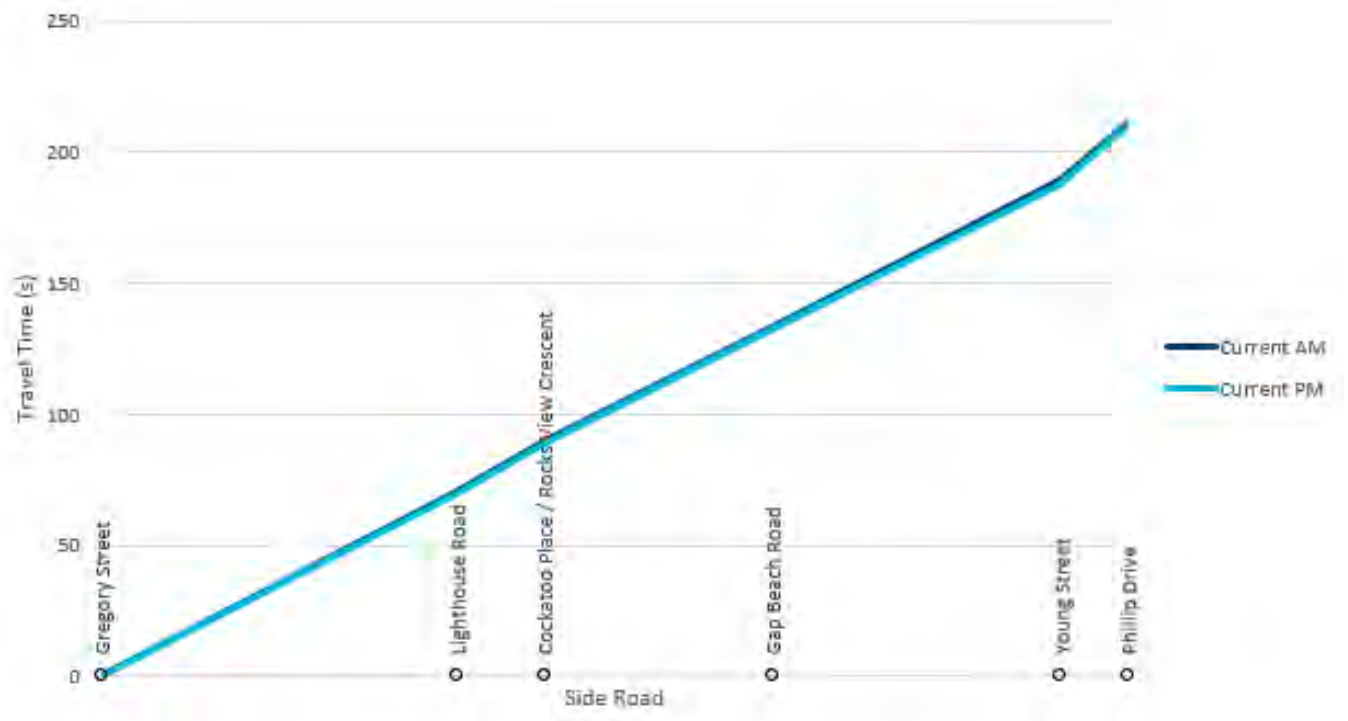


Figure 5.7 Travel time on Arakoon Road / Russell Street northbound between Gregory Street and Phillip Drive

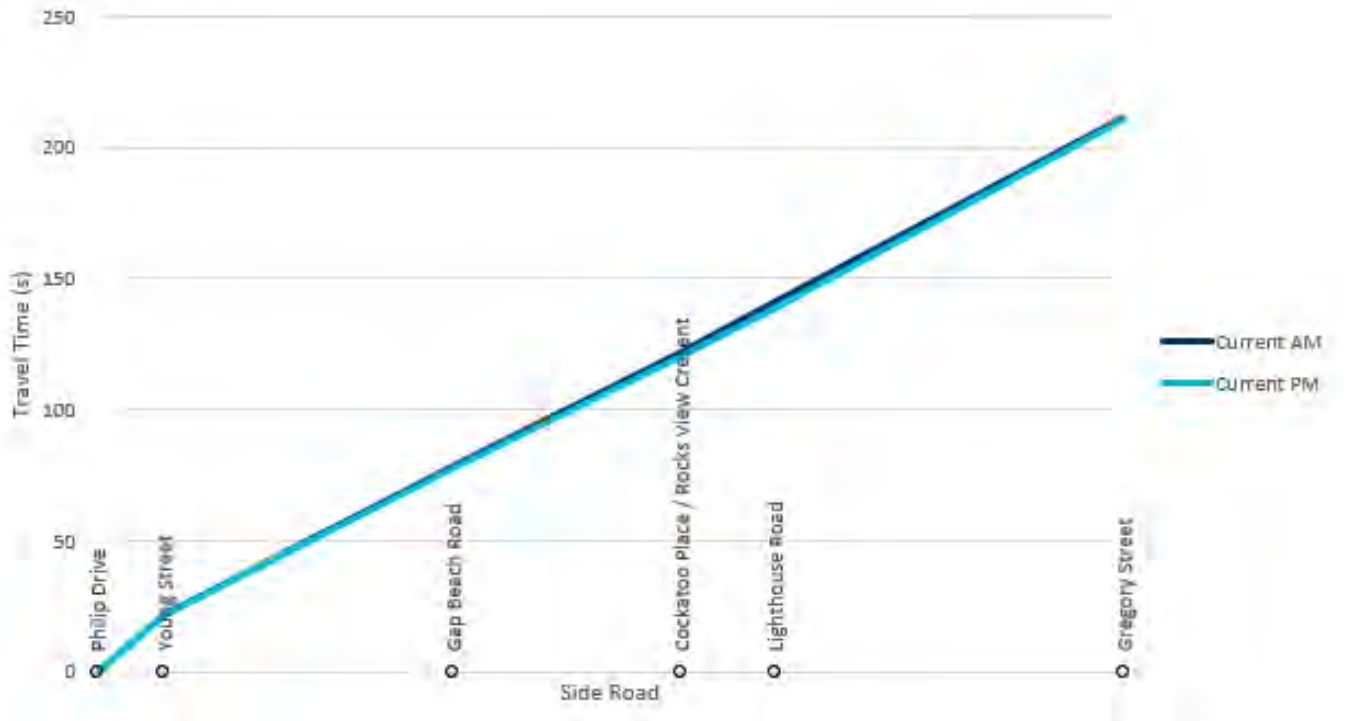


Figure 5.8 Travel time on Arakoon Road / Russell Street southbound between Phillip Drive and Gregory Street

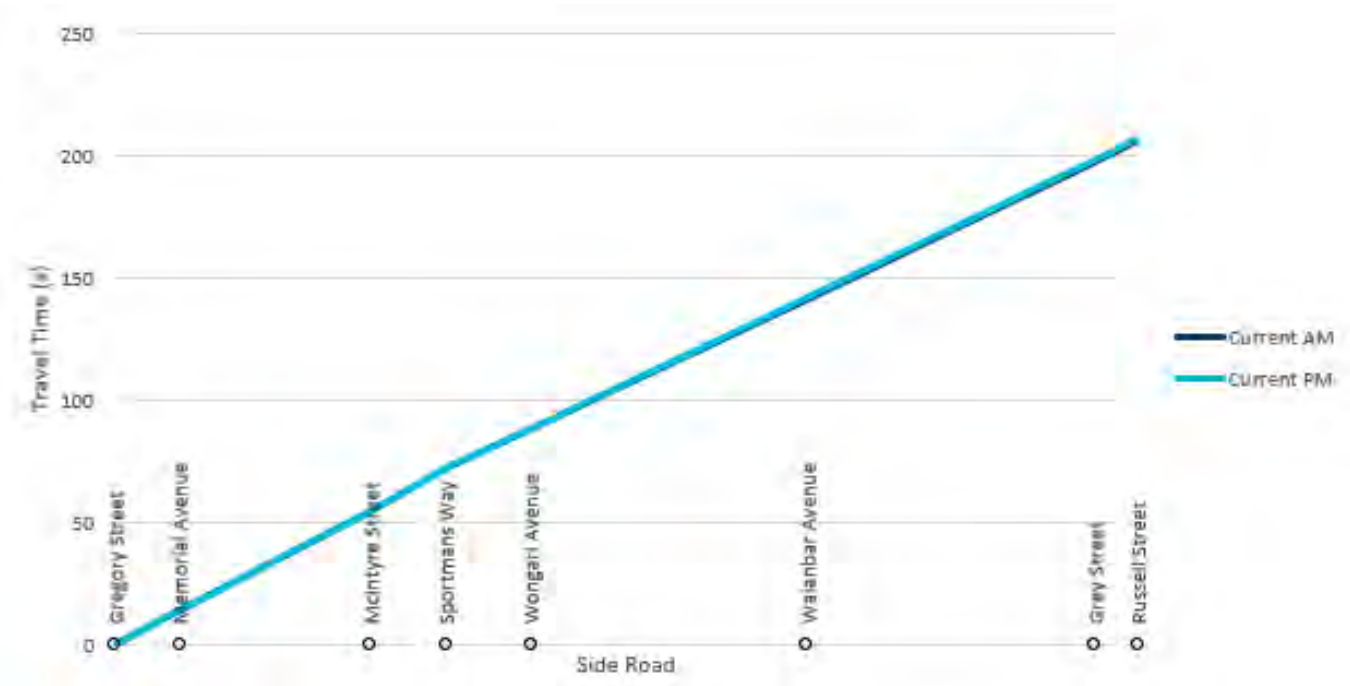


Figure 5.9 Travel time on Landsborough Street / Phillip Drove eastbound between Gregory Street and Russell Street

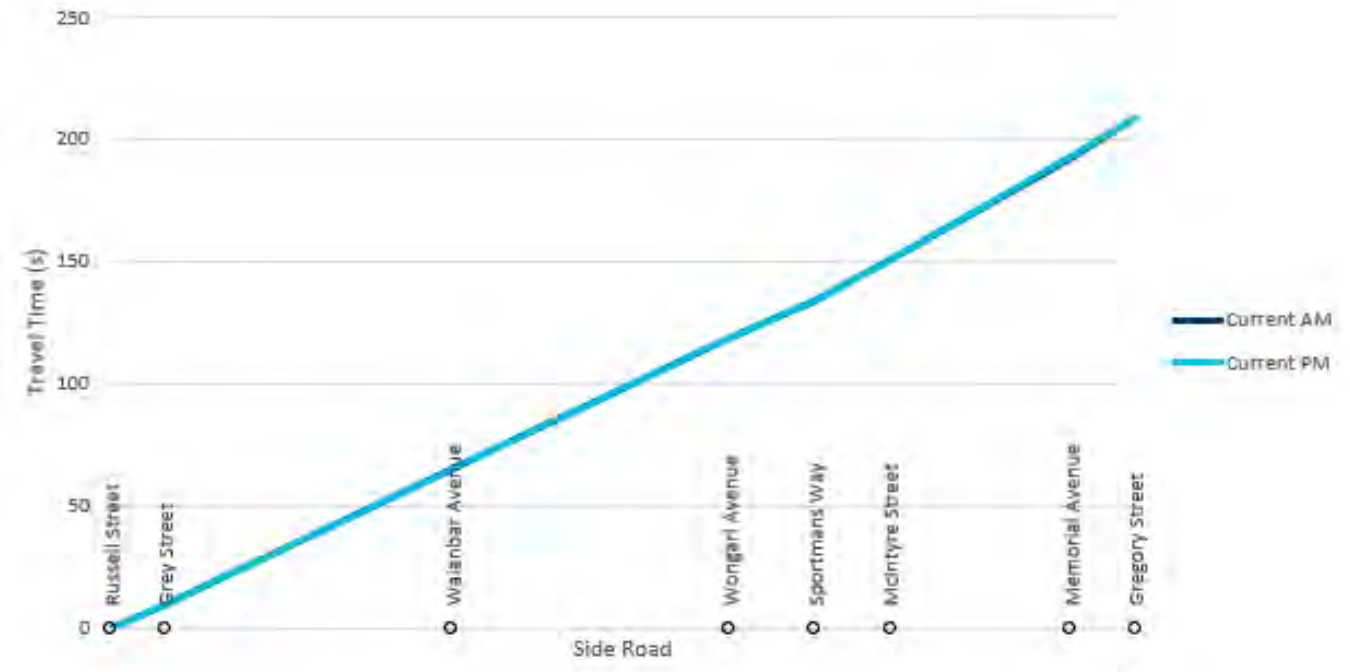


Figure 5.10 Travel time on Landsborough Street / Phillip Drive westbound between Russell Street and Gregory Street

5.2 Forecast demand

Forecast future demand was developed for a‘2030 demand model’ which was determined based on background growth and specific development growth discussed in Section 4.5. An additional ‘2040 demand model’ was also considered, whose demand was conservatively based on background growth applied to the forecast 2030 demand. The background growth has been taken conservatively to be 2.5% linear growth per annum. The outputs of the model are as such reflective of this forecast traffic growth plus development traffic growth as follows:

– ‘2030 demand model’ = 9 years of 2.5% linear growth with adjustments for the developments detailed in Section 4.5.
– ‘2040 demand model’ = ‘2030 demand model’ with an additional 10 years of linear growth applied.

Both models are considered to provide a conservative estimate of private vehicle demand generation – however the result indicate satisfactory performance under the future scenarios suggest there is a high theoretical capacity within the network.

5.2.1 Network performance statistics

Table 5.3 outlines a summary of the AM and PM network statistics under estimated 2030 and 2040 demand. In 2030 and 2040, the PM peak has a higher VKT, indicating that demand is greater in the PM peak than the AM peak, consistent to the current demand. The difference in VHT aligns with the difference in VKT between the AM and PM peaks, resulting in similar average speeds and indicating that conditions on the network are similar in the AM and PM peaks in 2030 and 2040.

Table 5.3 Traffic model peak period future network statistics

Network Statistic	Year	AM Peak (7:00 – 9:00 AM)	PM Peak (3:30 – 5:30 PM)
VKT (km)	2030	14,389	16,396
	2040	17,095	19,521
VHT (hours)	2030	245	284
	2040	297	349
Average Speed (km/h)	2030	58.8	57.8
	2040	57.6	55.9

The average speeds are very similar to those in current conditions, indicating that conditions are similar under current, estimated 2030 and 2040 demand on a network level, with some minor overall reductions in average speed which is considered to be a combination of increase in trips on lower speed routes and some minor overall speed reductions.

The average speed limit on the modelled network is 55.8 km/h. The average speeds calculated for the AM and PM peaks are still slightly higher than the average speed limit, indicating that traffic generally experiences free flow conditions under current demand.

5.2.2 Delays

Delay at key locations on the network for 2030 and 2040 are shown for each of the peak hours in Figure 5.11 - Figure 5.14.

