Williamtown SAP

B.3.2C Traffic and Transport Report

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Executive Summary

The Williamtown Special Activation Precinct (SAP) site is located 15km north of Newcastle, adjacent to Newcastle Airport. The proposed SAP is connected by an existing rural road network, with Newcastle to the south, A1 Pacific Highway to the west and Nelson Bay to the north-east. The road network surrounding the SAP is generally flat terrain, single lane in each direction with limited active transport and public transport facilities. The existing road network covering the SAP currently operates at sufficient traffic capacity. However, Nelson Bay Road, Pacific Highway and Tomago Road are nearing capacity and upgrades are planned by TfNSW for a section of these roads.. The proposed Nelson Bay Road upgrade by TfNSW will benefit the broader Hunter Region community by improving safety and reducing travel time between Newcastle and Nelson Bay via Williamtown, Bobs Farm, and Salt Ash. It will also enhance freight and general access to the SAP as the proposed Nelson Bay Road upgrade as an additional route which reduces through traffic on the existing roads adjacent to the SAP.

The SAP is strategically located for freight distribution, including proximity to the Port of Newcastle, M1, HEX, and Newcastle Airport. It is served well by freight routes in all directions, including Medowie Road to the north, Tomago Road, Cabbage Tree Road and Masonite Road to the west and Nelson Bay Road to the east and south.

For each of the SAP structure scenarios considered, the transport requirements were tested to understand impacts, gaps, and upgrade requirements to allow the scenarios to function. The SAP development anticipated completion date is yet to be determined. However, the year 2036 was used for the purpose of this report.

Our analysis also suggests construction or upgrade of the following roads and intersections are required by 2036 due to traffic growth in the area and traffic generated by the SAP development.

- Tomago Road. (The timing of the required north and south bound lane upgrades)
- Upgrade of the existing Nelson Bay Road – Williamtown Drive intersection
- Upgrade of the existing Tomago Road - WesTrac access road intersection

The structure plan benefits from a compact layout, which results in easier and faster journeys and promotes active travel as a viable and attractive mode of transport. With increased density, enhanced public transport connections are more feasible and justifiable, including consideration for linking the SAP with the future planned Fast Rail connection into Newcastle to provide increased transport opportunities. Bus patronage data indicate that there is available capacity to accommodate the potential increase in bus usage. It is recommended to provide ongoing monitoring of the usage of these services during the first few years after the SAP is established at six-month intervals. Should bus service reliability and journey time be impacted, a review and consideration of additional services and increased bus frequencies can be undertaken.

The internal green space serves the surrounding land use and will increases health and recreation benefits. Walkability within the SAP will be integral to its success, with recommendations to consider providing a walkway along Cabbage Tree Road and Nelson Bay Road, adjacent to and within the SAP. It is also important to provide an adequate network of high-amenity footpaths internally to the SAP, wide footpaths with adequate lighting, rest opportunities, and other amenities to support walking journeys. The cycleway along Nelson Bay Road should be connected to this loop to provide a connected cycling network.

Although there may be capacity challenges on some roads and intersections, particularly as the SAP develops, the proposed layout is suitable from a traffic and transport perspective. It is recommended during subsequent design development of the SAP, the intersection layout will be further refined to enhance the performance.

1 Introduction

1.1 Purpose

1.1.1 Vision

As discussed in the Structure Plan Report by Hatch Robert Day, the vision for the Williamtown SAP is multi-faceted. All government institutions have expressed the need to build on the existing defence and aerospace nature of the area. Accompanied by vital SAP aspects including road network capacity, public transport options, freight movement and active transport facilities with a sustainable focus geared towards economic development (refer to Figure 1-1). The scenarios were assessed and evaluated against the vision and objectives to land on a structure plan.

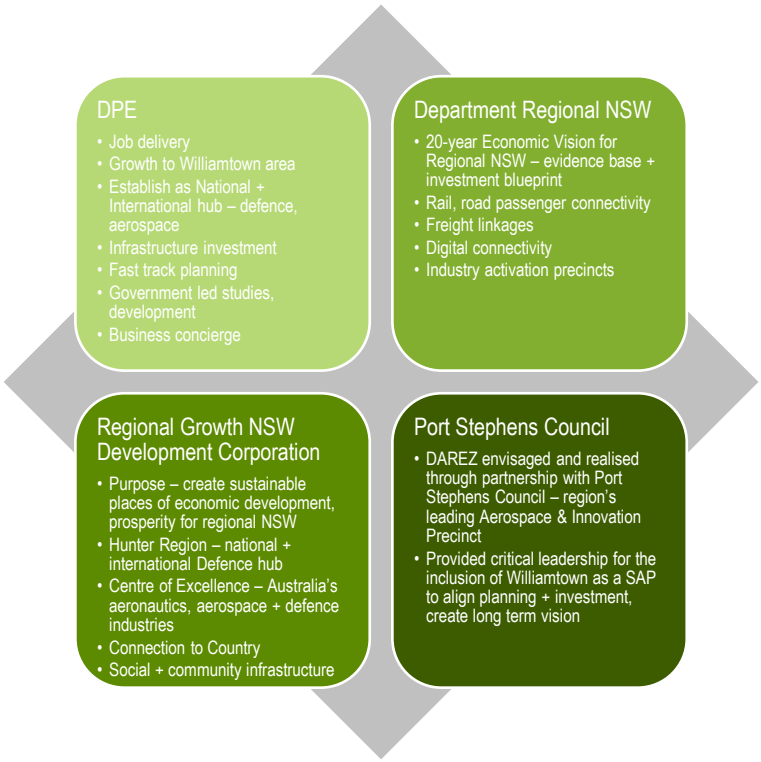


Figure 1-1: Williamtown Vision (Source: Structure Plan Report, Hatch Roberts Day)

1.1.2 Scope

The individual phase of the Williamtown SAP project was to determine the existing regional context as part of the baseline assessment. From this, potential scenarios and the structure plan was developed and assessments across the disciplines undertaken. The respective strengths and weaknesses of each option were expanded upon. For the Traffic and Transport study, a comparison of the scenarios included a review of these in terms of the precinct vision and respective road network impacts, similarly for the structure plan layout.

This comparison took place both on a macro and micro level:

- Macro in terms of reviewing the overarching focus of each option and how it satisfies the transport-related vision (transport planning)
- Micro in terms of whether the road network can accommodate the traffic demand by applying the necessary assumptions and conducting an analysis (traffic engineering)

In order to perform the micro analysis, the team used SIDRA intersection analysis software to consider the performance of the individual intersections, these results are presented in Chapters 3 and 4. The outcomes of this analysis identified key infrastructure upgrades that would be required to support the future development of the SAP. The feasibility of the traffic and transport recommendations was not considered.

1.1.3 Williamtown SAP Strategy

The Department of Planning, Industry and Environment (DPE) and Regional Growth NSW Development Corporation's (DRNSW) establishment of Special Activation Precincts (SAPs) is an innovative approach to plan and deliver infrastructure projects in strategic regional locations in NSW. Investment in these specific areas of Regional NSW 'activate' State or regionally significant economic development and job creation as part of the 20-Year Economic Vision. A strategic need from a land use demand and supply perspective, is that there is limited long term availability of readily developable land. The SAP will seek to resolve environmental, drainage and other development constraints in a coordinated precinct scale approach as opposed to a site-by-site basis.

The Williamtown SAP's vision is based on six key visions as shown in Figure 1-2. The strategic need for growth in the Hunter Region involves:

- **The Place** – leveraging the vicinity of the RAAF and civil aviation operators attract local employment and commercial investment
- **Economy and Industry** – facilitate development of additional employment land for Defence and aerospace industries
- **Environment and Sustainability** – regionally coordinated approach to flooding, water cycle management and contamination while preserving and enhancing the natural environment
- **Infrastructure and Connectivity** – providing infrastructure to resolve development constraints to reduce investment barriers to entry and enable effective connections to nearby Hunter Region infrastructure
- **Connection to Country** – To preserve, respect and integrate Aboriginal cultural heritage, particularly the Worimi people
- **Social and Community Infrastructure** – Enabling high skill employment, innovation, education and skill training opportunities

Figure 1-2: Williamtown SAP Visions

2 Background Context

2.1 Williamtown SAP

2.1.1 Williamtown SAP Location

Williamtown is located approximately 150km north-east of Sydney and 30km north-east of the Newcastle CBD in New South Wales.

The Hunter Region has the largest share of both regional population growth and regional employment and is in the state's fastest growing corridor (Sydney to Newcastle). Greater Newcastle is the centrepiece of the Hunter Region with 95% of residents living within 30 minutes of the strategic centre.

Newcastle Airport and the Port of Newcastle are recognised as global gateways that maximise exports and tourism, and a centre of excellence for health and education (Hunter Regional Plan 2041). The Hunter Regional Plan 2041 identifies that the region's ongoing economic prosperity will depend on its ability to build on previous efforts and promote sustainable growth, connections, and resilience. The plan's key focus is creating sustainable 15-minutes mixed-use neighbourhoods where people's everyday needs can be met close to home with a short walk, bike ride, or a car trip in rural areas. The close access to jobs and services will encourage exercise, public transport use, and reduce dependency on cars.

The Williamtown SAP site study area covers approximately 11,408ha of land and is low-lying coastal land on the edge of Fullerton Cove and Stockton Beach within Port Stephens Local Government Area in the Hunter Region and Greater Newcastle.

The Williamtown SAP is focused on leveraging employment and investment opportunities associated with its strategic location to the Williamtown Aerospace Precinct (WAP) which includes:

- RAAF Base Williamtown where the F35 Australia Joint Strike Fighter (JSF) fleet is based in. The area has also been affected by Per- and Polyfluoroalkyl Substances (PFAS) contamination associated with past activities conducted at the Williamtown RAAF Base.
- Newcastle Airport which is jointly owned by Port Stephens Council and Newcastle City Council, leased from the Department of Defence, and shares their airport runway with RAAF Base Williamtown
- The Defence and Aerospace Related Employment Zone (DAREZ) which is intended for the development of aerospace and defence specific industries near the adjoining Newcastle Airport
- Bushland vegetation is prominent in the area with some areas containing threatened flora and fauna species as well as important wetland areas
- Rural and agricultural lands
- Rural and low density residential development in Williamtown
- Commercial and light industrial clusters associated with the airport and RAAF Base along key road corridors
- The study area is also crossed by several roadways

The study area is presented in Figure 2-1.

Figure 2-1: Williamtown SAP Study Area with current and future developments

2.1.2 Williamtown Traffic and Transport Strategic Context

With the Hunter Region incorporating the state's largest share of both regional population growth and employment and located adjacent to the state's fastest growing corridor (Sydney to Newcastle), the Williamtown SAP will contribute to this forecasted growth. The SAP aims to build on the identity of the area as a civil aviation hub, supported by other industrial operations. Additional employment opportunities will be generated by the development of the Williamtown SAP, with environmental and sustainable policies at the heart of the strategy. With the projected increase in people living and working in and around the SAP, there are opportunities to improve the local and regional transport system to support the effective growth and development of the area.

The major road upgrades relevant to the Williamtown SAP include the Nelson Bay Road upgrade and the M1 Pacific Motorway extension to Raymond Terrace. Both these projects will yield significant improvements for the area in terms of journey time, road safety and connectivity both internally and externally to the Williamtown SAP. Enhanced facilities for pedestrians and bicycle riders will also contribute to the health and social wellbeing of the communities. Lastly the movement of freight, tourism and rural industries are all advanced by the road upgrade projects.

2.2 Existing Land Use

Williamtown is currently dominated by the Royal Australian Air Force (RAAF) Base in Williamtown and Newcastle Airport, which serve as key local employment providers. The western section of Williamtown is primarily semi-rural with low density residential dwellings. The 2016 Census shows a total of 885 people living in Williamtown, with 39.1% of residents working for the RAAF Base in Williamtown.

The existing land use within the SAP is shown in Figure 2-2. Land use is different for the areas north and south of Cabbage Tree Road and Nelson Bay Road. To the north, the land use is predominantly managed resource protection and nature conservation, with the area surrounding Newcastle Airport allocated to services. To the south, land use is predominantly grazing modified pastures.

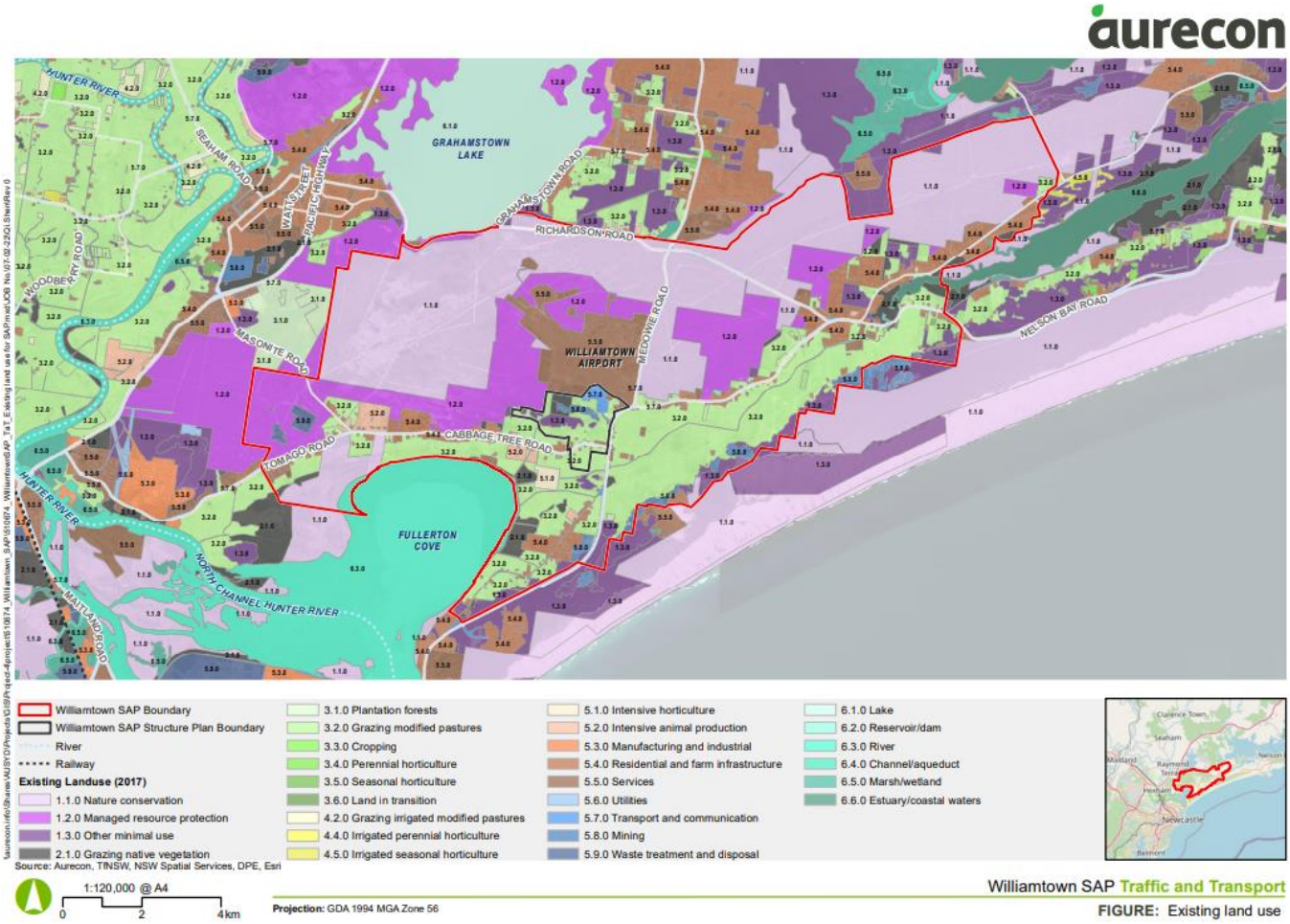


Figure 2-2: SAP Precinct Existing Land Use

2.3 Existing Transport Conditions

Data for Port Stephens LGA was obtained from the Economic Development Team at Port Stephens Council. The majority of people working in the LGA also reside in the LGA, followed by Newcastle, Maitland and Lake Macquarie (refer to Figure 2-3). Trips into the LGA tend to originate from the south/southwest in the morning peak and reverse in the evening peak.

For those residing in Port Stephens, LGA, the patterns are similar (refer to Figure 2-4), with most residents working in the LGA itself, followed again by Newcastle, Maitland and Lake Macquarie. Port Stephens is largely a residential area, so trip numbers from Port Stephens are higher than those into the LGA, suggesting that many residents work in Newcastle, Maitland, Lake Macquarie.

A total of 13,137 employed people resides in Port Stephens, with 8,520 of those working in the LGA as well (refer to Table 2-1). A total of 4,617 residents leave Port Stephens to travel to work outside of the LGA, and 2,664 travel from other LGAs into Port Stephens for work. With these trip patterns, roads to the south and southwest of Port Stephens are expected to be busier than other roads, particularly as the Williamtown SAP develops. Internal movements will also influence capacity of the road network.

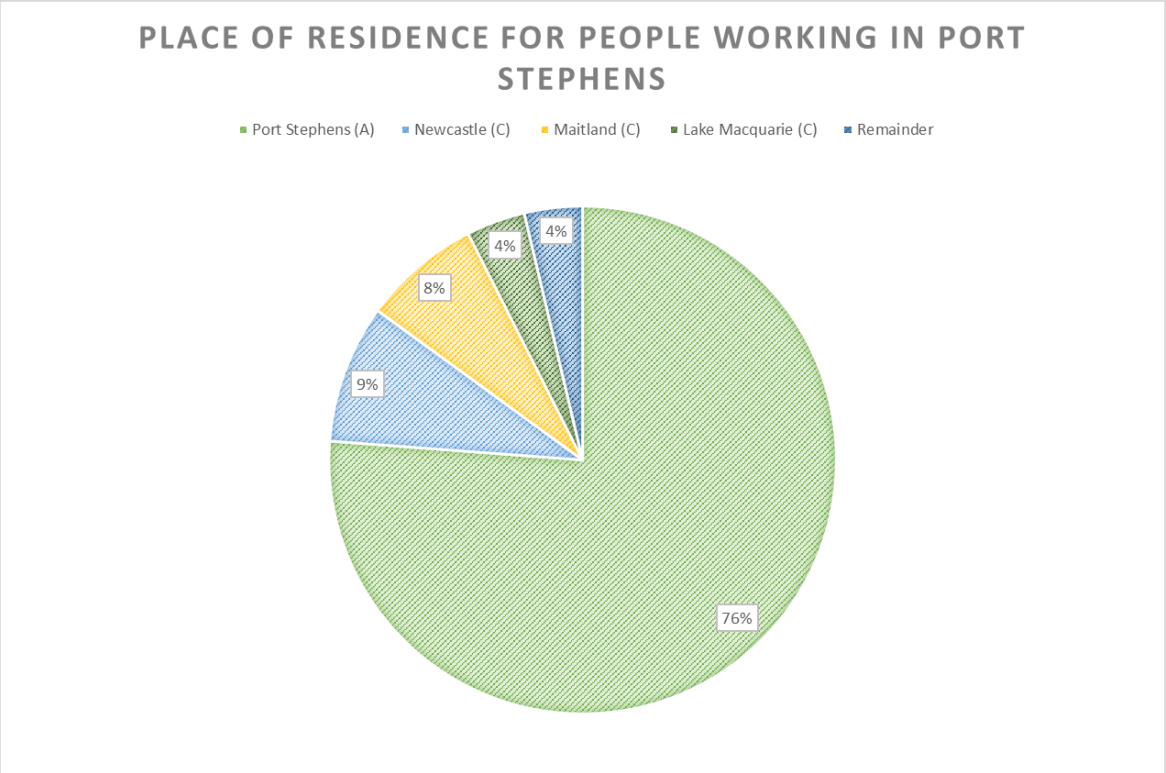


Figure 2-3: Place of Residence for People Working in Port Stephens (Source: Port Stephens Council Remplan[1])

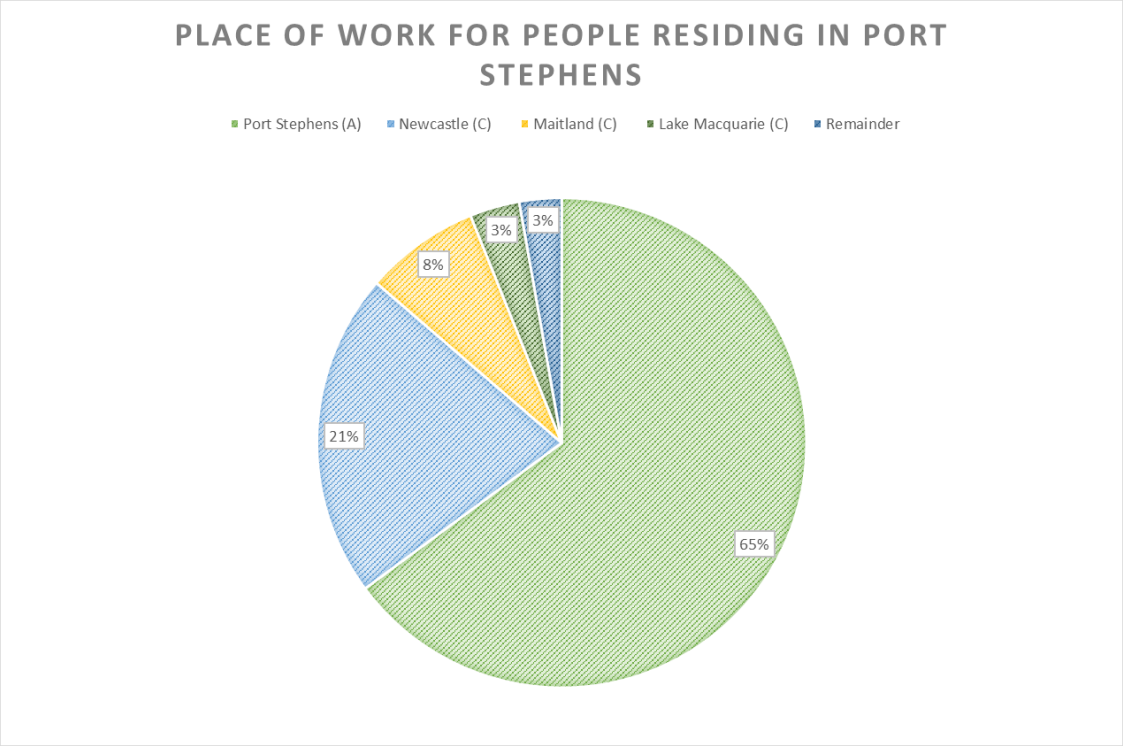


Figure 2-4: Place of Work for People Residing in Port Stephens (Source: Port Stephens Council Remplan[2]

[1] Source: https://app.remplan.com.au/portstephens/economy/workers/place-of-usual-residence?state=o1gGcR!VvbAIA0gGFY8oRmSkPAPvs1s4hgx6TwMhyh7GFKHdD47jkhJ7RyC2SllK3uY89
[2] Source: https://app.remplan.com.au/portstephens/economy/workers/place-of-usual-work?state=o1gGcR!4Yd3ioNPlFky01ef64P4viPskho82tBJsWhkRSOHkmG4jxfee6MohdSmm6PI64Y

Table 2-1: People working and residing in Port Stephens (Source: Port Stephens Council Remplan)

People working in Port Stephens		People residing in Port Stephens	
Place of Usual Residence	**Number of people**	**Place of Usual Work**	**Number of people**
Port Stephens (A)	8521	Port Stephens (A)	8520
Newcastle (C)	988	Newcastle (C)	2820
Maitland (C)	841	Maitland (C)	998
Lake Macquarie (C)	420	Lake Macquarie (C)	433
Remainder	414	Remainder	366
Total	**11,184**	**Total**	**13,137**

2.4 Policy Overview and Analysis

A number of relevant government plans, policies and strategies relating to the vision, development and objectives for Williamtown SAP are detailed below.

2.4.1 NSW Future Transport Strategy 2056

Future Transport 2056 Strategy is the overarching State Government plan to guide better delivery of Government services and provides priorities for action. Transport in regional NSW will be built on the hub and spoke model, to capitalise on the role that regional cities and centres play as hubs for employment and services such as retail, health, education and cultural activities.

Some relevant transport initiatives identified over the next 10 to 20 years in the Strategy that will impact on the Williamtown SAP include:

- Nelson Bay Road improvements
- M1, Hexham, Raymond Terrace upgrades
- Lower Hunter freight corridor protection
- Tomago Road improvements focusing on Pacific Highway to Williamtown Greater Newcastle rapid bus package
- Greater Newcastle place plans
- Newcastle light rail network extension
- Fast Rail Network – Northern Corridor: Central Coast, Newcastle, Taree and Port Macquarie
- Hunter Pinch Points

2.4.2 Regional NSW Services and Infrastructure Plan

The Regional NSW Services and Infrastructure Plan is a blueprint for NSW Government's regional transport strategy through to 2056. It identifies trends, services and infrastructure needs that are shaping transport in regional NSW, including improvements to road and rail as shown in Figure 2-5.

Of note are the new/improved sections of the M1 Pacific Motorway, Golden Highway and works at nearby Muswellbrook and Singleton, along with upgrades to nearby sections of existing rail and improving connectivity in the region around Williamtown. A potential higher speed rail connection could benefit the Williamtown SAP, with faster access for areas located to the north and south. The plan includes forecast population growth for the Hunter region as outlined over page in Figure 2-5.

Figure 2-5: Future Movement Corridors (Source: Regional NSW Services and Infrastructure Plan, 2018)

Table 2-2: Hunter Population Projections (Source: Regional NSW Services and Infrastructure Plan, 2018)

Location	Population		
	2016	2036	2056
– Hunter	0.73M	0.86M	0.94M

2.4.3 Hunter Regional Plan 2041

The Hunter Regional Plan 2041 is a 20-year blueprint for the future of the Hunter. The plan's vision is to ensure continued prosperity and wellbeing of the Hunter's vibrant and connected communities, building on previous efforts and responding to this era of rapid change to promote sustainable growth, connections, and resilience. Recognising the need to prioritise creating 15-minute neighbourhoods and homes within 30 minutes of strategic centres. This close access to jobs and services will encourage exercise, public transport use, and reduce dependency on cars. This extends to the Williamtown SAP with planning priority 1, from part 3 of the plan for district planning and growth areas, which is to prioritise housing within 30 minutes of the Williamtown SAP.

As Defence is an important contributor to the Hunter economy, the RAAF Base has plans to upgrade the national air defence infrastructure in the area, catering to an emerging cluster of aerospace knowledge industries, creating opportunities for new and existing business for the area. Newcastle Airport will also play a key role in providing ongoing support to the operations of the RAAF Base in Williamtown, enabling the development of high-technology industries, defence, and aerospace activities.

2.4.4 Greater Newcastle Future Transport Plan

This plan identifies and explores key relevant initiatives across Greater Newcastle including:

- Development of integrated public transport network including bus, rail and station upgrades
- Facilitating car sharing services
- Development of active transport networks
- Opportunities to extend Newcastle Light Rail
- Addressing road network pinch points
- Protection of freight corridors and reinforcing links to port and airport

Similar to other strategic plans, the Greater Newcastle Transport Plan identifies the expansion of Newcastle Airport and recent investment in the airport's facilities along with substantial upgrades that are proposed for the Williamtown RAAF base to support the F-35 program. The Plan highlights investment in key regional roads including the Nelson Bay Road upgrade to improve connectivity through Williamtown.

The Plan also recognises the economic benefits that the airport and its facilities provide to the wider region and that improving transport infrastructure around the airport will improve access for tourism and trade and encourage investment.

2.4.5 Greater Newcastle Metropolitan Plan 2036

The four key outcomes of the Greater Newcastle Metropolitan Plan 2036 include:

- Create a workforce skilled and ready for the new economy
- Enhance environment, amenity and resilience for quality of life
- Deliver housing close to jobs and services
- Improve connections to jobs, services and recreation

Williamtown is recognised as the main defence base for the maintenance of advanced Joint Strike Fighters (F-35). A defence and aerospace industry has emerged from links between universities, Newcastle Airport and the RAAF Base. Williamtown is also recognised as a key trading hub, due to its proximity to Newcastle Airport and key road corridors linking the airport to surrounding regions. The Plan outlines key growth in passengers (1.2m in 2016 to 2.6m in 2036) and jobs (5,300 jobs in 2016 to 8.300 jobs in 2036) for the aerospace and defence precinct and envisions a 25-minute drive by private vehicle or 45-minute bus ride through improved transport connections.

2.4.6 Freight Plans

The NSW Freight and Ports Plan (2018-2023) emphasises the importance of freight to the economy. Most of the freight is moved by road in NSW, with rail also serving a significant component of the local freight task. The three highest volume outbound commodities by 2036 for the Hunter Region include:

- Manufactures (fuel and lubricant) – 46%
- Coal – 11%
- Construction materials – 4%

In the Plan, Newcastle Port is identified as Australia's largest terminal for coal exports, with plans to diversify and expand the Port's trading base to include a wider range of commodities. Medium to long-term constraints include the pressures on the shared rail network in the Upper Hunter Valley and access via the New England and Golden highways.

2.4.7 Other Guiding Policies and Strategies

Other relevant policies and strategies include:

Future Transport 2056 – NSW Electric and Hybrid Vehicle Plan

This plan recognises the global transformation that is taking place from traditional combustion engines to electric, hybrid and fuel cell vehicles. Actions within the plan include the following three key priority areas:

- Vehicle availability
- Charging points
- Customer information

For the Williamtown SAP the main consideration for electric and hybrid vehicles is around charging points.

Future Transport 2056 – Connected and Automated Vehicles Plan

This plan provides details on the NSW Government approach to the adoption of connected and automated vehicles. Key goals outlined in the plan include:

- Support implementation of nationally consistent regulation, standards and policies
- Increase the proportion of passenger and freight vehicles in NSW with the latest CAV safety technologies
- Build infrastructure capability to support at-scale operations of partially, conditionally and highly automated vehicles on motorways and major roads

For the Williamtown SAP the main consideration of this plan is adopting infrastructure than will not hinder future implementation of technologies to support connected and automated vehicles.

2.5 Current and Future Developments

This section details key existing and committed future developments within the SAP investigation area that have or are likely to have an impact on the traffic, transport and freight in the region (all shown on Figure 2-1).

2.5.1 Newcastle Airport

Newcastle Airport in Williamtown is one of Australia's largest combined defence and civilian aerodromes, encompassing the RAAF Base Williamtown. Newcastle Airport is currently expanding, with recent investments in the airport's facilities and major upgrades planned to the RAAF Base to accommodate new Joint Strike Fighters (F-35). These upgrades will create a cluster of economic activity and new jobs at Williamtown. The airport may also have a more significant role in the future in supporting freight movements.

The **2036 Newcastle Airport Vision** (or master plan) sets the longer-term vision as a thriving and dynamic aerospace and aviation cluster driving innovation and excellence and generating economic, social and employment benefits for the region. At a minimum, the airport is expected to generate more than 3,000 additional jobs and double its passenger numbers by 2036 by offering direct international flights to key trading destinations. The master plan also sets that if successful in acquiring a Code E runway, total jobs generated would likely exceed 7,000 and passenger numbers forecasted to be 2,649,100 Pax in 2036 as shown in Figure 2-6. The airfield, terminal, landside, ground transport and aviation support facilities needed to cater for these increased numbers, which include:

- Terminal transformation to offer facilities expanded over two levels
- Additional food, beverage and retail businesses
- International services implemented into the facilities
- Aerobridges from the upper level
- Major modifications to integrate ground transport and road access
- Creation of a pedestrian plaza
- Additional car parking areas and offerings
- Creation of a ‘campus’ style business precinct

BASE CASE FORECAST SUMMARISED RESULTS – PASSENGERS							
		2015	2016	2021	2026	2036	2076
		Actual	Actual	Forecast	Forecast	Forecast	Forecast
Domestic	pax	1,139,700	1,216,624	1,363,500	1,525,700	2,288,800	4,532,500
International	pax	-	-	82,900	240,500	360,300	1,043,200
TOTAL	pax	1,139,700	1,216,624	1,446,400	1,766,200	2,649,100	5,575,700

Figure 2-6: Newcastle Airport Vision for 2076 (Source: 2036 Newcastle Airport Vision)

The forecasted growth in workforce, development and travellers require a significant investment in improving the transport and accessibility to the Airport Precent.

2.5.2 Astra Aerolab and Technology Park

The Astra Aerolab in Williamtown is a globally significant Defence and Aerospace precinct which is being developed on 76 hectares of rezoned land in Port Stephens. Stage one of the development is now completed and offered for leasing. The development adjoins the Williamtown RAAF Base and Newcastle Airport. It presents a rare opportunity to build a nationally significant and unique industry cluster that is a catalyst for the expansion of science, technology and manufacturing industries, increasing employment and jobs for the area. The development location and the extent of stage one is shown in Figure 2-7.

The strategic importance of Astra Aerolab is highlighted as follows:

- Increase economic activity and industry in the region in the commercial, industrial and technological fields
- Protect and support the operations of the RAAF Base in Williamtown, which is a significant element in the Australian Defence Force capability
- Protect and support the Newcastle Airport
- Critical need for employment lands in proximity and having strong supportive synergies to these existing Base and Airport facilities
- Strategically connected at the junction of road links to Newcastle and the Pacific Highway
- The area is important to the environmental management needs of the area including flooding, soils, and habitat management

Figure 2-7: Location of Astra Aerolab development and staging[3]

The 2016 traffic volumes for the Astra Aerolab indicate 85 two-way trips from 8:00am to 10:00am in the ARUP Technical Note titled Extract in Traffic Demand.

BAE Systems is based in Williamtown for over 20 years supporting the maintenance and upgrade of Defence aircraft. Currently BAE's warehouse footprint is around 8,000m^2 at Williamtown and employs around 260 people. Current indication is that around 12 heavy vehicle deliveries are made each day to the BAE Systems Warehouse in Williamtown. It is indicated that currently no B-double vehicles can access the BAE Williamtown site/Airport. The Hawk Lead-In Fighter (LIF) project includes the following vehicle trips (excluding delivery vans):

- 2 Semi-Trailers per week (average)
- 8-10 Rigid Trucks per week (average)

By 2025, the F-35 program is predicted to employ an additional 280 people at BAE Systems in Williamtown and the required warehouse footprint will increase to approximately 20,000m^2. This includes a new F-35 Air Vehicle Support Services (AVSS) contract to establish sovereign maintenance and supply-chain support for the Australian fleet at RAAF Bases at Williamtown, which will employ 46 BAE Systems Australia staff, providing direct, on-the-ground support to RAAF personnel sustaining the F-35. Minimal vehicle movements are expected for 2020 but are presumed to increase in the next 5 years. Weekly expectations are indicated in Table 2-3, over page.

[3] Source: **https://www.urbantaskforce.com.au/urban-taskforce-supports-astra-aerolab-in-the-hunter/**

Table 2-3: Expected weekly vehicle movement for the F35 program (Source: BAE Systems Australia)

Type	2020	2021	2022	2023	2024	2025
Semi-Trailers	1	1	2	2	3	4
Rigid Trucks	4	10	15	20	25	25

2.5.3 Williamtown Aerospace Centre

The Williamtown Aerospace Centre (WAC) is located adjacent to the Newcastle Airport between Williamtown Drive and Nelson Bay Road (refer to Figure 2-8). The WAC was designed from the ground up to enhance and facilitate commercial activities in the land adjoining the RAAF Base Williamtown and Newcastle Airport. As a site, WAC includes the Newcastle Airport Precinct and 120 hectares of industrial and business land[4]. The commercial, campus-style tech park includes commercial offices, and technical and light industrial spaces for lease.

The next stage of the WAC development is expected to be Precinct 52, which estimated to commence construction during 2023 potentially. The new 14 ha land development will include full scale B-double industrial road access. Once completed, Precinct 52 is expected to generate and attract traffic which will impact the SAP study area.

Figure 2-8: Williamtown Aerospace Centre (Source: Williamtown Aerospace website)

2.5.4 RAAF Base Williamtown

The Air Force has been in the Hunter since the late 1930s, when the Defence Practice Area was first designated at Williamtown. The Royal Australian Airforce (RAAF) Base Williamtown is home to the tactical fighter element of the Air Combat Group and the Airborne Early Warning and Control (AEW&C) element of the Surveillance and Response Group. The RAAF Base Williamtown has the largest footprint in Williamtown and employs 4,500 people.

Fuel deliveries represent a substantial proportion of base freight and is generally delivered via the access on Medowie Road). Other road freight for the base comes from the Defence Storage National Distribution Centre in Wattle Grove along with Orchard Hills and Myambat bases, which provide Williamtown RAAF Base with deliveries of dangerous goods and other high-value freight.

Dangerous goods furthermore include Class 1 dangerous goods (for example, ammunition), with deliveries to the base arriving 24/7, dependent upon operational tempos.

[4] Source: https://www.defenceconnect.com.au/key-enablers/5625-williamtown-aerospace-centre-the-leading-edge-defence-industry-cluster-at-the-heart-of-the-raaf

Base freight deliveries will grow in proportion to BAE contracts with JSF (Joint Strike Fighter) and international partners. As a result, PBS level 2/3 vehicles will have to enter and operate along the final mile to service potential warehousing and freight depots. These vehicles will also travel along connecting roads to gain access to airport cargo movements. The transportation and storage of dangerous goods, truck parking, and trailer parking will require available land space to conduct these movements and operations. The Williamtown RAAF currently forecasts a moderate increase in personnel of around 20% over the next 20 years.

2.5.5 Cabbage Tree Road Sand Quarry

The Cabbage Tree Sand Quarry is located at 398 Cabbage Tree Road. The Cabbage Tree Sand quarry is currently operational and is planned to extract up to 530,000 tonnes per annum over a period of 6 to 15 years[5]. The establishment of the Quarry includes the construction of an intersection with Cabbage Tree Road, sealed and gravel access roads, a site office, a workshop and weighbridges. As part of the project, upgrades have been made to the existing property access to a left in left out intersection with deceleration and acceleration lanes included in the project. Cabbage Tree Road is an important corridor for freight movement.

The sand quarry generates an average daily traffic of 126 one-way heavy vehicle movements during operation, resulting in a 29% increase in heavy vehicles and 2% increase in overall traffic along Cabbage Tree Road. Cabbage Tree Road is part of the HML network[6] (refer to Figure 2-19).

2.5.6 Kings Hill Development

The Kings Hill Urban Release Area (URA) is a 3,500-lot housing development master plan located north of Raymond Terrace and south of Eagleton in the Port Stephens Local Government Area. The concept plan went through public exhibition mid-2019. The Master Plan and proposed Concept Access Road Plan was included in the Development Application (DA) Planning Agreement (October 2019). Negotiations are taking place about providing an interchange along the Pacific Highway to provide access to the Kings Hill URA.

The latest information about Kings Hill Development includes the Community and Recreation Infrastructure Study, dated April 2020. According to the study, it is understood that only 250 dwellings can be developed before the interchange is built. Timing of construction of the interchange is currently unknown, therefore scheduling of the overall Kings Hill development is also uncertain.

2.5.7 Forgacs Shipyard in Tomago

Civmec recently purchased the Forgacs shipyard at Tomago. The purpose-built shipyard is situated on the Hunter River, 14 kilometres from the Port of Newcastle, with the 227,000m^2 site incorporating 535 metres of river frontage and two ship basins[7]. Civmec will develop the Tomago site to operate as a multi-disciplinary facility which will in future replicate Civmec's flagship operations at Henderson, Western Australia.

2.5.8 WesTrac in Tomago

The WesTrac NSW head office has been located in Tomago since 2012, west of the SAP, and is a major Cat equipment dealer. WesTrac covers a wide range of machinery and construction equipment as well as comprehensive whole-of-life management solutions assisting with maintenance aspects. WesTrac services many mines in the Hunter Valley and is therefore a significant stakeholder, their services include moving Over-Size Over-Mass (OSOM) Load Carrying vehicles along Tomago Road. Tomago Road / Cabbage Tree Road important for freight movements (OSOM transported 24/7), to be considered for future SAP road planning.

2.5.9 Tomago Aluminium

Tomago Aluminium is located north of Tomago Road, west of the Williamtown SAP. Tomago Aluminium is one of Australasia's largest aluminium smelters and operates 24 hours a day since 1983[8]. The smelter produces 580,000 tonnes of aluminium every year, which is 25% of Australia's primary aluminium. Ninety percent of the product made at Tomago is exported to the Asia-Pacific region.

[5] Source: 2019 Annual Environmental Review, Cabbage Tree Road Sand Quarry
[6] Source: https://www.rms.nsw.gov.au/business-industry/heavy-vehicles/maps/restricted-access-vehicles-map/map/index.html
[7] Source: https://www.civmec.com.au/what-we-do/capabilities/shipbuilding
[8] Source: https://www.tomago.com.au/about-us/our-story

The plant currently employs 950 staff (full-time equivalent) and 190 contractors. Tomago Aluminium staff are divided into day personnel and operational workforce working 12-hour shifts on rotation. Employees are drawn from a significant geographic area throughout the Hunter Valley and Central Coast, travelling from as far as 100 km south, 80 km north and 50 km west of the plant.

The inbound movements (raw products) are moved by road from Kooragang Island to Tomago Aluminium and include:

- Alumina approximately 1,150,000 tonnes per annum, 75 trucks per day (7 days per week 24hr)
- Petroleum Coke approximately 220,000 tonnes per annum, 15 trucks per day (7 days per week 24hr)

The outbound movements (finished product) are moved from Tomago Aluminium to the rail siding at Sandgate and include:

- Approximately 600,000 tonnes per annum, 60 trucks per day (Monday to Friday excluding public holidays from 6am to 3pm)

  Other imported products, typically in via Sydney Port to rail siding at Sandgate and trucked to site via road:

- Approximately 16,000 tonnes per annum, 5 trucks per day (6:00 am to 3:00 pm Monday to Friday, excluding public holidays)

2.5.10 Sand Mines in the Area

As indicated in Section 2.4.6, the Port Stephens area is home to various industries involved in manufacturing as well as construction and materials. A number of mines are present in the area, including Newcastle Sand located at 282 Cabbage Tree Road which constitutes a 3.25 million tonne sand resource quarry. Newcastle Sand supplies to the Hunter and Sydney regions and produces three key products:

- White/Industrial sand
- Concrete/Asphalt
- Landscaping sand

Newcastle Sand extracts a maximum of 530,000 tonnes per annum[9] and trades 69 hours per week. Important to note that Newcastle Sand is responsible for a maximum of 10 truckloads per hour. Therefore, the impact on the surrounding road network is well-controlled and managed.

Holcim Salt Ash is also located within the Williamtown SAP study area along Oakvale Drive, south of the Nelson Bay Road / Lemon Tree Passage Road / Oakvale Drive intersection. Holcim Salt Ash was purchased in April 2020 from Sibelco Australia and is a sand operation. Holcim supplies construction materials including aggregates, sand, concrete and precast concrete products. According to the NSW Planning Portal, Holcim Salt Ash Sand Operations proposes to extract and process up to 550,000 tonnes per annum of sand using dry extraction and dredging techniques to import up to 200,000 tonnes per annum of sand from Holcim's Tanilba Bay, Anna Bay and other local operations. The magnitude of annual sand extraction is quite similar between Holcim Salt Ash and Newcastle Sand. Therefore, it is expected that the truckloads per hour will be in the same range of approximately 10 per hour.

