BETTER TRANSPORT FUTURES
MARK WAUGH

Proposed Stockton Rifle Range Site Planning Proposal

Defence Housing Australia

Transport Study Report
October 2018

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Document History and Status

Issue	Rev.	Issued To	Qty	Date	Approved for Release
Draft	Rev01	DHA	1	30 Jul 16	M Waugh
FINAL DRAFT	Rev02	DHA, NPC	1	30 Sep 16	M Waugh
FINAL	Rev03	DHA, NPC	1	31 Oct 16	M Waugh
FINAL	Rev04	DHA, NPC	1	25 Nov 16	M Waugh
FINAL	Rev05	DHA, NPC	1	05 May 17	M Waugh
FINAL DRAFT	Rev06	DHA, NPC	1	30 July 18	M Waugh
FINAL	Rev07	DHA, NPC	1	30 Oct 18	M Waugh

Printed:	30 October 2018
Last Saved:	30 October 2018
File Name:	C:\Users\Mark.Waugh\Documents\WORK\ACTIVE\#093 DHA Stockton\VARY D MASTERPLAN REVIEW\REPORT\BTF2016093 DHA Stockton RR Transport Report Rev07.Docx
Author:	Mark Waugh
Name of Organisation:	Defence Housing Australia
Name of Project:	Defence Housing Australia Stockton Transport Studies
Name of Document:	RIFLE RANGE TRANSPORT REPORT
Document Version:	FINAL Rev07
Project Number:	BTF2016093RR

Contents

1 Executive Summary

1.1 Background

DHA has an ongoing requirement for additional housing in the Newcastle area to cater for Newcastle based Defence members and their families and to replace existing DHA dwellings that do not meet current standards. DHA has recently purchased two surplus Defence sites at Stockton with the objective of obtaining the necessary planning approvals and developing them for a mix of housing for ADF personnel and the private market. These two sites (Fort Wallace and the Stockton Rifle Range) are located just a few kilometres north of the Newcastle CBD across the Hunter River on the Stockton Peninsula. As such the sites are comparatively close to Williamtown RAAF Base (approx. 11 to 12 km by road).

This report updates transport investigations based on a revised Masterplan for the Rifle Range site in support of the rezoning proposal.

Site details are:

	Rifle Range
Title	Lot 5 DP233358
Area	111.35ha
Council	Port Stephens (subject to amalgamation)
Existing Land use Zoning	E2 – Environmental Conservation

A number of earlier assessments of the site have been prepared over a number of years. As part of this work, notional development yields were prepared indicating some 249 development lots may be achievable on the Rifle Range site. This current update has reviewed this yield to a revised total of 318 dwellings. The dwellings are proposed to be a mix of apartments, townhouses, courtyard and cluster homes, with a small number of single 'Eco' homes.

1.2 Summary

The following observations have been made in relation to the assessment of the transport system in the vicinity of the Rifle Range sites at Fern Bay:

a. **Location** – Stockton is a suburb of Newcastle located on the north side of the Hunter River, and adjacent to the Pacific Ocean. It is a narrow peninsula with road access available from the north. Fern Bay is a small village at the northern end of the Stockton peninsula, between the Hunter River north arm, and the Pacific Ocean.

b. **Transport Network –**

   a. **Road Network** – Access to Fern Bay is provided by road from the north and south, via Nelson Bay Road (B63 Route). The Fern Bay road network is a series of local streets on the eastern side of Nelson Bay Road. Access to the wider Newcastle area is provided via the Stockton Bridge to Kooragang Island and on to Tourle Street and Industrial Drive. Access north to Williamtown Airport is via the B63 Nelson Bay Road.

   b. **Ferry Service** – The Newcastle to Stockton Ferry connects Stockton at its southern end, on the Hunter River, to Queens Wharf in the Newcastle CDB

   c. **Bus Services** – Newcastle Buses Bus operates Route 118 serving Fern Bay and Stockton, although the route is quite circuitous. Buses to Williamtown are also available, operated by Port Stephens Coaches.

   d. **Cycle ways** – The Stockton Cycle way was opened in 2013, connecting the peninsula from Stockton Bridge in the north to the Stockton Ferry terminal in the south.

c. Road Network performance

   a. **Peak Periods** – Traffic Movement surveys were conducted previously on 8 June 2016 and 27 October 2016 at the following locations:

i. Nelson Bay Road and Fullerton Street roundabout (8 June 2016)

ii. Nelson Bay Road and Taylor Road (priority control) (8 June 2016)

iii. Nelson Bay Road and Vardon Road (priority control) (27 October 2016)

b. AADT flow data is also available for traffic crossing the Stockton Bridge.

c. Observed flows were well within the technical mid-block capacity of the various roads under review.

d. The offset roundabout at the junction of Nelson Bay Road and Fullerton Street has been tested as operating at a very good level of service.

e. The priority junctions of Nelson Bay Road with Taylor Road and Vardon Road operate with minimal levels of delay on the main road, but with some delay for particularly right turn movements out of the side roads.

d. **Land Use Proposals** – The revised draft indicative Master Plan (Architectus Revision H 10th May 2018) allows for a development yield of 318 dwellings on the Rifle Range site. This has been used in this updated assessment of traffic generation levels form the subject site.

e. **Other Known Development** – Port Stephens Council and The City of Newcastle has recently completed the Fern Bay and North Stockton Traffic & Transport Study (Seca Solution for Port Stephens Council and The City of Newcastle, 28 June 2018) This study has considered traffic impacts of known development proposals in the Fern Bay and North Stockton localities which are of direct relevance to the road network supporting the Rifle Range site. This work has been used with permission of Port Stephens Council and The City of Newcastle to update the traffic assessment of the Rifle Range site along with its revised Master Plan.

f. **Traffic Generation** – Forecast traffic flows would be in the order of 156 trips AM and 172 trips PM for the Rifle range site. The external road network is more than capable of absorbing these levels of additional trips, while remaining at a very good operational level of service.

g. **Initial Site Access Considerations** –

a. **Rifle Range** – The existing flow levels on Nelson Bay Road, coupled with the existing channelised right turn facilities at Taylor Road have been assessed as able to provide a good intersection level of service.

b. **Right turn movements** – Existing right turn movements while very small, show a poor level of service. Additional flows are not expected to be high, and would be able to be dispersed between Taylor Road and Vardon Road.

With the subject site earmarked for active defence force personnel it is expected that local traffic from the site will show a bias in trips to the north more so than a site that is not aligned with defence activity. As such the flows are expected to be split fairly evenly between northbound trips toward RAAF Williamtown and southbound trips, rather than being heavily biased toward the Stockton Bridge and the south.

Performance of right turn movements under existing access arrangements would be poor and it is recommended that one intersection (either Taylor Road or Vardon Road) be provided with improvements to facilitate safe right run movements. This could be in the form of either seagull priority control, or traffic signal control.

Input from NSW RMS is required in this regard. Whilst some informal communication has been made, to date RMS have not been willing (or) able to meet with the study team.

h. **Road Capacity** – Existing traffic flow levels suggest the mid-block two lane two way capacity of the surrounding road network is very satisfactory and has ample spare capacity to cater for the subject development proposals.

i. **Access Strategy** – Two site entrances on Popplewell Road to Council residential street standards. Leading to one upgraded intersection treatments at either of Vardon Rd (traffic to and from the north) and / or Taylor Road (traffic to and from the south)

j. **Other Considerations** –

k. Internal road design – to meet Council road design standards. Carriageways at Local Street, Access Street, Access Place standard.

l. North extension of Stockton cycleway, or possible cycle connection between the two sites lining to the exiting cycleway.

1.3 Conclusion and Next Steps

This report presents the findings of the latest traffic and transport investigations for the updated Draft indicative Master Plan for use of the Rifle Range development site as additional housing in the Newcastle area to cater for Newcastle based Defence members and their families and to replace existing DHA dwellings that do not meet current standards.

The investigations have found that subject to road and intersection improvements as outlined in these investigations the site is able to be accommodated on the surrounding transport (road) network. The potential works of significance are:

1. Upgrade of one intersection with Nelson Bay Road. Vardon Road has been recommended previously to provide safe right turn facilities and this has been reinforced by the independent work conducted by Port Stephens Council and the City of Newcastle.
2. Upgrade of the local road network to current Council standards from the entrance to the subject site along Popplewell Road to both Taylor Road and Vardon Road (to cater for movements north and south generated by the subject site.)

The overall conclusion is that given the potential level of future development proposed for the Rifle Range site at Fern Bay, along with the Councils' investigations into development in the Fern Bay and North Stockton areas, an access strategy focussing on the Vardon Road intersection with Nelson Bay Road, provided with improved right turn facilities, combined with upgrading of the one local road network to Council standards to support this access arrangement, will present an effective access solution for the subject site. Further liaison is required with the road authorities to confirm their requirements in line with the current strategy being developed by Roads and Maritime Services for the Nelson Bay Road Corridor.

The conclusion here is that subject to the recommended upgrades to road access the planning proposal for the Rifle Range site is supported from a traffic and transport perspective.

The next steps recommended are to seek more detailed engineering advice from The City of Newcastle, Port Stephens Council and NSW Roads and Maritime Services on the form of road and intersection improvements that would best serve the subject site and local Fern Bay community, and best align with the road network development strategy being developed by NSW RMS for the Fern Bay area for Nelson Bay Road.

2 Introduction and Background

2.1 Background

DHA has an ongoing requirement for additional housing in the Newcastle area to cater for Newcastle based Defence members and their families and to replace existing DHA dwellings that do not meet current standards. DHA has recently purchased two surplus Defence sites at Stockton with the objective of obtaining the necessary planning approvals and developing them for a mix of housing for ADF personnel and the private market. The subject site (Stockton Rifle Range) is located just a few kilometres north of the Newcastle CBD across the Hunter River on the Stockton Peninsula. These sites are comparatively close to Williamtown RAAF Base (approx. 11 to 12 Km by road).

The details of the two sites are:

	Rifle Range
Title	Lot 5 DP233358
Area	111.35ha
Council	Port Stephens
Existing Land use Zoning	E2 – Environmental Conservation

A number of earlier assessments of the site have been prepared over a number of years. As part of this work, notional development yields were prepared indicating some 249 development lots may be achievable on the Rifle Range site. This current update has reviewed this yield to a revised total of 318 dwellings. The dwellings are proposed to be a mix of apartments, townhouses, courtyard and cluster homes, with a small number of single 'Eco' homes.

2.2 Site Context

The subject site under consideration by DHA for housing for Newcastle based Defence members and their families is located at Fern Bay just north of Newcastle. The close proximity to the RAAF Williamtown base which is about 12 kms to the north of the sites, and the closeness to the regional centre of Newcastle make these sites attractively located for the purposes of housing defence families.

The sites are shown in **Figure 1 – Regional Context** below.

Figure 1 – Regional Context
Source: architectus™ 2016

The local context of the site is shown in **Figure 2 – Local Context** below.

Figure 2 – Local Context
Source: architectus™ 2016

2.3 Objectives of Traffic Investigation

The Traffic/Transport investigations have assessed the constraints and opportunities of the subject site, as a contribution to the design development of the preferred scheme for inclusion in the sites Planning Proposal. Specific work tasks have included:

- Site visits the two sites,
- Review existing information on the sites and surrounding transport network,
- Review any Council Plans, Policies or Strategies relevant to the sites and local area,
- Undertake assessments (traffic, transport, pedestrian, cycleways) to develop a sufficient understanding of the sites and their constraints and opportunities to inform the subsequent Planning Proposal and Development Application(s),
- Liaise with the urban design team on matters relating to the traffic/transport constraints and opportunities of the two sites,
- Contribute to the options development for the two sites,
- Prepare the following reports covering the traffic/transport constraints, opportunities and proposals to support the development and planning proposals:

  1. Initial review of the development options (Summary Working Report),
  2. Supporting summary report for the preferred development option,
  3. Supporting report for the Planning Proposal,
  4. Supporting report for the Development Application,

  This report forms the supporting report for the Planning Proposal.

It should be noted that a comparable report has been prepared for the second site under consideration, and that both pieces of work have taken into account the traffic generation and impacts of the other proposal.

3 Existing Conditions

3.1 Road Network

External Roads

The site is accessed from Popplewell Road in Fern Bay, and is connected back to the B63 Nelson Bay Road via a series of local streets:

1. Vardon Road to the north, with full access to Nelson Bay Road
2. Rankin Road, with left in left out access only at Nelson Bay Road, and
3. Taylor Road also with full access to Nelson Bay Road

Nelson Bay Road (B63)

Nelson Bay Road (B63) is the main road connection from Newcastle via Kooragang Island to the Port Stephens area, including the nearby airport and Defence base at RAAF Williamtown. It is built to a 4 lane dual carriageway arterial standard with sealed shoulders in the vicinity if the subject sites. At its southern end it connects to Fullerton Street via an offset roundabout junction. The western leg of this roundabout connects Nelson Bay Road to Kooragang Island via the Stockton Bridge.

Nelson Bay Road is used as a bus route for regular and for school services. (A copy of the Newcastle Buses bus network map is included in **Appendix B** for reference). Buses serve Stockton and Fern Bay, and complete a loop via Vardon Road Popplewell Road and Rankin Rod to access Nelson Bay Road for the return journey to Newcastle.