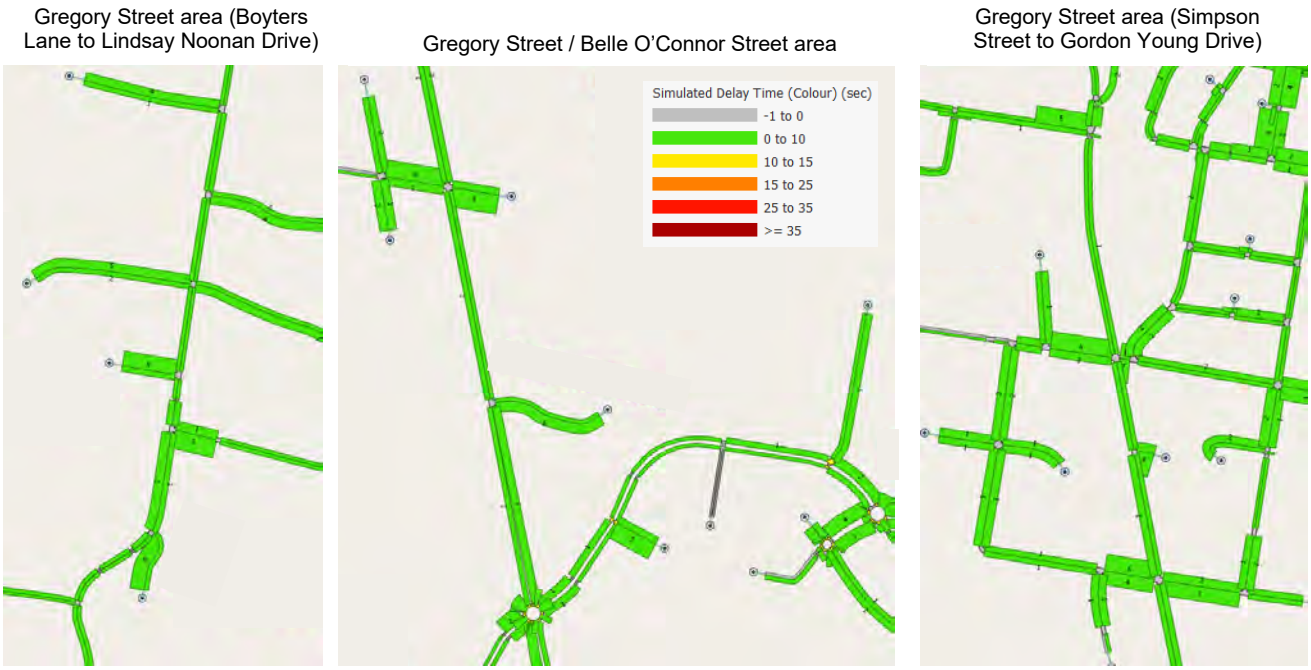


Figure 5.11 2030 AM simulated delay time (s)

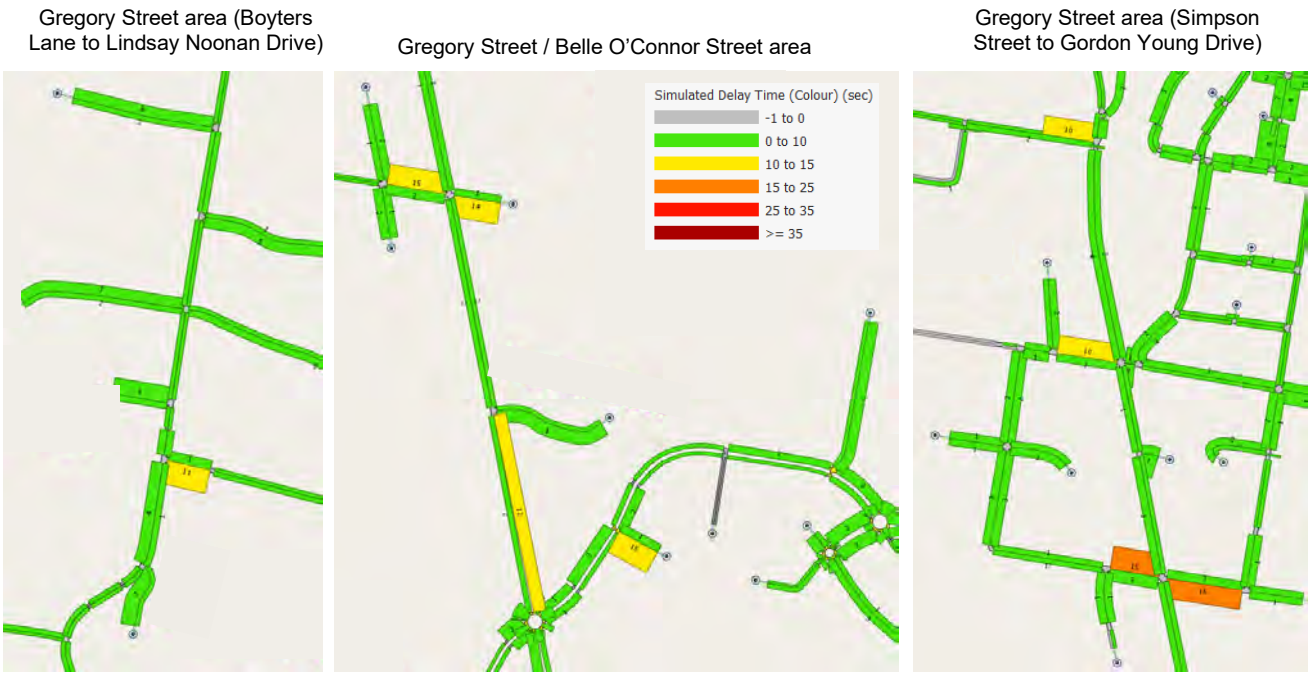


Figure 5.12 2030 PM simulated delay time (s)

In the 2030 AM peak, very little delay was observed with all model sections experiencing delay of less than 10 seconds (LoS A), similar to current delay.

In the 2030 PM peak, the majority of the network was observed to experience delays of less than 10 seconds. The greatest delays observed were of up to 16 seconds (LoS C) on the Simpson Street approaches to Gregory Street. Delays of up to 15 seconds were observed on the Arakoon Road, Frank Cooper Street, Arthur Street eastbound and Gordon Young Drive approaches to Gregory Street, on the Gregory Street southbound approach to Belle O'Connor Street / Steve Eagleton Drive and the Dennis Crescent approach to Belle O'Connor Street. These delays are likely to have been caused by the significant increase in traffic on Belle O'Connor Street as a result of planned developments, it is noted that the demand generated is based on standard factors as detailed in Section 4.5 making the estimate conservative. This result indicates that alternative transport connections (i.e. active transport) will be important to be provided alongside development to minimise broader impact, however impact is generally minor. All delays still indicate a reasonable level of service provided.

Figure 5.13 2040 AM simulated delay time (s)

Figure 5.14 2040 PM simulated delay time (s)

In the 2040 AM peak, very little delay was observed with all model sections experiencing delay of less than 10 seconds (LoS A), similar to current and 2030 AM delay.

In the 2040 PM peak period, delays on the majority of the network were observed to be less than 10 seconds. There were several areas which experienced slightly higher delays. The greatest delay of 26 seconds (LoS D) was observed on the Arakoon Road approach to Gregory Street, as a result of higher demand on Gregory Street to which traffic from Arakoon Road is required to give way. Delays of 17 seconds (LoS C) were observed on the Gregory Street southbound approach to the Belle O'Connor Street / Steve Eagleton Drive, as a result of the high volume of traffic accessing Belle O'Connor Street from the eastbound and northbound approaches to the roundabout, to which southbound traffic on Gregory Street are required to give way. These delays were observed to result in queuing along Gregory Street which resulted in delays of up to 17 seconds (LoS C) on the Meehan Close and Frank Cooper Street approaches to Gregory Street. Further north, the Simpson Street, Arthur Street and Gordon Young Drive approaches to Gregory Street experienced delays of up to 18 seconds (LoS C). All delays still indicate a reasonable level of service provided.

5.2.3 Key route travel times

Travel time, average speed and LOS for urban and suburban arterial roads with interrupted flow conditions were determined in both direction for each key route under estimated 2030 and 2040 demand conditions and are shown in Table 5.4. In the peak periods observed, travel times and speeds on key routes were observed to perform well, particularly for a peak period, and with acceptable LOS.

Table 5.4 Future key route travel times (s) and average speeds (km/h)

Route	Direction	2030				2040			
		AM Peak		PM Peak		AM Peak		PM Peak	
		Travel Time	Av Speed [LOS*]	Travel Time	Av Speed [LOS*]	Travel Time	Av Speed [LOS*]	Travel Time	Av Speed [LOS*]
Gregory St (Plummers Ln - Livingstone St)	NB	315	50 [A]	317	50 [A]	321	49 [A]	326	48 [A]
	SB	310	51 [A]	313	50 [A]	316	50 [A]	321	49 [A]
Gregory St (Frank Cooper St - Livingstone St)	NB	122	46 [A]	123	46 [A]	126	45 [A]	127	44 [A]
	SB	118	47 [A]	115	49 [A]	122	46 [A]	117	48 [A]
Arakoon Rd / Russell St (Gregory St - Phillip Dr)	NB	213	78 [A]	214	78 [A]	213	78 [A]	215	77 [A]
	SB	223	75 [A]	228	73 [A]	245	68 [A]	285	59 [B]
Landsborough St / Phillip Dr (Gregory St - Russell St)	EB	211	50 [A]	214	49 [A]	213	49 [A]	217	49 [A]
	WB	213	49 [A]	214	49 [A]	216	49 [A]	217	48 [A]

**For the purposes of this assessment the BFFS has been estimated as the speed limit.*

Modelled travel time on these routes is shown graphically in Figure 5.15 – Figure 5.22. Overall, 2030 and 2040 travel times were similar to current travel times, with the exception of Arakoon Road / Russell Street southbound between Lighthouse Road and Gregory Street, which had a higher travel time as shown in Figure 5.20. There is observed general reductions in travel times as traffic volume increases, however a high level of service and general free flow conditions are still observed for the majority of the network.

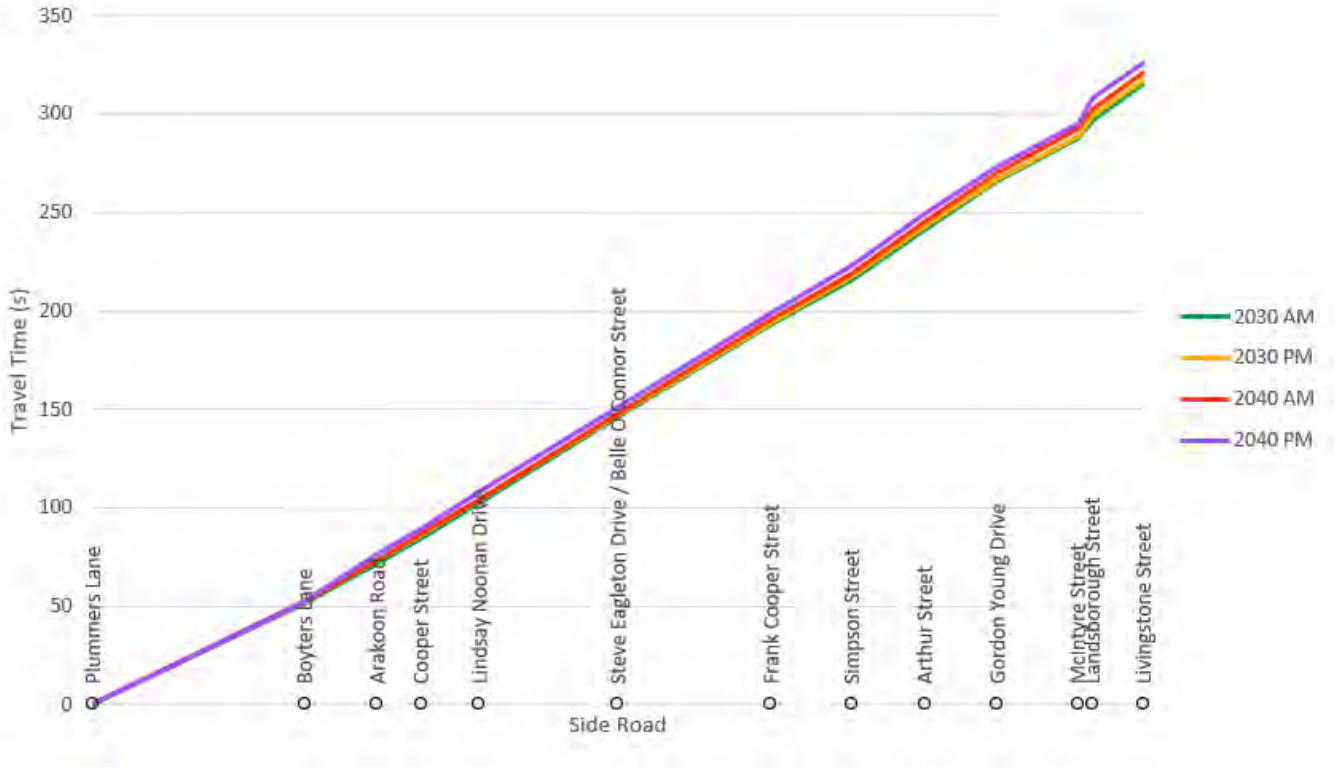


Figure 5.15 Travel time on Gregory Street northbound between Plummers Lane and Livingstone Street

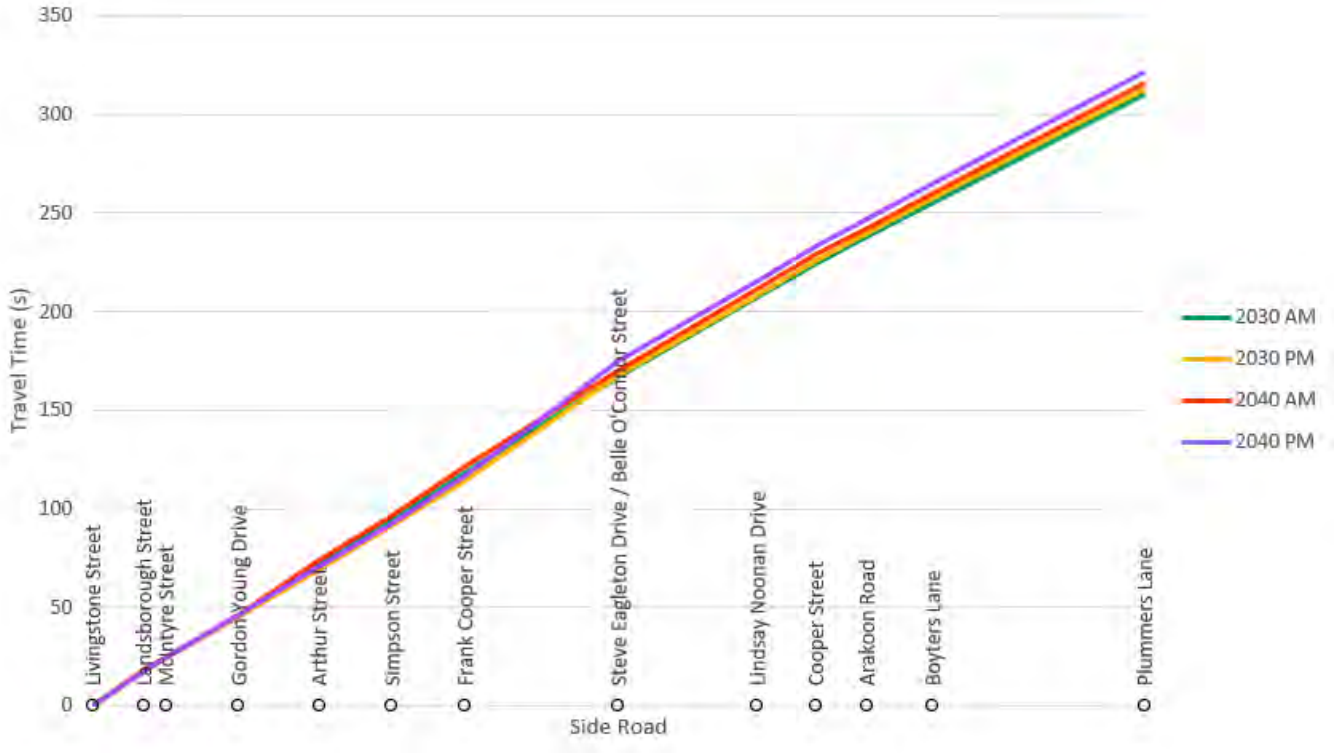


Figure 5.16 Travel time on Gregory Street southbound between Livingstone Street and Plummers Lane

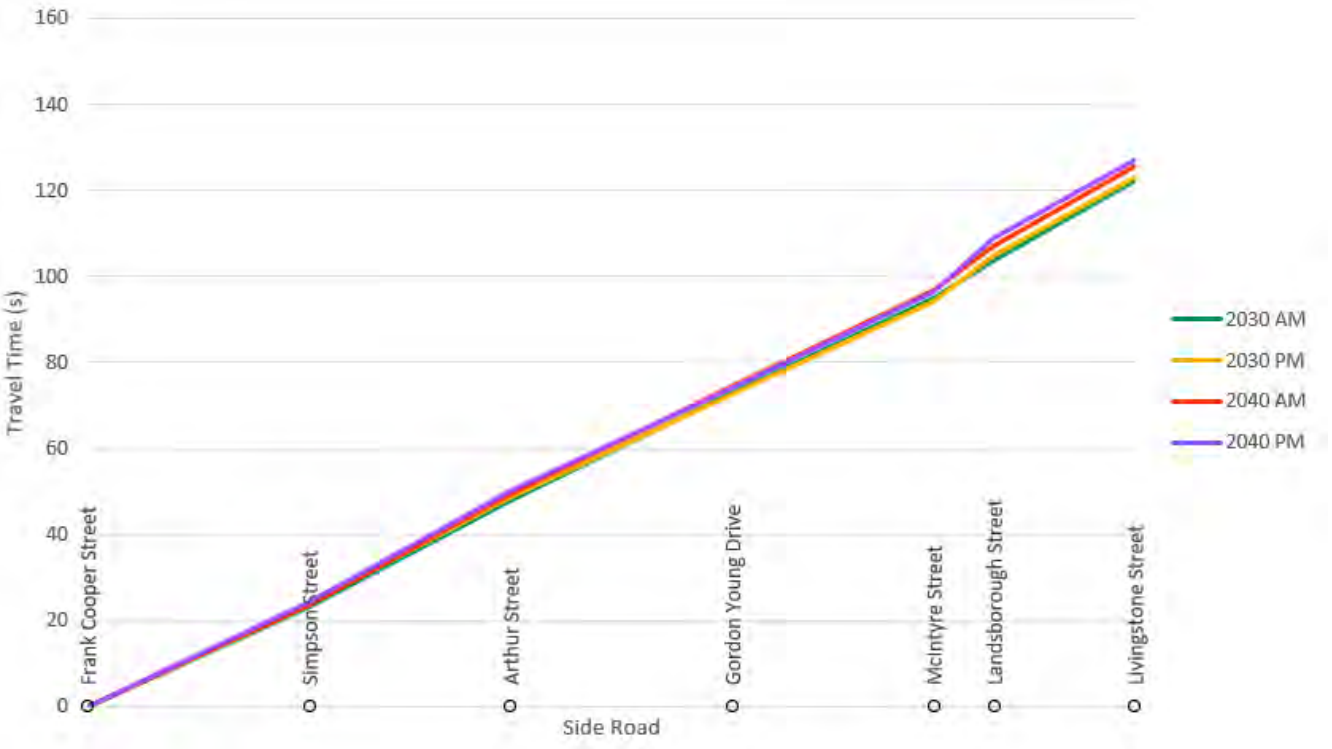


Figure 5.17 Travel time on Gregory Street northbound between Frank Cooper Street and Livingstone Street