Macka's Sand and Soil Supplies is located next to Holcim Salt Ash south of Nelson Bay Road and east of Oakvale Drive, close to the Nelson Bay Road / Lemon Tree Passage Road / Oakvale Drive intersection and has been operating since 1992. Macka's Sand and Soil supplies to a variety of industrial uses including construction, landscape, sport and recreation, glass and foundry and government sectors. Macka's Sand and Soil moves 2 million tonnes of Stockton sand per year[10]. Macka's Sand and Soil has requested a modification in October 2020 to allow the transportation of 10% additional product from Lot 218. This increase includes a further 100,000t, increasing the total tonnage to 1,100,000t during the calendar year 2020[11].

It is important to consider all road access points for freight whilst undertaking future planning for the SAP, as it is critical for these sand mines. Industries like WesTrac and the mines in and around Williamtown support each other, thereby generating a market and growing the economic potential of the area.

[9] Source: https://www.newcastlesand.com.au/
[10] Source: https://www.cjd.com.au/about/testimonials/construction/mackas-and-cjd/
[11] Source: https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=MP08-0142-MOD-3%2120201026T044633.836%20GMT

2.6 Overview of Committed Infrastructure

2.6.1 Nelson Bay Road Upgrade

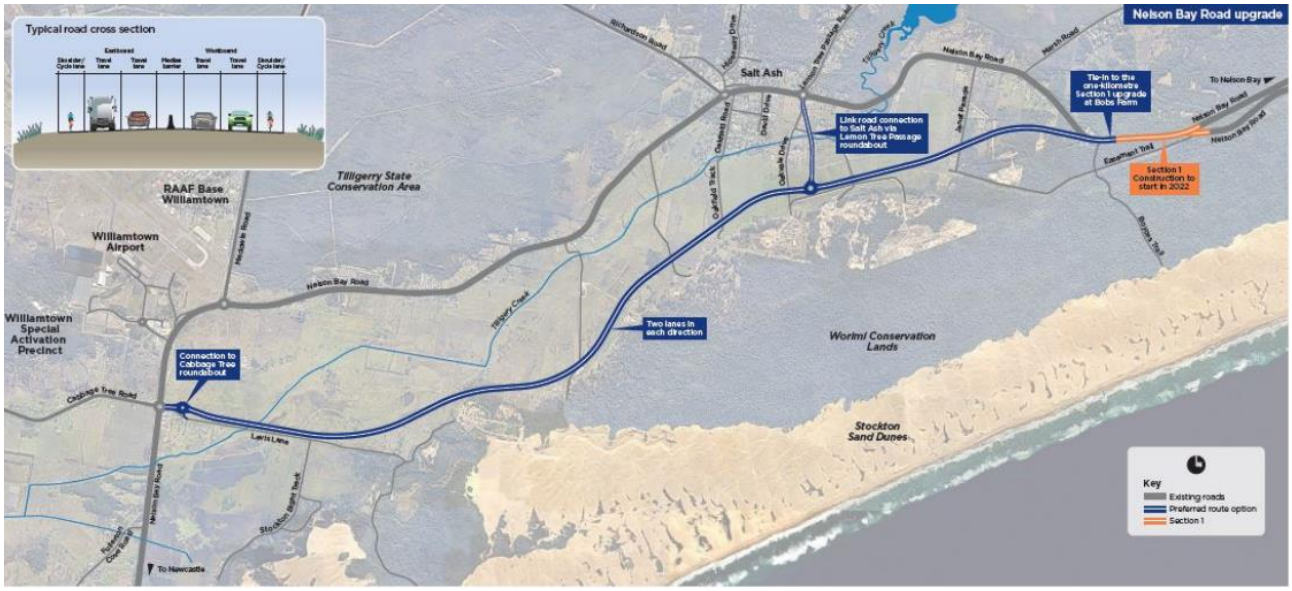


Figure 2-9: Nelson Bay Road to Williamtown upgrade preferred route map[12]

Nelson Bay Road is a major connection between Newcastle and the Newcastle Airport, RAAF base, and Nelson Bay. It is used by around 25,000 daily drivers, with increased volumes during holiday periods. TfNSW allocated $275 million in funding to upgrade the Nelson Bay Road corridor. This upgrade will improve access to Williamtown SAP from Port Stephens and Nelsons Bay area. The project includes road duplication between Williamtown and Bobs Farm, aiming to:

- Provide better connectivity for residents, businesses and the community to Newcastle Airport and Williamtown RAAF base
- Improve traffic flow, journey times and safety for motorists on Nelson Bay Road
- Improve pedestrian and bicycle safety by providing enhanced facilities
- Promote freight efficiency by ensuring future freight demands are met and encouraging the use of higher productivity vehicles
- Support tourism and rural industries as a major economic driver in the Port Stephens area

2.6.2 M1 to Raymond Terrace

The Australian and NSW Governments have committed $2.1 billion to deliver the M1 Pacific Motorway extension to Raymond Terrace and Hexham Straight projects. The M1 Motorway extension would boost the regional economy and improve connectivity, road transport efficiency and safety for local and interstate drivers. The project addresses a crucial national motorway 'missing link' between Sydney and Brisbane as the existing M1 Pacific Motorway, New England Highway and Pacific Highway carry some of the highest traffic volumes across the Hunter. The M1 Pacific Motorway extension to Raymond Terrace is expected to support around 2,700 jobs during construction. Once completed, the extension would remove up to 25,000 vehicles a day from key congestion and merge points along this corridor. The project would also save drivers between seven and nine minutes of travel time during peak periods and help keep freight, commuters and tourists moving. Refer to Figure 2-10 for the project overview and Figure 2-11 for the proposed work on the Tomago Road interchange, both over page.

Based on the M1 Pacific Motorway extension to Raymond Terrace Appendix C (traffic assessment) of the Submissions Report developed by TfNSW in June 2022, the scope of work will include allowing a Through movement from Tomago Road to head south on the M1. However, the traffic assessments developed to date do not provide an assessment of the proposed work on Cabbage Tree Road. And the trip generated by the nearby

12 Source: https://roads-waterways.transport.nsw.gov.au/projects/nelson-bay-road/nelson-bay-road-from-williamtown-to-bobs-farm.html

developments like Williamtown SAP were not included in the assessment. The project is currently at the tender design evaluation stage, and its expected work completion by 2028.

Figure 2-10: M1 Pacific Motorway extension to Raymond Terrace project overview map (Source: TfNSW website[13])

The project benefits include:

- Improved connection between the M1 Motorway and A1 Pacific Highway.
- Improved traffic flow for motorists and freight, more reliable travel times.
- Improved access to the surrounding road network; and
- Improved safety for all road users.

Figure 2-11: Tomago Interchange (Source: TfNSW website[14])

[13] Source: https://caportal.com.au/tfnsw/m1rt/map
[14] Source: https://caportal.com.au/tfnsw/m1rt/map

2.7 Existing Transport Infrastructure

This section details the transport context of the SAP investigation area in terms of existing road, public, active and freight transport infrastructure.

2.7.1 Arterial Road Network

The Arterial Road Network is explained and indicated in Table 2-4 and Figure 2-12. The Pacific Highway is the only national road located within the study area and three State-controlled roads, including Nelson Bay Road, Cabbage Tree Road and Richardson Road. Medowie Road and Lemon Passage Road are both regional roads. The Pacific Highway has a four-lane cross-section, all the other roads have a two-lane cross-section.

Table 2-4: Arterial Road Numbers and Jurisdiction

Road	Road Nr	Control Jurisdiction
Pacific Highway Four-land divided Highway Permanent Counter 05001 – 2019 AADT – 48,564[15] (both directions)	HW10	National
Nelson Bay Road Two-lane undivided road Permanent Counter 05191 – 2016 AADT - 24933[16] (both directions)	108	State
Richardson Road Two-lane undivided road	104	State
Cabbage Tree Road/Tomago Road Two-lane undivided road	302	State
Medowie Road Two-lane undivided road	518	Regional
Lemon Tree Passage Road Two-lane undivided road	7765	Regional

[15] Source: TfNSW – Traffic Volume Viewer Station Id 05001
[16] Source: TfNSW – Traffic Volume Viewer Station Id 05191

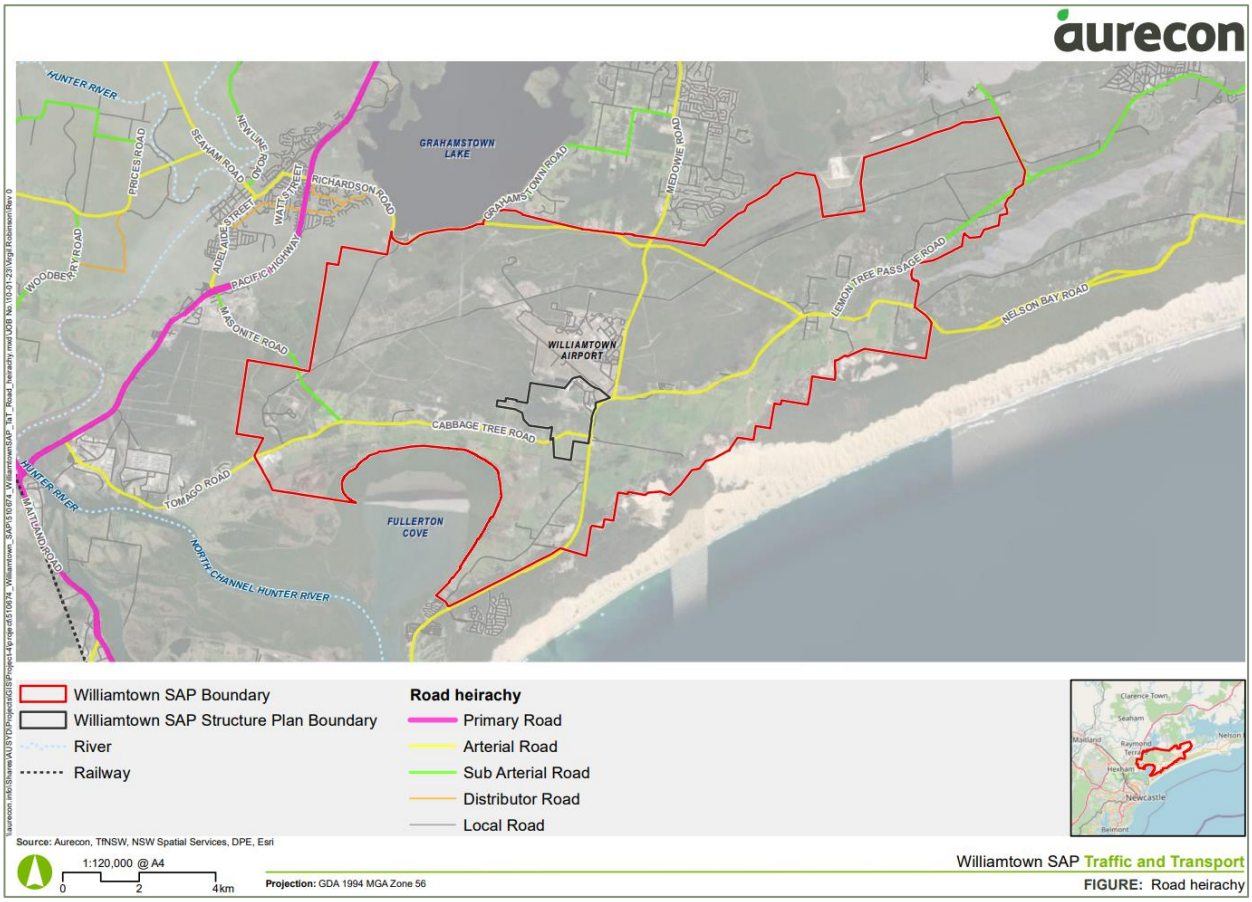
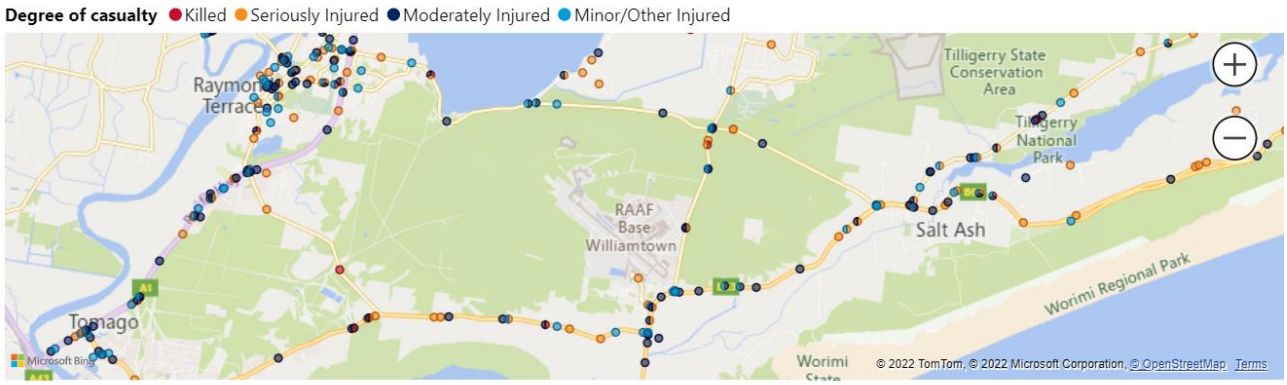


Figure 2-12: Key road hierarchy in Williamtown

2.7.2 Crash Statistics

Crash data for the Port Stephens LGA is available for the five-year period from 2016 to 2020. During this period, the number of Fatal and Serious Injury (FSI) crashes were as follows. Figure 2-13 indicates the location of these crashes, while Figure 2-14 shows the location of all crashes that occurred in the LGA.

- Number of fatal crashes – 32
- Number of serious injury crashes – 222
- The 32 fatal crashes included 36 fatalities
- The 222 crashes with serious injuries involved 274 people being seriously injured



Casualties	2016	2017	2018	2019	2020
Killed	10	4	8	9	5
Seriously Injured	44	68	64	54	44
Moderately Injured	65	94	64	53	64
Minor/Other Injured	39	54	34	25	46

Crashes	2016	2017	2018	2019	2020
Fatal	9	4	7	8	4
Serious Injury	37	54	53	43	35
Moderate Injury	49	64	50	38	48
Minor/Other Injury	22	25	20	17	33

Figure 2-13: Crash and Casualty Summary for Port Stephens LGA

Casualties	2016	2017	2018	2019	2020
Killed	10	4	8	9	5
Seriously Injured	44	68	64	54	44

Crashes	2016	2017	2018	2019	2020
Fatal	9	4	7	8	4
Serious Injury	37	54	53	43	35

Figure 2-14: Fatal and Serious Injury Crashes – Port Stephens LGA (2015-2020)[17]

Crash data indicates that most FSI crashes occurred along Cabbage Tree Road and the Nelson Bay Road section from Cabbage Tree Road towards Tilligerry Creek. Figure 2-15 provides an understanding of how the Port Stephens LGA compares with the North Region and NSW in terms of crash severity. Port Stephens LGA has a higher percentage of FSI crashes than both the Hunter Region and the entire NSW.
It should be noted that following a review by TfNSW Centre for Road Safety conducted in August 2020, speed limits along Cabbage Tree Road and Tomago Road have both been reduced from 90 km/h to 80 km/h. This should decrease the number and severity of crashes in the area. However, trends have not been assessed after this period as crash data was not provided.

[17] Source: TfNSW Centre for Road Safety

Figure 2-15: Port Stephens Crash comparison with Hunter Region and all NSW[18]

2.7.3 Public Transport Network

2.7.3.1 Bus Network

Two bus operators currently provide services in the Williamtown area which run multiple services daily. These operators are Hunter Valley Buses and Port Stephens Coaches. Currently there is no dedicated airport bus service. An overview of public transport in the area is provided in Figure 2-16.

[18] Source: TfNSW Centre for Road Safety

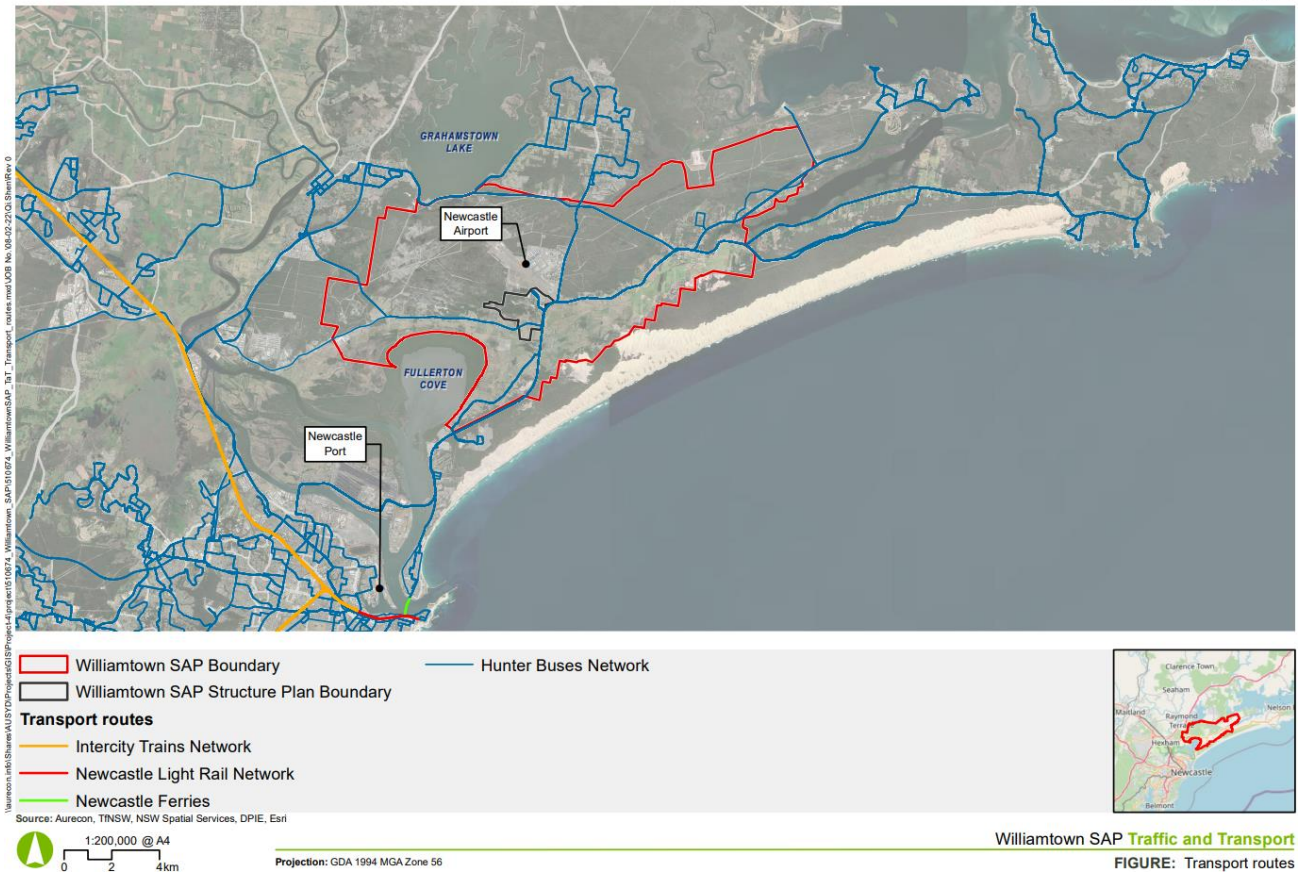


Figure 2-16: Transport networks servicing Williamtown SAP and Greater Newcastle

A number of bus routes are operated in the area including Routes 130 to 135 by Port Stephens Coaches and Routes 136, 138 and 145 by Hunter Valley Buses, as shown below in Figure 2-17. The relevant bus routes can be described as follows:

- Route 130 and 131 links Newcastle Interchange (including Newcastle Train Services and Newcastle Light Rail Services) with Newcastle Airport and carries on further eastbound to Nelson Bay. Frequencies include approximately one bus per hour per direction on weekdays, with a maximum of two buses per hour per direction between 4:36am and 10:19pm. Journey time between Newcastle Interchange and Newcastle airport takes about 30 minutes according to the bus route timetable.
- Routes 132 and 133 operate between Soldiers Point, Nelson Bay and Fingal Bay. These routes are more infrequent and are operated between 7:55am and 9:35pm on weekdays.
- Route 134 operates between Soldiers Point and Anna Bay. Fifteen bus routes per weekday operate along this route.
- Route 135 links Raymond Terrace with the Newcastle Airport precinct and carries on further to Nelson Bay, but no bus stop is located close to Newcastle Airport. Eight bus routes per weekday operate along this route.
- Route 136 connects Stockton with the Newcastle Airport precinct and departs from Stockton Wharf. This route carries on beyond the Newcastle Airport into Medowie and onwards to Raymond Terrace. Frequencies include approximately one bus per hour per direction on weekdays, with a maximum of two buses per hour per direction between 5:45am and 8:55pm. Journey time between Stockton Wharf and Raymond Terrace takes about one hour and 15 minutes according to the bus route timetable.
- Route 138 connects the Newcastle Interchange (including Newcastle Train Services and Newcastle Light Rail Services) with Newcastle Airport. This route carries on beyond Newcastle Airport along Nelson Bay Road and Lemon Tree Passage Road. Four bus routes per weekday operate along this route.
- Route 145 connects the Newcastle Airport with Raymond Terrace and carries on further to Stockland Greenhills. Buses depart on the hour from 6am to 6pm on weekdays.

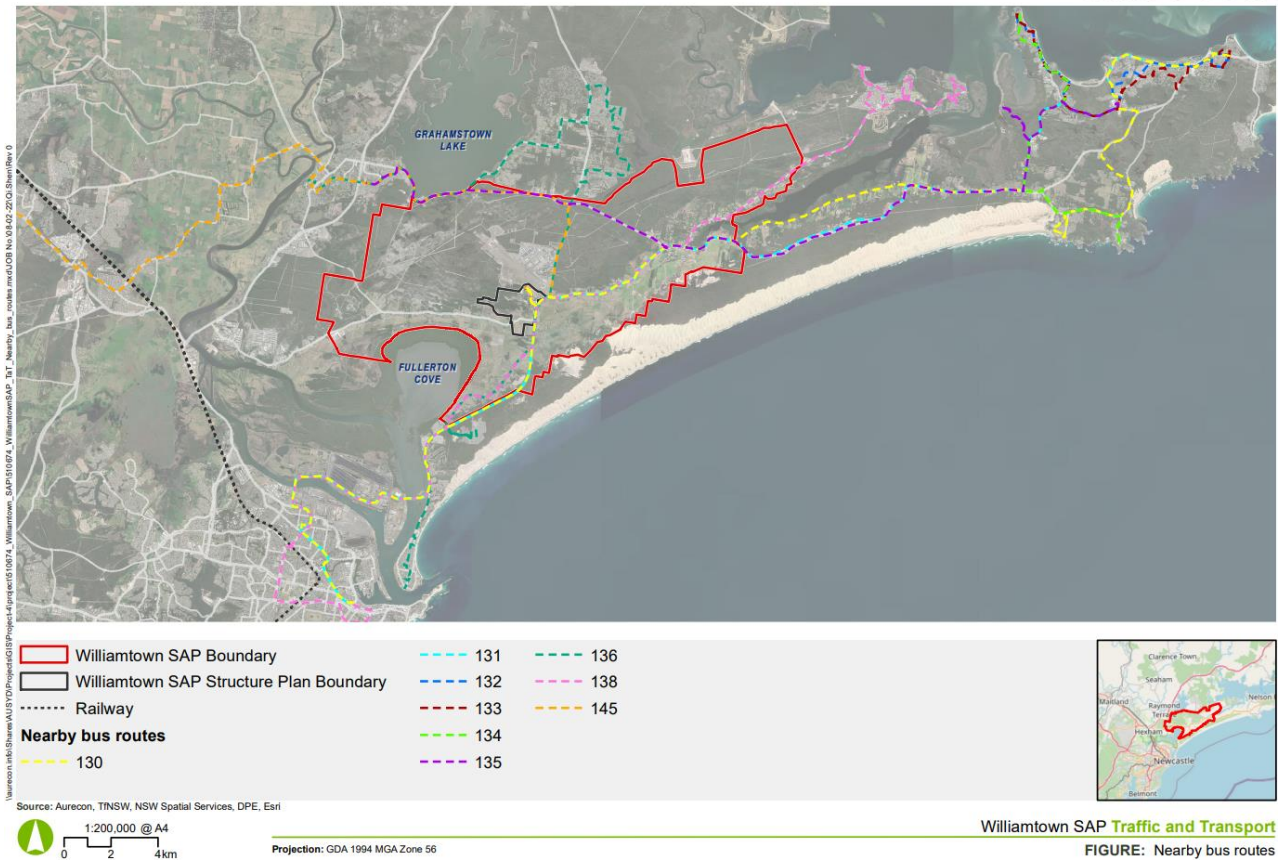


Figure 2-17 Bus routes connecting to and surrounding Williamtown SAP

Information from TfNSW has provided utilizations for all these bus routes for the month of November in the year 2019, from Table 2-5 it is noted that routes 136, 130 and 133 have the highest occupancies during this month. An analysis of the average utilization per route yielded results below 6% for all routes except 12% for route 131. Therefore, ample capacity is still available on all these routes, and it shows that these services will be able to accommodate increased demand from potentially new Williamtown SAP users.

Table 2-5: Bus route max occupation during November 2019 (Source: TfNSW data)

Bus route	Max # of occupants	Seating capacity	Max occupation %
130 (Port Stephens Coaches)	21	53	40%
131 (Port Stephens Coaches)	17	53	32%
132 (Port Stephens Coaches)	8	53	15%
133 (Port Stephens Coaches)	20	53	38%
134 (Port Stephens Coaches)	13	53	25%
135 (Port Stephens Coaches)	5	43	12%
136 (Hunter Valley Buses)	28	49	57%
138 (Hunter Valley Buses)	6	49	12%
145 (Hunter Valley Buses)	10	49	20%

2.7.3.2 On Demand Bus

The City of Newcastle received $5 million in grant funding through the Federal Government's Smart Cities and Suburbs Program for the award-winning Smart Moves Newcastle program[19]. The on-Demand transport service that was trialled in Newcastle is part of this program and carried on for a 12-month period until 30 October 2020. Bookings were made via an app with journeys costing a flat fare of $3.20.

[19] Source: https://www.newcastle.nsw.gov.au/council/news/latest-news/new-on-demand-transport-service-to-be-trialled-in

The on-Demand trial supports the City's long-term planning and ambition for higher levels of public transport patronage and active travel creating a more pedestrian-friendly city centre. The on Demand Service trial operated in peak hours between 6.30am-9:00am and 3.30pm-6:00pm on weekdays, Monday to Friday. A total of 1395 customers used this service during the trial period[20].

2.7.3.3 Rail Network

Several rail services are operated to/from Newcastle. These train services include the Intercity trains network and light rail services, shown above in Figure 2-16. The Intercity trains network include the Hunter Line that runs between the Newcastle Interchange and Scone in the northwest and Dungog north of Newcastle. The Central Coast & Newcastle Line runs between Newcastle and Central Coast and Sydney.

Newcastle light rail serves the area between the Newcastle Interchange and Newcastle Beach. As no rail facilities exist to/from the Newcastle Airport precinct, this area can be reached by the bus services described in section 2.7.3.1. Depending on growth and demand for rail services to and from the Williamtown SAP as it develops, consideration could be given to the future expansion of the intercity rail network to service the precinct, particularly linking it with the future Fast Rail connection into Newcastle.

In terms of the Hunter Line's two branches, Newcastle to Scone and Newcastle to Dungog, services usually run between Telarah and Newcastle at a frequency of two trains per hour. One train is express, skipping some stops in the core section between Maitland and Newcastle and the other train stops at all the stations.

In terms of the Central Coast & Newcastle Line, services usually run between Wyong and Central Station, Gosford and Central Station or Newcastle Interchange and Central Station at a frequency of one train per hour. Some trains run express, skipping several stops and provide a significant reduction in travel time and the other trains stop at all the stations.

Future Fast or High-Speed Rail Opportunities

According to the NSW Government website[21], in July 2018 the NSW government released a 20-Year Economic Vision for Regional NSW, which focuses on improving connections between cities, international gateways and regional nodes. Four potential routes were identified in this vision as a start to investigate a NSW fast rail network. The route that is relevant to this study is the Northern Corridor, which links Sydney to Gosford, and continues to Newcastle, Taree and Port Macquarie.

Potential opportunities for the SAP associated with a high-speed rail connection to Newcastle presents a significant opportunity for the region and provides increased accessibility to Newcastle and the SAP from the Central Coast and Sydney, expanding employment opportunities. Whilst the alignment is unlikely to service the SAP directly, the flow-on benefits from a station in Newcastle could be significant and provide increased transport opportunities to connect the airport and SAP.

2.7.4 Active Transport Network

2.7.4.1 Pedestrian Network

The Greater Newcastle Future Transport Plan indicates weekday and weekend mode shares, showing that, based on household travel surveys, 12% of travel is done by walking and cycling on a typical weekday and 14% by active transport on a weekend (refer to Figure 2-18), which indicates strong mode share. Over half of the trips made by Greater Newcastle's residents are short journeys under 5km, which further builds the case to focus on active transport in the area.

Results are also available for Port Stephens LGA from the Household Travel Survey for the 2018/2019 period. These results indicate quite a different situation with only 1.4% using walking as mode of transport (refer to Table 2-6), vehicle driver and passenger in combination taking up 96.7% of the mode share and public transport only being used by 0.8% of the Port Stephens residents[22].

[20] Source: https://newcastleondemand.info/
[21] Source: https://www.nsw.gov.au/projects/a-fast-rail-future-for-nsw
[22] Source: https://www.transport.nsw.gov.au/data-and-research/passenger-travel/surveys/household-travel-survey-hts/household-travel-survey-1

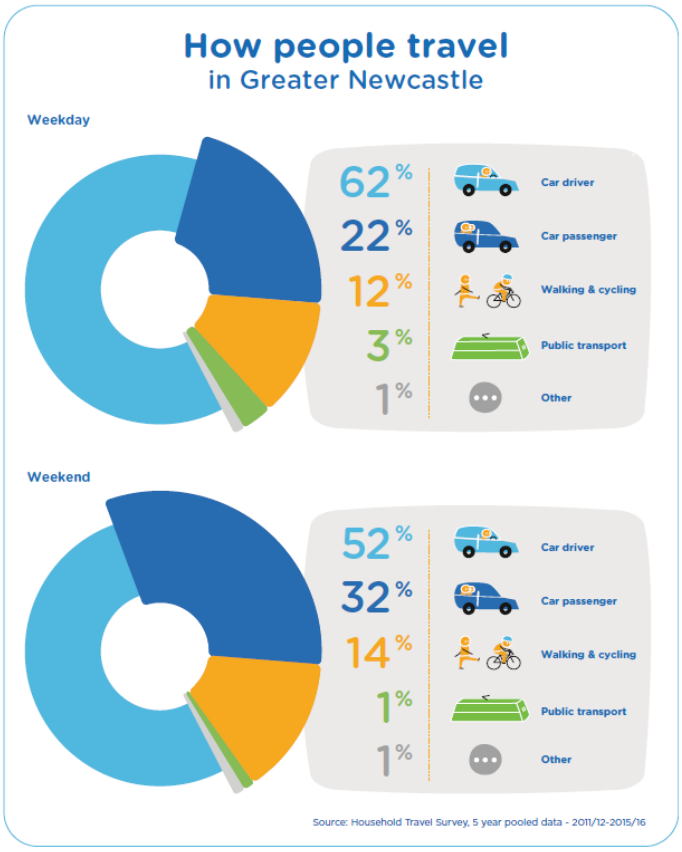


Figure 2-18: Weekday and Weekend Mode Share (Source: Greater Newcastle Future Transport Plan, March 2018)

Table 2-6: Mode Share for Port Stephens LGA (Source: Household Travel Survey)[23]

Travel by MODE, Port Stephens 2018/19

	Number of Trips	% of Total Trips	Mode Share %*
Vehicle Driver	139K	72.4	72.4
Vehicle Passenger	47K	24.3	24.3
Bus	2K	0.8	0.8
Walk Only	3K	1.4	1.4
Other	2K	1.1	1.1

Mode figures are based on unlinked trips. See Glossary for Unlinked trips.
*Mode Share is calculated excluding Walk LInked trips

2.7.4.2 Cycling Network

The existing regional cycle ways include a cycle route along Nelson Bay Road, as well as a section between Stockton and Fern Bay. Through Williamtown there is varying cyclist provision. Predominantly cycle facilities are on-road with some paths available at Salt Ash and nearer to Nelson Bay. Cycling within the area is uncommon and generally recreational. Dispersed communities and employment locations make commuter cycling less desirable.

[23] Source: https://www.transport.nsw.gov.au/data-and-research/passenger-travel/surveys/household-travel-survey-hts/household-travel-survey-1

Williamtown is generally flat so the area could lend itself more to cycling if improved facilities were available. The Nelson Bay Road upgrade project will provide for some improvement to on-road cycle facilities.

As part of the Nelson Bay Road upgrade project discussed in Section 2.6, all three options include two lanes in each direction, improved intersection access, improved shoulders for cyclists and minimum 80km/h design. This project will therefore improve the cycling infrastructure along the upgraded section of Nelson Bay Road. It is noted that future cycleways are proposed along:

- The entire Nelson Bay Road
- Medowie Road between Nelson Bay Road and Richardson Road
- Richardson Road between Medowie Road and Raymond Terrace

A shared path has recently been completed within Medowie south to the new Catholic School, and there is an existing shared path connecting Medowie to Raymond Terrace.

2.7.5 Freight

This section will consider road freight, rail freight and air freight aspects.

2.7.5.1 Road Freight

The National Land Transport Network for roads in the study area includes the New England Highway and the Pacific Highway. The study area connects well with the National Land Transport Network including the Pacific Highway via Cabbage Tree Road/Tomago Road, Cabbage Tree Road and Masonite Road, Richardson Road and Medowie Road. Military freight including dangerous goods are to be transported to/from Salt Ash along Medowie Road, Richardson Road and Lemon Tree Passage Road.

The restricted access vehicle map is included in Figure 2-19. All the above-mentioned routes are gazetted as 25/26m B-double routes. Further to the previously mentioned routes, the study area is connected with the Newcastle Interchange via Nelson Bay Road, Cormorant Road, Industrial Drive and Hannell Street, also gazetted to allow 25/26m B-double vehicles. With respect to PBS (Performance Based Standard) routes for Level 2 Class A (≤ 26m in length), all these previously mentioned routes are gazetted to accommodate PBS Level 2 Class A vehicles.

In terms of Oversize Overmass (OSOM) Load Carrying Vehicles Network Approved roads, all of the above roads can accommodate OSOM vehicles except two restricted structures, railway level crossings, along Cormorant Road.

It has been confirmed that the majority of the freight destined for the Williamtown RAAF Base originates from the Defence Storage National Distribution Centre in Wattle Grove. Road freight will then be transported along the Pacific Highway, leave the Pacific Highway and turn right into Tomago Road, which becomes Cabbage Tree Road and turn left into Medowie Road to access the Williamtown RAAF base.

Two freight intermodal terminals are located close to the Williamtown SAP, one in Sandgate and one in Carrington which support IMEX container operations. The IMEX containers currently move through both terminals. An intermodal terminal at Walsh Point on Kooragang Island is currently non-operational.

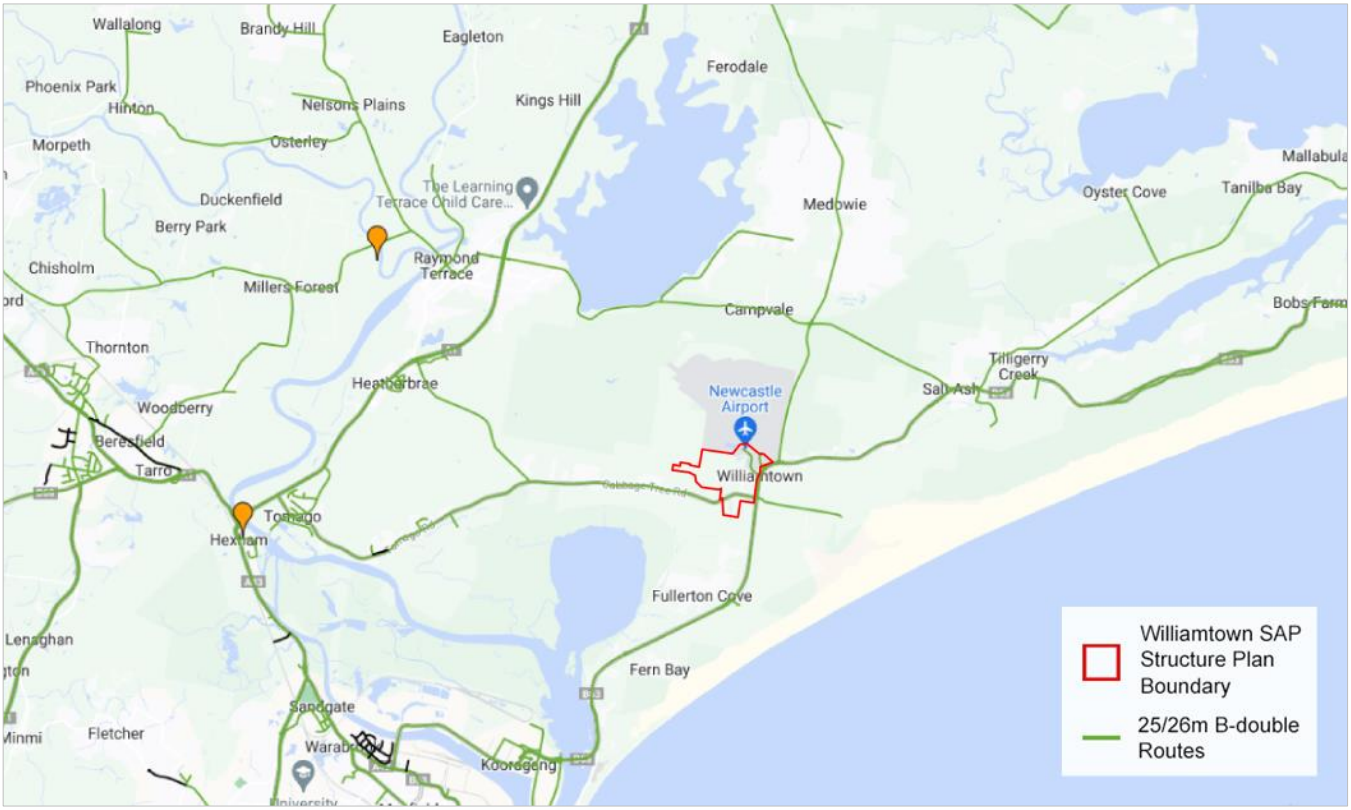


Figure 2-19: Restricted Access Vehicle Map – 25/26m B-double Routes (Source: TfNSW Website[24])

2.7.5.2 Rail Freight

The National Rail Network includes rail lines between Sydney and Brisbane via Newcastle and from Newcastle northwest to Narrabri. These national rail lines pass the Williamtown SAP on the western side, access to these rail lines are provided by road. The road distance between Newcastle Airport and the Newcastle Interchange is 25km. Sydney Trains operate between Sydney and Newcastle and Australian Rail Track Corporation operate north of Newcastle to Narrabri and towards Queensland via Taree, Coffs Harbour and Casino. As the Newcastle Airport vision for 2036 also calls for a rail link, it is recommended to consider further investigations into rail connecting directly into the Williamtown SAP as growth in travel demand increases with the development of the SAP.

2.7.5.3 Air Freight

Newcastle Airport handled approximately 100 tonnes of air freight per annum in 2016/17, all of which was transported via Regular Public Transport operations as belly freight[25]. Based on 2015/16 traffic on aircraft with freight capacity operating to/from Newcastle to Melbourne and Brisbane and adopting the national average per passenger carried, a more realistic annual target is about 1200 tonnes. Even though such a realistic target is far below the maximum capacity, there is still more potential for domestic belly freight to be carried into and out of Newcastle than has been the case. With the upgrade of the runway to Code E as part of the master plan, the airport will be able to accommodate larger aircraft and therefore increased air freight capacity.

2.7.6 Electric Vehicles

The NSW electric vehicle strategy provides insight into the predicted growth in electric vehicle ownership. It indicates the potential uptake in owning and operating electric vehicles if the co-investing in fast chargers on major regional corridors program progresses by the government in partnership with charging suppliers and councils. This program will work with councils, communities, and commercial partners to target key regional routes and destinations where charging points are less likely to be provided on a fully commercial basis.

This will help regional residents and businesses experience the cost savings and other benefits of EV, improve access to regional NSW by EV owners, including freight operations, and reinforces the regional tourism economy.

[24] Source: https://www.rms.nsw.gov.au/business-industry/heavy-vehicles/maps/restricted-access-vehicles-map/map/index.html
[25] Source: https://www.infrastructure.gov.au/transport/freight/freight-supply-chain-submissions/Newcastle_Airport.pdf

It also supports local investment in regional centres, consistent with the 20-Year Economic Vision for Regional NSW.

The regional fast charger locations will be carefully chosen to complement and not duplicate current and proposed charger locations. Further considerations of the corridors will be made based on the significance of the route, availability of electricity supply, and proximity to services. The Pacific Highway is one of the targeted corridors identified by the program. Williamtown SAP will be served well by this program in terms of improving the sustainability of road transport along the Pacific Highway and other highways used by vehicles to and from the SAP. It is recommended to provide charging stations within the private lots, service stations, and communal car parks.

In the context of the Green Travel Plan, this measure will encourage the use of sustainable transport as a part of the commute. It will tackle range anxiety, identified as one of the biggest barriers to purchasing an EV. Range anxiety is often a concern for potential EV owners regarding running out of charge without being able to find places to recharge easily, especially on longer trips.

The provision of charging stations is not limited to passenger vehicles only and should include commercial vehicles and buses. The NSW government Future Transport Technology Roadmap 2021–2024 highlights the NSW government's goal to transition NSW's 8,000 buses to zero emissions, aiming to bring local benefits for regional customers and communities, and is already bringing valuable new jobs and investment to regional centres for electric bus manufacturing.

2.7.7 Port of Newcastle

The Port of Newcastle is 50% owned by The Infrastructure Fund and 50% owned by the China Merchants Port Holdings Company (CMPort). A total of 2,296 ships arrived in the port in 2019. Of these arrivals:

- 1% were cruise related
- 79% were coal
- 20% were diversified trade

With the strategic location of the Port and airport in close proximity, there may be opportunity for freight efficiencies, particularly for freight distribution across regional NSW, through enhanced connections between the port and the airport.

2.7.8 Emergency Services

The nearest hospitals to the Williamtown SAP include the John Hunter Hospital and the Calvary Mater in Newcastle. These hospitals are accessed via Stockton bridge. These provide two options in case of an emergency on one of these routes. Ambulance Stations are located in Stockton and in Raymond Terrace. One Fire and Rescue Station is located in Stockton that can serve the Williamtown SAP. Several other Fire and Rescue Stations are located around the Williamtown SAP and within Newcastle.