Photo Plate 1 – Nelson Bay Road (B63) looking south from near Vardon Road (on the left of photo)

Photo Plate 2 – Nelson Bay Road (B63) looking north from Taylor Road

Photo Plate 3 – Nelson Bay Road (B63) looking south from Taylor Road (on the left of photo)

Photo Plate 4 – Nelson Bay Road (B63) / Fullerton Street roundabout

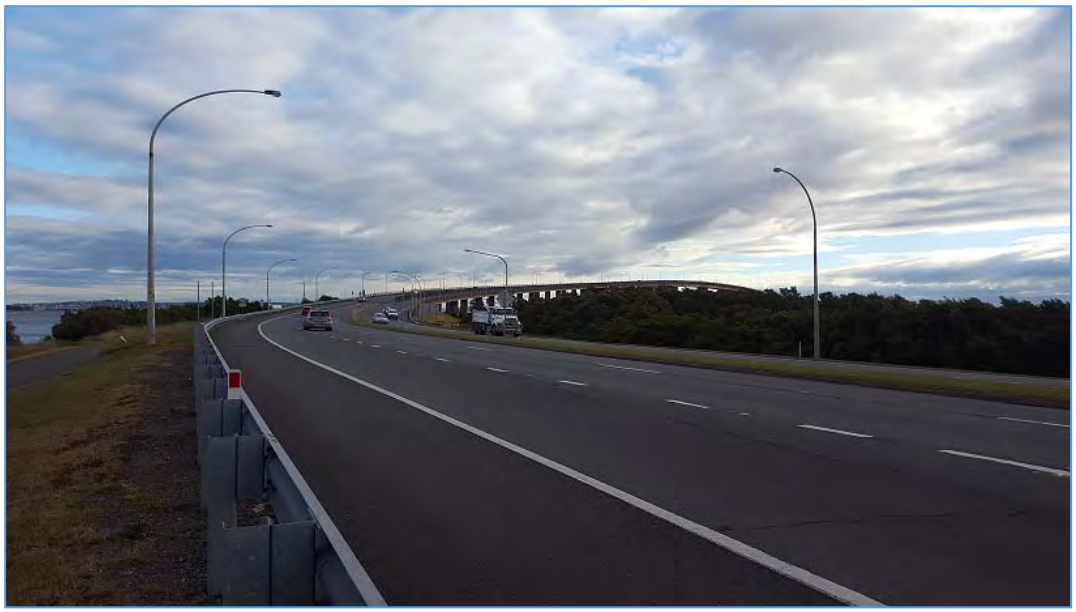


Photo Plate 5 – Nelson Bay Road (B63) looking south and west toward Stockton Bridge

Local Roads serving Rifle Range site

The Rifle Range site is accessed from Popplewell Road in Fern Bay, and connecting back to the Nelson Bay Road (B63) via a series of local streets.

Popplewell Road

Popplewell Road is a local street of approximately 6 metres sealed width. It operates as a two-way single carriageway and performs as part of the local us route to allow scheduled services to return from Fern Bay to Stockton and Newcastle. It does not meet current residential street standards as set down by Council.

Photo Plate 6 – Popplewell Road looking south from Vardon Road

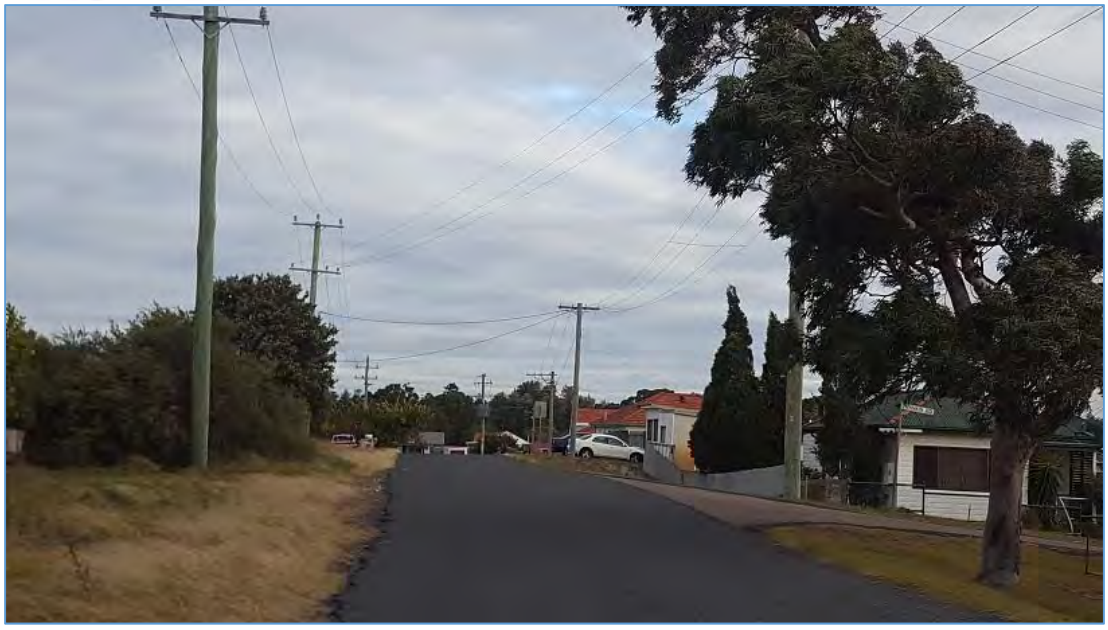


Photo Plate 7 – Popplewell Road looking south near Rankin Road

Vardon Road

To the north of the Rifle Range site, Vardon Road is a local street operating as a two way two lane residential street. It serves a mixture of property including the local public school, community hall, residential property and also the Newcastle Golf Club. It is built to a higher standard than Popplewell Road, with kerb and gutter installed on its northern side. There is a School Speed zone installed along part of its length.

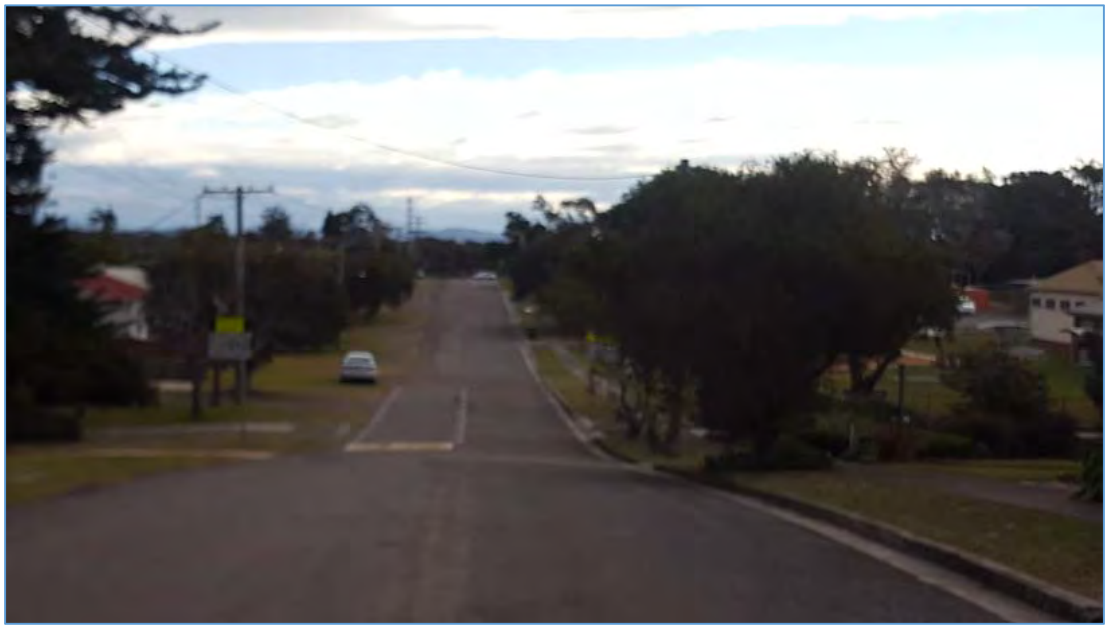


Photo Plate 8 – Vardon Road looking west toward Nelson Bay Road

Rankin Road

Rankin road is another local street of similar construction standard to Popplewell Road and Taylor Road. A two way single lane carriageway, in average condition. It is also part of the local bus route loop to allow services to return from Fern Bay via Stockton, to Newcastle.

Photo Plate 9 – Rankin Road looking east from Nelson Bay Road toward Popplewell Road

Taylor Road

Taylor Road is currently a similar standard to Rankin Road and Popplewell road, but the pavement condition is probably best described as fair to poor, with numerous repairs along its length. Its intersection with Nelson Bay Road provides for full access, allowing for all turning movements.

Photo Plate 10 – Taylor Road looking west toward Nelson Bay Road from Popplewell Road

Photo Plate 11 – Taylor Road looking east from Nelson Bay Road toward Popplewell Road

3.2 Traffic Surveys and Site Observations

2016 Traffic Surveys

In considering the appropriate times for analysis of the impacts of future site activities it is important to ensure all periods of significant on road activity are captured.

Monitoring of traffic movements was conducted over an AM and PM peak for a typical weekday. The traffic surveys were conducted on Wednesday 8 June 2016 and Thursday 27th October 2016. Traffic Survey data was collected at three locations on Nelson Bay Road, at Fullerton Street, Taylor Road and Vardon Road.
The survey data is included in **Appendix C – Traffic Survey Data**.

2017 Traffic Surveys

As part of the Councils' Fern Bay and North Stockton Traffic and Transport Study traffic movement surveys were conducted at various locations in the study area. These included the intersections of Vardon Road and Taylor Road with Nelson Bay Road, the two potential access points for the Rifle Range site.

The following observations of note are made about the 2017 surveys when compared to the BTF surveys conducted 2016:

- Through traffic movements on Nelson Bay Road are comparable, and in fact were observed at higher levels in 2016
- Local road flows were also comparable, and within what would be considered normal daily and seasonal fluctuations in traffic flows.
- The surveys conducted for the Councils were interrupted by a traffic accident on 7th February 2017 which makes the results unreliable.

Our conclusion from considering the traffic flow data available at the time of this review is that reliance on the 2016 survey results is still applicable to develop the baseline data for considering the revisions to the Rifle Range site's Master Plan.

General Site Observations

The most significant observations from a traffic movement efficiency and road safety perspective that were observed from the data monitoring and site observations Wednesday 8th June 2016 were:

1. Traffic flows along Nelson Bay Road are well within technical capacity of a 4 lane dual carriageway road.
2. Parking on the main road is low, but observed on local Fern Bay roads, particularly outside business hours.
3. Bus movements along the local street network were observed, on Vardon Road and Rankin Road.
4. Left turn movements (in and out) from the local road network all operate at satisfactory Service levels
5. The right turns out of Taylor Road and Vardon Road onto Nelson Bay Road northbound, while only small in volume, do not perform well at peak times, operating at a modelled Level of Service 'F'.
6. Right turns at Vardon Road operate at similar levels to Taylor Road, with slightly higher flows because of the location of the local public School and the entrance to Newcastle Golf Club.
7. Consideration of the alternative of allowing the turning movements to occur at Vardon Road onto Nelson Bay Road is a viable alternative to using Taylor Road. This has some merit in that it would allow all the north bound flows from the local area to be accommodated at this location and separate to the southbound flows (accommodated via Taylor Road). The right turn out of Vardon Road northbound has subsequently been monitored in October 2016. While also quite low in volume, it is a larger volume than at Taylor Road. The performance when tested with the SIDRA intersection modelling tool was also at LoS 'F', with slightly higher levels of delay than at Taylor Road.

The above observations have been taken into account when considering the development proposals.

3.3 Cycling Facilities

The road network in the vicinity of the subject site includes generous sealed shoulders along Nelson Bay Road, and Fullerton Street. These are available for use by cyclists.

The Stockton Cycle way, which runs parallel to Fullerton Street from near the Stockton Bridge, was opened by Council in 2013, connecting the peninsula from Stockton Bridge in the north to the Stockton Ferry terminal in the south. It is constructed as high standard concrete pavement dual use path.

The City of Newcastle Council has actively promoted cycling as a mode of transport as well as a recreational activity for many years. This is not without its challenges, including some topography challenges, but with much of the local Stockton area quite flat, it lends itself to the promotion of cycling in the local area.

Appendix B - Newcastle Cycling Map illustrates the existing and planned network of cycleways being development by Council.

3.4 Public Transport Services

The locality is well service by bus public transport, and is also linked to the Newcastle CBD by the Newcastle to Stockton Ferry Service. Scheduled bus and ferry services are operated By Newcastle Buses and Ferries, a State Government owned corporation. Bus services operated by Port Stephens Coaches also serve to area, linking to locations in the north such as Newcastle Airport at Williamtown. The networks, bus and ferry, are illustrated in **Appendix C.**

3.5 Road Authority Liaison

Liaison has been undertaken with officers of both the City of Newcastle and NSW Roads and Maritime. No specific issues were raised from a traffic and transport perspective by either authority although it is noted here that NSW RMS are currently conducting a route development strategy for Nelson Bay Road. It is understood that RMS has a requirement to deliver 20 year strategies on all roads under its jurisdiction. Date of completion was not known at the time of publishing this report.

3.6 Crash History

Data was original sourced for review from the NSW RMS Crash Database. Summary information is provided in **Appendix D** to this report.

The data covered the period from 1st July 2010 to 30th June 2015, and is focussed on the Stockton Bridge, Nelson Bay Road, and Fullerton Street Fern Bay location. Over the period of review there were 20 recorded crashes with 9 casualties. No fatalities were recorded in this vicinity. Of the casualties 4 incidents involved serious injuries. 75% of the incidents occurred on non-intersection locations, with a third involving hitting objects when leaving the (straight) carriageway. 45% of recorded incidents involved single vehicles. Contributing factors were noted as speed (15% and fatigue (10%)

Further to the north and approaching the Newcastle (Williamtown) Airport precinct there were 10 recorded incidents with 13 casualties, in the vicinity of Cabbage Tree Road and Williamtown Drive. In this area speed was noted as a significant contributing factor (40%) and fatigue also but to a lesser extent (20%).

At the key intersections on approaches to the subject site, there have been 2 incidents, one involving a moderate injury in 2011, at the Nelson Bay Road / Fullerton Street intersection. The roundabout control at this junction was upgrade some years ago, with the northbound lanes able to bypass the offset roundabout layout that controls southbound movements and the Fullerton Street approach to the junction. It is understood these changes have had a positive impact on the number type and severity of incidents since that time.