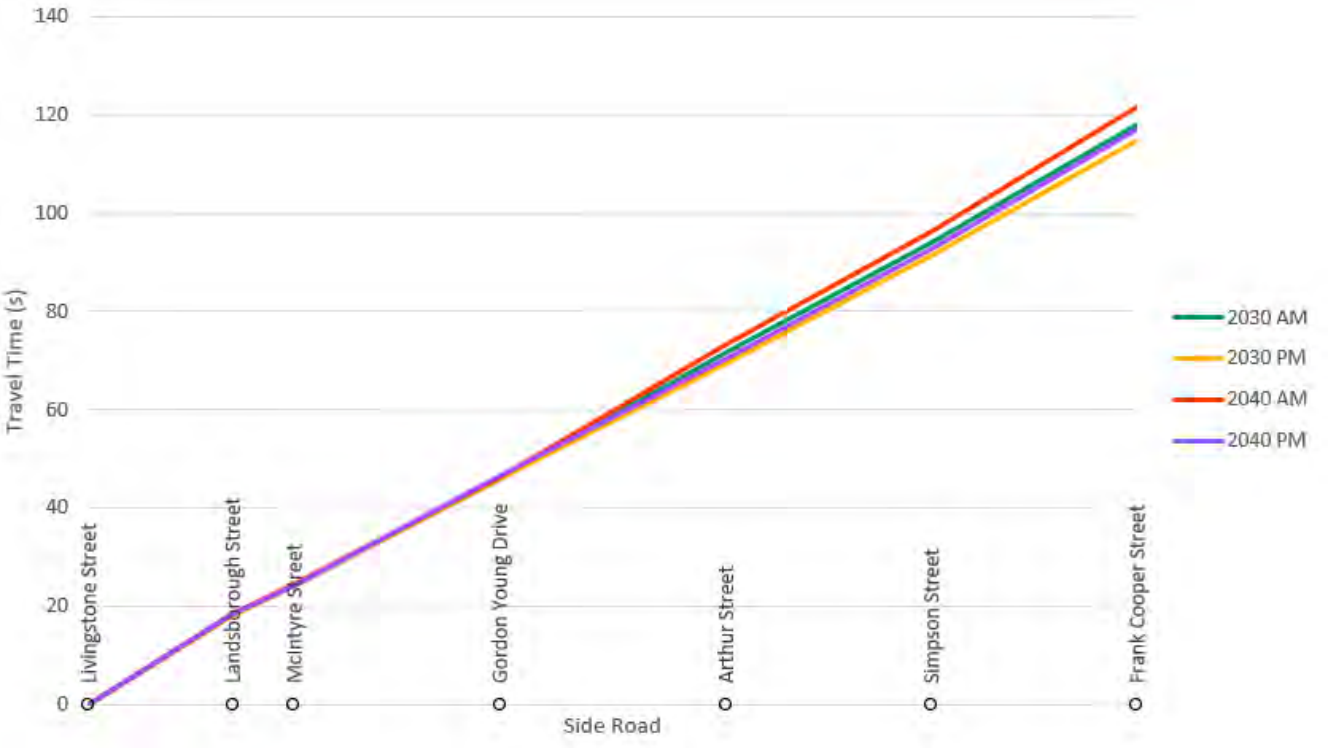


Figure 5.18 Travel time on Gregory Street southbound between Livingstone Street and Frank Cooper Street

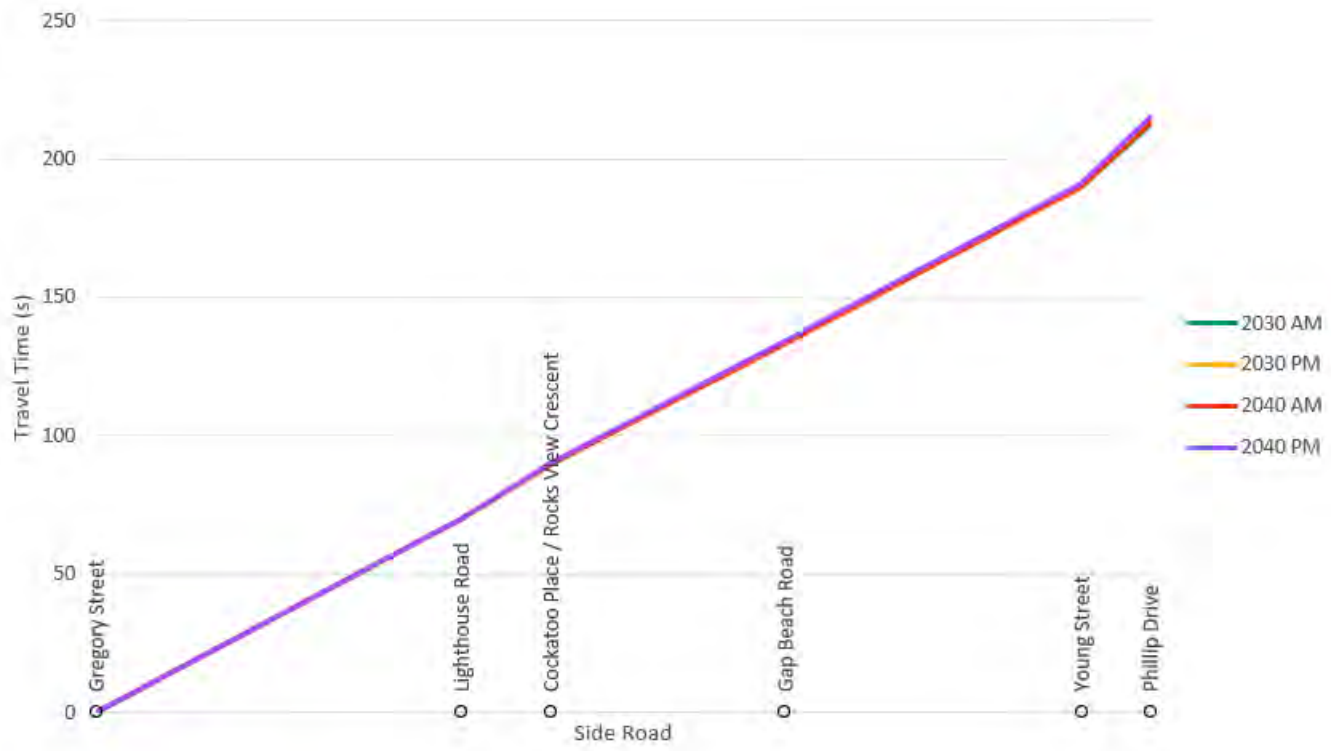


Figure 5.19 Travel time on Arakoon Road / Russell Street northbound between Gregory Street and Phillip Drive

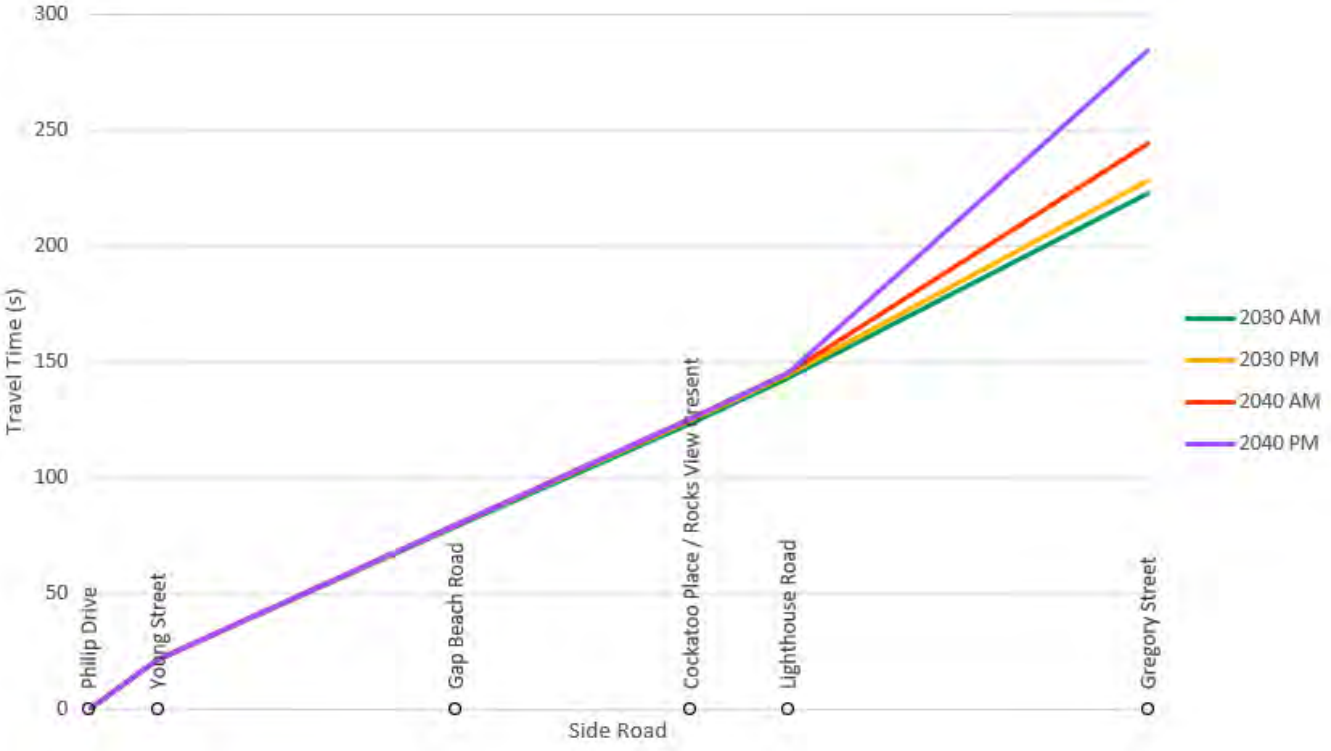


Figure 5.20 Travel time on Arakoon Road / Russell Street southbound between Phillip Drive and Gregory Street

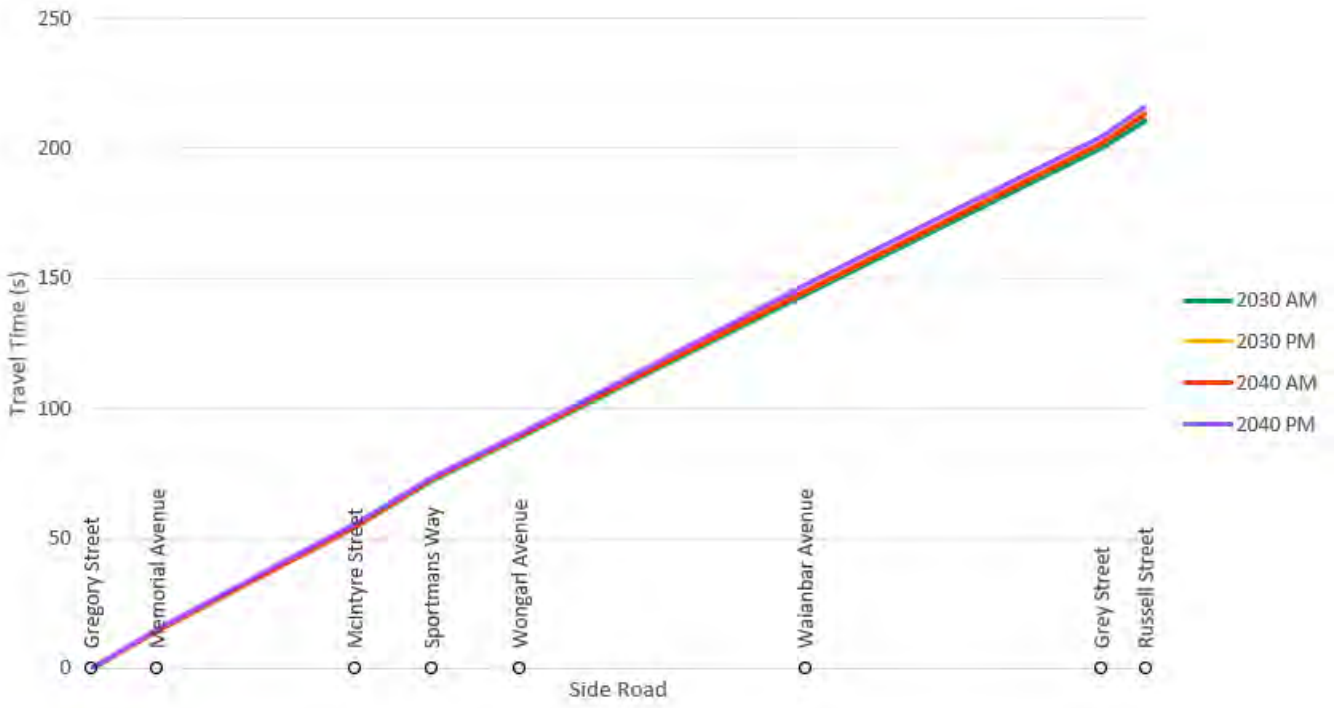


Figure 5.21 Travel time on Landsborough Street / Phillip Drive eastbound between Gregory Street and Russell Street

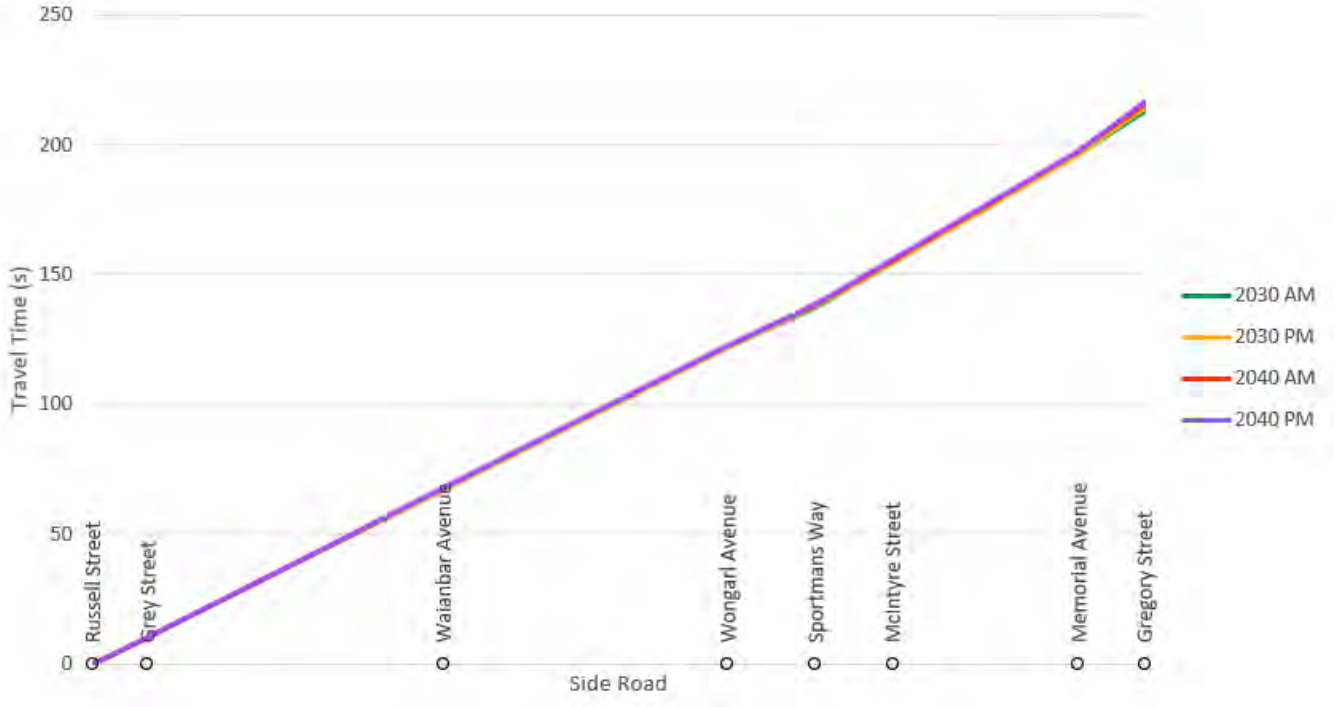


Figure 5.22 Travel time on Landsborough Street / Phillip Drive westbound between Russell Street and Gregory Street

5.3 Performance summary

From the current demand and forecast demand modelling, further analysis of the network particularly with regard to network performance, was able to be undertaken. The modelling indicated a high level of service achieved both currently and with forecasted demand. It is noted that some travel times in the model are faster than recorded conditions, this indicates two key factors:

– Free flow conditions on site mean vehicles are able to ‘choose’ their speed, given the area context this may mean choosing a speed lower than posted speed limit
– Road conditions may be limiting factor of speed and travel time rather than posted speed limit

Some minor delays were observed under forecast demand conditions generally associated with concentrated development growth. This provides a key opportunity for alternative transport modes to service demand – particularly active transport. Concentrated growth indicates priority areas for public and active transport provisions to support more sustainable mode uptake.

6. Road hierarchy

As discussed in Section 2.3, a road hierarchy can provide a strategic framework in the context of which planning and management of the road network can be conducted. This section will consider the road hierarchy in the study area in terms suitability, strengths and weaknesses of the current hierarchy, and the opportunities that can be created through the redefinition of road categories. This will include opportunities to reduce 'rat running' and investigate a suitable road link between Belle O'Connor Street and Phillip Drive as part of the Saltwater precinct.