2.8 Transport Performance

This section details the transport performance of key midblock locations and intersections within the SAP investigation area. The data used to develop the existing and the future performance assessment were sourced from the following data sources:

- SCATS Traffic Signals Scats Data
- TfNSW permanent traffic counters and intersection surveys undertaken by Matrix on Thursday, 13 February 2020 for key roads in an around the Williamtown SAP, including Cabbage Tree Road, Nelson Bay Road, and Pacific Motorway

2.8.1 Midblock Performance

An assessment of baseline midblock performance and capacity was conducted was assessed through the flow/capacity ratio method and the estimated road capacities. The aforementioned methods are outlined in the Roads and Maritime Motorway Design Guide: Capacity and Flow Analysis (2017) Traffic assumptions

The following assumptions were made for this assessment:

- A typical Passenger Car Unit (PCU) value of 1 for private vehicles, and 3 for heavy vehicles
- Typical traffic distribution in which 10% of daily traffic occurs during each peak hour
- Typical heavy vehicle percentage of 10% on midblock with no data
- Even split in volumes across north/south and east/west bound carriageways
- Capacity of unmanaged highway is 1,700 pcu/hr/lane, and capacity of managed highways is 2,100 pcu/hr/lane based on Roads and Maritime Motorway Design Guide – Capacity and Flow Analysis (2017)

2.8.1.1 Midblock Volumes

The volumes of key midblock within the SAP precinct are summarised in Table 2-7.

Table 2-7: Midblock Traffic Volumes at Key Routes around the SAP Precinct

Midblock	Direction	AADT	AM Peak			PM Peak		
			LV	HV	PCUs	LV	HV	PCUs
Pacific Highway	**NB**	52,542	2,364	263	3,153	2,364	263	3,153
	SB		2,364	263	3,153	2,364	263	3,153
Nelson Bay Road north of Cabbage Tree Road	**NB**	-	1,295	82	1,541	1,415	51	1,568
	SB	-	1,219	81	1,462	1,216	40	1,336
Cabbage Tree Road	**EB**	-	378	47	519	543	20	603
	WB	-	323	31	416	336	27	417

2.8.1.2 Midblock Capacity

A high-level capacity assessment was undertaken for key midblock identified in Table 2-7. The assessment measured the current utilisation and expected capacity based on the estimated capacity of different types of roads outlined in Roads and Maritime Motorway Design Guide – Capacity and Flow Analysis (2017). The results of the assessment are presented in Table 2-8.

Table 2-8: Midblock Capacity Assessment

Midblock	Utilisation	Capacity
Pacific Highway	75%	25%
Nelson Bay Road north of Cabbage Tree Road	44%	56%
Nelson Bay Road south of Cabbage Tree Road	74%	26%
Cabbage Tree Road	30%	70%

The capacity assessment shows that at this stage of the project, key midblock within the SAP precinct have residual capacities between 55-76%, with the Pacific Highway having a lower residual capacity of 25%. Based on these criteria, the midblock assessment of the year 2020 shows that the capacity of all major roads in the network might have residual capacity to accommodate future growth.

2.8.2 Intersection Performance

Key intersections within the SAP were modelled on SIDRA to assess baseline intersection performance. . The intersections at the future access points of the development were analysed as a signalised control intersection and

not roundabout or priority control due to safety and efficiency considering the high number of traffic volumes and the percentage of heavy vehicles

Four intersections were modelled:

- Nelson Bay Road / Williamtown Drive
- Nelson Bay Road / Cabbage Tree Road
- Wes Trac Access Road / Tomago Road
- Pacific Highway/ Tomago Road

Results of the traffic modelling are presented in Table 2-9, over page.

Table 2-9: SIDRA Intersection Modelling Results

Intersection	Approach	Peak Hour Volume	Degree of Saturation	Delay [s]	Level of Service		Queue [m]
Nelson Bay Rd / Williamtown Dr (Newcastle Airport)	**S**	1540	0.83	29.9	LOS C	LOS B	235.7
	N	1475	0.56	7.7	LOS A		118.3
	NW	111	0.24	29.4	LOS C		20.4
Nelson Bay Rd / Cabbage Tree Rd	**S**	1147	0.58	7.4	LOS A	LOS A	36.8
	E	215	0.50	17.7	LOS B		23.2
	N	1379	0.68	7.1	LOS A		50.1
	W	413	0.50	10.1	LOS B		24.6
Tomago Rd / WesTrac Access Rd	**S**	23	0.03	22.0	LOS C	LOS B	1.4
	E	441	0.31	19.1	LOS B		35.4
	W	442	0.21	7.8	LOS A		13.9
Pacific Hwy / Tomago Rd	**S**	358	0.37	22.5	LOS C	LOS B	32.9
	E	1181	0.81	20.1	LOC C		139.2
	W	1992	0.84	14.4	LOS B		107.9

Intersection	Approach	Peak Hour Volume	Degree of Saturation	Delay [s]	Level of Service		Queue [m]
Nelson Bay Rd / Williamtown Dr (Newcastle Airport)	**S**	1550	0.84	27.3	LOS C	LOS C	235.7
	N	1143	0.43	7.1	LOS A		118.3
	NW	412	0.80	34.1	LOS C		20.4
Nelson Bay Rd / Cabbage Tree Rd	**S**	1082	0.59	7.3	LOS A	LOS A	34.7
	E	335	0.74	24.0	LOS C		46.3
	N	1286	0.64	7.0	LOS A		44.8
	W	547	0.60	10.5	LOS B		31.3
Tomago Rd / WesTrac Access Rd	**S**	233	0.39	20.0	LOS B	LOS B	17.3
	E	327	0.39	20.6	LOS C		32.1
	W	557	0.26	5.2	LOS A		25.6
Pacific Hwy / Tomago Rd	**S**	1153	0.84	30.9	LOS C	LOS B	167.7
	E	926	0.83	29.0	LOS C		135.2
	W	2251	0.67	5.5	LOS A		48.2

The SIDRA results show that key intersections within the SAP study area precinct operate at an overall level of service A to B during the peak hours with a degree of saturation between 0.5 to 0.6. Based on this assessment, it is

expected that these intersections will have some capacity to absorb future additional demand. More in-depth analysis would be required to determine an accurate review of the future performance of these intersections with additional Williamtown SAP traffic demands.

2.9 Constraints and Opportunities

In the Williamtown SAP design development process, all existing constraints identified in the baseline assessment were holistically evaluated to identify preferred elements which should be included in the structure plan, areas for further investigation and no-go zones. The constraints and opportunities identified from a traffic and transport perspective are identified below.

2.9.1 Constraints

In terms of the Williamtown SAP, after considering the Williamtown SAP traffic baseline analysis, the following constrains have been identified:

- The location of the Williamtown SAP, remote from the rail network, limits the site's ability to capitalise on the strategic advantage enabled through direct access to a railhead. However, the close proximity to road-rail intermodal facilities available in the Newcastle area could provide significant cost savings for the movement of freight on interstate routes or through Port Botany.
- Lack of public transport access to/from the Williamtown SAP (and the Newcastle Airport). This is seen as a constraint from a passenger transport perspective.
- The Nelson Bay Road Upgrade options and further possible infrastructure upgrade options will initially hinder movement through the SAP, but this is seen as a short-term constraint during construction. Over the long-term, it will benefit the movement through the SAP.
- Two restricted structures in the form of railway level crossings, are located along Cormorant Road in terms of the Oversize Overmass Load Carrying Vehicles Network Approved roads which might hinder the movement of OSOM vehicles through the SAP.
- A significant portion of the works to develop the SAP are related to earthworks, with significant construction phase traffic implications. With 1,500,000 cubic metres of imported fill to be delivered by trucks for the ultimate SAP during the early years of development. ~~A detailed~~ planning and consideration should be given to construction traffic management in future stage in order to manage the impact of the construction traffic on the surrounding road network taking into consideration the key road upgrade projects that are likely to take place during the development of the SAP.
- Development within the SAP must not significantly impact road access and businesses in the region.
    - Nelson Bay Road, Cabbage Tree Road and Medowie Road provide key road access throughout the SAP precinct study area for commuters and freight operators, any development will need to limit the impact on the efficiency of these roads.
    - Currently operating businesses (e.g., sand mining, WesTrac, Tomago Aluminium) are significant employment and economic drivers. They will need to be consulted throughout development to minimise impact to their business.
    - Nelson Bay Road and Medowie Road support heavy vehicle transport of sand from Quarries, retail and industrial freight and operate as road links for freight supporting industry in Heatherbrae and Tomago. These critical roads cannot be undermined with incompatible land use developments. The road freight network needs to be protected as a minimum to support existing industry requirements. The current road network will be enhanced through any of the proposed three Nelson Bay Road upgrade alignments. Noting that the emphasis may shift with respect to final mile freight for each scenario in terms of road access, particularly near the airport.

After considering these constraints, opportunities have been identified that can possibly address these constraints and further improve the traffic efficiency of Williamtown SAP study area.

2.9.2 Opportunities

A number of opportunities exist to benefit the Williamtown SAP study area and the long-term development of the area. These include:

- The development of the Williamtown SAP will provide motivation for improved freight transport to/from the SAP. Strengthening of the freight connections will improve the economic development within the area and boost all the development already located within the SAP.
- Increased frequency of bus services and introducing bus priority will improve accessibility to the SAP and Newcastle Airport precinct. These changes will improve the journey reliability and encourage commuters to use public transport.
- With the construction work completed as part of the Nelson Bay Road upgrade project, cycling opportunities will improve and motivate further required active transport upgrade projects.
- As public transport provision is limited in the Williamtown SAP, the possibility to expand the on-demand public transport trial in Newcastle to include some of the major nodes inside the SAP e.g., Newcastle Airport, should be investigated. This opportunity will improve connections to/from the Airport precinct. As these services are expanded and patronage increases, it will pave the way for additional scheduled public transport services.
- Promoting ridesharing can be a first step towards fostering more sustainable travel choices which can lead to additional public transport offering for the SAP. Thereby targeting increased public transport usage via multi-dimensional strategies.
- As Port Stephens LGA has a higher percentage of fatal and serious injury crashes than the Hunter Region and the entire NSW, the improvement of road safety need to be prioritised as the Williamtown SAP is developed. The planned upgrade projects have already identified road safety as an important consideration. As further infrastructure is planned, this theme should be carried forward.
- As the transport offering is improved throughout the SAP, the existing tourism industry will also reap the benefits. It is an opportunity to include the tourism organisations as stakeholders to further guide and motivate the development within the SAP.
- Similarly, by increasing the connections to/from the SAP, the freight and distribution networks are benefitted. From an industry-employment perspective, employers are in a better position to attract employees from an increased employee talent pool.
- Investigate the possibility to reinstate the intermodal terminal at Walsh Point on Kooragang Island.
- Being in close vicinity and having access to a major trade gateway at Newcastle Port is a significant opportunity.
- Provision of public transport to and from the SAP would provide an efficient alternate access for employees. This would reduce the impact of light vehicle traffic on roads within both the SAP and the surrounding areas and would extend the lifespan of this infrastructure.
- On-demand bus services such as those currently being trialled in Newcastle could be integrated into the transport offering to align with changing customer needs over traditional bus services. The feasibility and appropriateness of such services would need to be considered as the SAP develops.
- Road corridor widths should accommodate for the provision of a shared path, where possible, to provide the option for active travel to and from the SAP and enable future public transport infrastructure such as bus stops to be implemented across development of the SAP, as necessary.

3 Scenario Testing

The baseline investigations resulted in the development of a range of structure plan scenarios based on holistic themes which aimed to maximise certain regional opportunities. As part of the subsequent scenario testing phase of the Williamtown SAP, comparative assessments were conducted to explore the strengths, weaknesses, risk, and opportunities of each development scenario.

A high-level comparison between the various scenarios was completed which considered both strategic transport planning aspects and traffic modelling outputs as well as planned infrastructure upgrades. A SWOT analysis was undertaken to assess the strengths, weaknesses, opportunities, and threats of each option.

To complete the comparative assessment for the traffic and transport aspect of the Williamtown SAP, seven principles were utilised as a basis of comparison to ensure that the scenarios not only performed from a traffic and transport perspective, but that the scenarios also contributed to meeting the objectives of the precinct in its entirety.

These principles include:

- Equity – Stay and Play
- Identity – Design for Country and Community
- Greenery – Blue Green Grid
- Urbanity – More than an Airport
- Mobility – Movement and Place
- Wellness – Healthy City
- Resilience – An Innovative Ecosystem

The planned and proposed road and infrastructure upgrades were taken into account, and the outputs of the trip generation and traffic modelling were incorporated into the analysis. A qualitative SWOT analysis was also completed to accompany the quantitative analysis, the results of which can be found below.

The testing criteria used in the traffic and transport assessment ensures that the structure plan adequately considered the impact on the natural environment, movement functions within the SAP and surrounding area, and the economic opportunities of the SAP development, identifying opportunities to enhance active and public transport connections, ensure access to open/green space, and capitalise on the aspiration of creating a global destination to deliver appropriate transport infrastructure.

Following the individual specific technical assessments, several rounds of stakeholder review and multi-disciplinary workshops were conducted to explore all the technical findings, provide a holistically balanced approach to managing constraints and develop the Williamtown SAP structure plan.

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4 Structure Plan

4.1 Proposed Structure Plan

The proposed layout (refer to Figure 4-1) is compact with a good active transport connection with the Newcastle Airport, Williamtown RAAF base and Astra Aerolab as shown in the mobility network in Appendix E which is a benefit, from a transport planning perspective.. The internal green space serves the surrounding land use well and increases health and recreation benefits. The SAP development will be an employment destination in the region attracting workers from the neighbouring residential areas, therefore, the SAP requires improved public transport services and connectivity to reduce the private vehicles trips generated by the development

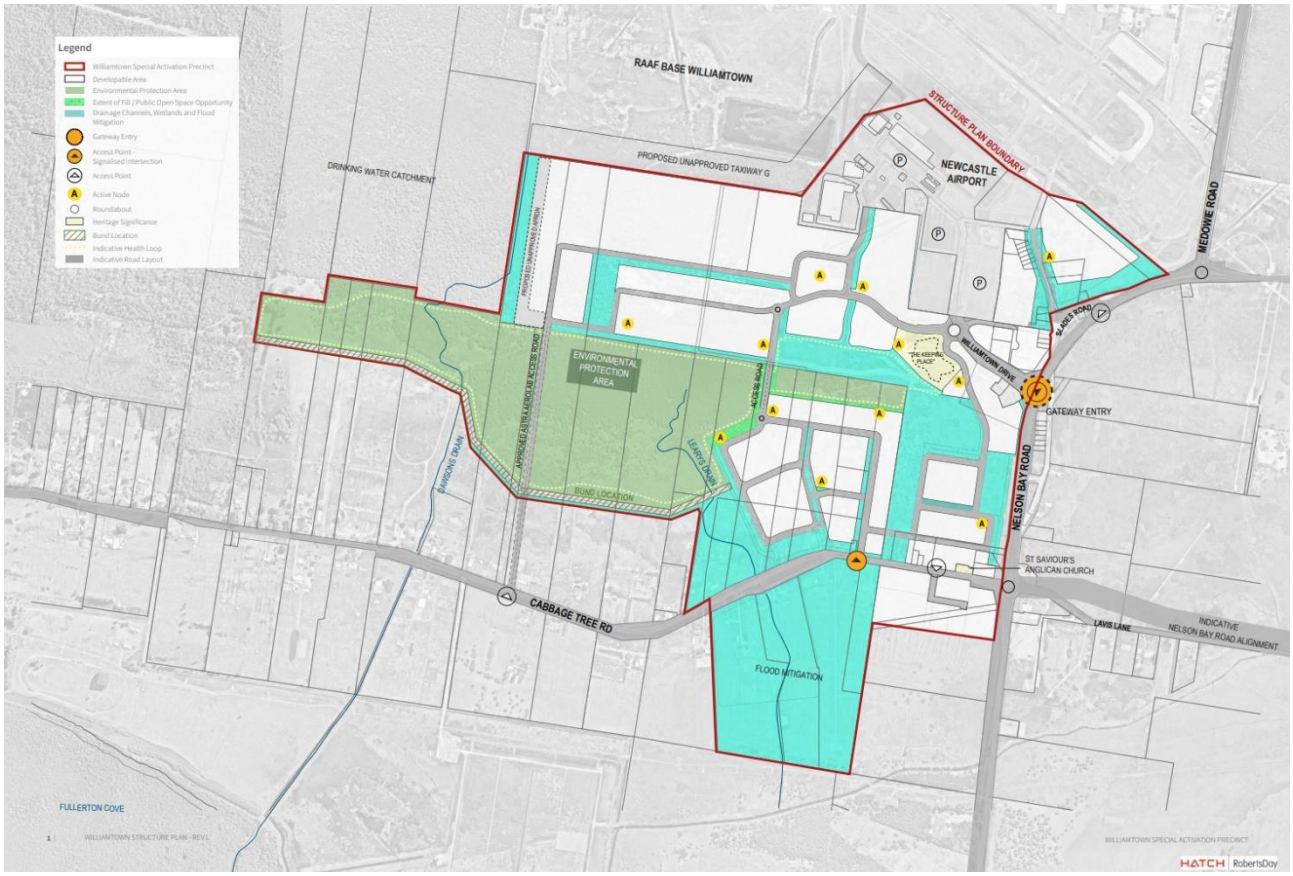


Figure 4-1: Williamtown SAP Structure Plan (Source: Hatch RobertsDay Structure Plan)

The traffic and transport implications of this specific layout will be expanded upon in this chapter of the report. Traffic analysis is included to consider the impact of the new layout on the road network and qualitative commentary about the transport planning aspects is provided.

4.2 Transport Network

4.2.1 Overview

The objective of the development of a transport network for the SAP is aimed at optimising benefit to the SAP while minimising cost and maintaining functionality to the surrounding network. The SAP will be successful in its intent in terms of traffic and transport aspects with the road network functioning at acceptable performance levels, constituting a compact active transport network and good opportunities for public transport options that can operate at satisfactory frequencies and available capacity.

In terms of the road network, acceptable performance levels will have to be maintained to ensure that the effect of the SAP is not detrimental to the surrounding road network, as this will not work in favour of new users of the SAP.

Connectivity is related to the road network, the public transport network as well the active transport network.

Public transport status quo and recommendations are included in section 4.5.2 discussing the existing capacity on the services to/from the area and what is recommended for the establishment of the SAP.

Active Transport internal and external to the site is discussed in section 4.5.1, it is recommended to maximise opportunities presented by the Environmental Protection Area to promote healthy living and provide opportunities to engage with nature and assist with mental health.

4.2.1.1 Design principles

The following includes a discussion about the transport relationship between the Structure Plan and seven essential SAP elements:

- Equity (stay and play) – the Environmental Protection Area will assist with the “play” aspect and contribute to the equity of the Williamtown SAP by being walkable, also leveraging the proximity of the Airport. The compact land use distribution around the Environmental Protection Area provides good connection onto the Environmental Protection Area. Good opportunities to interact with nature, sport and other SAP industries via the Environmental Protection Area. These attributes will be able to attract a skilled workforce that will further activate the SAP.
- Identity (design for country and community) - Opportunities related to the improved movement network connections to the existing Dune Activities. Appreciation and education opportunities are identified as tourism prospects. High value cultural sites to be included into experiences of the area.
- Greenery (blue green grid) – Ecological corridor greatly enhances the offering of the SAP. The central green space provides good connections and opportunities to explore nature. The wetland system is linked to conservations lands. The blue green grid can be linked to potential future developments adjacent to the SAP.
- Urbanity (more than an airport) - Airport and defence uses are catalysts for a place for people and innovation. Incorporate a future-proof approach via staged development.
- Mobility (movement and place) – Well-connected road layout with four proposed accesses and a freight access point. Walkable with an approximate 5-minute walk connecting the various land uses.
- Wellness (healthy city) – The health loop is conducive to promoting healthy living, the bush walking trail is a good initiative, Indigenous stories from the area can be further incorporated into the trail. Healthy living supports mental wellbeing.
- Resilience (an innovative ecosystem) - the well-connected transport system serves active transport movements well, provides densities for public transport and a good number of road access points are proposed. Thus, resilience is built into the transport system. Presence of the enhanced wetland corridor further assist with resilience of the SAP.

4.2.2 Transport Authority Engagement

The Williamtown SAP traffic and transport report was developed in consultation with key local transport stakeholders, including TfNSW, Port Stephens Council (PSC). Stakeholder engagement meetings for Williamtown SAP were held with the following key topic areas were discussed with TfNSW and Port Stephens Council:

- Traffic and transport needs in relation for the Williamtown SAP
- Baseline traffic and forecast data
- Nelson Bay Road upgrade/realignment options.
- M1 to Raymond Terrace project.
- Astra Aerolab development, including traffic assumptions, current construction, and approval status of the various development stages

4.3 Traffic Modelling Process

Traffic modelling was undertaken to model the future transport performance of key intersections and midblock road sections to inform infrastructure upgrades required to accommodate any additional traffic generated. The following intersections and midblock road sections were analysed as part of this process:

Intersections

- Nelson Bay Road / Williamtown Drive
- Nelson Bay Road / Cabbage Tree Road

Midblock

- Nelson Bay Road east of Medowie Road
- Nelson Bay Road between Medowie Road and Williamtown Drive
- Nelson Bay Road between Williamtown Drive and Cabbage Tree Road
- Nelson Bay Road South of Cabbage Tree Road
- Cabbage Tree Road west of Nelson Bay Road

Modelling was based on midblock and turn counts extracted from the VISSIM model for Nelson Bay Road Upgrade – Williamtown to Bobs Farm obtained from TfNSW on 9th March 2021. A total of 11 potential upgrade scenarios were modelled in VISSIM. It is noted that volumes extracted from VISSIM were for the future year 2045.

4.3.1 Assessment Approach

The road network performance assessment was carried out for the roads and intersections surrounding the site. The key intersection was assessed using SIDRA modelling software, and the midblock capacity was assessed through the flow/capacity ratio method and the estimated road capacities. The aforementioned methods are outlined in the Roads and Maritime Motorway Design Guide: Capacity and Flow Analysis (2017). In addition, the critical volume (maximum experienced in AM or PM peak) for each midblock and flow direction was used for the assessment. The assessment included three scenarios:

- Base Year Assessment, this scenario will provide an indication of the current roads' capacity and intersections performance
- Opening Year Assessment 2036, this scenario will provide an indication of the roads' capacity and intersections performance with and without the development in the year 2036 when the development is completed

The assessment locations are shown in Figure 4-2. These were grouped in two categories based on proximity to the SAP area:

1. Roads and intersections providing direct access to the development

- Cabbage Tree Road Between Tomago Road and Nelson Bay Road
- Cabbage Tree Road and SAP Access Road (proposed) intersection
- Nelson Bay Road and Williamtown Drive intersection

2. Wider network of roads and intersections

- Nelson Bay Road between Williamtown Drive and Stockton Bridge
- Tomago Road between Pacific Highway and Cabbage Tree Road
- Nelson Bay Road and Cabbage Tree Road intersection
- Pacific Highway and Tomago Road intersection

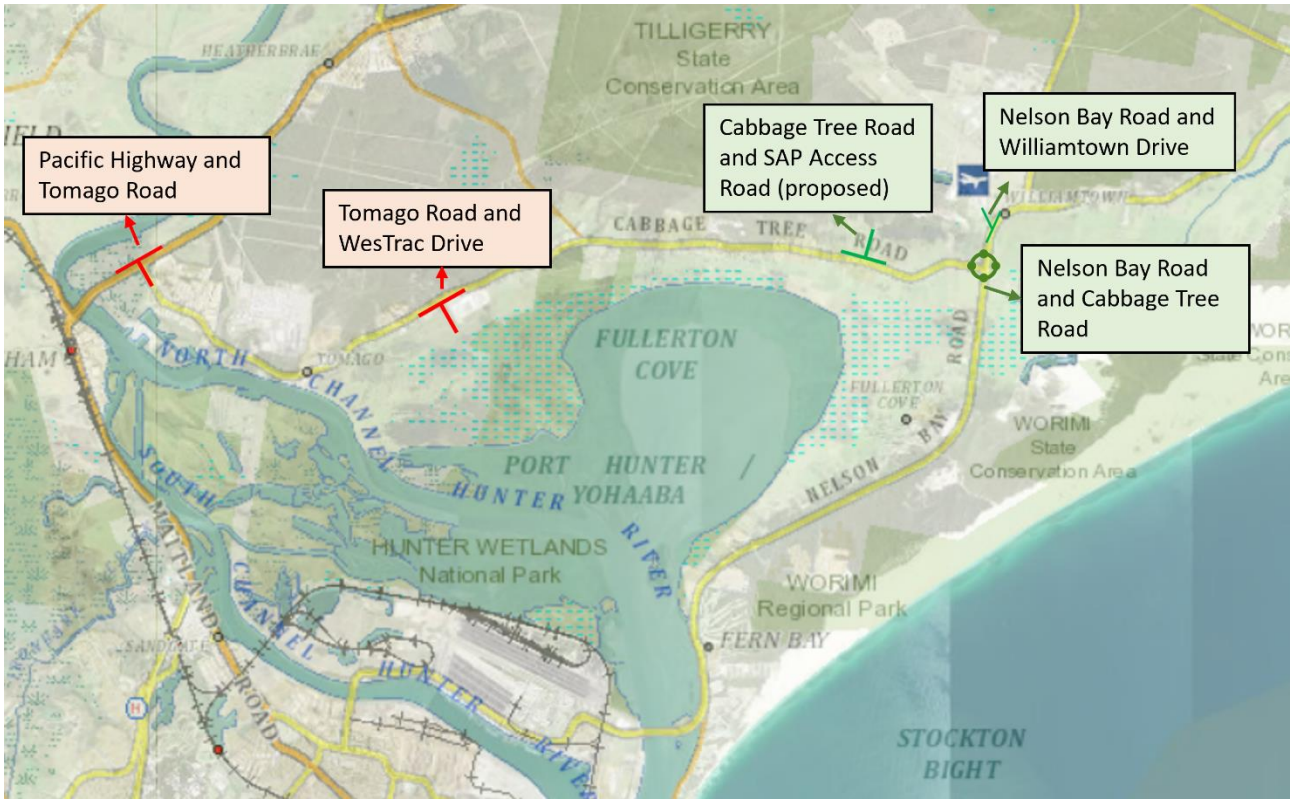


Figure 4-2 : Location of Assessed Intersections and Midblocks

Midblock performance between named intersections was calculated with a high-level capacity assessment, based on the TfNSW Motorway Design Guide: Capacity and Flow Analysis (2017), which uses the flow/capacity ratio method to determine road efficiency. Guidelines indicate that the maximum flow/capacity ratio of mainline traffic for sustainable operations should be 100%, with a desirable ratio of 95%. It should be noted that although this method does not account for the loss of efficiency caused by intersections, it provides an understanding of major roads' residual capacity to accommodate future growth.

The assessment considers critical volumes as the maximum experienced flows in AM and PM peaks for each midblock location, and the flow direction in the passenger car unit PCU. As per TfNSW's recommended use of the Passenger Car Equivalent table from *Transport for NSW Economic Parameter Values*, light vehicles are considered as 1.0 PCU and Heavy Vehicles as 3.0 PCU. In addition, the design road capacity of an unmanaged highway is 1,700 pcu/hr/lane, based on TfNSW Motorway Design Guide – Capacity and Flow Analysis (2017).

The operation of existing intersections in the study area was assessed using SIDRA 9.0. The Traffic Modelling Guidelines (Transport, 2013) specify that intersection operation is generally measured by the degree of saturation, level of service and 95th percentile base of queue distance.

SIDRA Intersection measures these elements, with the intersection Level of Service being a measure of the average delay at the intersection, as defined by the criteria set out in Table 4-1.

It is noted that the critical movement for Level of Service at a roundabout or priority-controlled intersection is the movement with the worst delay, whereas, for a signalised intersection, the average movement delay and Level of Service overall movements are adopted.

Table 4-1: Level of Service Criteria for Intersections

LoS	Average delay per vehicle (seconds per vehicle)	Traffic signals, roundabout	Give way and stop sign
A	0 to 14	Good operation	Good operation
B	15 to 28	Good operation with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Near capacity	Near capacity, accident study required

LoS	Average delay per vehicle (seconds per vehicle)	Traffic signals, roundabout	Give way and stop sign
E	57 to 70	At capacity, incidents at signals will cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

Source: Traffic Modelling Guidelines, Transport for NSW, 2013

4.3.2 Traffic Modelling Assumptions

The following assumptions were made to assist in the modelling process. The assumptions were presented to TfNSW during coordination meetings also the SIDRA model files were provided. The analysis assumptions were presented to TfNSW during multiple meetings and comments provided by TfNSW were taken into consideration and amended in this revision of the report

Future year and growth

- The future year modelled was 2036
- Midblock and turn count volumes were obtained from base and future VISSIM model for the future year 2045. They have been conservatively applied to the 2036 SAP generation without a reduction factor.

Trip Distribution

Traffic generated by and attracted to the SAP was assumed to be distributed along the wider road network according to the following ratios:

- 40% to/from Pacific Highway via Tomago Road and Masonite Road
- 50% to/from Newcastle via Nelson Bay Road
- 10% to/from Nelson Bay via Nelson Bay Road
- AM and PM peak hour periods account for 10% of average daily traffic
- 15% of trips generated by the SAP were assumed to be heavy vehicles
- The passenger car equivalent of heavy vehicles in the SAP was assumed to be 3
- The traffic split is assumed to be 80% incoming and 20% outgoing in the AM peak period, and inverse for the PM peak.

Road Capacity

- Capacity of unmanaged highway is 1,700 pcu/hr/lane, based on Roads and Maritime Motorway Design Guide – Capacity and Flow Analysis (2017)

4.3.3 Midblock Performance

A high-level capacity assessment of future midblock performance was conducted based on traffic growth, generation and distribution assumptions outlined above.

It was undertaken using the flow/capacity ratio method and estimated road capacities outlined in the *Roads and Maritime Motorway Design Guide: Capacity and Flow Analysis (2017)*, using the critical volume (maximum experienced in AM or PM peak) for each midblock and flow direction. According to the *Motorway Design Guide (2017)*, the maximum flow/capacity ratio of mainline traffic for sustainable operations is 100%, with a desirable ratio of 95%. Note that this method does not account for the loss of efficiency caused by intersections.

Based on these criteria, the midblock assessment provided an understanding of the 2045 Do Minimum scenario and the residual capacity of the major roads in the network to accommodate additional SAP development. Widening upgrades (i.e., additional lanes) would therefore be required if there are any instances of road segment capacity exceedance which is defined as flow capacity ratio above 95%. From this, the associated road infrastructure upgrades could be attributed to each scenario

4.3.4 Assumptions

To overcome the project limitation and enable a robust transport and access assessment for the proposed precinct the following assumptions were used taking into consideration the development timeframes and the dynamic changes in the transport network surrounding site.

- opening year is 2036 and the estimated land use of 93 ha
- In agreement with TfNSW, a traffic growth factor of 1.5% per annum was used to calculate the future years' traffic volumes
- Heavy vehicles represent 10% of the total average daily traffic (ADT)
- The peak hours traffic represents 10% of the ADT
- Trip generation factor of 130 daily trip per ha

4.4 Transport Performance Analysis

The current and future transport performance were assessed at the locations shown on the map in Figure 4-3 which included the major intersections to access the SAP and other key intersections forming part of the wider road network.

Figure 4-3: Locations of current and future intersection and midblock assessments

4.4.1 Midblock Performance

A capacity assessment of midblock performance was conducted based on the traffic volumes, road capacity, trip generation, trip distribution and the assumptions outlined in section 4.3. Summary tables below provide the results of the midblock analysis for the roads surrounding the SAP during the critical peak hour for the year 2036 excluding the sap traffic and assumed opening year 2036 including the traffic generated by the development (estimated at 9,672 vehicles per day).

According to the *Motorway Design Guide (2017)*, the maximum flow/capacity ratio of mainline traffic for sustainable operations is 100%, with a desirable ratio of 95%. Note that this method does not account for the loss of efficiency due to the impact of intersections.

The midblock assessment for the year 2036 predevelopment indicates some major roads exceed the design capacity as shown in Table 4-2. Nelson Bay Road North of Cabbage tree Road exceeds its capacity, as does Tomago Road and Pacific Highway. These results trigger a network upgrade requirement to accommodate the traffic growth in the area excluding the SAP-generated traffic, the upgrades are represented by adding an additional trafficable lane in each direction as required.

Table 4-2: Year 2036 Midblock Assessment Results – With no SAP

Intersection	Midblock	Direction	Lanes per Direction	Current Capacity	2036 Critical Peak Volume	2036 Flow/ Capacity Ratio
Nelson Bay Road / Williamtown Drive (Newcastle Airport)	Nelson Bay Rd north of Williamtown Dr	NB	2	3,400	1,942	57%
		SB	2	3,400	1,197	35%
	Williamtown Dr west of Nelson Bay Rd	EB	1	1,700	672	40%
		WB	1	1,700	433	25%
	Nelson Bay Rd south of Williamtown Dr	NB	2	3,400	2,178	64%
		SB	2	3,400	1,371	40%
Nelson Bay Road / Cabbage Tree Road	Nelson Bay Rd north of Cabbage Tree Rd	NB	2	3,400	1,837	54%
		SB	2	3,400	1,385	41%
	Cabbage Tree Rd west of Nelson Bay Rd	EB	1	1,700	746	44%
		WB	1	1,700	484	28%
	Nelson Bay Rd south of Cabbage Tree Rd	NB	1	1,700	1,790	105%
		SB	1	1,700	1,879	111%
	Lavis Lane east of Nelson Bay Rd	EB	2	3,400	728	21%
		WB	2	3,400	1,214	36%
Tomago Road / WesTrac Drive	Tomago Rd east of WesTrac Dr	EB	1	1,700	937	55%
		WB	1	1,700	626	37%
	WesTrac Dr south of Tomago Rd	NB	2	3,400	355	10%
		SB	2	3,400	230	7%
	Tomago Rd west of WesTrac Dr	EB	1	1,700	848	50%
		WB	1	1,700	731	43%
Pacific Highway / Tomago Road	Pacific Hwy east of Tomago Rd	EB	2	3,400	2,610	77%
		WB	2	3,400	1,798	53%
	Tomago Rd south of Pacific Hwy	NB	1	1,700	1,756	103%
		SB	1	1,700	1,253	74%
	Pacific Hwy west of Tomago Rd	EB	2	3,400	3,428	101%
		WB	2	3,400	3,149	93%

Table 4-3 Year 2036 Midblock Assessment Results – With SAP

Intersection	Midblock	Direction	Lanes per Direction	Current Capacity	2036 Critical Peak Volume	2036 Flow/ Capacity Ratio
Nelson Bay Road / Williamtown Drive (Newcastle Airport)	Nelson Bay Rd north of Williamtown Dr	NB	2	3,400	1,975	58%
		SB	2	3,400	1,279	38%
	Williamtown Dr west of Nelson Bay Rd	EB	1	1,700	997	59%
		WB	1	1,700	758	45%
	Nelson Bay Rd south of Williamtown Dr	NB	2	3,400	2,478	73%
		SB	2	3,400	1,672	49%
Nelson Bay Road / Cabbage Tree Road	Nelson Bay Rd north of Cabbage Tree Rd	NB	2	3,400	2,162	64%
		SB	2	3,400	1,617	48%
	Cabbage Tree Rd west of Nelson Bay Rd	EB	1	1,700	1,060	62%
		WB	1	1,700	890	52%
	Nelson Bay Rd south of Cabbage Tree Rd	NB	1	1,700	2,197	129%
		SB	1	1,700	2,152	127%
	Lavis Lane east of Nelson Bay Rd	EB	2	3,400	728	21%
		WB	2	3,400	1,214	36%
Tomago Road / WesTrac Drive	Tomago Rd east of WesTrac Dr	EB	1	1,700	1,076	63%
		WB	1	1,700	823	48%
	WesTrac Dr south of Tomago Rd	NB	2	3,400	355	10%
		SB	2	3,400	230	7%
	Tomago Rd west of WesTrac Dr	EB	1	1,700	998	59%
		WB	1	1,700	1,056	62%
Pacific Highway / Tomago Road	Pacific Hwy east of Tomago Rd	EB	2	3,400	2,610	77%
		WB	2	3,400	1,798	53%
	Tomago Rd south of Pacific Hwy	NB	1	1,700	2,081	122%
		SB	1	1,700	1,578	93%
	Pacific Hwy west of Tomago Rd	EB	2	3,400	3,567	105%
		WB	2	3,400	3,474	102%
SAP Access Road / Cabbage Tree Road	Cabbage Tree Road east of SAP Access Road	EB	1	1,700	1,125	66%
		WB	1	1,700	866	51%
	SAP Access Road north of Cabbage Tree Road	NB	1	1,700	509	30%
		SB	1	1,700	509	30%
	Cabbage Tree Road west of SAP Access Road	EB	1	1,700	923	54%
		WB	1	1,700	855	50%

4.4.2 Intersection Performance

The following five key intersections within and adjacent to the SAP precinct were modelled in SIDRA 9.0:

- Nelson Bay Road – Williamtown Drive (Newcastle Airport)
- Nelson Bay Road – Cabbage Tree Road
- Cabbage Tree Road – SAP Access Road (proposed)
- Tomago Road – WesTrac Access Road
- Pacific Highway – Tomago Road

For the first two intersections, the previous volumes modelled with VISSIM, were adopted. To conduct an assessment of the baseline intersection performance for the existing intersections, the analysed turn volumes were based on SCATS phasing and volumes received from TfNSW for the dates Monday 10th to Friday 14th February 2020. A heavy vehicle portion of 10% was assumed. The existing intersections assessed were Nelson Bay Road /

Williamtown Drive (Newcastle Airport), Nelson Bay Road / Cabbage Tree Road, Tomago Road / WesTrac Access Road, and Pacific Highway / Tomago Road.

As the access road to the SAP via Cabbage Tree Road will only be required once the development has commenced, the base case of this intersection is modelled for the year 2025. This analysis included 1.5% annual growth in traffic volumes along Cabbage Tree Road and 25% of the SAP generated traffic.

The SIDRA analysis results for the five intersections, base case AM and PM peak hours, are shown per approach in the table below.

Table 4-4: AM Peak SIDRA Analysis Results for Future Conditions – 2036 no SAP

Intersection	Approach	Peak Hour Volume	Degree of Saturation	Delay [s]	Level of Service		Queue [m]
Nelson Bay Rd / Williamtown Dr (Newcastle Airport)	S	1815	0.90	33.5	LOS C	LOS C	421.0
	N	998	0.74	9.7	LOS A		76.4
	NW	166	0.41	36.5	LOS D		42.1
Nelson Bay Rd / Cabbage Tree Rd	S	1492	0.82	14.9	LOS B	LOS D	105.9
	E	1012	1.09	80.9	LOS F		413.7
	N	877	0.57	12.5	LOS B		40.3
	W	562	1.02	60.3	LOS E		175.8
Tomago Rd / WesTrac Access Rd	S	29	0.03	27.7	LOS C	LOS B	2.4
	E	521	0.32	19.8	LOS B		51.1
	W	561	0.32	10.0	LOS A		21.8
Pacific Hwy / Tomago Rd	S	454	0.41	36.9	LOS D	LOS D	83.6
	E	1498	0.92	48.4	LOS D		424.5
	W	2528	0.92	28.1	LOS C		308.7

Table 4-5: PM Peak SIDRA Analysis Results for Future Conditions – 2036 no SAP

Intersection	Approach	Peak Hour Volume	Degree of Saturation	Delay [s]	Level of Service		Queue [m]
Nelson Bay Rd / Williamtown Dr (Newcastle Airport)	S	1459	0.98	74.5	LOS E	LOS E	512.0
	N	857	0.51	18.9	LOS B		125.0
	NW	560	0.96	60.6	LOS E		242.0
Nelson Bay Rd / Cabbage Tree Rd	S	1330	0.69	10.4	LOS B	LOS C	60.6
	E	581	0.91	28.7	LOS C		91.0
	N	1154	0.86	28.7	LOS C		125.5
	W	622	0.85	19.3	LOS B		66.8
Tomago Rd / WesTrac Access Rd	S	295	0.33	30.1	LOS C	LOS B	32.6
	E	415	0.31	20.8	LOS C		52.3
	W	707	0.33	8.3	LOS A		54.3
Pacific Hwy / Tomago Rd	S	1463	0.99	82.3	LOS F	LOS D	477.2
	E	1175	0.99	80.4	LOS F		370.5
	W	2856	0.79	6.8	LOS A		93.2

The SIDRA results for 2036 with the SAP development is shown in the following tables, the results show the southern and eastern approach of Nelson Bay Drive and Cabbage Tree Road intersection operate at a level of service F, this change in LOS driven by the traffic generated by the SAP, the upgrade in Nelson Bay Road and the

traffic growth in the area. Also, Pacific Highway and Tomago Road intersection LOS drops from LOS D to E, these results are indicative only. The future layout of these two intersections requires further review and option analysis taking into consideration the major planned upgrades of the M1 and Nelson Bay Road

Table 4-6: AM Peak SIDRA Analysis Results for Future Conditions – 2036 with SAP

Intersection	Approach	Peak Hour Volume	Degree of Saturation	Delay [s]	Level of Service		Queue [m]
Nelson Bay Rd / Williamtown Dr (Newcastle Airport)	S	2065	0.94	39.2	LOS D	LOS C	564.2
	N	1066	0.89	12.6	LOS B		82.7
	NW	283	0.48	50.8	LOS D		53.0
Nelson Bay Rd / Cabbage Tree Rd	S	1830	1.15	159.8	LOS F	LOS F	825.3
	E	1012	1.32	229.6	LOS F		972.2
	N	1070	0.68	15.4	LOS B		54.5
	W	784	0.47	14.6	LOS B		22.9
Cabbage Tree Rd / SAP Access Rd (proposed)	E	722	0.39	4.7	LOS A	LOS B	37.5
	N	182	0.39	35.4	LOS D		41.7
	W	770	0.40	22.0	LOS C		108.5
Tomago Rd / WesTrac Access Rd	S	29	0.04	18.3	LOS B	LOS B	1.4
	E	638	0.63	22.1	LOS C		61.4
	W	832	0.32	6.5	LOS A		31.7
Pacific Hwy / Tomago Rd	S	570	0.45	36.8	LOS D	LOS E	114.9
	E	1498	1.00	97.6	LOS F		627.7
	W	2799	1.01	54.6	LOS D		567.3

Table 4-7: PM Peak SIDRA Analysis Results for Future Conditions – 2036 with SAP

Intersection	Approach	Peak Hour Volume	Degree of Saturation	Delay [s]	Level of Service		Queue [m]
Nelson Bay Rd / Williamtown Dr (Newcastle Airport)	S	1595	0.90	39.0	LOS D	LOS D	387.0
	N	887	0.61	14.0	LOS B		100.3
	NW	831	0.88	52.5	LOS D		200.9
Nelson Bay Rd / Cabbage Tree Rd	S	1475	0.79	14.1	LOS B	LOS F	90.1
	E	581	1.06	103.3	LOS F		258.5
	N	1347	1.13	164.9	LOS F		601.2
	W	883	0.79	13.6	LOS B		50.1
Cabbage Tree Rd / SAP Access Rd (proposed)	E	642	0.35	3.3	LOS A	LOS B	22.8
	N	425	0.48	31.1	LOS C		88.4
	W	766	0.47	26.9	LOS C		135.0
Tomago Rd / WesTrac Access Rd	S	295	0.65	22.6	LOS C	LOS B	24.2
	E	685	0.73	23.9	LOS C		78.9
	W	823	0.37	5.1	LOS A		38.1
Pacific Hwy / Tomago Rd	S	1734	1.17	224.8	LOS F	LOS F	1074.5
	E	1175	1.18	232.1	LOS F		701.6

Intersection	Approach	Peak Hour Volume	Degree of Saturation	Delay [s]	Level of Service		Queue [m]
	W	2973	0.77	7.0	LOS A		126.4

4.5 Transport Considerations for Structure Plan

The following transport considerations regarding access to the Williamtown SAP and movement within the SAP have been explored and coordinated in preparation of the structure plan. Refer to Appendix E for plans of the road hierarchy, mobility plan, pedestrian connection network and location of key focal points within the Williamtown SAP structure plan.