Of note from the crash data is that there were no recorded incidents involving traffic pulling out of local roads onto Nelson Bay Road. This information has been taken into consideration in developing the access strategy for the subject site.

The Councils' work considered the 5 year period from 2012 to 2017, and noted 33 recorded accidents over that 5 year period. Noting also a cluster of incidents within the vicinity of the roundabout controlled intersection of Nelson Bay Road / Fullerton Cover Road / Seaside Boulevard. Also of concern were 2 recorded accidents involving pedestrians near Vardon Road and the Fern Bay Store.

4 Development Proposals

A number of earlier assessments of the subject site have been prepared over several years. As part of this work, a notional development yield was prepared indicating some 249 development lots may be achievable on the Rifle Range site. This yield is being tested as part of the current investigations and are noted here for the purpose of forming a notional understanding of what the impacts may be and what development levels may be possible. The Stockton Rifle Range Indicative Master Plan is illustrated in Appendix A to their report. Key access features include road connections to both Vardon Road and Taylor Road.

4.1 Rifle Range

The details of the site are:

Table 4-2 Rifle Range Site Description

	Rifle Range
Title	Lot 5 DP233358
Area	111.35ha
Council	Port Stephens (subject to amalgamation)
Existing Land use Zoning	E2 – Environmental Conservation
Potential Residential Dwellings	318 dwellings: - 66 Dune Apartments - 68 Townhouses - 48 Courtyard Homes - 120 Cluster Homes - 16 Eco Houses
Proposed Site Access	Via Popplewell Road to Nelson Bay Road

It should be noted that a comparable report has been prepared for the second site under consideration, and that both pieces of work have taken into account the traffic generation and impacts of the other proposal.

4.2 Other Known Developments

The work of Port Stephens Council and The City of Newcastle has identified approximately 1400 (1417) additional dwellings within the North Stockton and Fern Bay localities that could be developed in the forward planning horizon to 2016. This includes:

- For Wallace (100 dwellings)
- Rifle Range (Noted as 300 dwellings)
- The Councils' preferred site for a mixed use centre (750 dwellings and 5000 m^2 retail centre)
- Newcastle Golf Course (80 dwellings)
- Fullerton Cove Caravan Park (145 dwellings)
- Fern Bay Infill development (42 dwellings)

The Councils' work has also taken into account an estimated 300 dwellings yet to be constructed and occupied within the existing Seaside Estate at the northern end of the Fullerton Cove locality.

4.3 Access, Trip Distribution and Assignment Assumptions

It is proposed to access the Rifle Range site via one access point to Popplewell Road, and then via a possible combination of Vardon Road and Taylor Road to Nelson Bay Road. This would allow traffic heading north to travel via Vardon Road, and traffic heading to and from the south via Taylor Road, although technically it would be possible to direct all traffic to either one of these junctions on capacity grounds alone.

If the pattern of trips were to be dispersed this would mean that the right turn movements out of the Fern Bay Precinct heading north can be assumed to travel via Vardon Road. And similarly traffic heading south would be expected to travel via Taylor Road. Irrespective of whether the right turn assignment of trips is made at Taylor Road or Vardon Road there is a need to understand the performance level of this movement as it is one of the most critical for satisfactory and safe intersection performance.

The fundamental assignment and distribution of trips irrespective of the local road assignments has been assumed as follows:

Rifle Range
Assignment of Trips

a. AM – 10% IN, 90% OUT
b. PM – 90% IN, 10% OUT

Directional Distribution

a. 50% northbound via Vardon Road
b. 50% southbound via Taylor Road

The Councils' assessment work applied an overall distribution of 70% south (55% toward Newcastle, 15% toward Stockton) and 35% north toward Williamtown. This was based on the existing directional split of flows at the intersections of Fullerton Street and Seaside Boulevard from surveys conducted in 2017. However, given the specific nature of the Defence Housing Australia development proposals to support housing for personnel from the nearby Williamtown RAAF base, it is still considered appropriate to use the 50% north, 50% south distribution of traffic as applied in earlier assessments for the Rifle Range development proposal.

4.4 Traffic Generation

Standard residential trips rates have been applied in past assessment work, and it is proposed to continue this practice. This is also consistent with the approach applied in the Councils' recent Fern Bay and North Stockton Traffic and Transport Study. This is conservative, in that the proposed mix of townhouses, apartments, courtyard and cluster homes would have a lower traffic generation than that of the single residential dwellings that has been applied here.

Table 4-3 – Applied Traffic Generation Rates presents the revised traffic generation characteristics of the Rifle Range site base on the updated total of 318 dwellings.

Table 4-3 – Future Traffic Generation Assumptions

Masterplan Component	AM Peak Generation Rate (vph)	AM Peak Trips (vph)	PM Peak Generation Rate (vph)	PM Peak Trips (vph)	Comments
Rifle Range	0.71	23 IN 203 OUT	0.78	223 IN 25 OUT	

Notes: All peak trip rates are expressed in vehicles per hour (vph)

These updated traffic generation forecasts represent an increase in the order of 25% over previous allowances for the Rifle Range site. They are however comparable to estimates used in the Councils' recent Traffic and Transport Study.

5 Existing Network Performance

5.1 Road Network

Traffic volume data for the project was collected during a 1 day survey of intersection traffic volumes as outlined in Section 3.2 of this report. These surveys were completed on a typical weekday. The surveys were completed using video monitoring and data capture techniques, and allow post survey viewing of video footage for review of characteristics such as queuing, driver behaviour and so on. Data reduction has been completed that focusses on the typical peak periods for commuters (and school based activity) at the start and end of the business day, i.e. 7.00 AM to 9.30 AM, and 2.00PM to 4.30PM. The results of this monitoring are provided in **Appendix E** of this report.

AM Operations

The results from the 2016 traffic survey indicated that during the surveyed morning AM peak commute period (7.00 to 8.00 AM) the two-way traffic flow along Nelson Bay Road south of Taylor Road was in the order of 1900 vph (864 NB +1060 SB). These flows are well within the technical capacity of a dual carriageway 4 lane urban arterial road at Level of Service (LoS) 'A' northbound, and 'B' southbound.

PM Operations

The corresponding results from the PM survey at Nelson Bay Road and Taylor Road between 3.30 PM and 4.30 PM (peak PM activity) show flows of a similar magnitude to the AM peak period. The PM data set indicates that during the surveyed afternoon peak period the two-way traffic flow along Nelson Bay Road was in the order of 2000 vph (1284 NB +720 SB), slightly more than the morning peak observed. These flows are again well within the technical capacity of urban traffic lanes at LoS 'B' northbound and LoS 'B' southbound.

A summary of the 8th June and 27th October 2016 traffic data is presented in **Table 5.1 – Base Traffic Volumes** below.

Table 5.1 – Base Traffic Volumes

Road	Location	Peak Period	Peak flow(1)	Mid-Block Road Capacity	Level of Service
Nelson Bay Road	North of Taylor Road	AM peak	861 N/B 1055 S/B	900 (one-way) (3) 1400 (one-way) (4)	A B
		PM peak	1260 N/B 714 S/B	900 (one-way) (4) 1400 (one-way) (4)	B A
Nelson Bay Road	South of Taylor Road	AM peak	864 N/B 1060 S/B	900 (one-way) (4) 1400 (one-way) (4)	B A
		PM peak	1284 N/B 720S/B	1400 (one-way) (4) 900 (one-way) (4)	B A
Taylor Road	East of Nelson Bay Rd	AM peak	4 eastbound 15 westbound	200 (one-way) (2)	A A
		PM peak	31 eastbound 18 westbound	200 (one-way) (2)	A A
Vardon Road	East of Nelson Bay Rd	AM peak	46 eastbound 23 westbound	200 (one-way) (2)	A
		PM peak	23 eastbound 27 westbound	200 (one-way) (2)	A

Notes: 1. Traffic flows from 8th June 2016 (Taylor Rd & Fullerton St) & 27th October 2016 (Vardon Road) traffic survey results by Mark Waugh Pty Ltd
2. RTA 2002, Urban Road Conditions, One Lane, Level of Service (Refer Table 5.2 below)
3. RTA 2002, Urban Road Conditions, Two Lanes, Level of Service (Refer Table 5.2 below)

Table 5.1 demonstrates that the roads serving as the main access routes for the subject site will continue to operate well within their technical and functional lane capacity levels as described by Austroads and NSW RMS guidelines.

The results above are drawn from the urban flow conditions Levels of Service definitions as presented in the Guide to Traffic Generating Developments ((NSW ART October 2002) Theses are reproduced here as Table 2.2 - Urban Road peak hour flows per direction, overleaf. It can be seen that the ultimate capacity for Taylor Road and Vardon Road for example in this location is 900 vph at the limit of acceptable flow conditions under urban conditions Level of Service 'D', and possibly up to 1400 vehicles per hour in one direction for LoS 'E'. For the current observed traffic flows along Taylor Road and Vardon Road it can be seen that the level of service for road users is very good at either 'A' and for Nelson Bay Road 'A' or 'B'.

Table 5.2 - Urban Road peak hour flows per direction

Level of service	One Lane (vph)	Two Lanes (vph)
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

Source: RTA Guide to Traffic Generating Developments, version 2.2 dated October 2002.

The conclusion drawn from this data is that the technical lane capacity of the road system adjacent to the subject sites is high and the performance is very good.

5.2 Intersection Performance

Local Intersections

As discussed above, there are a number of intersections and local access streets serving the subject site. Intersections of and with the local streets are priority controlled, with the Nelson Bay Road intersections with Taylor Road and Vardon Road currently operating under priority control. All local street intersections to the east of Nelson Bay Road also operate under priority control. This reflects the local function of these roads.

For the assessment of intersection performance it is useful to firstly consider the Austroads threshold levels for intersection capacity under uninterrupted flow conditions. Table 5.3 Intersection Capacity – Uninterrupted Flow Conditions below presents these thresholds. Where traffic flows fall within these limits intersection performance is essentially operating with little or no delay for approaching drivers other than to obey the requisite road rules.

Table 5.3 Intersection Capacity – Uninterrupted Flow Conditions

Road Type	Light Crossing or turning volumes Maximum Design Hour Volumes, Two-way (vph)		
Two Lane through Roadway	400	500	650
Cross Road	250	200	100
Four Lane through roadway	1000	1500	2000
Cross road	100	50	25

Source: Austroads Guide to Traffic Engineering Practice - Part 5, 1988

For both the morning and afternoon peak periods, the survey results indicate that these limits are not met on all the local street priority junctions involving local streets only. Essentially, traffic is required to slow down to negotiate turns with little if any delay for the through traffic movements. This is consistent with the site observations.

Operation of Nelson Bay Road intersections

The higher order interactions that are part of the road network providing access to the subject site are the Nelson Bay Road intersections operating under priority control at Taylor Road and Vardon Road. (While Rankin Road also connects Popplewell Road to Nelson Bay Road it operates under priority control and allows only left in left out turning movements. Given the full access available at both Taylor Road and Vardon Road Rankin Road has not been considered further in these investigations.)

A review of the mid-block capacities on Nelson Bay Road has shown there is significant spare capacity on this route.

For the above intersections, SIDRA[7] Intersection modelling has indicated a good Level of Service (LoS) of "A". The only exception to this is the right turn movements from Vardon Road and Taylor Road which were modelled at a LoS 'F'. This is despite the very low traffic volumes performing these movements. These results are a reflection of the quite high peak traffic flows along Nelson Bay Road. As such investigation of higher order traffic controls is warranted.

What is clear from the intersection analysis is that one of either the intersection of Taylor Road or Vardon Road with Nelson Bay Road is capable of accommodating all of the traffic movements forecast from the subject site.

That is, only one intersection upgrade is required.

Given the existing form of both the Taylor Road and Vardon Road intersections with Nelson Bay Road, the existing lane configurations are acceptable and could be used as the basis for intersection layouts with signalised control.

An alternative form of control that has been considered in past analysis is seagull style priority control that allows the staged movement of right turning vehicles across the main road flows. This was considered an attractive option possibly because of the very low side road flows, and the imposition of additional delay on through flows along Nelson Bay road if traffic signals were to be introduced.

However having reviewed the Councils' work for the Fern Bay and North Stockton Traffic and Transport Study which has considered the continued development within the immediate vicinity of the Rifle Range site, it is considered that the most appropriate form of upgraded intersection control to provide for safer right turn movements onto Nelson Bay road would be traffic signals installed at Vardon Road. This will also allow for the provision of upgraded pedestrian crossings which will go towards alleviating the concern caused by recent incidents involving pedestrian injuries in the locality.

Continued liaison with the road authorities is recommended to allow further development and confirmation of an acceptable overall access strategy along Nelson Bay Road for the Fern Bay community.

Further details of the intersection analyses are provided in **Appendix F** to this report.

Background Traffic Growth

The NSW RMS has for some time considered it necessary to make allowance for 'background growth' along its road corridors. This is to take into account additional traffic flows from unknown sources that add to the base traffic flows. In earlier assessment work for both the Fort Wallace and Rifle Range development proposals background traffic growth was not applied. This is because the growth factor in the area was considered to be the development proposals themselves, and so no growth factor was applied to avoid double dipping.

In the more recent work conducted for the Councils, a background growth factor of 2% per annum applied for 10 years was adopted. , but it is considered that because of the substantial spare capacity in the road network in the vicinity of the subject site, the only issue requiring consideration is the form and performance of the intersections with the local road network.

Traffic from Fort Wallace Planning Proposal

It should be noted that a comparable report has been prepared for the second site under consideration, and that both pieces of work have taken into account the traffic generation and impacts of the other proposal.

6 Future Network Performance

6.1 Road Network

The forecast traffic generation form the subject site presented in Table 4-3 have been added to the existing flows to arrive at the 'with development' scenario.

A summary of the changes in peak traffic flows, assuming 50% of the forecast additional site movements the development are assigned along both Taylor Road and Vardon Road (which is extremely conservative) is presented below.