6.1 Overview of road hierarchy and classification processes

Generally, for the classification of roads in NSW, the following applies:

- New South Wales has two different systems for classifying roads, one which is a legal framework and one that is used purely for funding and responsibility allocation.
- Legal class framework includes the following road classifications: Freeways, State Highways, Main Roads, Secondary Roads and Tourist Roads (refer NSW Roads Act 1993 – Part 5).
- State Roads are the primary network of principal traffic carrying and linking routes for the movement of people and goods within the urban centres of Sydney, Newcastle, Wollongong and Central Coast, and throughout the State.
- The council remains the "owner" and "authority" for State Roads other than Freeways, and TfNSW only exercises road authority functions to the extent necessary for the functioning of the road as a State Road.
- At a local level, assessment parameters provide guidance, and absolute assessment against only one criteria alone is recommended to be avoided.
- Local government road classification is based on the function of the road with different AADT thresholds for local roads classified as Urban and Rural.
- Local classifications often consider any bus routes along the road segment, if the road is linking communities, and its connectivity to local and state networks.
- Local road function often varies for sealed and unsealed roads.
- Level of services are often not linked to the local road hierarchy and are determined by council and consultation with local community.

6.1.1 Design standards

Council's Geometric Road Design Guide refers to a more detailed hierarchical road network, depicted in Figure 6.1 categorised as follows:

- **Access place or cul-de-sac:** a minor road which carries a low volume of traffic, providing direct access to a limited number of allotments and maximum length of 150 metres. Vehicle, pedestrian and recreation use is shared, with pedestrians having priority.
- **Local Street:** a minor road which carries a higher volume of traffic and provides direct access to lots. Vehicles, pedestrian and recreation use is shared, with traffic access having priority.
- **Collector Road:** a road linking access streets to major roads, possibly providing bus routes and giving restricted access to lots. A collector road would typically facilitate up to 6,000 vpd and a speed of up to 60 km/h.
- **Distributor:** within a development should have as its main function the conveyance of traffic generated by the development. Direct access should not be provided for single dwelling allotments but access can be provided to multi-unit developments and non-residential land uses. The local distributor should serve only the development and should not attract through traffic.
- **Arterial:** Not explicitly defined within the guide, however considered to be the highest traffic carrying load carrying through traffic however not servicing direct access to single dwelling allotments.

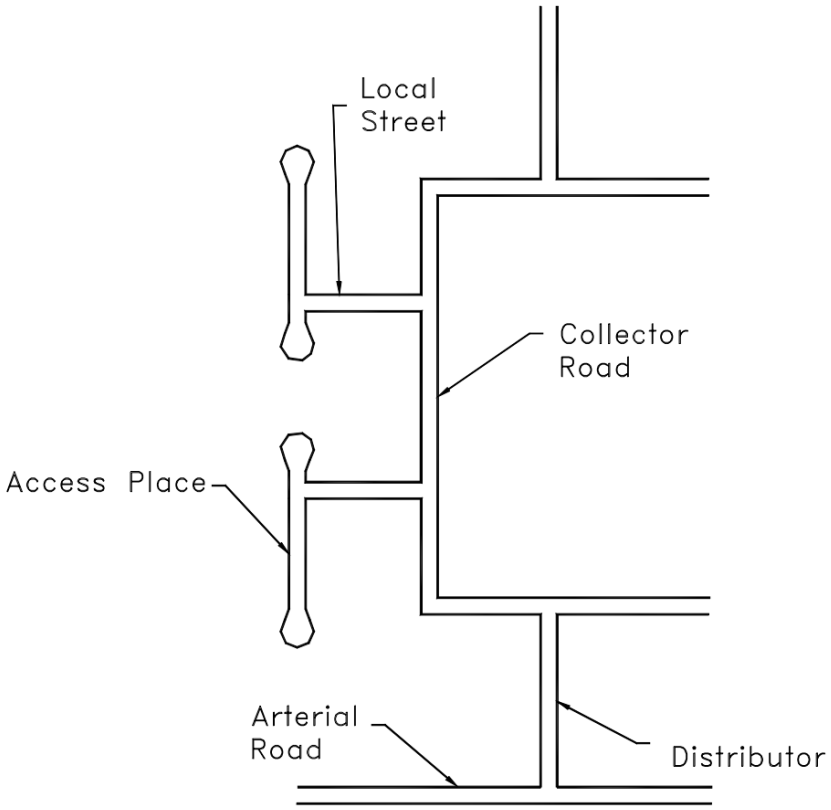


Figure 6.1 Typical Road Hierarchy
Imagery obtained from the Geometric Road Design Guide (Kempsey Shire Council, 1997), accessed June 2022

The classifications have specific quantitative design references, the summary table for characteristics from the guide is shown in Figure 6.2.

Category/ Characteristics	1 Access Place	2 Local Street	3 Collector Road	4 Commercial/Industrial	5 Arterial	6 4 Lane Arterial
Maximum No of potential tenements or vehicles/day (vpd)	20 ET 200	100 ET 2000	300 ET 6000	NA 10000	NA 10000	NA >1000
Carriageway width (m)	7	9	11	13 or on merit	15 (min) Includes median	25 (min) (includes median)
Verge width (m)	4	3.5	4 to 5	3.5 (min)	3.5	4.5 (desirable) (3.5 min)
Reserve width (m)	15	16	19	20 (min)	22	34 (min)
Kerb Type	Lay back (8) SE	Lay back (8) SE	Barrier SA	Barrier SA	Barrier SA	Barrier SA
Design Speed (km/h)	50 max	50 max	60 max	60	80	80
Minimum Distance between Intersection	30	60	80	60	80	500 m (desirable)
Longitudinal Grading Max	16% (10)	16%	12%	5%	10%	10%
Min	1%	1%	1%	1%	1%	1%
Crossfall	3% to 4%	3%	3%	3%	3%	3%
Superelevation	N/A	N/A	N/A	N/A	Required	Required
Minimum Pavement Surface	2 Coat Seal	2 Coat Seal	AC (11) 40 mm thick	AC(11) 40 mm thick	AC(11) 40 mm thick	AC(11) 40 mm thick
Minimum Pavement Design Traffic ESA's	1.5 x 10.5 ESA	10^6 ESA	2 x 10^6 ESA	2 x10^7 ESA	6x10^6 ESA	2x10^7 ESA

Figure 6.2 Typical road hierarchy – characteristics
Imagery obtained from the Geometric Road Design Guide (Kempsey Shire Council, 1997), accessed June 2022

6.1.2 Framework review and recommended approach

As part of the assessment a number of frameworks and their applicability and potential application were reviewed including:

– Movement and Place Framework (TfNSW)
– Network Operations Planning (Austroads)
– Guiding policy documentation
  - *Road User Space Allocation (RUSA) policy (TfNSW)*
  - *Better Placed (GANSW 2017)*

Review summaries are provided in Appendix E. Reviewing current hierarchy and classifications methods used in other jurisdictions a number of key considerations emerge. The current classification of roads lacks granularity at the local level, particularly for areas of activity where place may have a higher value than movement.

A hierarchy that is underpinned by traffic volume will prioritise roads which are currently experiencing high levels of movement, but this may not be in line with aspirational function. Movement emphasis should focus towards the network's functional importance for moving people and goods, by any mode.

There are a number of existing and new frameworks that could be employed, however given the relative use and function of the South West Rocks road network a framework should be selected that does not overcomplicate the process. Regardless of the approach used, the integration of future land use scenarios and place value is critical to ensure an aspirational network is defined, and the role the transport network plays as part of the wider public realm. Using a current network hierarchy and a future aspirational hierarchy which has been developed based on vision and strategic objectives enables functionality gaps to be identified and guide investment decision-making.

A framework should consider the broader strategies and objectives for the region, this may be fulfilled through:

– Reference to the Movement and Place Framework
– Reference to the Road User Space Allocation policy
– Reference to the Better Place seven objectives
– Close alignment to the Geometric Road Design Guide

The proposed road hierarchy approach will allow creation of additional levels of granularity at the local level. The additional granularity, in alignment with Movement and Place and the Geometric Road Design Guide, will allow identification of routes that may be determined 'rat-running' where local area traffic management approaches may be applied to deter movement. The approach should also apply the RUSA policy through the order of consideration for modes.

A more robust approach to development of a Road User Hierarchy through stakeholder workshops could be undertaken in future, this approach should set an initial guiding framework that can be built upon and evolved as aspirations for the network are realised. An example of a robust approach is shown in the flow chart below.

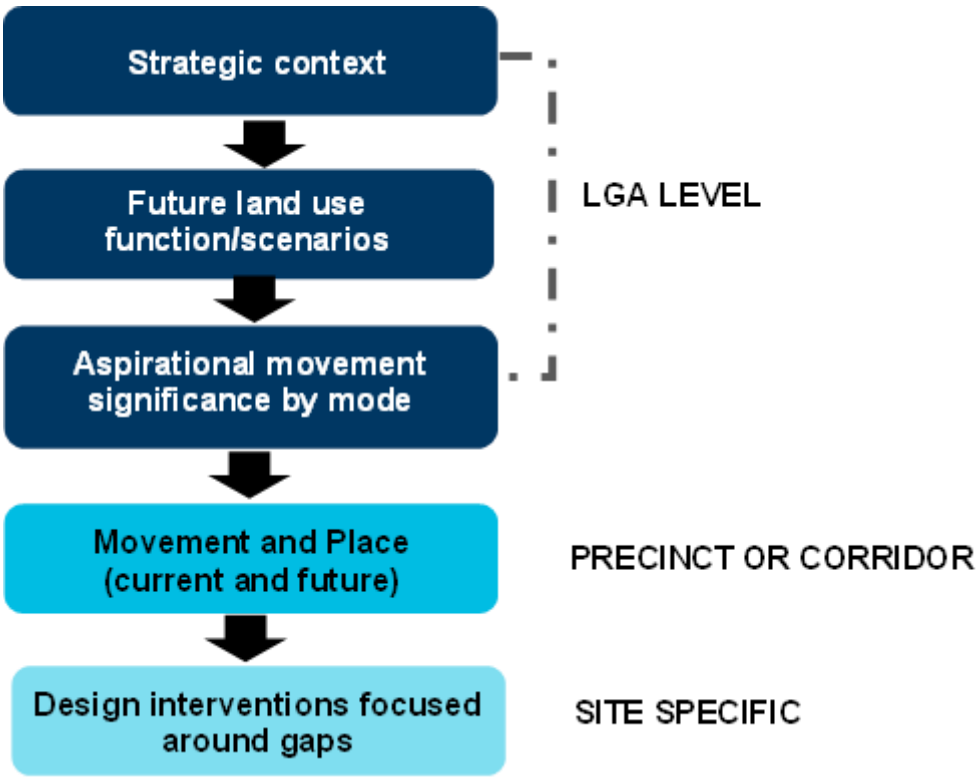


Figure 6.3 Road User Hierarchy development approach

This initial movement and place review has been conducted in Section 6.2.

Although a significant process to work through, initially the current network could be reviewed against Movement and Place by separating roads into the four categories of Main Roads, Main Streets, Local Streets and Civic spaces with reference to their current use (refer Figure E.2). The TfNSW model has been adopted for this process such that Council can align to state-wide processes and objectives. This could be undertaken alongside review of how different road classifications are defined within geometric standards to better enable infrastructure to respond to road function. In doing so, granularity is provided through the four categories which details the function of the road from a broader perspective than just traffic carrying capacity.

6.2 Movement and place approach

The Movement and Place mapping and analysis focuses key outcomes for the shire such as "*Coastal towns are under pressure to grow. The existing character of towns can easily be lost as town are considered to be more at risk from the impact of increased traffic and the potential loss of identity created by surrounding subdivisions / suburbanisation and provision of large-scale or tall new buildings in what is typically a low-rise environment." (Kempsey Shire LGMS Local Character Statements Review)* and referring to the key themes developed in the Structure Plan as shown in Figure 6.4.

Figure 6.4 Structure Plan Excerpt (November 2022)

Using the Movement and Place approach as specified above, the road network has been mapped against the four categories based on current land use and travel patterns. The network mapping is summarised in Figure 6.5. The mapped network highlights the largely 'local street' nature of the road network, with a few key roads performing the 'main road' function. This indicates that there may be opportunity to use road assets more efficiently, with the intent to be effective and strategic about assets which Council maintains.

The mapping undertaken is based on existing transport and planning conditions. Although a more comprehensive approach would be required to look at aspirational and modal networks (as discussed in Section 6.1.2), some network considerations have been taken into consideration and shown on the existing conditions mapping.

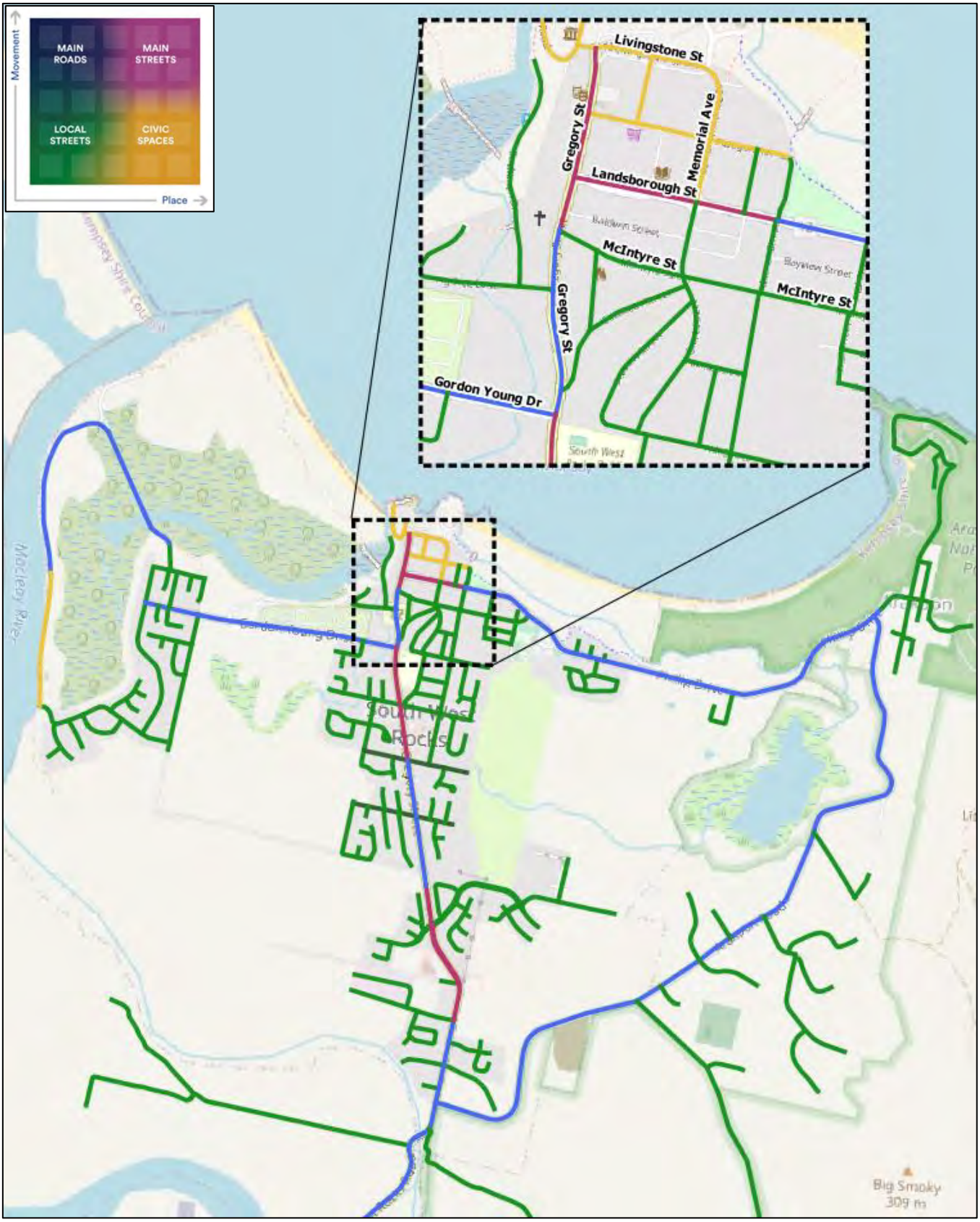


Figure 6.5 Northern extents – Movement and Place mapping (Source: OpenStreetMap)

A large proportion of the network has been classified as Local Streets. This is primarily due to the existing land use function of the streets requiring local function opposed to civic functions, and the road network providing local access functions rather than more through connectivity. With future population growth predicted there are opportunities to consider the allocation of existing network to cater for this growth through optimising of existing assets, through:

– Upgrading Simpsons Street's movement function to facilitate access to the surrounding residential sites.
– Consideration to improved utilisation of road asset to optimise road typologies and to streamline maintenance tasks.
– Target development growth to use key existing transport routes to allow form and function alignment.
    - Belle O' Connor Street will be a focus, based on the concentrated amount of development as indicated in previous sections.
    - Further development areas should be identified and should consolidate key transport routes.