4.5.1 Active Transport

Cycleways

It is important to connect the proposed cycleway along Nelson Bay Road with the health loop internal to the SAP Structure Plan, thereby constituting a connected cycling network, and consideration could be given to extension of the cycleway linking Medowie to the SAP.

In terms of improving the provision of alternative transport mode infrastructure, separated cycling facilities should be incorporated into the Concept Design for review and approval by TfNSW and DPE. This would provide improved safety outcomes for bicycle riders in comparison to on-road facilities along busier arterial routes leading to the SAP that may comprise larger volumes of heavy vehicles. As on-road cycling facilities can be daunting for bicycle riders who may be interested but concerned, any new cycling infrastructure should cater to riders of all ages and abilities.

Refer to Appendix E which shows proposed regional cycle routes along Medowie Road and Nelson Bay Road, which should aim to connect with any internal SAP cycleways that are proposed at Concept Design stage. Alignment of any internal cycleways should focus around the Environmental Protection Area, which ensures separation to the main freight routes (to and from the two Freight and Logistics hubs).

Pedestrian network

It is key for the development of the Williamtown SAP to have a well-connected walking network. The walkable internal green space will be the active space anchor within the SAP. This space will filter through the built-up areas surrounding the internal space. It is recommended to consider providing a walkway along Cabbage Tree Road as well as along Nelson Bay Road in the vicinity of the Williamtown SAP. It is also important to provide an adequate network of high amenity footpaths internally to the SAP. These high amenity footpaths should be at least 2.5m wide, include lighting for after dark travel, incorporate seats to allow pedestrians to rest, bins and drinking fountains. Considerations at crossing facilities should focus on safeguarding pedestrians to promote the use of this mode of travel.
Concept Design should focus on identifying key pedestrian access points and routes, particularly focusing on critical pedestrian movements such as those between the airport terminal, bus stop locations, car parking and employment areas. Refer to Appendix E, which shows key public places and pedestrian connections for consideration in Concept Design stage.

4.5.2 Public Transport

As discussed in Section 2.7.3, the following routes currently service the SAP area:

- Routes 130, 131 links Newcastle with Newcastle Airport and carries on further to Nelson Bay.
- Route 135 connects Raymond Terrace with Nelson Bay and passing the SAP along Cabbage Tree Road, no bus stop is located at the Newcastle Airport.
- Route 136 connects between Stockton Wharf, Medowie and Raymond Terrace, stopping at the Newcastle Airport.

- Route 138 connects the Newcastle Interchange with Newcastle Airport, carries on along Nelson Bay Road and Lemon Tree Passage Road.
- Route 145 connects the Newcastle Airport with Raymond Terrace and carries on further to Stockland Greenhills.

TfNSW provided information on the number of passengers boarding and alighting the various bus services for the month of November in the year 2019. Based on the assessment outputs provided in Table 2-5 and the analysis of the average utilisation per route yielding results below 6% for all routes except 12% for route 131, there is available capacity to accommodate potential increase in bus patronage.

With route 135 to/from Raymond Terrace not stopping at Newcastle Airport, it is recommended to consider bus stops along Cabbage Tree Road. The design of the bus stops will preferably accommodate seating, lighting, rubbish bins and real-time bus schedules. This would further encourage growth in the use of public transport, especially for employees at the Williamtown SAP. There are a few road safety concerns, primarily on the ability to safely allow pedestrians to cross the road to access the bus stops along Cabbage Tree Road. It is recommended to undertake further investigation to determine possible options for safe crossings. With route 145 already connecting Raymond Terrace with Newcastle Airport, this route will likely be able to facilitate the demand to/from Raymond Terrace, but for the longer-term it will provide better service delivery to have the option of two routes from Raymond Terrace (Routes 135 and 145) and have bus stops along Cabbage Tree Road.

It is recommended to provide ongoing, at least annual, monitoring of the usage of these services during the development stages of the SAP. Should bus service reliability and journey time be impacted, a review and consideration of additional services and increased frequencies can be undertaken.

Potential incentives to motivate a modal shift to public transport includes increased service frequencies and reduced fares. An option might be to run a period with reduced fares and test the effect, as trips in this area are typically undertaken by private car. Consider including bus-priority treatments at pinch points on the road network. Further consider introducing differential pricing for parking to additionally motivate bus use. Practicality of modal shifts should be considered, as it may not be appropriate for some users (such as logistics workers transporting large goods and shift workers amongst other) to transfer their journeys to alternate modes.

Another option involves extending the On Demand trial to also include the Newcastle Airport as a destination and monitor the uptake.

It's recommended that the public transport connections and bus stop locations within the SAP t to be located close to the key public places and commercial centres.. Refer to Appendix E for indicative bus stop locations. Specific bus stop locations and key public transport corridors will be determined in the subsequent design stages and in coordination with TfNSW.

4.5.3 Road Hierarchy and Network

The road network as indicated in the Structure Plan suggests one access point along Cabbage Tree Road and another access at the intersection of Nelson Bay Road/Williamtown Drive with maintaining the current access to the lot located on the southeast corner of the development via the existing intersection of Williamtown Drive and Slades Road.

In terms of the road hierarchy, Cabbage Tree Road and Nelson Bay Road are indicated as higher order roads and the internal roads as lower order roads, as shown in Figure 4-4.

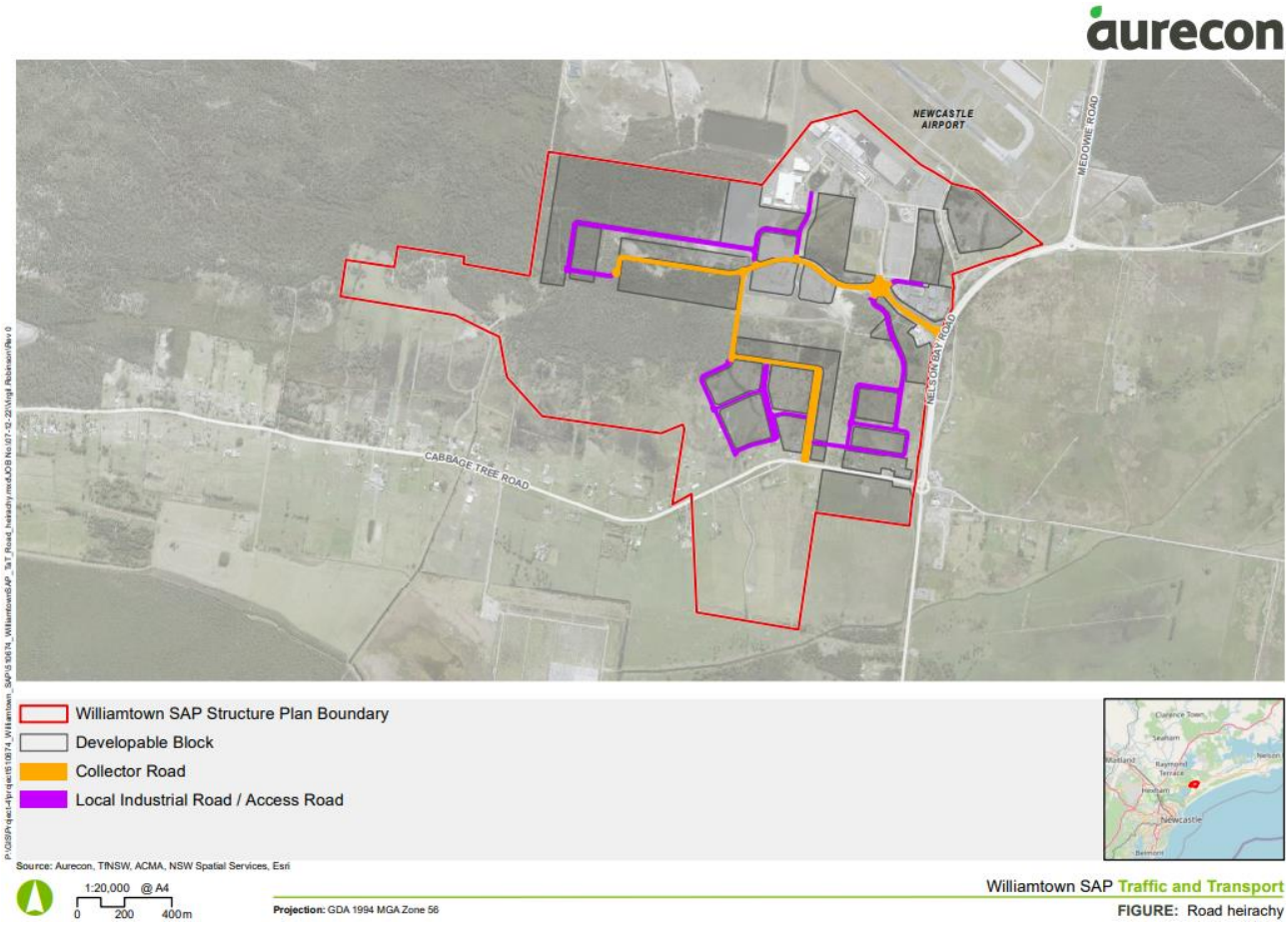


Figure 4-4: SAP internal road hierarchy

As shown in Figure 4-4, the key roads connecting the SAP with the external road network are classified as collector roads and the roads providing connection between the lots and the collector roads are classified as local access roads. The classifications are in line with TfNSW guidelines and Austroad Guide to Traffic Management.

The road layout has been purposely designed without a key east-west local distributor route through the southern section of the SAP to discourage vehicles using the SAP roads as a rat-run during peak hour traffic. East-west routes are designed to be maintained for local access only with Cabbage Tree Road used for the main regional traffic. Refer to Appendix E for more detail on proposed movement routes.

As mentioned in section 2.5.2, the Astra Aerolab development will adjoin Newcastle Airport and the RAAF Base Williamtown west of the Williamtown Drive roundabout. The aerospace precinct provides an additional access road along Cabbage Tree Road, west of the proposed Williamtown SAP access road.

4.5.4 Freight Access

The Williamtown SAP Plan is well served by freight gazetted routes in all directions, including Medowie Road to the north, Tomago Road, Cabbage Tree Road and Masonite Road to the west and Nelson Bay Road to the east and south.

Key freight access points to the SAP include one along Cabbage Tree Road (at the site of the proposed signalised intersection) that would be used to access the north-west freight and logistics hub, and another point along Nelson Bay Road via Kindler Way that would be used to access the north-east freight and logistics hub. Movement between the two freight and logistics hubs would be along Local Distributor A. Timeline for the proposed signalised intersection would need to be determined during Concept Design stage.

It is important to ensure that PBS levels can be maintained for vehicles entering/exiting the SAP at this access point, as well as accommodate these vehicles *route* as first mile/last mile to the respective origin/destination locations. Further investigations to consider the interface between the Freight and Logistics development and a possible new freight terminal/apron located Airside should be undertaken.

It will be beneficial in terms of the road function, related road geometry, impact on the adjacent land uses and potential road users to prioritise one access for freight off Cabbage Tree Road. Allowance for the oversize over

mass (OSOM) vehicle movements should be considered at these key intersections. Prior to developing the design criteria of these intersections, further discussion with TfNSW to identify the level of OSOM appropriate for the land-use will be required in the development.

4.5.5 Possible airside access

Delivery operations and emergency vehicles need access to the airside. Currently delivery related access to the airside is provided east of the Newcastle Airport terminal area. It is recommended to safeguard for another access point west of the terminal area as it may become necessary to access the airside from both sides. A number of considerations are at play:

- to prevent excessive vehicle movement on the apron system, contributing to airside congestion and delay
- potential differences in airside access types and needs - driven by dissimilar land uses (for example general freight in the east and specialised cargo in the west)
- general future capacity and redundancy

Secondary to the freight delivery access, a separate access point for emergency purposes is good practice. The emergency access point will not be frequently used, the main purpose being able to facilitate quick response times in an emergency situation to the airfield and apron. It is assumed that the RAAF Base Williamtown has measures in place for this type of access.

Future consideration could be given to autonomous logistics at the airside interface for greater efficiencies in both movement / sorting of goods as well as land take and general airport operations.

4.6 Integration of Transport Opportunities

4.6.1 Planned Transport Upgrades

TfNSW are investigating several road upgrade projects including future upgrades to Nelson Bay Road and the M1 to Raymond Terrace project detailed in 2.6. The planned roads upgrades benefit the SAP users and the wider road users. As shown in the midblock assessment of the existing roads, some sections will be at or exceed capacity due to the predicted traffic growth in the area and not related to the SAP. Making these upgrades essential for the future development of the area.

4.6.2 Strategic Transport Opportunities

There are several strategic transport opportunities for roads connecting to or surrounding the SAP, including:

- The intersection of Nelson Bay Road and Cabbage Tree Road upgrades are , depending on the outcome Nelson Bay Road upgrade, TfNSW project
- The upgrade of the M1 Pacific Motorway to Raymond Terrace project will determine the future performance of Tomago Road and Pacific Highway and Cabbage Tree Road usage in the future, The analysis for the M1 project should take into consideration the SAP development and provide enhance intersection layout to benefit all road users.

4.6.3 Required Upgrades

Cabbage Tree Road SAP intersections

One new signalised intersection proposed along Cabbage Tree Road to provide access to the SAP, full movement required to at this intersection to enable movement of people and freight in and out of the development.

As noted in the midblock assessment results for the year 2036 with and without the SAP shown in Table 4-2. The northern section of Nelson Bay Road and the section of Tomago Road heading to Newcastle reaches capacity without the SAP development and once the SAP developed the capacity will be further constrained. Based on the assessment additional lanes maybe required to improve the road capacity as shown in Figure 4-5. Noting these upgrades are proposed based on the SIDRA analysis and the midblock capacity analysis which are very limited in analysis wider network impact. Further analysis is required in the future to understand the impact on the road

network driven by the key road projects taken place in the area and the SAP development is recommended. *Note: All timings are approximate and require further assessment. All upgrades subject to.*

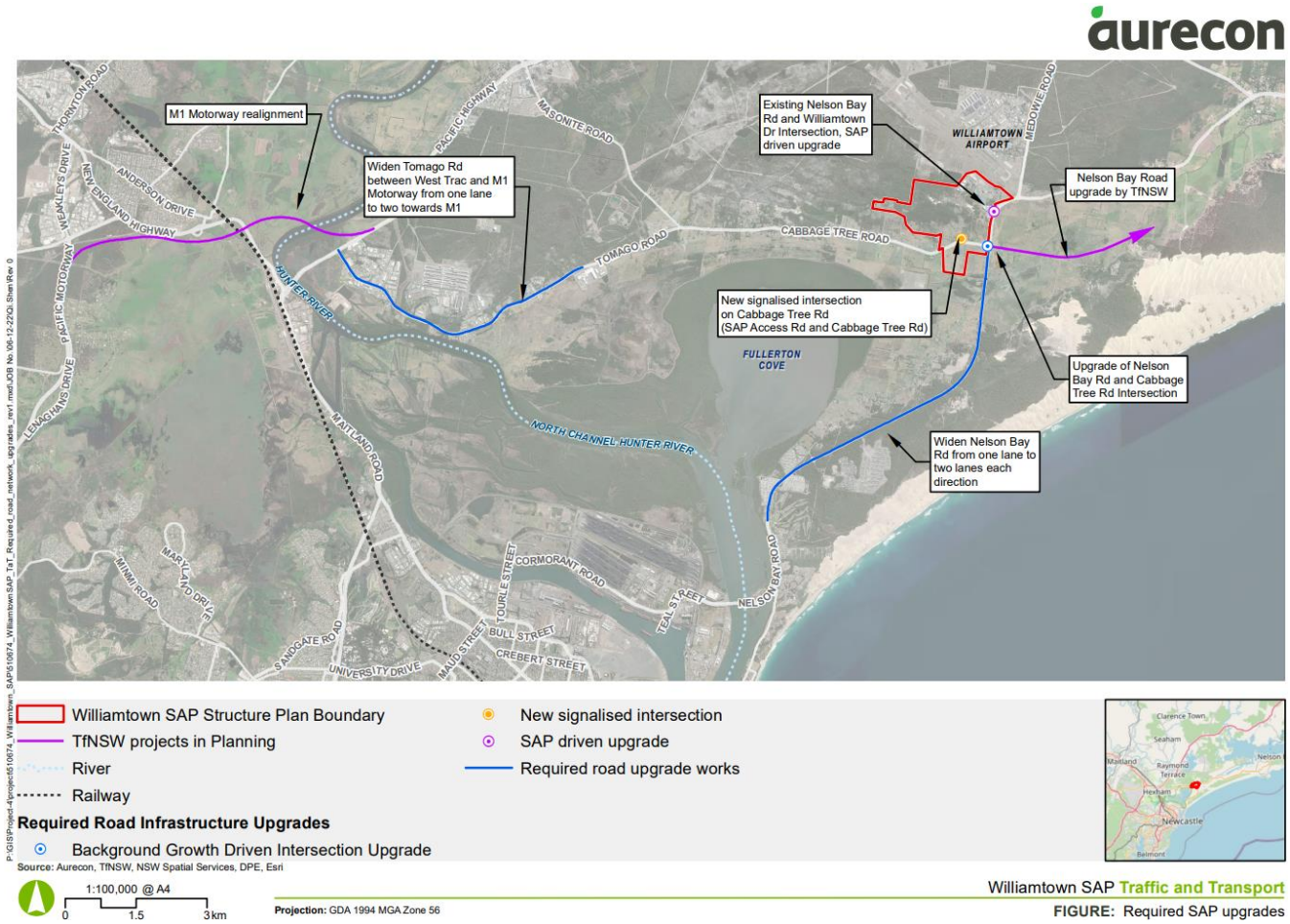


Figure 4-5: Required Road Network Upgrades

4.6.4 Indicative Road Cross Sections

4.6.4.1 Collector Road

The width of a local collector road within the SAP will generally achieve a travel lane in each direction.

Design considerations of a local collector road within the SAP are listed below:

- To guide the geometric road design, a lower posted speed limit (e.g., of up to 60 km/h) for efficient and safer operations of the road network. Lower posted speed limit may be considered in high-activity areas with the aid of more constrained road geometry and/or traffic calming devices.
- Traffic lane widths to be suitable to accommodate high productivity vehicles (HPV) as per Austroads Guide to Road Design.
- On-street parking to be considered in high-activity areas (i.e. commercial locations).
- For safety reasons, consider providing minimum turning radii into access driveways or around streets to manage entry/exit speed and conflict at footpaths/shared paths.
- Consideration of verge width to provide suitable space for ancillary facilities (i.e., footpaths and/or shared paths, bus stops, road furniture).
- Consideration to oversize over mass vehicles

To safeguard future road network capacity requirements, wider road widths suitable to accommodate future lane quantity needs are advisable at locations that are likely to be highly trafficable (e.g., at entry points to the proposed SAP).

Typical cross sections of a local collector road are shown in Figure 4-6 and Figure 4-7 below. The provision of a channelised right turn bay, or parking lanes on either side of the travel lanes will depend on the type of land uses, precinct requirements, associated parking, access and operational needs (i.e., manoeuvrability of vehicles required to service the developments). These details will need to be addressed in concept/detailed design stage.

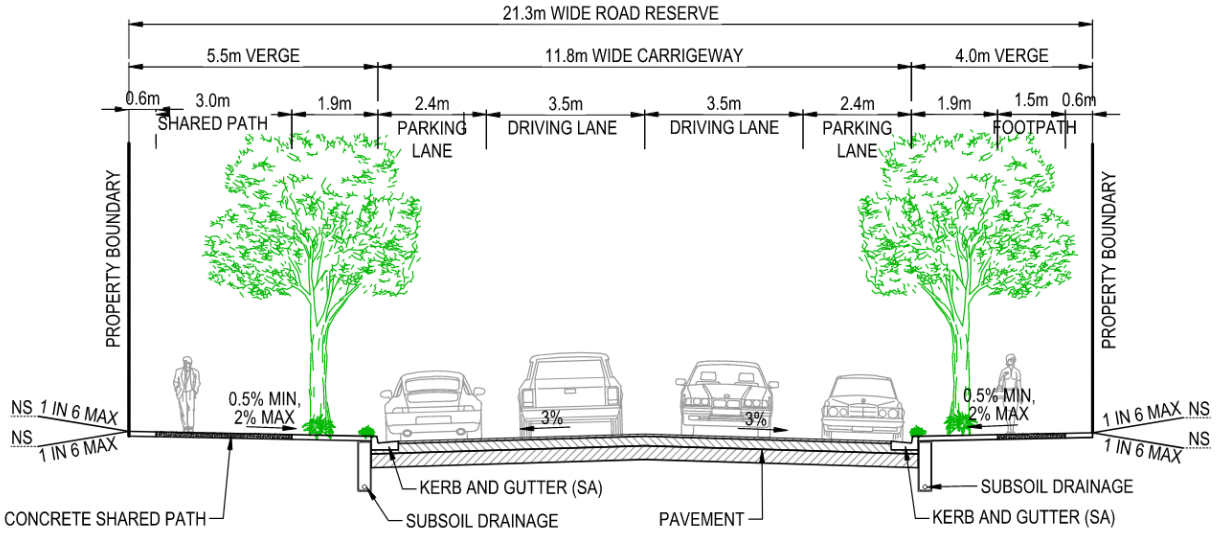


Figure 4-6 Collector Road typical cross section

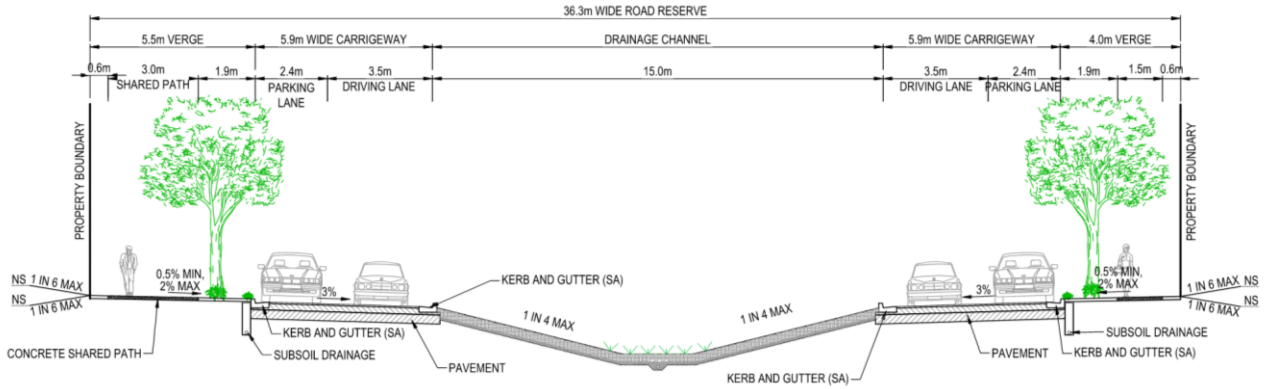


Figure 4-7 Collector Road with drainage channel typical cross section

4.6.4.2 Local Industrial Road

The width of a local industrial road within the SAP will generally achieve a travel lane in each direction. Design considerations of a local industrial road within the SAP are the same as those listed above for the collector roads.

To safeguard future road network capacity requirements, wider road widths suitable to accommodate future lane quantity needs are advisable at locations that are likely to be highly trafficable (e.g., at entry points to the proposed SAP).

Typical cross sections of a local industrial road are shown in Figure 4-8, Figure 4-9 and Figure 4-10 below. The provision of a channelised right turn bay, or parking kerbside lanes on either side of the travel lanes will depend on the type of land uses, associated parking, access and operational needs (i.e., manoeuvrability of vehicles required to service the developments). These details will need to be addressed in concept/detailed design stage.

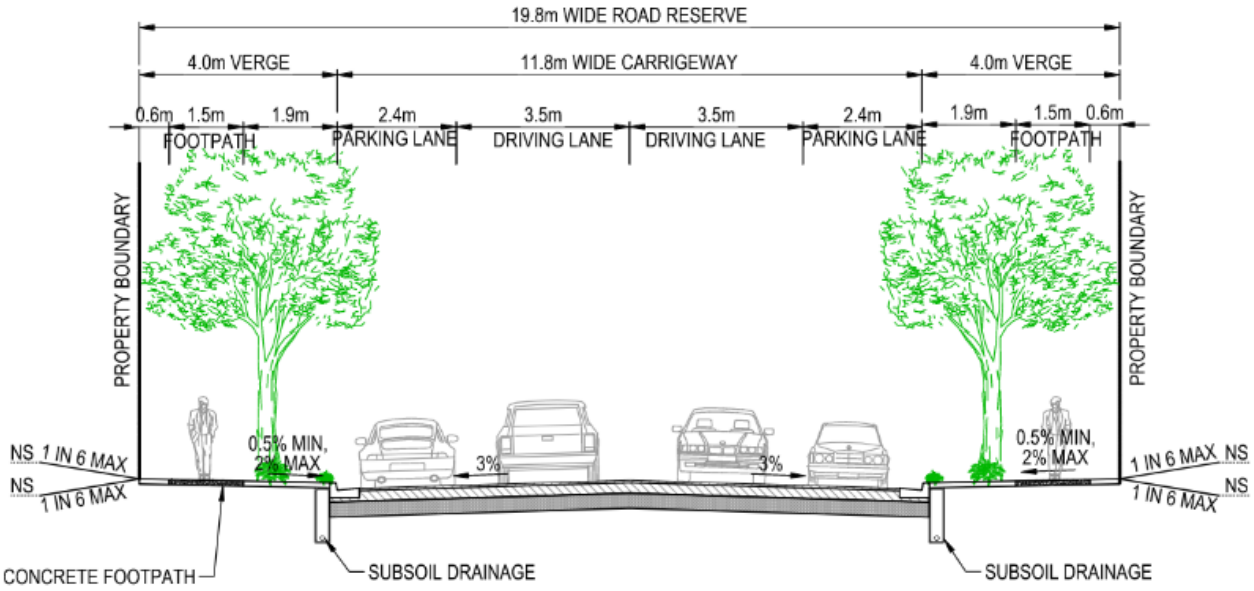
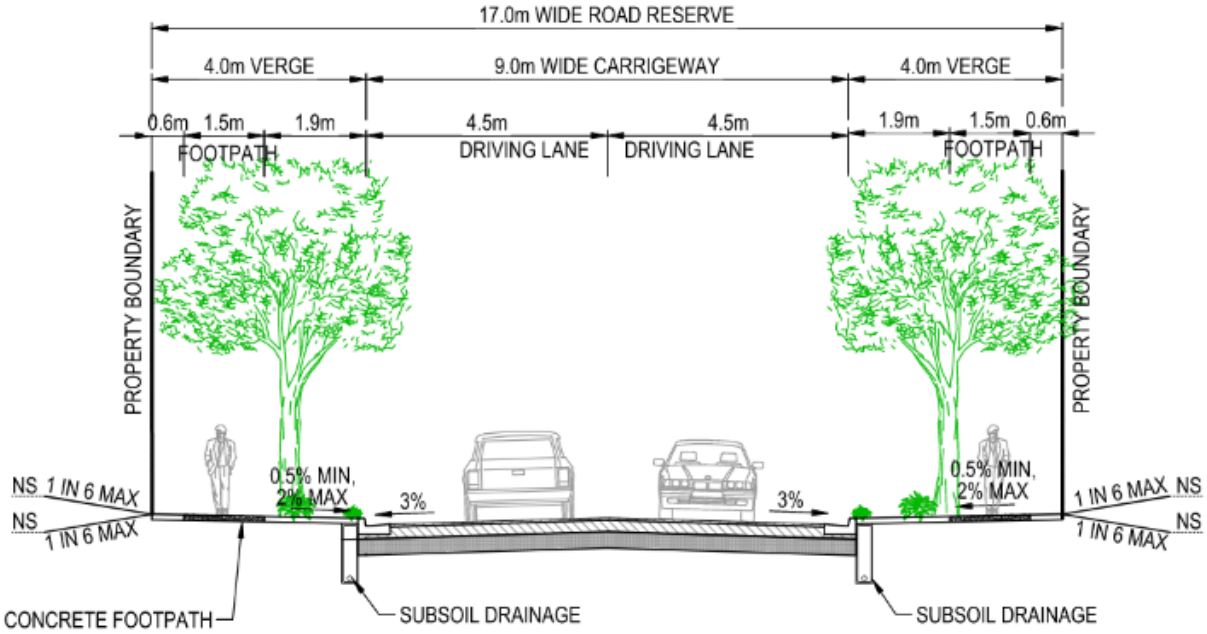


Figure 4-8 Local Industrial Road typical cross section



TYPICAL ROAD CROSS SECTION - LOCAL INDUSTRIAL ROAD TYPE 2
9.0m CARRIAGEWAY - 1.5m FOOTPATH - 17.0m ROAD RESERVE
1:100

Figure 4-9 Local Industrial Road typical cross section (no parking)

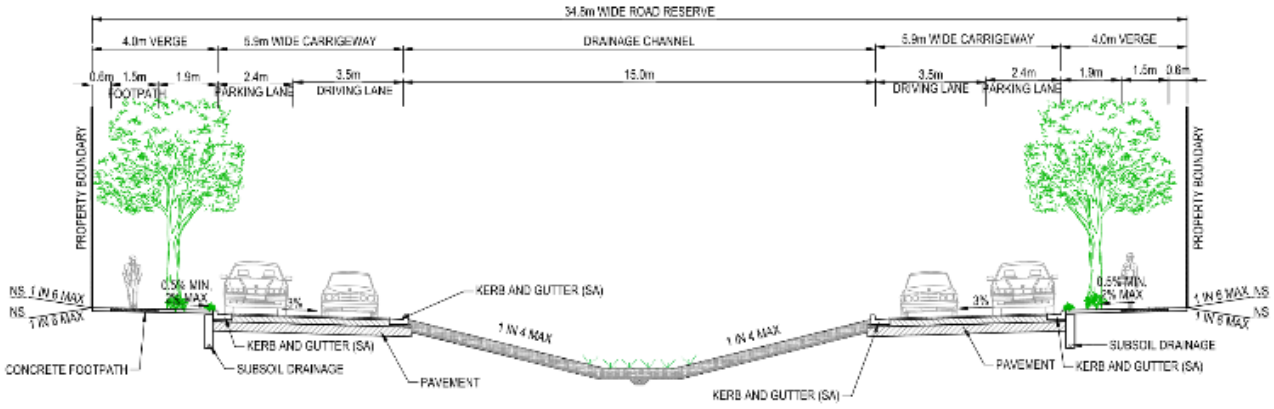


Figure 4-10 Local Industrial Road with drainage channel typical cross section

Utilities allocation within the road verge is shown in Figure 4-11 below.

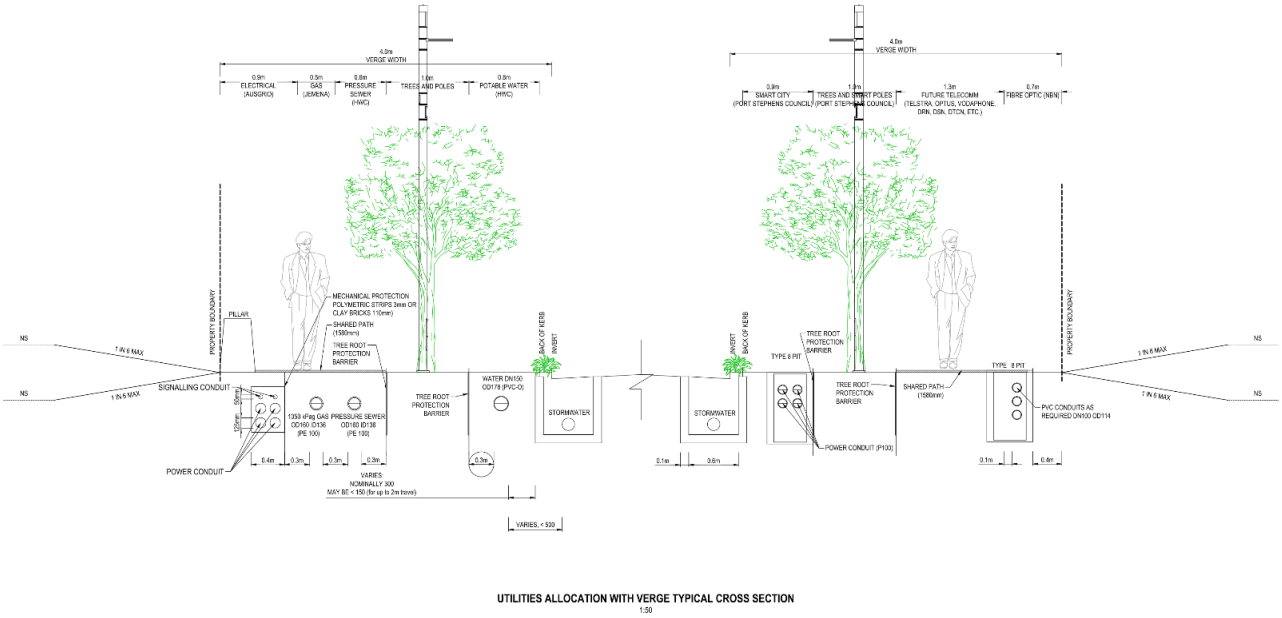


Figure 4-11 Utilities allocation with verge typical cross section

4.7 Conclusions

Based on the Structure Plan developed, and the predicted economic opportunity of the Williamtown SAP, it is predicted that around 93 ha of land will be developed. Given the current baseline traffic volumes, predicted regional growth and predicted traffic generated by the SAP, certain roads and intersections in the region are likely to have insufficient capacity to meet traffic demands in the future. Our analysis also suggests construction or upgrade of the following roads and intersections are required by 2036 due to traffic driven by the traffic growth in the area, future key infrastructure projects and the SAP development.

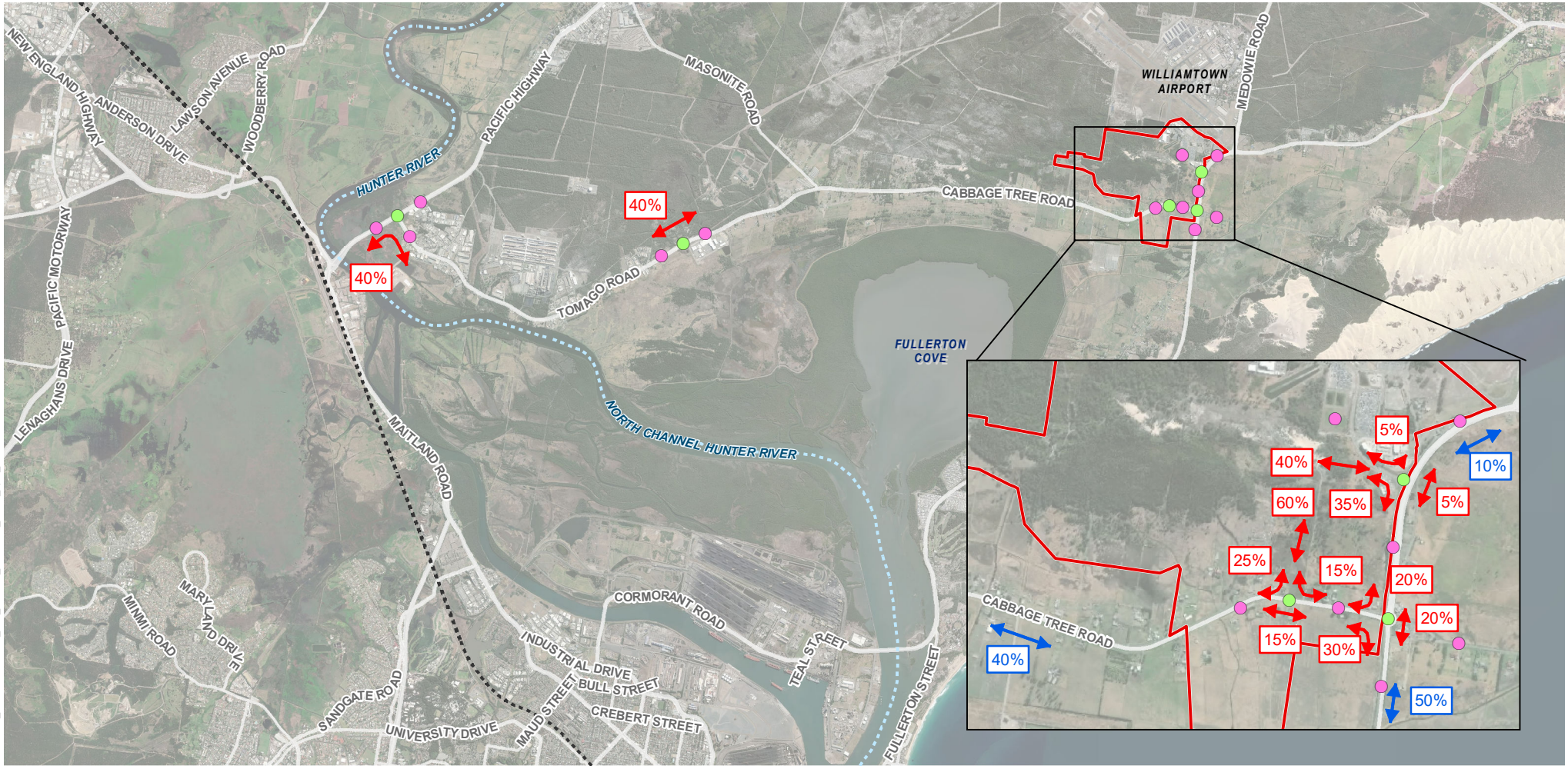
- Tomago Road.
- Upgrade of the existing Nelson Bay Road – Williamtown Drive intersection
- Nelson Bay Road south of Cabbage Tree Road
- Upgrade existing Nelson Bay Road - Cabbage Tree Road intersection, this upgrade is part of TfNSW commitment to upgrade Nelson Bay Road announced in December 2021

During subsequent design development of the SAP, further consideration could be given to the internal layout of the SAP and opportunities to encourage traffic from the Newcastle City Centre to the site via Tomago / Cabbage Tree Road. This route is generally considered to have more residual traffic capacity than via Stockton Bridge, Fern

Bay and Nelson Bay Road. The utilisation of existing residual capacity would therefore maximise outcomes for the regional road network.

In addition, opportunities should be sought to maximise public and active transport usage within and to the Williamtown SAP to encourage mode shift, where appropriate, and provide increased transport options. Future connections to the SAP via transport links should be explored, particularly in the later stages of SAP development when travel demand is likely to be higher due to increased jobs and activity in the area. Walkability will be integral to the success of the SAP, and ample road space should be allocated to pedestrians and bicycle riders to enable sustainable journeys while simultaneously creating a connected network.

The lake of strategic modelling that includes all the development in the area represent a challenge in assessing the impact of the development or predict the growth in the area. In order to maximise the benefit of the future TfNSW major road upgrade projects (M1 and Nelson Bay Road) and the SAP development and develop efficient intersections layout . It is recommended that further traffic analysis for and option developments for the M1 and Nelson Bay Road upgrades take into consideration the SAP development and the future demand on Cabbage Tree Road corridor .