Table 6.1 – Forecast Mid-Block Traffic Volumes

Road	Location	Peak Period	Peak flow(1)	Mid-Block Road Capacity	Level of Service
Nelson Bay Road	North of Taylor Road	AM peak	951 N/B[4] 1062 S/B[4]	900 (one-way) [3] 1400 (one-way) [3]	B B
		PM peak	1276 N/B[4] 811 S/B[4]	900 (one-way) [3] 1400 (one-way) [3]	B A
Nelson Bay Road	South of Taylor Road	AM peak	875 N/B[4] 1174 S/B[4]	900 (one-way) [3] 1400 (one-way) [3]	A B
		PM peak	1406 N/B[4] 732 S/B[4]	1800 (one-way) [3] 900 (one-way) [3]	C A
Taylor Road	East of Nelson Bay Rd	AM peak	22 eastbound[4] 178 westbound[4]	200 (one-way) [2]	A A
		PM peak	310 eastbound[4] 39 westbound[4]	380 (one-way) [2] 200 (one-way) [2]	B A
Vardon Road	East of Nelson Bay Rd	AM peak	65 eastbound 206 westbound	200 (one-way) [2] 380 (one-way) [2]	A B
		PM peak	203 eastbound 196 westbound	380 (one-way) [2] 200 (one-way) [2]	B A

Notes: 1. Peak flow from 8th June 2016 traffic survey results by Mark Waugh Pty Ltd
2. RTA 2002, Urban Road Conditions, One Lane, Level of Service (Refer Table 5.2 below)
3. RTA 2002, Urban Road Conditions, Two Lanes, Level of Service (Refer Table 5.2 below)
4. 100% of site future traffic assigned to Taylor Road
4. 100% of site future traffic assigned to Vardon Road
5. Traffic Volumes are based on Revision 5 Development yield of 249 lots for Rifle Range

Table 6.1 demonstrates that the roads surrounding the subject site will continue to operate well within their technical and functional lane capacity levels as described by Austroads and NSW RMS guidelines. This includes a review of the updated Indicative Masterplan for the Rifle Range site, with all mid-block capacities still forecast to be within the acceptable Level of Service range of 'A' to 'C' for peak urban traffic flow conditions.

6.2 Potential Intersection Layouts

Two forms of intersection upgrade were considered in past investigations, and were considered to be applicable to either of the Vardon Road or Taylor Road junctions depending on road authority requirements.

Following review of the Councils' recent Fern Bay and North Stockton Traffic and Transport Study the form of intersection upgrade considered most appropriate to support the Rifle Range site and adjacent development is a potential traffic signal upgrade to the Nelson Bay Road / Vardon Road intersection.

Photo Plate 13– Nelson Bay Road (B63) at Vardon Road. U-turn lane in foreground could also be used in a seagull junction.

This form of intersection control can essentially fit within the existing junction configuration. An example of this type of signalised T junction layout is illustrated below.

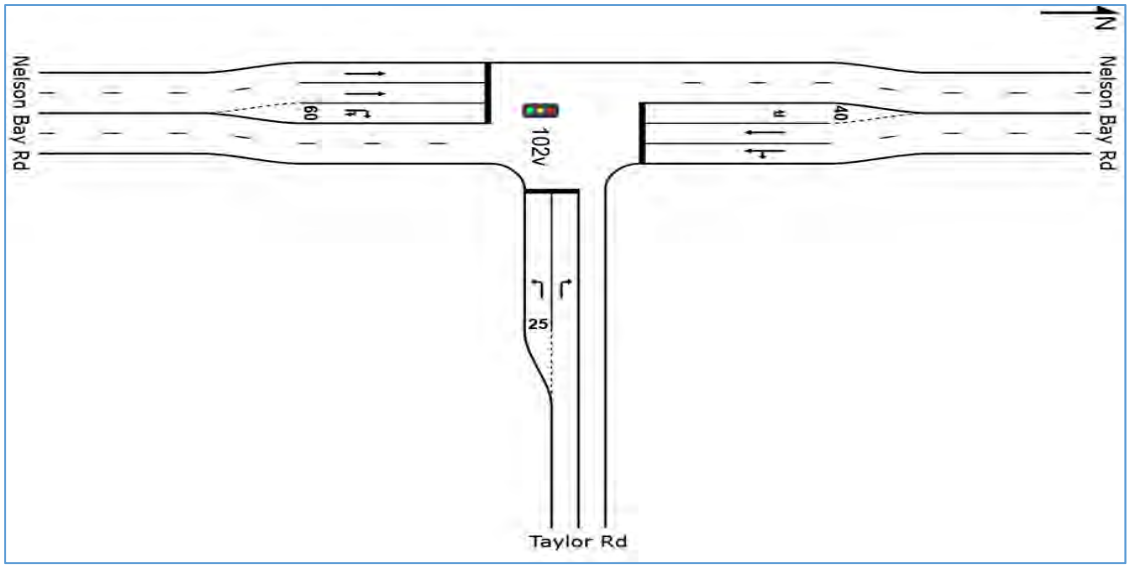


Figure 4 -Schematic layout of signalised intersection treatment.

6.3 Modelled Intersection Performance

Intersection performance have been re-tested here as part of the future site access considerations. The operations of Nelson Bay Road / Taylor Road and/or Vardon Road have been tested to demonstrate the potential future intersection performance. The results of the SIDRA analysis indicate the following potential operating issues:

a. Priority controlled access to local streets can function at very high and satisfactory service levels.

b. Upgrade of the Nelson Bay Road / Vardon Road intersection only is required to accommodate safe right turns out onto Nelson Bay Road.

The intersection analysis performed with SIDRA modelling has been reviewed to a level to confirm the validity of the potential upgraded access option at Vardon Road to support the Rifle Range rezoning proposal. The

SIDRA results are now based on the Revision H dwelling yield of 318 dwellings. The updated modelling results indicate that the critical AM right turn out of Vardon Road under current priority control is forecast to operate at a level of Service LoS 'F' with the updated Rifle Range traffic flows. Consequently signalisation of the intersection will be required to cope with the forecast increase in right turn volumes.

Level of Service Summaries for the junction analyses are included in **Appendix F** to this report.

6.4 Recommended Access Strategy

(Traffic Management Principles from Austroads Guide to Traffic Management Part 4: Network Management)

The functional class of a road determines the balance that needs to be struck between the traffic function and the access function of the abutting land.

The local access requirements of the subject site connecting to Popplewell Road will be satisfied by priority junction control, and road cross sections consistent with the engineering standards of the City of Newcastle for local street design.

Nelson Bay Road is an arterial road, and so its important function is primarily to favour traffic movement over access considerations. Direct access is generally discouraged and in this instance can be avoided by using local road connections.

TRAFFIC ENGINEERING RECOMMENDATIONS:

Having regard for the recent Fern Bay and North Stockton Traffic and Transport Study completed by Port Stephens Council and the City of Newcastle, and also considering the revised and updated Indicative Masterplan for the Rifle Range site.

It is recommended that the forecast level of development activity from the subject site be accommodated on the road network by way of the following road improvements:

a) Upgrade to RMS requirements for traffic signal control of the Vardon Road / Nelson Bay Road
b) Upgrade to Council road design standards of the local roads , Taylor Road and Vardon Road to Nelson Bay Road

Subsequent detailed investigations and design (at Development Application stage and beyond) in conjunction with the road authorities are recommended to confirm acceptable access arrangements for the site.

7 Summary and Conclusions

7.1 Summary

The Defence Housing Australia proposes to cater for Newcastle based Defence members and their families and to replace existing DHA dwellings that do not meet current standards. DHA has recently purchased two surplus Defence sites at Stockton with the objective of obtaining the necessary planning approvals and developing them for a mix of housing for ADF personnel and the private market. This updated traffic study has investigated the existing conditions and potential development of Defence Housing Australia housing facilities on the Rifle Range site at Fern Bay near Newcastle NSW, arriving at the following outcomes:

Existing Conditions

a. Existing flow conditions on Nelson Bay Road are well within technical capacity limits of its function and standard of construction.
b. Local roads in Fern Bay are quite old, but serviceable for the existing low levels of local traffic. Pavement conditions are generally fair to poor.
c. Intersections have been assessed as operating at satisfactory service levels, with the exception of existing right turns out of Taylor and Vardon roads onto Nelson Bay Road.
d. Cycling facilities are provided along the Hunter River foreshore, from near Stockton Bridge to the Stockton Ferry terminal.
e. The Newcastle to Stockton ferry service links Stockton to the Newcastle CBD with regular scheduled services.
f. Existing bus services connect Fern Bay and Stockton to Newcastle, and also north to Newcastle Airport.

Proposed Development

g. Additional traffic generation associated with the Rifle Range site has been updated to reflect the 318 dwellings of the Indicative Master plan (Architectus Revision H 10th May 2018)

h. The Fern Bay and North Stockton Traffic and Transport Study completed recently by Port Stephens Council and the City of Newcastle has also been considered in the review and updates to this traffic assessment.

i. Access is still planned via Popplewell Road to Taylor Road and Vardon Road, connecting to Nelson Bay Road.

Future Performance

j. Future flow conditions on Nelson Bay Road are forecast to remain well within technical capacity limits for the function and standard of construction of the road under urban flow conditions.
k. Intersections have been assessed under future flow conditions as operating at satisfactory service levels, with the exception of northbound right turns out of either Taylor or Vardon Roads onto Nelson Bay Road.

ACCESS RECOMMENDATIONS:

In view of the conditions of the local roads and performance of intersections on Nelson Bay Road the following recommendations are made for improvements to support the development proposal:

a. Upgrade of the intersection of Nelson Bay Road with Vardon Road to provide safe right turn access for the existing Fern Bay community and future development, including the proposal for the Rifle Range site.
b. Confirm design requirements and upgrades to Taylor Road and Vardon Road to Council local street standards, with both roads performing a local access function connecting to Nelson Bay Road.

7.2 Conclusion

Access focussing on the Vardon Road intersection with Nelson Bay Road, provided with improved right turn facilities, combined with upgrading of the local road connections to the main road network, to Council design standards, will present a very effective access solution. The improvements will also greatly benefit the existing Fern Bay community. Further liaison is required with the road authorities but on the basis of this revised traffic assessment the updated Indicative Masterplan for the Rifle Range sites is considered satisfactory from a traffic and transport perspective.

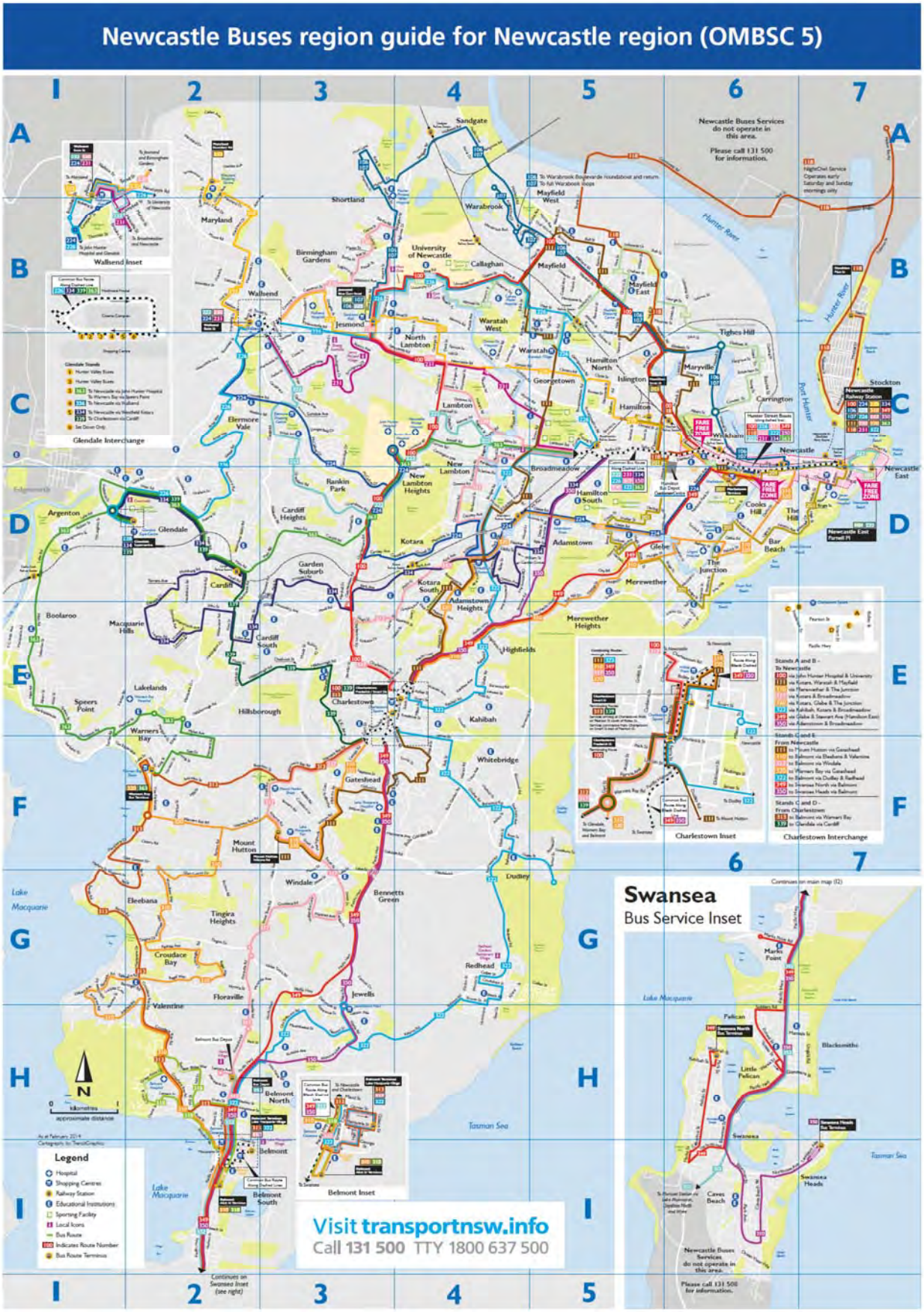
The overall conclusion is that given the potential level of future development now proposed for the Rifle Range site at Fern Bay, the access strategy put forward here to support the planning proposal is supported.