There is limited areas classified as Civic Spaces or Main Streets. This is reasonable given the current use of the network and focused civic spaces, however, might not reflect future use or aspirations for the area. Where areas are classified as place-oriented, the network should be given high priority on place and active movement features. Due to the limited Civic areas the following considerations could be made to ensure appropriate place features are enabled:

Areas that are Civic Streets should have lower traffic function, including:

– New Entrance Road could function predominantly as a tourist route rather than a throughput road, with a focus on experience (i.e. slow speeds, safe environment, opportunities for lookouts) with increased provision for pedestrian or bike riding movements.
– Livingstone Street, Gregory Street, Prince of Wales Avenue, Memorial Avenue, and Paragon Avenue could have a reduction in on-street parking provisions and increase in place and active mode functions. There are substantial road widths provided in this area which may provide opportunity to limit traffic movements to an access function, while prioritising public and active transports to the Horsehoe Bay area. Parking losses may be offset in the immediate term to the sections of Landsborough Street between Sturt Street and Mitchell Street and McIntyre Street from Sturt Street to Trial Street. Off-street parking areas may also be reconfigured to offset the parking losses. Consideration to temporal and seasonal supply solutions may also be given.
– Areas that are Main Streets still service an important traffic carrying function, however the interaction between the traffic carrying and high place surroundings should be carefully considered.
    - A short section of Gregory Street between Gordon Young Drive and McIntyre Street has Main Road function, whilst the adjacent sections of Gregory Street have high place. It may be more appropriate to downgrade this movement function to create a consistent corridor aligned with the Main Street functions.
    - Gregory Street north of Landsborough Street has a lower traffic carrying importance and such, consideration to making this more of a Civic Space could be made. This would be facilitated through land use planning, strong active and public transport linkages, and traffic calming measures in this segment.
    - Gregory Street was also observed to have high crash rate for the area which could be addressed through some traffic calming interventions and/or altering road typology.
    - McIntyre Street and Landsborough Street are routes that run parallel east to west with Landsborough Street facilitating a higher place and movement function. McIntyre Street could be considered to be upgraded to a main road for vehicle movement. This will allow Landsborough Street, the road closer to Horseshoe Bay, to focus on place, access and active transport thus promoting safer interactions between modes.

From the mapping some 'segmentation' of transport routes is evident. In practice this segmentation would not occur and transport is being facilitated by existing routes. This may cause some conflict between form and function of these segments, including:

– New Entrance Road connects to Gordon Young Drive by a Local Street network. Although the road form in this area is likely sufficient for current traffic volumes, facilitating growth with a defined and consistent route for this more destination / tourist route based connection should be established. This will allow the road form to reflect this function and also be supported with wayfinding.

In certain locations within the network there is a level of redundancy, these areas provide opportunities to define the dominant transport route or dominant modal routes. This definition should follow the Road User Space Allocation Policy when considering prioritising different movements. These include:

– Upgrading Simpsons Street's movement function to facilitate access to the surrounding residential sites was noted above. This gives consideration to redundancy between Simpson Street and Arthur Street and would then indicate Arthur Street to be a lower traffic function. Similarly due to development, Belle O'Connor Street will provide a high traffic function than Frank Cooper Street. Differentiating the key function of these routes enables development planning to create the most effective and beneficial local street connections.
– Arakoon Road and Phillip Street create a loop road around the eastern portion of South West Rocks, connecting to Gregory Street with Philip Street to the north via McIntyre or Landsborough Street and Arakoon Road to the south. This provides a redundancy for Gregory Street. Based on this Phillip Street and Arakoon Road may be a more suitable alternative to facilitate private vehicle trips to the northern bay areas. Some infrastructure improvements such as shoulder upgrades may be necessary to ensure this is a safe alternative if higher traffic volumes were to shift here.
– Active transport could be further supported on routes identified within the PAMP through traffic calming on Gregory Street and Gordon Young Drive where active transport is facilitated adjacent to road traffic.
– Within the network there is also road width redundancy which could be converted for place-activities. Potential reallocation of road width could be identified through asset investigation and supported with scenario modelling.

Proposed development (see Section 4.5) has been considered within this report, however unknowns remain around further development beyond this point. Consideration to future transport connections should be made such that the network is best positioned for future requirements to capitalise on developer and government investment.

– Belle O'Connor Street will be an important connection for future development. The route is typically wide and separated by a green median which enables a high traffic carrying capacity. Development plans should consider active transport that crosses such key transport routes.
– Some development is proposed off Phillip Drive. It has been noted that higher traffic volumes on the northern extents of Gregory Street may be less desirable. It is noted that alternative vehicular access is facilitated via Arakoon Road, however continued through function of Gregory Street is recommended at slower speeds with local area traffic management to enable more active and place based uses of Gregory Street and surrounds whilst continued access is facilitated.
– Further development of the broader South West Rocks area is not known, however if further development were to occur north of Belle O'Connor and between Gregory Street and Arakoon Road, a tactical approach to planning the road network will be required. This should pre-empt present development to ensure appropriate private vehicle and active transport connections are facilitated as well as consideration to public transport catchments. For instance, the design of Belle O'Connor Street connections should consider future traffic they may service.
– Spencers Creek is an important crossing facilitated by South West Rocks Road (via Gregory Street). As the sole access to the South West Rocks area, redundancy of this connection may be a consideration as the area grows.

Generally there is opportunity, despite traffic growth, to be more strategic and planned in the use of existing road assets and to enable greater provision of place and active movements. Active corridors have been identified as part of the Structure Plan. Opportunities for these should be realised through the opportunities discussed above and a more comprehensive laneway and active corridor strategies.

The proposed link road discussed in Section 4.6 provides a significant through connection providing a parallel movement to Gregory Street and Arakoon Road. Although some performance impact was observed as a result of potential future concentrated development accessed via Belle O'Connor Street this impact will likely be lessened by the link road, when volume necessitates this. It should also be noted that an additional traffic route without traffic calming may encourage more private vehicle use within the area. The function of the link road with respect to parallel routes and the function of the existing roads it links between should be identified to develop the link road's network function. Traffic calming may be required to support appropriate traffic generation between the link road and parallel routes.

7. Transport and movement strategy

This report details the Transport and Movement study of South West Rocks. The overall aim of the study is to provide a basis for the South West Rocks road hierarchy for road users within the area and ultimately inform the Structure Plan in relation to transport issues and opportunities.

Future road network improvements are proposed which generally seek to review opportunities to:

– Identify core function of road network sections with respect to movement of various modes and place functions
– Support increased activity, permeability and active transport connections
– Support safe and fit for purpose transport infrastructure, targeting growth to 'for purpose' corridors
– Support network wide resilience over time

The report investigates the strategic context of South West Rocks, provides a detailed review of existing transport for all modes including freight, public transport, active transport and private car and investigates future traffic conditions. Based on assessment undertaken within this report, and particular reference to the Movement and Place mapping in Section 6.2, and the forecast demand modelling in Section 5.2. Proposed improvements were identified and confirmed with Council from the transport and movement assessments are provided as short, medium and long term horizons in Table 7.1.

The proposed improvements listed specifically relate to identifying and establishing clear function within the road network. Further network improvements are foreseen to result from the identified pieces, such as:

– Increasing coverage of 40 km/h speed zone (with reference to *40km/h High Pedestrian Activity Area Guidelines*)
– Pedestrian improvements aligning with the *Pedestrian Access and Mobility Plan* and *Local Community Plan*
– Cycling connections with reference to *Kempsey Shire Bike Plan* and *Local Community Plan*
– Public transport improvements aligning with the *Local Community Plan* public transport vision such as promotion and advocacy for more community transport and small buses with three round trips to Kempsey per day linked with trains and coaches (high priority), and investigation of transport options and a needs analysis (low priority)
– Road safety upgrades and maintenance upgrades aligning specifically to updated road hierarchy and prescribed road functions.

Table 7.1 Proposed road network improvements

Activity	Type	Location	Description	Mode	Related Strategy/Plan	Term
Cycling & Pedestrian Improvements	Planning	Study Area wide	Review Council adopted Bikeplan and PAMP to include structure plan site specific improvements, including new town centre pedestrian connections and review of laneways to define permeability and active transport improvements.	Walking and Cycling	KSC Bikeplan, Pedestrian Access Mobility Plan (PAMP) & Town Centre Public Domain Plan	Short
40kmh High Pedestrian Activity Area	Design & deliver	Town Centre	Review existing 40kmh HPAA with the view of expanding further south.	All	Town Centre Public Domain	Short

Activity	Type	Location	Description	Mode	Related Strategy/Plan	Term
Road Safety and Function Audit	Plan	Study Area wide	Audit main roads and streets and associated intersections as depicted in Figure 6.5 of the Transport & Movement report. Include review of current road widths for these roads to identify opportunities for active places and provisions for traffic demand based on Council adopted geometric road design guidelines.	All	LGA Road Safety Strategic Plan Aus- Spec 1 – Geometric Road Design Guide.	Short
Movement & Place Plan	Plan	Study Wide Area	Undertake full movement and place assessment and hierarchy for the area, investigating further the recommendations provided in Section 6.2 of the Transport & Movement Report. Opportunities for road asset consolidation may be identified through this process through identifying key modal corridors.	All	TfNSW Movement & Place Framework Road User Space allocation policy (TfNSW).	Short
Road Safety Upgrades	Design & deliver	Arakoon Road & Phillip Drive	Design and deliver staged road safety and rehabilitation upgrades of Arakoon Road & Phillip Drive	Vehicles & Cycling	LGA Transport Infrastructure Asset Management Plan	Medium
Civic Space improvements	Plan	Town Centre	Identify Civic Space upgrades to make better integration between movement and place functions. Plan & design for town entry improvements at intersections of Landsborough and Livingstone Streets with Gregory Street.	All	Structure Plan Town Centre Public Domain Plan	Medium
Civic Street improvement	Plan	New Entrance Road	Investigate and design as a tourist route with a focus on experience (i.e slow speeds, safe environment and lookouts)	All	TfNSW Movement & Place Framework	Medium
Main Street Cross Connection Improvements	Plan	Landsborough & McIntyre Streets	Investigate feasibility and develop concept designs for modifying Landsborough Street as a higher place function to focus on place , access, and active transport with McIntyre Street to provide a higher movement function.	All	Town Centre Public Domain Plan TfNSW Movement & Place Framework.	Medium
Link Road	Plan & deliver	Belle O'Connor St to Phillip Drive	Continue to plan as a work associated with staged developments of the Saltwater precinct delivery of the Link Road as described in Section 6.2 of the Transport & Movement Report.	All	Saltwater Development master plans. Development Application approvals.	Medium
Traffic Monitoring	Plan	Belle O'Connor	Monitor traffic conditions and safety in Belle O'Connor Street (including intersection with Gregory Street) in conjunction with land use development growth and identify necessary road upgrades.	All	Saltwater Development master plans. Development Application approvals.	Long

Activity	Type	Location	Description	Mode	Related Strategy/Plan	Term
Road Corridor Preservation	Plan	New Land release sites	Identify as part of planning for future greenfield sites suitable road corridors to ensure suitable accessibility and connectivity for all modes of transport.	All	South West Rocks Structure Plan Future Development Control Planning	Long
Town entry preservation	Plan	Spencers Creek bridge and approach roads	Investigate condition and traffic (all modes) capacity of bridge and approaches and plan for future road safety, capacity, and asset condition upgrades.	All	LGA Transport Infrastructure Asset Management Plan	Long

Appendices

Appendix A

Provided traffic data

Table A.1 Provided ATC data summary

Road	Location	Date
Arakoon Road*	192 m south of Lighthouse Road	November / December 2016
	168 m south of Bullocks Quarry Road	November / December 2016
	247 m east of Gregory Street	December 2014
Belle O'Connor Street	45 m east of Nineteenth Avenue	March 2021
Buchanan Drive	138 m north of Fig Tree Lane	December 2016
	133 m north of Fig Tree Lane	October 2016
Gregory Street	62 m south of Spencers Creek Road	October / November 2021
	65 m south of Buchanan Drive	October / November 2021
	123 m north of Arthur Street	October / November 2021
	120 m north of Belle O'Connor Street	March 2021
	90 m north of Spencers Creek Road	March 2021
	120 m north of Belle O'Connor Street	April 2020
	North of Lindsay Noonan Drive	March 2018
	South of Arthur Street	March 2018
	100 m north of Arthur Street	April 2016
	153 m north of Spencer Creek Road	January 2016
	224 m south of Belle O'Connor Street	January 2016
	60 m south of Arakoon Road	December 2014
Horseshoe Bay Headland Entrance*	20 m north of Livingstone Street	August 2018
	160 m north of Livingstone Street	August 2018
Lawson Street	24 m north of Arthur Street	November / December 2016
Lighthouse Road	2,341 m east of Arakoon Road	December 2016
Marlin Drive	41 m west of Ocean Street	September 2015
New Entrance Road	25 m south of Marlin Drive	March / April 2020
Phillip Drive	65 m east of McIntyre Street	October / November 2021
	370 m west of Waianbar Avenue	September / October 2021
	292 m west of Grey Street	August / September 2015
	323 m east of Michael Osling Place	February 2015
	101 m south of McIntyre Street	November / December 2012
Steve Eagleton Drive	29 m west of Gregory Street	February / March 2021

**On Arakoon Road, Gregory Street and at Horseshoe Bay, data was provided for two locations for the same dates. The data from the locations considered to provide the more comprehensive vehicular traffic data in each case (Arakoon Road 192 m south of Lighthouse Road, Gregory Street 62 m south of Spencers Creek Road and Horseshoe Bay Headland Entrance 20 m north of Livingstone Street) has been considered.*

Table A.2 Provided traffic data summary

Location	Data type
AM	
Lighthouse Road / Arakoon Road intersection	Peak turning movement counts
Russell Street / Phillip Drive intersection	Peak turning movement counts Peak queue length counts
Gregory Street / Steve Eagleton Drive / Belle O'Connor Street intersection	Peak turning movement counts Peak queue length counts
Gregory Street / Gordon Young Drive intersection	Peak turning movement counts Peak queue length counts
Gordon Young Drive / Gilbert Cory Street / Rudder Street intersection	Peak turning movement counts Peak queue length counts
Gregory Street / Landsborough Street intersection	Peak turning movement counts Peak queue length counts
Gregory Street / McIntyre Street intersection	Peak turning movement counts Peak queue length counts
Plummers Lane / South West Rocks Road intersection	Peak turning movement counts Peak queue length counts
Gregory Street / Arthur Street intersection	Peak turning movement counts Peak queue length counts
Mitchell Street / Arthur Street intersection	Peak turning movement counts Peak queue length counts
Landsborough Street / Memorial Avenue intersection	Peak turning movement counts Peak queue length counts
Landsborough Street / McIntyre Street / Phillip Drive intersection	Peak turning movement counts Peak queue length counts
PM	
Russell Street / Phillip Drive intersection	Peak turning movements Peak queue length counts
Gregory Street / Steve Eagleton Drive / Belle O'Connor Street intersection	Peak turning movements Peak queue length counts
Gregory Street / Gordon Young Drive intersection	Peak turning movements Peak queue length counts
Landsborough Street / McIntyre Street / Phillip Drive intersection	Peak turning movements Peak queue length counts
Simpson Street / Gregory Street intersection	Peak turning movements Peak queue length counts
Gregory Street / Arakoon Road intersection	Peak turning movement counts Peak queue length counts
Travel time	
Gregory Street between South West Rocks Road and Livingstone Street	Travel time surveys
Gregory Street between Arakoon Road and Simpson Street	
Gregory Street between Gordon Young Drive and Livingstone Street	
Livingstone Street / Memorial Avenue between Gregory Street and Landsborough Street	
Landsborough Street / Phillip Drive / Wilson Street between Memorial Avenue and Cardwell Street	
Arakoon Road / Russell Street between Gregory Street and Phillip Drive	

Location	Data type
Simpson Street / Mitchell Street / Landsborough Street between Gregory Street and Memorial Avenue	
Gordon Young Drive between Gregory Street and Gilbert Cory Street	
Gilbert Cory Street between Gordon Young Drive and Marlin Drive	
Marlin Drive between Gilbert Cory Street and New Entrance Road	
Marlin Drive between Ocean Street and New Entrance Road	
Ocean Street between Gordon Young Drive and Marlin Drive	
Rudder Street between Gilbert Cory Street and Ocean Drive	