Williamtown SAP Structure Plan Boundary

River

Railway

Intersection assessment

Midblock assessment

Source: Aurecon, TfNSW, NSW Spatial Services, DPE, Esri

1:100,000 @ A4

0 2 4km

Projection: GDA 1994 MGA Zone 56

Williamtown SAP **Traffic and Transport**

FIGURE: Current assumed traffic split

P:\GIS\Project-4\project\510674_Williamtown_SAP\510674_WilliamtownSAP_TaT_Current_assumed_traffic_split_rev1.mxd\JOB No.\16-12-22\Qi Shen\Rev 0

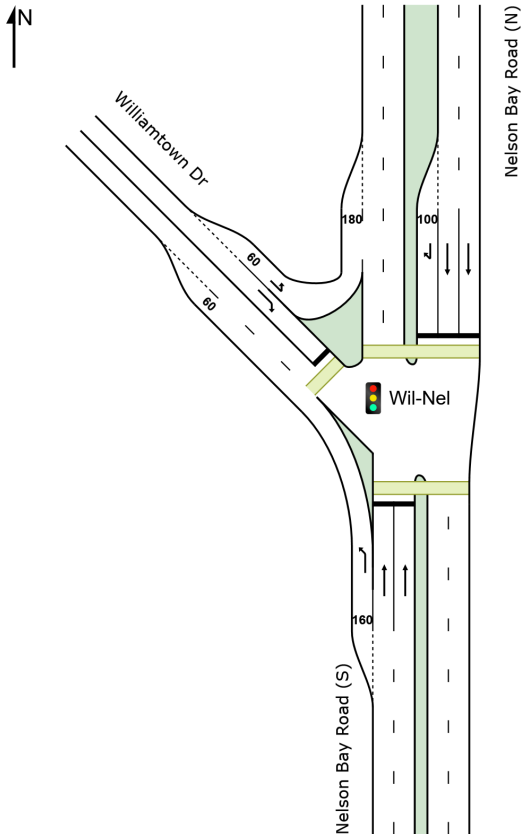
					2020 Base Case						2036 Excluding SAP Traffic						2036 Including SAP Traffic					
Intersection	Midblock	Direction	Lanes per direction	Current Capacity	2020 AM Total Volume	2020 PM Total Volume	2020 AM PCUs	2020 PM PCUs	2020 Critical Peak Volume [PCU]	2020 Flow/ Capacity Ratio	2036 AM Total Volume	2036 PM Total Volume	2036 AM PCUs	2036 PM PCUs	2036 Critical Peak Volume [PCU]	2036 Flow/ Capacity Ratio Excluding SAP	2036 Critical Peak Volume [PCU]	2036 Flow/ Capacity Ratio Including SAP	2036 Lanes Required	Proposed Additional Lanes	New Capacity	New 2036 Flow/ Capacity Ratio
Nelson Bay Road / Williamtown Drive (Newcastle Airpot)	Nelson Bay Road north of Williamtown Drive	NB	2	3,400	1,411	1,617	1,693	1,940	1,940	57%	1,619	1,503	1,942	1,803	1,942	57%	1,975	58%	2	-	3,400	58%
		SB	2	3,400	1,475	1,143	1,770	1,372	1,770	52%	998	857	1,197	1,029	1,197	35%	1,279	38%	2	-	3,400	38%
	Williamtown Drive west of Nelson Bay Road	EB	1	1,700	111	412	133	494	494	29%	166	560	199	672	672	40%	997	59%	1	-	1,700	59%
		WB	1	1,700	261	157	313	188	313	18%	361	231	433	277	433	25%	758	45%	1	-	1,700	45%
	Nelson Bay Road south of Williamtown Drive	NB	2	3,400	1,540	1,550	1,848	1,860	1,860	55%	1,815	1,459	2,178	1,751	2,178	64%	2,478	73%	2	-	3,400	73%
		SB	2	3,400	1,454	1,331	1,745	1,598	1,745	51%	999	1,142	1,199	1,371	1,371	40%	1,672	49%	2	-	3,400	49%
Nelson Bay Road / Cabbage Tree Road	Nelson Bay Road north of Cabbage Tree Road	NB	2	3,400	1,391	1,463	1,669	1,756	1,756	52%	1,531	1,263	1,837	1,516	1,837	54%	2,162	64%	2	-	3,400	64%
		SB	2	3,400	1,379	1,286	1,655	1,543	1,655	49%	877	1,154	1,052	1,385	1,385	41%	1,617	48%	2	-	3,400	48%
	Cabbage Tree Road west of Nelson Bay Road	EB	1	1,700	413	547	496	656	656	39%	562	622	674	746	746	44%	1,060	62%	1	-	1,700	62%
		WB	1	1,700	364	365	437	438	438	26%	403	362	484	434	484	28%	890	52%	1	-	1,700	52%
	Nelson Bay Road south of Cabbage Tree Road	NB	1	1,700	1,147	1,082	1,376	1,298	1,376	81%	1,492	1,330	1,790	1,596	1,790	105%	2,197	129%	2	1	3,400	65%
		SB	1	1,700	1,216	1,254	1,459	1,505	1,505	89%	1,566	1,455	1,879	1,746	1,879	111%	2,152	127%	2	1	3,400	63%
	Lavis Lane east of Nelson Bay Road	EB	2	3,400	183	168	220	202	220	6%	443	607	532	728	728	21%	728	21%	2	-	3,400	21%
		WB	2	3,400	215	335	258	402	402	12%	1,012	581	1,214	697	1,214	36%	1,214	36%	2	-	3,400	36%
Cabbage Tree Road / SAP Access Road	Cabbage Tree Road east of SAP Access Road	EB	1	1,700	464	617	557	741	741	44%	546	727	656	872	872	51%	1,125	66%	1	-	1,700	66%
		WB	1	1,700	434	416	521	499	521	31%	511	490	614	588	614	36%	866	51%	1	-	1,700	51%
	SAP Access Road north of Cabbage Tree Road	NB	1	1,700	102	44	122	52	122	7%	120	51	144	62	144	8%	509	30%	1	-	1,700	30%
		SB	1	1,700	44	102	52	122	122	7%	51	120	62	144	144	8%	509	30%	1	-	1,700	30%
	Cabbage Tree Road west of SAP Access Road	EB	1	1,700	481	576	577	691	691	41%	566	679	679	814	814	48%	923	54%	1	-	1,700	54%
		WB	1	1,700	393	433	472	519	519	31%	463	510	556	612	612	36%	855	50%	1	-	1,700	50%
Tomago Road / WesTrac Drive	Tomago Road east of WesTrac Drive	EB	1	1,700	341	615	409	738	738	43%	433	780	519	937	937	55%	1,076	63%	1	-	1,700	63%
		WB	1	1,700	411	327	493	392	493	29%	522	415	626	498	626	37%	823	48%	1	-	1,700	48%
	WesTrac Drive south of Tomago Road	NB	2	3,400	23	233	28	280	280	8%	29	296	35	355	355	10%	355	10%	2	-	3,400	10%
		SB	2	3,400	151	22	181	26	181	5%	192	28	230	34	230	7%	230	7%	2	-	3,400	7%
	Tomago Road west of WesTrac Drive	EB	1	1,700	442	557	530	668	668	39%	561	707	673	848	848	50%	998	59%	1	-	1,700	59%
		WB	1	1,700	384	480	461	576	576	34%	487	609	585	731	731	43%	1,056	62%	1	-	1,700	62%
Pacific Highway / Tomago Road	Pacific Highway east of Tomago Road	EB	2	3,400	1,181	1,714	1,417	2,057	2,057	60%	1,499	2,175	1,798	2,610	2,610	77%	2,610	77%	2	-	3,400	77%
		WB	2	3,400	1,181	926	1,417	1,111	1,417	42%	1,499	1,175	1,798	1,410	1,798	53%	1,798	53%	2	-	3,400	53%
	Tomago Road south of Pacific Highway	NB	1	1,700	358	1,153	430	1,384	1,384	81%	454	1,463	545	1,756	1,756	103%	2,081	122%	2	1	3,400	61%
		SB	1	1,700	823	548	988	658	988	58%	1,044	695	1,253	834	1,253	74%	1,578	93%	1	-	1,700	93%
	Pacific Highway west of Tomago Road	EB	2	3,400	1,992	2,251	2,390	2,701	2,701	79%	2,528	2,856	3,033	3,428	3,428	101%	3,567	105%	2	-	3,400	105%
		WB	2	3,400	1,527	2,068	1,832	2,482	2,482	73%	1,938	2,624	2,325	3,149	3,149	93%	3,474	102%	2	-	3,400	102%

SITE LAYOUT

Site: Wil-Nel [AM | Williamtown Dr - Nelson Bay Rd | 2020 Base (Site Folder: 2020 Base Year)]

AM | Williamtown Dr - Nelson Bay Rd | 2020 Base | Import
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Wil-Nel [AM | Williamtown Dr - Nelson Bay Rd | 2020 Base (Site Folder: 2020 Base Year)]

AM | Williamtown Dr - Nelson Bay Rd | 2020 Base | Import
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Nelson Bay Road (S)														
1a	L1	181	1	191	0.6	0.101	4.8	LOS A	0.0	0.0	0.00	0.55	0.00	54.2
2	T1	1359	56	1431	4.1	* 0.827	28.1	LOS C	32.5	235.7	0.93	0.90	1.00	41.0
Approach		1540	57	1621	3.7	0.827	25.3	LOS C	32.5	235.7	0.82	0.86	0.88	42.2
North: Nelson Bay Road (N)														
8	T1	1395	43	1468	3.1	0.555	6.9	LOS A	16.5	118.3	0.51	0.46	0.51	53.9
9b	R3	80	0	84	0.0	* 0.432	33.7	LOS C	2.9	20.0	0.97	0.76	0.97	38.1
Approach		1475	43	1553	2.9	0.555	8.4	LOS A	16.5	118.3	0.53	0.48	0.53	52.7
NorthWest: Williamtown Dr														
27b	L3	52	0	55	0.0	0.034	8.6	LOS A	0.0	0.0	0.00	0.58	0.00	54.8
29a	R1	59	5	62	8.5	* 0.239	45.2	LOS D	2.7	20.4	0.91	0.75	0.91	33.8
Approach		111	5	117	4.5	0.239	28.0	LOS C	2.7	20.4	0.48	0.67	0.48	41.3
All Vehicles		3126	105	3291	3.4	0.827	17.4	LOS B	32.5	235.7	0.67	0.67	0.70	46.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov	Input Vol.	Dem.	Aver.	Level of	AVERAGE BACK OF QUEUE	Prop.	Effective	Travel Time	Travel Dist.	Aver.

ID	Crossing		Flow	Delay	Service	[Ped	Dist]	Que	Stop Rate			Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Nelson Bay Road (S)												
P1	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	72.9	37.2	0.51
North: Nelson Bay Road (N)												
P3	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	78.0	43.8	0.56
NorthWest: Williamtown Dr												
P7	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	68.8	31.9	0.46
All Pedestrians		150	158	44.3	LOS E	0.1	0.1	0.94	0.94	73.2	37.6	0.51

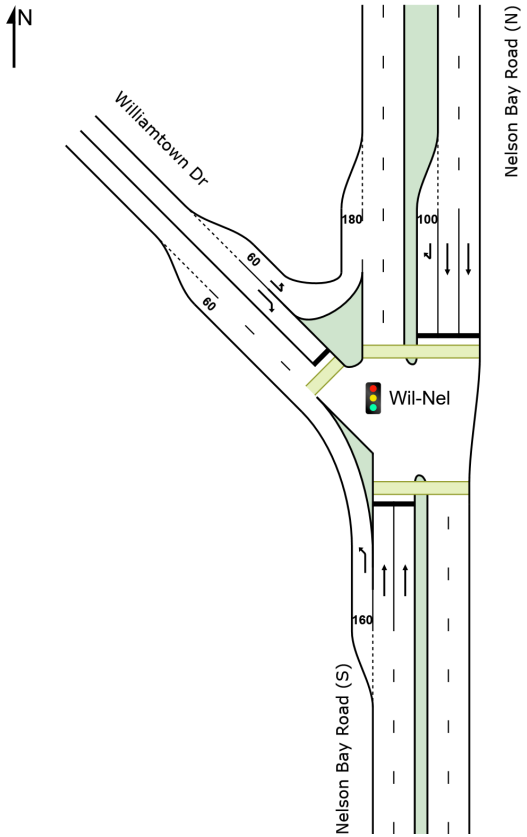
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: Wil-Nel [PM | Williamtown Dr - Nelson Bay Rd | 2020 Base (Site Folder: 2020 Base Year)]

PM | Williamtown Dr - Nelson Bay Rd | 2020 Base | Import
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Wil-Nel [PM | Williamtown Dr - Nelson Bay Rd | 2020 Base (Site Folder: 2020 Base Year)]

PM | Williamtown Dr - Nelson Bay Rd | 2020 Base | Import
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Nelson Bay Road (S)														
1a	L1	112	5	118	4.5	0.067	4.7	LOS A	0.0	0.0	0.00	0.55	0.00	54.0
2	T1	1438	28	1514	1.9	* 0.840	29.0	LOS C	35.1	250.1	0.94	0.92	1.02	40.6
Approach		1550	33	1632	2.1	0.840	27.3	LOS C	35.1	250.1	0.87	0.89	0.95	41.3
North: Nelson Bay Road (N)														
8	T1	1098	24	1156	2.2	0.430	6.0	LOS A	11.2	80.1	0.44	0.39	0.44	54.6
9b	R3	45	0	47	0.0	* 0.243	32.8	LOS C	1.6	10.9	0.94	0.74	0.94	38.5
Approach		1143	24	1203	2.1	0.430	7.1	LOS A	11.2	80.1	0.46	0.41	0.46	53.7
NorthWest: Williamtown Dr														
27b	L3	179	1	188	0.6	0.117	9.0	LOS A	0.0	0.0	0.00	0.58	0.00	54.7
29a	R1	233	0	245	0.0	* 0.802	53.3	LOS D	12.6	88.5	1.00	0.92	1.18	31.5
Approach		412	1	434	0.2	0.802	34.1	LOS C	12.6	88.5	0.57	0.77	0.67	38.8
All Vehicles		3105	58	3268	1.9	0.840	20.7	LOS C	35.1	250.1	0.68	0.70	0.73	44.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov	Input Vol.	Dem.	Aver.	Level of	AVERAGE BACK OF QUEUE	Prop.	Effective	Travel Time	Travel Dist.	Aver.

ID	Crossing		Flow	Delay	Service	[Ped	Dist]	Que	Stop Rate			Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Nelson Bay Road (S)												
P1	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	72.9	37.2	0.51
North: Nelson Bay Road (N)												
P3	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	78.0	43.8	0.56
NorthWest: Williamtown Dr												
P7	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	68.8	31.9	0.46
All Pedestrians		150	158	44.3	LOS E	0.1	0.1	0.94	0.94	73.2	37.6	0.51

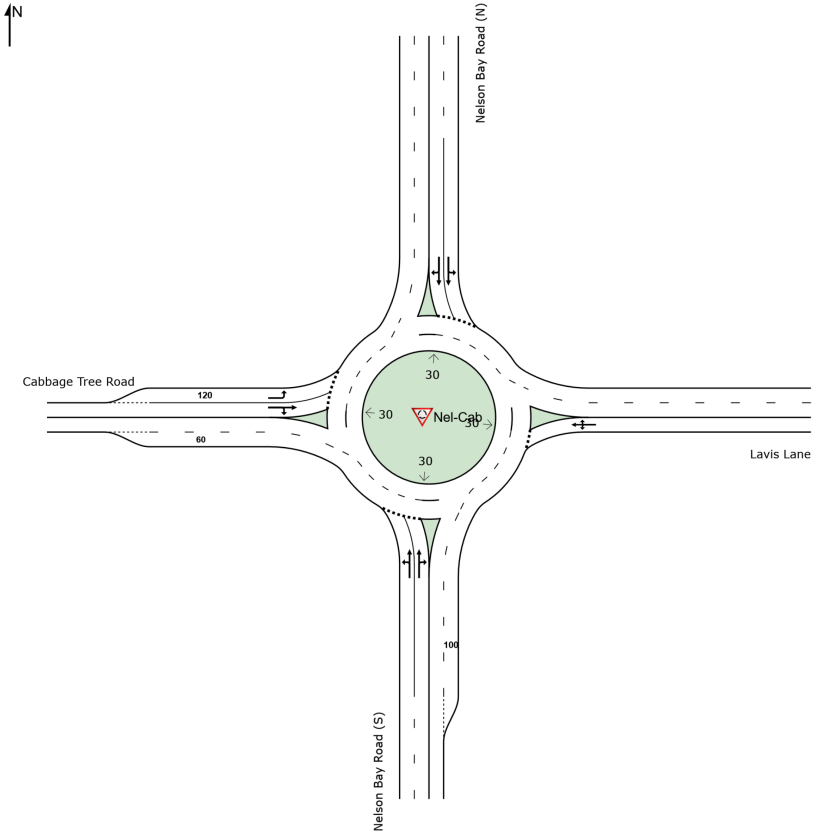
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: Nel-Cab [AM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base (Site Folder: 2020 Base Year)]

AM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base | Import
Site Category: 2020 AM
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Nel-Cab [AM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base (Site Folder: 2020 Base Year)]

AM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base | Import
Site Category: 2020 AM
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Nelson Bay Road (S)														
1	L2	63	4	66	6.3	0.577	7.3	LOS A	5.1	36.8	0.73	0.69	0.78	52.8
2	T1	1011	31	1064	3.1	0.577	7.0	LOS A	5.1	36.8	0.74	0.73	0.80	54.2
3	R2	73	0	77	0.0	0.577	13.0	LOS B	5.1	36.2	0.75	0.77	0.82	54.3
Approach		1147	35	1207	3.1	0.577	7.4	LOS A	5.1	36.8	0.74	0.73	0.80	54.2
East: Lavis Lane														
4	L2	79	0	83	0.0	0.503	17.9	LOS B	3.3	23.2	0.90	1.03	1.16	47.6
5	T1	70	0	74	0.0	0.503	15.0	LOS B	3.3	23.2	0.90	1.03	1.16	48.9
6	R2	66	0	69	0.0	0.503	20.2	LOS C	3.3	23.2	0.90	1.03	1.16	49.2
Approach		215	0	226	0.0	0.503	17.7	LOS B	3.3	23.2	0.90	1.03	1.16	48.5
North: Nelson Bay Road (N)														
7	L2	84	0	88	0.0	0.481	5.0	LOS A	3.6	26.0	0.52	0.50	0.52	54.0
8	T1	1064	35	1120	3.3	0.676	6.4	LOS A	6.9	50.1	0.59	0.53	0.59	54.8
9	R2	231	13	243	5.6	0.676	10.8	LOS B	6.9	50.1	0.63	0.55	0.63	54.5
Approach		1379	48	1452	3.5	0.676	7.1	LOS A	6.9	50.1	0.59	0.53	0.59	54.7
West: Cabbage Tree Road														
10	L2	314	26	331	8.3	0.500	9.2	LOS A	3.3	24.6	0.86	0.98	1.02	51.9
11	T1	26	2	27	7.7	0.232	9.5	LOS A	1.1	7.9	0.78	0.91	0.78	50.8
12	R2	73	0	77	0.0	0.232	14.7	LOS B	1.1	7.9	0.78	0.91	0.78	51.3
Approach		413	28	435	6.8	0.500	10.1	LOS B	3.3	24.6	0.84	0.96	0.96	51.7
All Vehicles		3154	111	3320	3.5	0.676	8.3	LOS A	6.9	50.1	0.70	0.69	0.76	53.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: Nel-Cab [PM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base (Site Folder: 2020 Base Year)]

PM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base | Import
Site Category: 2020 PM
Roundabout

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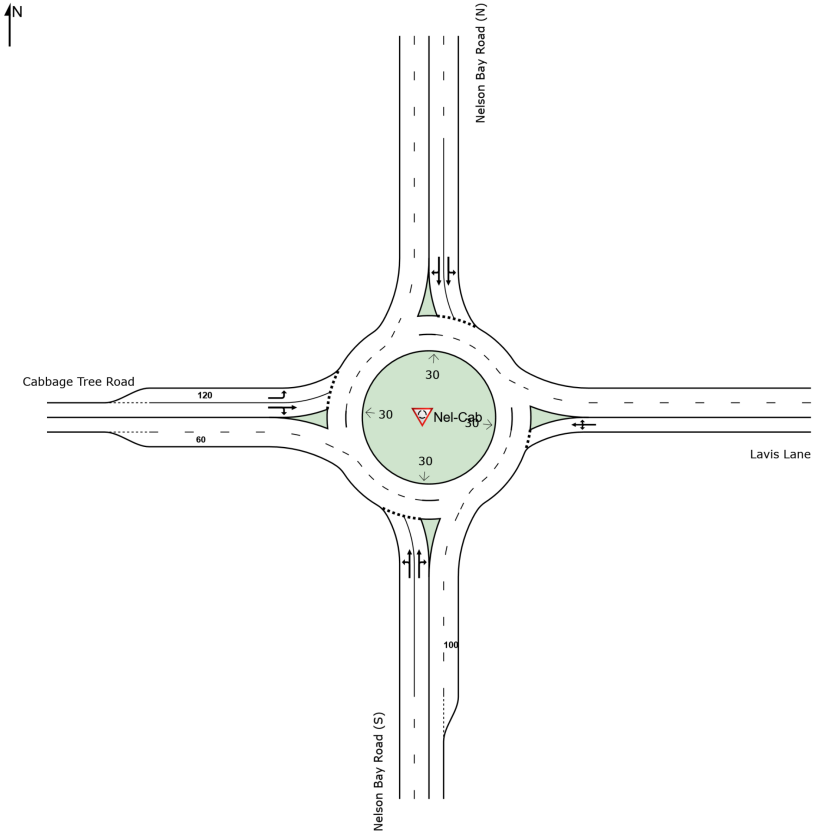


MOVEMENT SUMMARY

Site: Nel-Cab [PM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base (Site Folder: 2020 Base Year)]

PM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base | Import
Site Category: 2020 PM
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Nelson Bay Road (S)														
1	L2	51	4	54	7.8	0.558	7.3	LOS A	4.8	34.7	0.74	0.69	0.79	52.7
2	T1	980	26	1032	2.7	0.558	7.1	LOS A	4.8	34.7	0.75	0.73	0.80	54.3
3	R2	51	0	54	0.0	0.558	13.0	LOS B	4.8	34.0	0.75	0.77	0.82	54.4
Approach		1082	30	1139	2.8	0.558	7.3	LOS A	4.8	34.7	0.75	0.73	0.80	54.2
East: Lavis Lane														
4	L2	144	0	152	0.0	0.741	24.7	LOS C	6.6	46.3	0.96	1.20	1.63	44.2
5	T1	119	0	125	0.0	0.741	21.6	LOS C	6.6	46.3	0.96	1.20	1.63	45.3
6	R2	72	0	76	0.0	0.741	26.8	LOS C	6.6	46.3	0.96	1.20	1.63	45.5
Approach		335	0	353	0.0	0.741	24.0	LOS C	6.6	46.3	0.96	1.20	1.63	44.8
North: Nelson Bay Road (N)														
7	L2	81	0	85	0.0	0.455	5.0	LOS A	3.4	23.9	0.54	0.50	0.54	53.9
8	T1	1010	9	1063	0.9	0.639	6.4	LOS A	6.3	44.8	0.60	0.53	0.60	54.9
9	R2	195	14	205	7.2	0.639	10.8	LOS B	6.3	44.8	0.63	0.54	0.63	54.5
Approach		1286	23	1354	1.8	0.639	7.0	LOS A	6.3	44.8	0.60	0.53	0.60	54.8
West: Cabbage Tree Road														
10	L2	411	0	433	0.0	0.598	9.7	LOS A	4.5	31.3	0.88	1.02	1.13	51.7
11	T1	36	0	38	0.0	0.302	9.1	LOS A	1.5	10.4	0.79	0.92	0.80	51.1
12	R2	100	0	105	0.0	0.302	14.7	LOS B	1.5	10.4	0.79	0.92	0.80	51.4
Approach		547	0	576	0.0	0.598	10.5	LOS B	4.5	31.3	0.86	1.00	1.05	51.6
All Vehicles		3250	53	3421	1.6	0.741	9.5	LOS A	6.6	46.3	0.73	0.74	0.85	52.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.

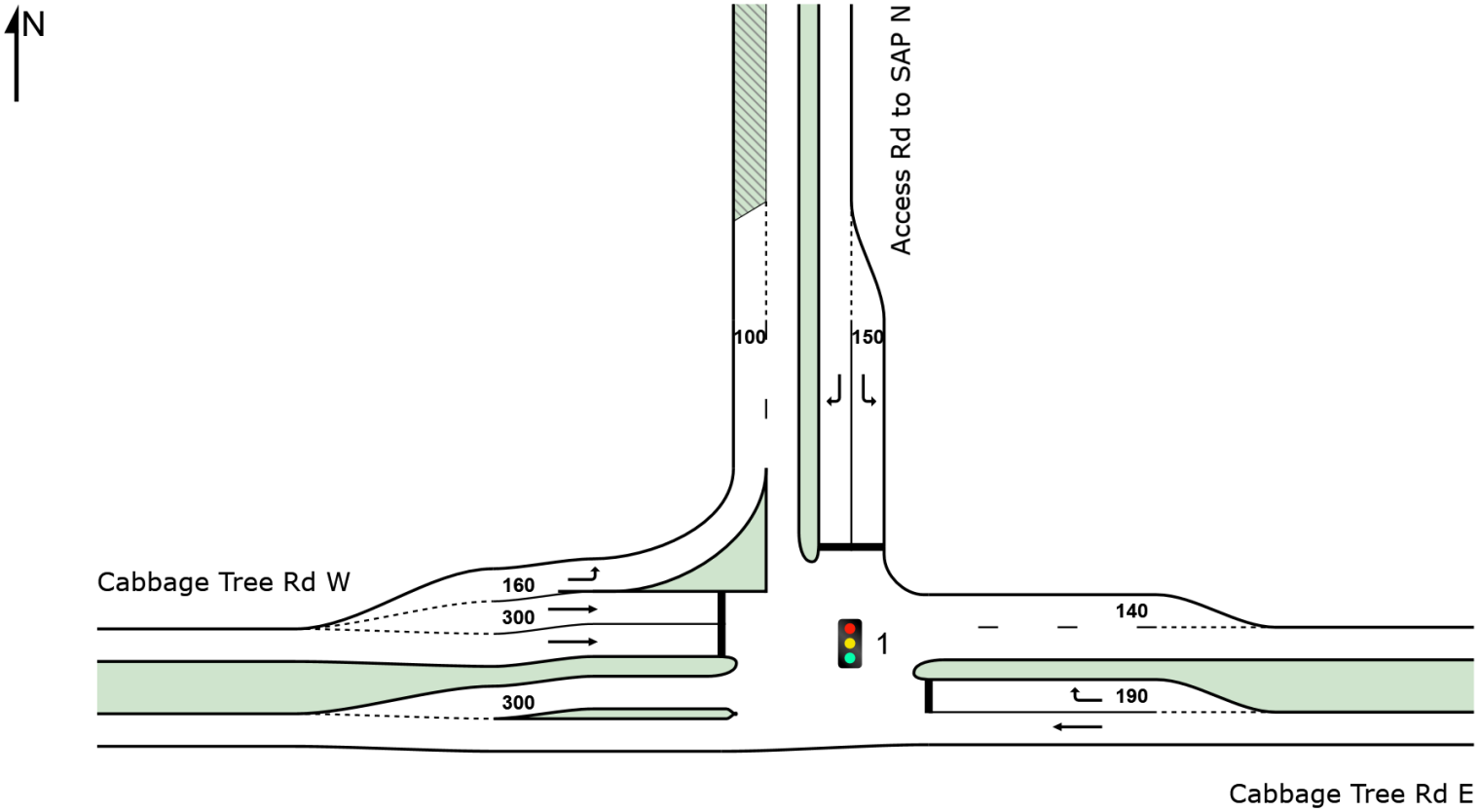
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 1 [AM | Cabbage Tree Rd - SAP Access Rd | 2020 (Site Folder: 2020 Base Year)]

Three-way intersection with "Seagull" treatment (Signals)
Site Category: Proposed Design 1
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 1 [AM | Cabbage Tree Rd - SAP Access Rd | 2020 (Site Folder: 2020 Base Year)]

Three-way intersection with "Seagull" treatment (Signals)
Site Category: Proposed Design 1
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Cabbage Tree Rd E														
5	T1	376	10.0	396	10.0	0.244	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
6	R2	66	10.0	69	10.0	* 0.107	8.4	LOS A	0.8	5.9	0.30	0.64	0.30	51.1
Approach		442	10.0	465	10.0	0.244	1.3	LOS A	0.8	5.9	0.04	0.10	0.04	58.4
North: Access Rd to SAP N														
1	L2	28	10.0	29	10.0	0.115	52.6	LOS D	1.5	11.3	0.88	0.72	0.88	31.8
2	R2	20	10.0	21	10.0	* 0.206	66.9	LOS E	1.2	9.4	0.98	0.71	0.98	28.4
Approach		48	10.0	51	10.0	0.206	58.6	LOS E	1.5	11.3	0.92	0.72	0.92	30.3
West: Cabbage Tree Rd W														
3	L2	47	10.0	49	10.0	0.032	5.8	LOS A	0.0	0.0	0.00	0.52	0.00	54.6
4	T1	441	10.0	464	10.0	* 0.221	5.5	LOS A	4.8	36.5	0.33	0.29	0.33	55.2
Approach		488	10.0	514	10.0	0.221	5.5	LOS A	4.8	36.5	0.30	0.31	0.30	55.2
All Vehicles		978	10.0	1029	10.0	0.244	6.2	LOS A	4.8	36.5	0.22	0.23	0.22	54.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

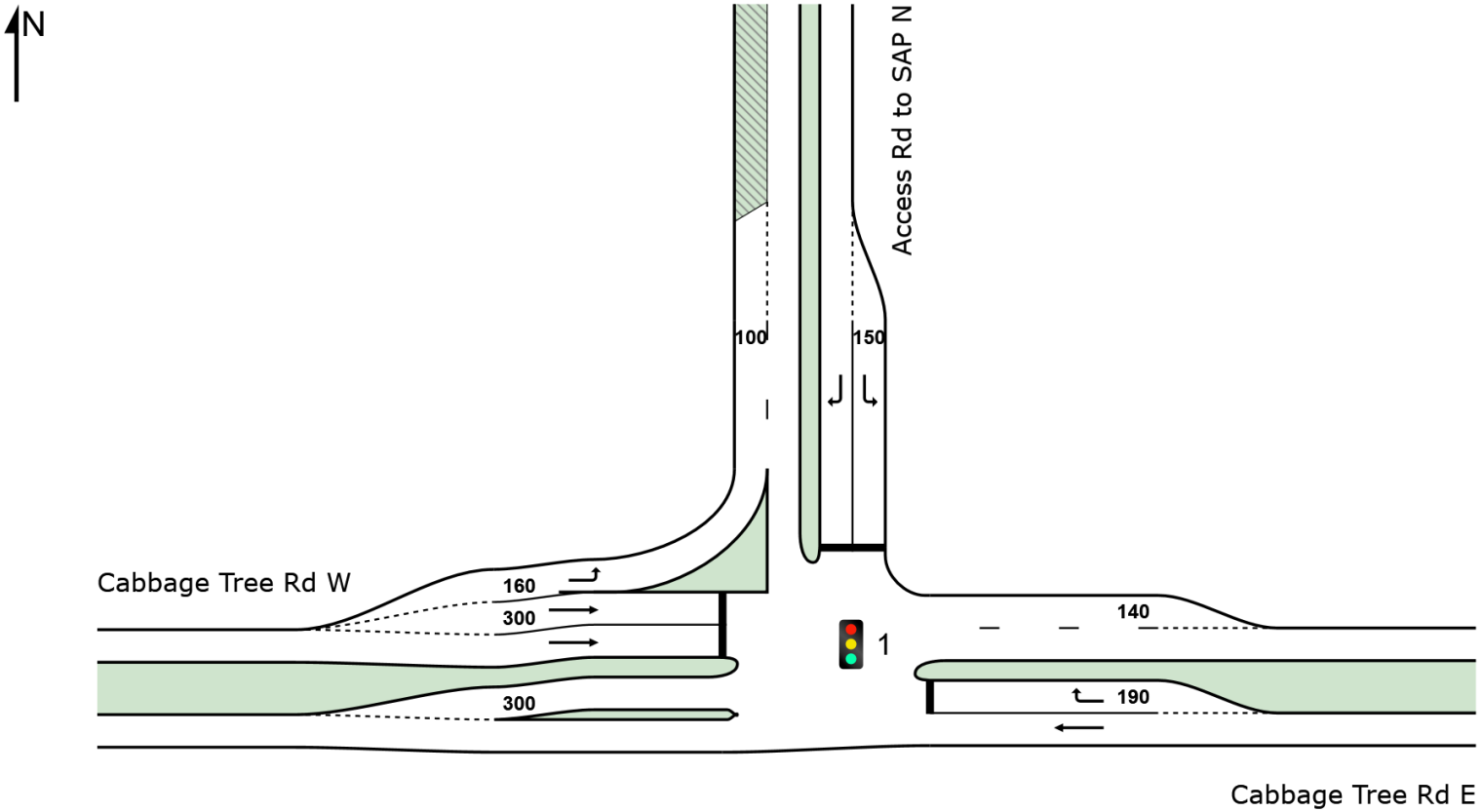
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: 1 [PM | Cabbage Tree Rd - SAP Access Rd | 2020 (Site Folder: 2020 Base Year)]

Three-way intersection with "Seagull" treatment (Signals)
Site Category: Proposed Design 1
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 1 [PM | Cabbage Tree Rd - SAP Access Rd | 2020 (Site Folder: 2020 Base Year)]

Three-way intersection with "Seagull" treatment (Signals)
Site Category: Proposed Design 1
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Cabbage Tree Rd E														
5	T1	393	10.0	414	10.0	0.255	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
6	R2	28	10.0	29	10.0	* 0.056	9.8	LOS A	0.4	3.0	0.36	0.64	0.36	50.2
Approach		421	10.0	443	10.0	0.255	0.7	LOS A	0.4	3.0	0.02	0.04	0.02	59.1
North: Access Rd to SAP N														
1	L2	66	10.0	69	10.0	0.218	49.4	LOS D	3.4	26.0	0.87	0.76	0.87	32.7
2	R2	47	10.0	49	10.0	* 0.298	61.7	LOS E	2.8	21.1	0.96	0.75	0.96	29.6
Approach		113	10.0	119	10.0	0.298	54.5	LOS D	3.4	26.0	0.91	0.75	0.91	31.4
West: Cabbage Tree Rd W														
3	L2	20	10.0	21	10.0	0.014	5.8	LOS A	0.0	0.0	0.00	0.52	0.00	54.6
4	T1	559	10.0	588	10.0	* 0.297	7.7	LOS A	7.4	56.6	0.41	0.35	0.41	53.5
Approach		579	10.0	609	10.0	0.297	7.7	LOS A	7.4	56.6	0.39	0.36	0.39	53.6
All Vehicles		1113	10.0	1172	10.0	0.298	9.8	LOS A	7.4	56.6	0.30	0.28	0.30	51.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

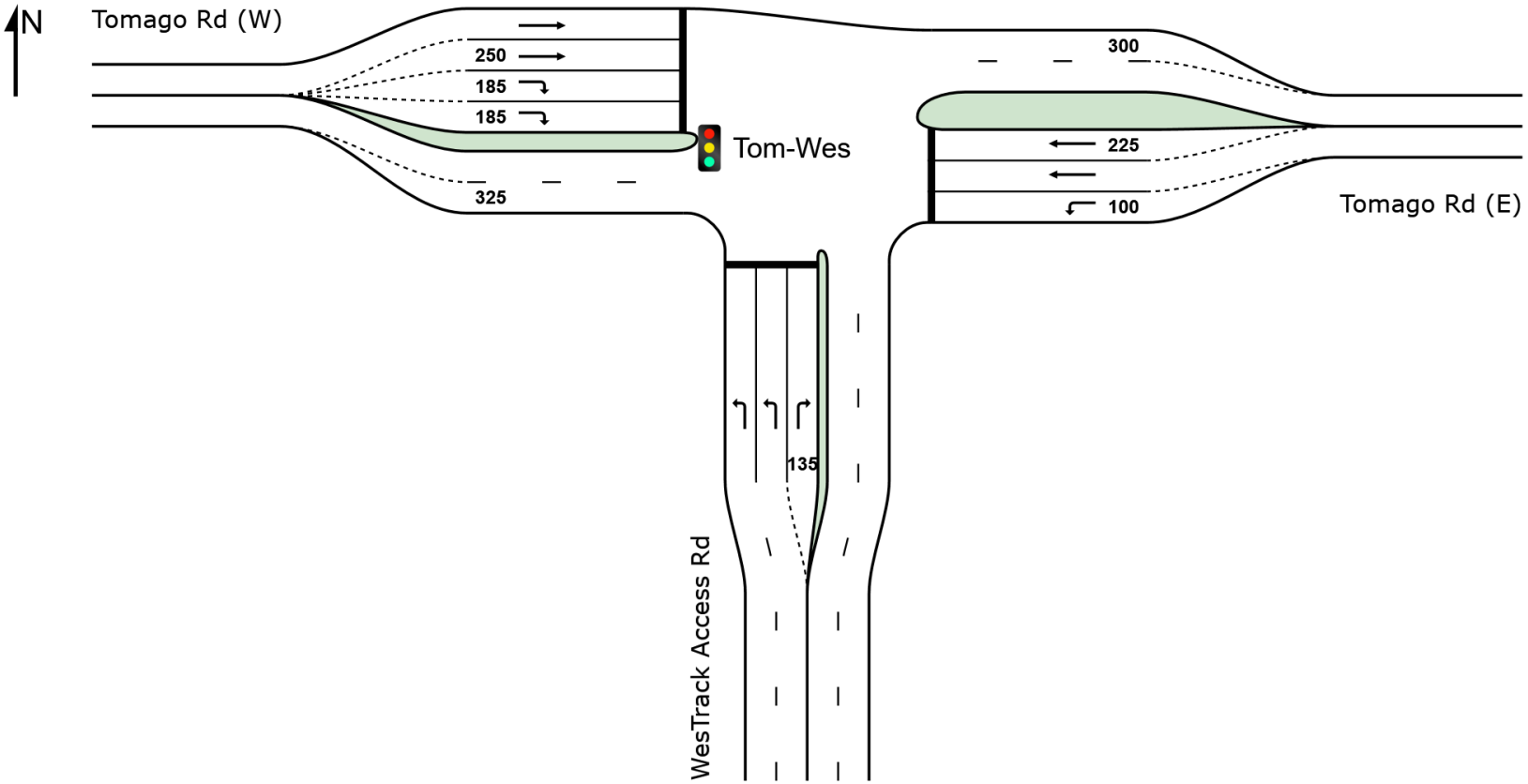
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Tom-Wes [AM | Tomago Rd - WesTrac | 2020 Base (Site Folder: 2020 Base Year)]

AM | Tomago Rd - WesTrack | 2020 Base
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Tom-Wes [AM | Tomago Rd - WesTrac | 2020 Base (Site Folder: 2020 Base Year)]

AM | Tomago Rd - WesTrack | 2020 Base
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: WesTrack Access Rd														
1	L2	18	10.0	19	10.0	0.014	17.5	LOS B	0.2	1.4	0.58	0.65	0.58	45.5
3	R2	5	10.0	5	10.0	0.034	37.9	LOS D	0.2	1.3	0.93	0.65	0.93	36.4
Approach		23	10.0	24	10.0	0.034	21.9	LOS C	0.2	1.4	0.65	0.65	0.65	43.1
East: Tomago Rd (E)														
4	L2	45	10.0	47	10.0	* 0.309	39.7	LOS D	1.6	12.3	0.96	0.74	0.96	35.6
5	T1	366	10.0	385	10.0	* 0.307	16.6	LOS B	4.7	35.4	0.74	0.61	0.74	47.3
Approach		411	10.0	433	10.0	0.309	19.1	LOS B	4.7	35.4	0.76	0.63	0.76	45.7
West: Tomago Rd (W)														
11	T1	336	10.0	354	10.0	0.149	3.3	LOS A	1.8	13.9	0.32	0.27	0.32	57.1
12	R2	106	10.0	112	10.0	* 0.212	22.1	LOS C	1.2	9.2	0.89	0.73	0.89	43.1
Approach		442	10.0	465	10.0	0.212	7.8	LOS A	1.8	13.9	0.46	0.38	0.46	53.0
All Vehicles		876	10.0	922	10.0	0.309	13.5	LOS B	4.7	35.4	0.61	0.50	0.61	49.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

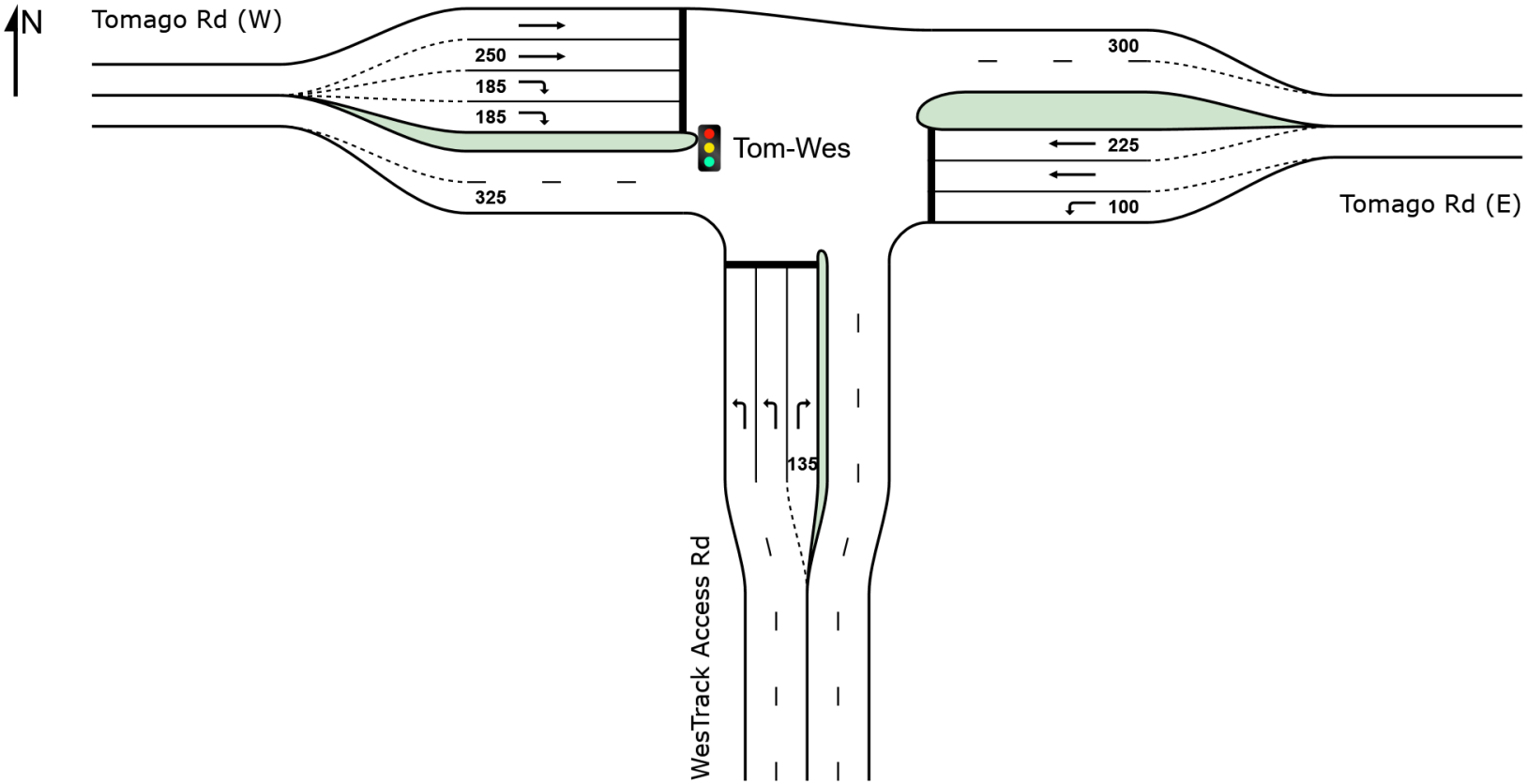
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Tom-Wes [PM | Tomago Rd - WesTrac | 2020 Base (Site Folder: 2020 Base Year)]

PM | Tomago Rd - WesTrack | 2020 Base
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Tom-Wes [PM | Tomago Rd - WesTrac | 2020 Base (Site Folder: 2020 Base Year)]

PM | Tomago Rd - WesTrack | 2020 Base
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: WesTrack Access Rd														
1	L2	158	10.0	166	10.0	0.102	13.4	LOS B	1.2	9.2	0.52	0.69	0.52	48.0
3	R2	75	10.0	79	10.0	* 0.386	33.3	LOS C	2.3	17.3	0.95	0.76	0.95	38.1
Approach		233	10.0	245	10.0	0.386	19.8	LOS B	2.3	17.3	0.66	0.71	0.66	44.3
East: Tomago Rd (E)														
4	L2	5	10.0	5	10.0	0.026	31.0	LOS C	0.1	1.1	0.89	0.65	0.89	38.8
5	T1	322	10.0	339	10.0	* 0.391	20.4	LOS C	4.2	32.1	0.86	0.71	0.86	45.1
Approach		327	10.0	344	10.0	0.391	20.6	LOS C	4.2	32.1	0.86	0.70	0.86	45.0
West: Tomago Rd (W)														
11	T1	540	10.0	568	10.0	0.262	4.8	LOS A	3.4	25.6	0.43	0.37	0.43	56.0
12	R2	17	10.0	18	10.0	* 0.029	17.1	LOS B	0.1	1.0	0.83	0.65	0.83	45.8
Approach		557	10.0	586	10.0	0.262	5.2	LOS A	3.4	25.6	0.44	0.38	0.44	55.6
All Vehicles		1117	10.0	1176	10.0	0.391	12.7	LOS B	4.2	32.1	0.61	0.54	0.61	49.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