Appendix A. Rifle Range Draft Indicative Master Plan (Revision H 10/05/18)

Source: Architectus 2018

Appendix B. Newcastle Cycling Map

Appendix C. Public Transport Maps



BETTER TRANSPORT FUTURES

Route 130

Section Point Number
Location:

00 **Fingal Bay Shops** Marine Drive
01 Rocky Point Road
02 Marine Drive
03 Shoal Bay Road
04 Shoal Bay Road
05 **Nelson Bay** Coles, Donald Street
06 Government Road
07 Sandy Point Road
08 **Salamander Shopping Centre**
09 Salamander Way
10 Nelson Bay Road
11 Frost Road
12 Frost Road
13 **Boat Harbour** Kingsley Drive
14 **Anna Bay Shops** Gan Gan Road
15 Nelson Bay Road
16 Nelson Bay Road
17 Nelson Bay Road
18 Nelson Bay Road
19 Nelson Bay Road OR Marsh Road
20 Nelson Bay Road OR Marsh Road
21 Nelson Bay Road OR Marsh Road
22 Nelson Bay Road OR Marsh Road
23 Nelson Bay Road
24 **Salt Ash School**
25 Nelson Bay Road
26 Nelson Bay Road
27 Nelson Bay Road
28 Nelson Bay Road
29 **Newcastle Airport**
30 Nelson Bay Road
31 Nelson Bay Road
32 Nelson Bay Road
33 Nelson Bay Road
34 **Fern Bay** Bay Way Caravan Park
35 Nelson Bay Road
36 Nelson Bay Road
37 Teal Street
38 Cormorant Road
39 Cormorant Road
40 **Mayfield** Woolworths, Maitland Road
41 Maitland Road
42 **Newcastle Station** Coach Terminal

Bus route map

130, 131, 132, 133, 134, 135

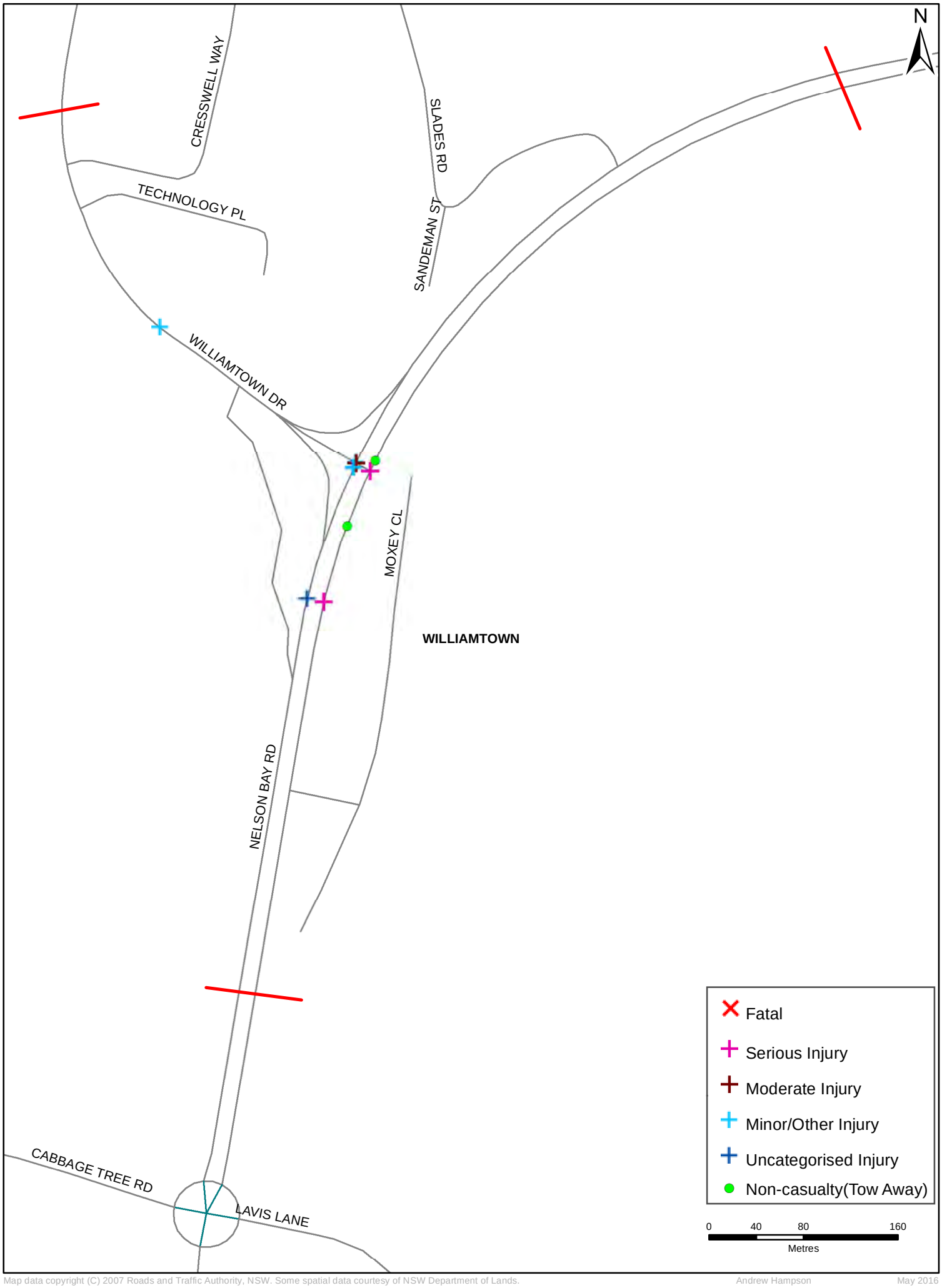
Timing Points

- A Fingal Bay Shops Marine Drive
- B Shoal Bay Resort Shoal Bay Road
- C Little Beach Dixon Drive
- D Tomaree Hospital & Seabreeze Shops
- E Nelson Bay Coles, Donald Street
- F Corlette Vantage Estate
- G Galoola Drive & Bagnall Beach Road
- H Corlette Post Office
- I Salamander Shopping Centre
- J Boat Harbour Kingsley Drive
- K Birubi Point Fitzroy Street
- L Anna Bay Shops Gan Gan Road
- M Taylors Beach Roundabout
- N Soldiers Point Ridgeway Avenue
- O Bobs Farm School Marsh Road
- P Salt Ash School
- Q Newcastle Airport
- R Fern Bay Bay Way Caravan Park
- S Mayfield Woolworths, Maitland Road
- T Newcastle Station Coach Terminal
- U Raymond Terrace Sturgeon Street

Appendix D. Crash History

Nelson Bay Road and Williamtown Drive, Williamtown

Crash period 01/07/2010 to 30/06/2015



Andrew Hampson

May 2016

Detailed Crash Report - sorted

Transport for NSW
Centre for Road Safety

Crash No. / Data Source	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
Natural Lighting																				**S F**
Hunter Region				**Port Stephens LGA**				**Williamtown**						**Nelson Bay Rd**						
737195 P	28/10/2010	Thu	09:00	10 m N	WILLIAMTOWN DR	TJN	CRV	Overcast	Dry	80	2	WAG	U U	S in NELSON BAY RD	Unk	Proceeding in lane	N	0	0	
E42597045				Daylight		RUM: 30	Rear end					CAR	M59	S in NELSON BAY RD	0	Stationary				
Hunter Region				**Port Stephens LGA**				**Williamtown**						**Nelson Bay Rd**						
754112 P	19/05/2011	Thu	15:38	5 m S	WILLIAMTOWN DR	TJN	STR	Fine	Dry	80	2	CAR	F53	N in NELSON BAY RD	80	Proceeding in lane	I	0	3	
E45001643				Daylight		RUM: 30	Rear end					CAR	F82	N in NELSON BAY RD	0	Stationary				
Hunter Region				**Port Stephens LGA**				**Williamtown**						**Nelson Bay Rd**						
761747 P	21/07/2011	Thu	18:20	at	WILLIAMTOWN DR	TJN	CRV	Raining	Wet	70	1	CAR	M26	S in NELSON BAY RD	70	Proceeding in lane	I	0	2	S
E45228464				Darkness		RUM: 87	Off lft/lft bnd=>obj					Utility pole								
Hunter Region				**Port Stephens LGA**				**Williamtown**						**Nelson Bay Rd**						
761799 P	22/07/2011	Fri	14:30	at	WILLIAMTOWN DR	TJN	CRV	Raining	Wet	80	2	CAR	F26	N in NELSON BAY RD	70	Proceeding in lane	I	0	1	
E156032296				Daylight		RUM: 30	Rear end					TRK	M40	N in NELSON BAY RD	70	Proceeding in lane				
Hunter Region				**Port Stephens LGA**				**Williamtown**						**Nelson Bay Rd**						
787583 P	07/03/2012	Wed	11:00	50 m W	WILLIAMTOWN DR	DIV	CRV	Raining	Wet	70	1	CAR	M26	S in NELSON BAY RD	60	Proceeding in lane	N	0	0	S
E48579555				Daylight		RUM: 87	Off lft/lft bnd=>obj					Drain/culvert								
Hunter Region				**Port Stephens LGA**				**Williamtown**						**Nelson Bay Rd**						
806499 P	06/08/2012	Mon	14:30	at	WILLIAMTOWN DR	TJN	CRV	Fine	Dry	80	1	UTE	M48	N in NELSON BAY RD	80	Proceeding in lane	I	0	1	F
E47846860				Daylight		RUM: 81	Off left/rt bnd=>obj					Signal pole								
Hunter Region				**Port Stephens LGA**				**Williamtown**						**Nelson Bay Rd**						
812166 P	28/09/2012	Fri	15:44	500 m N	CABBAGE TREE RD	DIV	STR	Fine	Dry	100	2	M/C	F44	N in NELSON BAY RD	70	Proceeding in lane	I	0	1	
E49410766				Daylight		RUM: 30	Rear end					TRK	M29	N in NELSON BAY RD	0	Stationary				
Hunter Region				**Port Stephens LGA**				**Williamtown**						**Williamtown Dr**						
1007282 P	09/10/2013	Wed	13:15	200 m W	NELSON BAY RD	2WY	CRV	Fine	Dry	60	1	WAG	M61	W in WILLIAMTOWN DR	50	Proceeding in lane	I	0	1	S F
E55232283				Daylight		RUM: 81	Off left/rt bnd=>obj					Signpost								
Hunter Region				**Port Stephens LGA**				**Williamtown**						**Nelson Bay Rd**						
1034425 P	09/07/2014	Wed	15:40	500 m N	CABBAGE TREE RD	DIV	STR	Fine	Dry	80	2	CAR	M29	N in NELSON BAY RD	30	Proceeding in lane	I	0	1	
E56102416				Daylight		RUM: 30	Rear end					CAR	M39	N in NELSON BAY RD	0	Stationary				

Detailed Crash Report - sorted

Crash No. / Data Source	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
Natural Lighting																				**S F**
Hunter Region				**Port Stephens LGA**					**Williamtown**					**Nelson Bay Rd**						
1040656 P	17/07/2014	Thu	16:30	5 m S	WILLIAMTOWN DR	TJN	CRV	Fine	Dry	60	4	TRK	M30	N in NELSON BAY RD	90	Proceeding in lane	I	0	3	S
E54998152				Daylight		RUM:	30	Rear end				TRK	M21	N in NELSON BAY RD	0	Stationary				
												CAR	M49	E in WILLIAMTOWN DR	20	Turning right				
												CAR	M20	S in NELSON BAY RD	0	Stationary				

Report Totals: Total Crashes: 10 Fatal Crashes: 0 Injury Crashes: 8 Killed: 0 Injured: 13

Crashid dataset Nelson Bay Road and Williamtown Drive, Williamtown - crash data from 01/07/2010 to 30/06/2015

Note: *Ordered by: Crash Date,Crash Time,Crash No.*

Crash self reporting, including self reported injuries began in Oct 2014. Trends from 2014 are expected to vary from previous years. More unknowns are expected in self reported data. For further information refer to Data Manual or report provider.