Appendix B

Daily Traffic Profiles

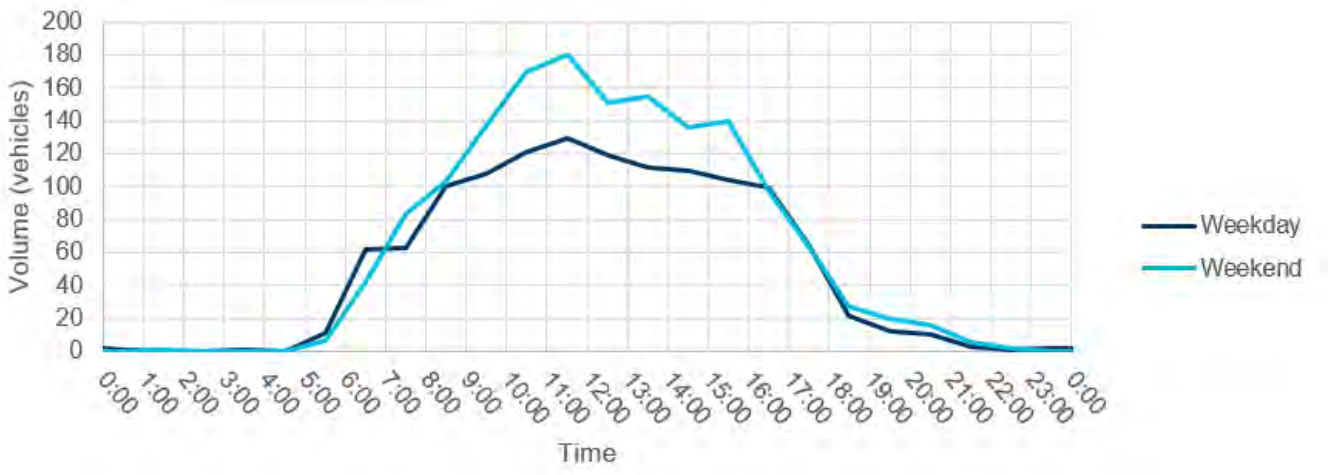


Figure B.1 *Horseshoe Bay Headland Entrance daily traffic profile 2018*

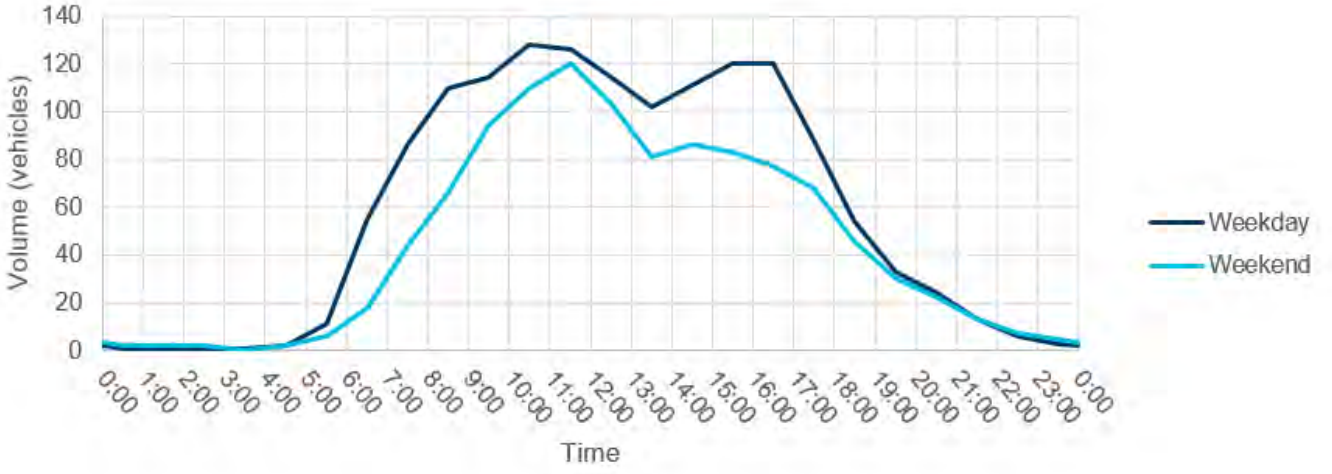


Figure B.2 *Belle O'Connor Street daily traffic profile 2021*

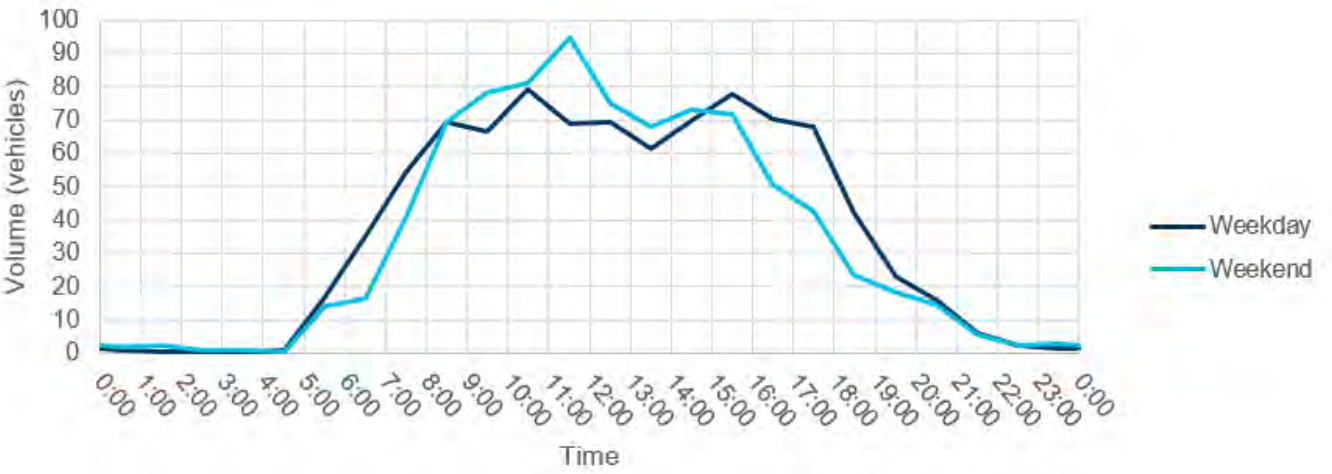


Figure B.3 *Marlin Drive daily traffic profile 2015*

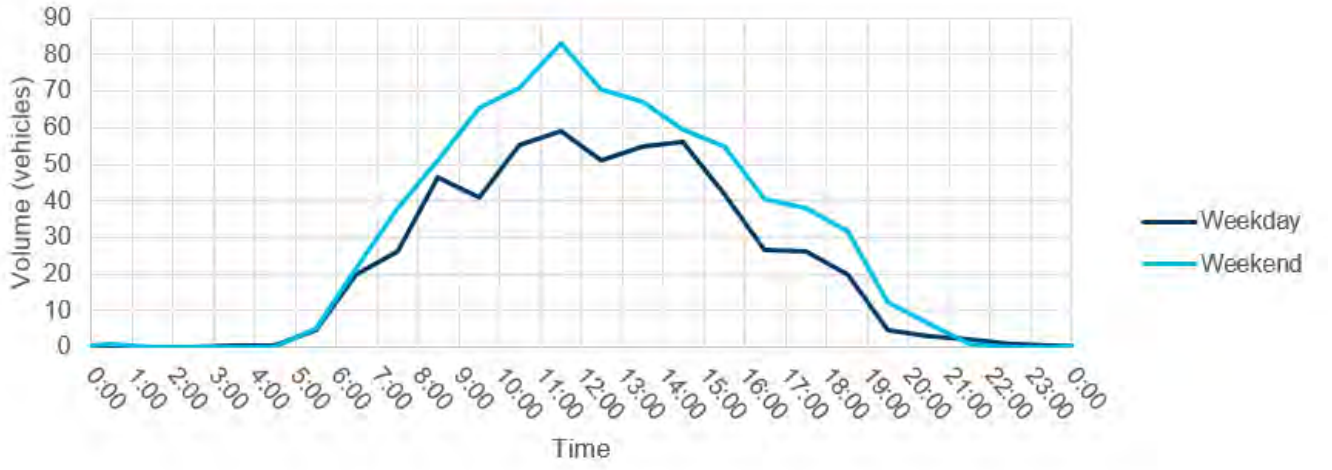


Figure B.4 New Entrance Road daily traffic profile 2020

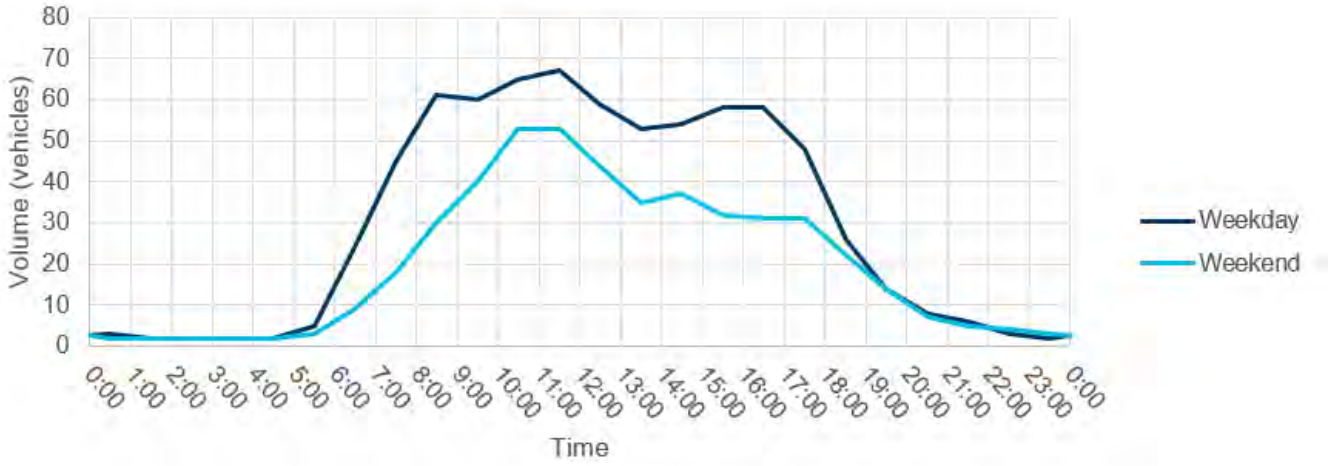


Figure B.5 Steve Eagleton Drive daily traffic profile 2021

Appendix C

Vehicle Class Profiles

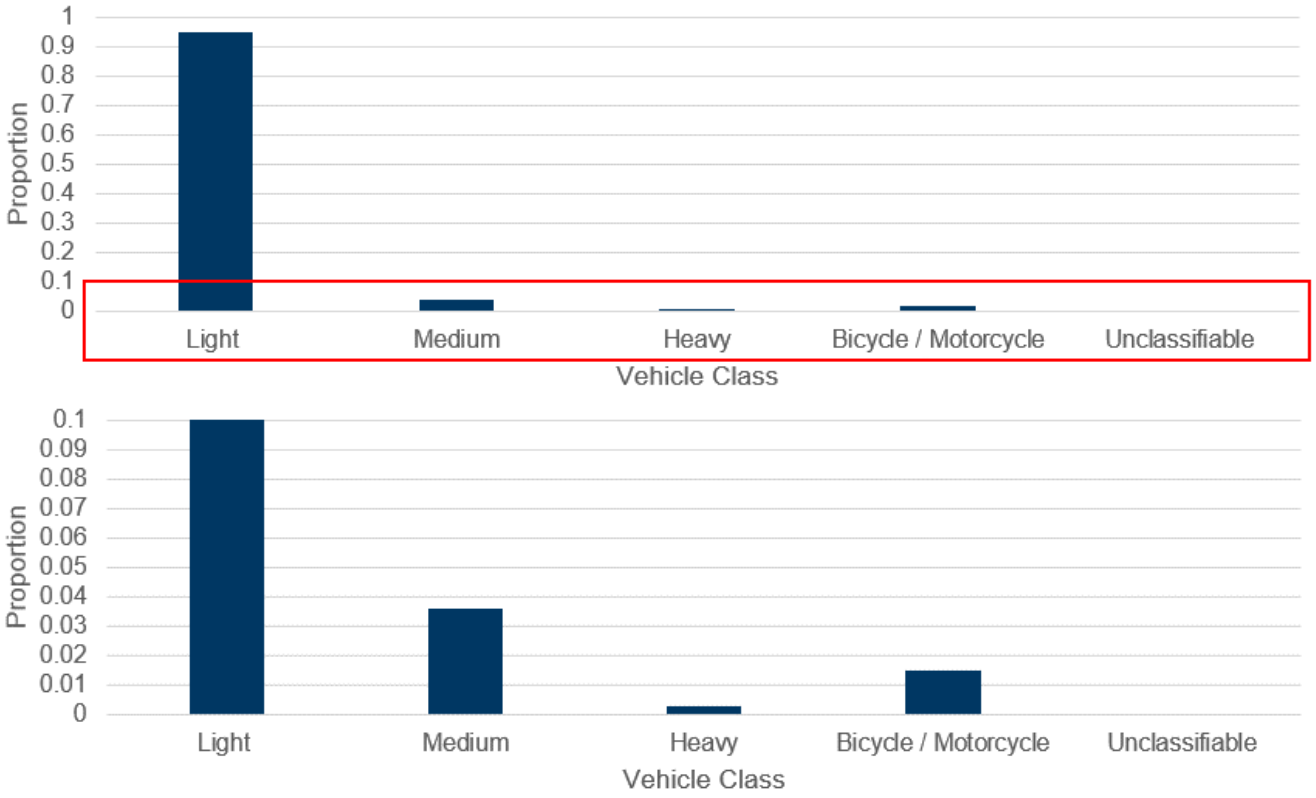


Figure C.1 *Vehicle class proportions on Arakoon Road 2016*

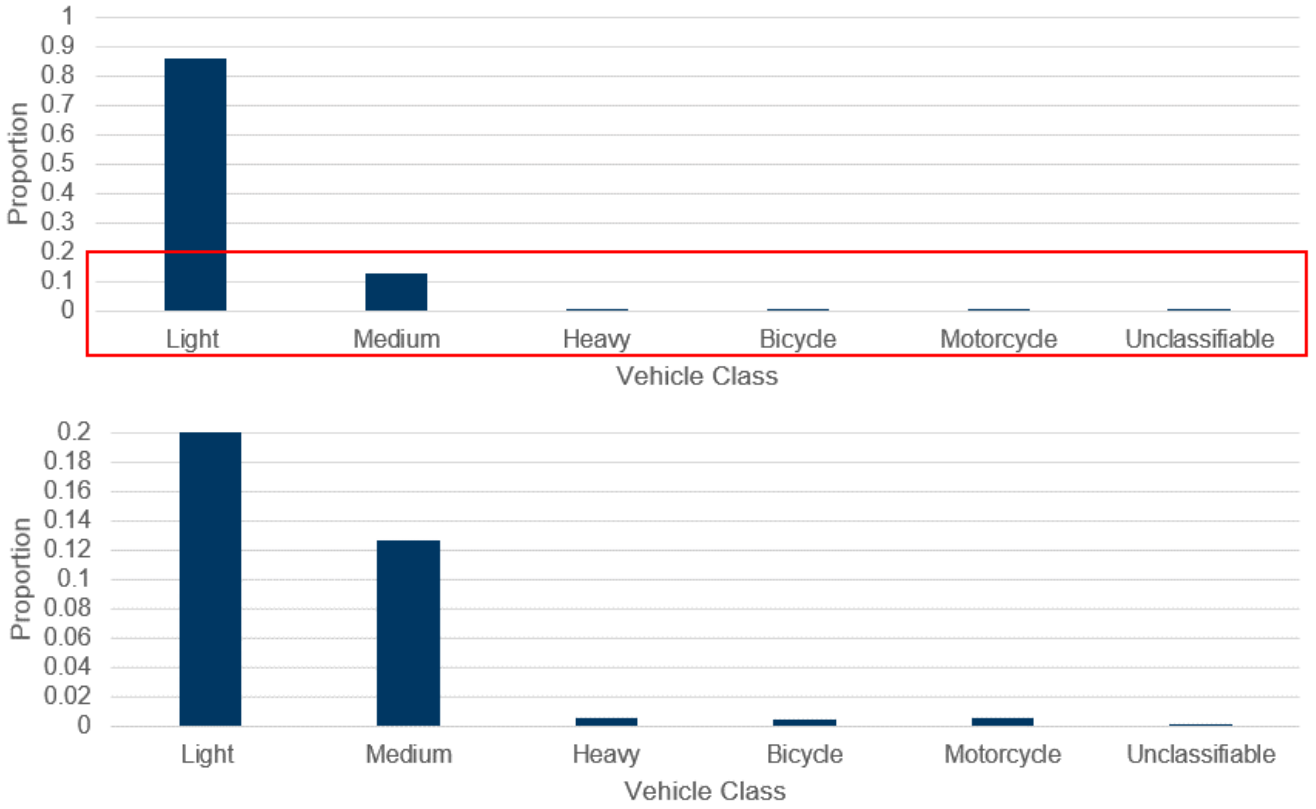


Figure C.2 *Vehicle class proportions on Belle O'Connor Street 2021*

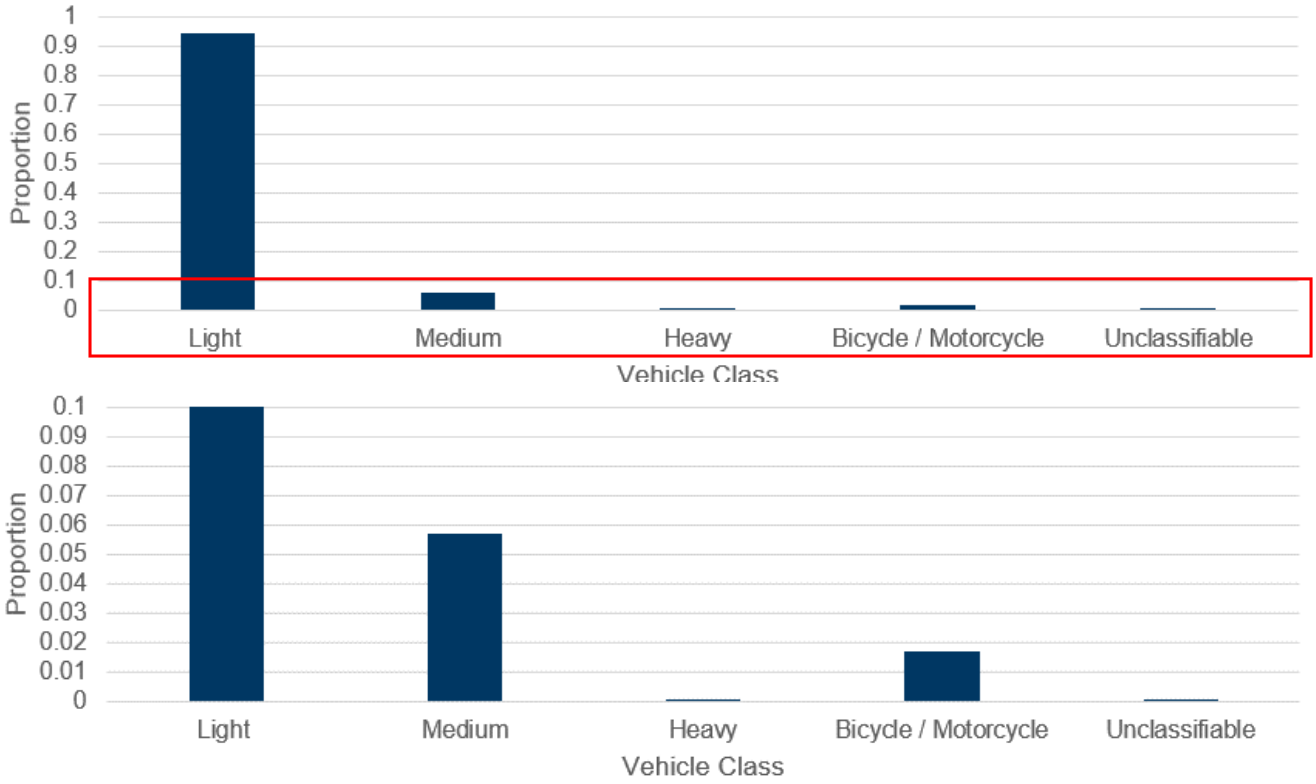


Figure C.3 *Vehicle class proportions on Buchanan Drive 2016*

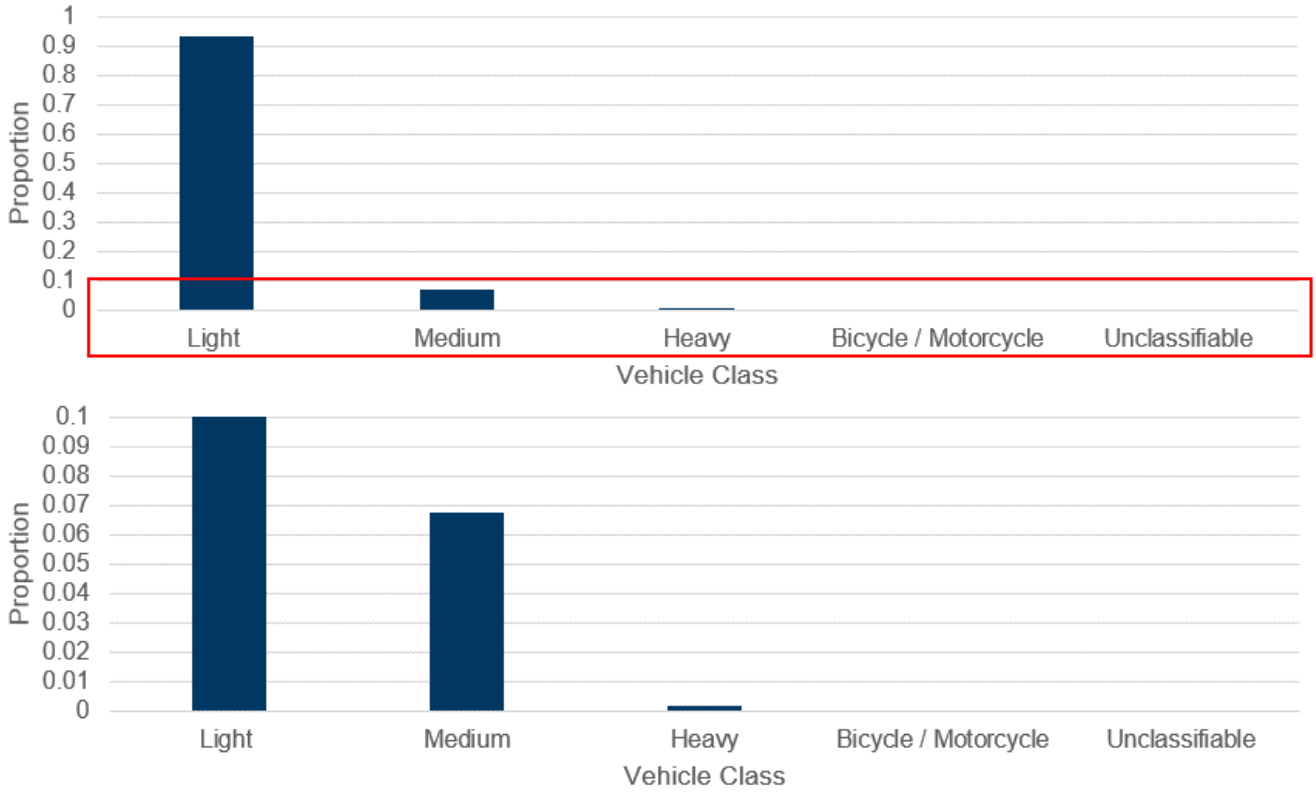


Figure C.4 *Vehicle class proportions on Horseshoe Bay Headland Entrance 2018*

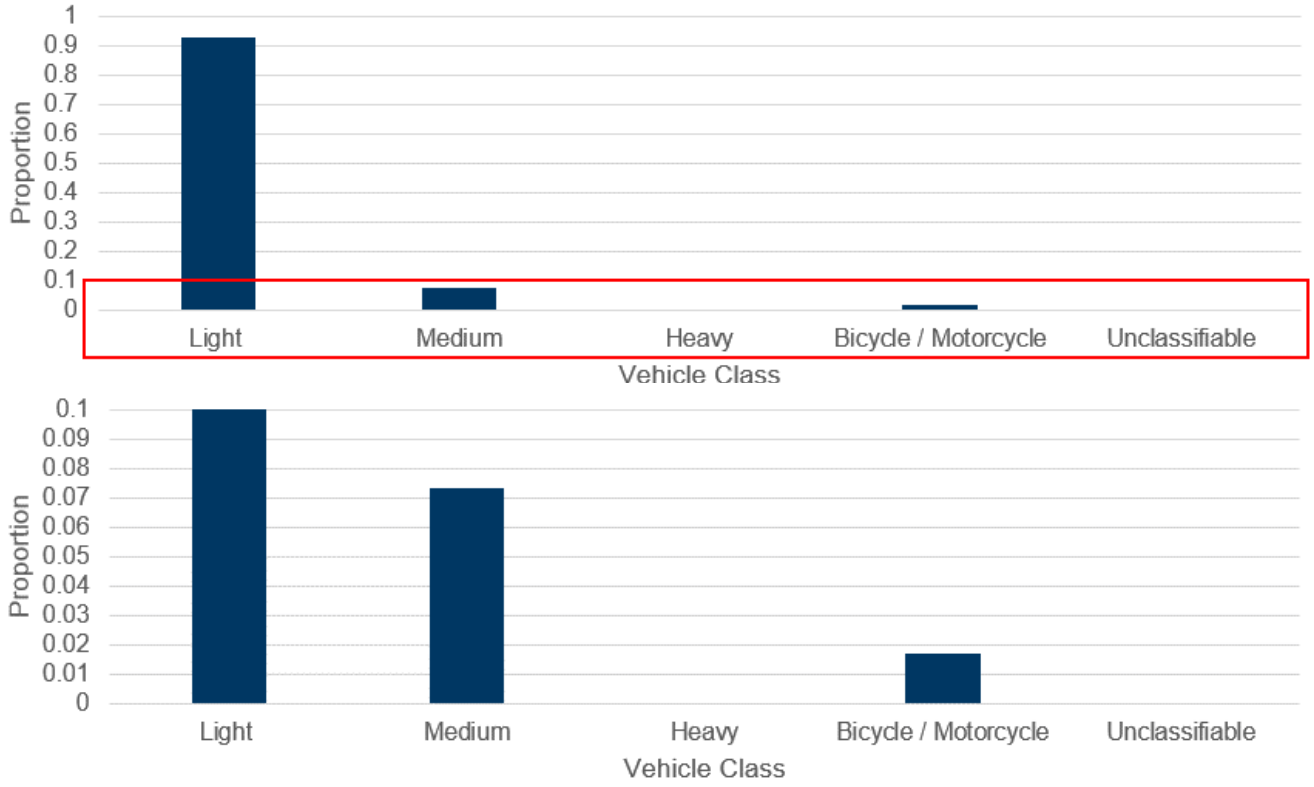


Figure C.5 *Vehicle class proportions on Lawson Street 2016*

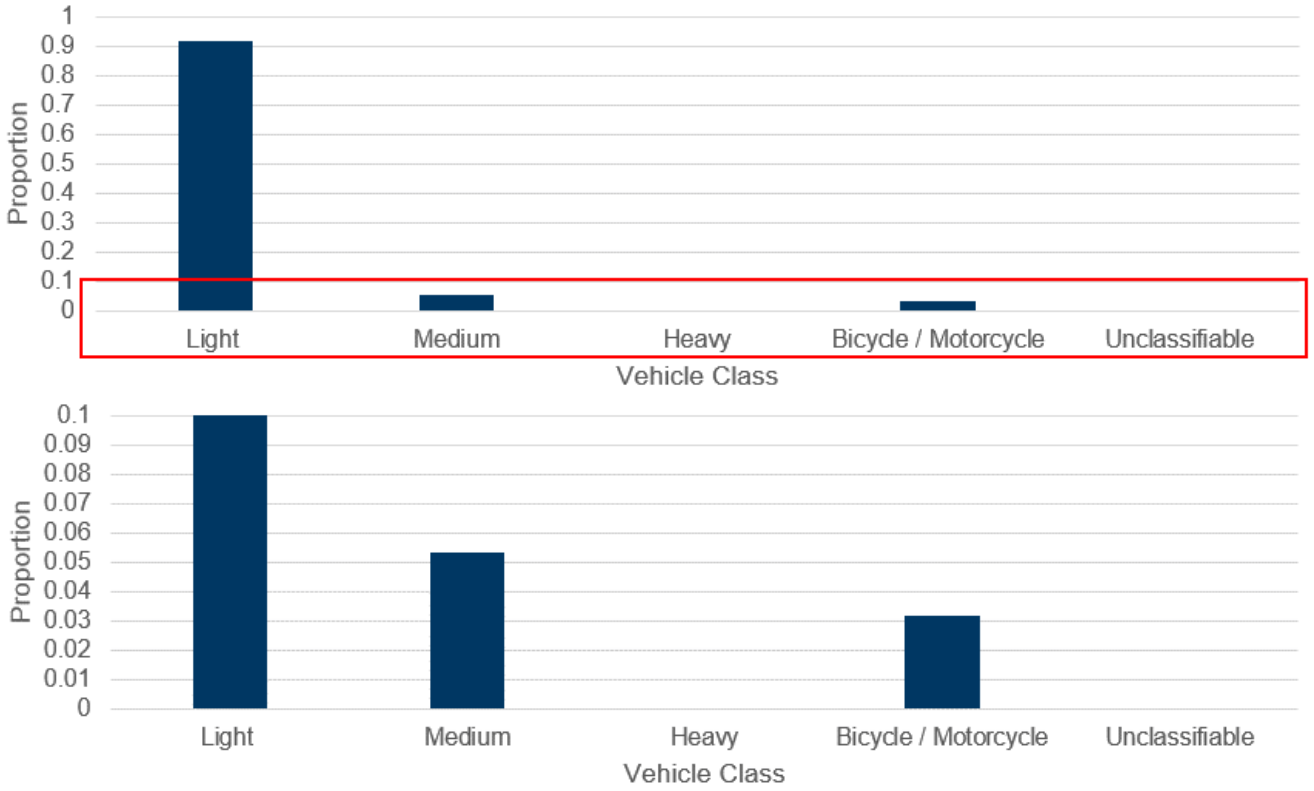


Figure C.6 *Vehicle class proportions on Lighthouse Road 2016*

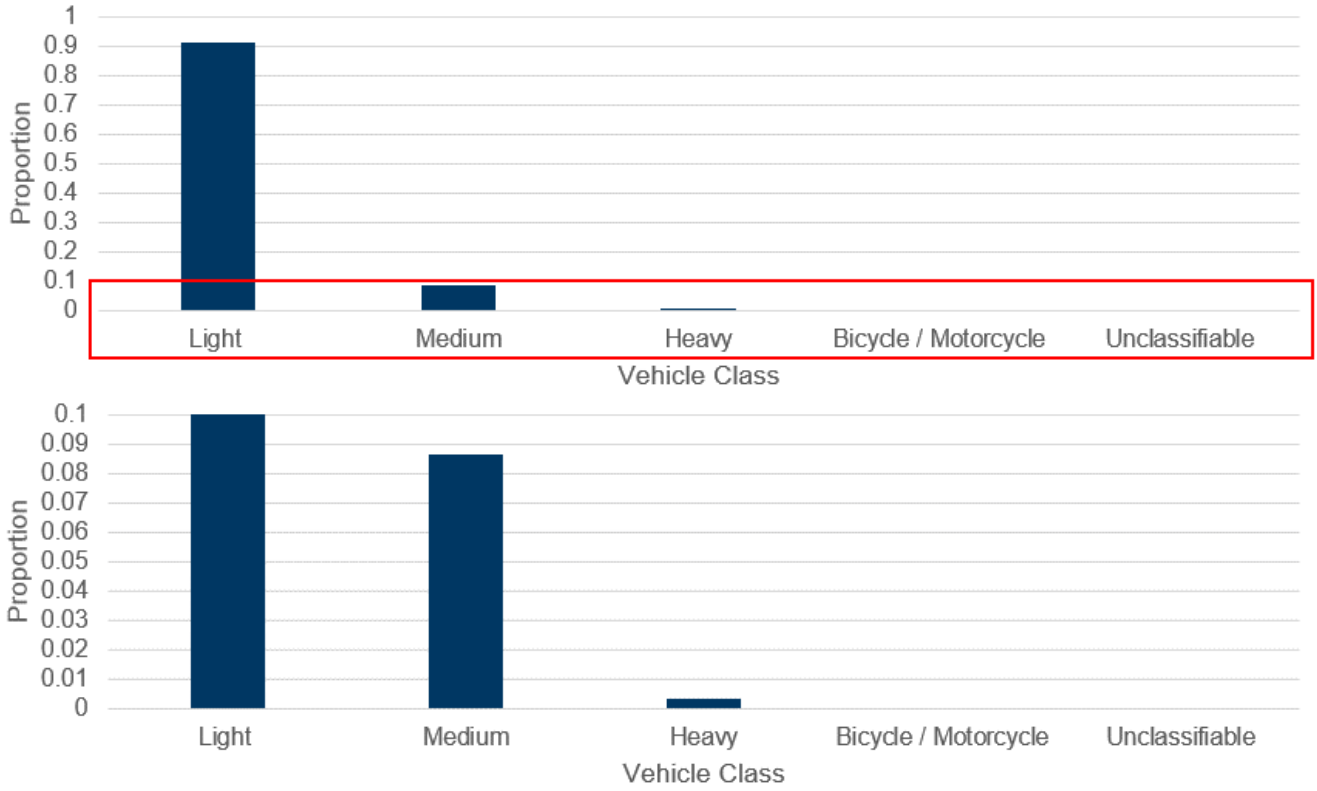


Figure C.7 *Vehicle class proportions on New Entrance Road 2020*

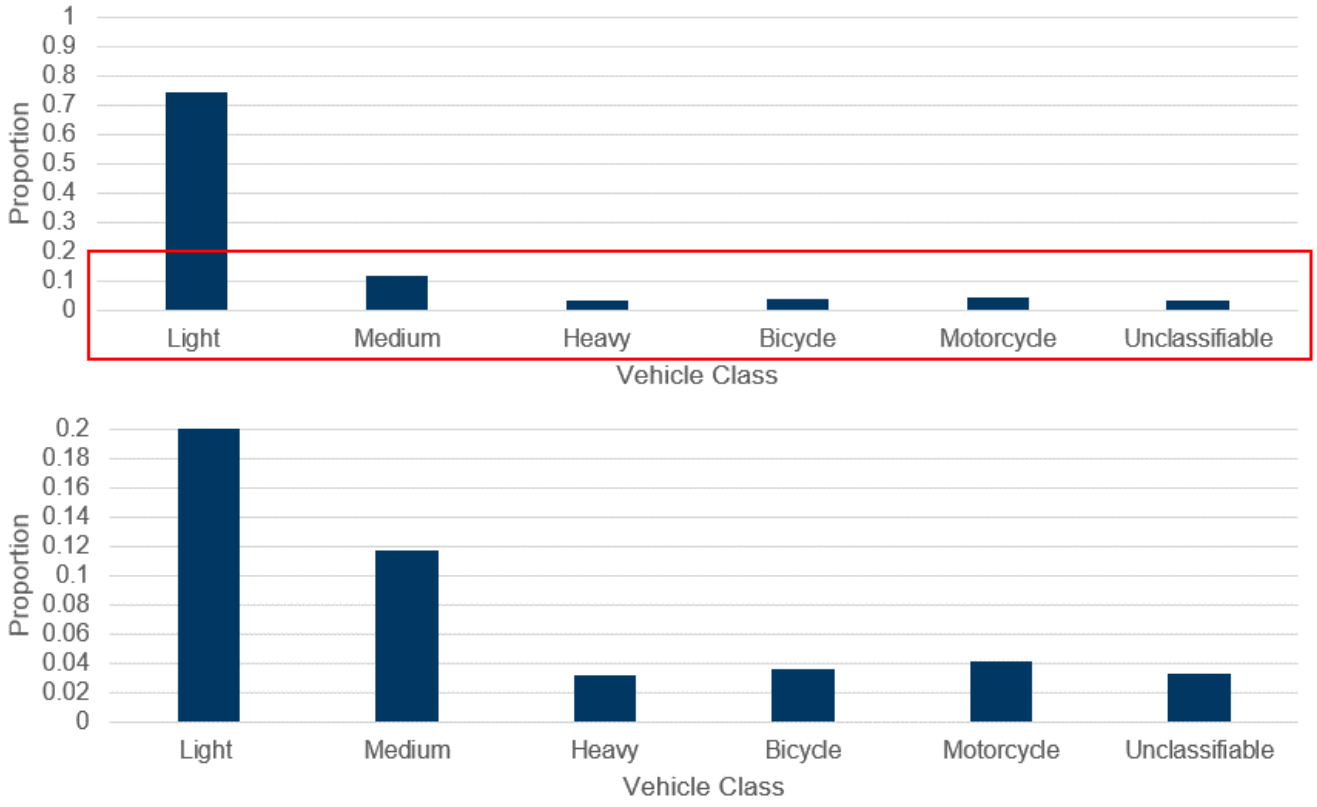


Figure C.8 *Vehicle class proportions on Steve Eagleton Drive 2021*

Appendix D

Travel Time Data

Table D.1 Travel time data

Street	Direction	Start	Finish	Travel Time	Time	Speed Zone
Gregory Street	Northbound	Spencers Creek Bridge	Livingstone Street	4 m 38 s	10:30 AM	50 km/h
				4 m 57 s	7:45 AM	
				5 m 23 s	5:20 PM	
	Southbound	Livingstone Street	Spencers Creek Bridge	5 m 12 s	7:50 AM	
	Northbound	Arakoon Road	Simpson Street	2 m 44 s	11:10 AM	
				2 m 56 s	8:10 AM	
				3 m 22 s	5:20 PM	
	Southbound	Simpson Street	Arakoon Road	3 m 17 s	8:15 AM	
	Northbound	Gordon Young Drive	Livingstone Street	1 m 5 s	11:20 AM	
				1 m 15 s	8:28 AM	
				1 m 22 s	5:15 PM	
	Southbound	Livingstone Street	Gordon Young Drive	1 m 11 s	8:32 AM	
Livingstone Street / Memorial Avenue	Eastbound	Gregory Street	Landsborough Street	1 m 5 s	10:40 AM	40 km/h
				1 m 22 s	8:20 AM	
	Westbound	Landsborough Street	Gregory Street	1 m 10 s	8:15 AM	
				1 m 15 s	5:25 PM	
Landsborough Street / Phillip Drive / Wilson Street	Eastbound	Memorial Avenue	Cardwell Street	4 m 35 s	10:50 AM	50 km/h
				5 m 10 s	8:32 AM	
	Westbound	Cardwell Street	Memorial Avenue	4 m 42 s	8:25 AM	
				5 m 5 s	5:30 PM	
Arakoon Road / Russell Street	Southbound	Phillip Drive	Gregory Street	4 m 40 s	11:00 AM	80 km/h
				5 m 8 s	8:44 AM	
	Northbound	Gregory Street	Phillip Drive	4 m 22 s	8:37 AM	
				5 m 18 s	5:35 PM	