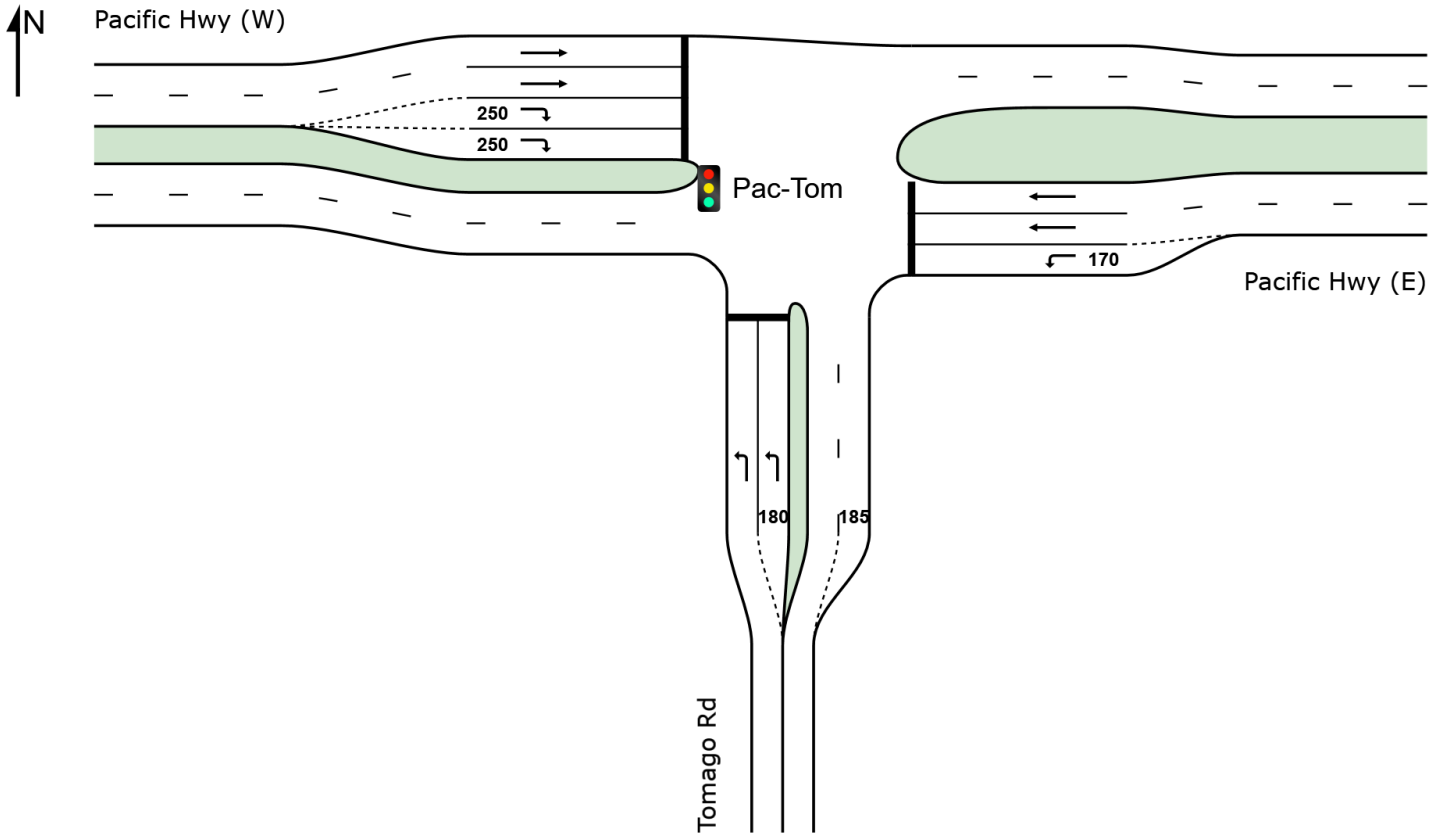
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Pac-Tom [AM | Pacific Hwy - Tomago Rd | 2020 Base (Site Folder: 2020 Base Year)]

AM | Pacific Hwy - Tomago Rd | 2020 Base
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Pac-Tom [AM | Pacific Hwy - Tomago Rd | 2020 Base (Site Folder: 2020 Base Year)]

AM | Pacific Hwy - Tomago Rd | 2020 Base
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tomago Rd														
1	L2	358	10.0	377	10.0	0.369	22.5	LOS C	4.3	32.9	0.80	0.78	0.80	42.7
Approach		358	10.0	377	10.0	0.369	22.5	LOS C	4.3	32.9	0.80	0.78	0.80	42.7
East: Pacific Hwy (E)														
4	L2	12	10.0	13	10.0	0.018	16.1	LOS B	0.2	1.5	0.56	0.65	0.56	46.9
5	T1	1169	10.0	1231	10.0	* 0.811	20.1	LOS C	18.3	139.2	0.92	0.94	1.09	45.1
Approach		1181	10.0	1243	10.0	0.811	20.1	LOS C	18.3	139.2	0.92	0.93	1.08	45.1
West: Pacific Hwy (W)														
11	T1	1181	10.0	1243	10.0	0.478	1.1	LOS A	3.1	23.3	0.35	0.23	0.35	58.4
12	R2	811	10.0	854	10.0	* 0.835	33.9	LOS C	14.2	107.9	0.99	0.98	1.28	37.9
Approach		1992	10.0	2097	10.0	0.835	14.4	LOS B	14.2	107.9	0.61	0.53	0.73	47.9
All Vehicles		3531	10.0	3717	10.0	0.835	17.2	LOS B	18.3	139.2	0.73	0.69	0.85	46.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

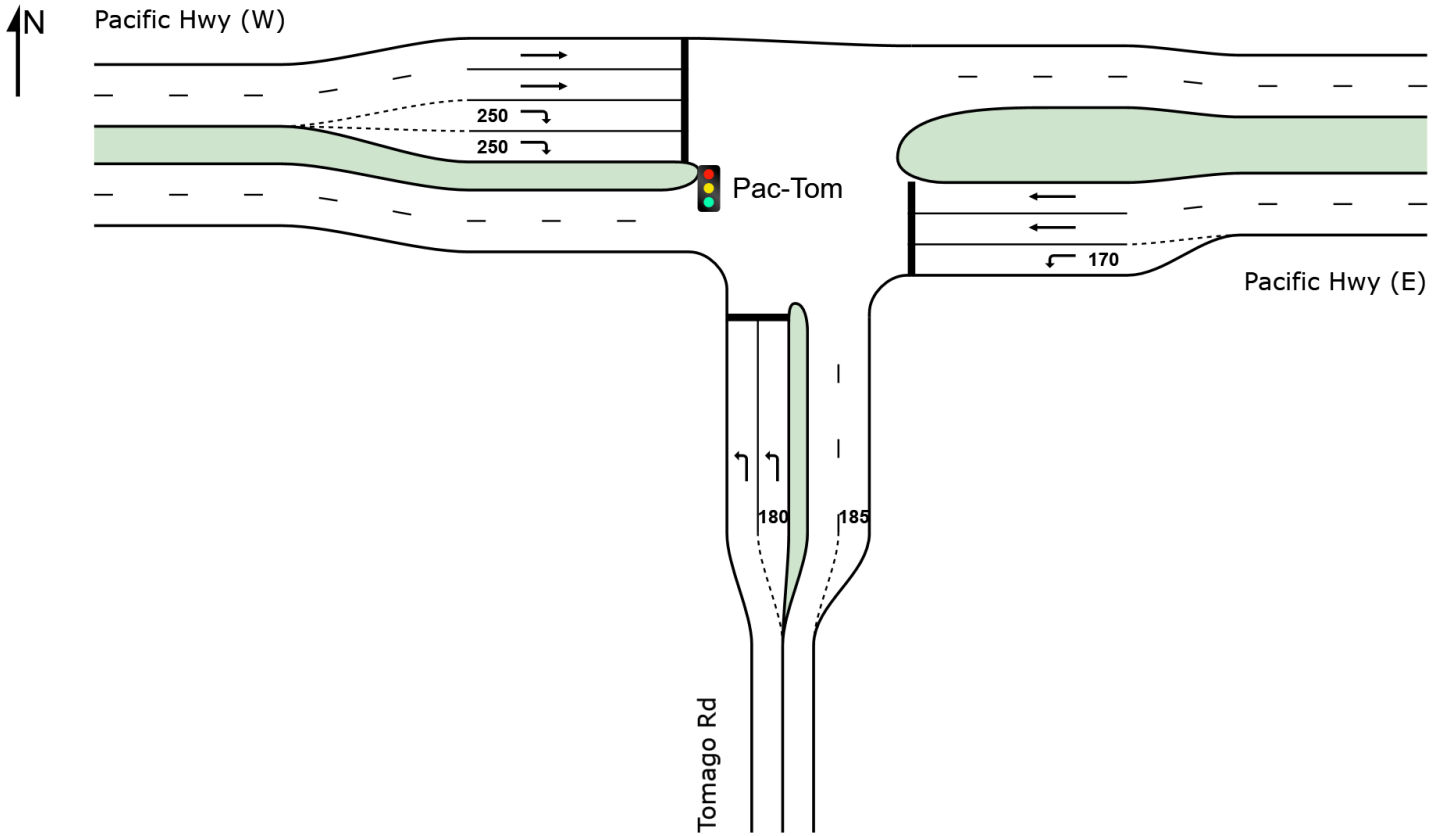
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Pac-Tom [PM | Pacific Hwy - Tomago Rd | 2020 Base (Site Folder: 2020 Base Year)]

PM | Pacific Hwy - Tomago Rd | 2020 Base
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Pac-Tom [PM | Pacific Hwy - Tomago Rd | 2020 Base (Site Folder: 2020 Base Year)]

PM | Pacific Hwy - Tomago Rd | 2020 Base
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tomago Rd														
1	L2	1153	10.0	1214	10.0	* 0.840	30.9	LOS C	22.1	167.7	0.94	0.96	1.13	38.9
Approach		1153	10.0	1214	10.0	0.840	30.9	LOS C	22.1	167.7	0.94	0.96	1.13	38.9
East: Pacific Hwy (E)														
4	L2	11	10.0	12	10.0	0.021	22.0	LOS C	0.3	1.9	0.67	0.66	0.67	43.3
5	T1	915	10.0	963	10.0	* 0.830	29.1	LOS C	17.8	135.2	0.98	1.00	1.19	40.6
Approach		926	10.0	975	10.0	0.830	29.0	LOS C	17.8	135.2	0.97	0.99	1.18	40.7
West: Pacific Hwy (W)														
11	T1	1714	10.0	1804	10.0	0.670	1.3	LOS A	6.1	46.6	0.42	0.27	0.42	58.1
12	R2	537	10.0	565	10.0	0.391	19.0	LOS B	6.3	48.2	0.69	0.77	0.69	44.7
Approach		2251	10.0	2369	10.0	0.670	5.5	LOS A	6.3	48.2	0.48	0.39	0.48	54.2
All Vehicles		4330	10.0	4558	10.0	0.840	17.3	LOS B	22.1	167.7	0.71	0.67	0.81	46.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

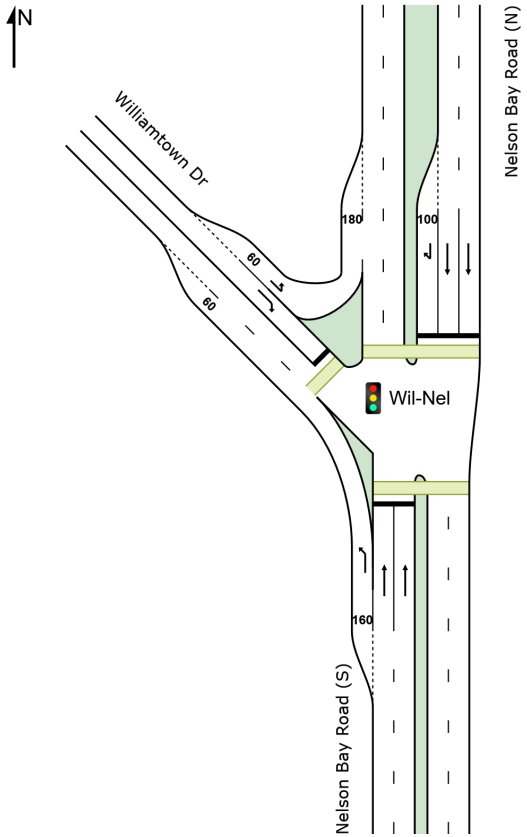
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Wil-Nel [AM | Williamtown Dr - Nelson Bay Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

AM | Williamtown Dr - Nelson Bay Rd | 2020 Base | Import
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Wil-Nel [AM | Williamtown Dr - Nelson Bay Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

AM | Williamtown Dr - Nelson Bay Rd | 2020 Base | Import
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 130 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Nelson Bay Road (S)														
1a	L1	273	10.0	287	10.0	0.182	4.9	LOS A	0.0	0.0	0.00	0.56	0.00	53.7
2	T1	1542	10.0	1623	10.0	* 0.902	38.5	LOS D	55.4	421.0	0.92	0.95	1.05	36.7
Approach		1815	10.0	1911	10.0	0.902	33.5	LOS C	55.4	421.0	0.78	0.89	0.89	38.5
North: Nelson Bay Road (N)														
8	T1	910	10.0	958	10.0	0.387	5.5	LOS A	10.0	76.4	0.37	0.33	0.37	55.0
9b	R3	88	10.0	93	10.0	* 0.741	53.1	LOS D	4.9	37.1	1.00	0.85	1.19	31.6
Approach		998	10.0	1051	10.0	0.741	9.7	LOS A	10.0	76.4	0.42	0.38	0.44	51.6
NorthWest: Williamtown Dr														
27b	L3	77	10.0	81	10.0	0.060	9.1	LOS A	0.0	0.0	0.00	0.57	0.00	54.4
29a	R1	89	10.0	94	10.0	* 0.405	60.2	LOS E	5.5	42.1	0.95	0.78	0.95	29.6
Approach		166	10.0	175	10.0	0.405	36.5	LOS D	5.5	42.1	0.51	0.68	0.51	37.8
All Vehicles		2979	10.0	3136	10.0	0.902	25.7	LOS C	55.4	421.0	0.65	0.71	0.72	42.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov	Input Vol.	Dem.	Aver.	Level of	AVERAGE BACK OF QUEUE	Prop.	Effective	Travel Time	Travel Dist.	Aver.

ID	Crossing		Flow	Delay	Service	[Ped	Dist]	Que	Stop Rate			Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Nelson Bay Road (S)												
P1	Full	50	53	59.3	LOS E	0.2	0.2	0.96	0.96	87.9	37.2	0.42
North: Nelson Bay Road (N)												
P3	Full	50	53	59.3	LOS E	0.2	0.2	0.96	0.96	93.0	43.8	0.47
NorthWest: Williamtown Dr												
P7	Full	50	53	59.3	LOS E	0.2	0.2	0.96	0.96	83.8	31.9	0.38
All Pedestrians		150	158	59.3	LOS E	0.2	0.2	0.96	0.96	88.2	37.6	0.43

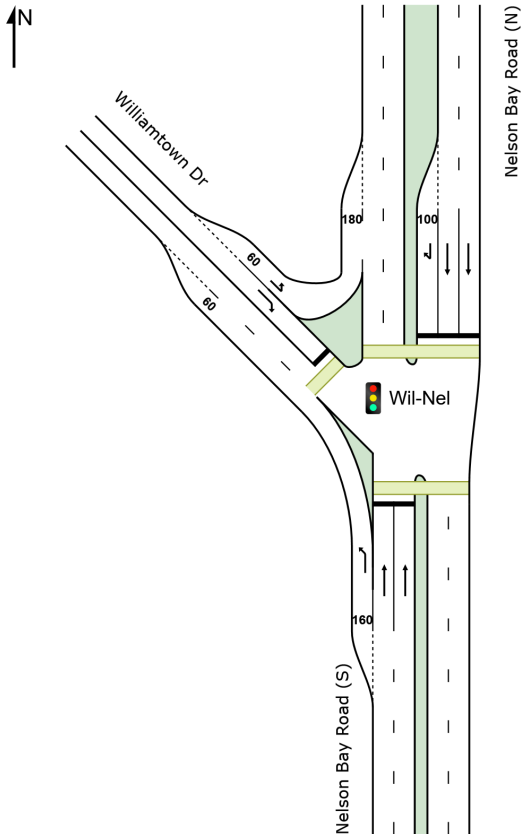
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: Wil-Nel [PM | Williamtown Dr - Nelson Bay Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

PM | Williamtown Dr - Nelson Bay Rd | 2020 Base | Import
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Wil-Nel [PM | Williamtown Dr - Nelson Bay Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

PM | Williamtown Dr - Nelson Bay Rd | 2020 Base | Import
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Nelson Bay Road (S)														
1a	L1	179	10.0	188	10.0	0.119	4.8	LOS A	0.0	0.0	0.00	0.56	0.00	53.8
2	T1	1280	10.0	1347	10.0	* 0.975	84.2	LOS F	67.4	512.0	1.00	1.18	1.33	25.1
Approach		1459	10.0	1536	10.0	0.975	74.5	LOS E	67.4	512.0	0.88	1.10	1.17	26.9
North: Nelson Bay Road (N)														
8	T1	805	10.0	847	10.0	0.435	17.1	LOS B	16.4	125.0	0.58	0.52	0.58	46.8
9b	R3	52	10.0	55	10.0	* 0.505	46.7	LOS D	2.4	18.3	1.00	0.75	1.00	33.5
Approach		857	10.0	902	10.0	0.505	18.9	LOS B	16.4	125.0	0.61	0.54	0.61	45.7
NorthWest: Williamtown Dr														
27b	L3	223	10.0	235	10.0	0.173	8.8	LOS A	0.0	0.0	0.00	0.57	0.00	54.4
29a	R1	337	10.0	355	10.0	* 0.964	94.9	LOS F	31.8	242.0	0.94	1.05	1.37	23.1
Approach		560	10.0	589	10.0	0.964	60.6	LOS E	31.8	242.0	0.56	0.86	0.82	30.2
All Vehicles		2876	10.0	3027	10.0	0.975	55.2	LOS E	67.4	512.0	0.74	0.88	0.93	31.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov	Input Vol.	Dem.	Aver.	Level of	AVERAGE BACK OF QUEUE	Prop.	Effective	Travel Time	Travel Dist.	Aver.

ID	Crossing		Flow	Delay	Service	[Ped	Dist]	Que	Stop Rate			Speed
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Nelson Bay Road (S)												
P1	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	97.9	37.2	0.38
North: Nelson Bay Road (N)												
P3	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	103.0	43.8	0.43
NorthWest: Williamtown Dr												
P7	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	93.8	31.9	0.34
All Pedestrians		150	158	69.3	LOS F	0.2	0.2	0.96	0.96	98.2	37.6	0.38

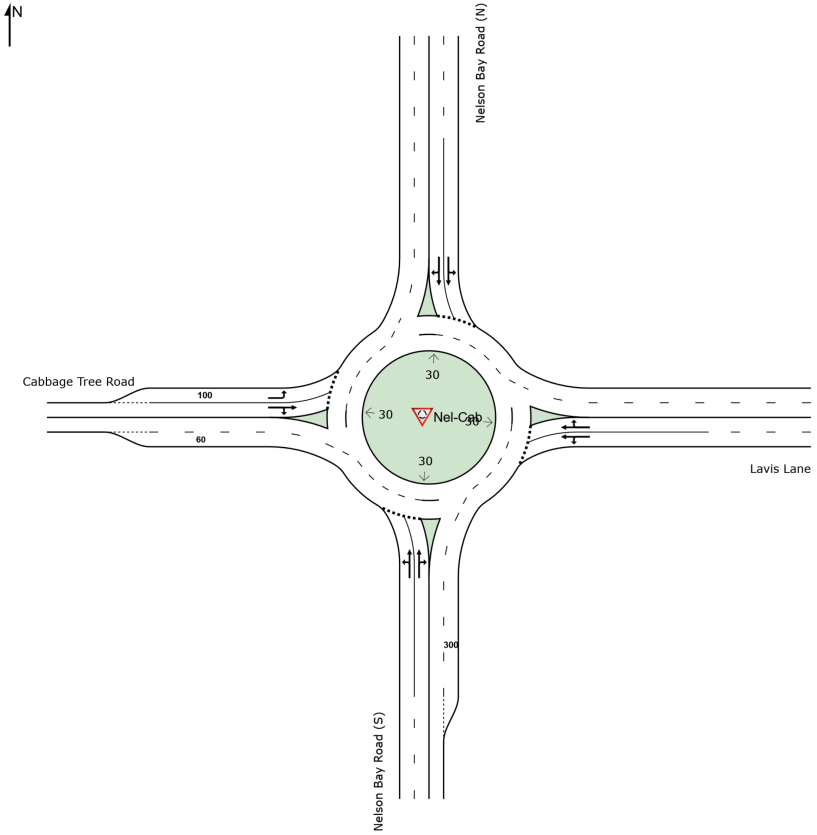
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: Nel-Cab [AM | Nelson Bay Rd - Cabbage Tree Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

AM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base | Import
Site Category: 2020 AM
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Nel-Cab [AM | Nelson Bay Rd - Cabbage Tree Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

AM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base | Import
Site Category: 2020 AM
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Nelson Bay Road (S)														
1	L2	87	10.0	92	10.0	0.823	13.4	LOS B	13.9	105.9	1.00	1.06	1.41	49.6
2	T1	1036	10.0	1091	10.0	0.823	13.2	LOS B	13.9	105.9	1.00	1.08	1.42	50.2
3	R2	369	10.0	388	10.0	0.823	20.0	LOS B	13.4	101.8	1.00	1.12	1.46	48.4
Approach		1492	10.0	1571	10.0	0.823	14.9	LOS B	13.9	105.9	1.00	1.09	1.43	49.7
East: Lavis Lane														
4	L2	723	10.0	761	10.0	1.084	106.7	LOS F	54.2	411.9	1.00	3.26	7.16	22.5
5	T1	224	10.0	236	10.0	0.633	13.5	LOS B	4.4	33.1	0.88	1.04	1.21	49.8
6	R2	65	10.0	68	10.0	0.633	19.2	LOS B	4.4	33.1	0.88	1.04	1.21	50.0
Approach		1012	10.0	1065	10.0	1.084	80.5	LOS F	54.2	411.9	0.97	2.63	5.46	26.8
North: Nelson Bay Road (N)														
7	L2	47	10.0	49	10.0	0.565	8.7	LOS A	5.3	40.3	0.86	0.88	0.98	52.0
8	T1	738	10.0	777	10.0	0.565	12.4	LOS B	5.3	40.3	0.86	0.90	1.00	53.2
9	R2	92	10.0	97	10.0	0.565	15.4	LOS B	5.1	38.5	0.86	0.93	1.01	52.6
Approach		877	10.0	923	10.0	0.565	12.5	LOS B	5.3	40.3	0.86	0.90	1.00	53.0
West: Cabbage Tree Road														
10	L2	430	10.0	453	10.0	1.021	72.2	LOS F	23.0	174.6	1.00	2.05	4.08	27.4
11	T1	27	10.0	28	10.0	0.477	15.3	LOS B	2.7	20.2	0.90	1.01	1.07	46.9
12	R2	105	10.0	111	10.0	0.477	21.0	LOS C	2.7	20.2	0.90	1.01	1.07	47.0
Approach		562	10.0	592	10.0	1.021	59.9	LOS E	23.0	174.6	0.98	1.81	3.37	30.5
All Vehicles		3943	10.0	4151	10.0	1.084	37.6	LOS D	54.2	411.9	0.96	1.54	2.65	38.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.

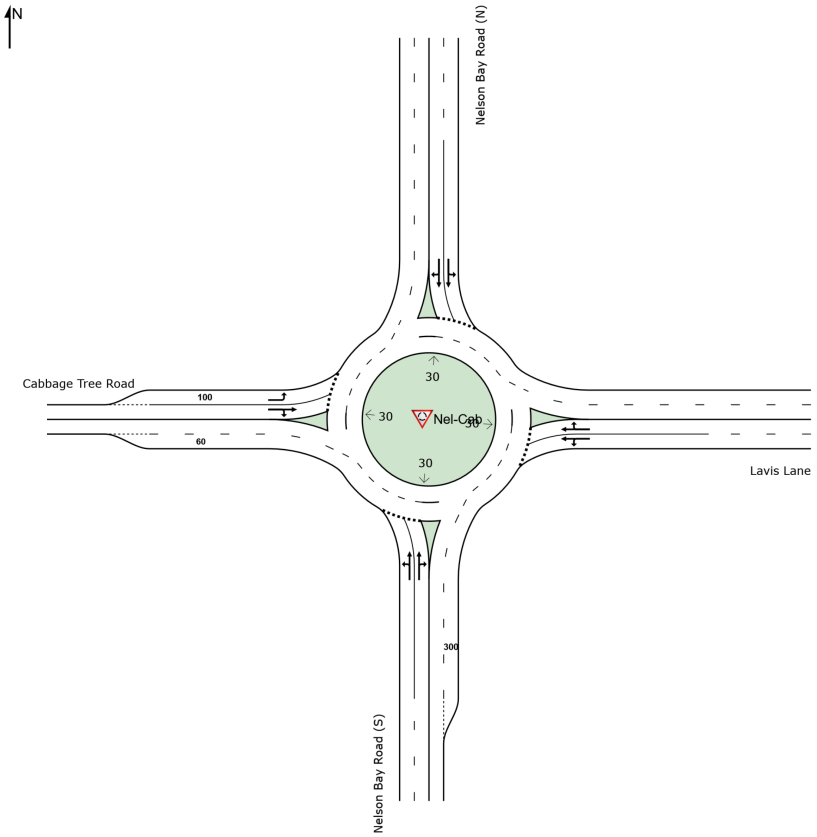
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: Nel-Cab [PM | Nelson Bay Rd - Cabbage Tree Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

PM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base | Import
Site Category: 2020 PM
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Nel-Cab [PM | Nelson Bay Rd - Cabbage Tree Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

PM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base | Import
Site Category: 2020 PM
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Nelson Bay Road (S)														
1	L2	67	10.0	71	10.0	0.687	8.5	LOS A	8.0	60.6	0.83	0.80	0.95	52.2
2	T1	790	10.0	832	10.0	0.687	8.1	LOS A	8.0	60.6	0.83	0.81	0.96	53.3
3	R2	473	10.0	498	10.0	0.687	14.5	LOS B	7.8	59.5	0.84	0.88	1.00	51.1
Approach		1330	10.0	1400	10.0	0.687	10.4	LOS B	8.0	60.6	0.84	0.84	0.97	52.4
East: Lavis Lane														
4	L2	477	10.0	502	10.0	0.914	32.8	LOS C	12.1	92.2	1.00	1.45	2.27	41.0
5	T1	80	10.0	84	10.0	0.325	11.1	LOS B	1.6	12.5	0.84	0.93	0.89	51.4
6	R2	24	10.0	25	10.0	0.325	16.8	LOS B	1.6	12.5	0.84	0.93	0.89	51.6
Approach		581	10.0	612	10.0	0.914	29.2	LOS C	12.1	92.2	0.97	1.35	2.02	42.6
North: Nelson Bay Road (N)														
7	L2	83	10.0	87	10.0	0.864	24.1	LOS C	16.5	125.5	1.00	1.41	2.00	43.1
8	T1	856	10.0	901	10.0	0.864	28.2	LOS C	16.5	125.5	1.00	1.42	2.02	43.4
9	R2	215	10.0	226	10.0	0.864	32.6	LOS C	15.0	113.8	1.00	1.42	2.05	42.0
Approach		1154	10.0	1215	10.0	0.864	28.7	LOS C	16.5	125.5	1.00	1.42	2.02	43.1
West: Cabbage Tree Road														
10	L2	449	10.0	473	10.0	0.849	20.1	LOS C	8.8	66.7	0.99	1.28	1.82	44.9
11	T1	51	10.0	54	10.0	0.490	12.9	LOS B	2.8	21.0	0.87	1.01	1.06	48.6
12	R2	122	10.0	128	10.0	0.490	18.6	LOS B	2.8	21.0	0.87	1.01	1.06	48.7
Approach		622	10.0	655	10.0	0.849	19.2	LOS B	8.8	66.7	0.96	1.21	1.61	46.0
All Vehicles		3687	10.0	3881	10.0	0.914	20.6	LOS C	16.5	125.5	0.93	1.16	1.58	46.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.

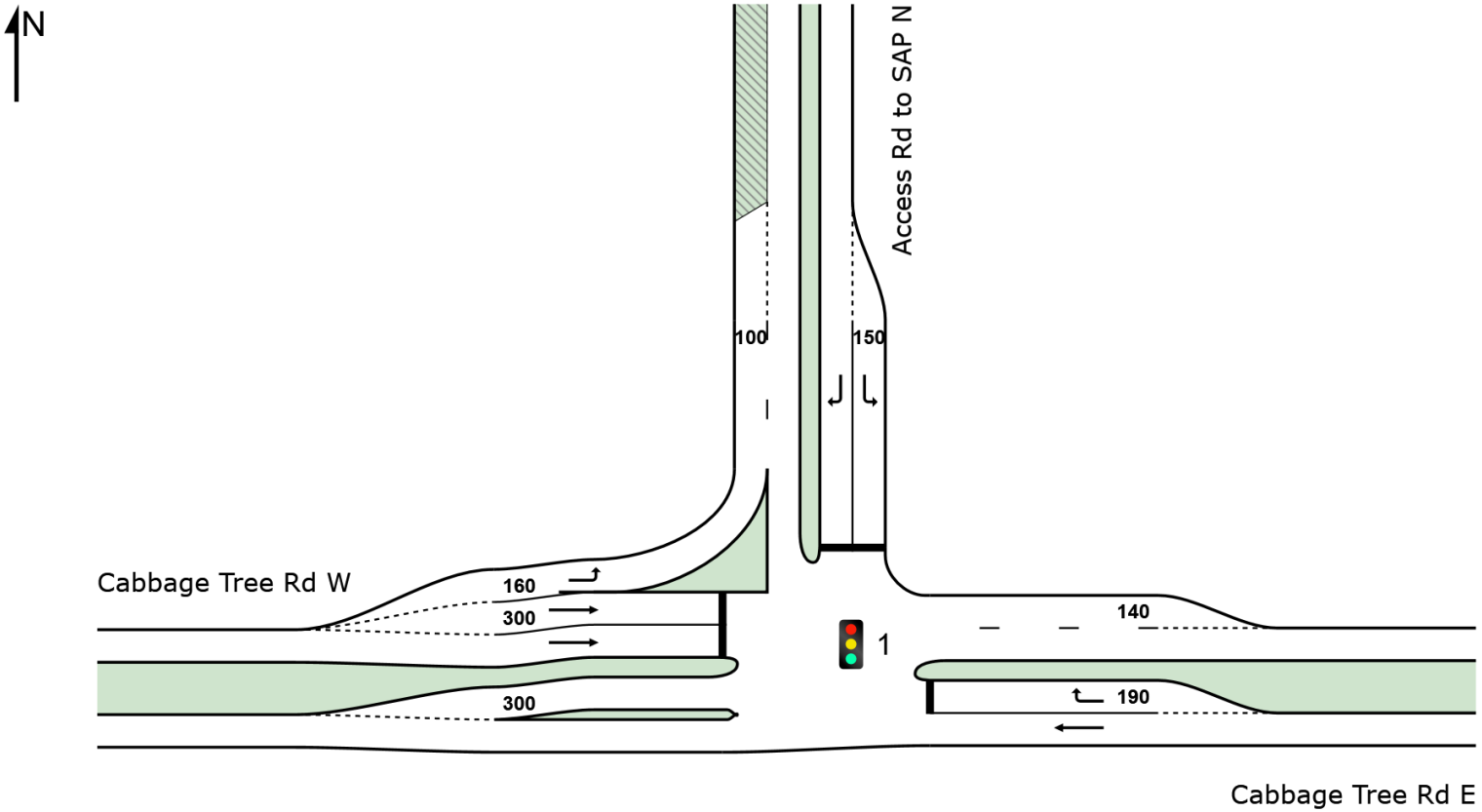
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 1 [AM | Cabbage Tree Rd - SAP Access Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

Three-way intersection with "Seagull" treatment (Signals)
Site Category: Proposed Design 1
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 1 [AM | Cabbage Tree Rd - SAP Access Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

Three-way intersection with "Seagull" treatment (Signals)
Site Category: Proposed Design 1
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Cabbage Tree Rd E														
5	T1	443	10.0	466	10.0	0.287	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
6	R2	78	10.0	82	10.0	* 0.120	8.5	LOS A	0.8	5.9	0.32	0.65	0.32	51.1
Approach		521	10.0	548	10.0	0.287	1.4	LOS A	0.8	5.9	0.05	0.10	0.05	58.3
North: Access Rd to SAP N														
1	L2	33	10.0	35	10.0	0.082	41.0	LOS D	1.5	11.4	0.77	0.71	0.77	35.4
2	R2	24	10.0	25	10.0	* 0.330	70.8	LOS E	1.5	11.8	1.00	0.72	1.00	27.6
Approach		57	10.0	60	10.0	0.330	53.5	LOS D	1.5	11.8	0.87	0.72	0.87	31.6
West: Cabbage Tree Rd W														
3	L2	56	10.0	59	10.0	0.038	5.9	LOS A	0.0	0.0	0.00	0.52	0.00	54.6
4	T1	520	10.0	547	10.0	* 0.306	11.1	LOS B	8.3	63.1	0.48	0.42	0.48	51.0
Approach		576	10.0	606	10.0	0.306	10.6	LOS B	8.3	63.1	0.44	0.43	0.44	51.3
All Vehicles		1154	10.0	1215	10.0	0.330	8.5	LOS A	8.3	63.1	0.28	0.29	0.28	52.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

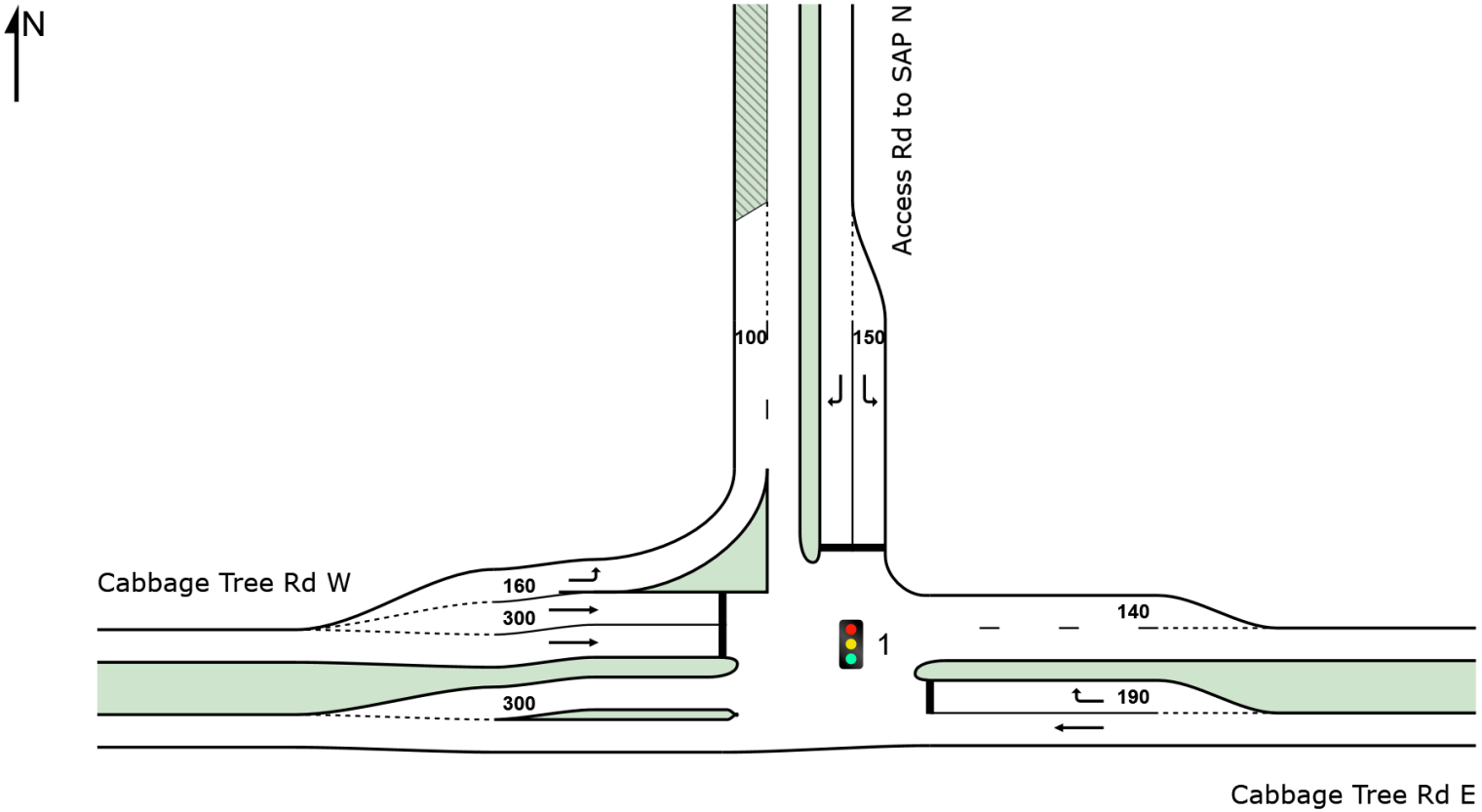
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: 1 [PM | Cabbage Tree Rd - SAP Access Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

Three-way intersection with "Seagull" treatment (Signals)
Site Category: Proposed Design 1
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 1 [PM | Cabbage Tree Rd - SAP Access Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

Three-way intersection with "Seagull" treatment (Signals)
Site Category: Proposed Design 1
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Cabbage Tree Rd E														
5	T1	463	10.0	487	10.0	0.300	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
6	R2	33	10.0	35	10.0	* 0.077	10.6	LOS B	0.5	3.7	0.40	0.65	0.40	49.6
Approach		496	10.0	522	10.0	0.300	0.8	LOS A	0.5	3.7	0.03	0.04	0.03	59.0
North: Access Rd to SAP N														
1	L2	78	10.0	82	10.0	0.247	49.1	LOS D	4.0	30.6	0.87	0.76	0.87	32.9
2	R2	56	10.0	59	10.0	* 0.330	61.2	LOS E	3.3	25.0	0.96	0.76	0.96	29.8
Approach		134	10.0	141	10.0	0.330	54.1	LOS D	4.0	30.6	0.91	0.76	0.91	31.5
West: Cabbage Tree Rd W														
3	L2	24	10.0	25	10.0	0.016	5.8	LOS A	0.0	0.0	0.00	0.52	0.00	54.6
4	T1	659	10.0	694	10.0	* 0.355	8.6	LOS A	9.5	71.9	0.44	0.38	0.44	52.9
Approach		683	10.0	719	10.0	0.355	8.5	LOS A	9.5	71.9	0.42	0.39	0.42	53.0
All Vehicles		1313	10.0	1382	10.0	0.355	10.2	LOS B	9.5	71.9	0.32	0.30	0.32	51.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

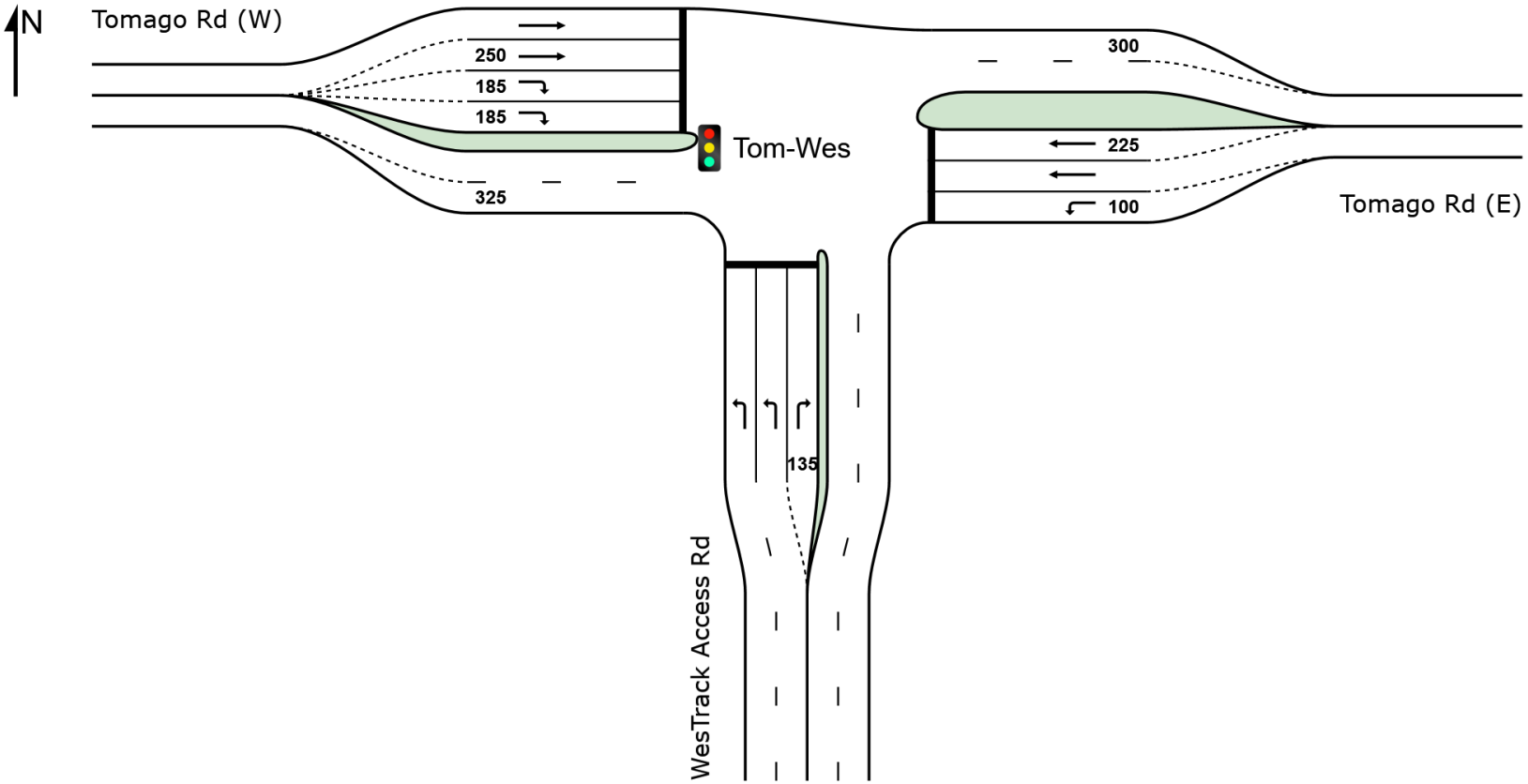
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Tom-Wes [AM | Tomago Rd - WesTrac | 2036 No SAP (Site Folder: 2036 No SAP)]

AM | Tomago Rd - WesTrack | 2020 Base
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Tom-Wes [AM | Tomago Rd - WesTrac | 2036 No SAP (Site Folder: 2036 No SAP)]