Summary Crash Report

# Crash Type		
Car Crash	9	90.0%
Light Truck Crash	3	30.0%
Rigid Truck Crash	0	0.0%
Articulated Truck Crash	0	0.0%
'Heavy Truck Crash	*(0)*	*(0.0%)*
Bus Crash	0	0.0%
"Heavy Vehicle Crash	*(0)*	*(0.0%)*
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	1	10.0%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	0	0.0%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	6	60.0%
Non intersection	4	40.0%

* Up to 10 metres from an intersection

Collision Type		
Single Vehicle	4	40.0%
Multi Vehicle	6	60.0%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	9	90.0%
Unclassified Road	1	10.0%

Contributing Factors		
Speeding	4	40.0%
Fatigue	2	20.0%

Weather		
Fine	6	60.0%
Rain	3	30.0%
Overcast	1	10.0%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	3	30.0%
Dry	7	70.0%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	0	0.0%
Daylight	9	90.0%
Dusk	0	0.0%
Darkness	1	10.0%

Crash Movement		
Intersection, adjacent approaches	0	0.0%
Head-on (not overtaking)	0	0.0%
Opposing vehicles; turning	0	0.0%
U-turn	0	0.0%
Rear-end	6	60.0%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	0	0.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	0	0.0%
Out of control on straight	0	0.0%
Off road, on curve	0	0.0%
Off road on curve, hit object	4	40.0%
Out of control on curve	0	0.0%
Other crash type	0	0.0%

Speed Limit					
40 km/h or less	0	0.0%	80 km/h zone	5	50.0%
50 km/h zone	0	0.0%	90 km/h zone	0	0.0%
60 km/h zone	2	20.0%	100 km/h zone	1	10.0%
70 km/h zone	2	20.0%	110 km/h zone	0	0.0%

~ 07:30-09:30 or 14:30-17:00 on school days	~ 40km/h or less	0	0.0%	~ School Travel Time Involvement	5	50.0%

Day of the Week												
Monday	1	10.0%	Wednesday	3	30.0%	Friday	2	20.0%	Sunday	0	0.0%	WEEKEND	0	0.0%
Tuesday	0	0.0%	Thursday	4	40.0%	Saturday	0	0.0%	WEEKDAY	10	**********			

CRASHES	10	
Fatal	0	0.0%
Serious inj.	2	20.0%
Moderate inj.	1	10.0%
Minor/Other inj.	3	30.0%
Uncategorised inj.	2	20.0%
Non-casualty	2	20.0%

Self Reported Crash	0	0%

Time Group		% of Day	
00:01 - 02:59	0	0.0%	12.5%
03:00 - 04:59	0	0.0%	8.3%
05:00 - 05:59	0	0.0%	4.2%
06:00 - 06:59	0	0.0%	4.2%
07:00 - 07:59	0	0.0%	4.2%
08:00 - 08:59	0	0.0%	4.2%
09:00 - 09:59	1	10.0%	4.2%
10:00 - 10:59	0	0.0%	4.2%
11:00 - 11:59	1	10.0%	4.2%
12:00 - 12:59	0	0.0%	4.2%
13:00 - 13:59	1	10.0%	4.2%
14:00 - 14:59	2	20.0%	4.2%
15:00 - 15:59	3	30.0%	4.2%
16:00 - 16:59	1	10.0%	4.2%
17:00 - 17:59	0	0.0%	4.2%
18:00 - 18:59	1	10.0%	4.2%
19:00 - 19:59	0	0.0%	4.2%
20:00 - 21:59	0	0.0%	8.3%
22:00 - 24:00	0	0.0%	8.3%

Street Lighting Off/Nil		% of Dark
0	of 1	in Dark 0.0%

CASUALTIES	13	
Killed	0	0.0%
Seriously inj.	2	15.4%
Moderately inj.	2	15.4%
Minor/Other inj.	5	38.5%
Uncategorised inj.	4	30.8%
^ Unrestrained	0	0.0%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Crashes		Casualties
2	2014	4
1	2013	1
3	2012	2
3	2011	6
1	2010	0

McLean Periods			% Week
A	0	0.0%	17.9%
B	0	0.0%	7.1%
C	5	50.0%	17.9%
D	0	0.0%	3.5%
E	0	0.0%	3.6%
F	1	10.0%	10.7%
G	4	40.0%	7.1%
H	0	0.0%	7.1%
I	0	0.0%	12.5%
J	0	0.0%	10.7%

#Holiday Periods												
New Year	0	0.0%	Easter	0	0.0%	Queen's BD	0	0.0%	Christmas	0	0.0%	Easter SH	0	0.0%	Sept./Oct. SH	1	10.0%
Aust. Day	0	0.0%	Anzac Day	0	0.0%	Labour Day	1	10.0%	January SH	0	0.0%	June/July SH	1	10.0%	December SH	0	0.0%

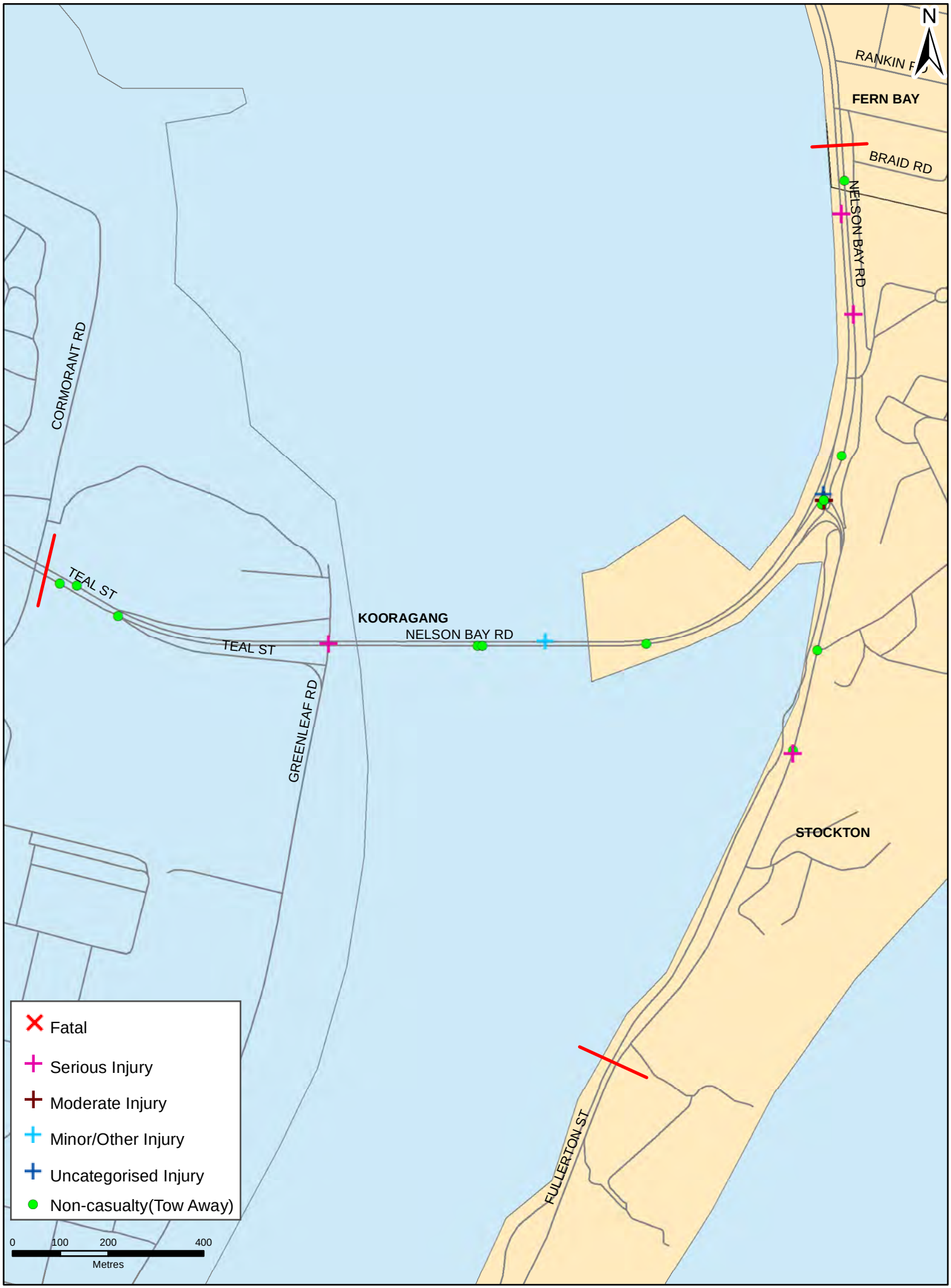
Crashid dataset Nelson Bay Road and Williamtown Drive, Williamtown - crash data from 01/07/2010 to 30/06/2015

Note: Crash self reporting, including self reported injuries began Oct 2014. Trends from 2014 are expected to vary from previous yrs. More unknowns are expected in self reported data. Reporting yrs 1996-2004 and 2014 onwards contain uncategorised inj crashes.

Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Stockton Bridge, Nelson Bay Road and Fullerton Street, Fern Bay

Crash period 01/07/2010 to 30/06/2015



Andrew Hampson

May 2016

Detailed Crash Report - sorted

Transport for NSW
Centre for Road Safety

Crash No. / Data Source	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
Natural Lighting																				**S F**
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
717007 P	03/07/2010	Sat	14:25	at	FULLERTON ST	RDB	CRV	Fine	Dry	80	2	CAR	F81	W in FULLERTON ST	10 Proceeding in lane		N	0	0	
E41773328					Daylight	RUM: 10	Cross traffic					TRK	M28	S in NELSON BAY RD	50 Proceeding in lane					
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
717500 P	12/07/2010	Mon	12:20	10 m	S FULLERTON ST	RDB	CRV	Fine	Dry	80	2	LOR	M67	S in NELSON BAY RD	40 Proceeding in lane		N	0	0	
E41570045					Daylight	RUM: 30	Rear end					CAR	F65	S in NELSON BAY RD	40 Proceeding in lane					
Hunter Region				**Port Stephens LGA**			**Fern Bay**							**Nelson Bay Rd**						
723113 P	12/08/2010	Thu	07:50	100 m	N FULLERTON COVE RD	DIV	STR	Fine	Dry	100	2	CAR	M21	S in NELSON BAY RD	Unk Proceeding in lane		N	0	0	
E41907766					Daylight	RUM: 30	Rear end					WAG	F47	S in NELSON BAY RD	Unk Proceeding in lane					
Hunter Region				**Newcastle LGA**			**Stockton**							**Fullerton St**						
740774 P	01/02/2011	Tue	08:50	555 m	S NELSON BAY RD	2WY	CRV	Fine	Dry	70	1	WAG	M40	S in FULLERTON ST	55 Proceeding in lane		N	0	0	F
E376143391					Daylight	RUM: 81	Off left/rt bnd=>obj					Utility pole								
Hunter Region				**Newcastle LGA**			**Kooragang**							**Teal St**						
750199 P	10/04/2011	Sun	01:14	600 m	N SANDPIPER CL	DIV	STR	Fine	Dry	80	1	WAG	M53	W in TEAL ST	80 Proceeding in lane		N	0	0	
E44524077					Darkness	RUM: 66	Object on road					Other non fixed object								
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
757281 P	05/05/2011	Thu	14:55	at	FULLERTON ST	RDB	STR	Fine	Dry	70	2	CAR	M17	N in NELSON BAY RD	20 Turning right		I	0	2	
E44540221					Daylight	RUM: 21	Right through					CAR	F71	S in NELSON BAY RD	20 Proceeding in lane					
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
765006 P	04/08/2011	Thu	12:45	600 m	N FULLERTON ST	DIV	STR	Fine	Dry	80	1	CAR	M59	N in NELSON BAY RD	75 Proceeding in lane		I	0	1	
E654664490					Daylight	RUM: 71	Off rd left => obj					Utility pole								
Hunter Region				**Newcastle LGA**			**Stockton**							**Fullerton St**						
770833 P	04/10/2011	Tue	12:00	560 m	S NELSON BAY RD	2WY	CRV	Fine	Dry	70	1	M/C	F43	N in FULLERTON ST	70 Pull out opposite		I	0	1	S
E46401051					Daylight	RUM: 51	Out of control otake													
Hunter Region				**Newcastle LGA**			**Kooragang Isla**							**Greenleaf Rd**						
781088 P	20/10/2011	Thu	21:45	at	STOCKTON BDGE	2WY	STR	Fine	Dry	60	4	CAR	M22	N in GREENLEAF RD	Unk Proceeding in lane		I	0	2	
E46808741					Darkness	RUM: 71	Off rd left => obj					CAR		N in GREENLEAF RD	0 Parked					
												PED	F18	GREENLEAF RD	Lie/sit on carriageway					
												PED	M19	GREENLEAF RD	Lie/sit on carriageway					

Detailed Crash Report - sorted

Transport for NSW
Centre for Road Safety

Crash No. / Data Source	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
Natural Lighting																				**S F**
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
789179 P	02/03/2012	Fri	04:50	700 m W	FULLERTON ST	DIV	STR	Raining	Wet	60	1	CAR	F57	E in NELSON BAY RD	60 Proceeding in lane		I	0	1	
E91173101					Darkness	RUM: 73	Off rd rght => obj					Fence (prior to 2014)								
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
787317 P	14/03/2012	Wed	05:30	400 m N	FULLERTON ST	DIV	STR	Fine	Dry	70	1	WAG	M57	S in NELSON BAY RD	60 Proceeding in lane		I	0	1	
E47407445					Darkness	RUM: 71	Off rd left => obj					Utility pole								
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
811301 P	11/09/2012	Tue	05:33	at	STOCKTON BDGE	DIV	CRV	Fine	Dry	80	4	4WD	M24	W in NELSON BAY RD	50 Proceeding in lane		N	0	0	
E50837287					Dawn	RUM: 30	Rear end					VAN	M38	W in NELSON BAY RD	50 Proceeding in lane					
												4WD	M34	W in NELSON BAY RD	50 Proceeding in lane					
												CAR	F61	W in NELSON BAY RD	50 Proceeding in lane					
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
836620 P	15/05/2013	Wed	10:00	at	FULLERTON ST	RDB	CRV	Fine	Dry	70	2	CAR	M62	W in FULLERTON ST	30 Proceeding in lane		N	0	0	
E51252036					Daylight	RUM: 10	Cross traffic					CAR	F19	S in NELSON BAY RD	50 Proceeding in lane					
Hunter Region				**Newcastle LGA**			**Kooragang**							**Teal St**						
857191 P	29/10/2013	Tue	16:45	100 m E	CORMORANT ROAD OP	DIV	STR	Overcast	Wet	80	1	CAR	F38	E in TEAL ST	90 Proceeding in lane		N	0	0	S
E53018456					Daylight	RUM: 71	Off rd left => obj					Fence (prior to 2014)								
Hunter Region				**Newcastle LGA**			**Stockton**							**Nelson Bay Rd**						
1009025 P	24/01/2014	Fri	20:10	at	FULLERTON ST	TJN	CRV	Overcast	Wet	70	1	CAR	M64	N in NELSON BAY RD	80 Proceeding in lane		I	0	1	S
E460723191					Darkness	RUM: 87	Off lft/lft bnd=>obj					Utility pole								
Hunter Region				**Newcastle LGA**			**Kooragang**							**Nelson Bay Rd**						
1010672 P	04/02/2014	Tue	07:40	at	STOCKTON BDGE	DIV	STR	Fine	Dry	80	1	CAR	M U	W in NELSON BAY RD	65 Proceeding in lane		N	0	0	
E53628132					Daylight	RUM: 71	Off rd left => obj					Bridge								
Hunter Region				**Newcastle LGA**			**Kooragang**							**Nelson Bay Rd**						
1014048 P	09/03/2014	Sun	18:50	500 m S	FULLERTON ST	DIV	STR	Fine	Dry	80	2	CAR	M31	W in NELSON BAY RD	40 Proceeding in lane		N	0	0	
E188434897					Daylight	RUM: 30	Rear end					CAR	M57	W in NELSON BAY RD	0 Stationary					
Hunter Region				**Newcastle LGA**			**Stockton**							**Fullerton St**						
1022452 P	17/04/2014	Thu	14:45	at	STOCKTON CENTRE ENT	2WY	STR	Fine	Dry	70	2	CAR	M52	W in FULLERTON ST	10 Forward from drive		N	0	0	
E54257614					Daylight	RUM: 47	Emerging from drive					4WD	M68	S in FULLERTON ST	55 Proceeding in lane					