Simpson Street / Mitchell Street / Landsborough Street	Northbound	Gregory Street	Memorial Avenue	1 m 57 s	11:15 AM	50 km/h
				2 m 18 s	8:20 AM	
				2 m 31 s	5:10 PM	
	Southbound	Memorial Avenue	Gregory Street	2 m 22 s	8:25 AM	
Gordon Young Drive	Westbound	Gregory Street	Gilbert Cory Street	1 m 22 s	11:25 AM	50 km/h
				1 m 19 s	8:10 AM	
				1 m 28 s	5:20 PM	
	Eastbound	Gilbert Cory Street	Gregory Street	1 m 25 s	8:13 AM	
Gilbert Cory Street	Southbound	Gordon Young Drive	Marlin Drive	1 m 5 s	11:30 AM	50 km/h
				1 m 3 s	8:17 AM	
	Northbound	Marlin Drive	Gordon Young Drive	1 m 15 s	8:15 AM	
				1 m 11 s	5:25 PM	

Street	Direction	Start	Finish	Travel Time	Time	Speed Zone
Marlin Drive	Westbound	Gilbert Cory Street	New Entrance Road	1 m 28 s	11:33 AM	50 km/h
				1 m 37 s	8:22 AM	
				1 m 22 s	5:30 PM	
	Eastbound	New Entrance Road	Gilbert Cory Street	1 m 42 s	8:26 AM	
Marlin Drive	Eastbound	New Entrance Road	Ocean Street	1 m 10 s	11:37 AM	50 km/h
				1 m 17 s	8:34 AM	
	Westbound	Ocean Street	New Entrance Road	1 m 14 s	8:30 AM	
				1 m 10 s	5:15 PM	
Ocean Street / Rudder Street	Northbound	Marlin Drive	Gordon Young Drive	1 m 22 s	11:42 AM	50 km/h
				1 m 27 s	8:37 AM	
				1 m 42 s	5:20 PM	
	Southbound	Gordon Young Drive	Marlin Drive	1 m 27 s	8:39 AM	
Rudder Street	Eastbound	Ocean Street	Gilbert Cory Street	0 m 35 s	11:47 AM	50 km/h
				0 m 45 s	8:43 AM	
	Westbound	Gilbert Cory Street	Ocean Street	0 m 37 s	8:40 AM	
				0 m 52 s	5:25 PM	

Appendix E

Hierarchy Frameworks

E-1 Movement Place Framework

Further to typical road classifications, TfNSW has developed, and is continuing to develop, a robust approach to classifying roads through the movement and place framework. The Movement and Place Framework is a critical tool for the effective planning and management of road networks with the overarching concepts summarised in Figure E.1 and the four categories are shown in the matrix in Figure E.2. The Framework brings together knowledge and experience from across State and local government to create a body of expertise and a community of practice. It aims to support the planning, design and delivery of a well-designed built environment that provides for the movement of people and goods as well as the needs of places and communities.

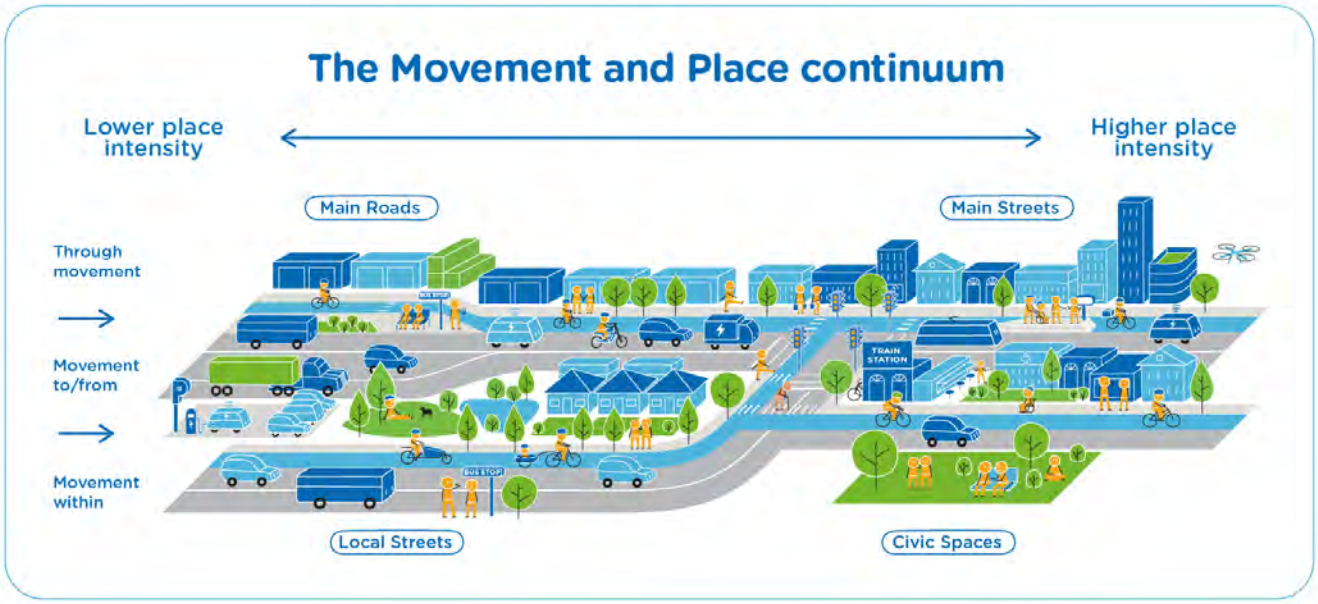


Figure E.1 The Movement and Place continuum (TfNSW, 2022)

Imagery obtained from Future Transport Strategy 2056 (TfNSW, 2022), accessed June 2022

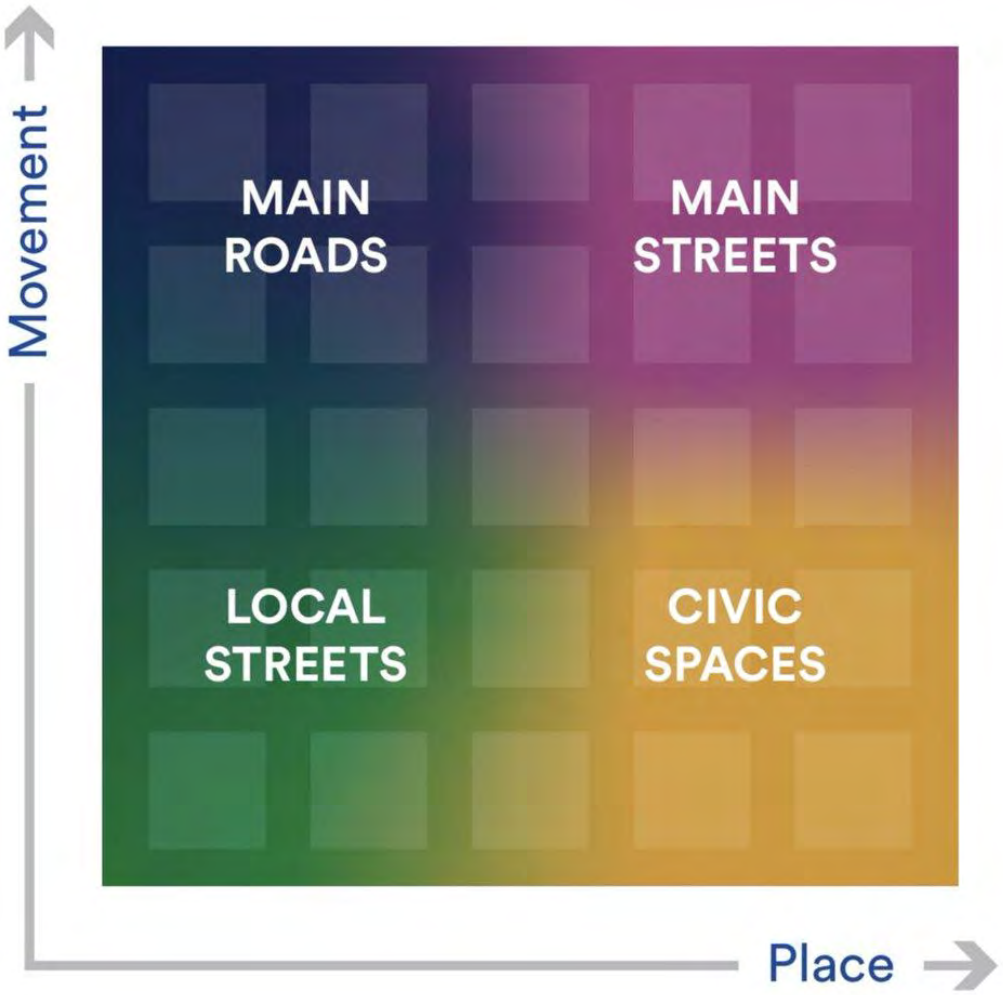


Figure E.2 Movement and place four street categories

Imagery obtained from Practitioner's Guide to Movement and Place (GANSW & TfNSW, 2020), accessed June 2022

E-2 Network Operations Planning