AM | Tomago Rd - WesTrack | 2020 Base
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: WesTrack Access Rd														
1	L2	23	10.0	24	10.0	0.020	23.3	LOS C	0.3	2.4	0.63	0.66	0.63	42.5
3	R2	6	10.0	6	10.0	0.034	44.2	LOS D	0.3	1.9	0.91	0.66	0.91	34.2
Approach		29	10.0	31	10.0	0.034	27.6	LOS C	0.3	2.4	0.68	0.66	0.68	40.5
East: Tomago Rd (E)														
4	L2	57	10.0	60	10.0	* 0.320	46.6	LOS D	2.5	19.3	0.95	0.76	0.95	33.4
5	T1	464	10.0	488	10.0	* 0.322	16.5	LOS B	6.7	51.1	0.67	0.57	0.67	47.4
Approach		521	10.0	548	10.0	0.322	19.8	LOS B	6.7	51.1	0.70	0.59	0.70	45.3
West: Tomago Rd (W)														
11	T1	426	10.0	448	10.0	0.185	3.8	LOS A	2.9	21.8	0.32	0.27	0.32	56.7
12	R2	135	10.0	142	10.0	* 0.321	29.2	LOS C	2.1	16.2	0.93	0.75	0.93	39.8
Approach		561	10.0	591	10.0	0.321	10.0	LOS A	2.9	21.8	0.46	0.39	0.46	51.4
All Vehicles		1111	10.0	1169	10.0	0.322	15.0	LOS B	6.7	51.1	0.58	0.49	0.58	48.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

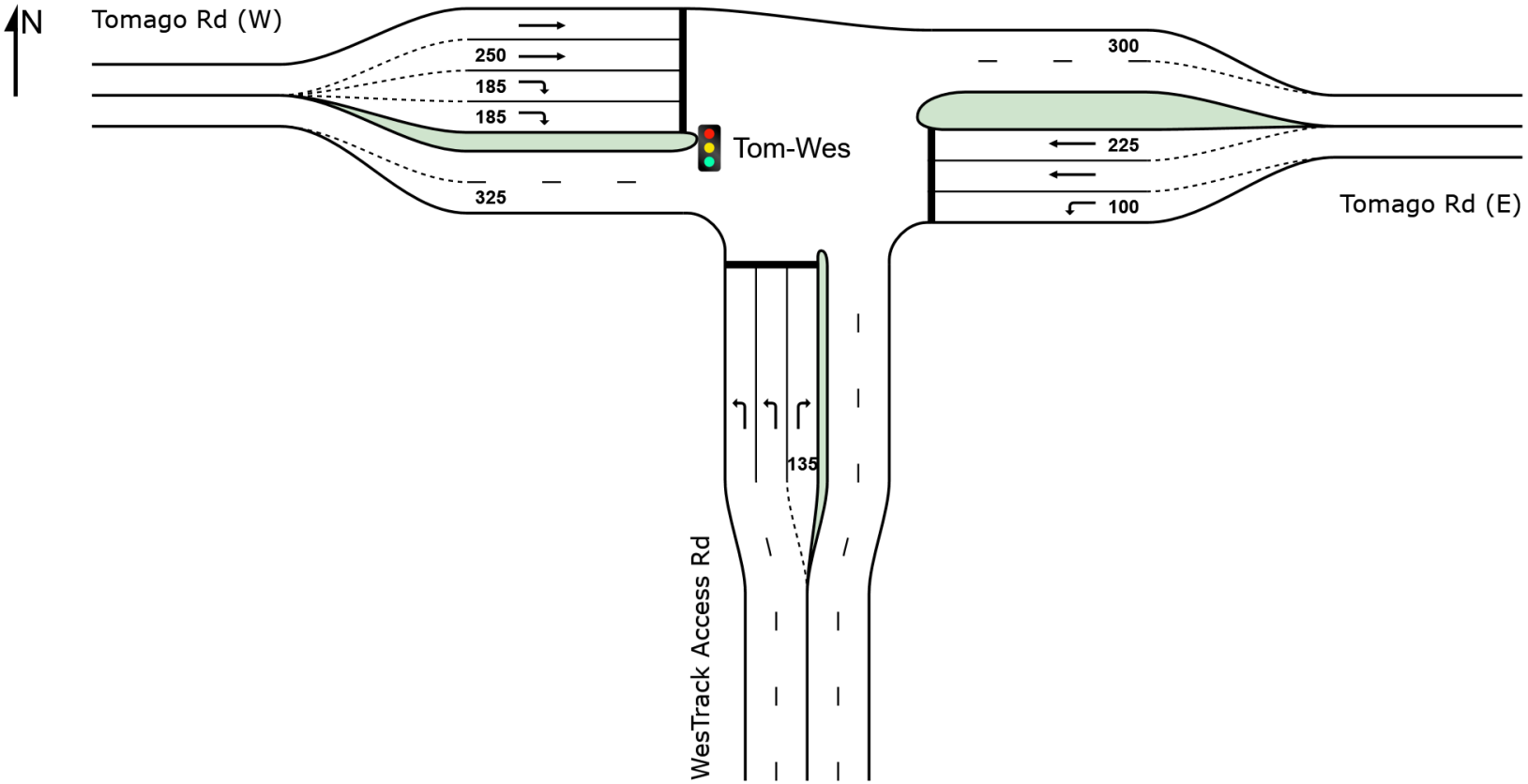
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Tom-Wes [PM | Tomago Rd - WesTrac | 2036 No SAP (Site Folder: 2036 No SAP)]

PM | Tomago Rd - WesTrack | 2020 Base
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Tom-Wes [PM | Tomago Rd - WesTrac | 2036 No SAP (Site Folder: 2036 No SAP)]

PM | Tomago Rd - WesTrack | 2020 Base
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: WesTrack Access Rd														
1	L2	200	10.0	211	10.0	0.153	23.4	LOS C	3.0	22.9	0.62	0.72	0.62	42.5
3	R2	95	10.0	100	10.0	* 0.326	43.5	LOS D	4.3	32.6	0.90	0.77	0.90	34.5
Approach		295	10.0	311	10.0	0.326	29.9	LOS C	4.3	32.6	0.71	0.74	0.71	39.5
East: Tomago Rd (E)														
4	L2	6	10.0	6	10.0	0.021	40.3	LOS D	0.2	1.9	0.83	0.66	0.83	35.4
5	T1	409	10.0	431	10.0	* 0.308	20.5	LOS C	6.9	52.3	0.70	0.59	0.70	45.2
Approach		415	10.0	437	10.0	0.308	20.8	LOS C	6.9	52.3	0.70	0.59	0.70	45.0
West: Tomago Rd (W)														
11	T1	685	10.0	721	10.0	0.326	7.6	LOS A	7.1	54.3	0.44	0.39	0.44	53.8
12	R2	22	10.0	23	10.0	* 0.058	29.2	LOS C	0.3	2.6	0.90	0.67	0.90	39.8
Approach		707	10.0	744	10.0	0.326	8.3	LOS A	7.1	54.3	0.46	0.40	0.46	53.3
All Vehicles		1417	10.0	1492	10.0	0.326	16.4	LOS B	7.1	54.3	0.58	0.53	0.58	47.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

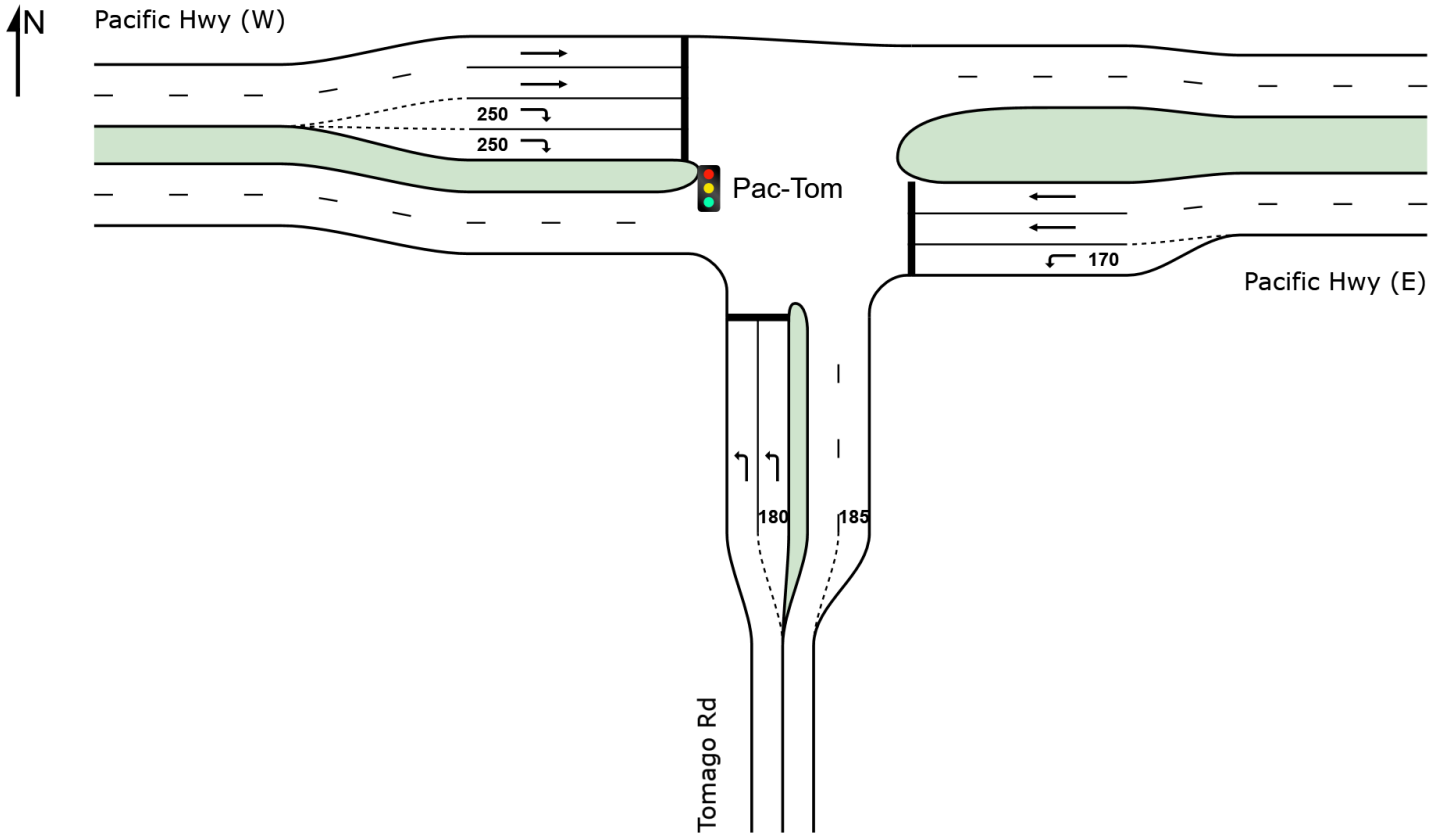
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Pac-Tom [AM | Pacific Hwy - Tomago Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

AM | Pacific Hwy - Tomago Rd | 2020 Base
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Pac-Tom [AM | Pacific Hwy - Tomago Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

AM | Pacific Hwy - Tomago Rd | 2020 Base
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 130 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tomago Rd														
1	L2	454	10.0	478	10.0	0.405	36.9	LOS D	11.0	83.6	0.78	0.79	0.78	36.6
Approach		454	10.0	478	10.0	0.405	36.9	LOS D	11.0	83.6	0.78	0.79	0.78	36.6
East: Pacific Hwy (E)														
4	L2	15	10.0	16	10.0	0.020	23.5	LOS C	0.5	3.6	0.50	0.65	0.50	43.3
5	T1	1483	10.0	1561	10.0	* 0.920	48.7	LOS D	55.9	424.5	1.00	1.06	1.17	33.4
Approach		1498	10.0	1577	10.0	0.920	48.4	LOS D	55.9	424.5	0.99	1.05	1.16	33.4
West: Pacific Hwy (W)														
11	T1	1499	10.0	1578	10.0	0.535	0.6	LOS A	4.5	34.2	0.19	0.12	0.19	59.1
12	R2	1029	10.0	1083	10.0	* 0.919	68.2	LOS E	40.6	308.7	1.00	1.00	1.25	28.1
Approach		2528	10.0	2661	10.0	0.919	28.1	LOS C	40.6	308.7	0.52	0.48	0.62	40.8
All Vehicles		4480	10.0	4716	10.0	0.920	35.8	LOS D	55.9	424.5	0.70	0.70	0.82	37.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

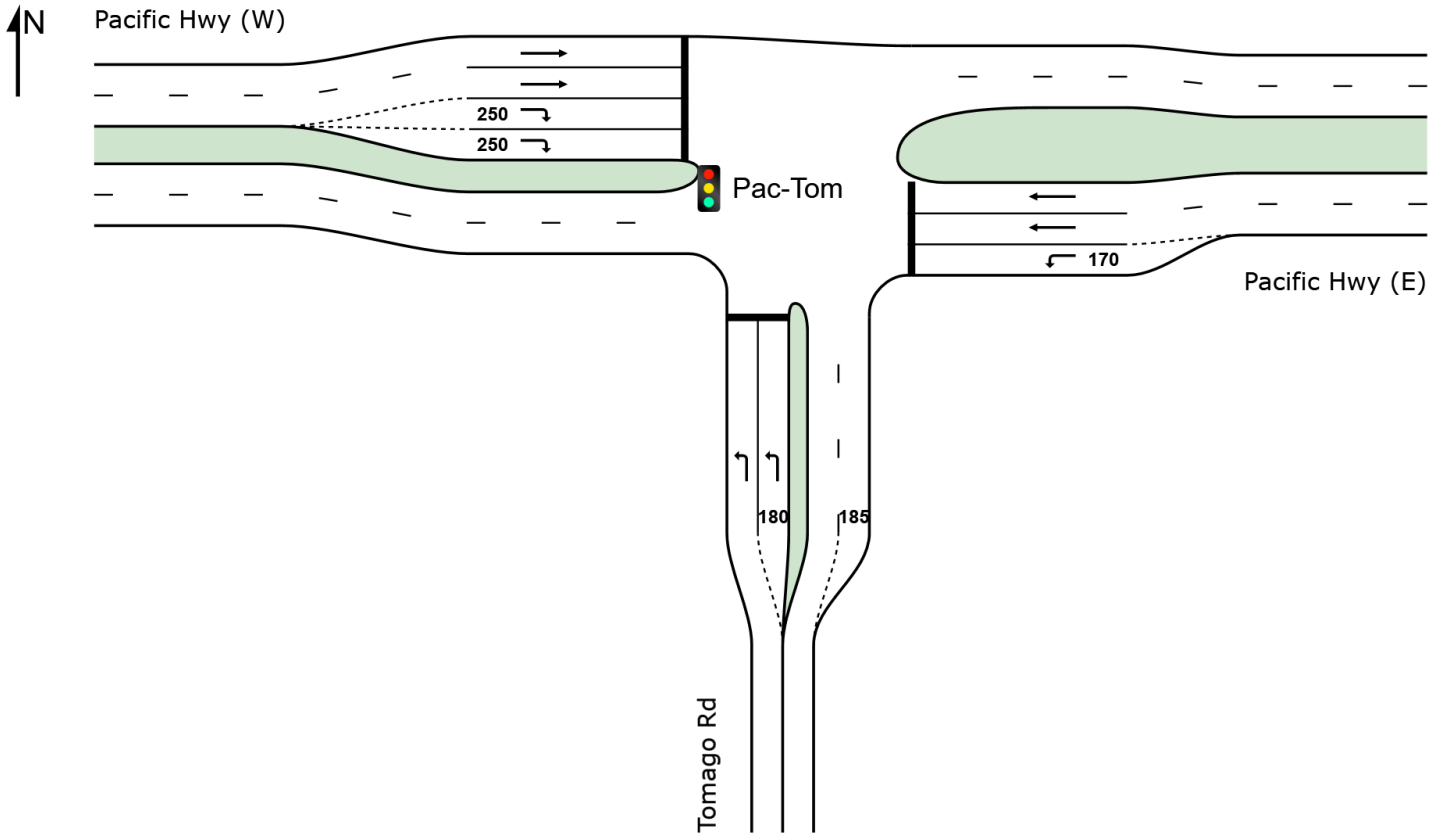
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Pac-Tom [PM | Pacific Hwy - Tomago Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

PM | Pacific Hwy - Tomago Rd | 2020 Base
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Pac-Tom [PM | Pacific Hwy - Tomago Rd | 2036 No SAP (Site Folder: 2036 No SAP)]

PM | Pacific Hwy - Tomago Rd | 2020 Base
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tomago Rd														
1	L2	1463	10.0	1540	10.0	* 0.987	82.3	LOS F	62.8	477.2	1.00	1.12	1.48	25.2
Approach		1463	10.0	1540	10.0	0.987	82.3	LOS F	62.8	477.2	1.00	1.12	1.48	25.2
East: Pacific Hwy (E)														
4	L2	14	10.0	15	10.0	0.025	29.0	LOS C	0.5	3.7	0.65	0.67	0.65	40.1
5	T1	1161	10.0	1222	10.0	* 0.985	81.1	LOS F	48.8	370.5	1.00	1.32	1.52	25.8
Approach		1175	10.0	1237	10.0	0.985	80.4	LOS F	48.8	370.5	1.00	1.31	1.51	25.9
West: Pacific Hwy (W)														
11	T1	2175	10.0	2289	10.0	0.791	1.2	LOS A	11.5	87.2	0.40	0.25	0.40	58.2
12	R2	681	10.0	717	10.0	0.459	24.6	LOS C	12.3	93.2	0.69	0.78	0.69	41.9
Approach		2856	10.0	3006	10.0	0.791	6.8	LOS A	12.3	93.2	0.47	0.38	0.47	53.2
All Vehicles		5494	10.0	5783	10.0	0.987	42.6	LOS D	62.8	477.2	0.72	0.77	0.96	34.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

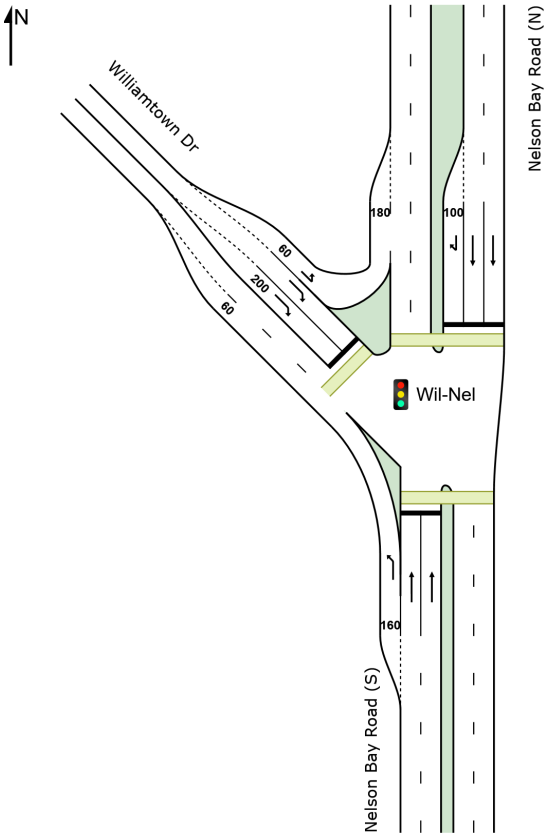
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Wil-Nel [AM | Williamtown Dr - Nelson Bay Rd | 2036 With SAP (Site Folder: 2036 With SAP)]

AM | Williamtown Dr - Nelson Bay Rd | 2020 Base | Import
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Wil-Nel [AM | Williamtown Dr - Nelson Bay Rd | 2036 With SAP (Site Folder: 2036 With SAP)]

AM | Williamtown Dr - Nelson Bay Rd | 2020 Base | Import
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Nelson Bay Road (S)														
1a	L1	510	10.0	537	10.0	0.339	5.0	LOS A	0.0	0.0	0.00	0.53	0.00	54.0
2	T1	1555	10.0	1637	10.0	* 0.937	50.4	LOS D	74.2	564.2	0.90	0.98	1.07	32.8
Approach		2065	10.0	2174	10.0	0.937	39.2	LOS D	74.2	564.2	0.68	0.87	0.81	36.3
North: Nelson Bay Road (N)														
8	T1	944	10.0	994	10.0	0.389	5.2	LOS A	10.9	82.7	0.33	0.30	0.33	55.3
9b	R3	122	10.0	128	10.0	* 0.889	70.2	LOS E	8.6	65.6	1.00	0.97	1.39	27.7
Approach		1066	10.0	1122	10.0	0.889	12.6	LOS B	10.9	82.7	0.41	0.38	0.45	49.6
NorthWest: Williamtown Dr														
27b	L3	92	10.0	97	10.0	0.072	8.9	LOS A	0.0	0.0	0.00	0.57	0.00	54.4
29a	R1	191	10.0	201	10.0	* 0.477	70.9	LOS E	7.0	53.0	0.97	0.79	0.97	27.3
Approach		283	10.0	298	10.0	0.477	50.8	LOS D	7.0	53.0	0.66	0.72	0.66	32.7
All Vehicles		3414	10.0	3594	10.0	0.937	31.9	LOS C	74.2	564.2	0.59	0.70	0.69	39.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Nelson Bay Road (S)												
P1	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	97.9	37.2	0.38
North: Nelson Bay Road (N)												
P3	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	103.0	43.8	0.43
NorthWest: Williamtown Dr												
P7	Full	50	53	69.3	LOS F	0.2	0.2	0.96	0.96	96.3	35.2	0.37
All Pedestrians		150	158	69.3	LOS F	0.2	0.2	0.96	0.96	99.1	38.7	0.39

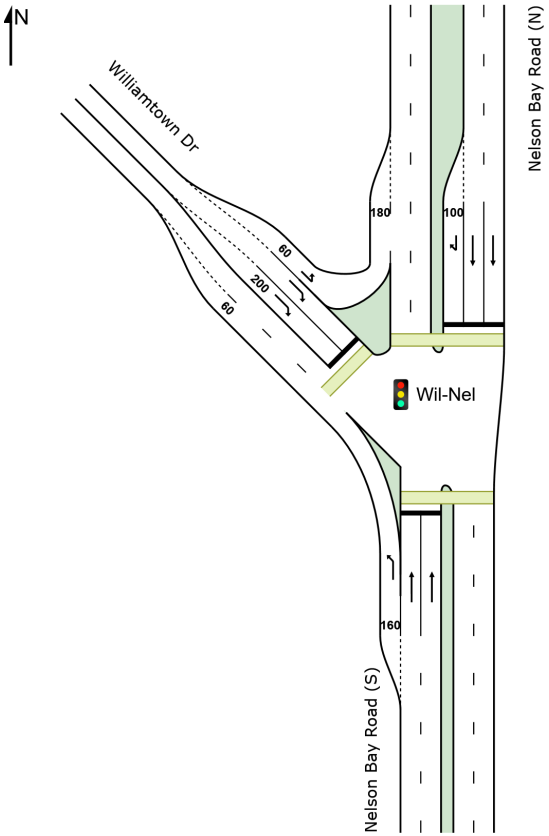
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: Wil-Nel [PM | Williamtown Dr - Nelson Bay Rd | 2036 With SAP (Site Folder: 2036 With SAP)]

PM | Williamtown Dr - Nelson Bay Rd | 2020 Base | Import
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Wil-Nel [PM | Williamtown Dr - Nelson Bay Rd | 2036 With SAP (Site Folder: 2036 With SAP)]

PM | Williamtown Dr - Nelson Bay Rd | 2020 Base | Import
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Nelson Bay Road (S)														
1a	L1	281	10.0	296	10.0	0.187	4.8	LOS A	0.0	0.0	0.00	0.54	0.00	54.1
2	T1	1314	10.0	1383	10.0	* 0.895	46.3	LOS D	50.9	387.0	0.96	0.98	1.08	34.1
Approach		1595	10.0	1679	10.0	0.895	39.0	LOS D	50.9	387.0	0.79	0.90	0.89	36.5
North: Nelson Bay Road (N)														
8	T1	820	10.0	863	10.0	0.400	11.3	LOS B	13.2	100.3	0.49	0.44	0.49	50.6
9b	R3	67	10.0	71	10.0	* 0.608	46.7	LOS D	3.3	25.1	1.00	0.78	1.05	33.6
Approach		887	10.0	934	10.0	0.608	14.0	LOS B	13.2	100.3	0.53	0.47	0.53	48.7
NorthWest: Williamtown Dr														
27b	L3	257	10.0	271	10.0	0.200	9.0	LOS A	0.0	0.0	0.00	0.57	0.00	54.4
29a	R1	574	10.0	604	10.0	* 0.883	71.9	LOS E	26.4	200.9	0.98	0.97	1.23	27.1
Approach		831	10.0	875	10.0	0.883	52.5	LOS D	26.4	200.9	0.68	0.84	0.85	32.2
All Vehicles		3313	10.0	3487	10.0	0.895	35.7	LOS D	50.9	387.0	0.69	0.77	0.79	37.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Nelson Bay Road (S)												
P1	Full	50	53	64.3	LOS F	0.2	0.2	0.96	0.96	92.9	37.2	0.40
North: Nelson Bay Road (N)												
P3	Full	50	53	64.3	LOS F	0.2	0.2	0.96	0.96	98.0	43.8	0.45
NorthWest: Williamtown Dr												
P7	Full	50	53	64.3	LOS F	0.2	0.2	0.96	0.96	91.3	35.2	0.39
All Pedestrians		150	158	64.3	LOS F	0.2	0.2	0.96	0.96	94.1	38.7	0.41

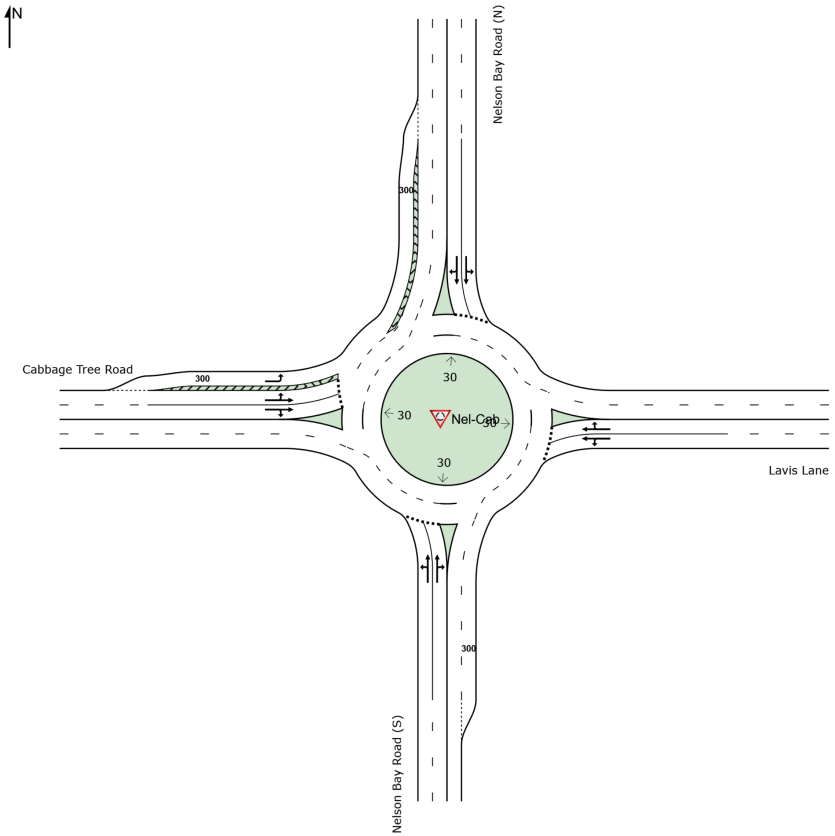
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: Nel-Cab [AM | Nelson Bay Rd - Cabbage Tree Rd | 2036 With SAP (Site Folder: 2036 With SAP)]

AM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base | Import
Site Category: 2020 AM
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Nel-Cab [AM | Nelson Bay Rd - Cabbage Tree Rd | 2036 With SAP (Site Folder: 2036 With SAP)]

AM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base | Import
Site Category: 2020 AM
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Nelson Bay Road (S)														
1	L2	290	10.0	305	10.0	1.146	153.7	LOS F	108.6	825.3	1.00	4.29	8.47	17.2
2	T1	1171	10.0	1233	10.0	1.146	160.7	LOS F	108.6	825.3	1.00	4.19	8.34	17.3
3	R2	369	10.0	388	10.0	1.146	162.0	LOS F	93.9	713.9	1.00	4.04	8.16	17.2
Approach		1830	10.0	1926	10.0	1.146	159.8	LOS F	108.6	825.3	1.00	4.18	8.32	17.3
East: Lavis Lane														
4	L2	723	10.0	761	10.0	1.321	312.2	LOS F	127.9	972.2	1.00	6.04	15.29	10.0
5	T1	224	10.0	236	10.0	0.781	21.8	LOS C	6.2	47.0	0.94	1.18	1.60	44.9
6	R2	65	10.0	68	10.0	0.781	27.5	LOS C	6.2	47.0	0.94	1.18	1.60	45.0
Approach		1012	10.0	1065	10.0	1.321	229.6	LOS F	127.9	972.2	0.98	4.65	11.38	12.9
North: Nelson Bay Road (N)														
7	L2	47	10.0	49	10.0	0.679	10.2	LOS B	7.2	54.5	0.89	0.99	1.15	51.3
8	T1	796	10.0	838	10.0	0.679	15.2	LOS B	7.2	54.5	0.89	1.01	1.16	52.0
9	R2	227	10.0	239	10.0	0.679	17.2	LOS B	6.8	51.7	0.89	1.06	1.19	50.4
Approach		1070	10.0	1126	10.0	0.679	15.4	LOS B	7.2	54.5	0.89	1.02	1.17	51.7
West: Cabbage Tree Road														
10	L2	565	10.0	595	10.0	0.309	13.0	LOS B	1.9	14.4	0.19	0.54	0.19	55.0
11	T1	27	10.0	28	10.0	0.309	9.5	LOS A	1.9	14.4	0.92	0.95	0.92	53.2
12	R2	192	10.0	202	10.0	0.466	17.7	LOS B	3.0	22.9	0.93	1.03	1.08	48.3
Approach		784	10.0	825	10.0	0.466	14.0	LOS B	3.0	22.9	0.40	0.68	0.43	53.0
All Vehicles		4696	10.0	4943	10.0	1.321	117.6	LOS F	127.9	972.2	0.87	2.98	6.03	21.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.

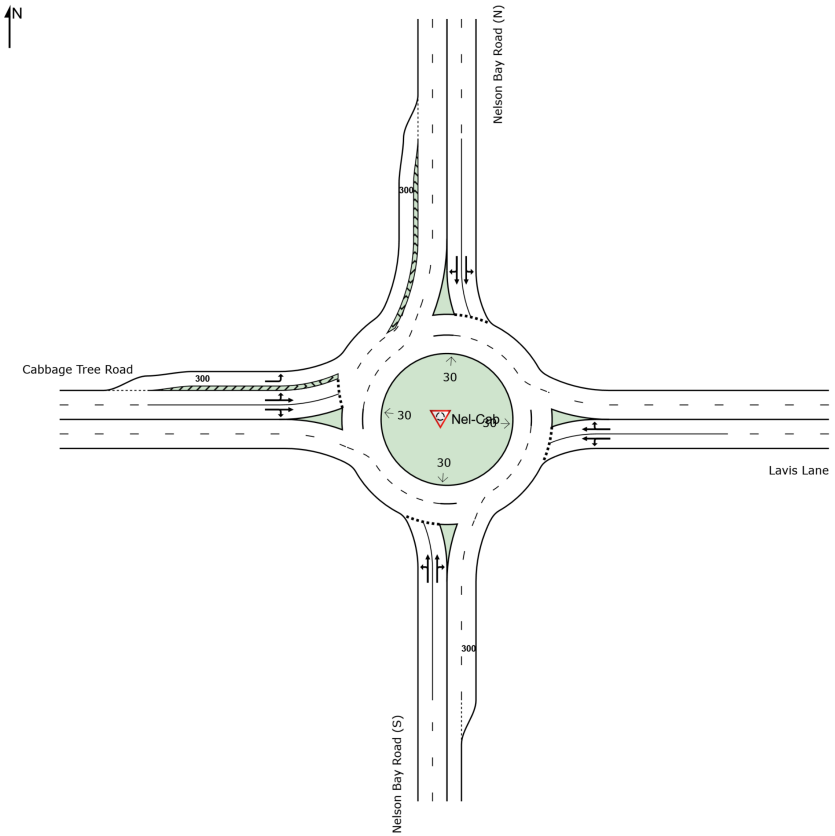
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: Nel-Cab [PM | Nelson Bay Rd - Cabbage Tree Rd | 2036 With SAP (Site Folder: 2036 With SAP)]

PM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base | Import
Site Category: 2020 PM
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Nel-Cab [PM | Nelson Bay Rd - Cabbage Tree Rd | 2036 With SAP (Site Folder: 2036 With SAP)]

PM | Nelson Bay Rd - Cabbage Tree Rd | 2020 Base | Import
Site Category: 2020 PM
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Nelson Bay Road (S)														
1	L2	154	10.0	162	10.0	0.786	10.6	LOS B	11.9	90.1	0.94	0.95	1.22	51.1
2	T1	848	10.0	893	10.0	0.786	12.8	LOS B	11.9	90.1	0.95	0.97	1.23	51.8
3	R2	473	10.0	498	10.0	0.786	17.5	LOS B	11.5	87.4	0.96	1.01	1.28	49.4
Approach		1475	10.0	1553	10.0	0.786	14.1	LOS B	11.9	90.1	0.95	0.98	1.25	50.9
East: Lavis Lane														
4	L2	477	10.0	502	10.0	1.060	122.7	LOS F	34.0	258.5	1.00	2.57	5.53	22.8
5	T1	80	10.0	84	10.0	0.358	13.4	LOS B	1.9	14.3	0.87	0.96	0.97	49.9
6	R2	24	10.0	25	10.0	0.358	19.1	LOS B	1.9	14.3	0.87	0.96	0.97	50.0
Approach		581	10.0	612	10.0	1.060	103.3	LOS F	34.0	258.5	0.98	2.28	4.71	25.4
North: Nelson Bay Road (N)														
7	L2	83	10.0	87	10.0	1.134	150.1	LOS F	79.1	601.2	1.00	3.96	8.53	17.6
8	T1	991	10.0	1043	10.0	1.134	167.5	LOS F	79.1	601.2	1.00	3.84	8.35	17.6
9	R2	273	10.0	287	10.0	1.134	159.8	LOS F	64.7	491.9	1.00	3.59	7.97	17.4
Approach		1347	10.0	1418	10.0	1.134	164.9	LOS F	79.1	601.2	1.00	3.79	8.28	17.6
West: Cabbage Tree Road														
10	L2	507	10.0	534	10.0	0.348	6.5	LOS A	0.0	0.0	0.00	0.44	0.00	55.9
11	T1	51	10.0	54	10.0	0.093	8.0	LOS A	0.5	4.1	0.85	0.79	0.85	53.7
12	R2	325	10.0	342	10.0	0.786	25.5	LOS C	6.6	50.1	0.98	1.19	1.56	44.0
Approach		883	10.0	929	10.0	0.786	13.6	LOS B	6.6	50.1	0.41	0.74	0.62	50.6
All Vehicles		4286	10.0	4512	10.0	1.134	73.5	LOS F	79.1	601.2	0.86	1.99	3.80	29.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.

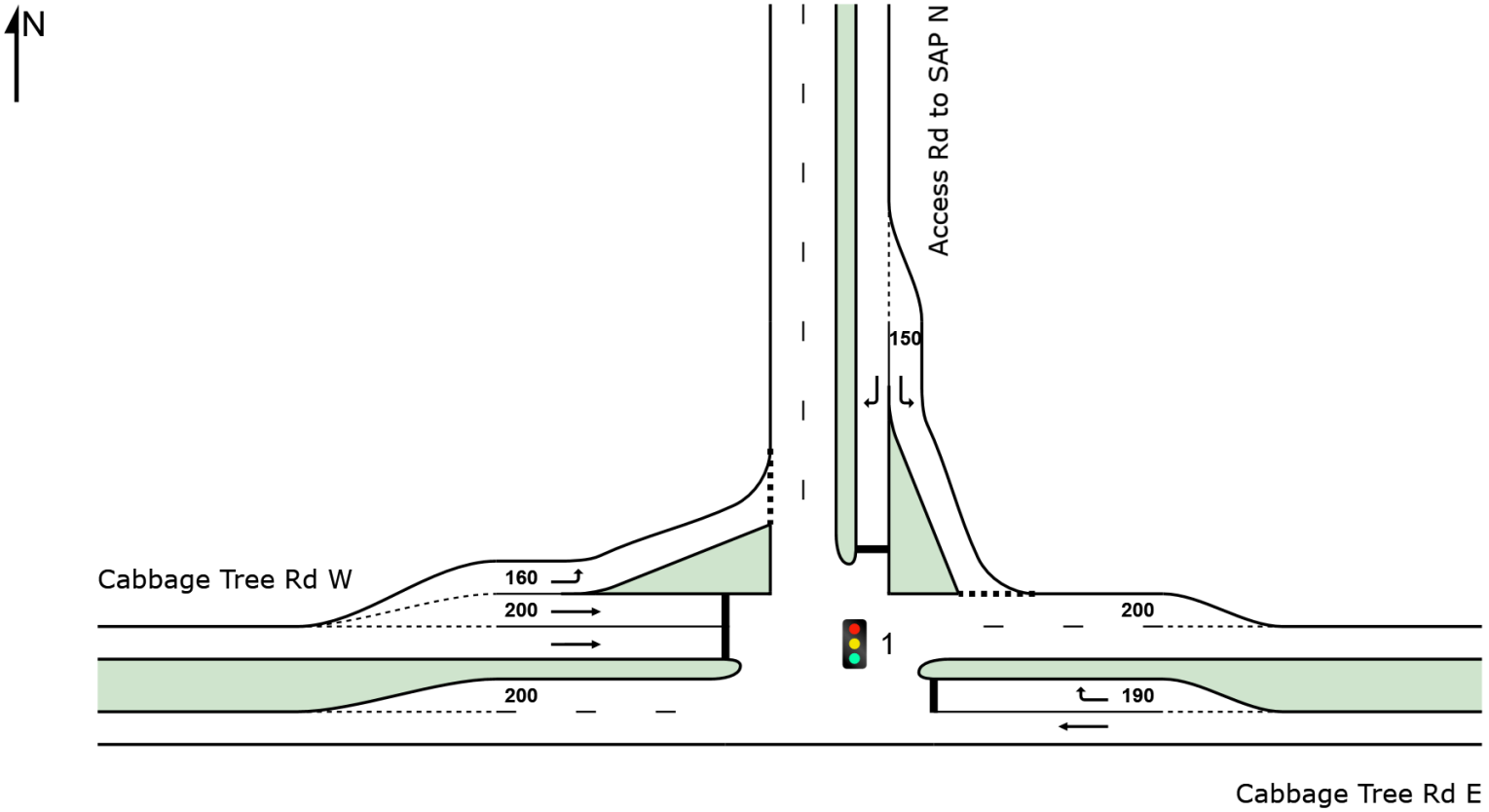
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 1 [AM | Cabbage Tree Rd x SAP Access Rd | 2036 with SAP (Site Folder: 2036 With SAP)]

Three-way intersection with "Seagull" treatment (Signals)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 1 [AM | Cabbage Tree Rd x SAP Access Rd | 2036 with SAP (Site Folder: 2036 With SAP)]

Three-way intersection with "Seagull" treatment (Signals)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Cabbage Tree Rd E														
5	T1	474	10.0	499	10.0	0.307	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
6	R2	248	10.0	261	10.0	* 0.392	13.4	LOS B	4.9	37.5	0.54	0.74	0.54	47.8
Approach		722	10.0	760	10.0	0.392	4.7	LOS A	4.9	37.5	0.19	0.25	0.19	55.0
North: Access Rd to SAP N														
1	L2	106	10.0	112	10.0	0.114	9.0	LOS A	1.5	11.6	0.24	0.62	0.24	51.9
2	R2	76	10.0	80	10.0	* 0.391	72.3	LOS E	5.5	41.7	0.96	0.78	0.96	27.3
Approach		182	10.0	192	10.0	0.391	35.4	LOS D	5.5	41.7	0.54	0.68	0.54	37.8
West: Cabbage Tree Rd W														
3	L2	177	10.0	186	10.0	0.176	7.8	LOS A	2.0	14.9	0.26	0.62	0.26	52.3
4	T1	593	10.0	624	10.0	* 0.395	26.3	LOS C	14.3	108.5	0.68	0.60	0.68	42.1
Approach		770	10.0	811	10.0	0.395	22.0	LOS C	14.3	108.5	0.58	0.60	0.58	44.1
All Vehicles		1674	10.0	1762	10.0	0.395	16.0	LOS B	14.3	108.5	0.41	0.46	0.41	47.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

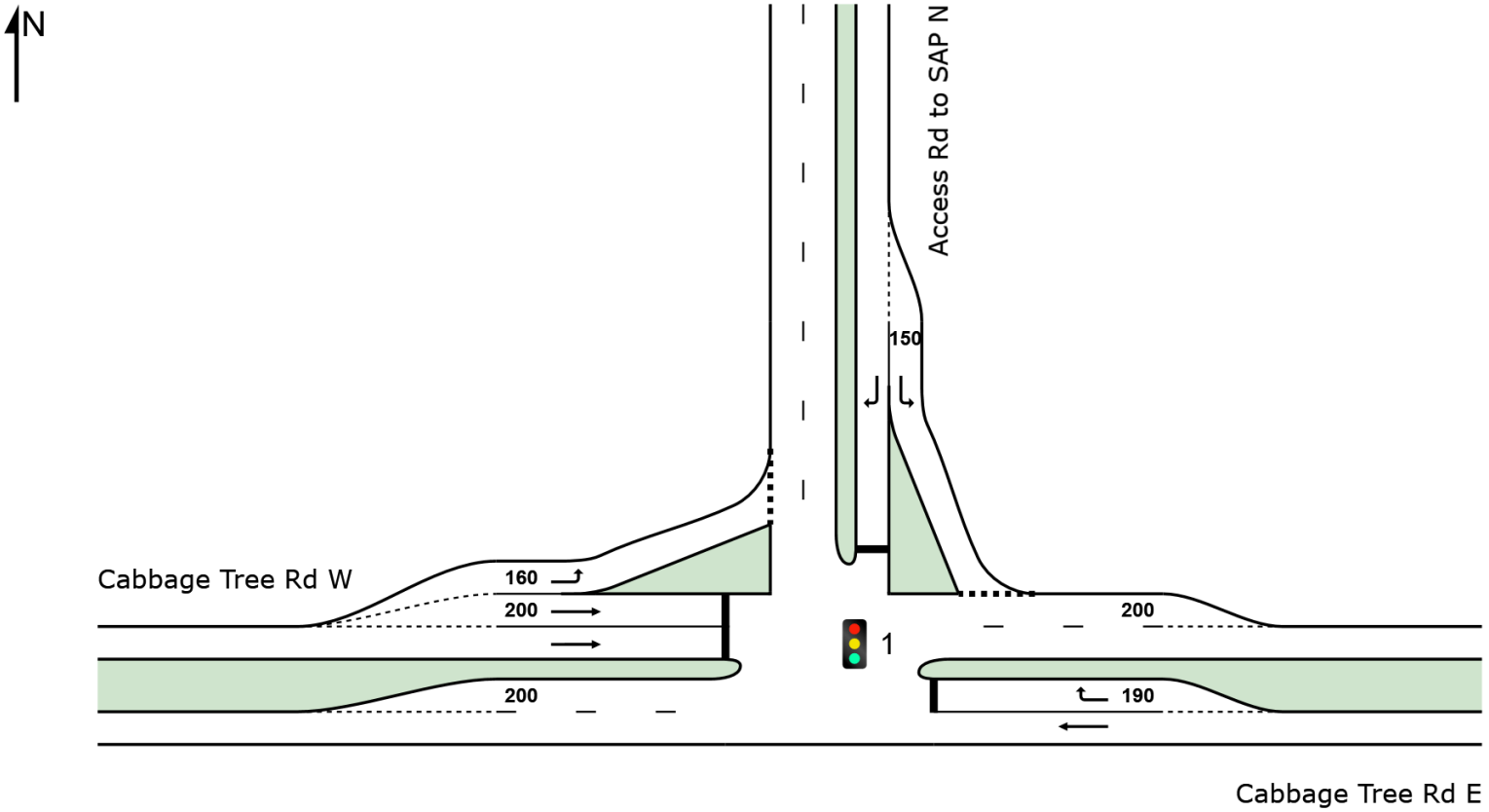
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: 1 [PM | Cabbage Tree Rd x SAP Access Rd | 2036 with SAP (Site Folder: 2036 With SAP)]