Detailed Crash Report - sorted

Crash No. / Data Source	Date	Day of Week	Time	Distance	ID Feature	Loc Type	Alignment	Weather	Surface Condition	Speed Limit	No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed	Injured	Factors
Natural Lighting																				**S F**
Hunter Region				**Newcastle LGA**					**Kooragang**					**Teal St**						
1038161 P	28/08/2014	Thu	21:00	at	GREENLEAF ROAD TO	DIV	STR	Overcast	Wet	80	3	CAR	M19	W in TEAL ST	40	Proceeding in lane	N	0	0	
E55550975					Darkness	RUM:	30	Rear end				CAR	F29	W in TEAL ST	0	Stationary				
												CAR	F17	W in TEAL ST	0	Stationary				
Hunter Region				**Port Stephens LGA**					**Fern Bay**					**Nelson Bay Rd**						
1041839 P	07/09/2014	Sun	04:30	150 m	S TAYLOR RD	DIV	STR	Raining	Wet	70	2	UTE	U U	S in NELSON BAY RD	70	Proceeding in lane	N	0	0	F
E56227779					Darkness	RUM:	71	Off rd left => obj				CAR		S in NELSON BAY RD	0	Parked footpath				

Report Totals: Total Crashes: 20 Fatal Crashes: 0 Injury Crashes: 7 Killed: 0 Injured: 9

Crashid dataset Stockton Bridge, Nelson Bay Road and Fullerton Street, Fern Bay - crash data from 01/07/2010 to 30/06/2015

Note: *Ordered by: Crash Date,Crash Time,Crash No.*

Crash self reporting, including self reported injuries began in Oct 2014. Trends from 2014 are expected to vary from previous years. More unknowns are expected in self reported data. For further information refer to Data Manual or report provider.

Summary Crash Report

# Crash Type		
Car Crash	19	95.0%
Light Truck Crash	1	5.0%
Rigid Truck Crash	1	5.0%
Articulated Truck Crash	0	0.0%
'Heavy Truck Crash	*(1)*	*(5.0%)*
Bus Crash	0	0.0%
"Heavy Vehicle Crash	*(1)*	*(5.0%)*
Emergency Vehicle Crash	0	0.0%
Motorcycle Crash	1	5.0%
Pedal Cycle Crash	0	0.0%
Pedestrian Crash	1	5.0%

' Rigid or Artic. Truck " Heavy Truck or Heavy Bus
These categories are NOT mutually exclusive

Location Type		
*Intersection	5	25.0%
Non intersection	15	75.0%

* Up to 10 metres from an intersection

Collision Type		
Single Vehicle	9	45.0%
Multi Vehicle	11	55.0%

Road Classification		
Freeway/Motorway	0	0.0%
State Highway	0	0.0%
Other Classified Road	16	80.0%
Unclassified Road	4	20.0%

Contributing Factors		
Speeding	3	15.0%
Fatigue	2	10.0%

Weather		
Fine	15	75.0%
Rain	2	10.0%
Overcast	3	15.0%
Fog or mist	0	0.0%
Other	0	0.0%

Road Surface Condition		
Wet	5	25.0%
Dry	15	75.0%
Snow or ice	0	0.0%

Natural Lighting		
Dawn	1	5.0%
Daylight	12	60.0%
Dusk	0	0.0%
Darkness	7	35.0%

Crash Movement		
Intersection, adjacent approaches	2	10.0%
Head-on (not overtaking)	0	0.0%
Opposing vehicles; turning	1	5.0%
U-turn	0	0.0%
Rear-end	5	25.0%
Lane change	0	0.0%
Parallel lanes; turning	0	0.0%
Vehicle leaving driveway	1	5.0%
Overtaking; same direction	0	0.0%
Hit parked vehicle	0	0.0%
Hit railway train	0	0.0%
Hit pedestrian	0	0.0%
Permanent obstruction on road	0	0.0%
Hit animal	0	0.0%
Off road, on straight	0	0.0%
Off road on straight, hit object	7	35.0%
Out of control on straight	0	0.0%
Off road, on curve	0	0.0%
Off road on curve, hit object	2	10.0%
Out of control on curve	0	0.0%
Other crash type	2	10.0%

Speed Limit					
40 km/h or less	0	0.0%	80 km/h zone	9	45.0%
50 km/h zone	0	0.0%	90 km/h zone	0	0.0%
60 km/h zone	2	10.0%	100 km/h zone	1	5.0%
70 km/h zone	8	40.0%	110 km/h zone	0	0.0%

~ 07:30-09:30 or 14:30-17:00 on school days	~ 40km/h or less	0	0.0%	~ School Travel Time Involvement	5	25.0%

Day of the Week												
Monday	1	5.0%	Wednesday	2	10.0%	Friday	2	10.0%	Sunday	3	15.0%	WEEKEND	4	20.0%
Tuesday	5	25.0%	Thursday	6	30.0%	Saturday	1	5.0%	WEEKDAY	16	80.0%			

CRASHES	20	
Fatal	0	0.0%
Serious inj.	4	20.0%
Moderate inj.	1	5.0%
Minor/Other inj.	1	5.0%
Uncategorised inj.	1	5.0%
Non-casualty	13	65.0%

CASUALTIES	9	
Killed	0	0.0%
Seriously inj.	4	44.4%
Moderately inj.	3	33.3%
Minor/Other inj.	1	11.1%
Uncategorised inj.	1	11.1%
^ Unrestrained	0	0.0%

^ Belt fitted but not worn, No restraint fitted to position OR No helmet worn

Self Reported Crash	0	0%

Time Group		% of Day	
00:01 - 02:59	1	5.0%	12.5%
03:00 - 04:59	2	10.0%	8.3%
05:00 - 05:59	2	10.0%	4.2%
06:00 - 06:59	0	0.0%	4.2%
07:00 - 07:59	2	10.0%	4.2%
08:00 - 08:59	1	5.0%	4.2%
09:00 - 09:59	0	0.0%	4.2%
10:00 - 10:59	1	5.0%	4.2%
11:00 - 11:59	0	0.0%	4.2%
12:00 - 12:59	3	15.0%	4.2%
13:00 - 13:59	0	0.0%	4.2%
14:00 - 14:59	3	15.0%	4.2%
15:00 - 15:59	0	0.0%	4.2%
16:00 - 16:59	1	5.0%	4.2%
17:00 - 17:59	0	0.0%	4.2%
18:00 - 18:59	1	5.0%	4.2%
19:00 - 19:59	0	0.0%	4.2%
20:00 - 21:59	3	15.0%	8.3%
22:00 - 24:00	0	0.0%	8.3%

Street Lighting Off/Nil		% of Dark
0	of 7	in Dark 0.0%

Crashes		Casualties
6	2014	1
2	2013	0
3	2012	2
6	2011	6
3	2010	0

McLean Periods		% Week	
A	6	30.0%	17.9%
B	1	5.0%	7.1%
C	6	30.0%	17.9%
D	1	5.0%	3.5%
E	0	0.0%	3.6%
F	1	5.0%	10.7%
G	1	5.0%	7.1%
H	1	5.0%	7.1%
I	0	0.0%	12.5%
J	3	15.0%	10.7%

#Holiday Periods																				
New Year	0	0.0%	Easter	1	5.0%	Queen's BD	0	0.0%	Christmas	0	0.0%	Easter SH	2	10.0%	Sept./Oct. SH	1	5.0%			
Aust. Day	1	5.0%	Anzac Day	0	0.0%	Labour Day	0	0.0%	January SH	1	5.0%	June/July SH	2	10.0%	December SH	0	0.0%			

Crashid dataset Stockton Bridge, Nelson Bay Road and Fullerton Street, Fern Bay - crash data from 01/07/2010 to 30/06/2015 plus provisional data to date

Note: Crash self reporting, including self reported injuries began Oct 2014. Trends from 2014 are expected to vary from previous yrs. More unknowns are expected in self reported data. Reporting yrs 1996-2004 and 2014 onwards contain uncategorised inj crashes.

Percentages are percentages of all crashes. Unknown values for each category are not shown on this report.

Appendix E. Traffic Movement Survey Results

Notes on Vardon Road Survey Data:

1. Surveys completed using IPad App TurnCount
2. Standard setup is 4 leg (12 movement) junction
3. Eastern leg used to monitor Nelson Bay Road NB and SB U-turn movements

TURNING MOVEMENT SURVEY

Nelson Bay Rd and Fullerton St, Nelson Bay
Wednesday, June 8, 2016

Weather:	Overcast
Suburban:	Nelson Bay
Customer:	Better Transport

Survey Start	
AM:	7:00
PM:	14:00

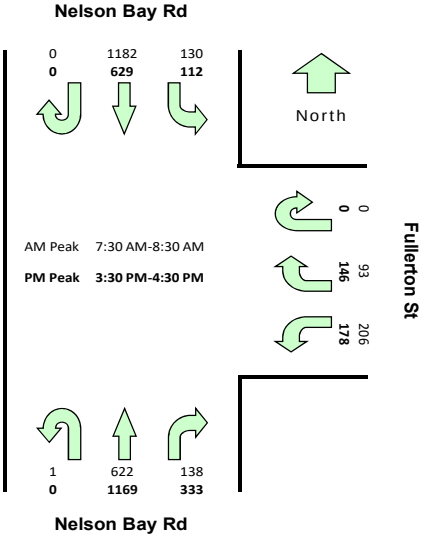
Peakhour	
AM:	7:30 AM-8:30 AM
PM:	3:30 PM-4:30 PM

All Vehicles

Time		North Approach Nelson Bay Rd			East Approach Fullerton St			South Approach Nelson Bay Rd			Hourly Total	
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	Hour	Peak
7:00	7:15	0	171	14	0	20	64	0	25	245	2286	
7:15	7:30	0	226	23	0	12	53	1	20	188	2350	
7:30	7:45	0	270	29	0	24	65	0	34	189	2372	Peak
7:45	8:00	0	298	22	0	22	55	1	32	183	2272	
8:00	8:15	0	333	41	0	26	40	0	36	127	2116	
8:15	8:30	0	281	38	0	21	46	0	36	123	1942	
8:30	8:45	0	216	57	0	22	44	0	42	130	1846	
8:45	9:00	0	168	47	0	37	59	0	47	99	1799	
9:00	9:15	0	185	24	0	30	48	0	29	113	1780	
9:15	9:30	0	197	35	0	30	54	0	31	102		
9:30	9:45	0	180	36	0	17	55	0	57	119		
9:45	10:00	0	168	39	0	23	48	0	45	115		
14:00	14:15	0	210	30	0	40	60	0	46	169	2326	
14:15	14:30	0	207	25	0	44	56	0	73	188	2404	
14:30	14:45	0	182	45	0	44	56	0	75	178	2389	
14:45	15:00	2	159	39	0	35	49	0	86	228	2495	
15:00	15:15	0	173	15	0	58	64	0	72	251	2526	
15:15	15:30	0	166	28	0	43	47	0	75	219	2512	
15:30	15:45	0	164	41	0	46	50	0	76	309	2567	Peak
15:45	16:00	0	145	29	0	31	38	0	98	288	2461	
16:00	16:15	0	153	21	0	34	53	0	77	281	2411	
16:15	16:30	0	167	21	0	35	37	0	82	291		
16:30	16:45	0	116	30	0	39	45	0	73	277		
16:45	17:00	0	149	29	0	26	45	0	87	243		

Peak Time		North Approach Nelson Bay Rd			East Approach Fullerton St			South Approach Nelson Bay Rd			Peak
Period Start	Period End	U	T	L	U	R	L	U	R	T	total
7:30	8:30	0	1182	130	0	93	206	1	138	622	2372
15:30	16:30	0	629	112	0	146	178	0	333	1169	2567

Graphic



Light Vehicles

Time		North Approach Nelson Bay Rd			East Approach Fullerton St			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	166	13	0	20	62	0	25	234
7:15	7:30	0	215	22	0	10	49	0	18	177
7:30	7:45	0	259	29	0	22	65	0	32	176
7:45	8:00	0	292	21	0	21	54	1	32	169
8:00	8:15	0	315	39	0	24	40	0	32	116
8:15	8:30	0	276	38	0	20	44	0	34	114
8:30	8:45	0	199	57	0	21	42	0	42	116
8:45	9:00	0	156	44	0	34	56	0	46	87
9:00	9:15	0	175	24	0	30	48	0	28	103
9:15	9:30	0	189	33	0	28	53	0	29	88
9:30	9:45	0	174	35	0	16	53	0	54	115
9:45	10:00	0	161	38	0	23	45	0	44	104
14:00	14:15	0	201	28	0	39	58	0	44	156
14:15	14:30	0	203	25	0	44	52	0	71	182
14:30	14:45	0	174	43	0	43	55	0	75	165
14:45	15:00	2	149	38	0	35	46	0	83	218
15:00	15:15	0	166	15	0	58	64	0	72	248
15:15	15:30	0	150	27	0	43	45	0	75	213
15:30	15:45	0	161	41	0	46	50	0	76	299
15:45	16:00	0	132	29	0	31	38	0	97	282
16:00	16:15	0	151	21	0	34	52	0	76	275
16:15	16:30	0	160	20	0	35	37	0	80	281
16:30	16:45	0	110	30	0	39	44	0	73	265
16:45	17:00	0	145	28	0	26	45	0	87	239