Another method commonly undertaken is Network Operations Planning. Network Operations Planning is a commonly used method for network planning and management within Australia and New Zealand. Austroads introduced the method in 2009 within the now superseded *Guide to Traffic Management, Part 4: Network Management, 2009.* The method has evolved further over the years, including the introduction of the Movement and Place concept which promotes a more integrated approach with land use and place.

Network Operations Planning (or sometimes referred to as tactical network planning) was introduced as a method to assist in resolving multiple strategic objectives at metropolitan and regional levels and balancing the competing demands for limited road space. Making localised or even corridor scale network changes can be met with decision making uncertainty, and resistance to embrace change without an overarching network plan that has been developed in collaboration with key stakeholders and with an understanding of community needs. This frustration is experienced at both local and state levels of government. Network modal hierarchy or classification frameworks form a key part of the Network Operations Planning process. This approach to hierarchy links strategic intent to operational decisions with the result referred to as a Road Use Hierarchy.

E-3 Guiding policy

The *TfNSW Network Planning and Precincts guide* refers to the *Road User Space Allocation (RUSA) policy*.

"*The policy ensures that road user space allocation:*

- *Considers place and movement functions*
- *Achieves the strategic intent and outcomes as set out in strategies and plans*
- *Achieves the movement and place vision of a corridor or network*
- *Considers the limited amount of space available*
- *Considers the safety of the most vulnerable users*
- *Can be adjusted to respond to specific circumstances, including temporal reallocation."*

An overview of the policy's application is provided in Figure E.3.

The *TfNSW Evaluators Guide for Movement and Place* refers to the *Better Placed (GANSW 2017)* seven objectives for design of built environment.

- Better fit – contextual, local, and of its place
- Better performance – sustainable, adaptable, and durable
- Better for community – inclusive, connected, and diverse
- Better for people – safe, comfortable, and liveable
- Better working – functional, efficient, and fit for purpose
- Better value – creating and adding value
- Better look and feel – engaging, inviting, and attractive

As part of the planning work TfNSW is undertaking, a Place Plan and Regional Transport Plan will be prepared for the North Coast region which includes South West Rocks.

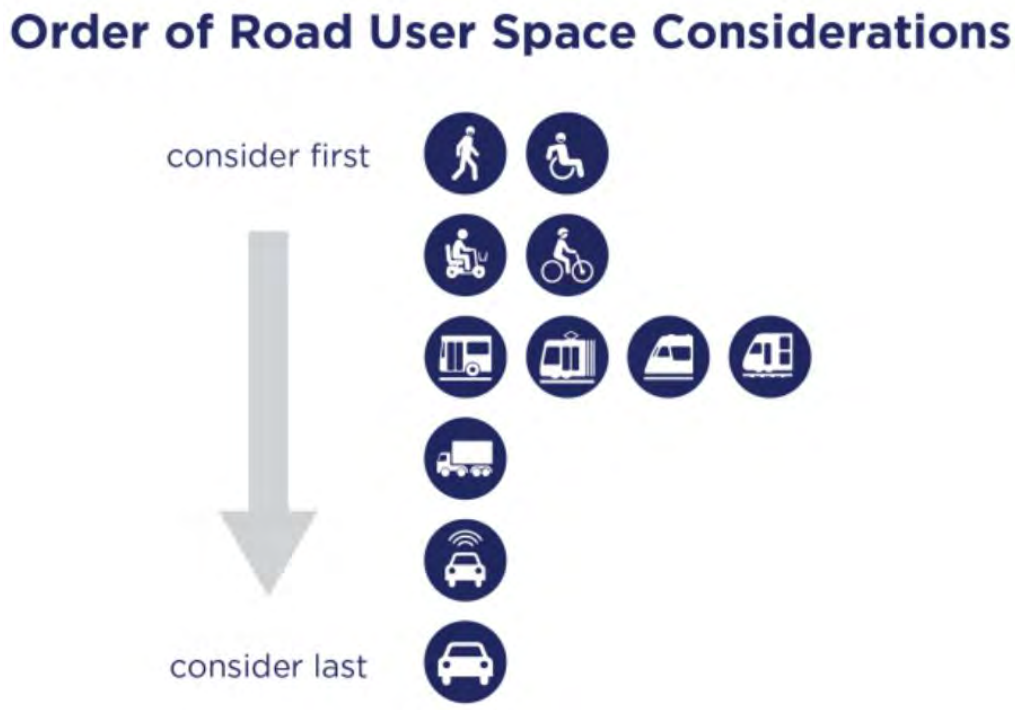


Figure E.3 Order of considerations for allocating space for road users

Imagery obtained from Road User Space Allocation Policy (TfNSW, 2021)

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