Three-way intersection with "Seagull" treatment (Signals)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 1 [PM | Cabbage Tree Rd x SAP Access Rd | 2036 with SAP (Site Folder: 2036 With SAP)]

Three-way intersection with "Seagull" treatment (Signals)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Cabbage Tree Rd E														
5	T1	536	10.0	564	10.0	0.347	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
6	R2	106	10.0	112	10.0	* 0.248	19.0	LOS B	3.0	22.8	0.62	0.73	0.62	44.5
Approach		642	10.0	676	10.0	0.347	3.3	LOS A	3.0	22.8	0.10	0.12	0.10	56.6
North: Access Rd to SAP N														
1	L2	248	10.0	261	10.0	0.278	11.6	LOS B	5.5	42.0	0.35	0.66	0.35	50.5
2	R2	177	10.0	186	10.0	* 0.480	58.5	LOS E	11.6	88.4	0.90	0.81	0.90	30.5
Approach		425	10.0	447	10.0	0.480	31.1	LOS C	11.6	88.4	0.58	0.72	0.58	39.7
West: Cabbage Tree Rd W														
3	L2	76	10.0	80	10.0	0.063	6.5	LOS A	0.4	3.4	0.15	0.58	0.15	53.3
4	T1	690	10.0	726	10.0	* 0.472	29.1	LOS C	17.8	135.0	0.73	0.64	0.73	40.9
Approach		766	10.0	806	10.0	0.472	26.9	LOS C	17.8	135.0	0.67	0.64	0.67	41.9
All Vehicles		1833	10.0	1929	10.0	0.480	19.6	LOS B	17.8	135.0	0.45	0.48	0.45	45.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

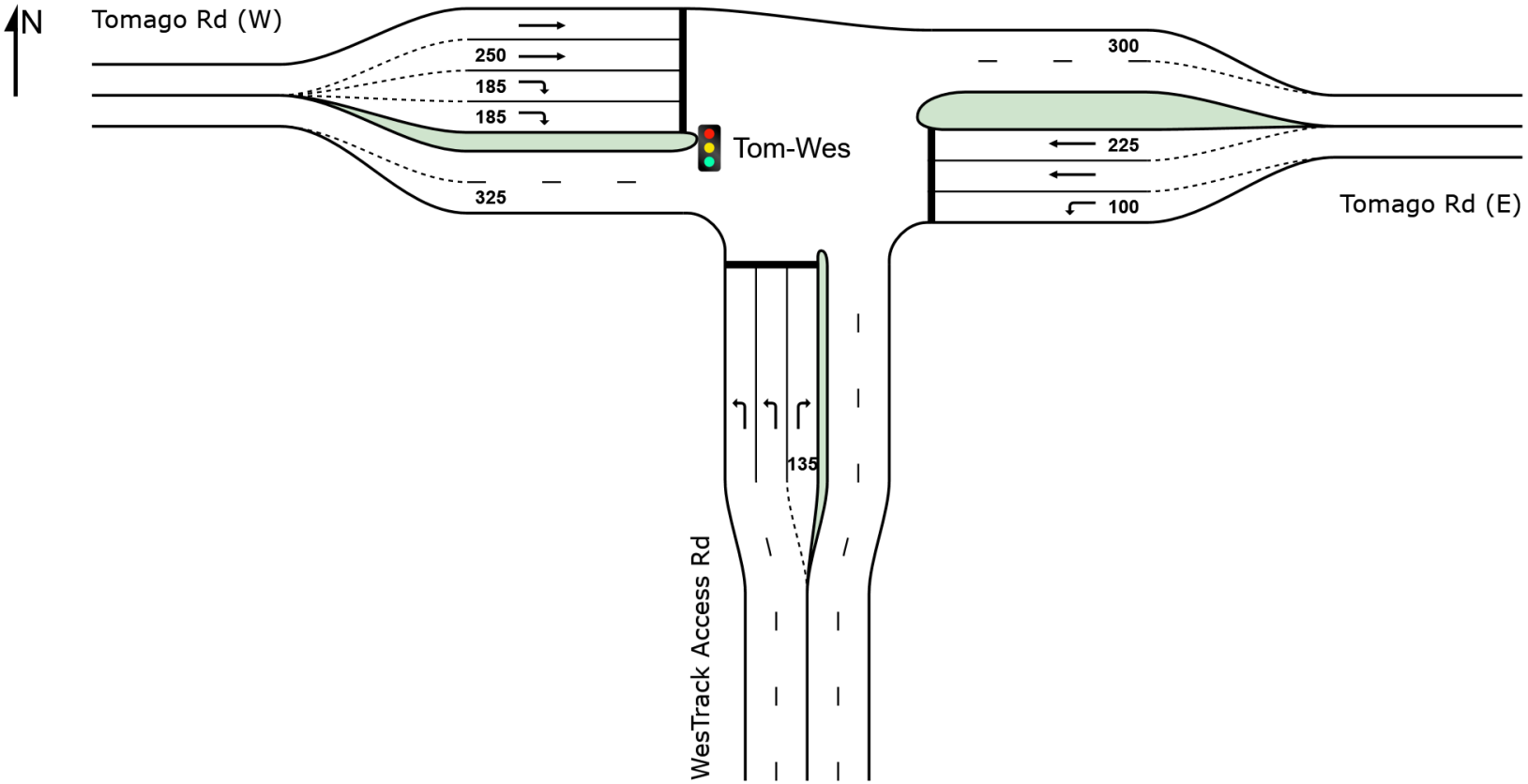
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Tom-Wes [AM | Tomago Rd - WesTrac | 2036 With SAP (Site Folder: 2036 With SAP)]

AM | Tomago Rd - WesTrack | 2020 Base
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Tom-Wes [AM | Tomago Rd - WesTrac | 2036 With SAP (Site Folder: 2036 With SAP)]

AM | Tomago Rd - WesTrack | 2020 Base
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: WesTrack Access Rd														
1	L2	23	10.0	24	10.0	0.016	14.1	LOS B	0.2	1.3	0.52	0.64	0.52	47.6
3	R2	6	10.0	6	10.0	0.041	33.6	LOS C	0.2	1.4	0.93	0.65	0.93	38.0
Approach		29	10.0	31	10.0	0.041	18.1	LOS B	0.2	1.4	0.61	0.65	0.61	45.2
East: Tomago Rd (E)														
4	L2	57	10.0	60	10.0	* 0.391	35.5	LOS D	1.8	13.7	0.97	0.75	0.97	37.1
5	T1	581	10.0	612	10.0	* 0.627	20.8	LOS C	8.1	61.4	0.92	0.79	0.93	45.0
Approach		638	10.0	672	10.0	0.627	22.1	LOS C	8.1	61.4	0.92	0.78	0.93	44.1
West: Tomago Rd (W)														
11	T1	697	10.0	734	10.0	0.322	4.2	LOS A	4.2	31.7	0.41	0.36	0.41	56.5
12	R2	135	10.0	142	10.0	* 0.232	18.3	LOS B	1.2	9.1	0.87	0.74	0.87	45.1
Approach		832	10.0	876	10.0	0.322	6.5	LOS A	4.2	31.7	0.49	0.42	0.49	54.3
All Vehicles		1499	10.0	1578	10.0	0.627	13.4	LOS B	8.1	61.4	0.68	0.58	0.68	49.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

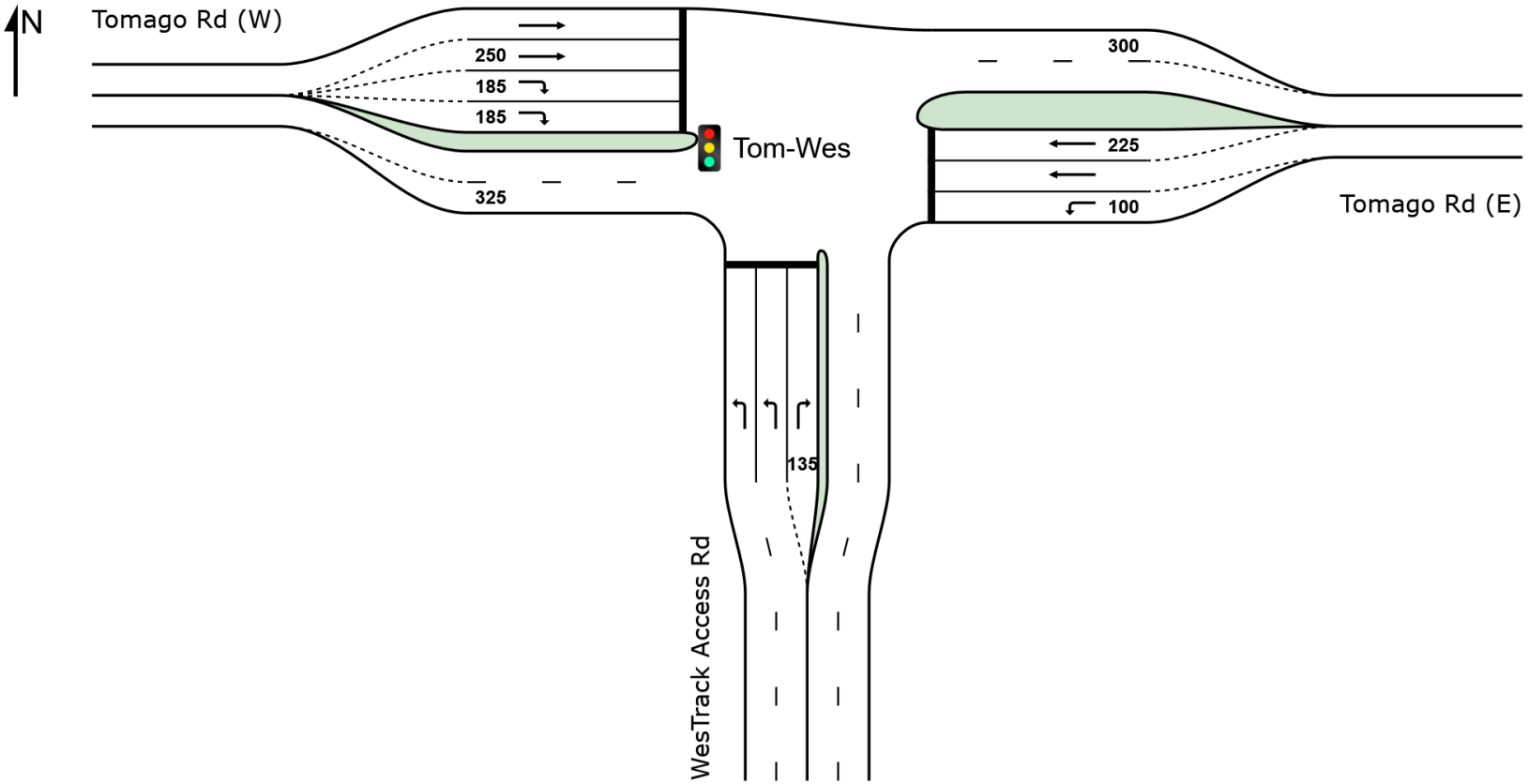
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Tom-Wes [PM | Tomago Rd - WesTrac | 2036 With SAP (Site Folder: 2036 With SAP)]

PM | Tomago Rd - WesTrack | 2020 Base
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Tom-Wes [PM | Tomago Rd - WesTrac | 2036 With SAP (Site Folder: 2036 With SAP)]

PM | Tomago Rd - WesTrack | 2020 Base
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: WesTrack Access Rd														
1	L2	200	10.0	211	10.0	0.137	15.1	LOS B	1.7	12.7	0.57	0.71	0.57	47.2
3	R2	95	10.0	100	10.0	* 0.652	37.5	LOS D	3.2	24.2	1.00	0.84	1.17	36.5
Approach		295	10.0	311	10.0	0.652	22.3	LOS C	3.2	24.2	0.71	0.75	0.76	43.1
East: Tomago Rd (E)														
4	L2	6	10.0	6	10.0	0.041	33.6	LOS C	0.2	1.4	0.93	0.65	0.93	37.8
5	T1	679	10.0	715	10.0	* 0.733	23.9	LOS C	10.4	78.9	0.95	0.89	1.07	43.6
Approach		685	10.0	721	10.0	0.733	23.9	LOS C	10.4	78.9	0.95	0.89	1.07	43.5
West: Tomago Rd (W)														
11	T1	801	10.0	843	10.0	0.371	4.8	LOS A	5.0	38.1	0.43	0.38	0.43	56.4
12	R2	22	10.0	23	10.0	* 0.038	17.5	LOS B	0.2	1.4	0.83	0.66	0.83	45.6
Approach		823	10.0	866	10.0	0.371	5.1	LOS A	5.0	38.1	0.44	0.39	0.44	56.0
All Vehicles		1803	10.0	1898	10.0	0.733	15.1	LOS B	10.4	78.9	0.68	0.64	0.74	48.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

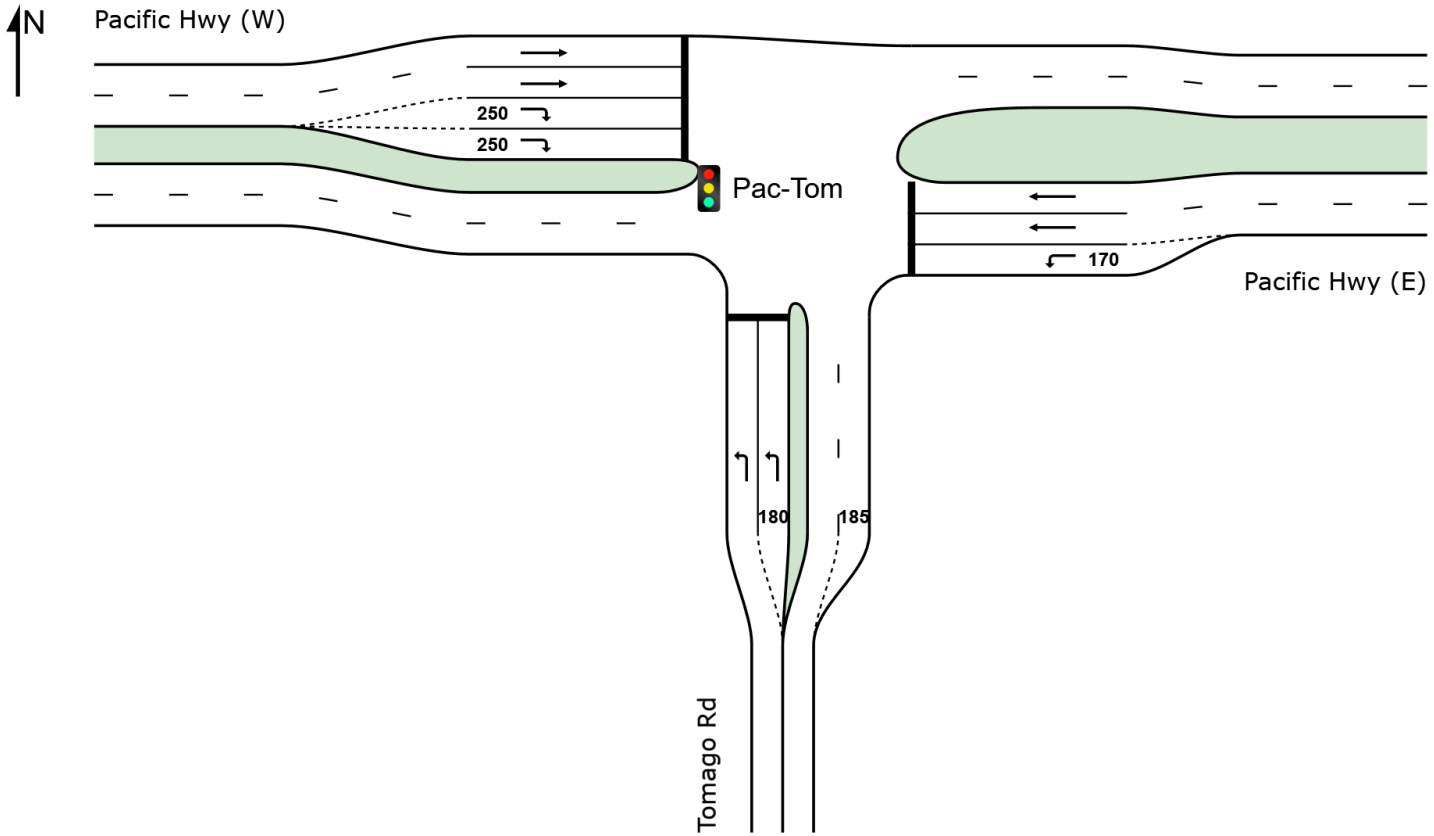
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Pac-Tom [AM | Pacific Hwy - Tomago Rd | 2036 With SAP (Site Folder: 2036 With SAP)]

AM | Pacific Hwy - Tomago Rd | 2020 Base
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Pac-Tom [AM | Pacific Hwy - Tomago Rd | 2036 With SAP (Site Folder: 2036 With SAP)]

AM | Pacific Hwy - Tomago Rd | 2020 Base
Site Category: 2020 AM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tomago Rd														
1	L2	570	10.0	600	10.0	0.445	36.8	LOS D	15.1	114.9	0.75	0.80	0.75	36.6
Approach		570	10.0	600	10.0	0.445	36.8	LOS D	15.1	114.9	0.75	0.80	0.75	36.6
East: Pacific Hwy (E)														
4	L2	15	10.0	16	10.0	0.021	31.1	LOS C	0.6	4.5	0.55	0.66	0.55	40.6
5	T1	1483	10.0	1561	10.0	* 1.004	98.2	LOS F	82.6	627.7	1.00	1.25	1.41	23.0
Approach		1498	10.0	1577	10.0	1.004	97.6	LOS F	82.6	627.7	1.00	1.24	1.40	23.1
West: Pacific Hwy (W)														
11	T1	1499	10.0	1578	10.0	0.528	0.5	LOS A	4.5	33.9	0.17	0.10	0.17	59.2
12	R2	1300	10.0	1368	10.0	* 1.014	116.9	LOS F	74.7	567.3	1.00	1.11	1.47	20.5
Approach		2799	10.0	2946	10.0	1.014	54.6	LOS D	74.7	567.3	0.55	0.57	0.77	31.5
All Vehicles		4867	10.0	5123	10.0	1.014	65.7	LOS E	82.6	627.7	0.71	0.80	0.96	28.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

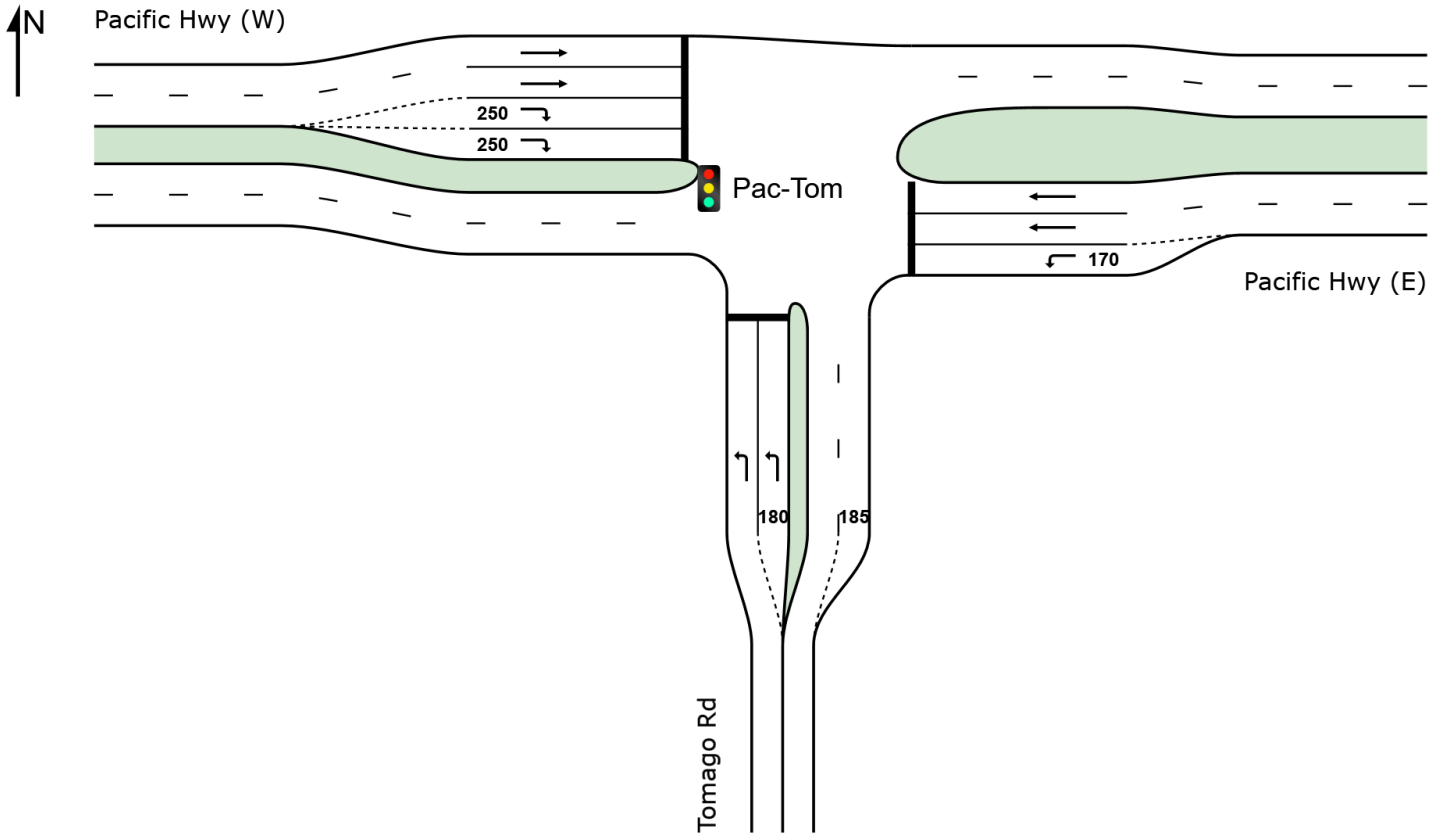
* Critical Movement (Signal Timing)

SITE LAYOUT

Site: Pac-Tom [PM | Pacific Hwy - Tomago Rd | 2036 With SAP (Site Folder: 2036 With SAP)]

PM | Pacific Hwy - Tomago Rd | 2020 Base
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: Pac-Tom [PM | Pacific Hwy - Tomago Rd | 2036 With SAP (Site Folder: 2036 With SAP)]

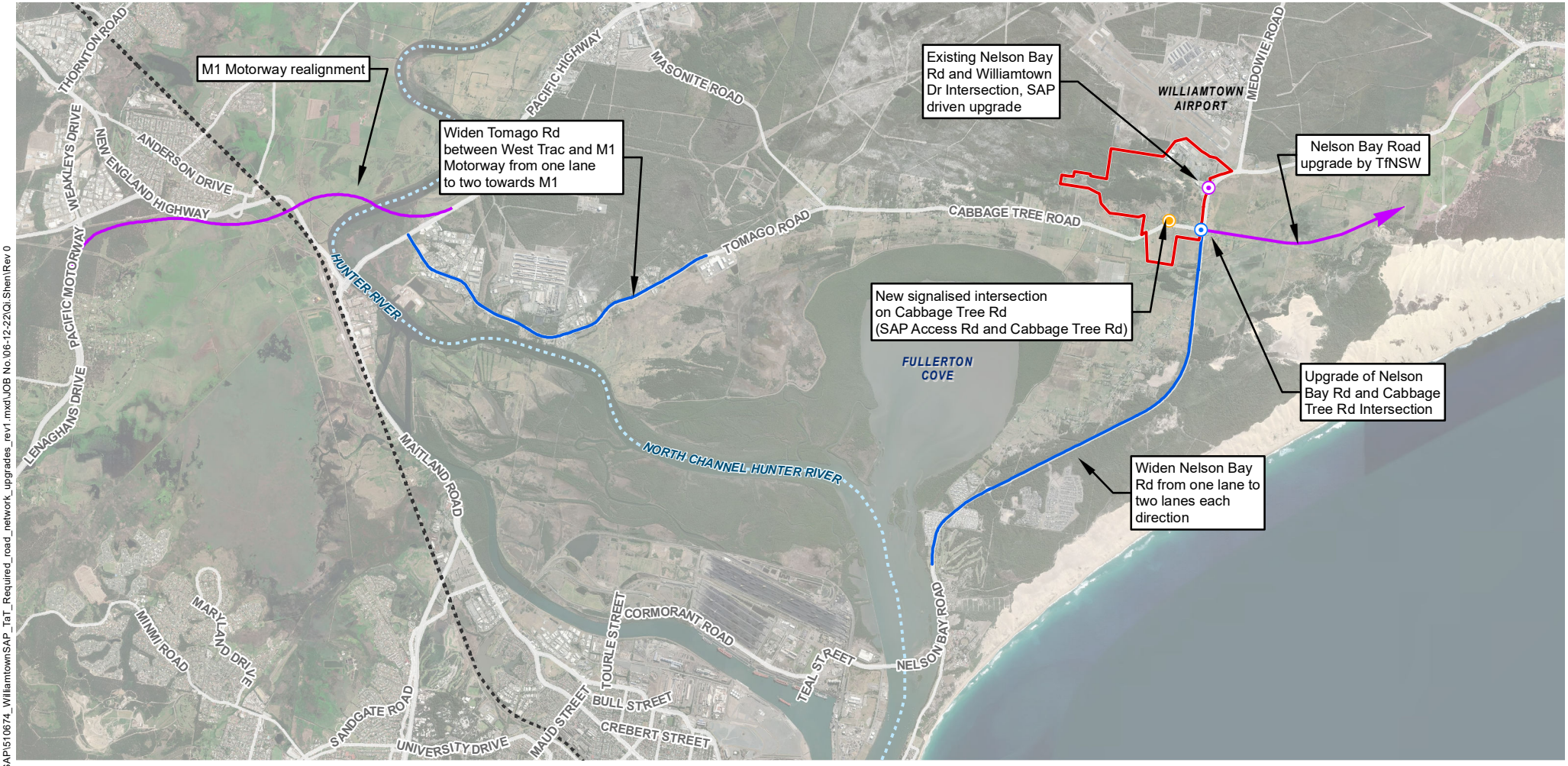
PM | Pacific Hwy - Tomago Rd | 2020 Base
Site Category: 2020 PM
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tomago Rd														
1	L2	1734	10.0	1825	10.0	* 1.167	224.8	LOS F	141.4	1074.5	1.00	1.37	2.07	12.5
Approach		1734	10.0	1825	10.0	1.167	224.8	LOS F	141.4	1074.5	1.00	1.37	2.07	12.5
East: Pacific Hwy (E)														
4	L2	14	10.0	15	10.0	0.030	43.8	LOS D	0.7	5.5	0.71	0.68	0.71	34.6
5	T1	1161	10.0	1222	10.0	* 1.175	234.3	LOS F	92.3	701.6	1.00	1.80	2.13	12.1
Approach		1175	10.0	1237	10.0	1.175	232.1	LOS F	92.3	701.6	1.00	1.79	2.12	12.2
West: Pacific Hwy (W)														
11	T1	2175	10.0	2289	10.0	0.766	0.9	LOS A	11.4	86.7	0.30	0.18	0.30	58.6
12	R2	798	10.0	840	10.0	0.457	23.7	LOS C	16.6	126.4	0.59	0.77	0.59	42.4
Approach		2973	10.0	3129	10.0	0.766	7.0	LOS A	16.6	126.4	0.38	0.34	0.38	53.2
All Vehicles		5882	10.0	6192	10.0	1.175	116.2	LOS F	141.4	1074.5	0.68	0.93	1.22	20.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)



Williamtown SAP Structure Plan Boundary

TfNSW projects in Planning

River

Railway

New signalised intersection

SAP driven upgrade

Required road upgrade works

Required Road Infrastructure Upgrades

Background Growth Driven Intersection Upgrade

Source: Aurecon, TfNSW, NSW Spatial Services, DPE, Esri

1:100,000 @ A4

0 1.5 3km

Projection: GDA 1994 MGA Zone 56

Williamtown SAP **Traffic and Transport**

FIGURE: Required SAP upgrades

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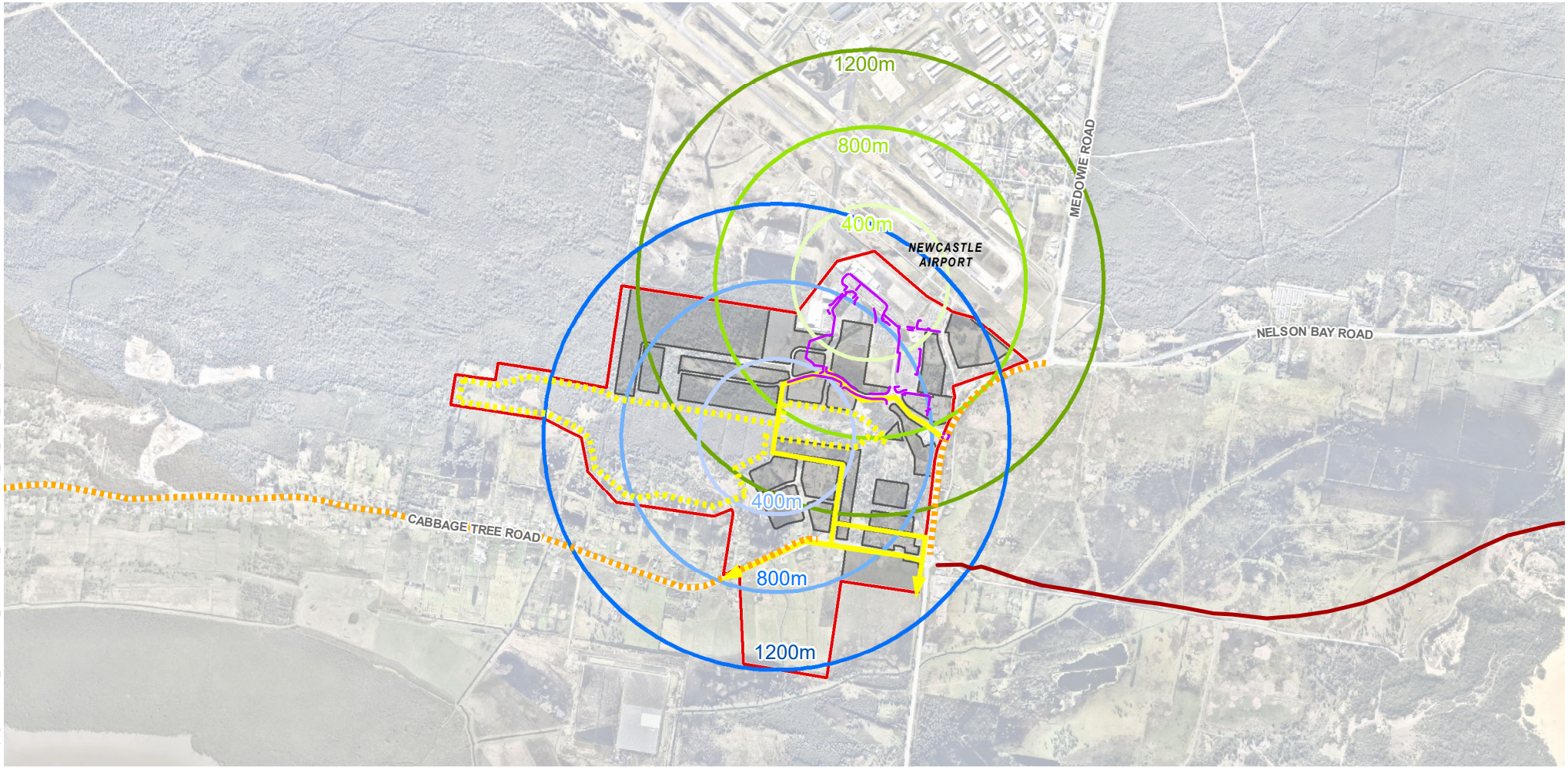


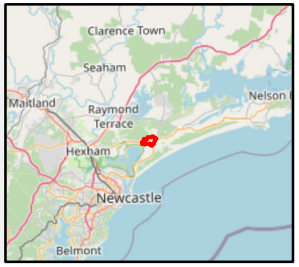
Williamtown SAP Structure Plan Boundary
Developable Block
Indicative Health Loop
Cycleway / Shared path EW and NS
Existing Sealed Shoulder
Potential Future Sealed Shoulder (Nelson Bay Road Upgrade)
Existing Footpaths

Williamtown SAP Structure Walking Catchment

400m/5 min walk
800/10 min walk
1200/15 min walk

Newcastle Airport Precinct Walking Catchment

400m/5 min walk
800/10 min walk
1200/15 min walk



Source: Aurecon, TfNSW, ACMA, NSW Spatial Services, Esri

1:30,000 @ A4
0 200 400m

Projection: GDA 1994 MGA Zone 56

Williamtown SAP **Traffic and Transport**

FIGURE: Active transport network

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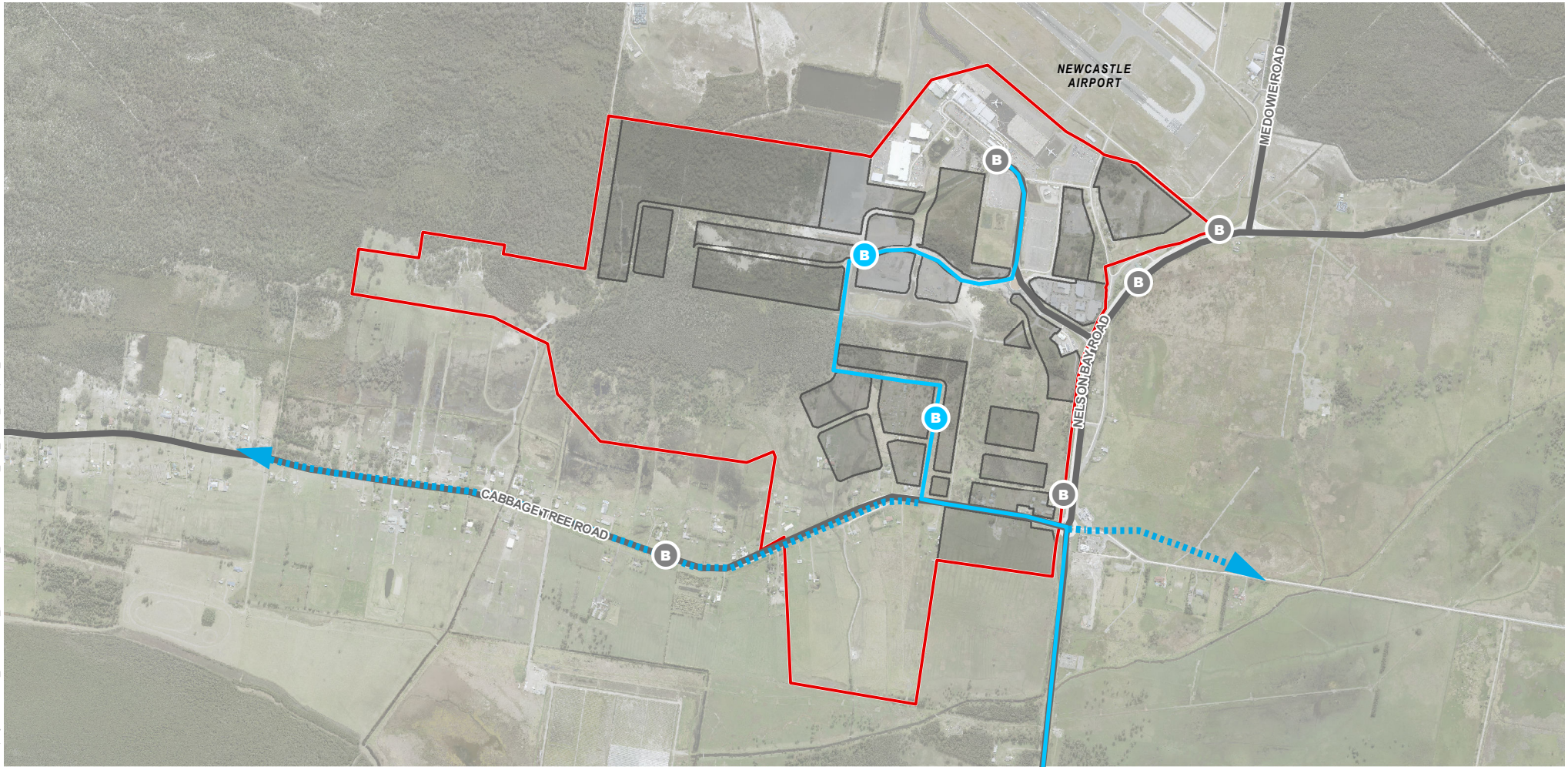
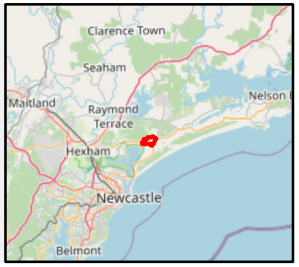


Williamtown SAP Structure Plan Boundary
Developable Block
Bus stop
Preferred bus route
Optional bus route
Existing bus stop
Existing bus route



Source: Aurecon, TfNSW, ACMA, NSW Spatial Services, Esri

1:20,000 @ A4
0 200 400 m

Projection: GDA 1994 MGA Zone 56

Williamtown SAP **Traffic and Transport**

FIGURE: Public transport network

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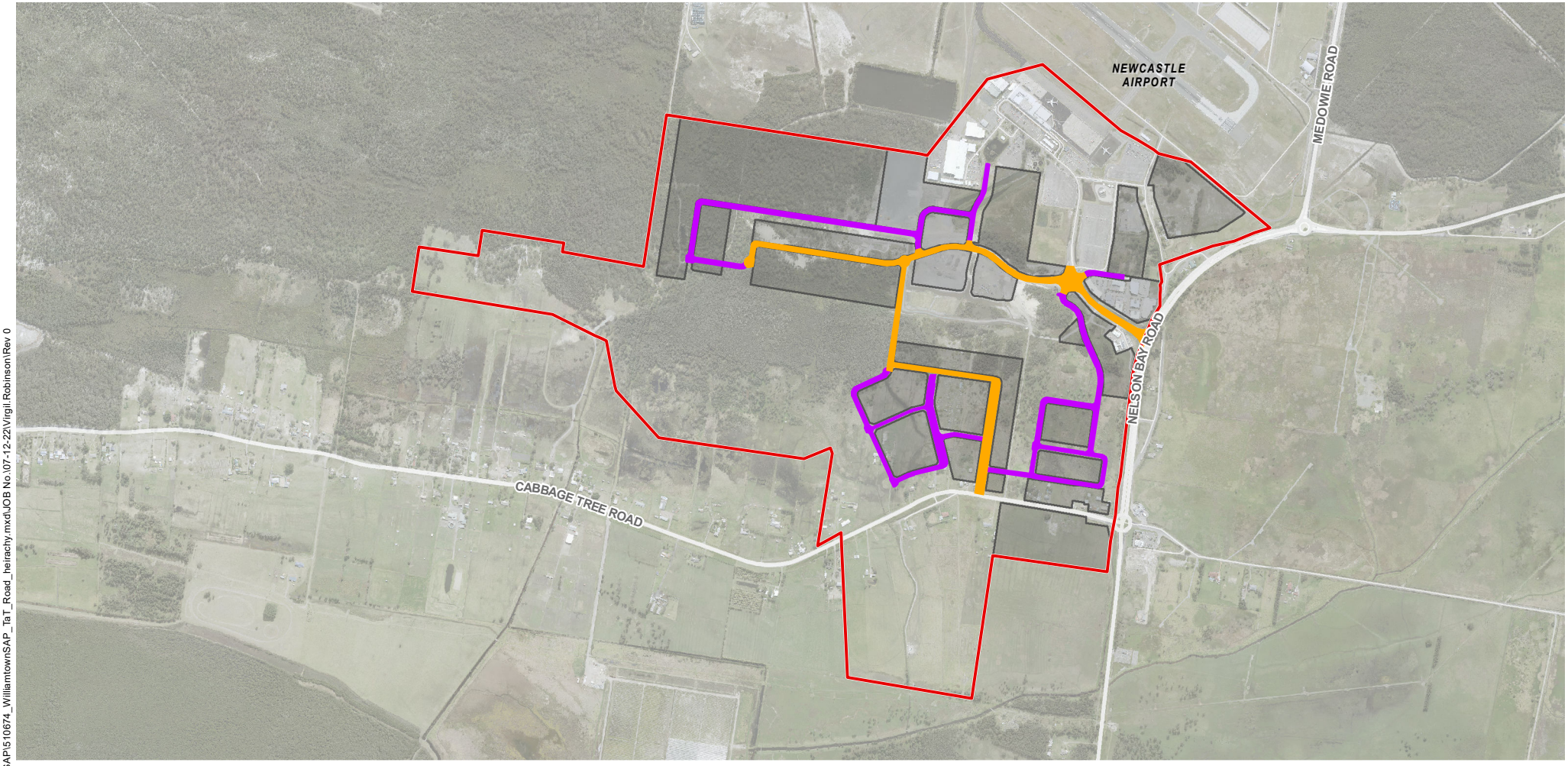
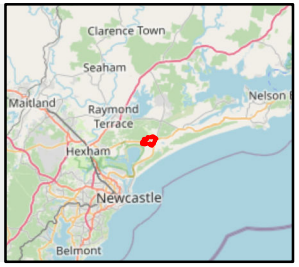


Williamtown SAP Structure Plan Boundary

Developable Block

Collector Road

Local Industrial Road / Access Road



Source: Aurecon, TfNSW, ACMA, NSW Spatial Services, Esri

1:20,000 @ A4

0 200 400 m

Projection: GDA 1994 MGA Zone 56

Williamtown SAP **Traffic and Transport**

FIGURE: Road heirachy

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