Heavy Vehicles

Time		North Approach Nelson Bay Rd			East Approach Fullerton St			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	5	1	0	0	2	0	0	11
7:15	7:30	0	11	1	0	2	4	1	2	11
7:30	7:45	0	11	0	0	2	0	0	2	13
7:45	8:00	0	6	1	0	1	1	0	0	14
8:00	8:15	0	18	2	0	2	0	0	4	11
8:15	8:30	0	5	0	0	1	2	0	2	9
8:30	8:45	0	17	0	0	1	2	0	0	14
8:45	9:00	0	12	3	0	3	3	0	1	12
9:00	9:15	0	10	0	0	0	0	0	1	10
9:15	9:30	0	8	2	0	2	1	0	2	14
9:30	9:45	0	6	1	0	1	2	0	3	4
9:45	10:00	0	7	1	0	0	3	0	1	11
14:00	14:15	0	9	2	0	1	2	0	2	13
14:15	14:30	0	4	0	0	0	4	0	2	6
14:30	14:45	0	8	2	0	1	1	0	0	13
14:45	15:00	0	10	1	0	0	3	0	3	10
15:00	15:15	0	7	0	0	0	0	0	0	3
15:15	15:30	0	16	1	0	0	2	0	0	6
15:30	15:45	0	3	0	0	0	0	0	0	10
15:45	16:00	0	13	0	0	0	0	0	1	6
16:00	16:15	0	2	0	0	0	1	0	1	6

16:15	16:30	0	7	1	0	0	0	0	2	10
16:30	16:45	0	6	0	0	0	1	0	0	12
16:45	17:00	0	4	1	0	0	0	0	0	4

Bus

Time		North Approach Nelson Bay Rd			East Approach Fullerton St			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	1	1	0	1	0	0	0	1
7:15	7:30	0	2	0	0	0	0	0	0	0
7:30	7:45	0	2	2	0	1	0	0	0	1
7:45	8:00	0	7	2	0	0	0	0	0	1
8:00	8:15	0	7	0	0	1	1	0	0	0
8:15	8:30	0	2	2	0	0	0	0	0	0
8:30	8:45	0	0	0	0	2	0	0	1	1
8:45	9:00	0	0	1	0	1	0	0	0	1
9:00	9:15	0	2	0	0	2	0	0	0	2
9:15	9:30	0	1	1	0	1	0	0	0	0
9:30	9:45	0	1	1	0	1	0	0	0	0
9:45	10:00	0	1	0	0	0	0	0	0	1
14:00	14:15	0	0	1	0	1	0	0	0	0
14:15	14:30	0	1	1	0	0	1	0	0	0
14:30	14:45	0	1	0	0	0	0	0	0	1
14:45	15:00	0	2	1	0	0	0	0	1	3
15:00	15:15	0	1	0	0	1	0	0	1	4
15:15	15:30	0	1	1	0	1	0	0	0	8
15:30	15:45	0	2	1	0	1	0	0	1	8
15:45	16:00	0	0	1	0	1	0	0	1	5
16:00	16:15	0	1	2	0	1	0	0	1	1
16:15	16:30	0	1	0	0	1	0	0	1	2
16:30	16:45	0	2	0	0	0	0	0	0	0
16:45	17:00	0	1	1	0	0	0	0	0	2

Cyclists

Time		North Approach Nelson Bay Rd			East Approach Fullerton St			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	0	0	1	0	2	0	0	0
7:15	7:30	0	0	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0	0	0	0
8:15	8:30	0	0	1	0	0	0	0	0	0
8:30	8:45	0	0	0	1	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	1	0	0	0
9:30	9:45	0	0	0	0	0	0	0	0	0
9:45	10:00	0	0	0	0	0	0	0	0	0
14:00	14:15	0	0	0	0	0	0	0	0	0
14:15	14:30	0	0	0	0	0	0	0	0	0
14:30	14:45	0	0	0	0	0	0	0	0	0
14:45	15:00	0	0	0	0	0	0	0	0	0
15:00	15:15	0	0	0	0	0	1	0	0	0
15:15	15:30	0	0	0	0	0	0	0	0	0
15:30	15:45	0	0	0	0	0	0	0	0	0

15:45	16:00	0	0	0	0	0	0	0	0	0
16:00	16:15	0	0	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	1	0	0	0
16:30	16:45	0	0	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0	0	0

Pedestrians Crossing

Time		Approach Nelson B		t Approach Fullerton		Approach Nelson B	
Period Start	Period End	Westbound	Eastbound	orthboun	outhboun	Westbound	Eastbound
7:00	7:15	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	0
8:00	8:15	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	0
9:30	9:45	0	0	0	0	0	0
9:45	10:00	0	0	0	0	0	0
14:00	14:15	0	0	0	0	0	0
14:15	14:30	0	0	0	0	0	0
14:30	14:45	0	0	0	0	0	0
14:45	15:00	0	0	0	0	0	0
15:00	15:15	0	0	0	0	0	0
15:15	15:30	0	0	0	0	0	0
15:30	15:45	0	0	0	0	0	0
15:45	16:00	0	0	0	0	0	0
16:00	16:15	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0

TURNING MOVEMENT SURVEY

Nelson Bay Rd and Taylor Rd, Nelson Bay
Wednesday, June 8, 2016

Weather:	Overcast
Suburban:	Nelson Bay
Customer:	Better Transport

Survey Start	
AM:	7:00
PM:	14:00

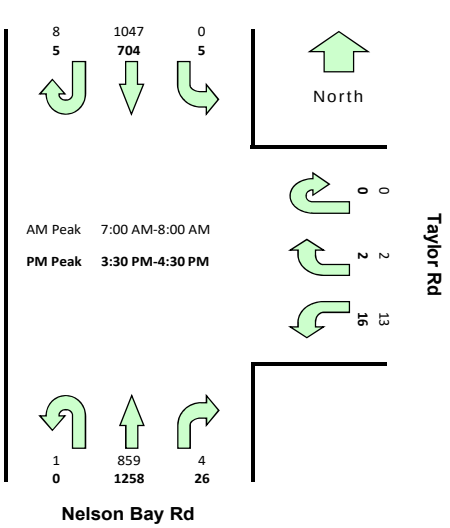
Peakhour	
AM:	7:00 AM-8:00 AM
PM:	3:30 PM-4:30 PM

All Vehicles

Time		North Approach Nelson Bay Rd			East Approach Taylor Rd			South Approach Nelson Bay Rd			Hourly Total	
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	Hour	Peak
7:00	7:15	1	196	0	0	1	2	1	1	263	1934	Peak
7:15	7:30	4	251	0	0	0	1	0	0	195	1888	
7:30	7:45	1	296	0	0	1	4	0	2	207	1886	
7:45	8:00	2	304	0	0	0	6	0	1	194	1785	
8:00	8:15	1	283	0	0	0	4	0	2	129	1629	
8:15	8:30	2	298	1	0	0	5	0	5	138	1575	
8:30	8:45	0	252	0	0	0	8	0	2	148	1494	
8:45	9:00	1	207	0	0	1	5	0	5	132	1433	
9:00	9:15	1	217	0	0	1	4	0	6	136	1406	
9:15	9:30	2	221	0	0	0	9	0	4	132		
9:30	9:45	1	210	0	0	0	4	0	1	133		
9:45	10:00	1	189	0	0	1	4	0	3	126		
14:00	14:15	2	222	0	0	1	6	0	4	196	1812	
14:15	14:30	3	231	0	0	0	3	0	1	238	1885	
14:30	14:45	0	231	1	0	2	4	0	4	225	1862	
14:45	15:00	1	184	0	0	0	3	0	3	247	1935	
15:00	15:15	4	191	2	0	0	3	1	9	294	1971	
15:15	15:30	2	190	0	0	0	2	0	6	253	1963	
15:30	15:45	0	194	2	0	1	3	0	5	335	2016	Peak
15:45	16:00	1	169	2	0	0	5	0	4	293	1935	
16:00	16:15	0	177	1	0	0	1	0	8	309	1927	
16:15	16:30	4	164	0	0	1	7	0	9	321		
16:30	16:45	0	139	0	0	0	4	0	9	307		
16:45	17:00	1	175	1	0	1	2	0	8	278		

Peak Time		North Approach Nelson Bay Rd			East Approach Taylor Rd			South Approach Nelson Bay Rd			Peak
Period Start	Period End	U	T	L	U	R	L	U	R	T	total
7:00	8:00	8	1047	0	0	2	13	1	4	859	1934
15:30	16:30	5	704	5	0	2	16	0	26	1258	2016

Graphic



Light Vehicles

Time		North Approach Nelson Bay Rd			East Approach Taylor Rd			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	1	190	0	0	1	2	1	1	250
7:15	7:30	4	242	0	0	0	1	0	0	186
7:30	7:45	1	289	0	0	1	4	0	2	193
7:45	8:00	2	298	0	0	0	6	0	1	182
8:00	8:15	1	270	0	0	0	4	0	2	120
8:15	8:30	2	293	1	0	0	5	0	5	130
8:30	8:45	0	244	0	0	0	8	0	2	135
8:45	9:00	1	196	0	0	1	5	0	5	117
9:00	9:15	1	209	0	0	1	4	0	6	126
9:15	9:30	2	213	0	0	0	9	0	4	117
9:30	9:45	1	205	0	0	0	4	0	1	129
9:45	10:00	1	183	0	0	1	4	0	3	117
14:00	14:15	2	213	0	0	1	6	0	4	185
14:15	14:30	3	229	0	0	0	3	0	1	232
14:30	14:45	0	224	1	0	2	4	0	4	214
14:45	15:00	1	177	0	0	0	3	0	3	238
15:00	15:15	4	188	2	0	0	3	1	9	290
15:15	15:30	2	178	0	0	0	2	0	6	250
15:30	15:45	0	192	2	0	1	3	0	5	328
15:45	16:00	1	157	2	0	0	5	0	4	289
16:00	16:15	0	173	1	0	0	1	0	8	304
16:15	16:30	4	160	0	0	1	7	0	9	321
16:30	16:45	0	134	0	0	0	4	0	9	301
16:45	17:00	1	172	1	0	1	2	0	8	273

Heavy Vehicles

Time		North Approach Nelson Bay Rd			East Approach Taylor Rd			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	6	0	0	0	0	0	0	13
7:15	7:30	0	9	0	0	0	0	0	0	9
7:30	7:45	0	7	0	0	0	0	0	0	14
7:45	8:00	0	6	0	0	0	0	0	0	12
8:00	8:15	0	13	0	0	0	0	0	0	9
8:15	8:30	0	5	0	0	0	0	0	0	8
8:30	8:45	0	8	0	0	0	0	0	0	13
8:45	9:00	0	11	0	0	0	0	0	0	15
9:00	9:15	0	8	0	0	0	0	0	0	10
9:15	9:30	0	8	0	0	0	0	0	0	15
9:30	9:45	0	5	0	0	0	0	0	0	4
9:45	10:00	0	6	0	0	0	0	0	0	9
14:00	14:15	0	9	0	0	0	0	0	0	11
14:15	14:30	0	2	0	0	0	0	0	0	6
14:30	14:45	0	7	0	0	0	0	0	0	11
14:45	15:00	0	7	0	0	0	0	0	0	9
15:00	15:15	0	3	0	0	0	0	0	0	4
15:15	15:30	0	12	0	0	0	0	0	0	3
15:30	15:45	0	2	0	0	0	0	0	0	7
15:45	16:00	0	12	0	0	0	0	0	0	4
16:00	16:15	0	4	0	0	0	0	0	0	5
16:15	16:30	0	4	0	0	0	0	0	0	0
16:30	16:45	0	5	0	0	0	0	0	0	6
16:45	17:00	0	3	0	0	0	0	0	0	5

Bus

Time		North Approach Nelson Bay Rd			East Approach Taylor Rd			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	2	0	0	0	0	0	0	2
7:15	7:30	0	2	0	0	0	0	0	0	0
7:30	7:45	0	4	0	0	0	1	0	0	2
7:45	8:00	0	12	0	0	0	0	0	0	1
8:00	8:15	0	3	0	0	0	0	0	0	1
8:15	8:30	0	4	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	2
8:45	9:00	0	1	0	0	0	1	0	0	0
9:00	9:15	0	2	0	0	1	0	0	0	4
9:15	9:30	0	2	0	0	0	0	0	0	1
9:30	9:45	0	1	0	0	0	0	0	0	0
9:45	10:00	0	1	0	0	0	0	0	0	1
14:00	14:15	0	1	0	0	0	0	0	0	1
14:15	14:30	0	1	0	0	0	0	0	0	0
14:30	14:45	0	2	0	0	0	0	0	0	1
14:45	15:00	0	1	0	0	0	0	0	0	3
15:00	15:15	0	2	0	0	0	0	0	0	5
15:15	15:30	0	1	0	0	0	0	0	2	7
15:30	15:45	0	1	0	0	0	0	0	1	7
15:45	16:00	0	1	0	0	0	0	0	0	7
16:00	16:15	0	1	0	0	0	1	0	0	2
16:15	16:30	0	2	0	0	0	0	0	0	1
16:30	16:45	0	1	0	0	0	0	0	0	0
16:45	17:00	0	2	0	0	0	0	0	0	2

Cyclists

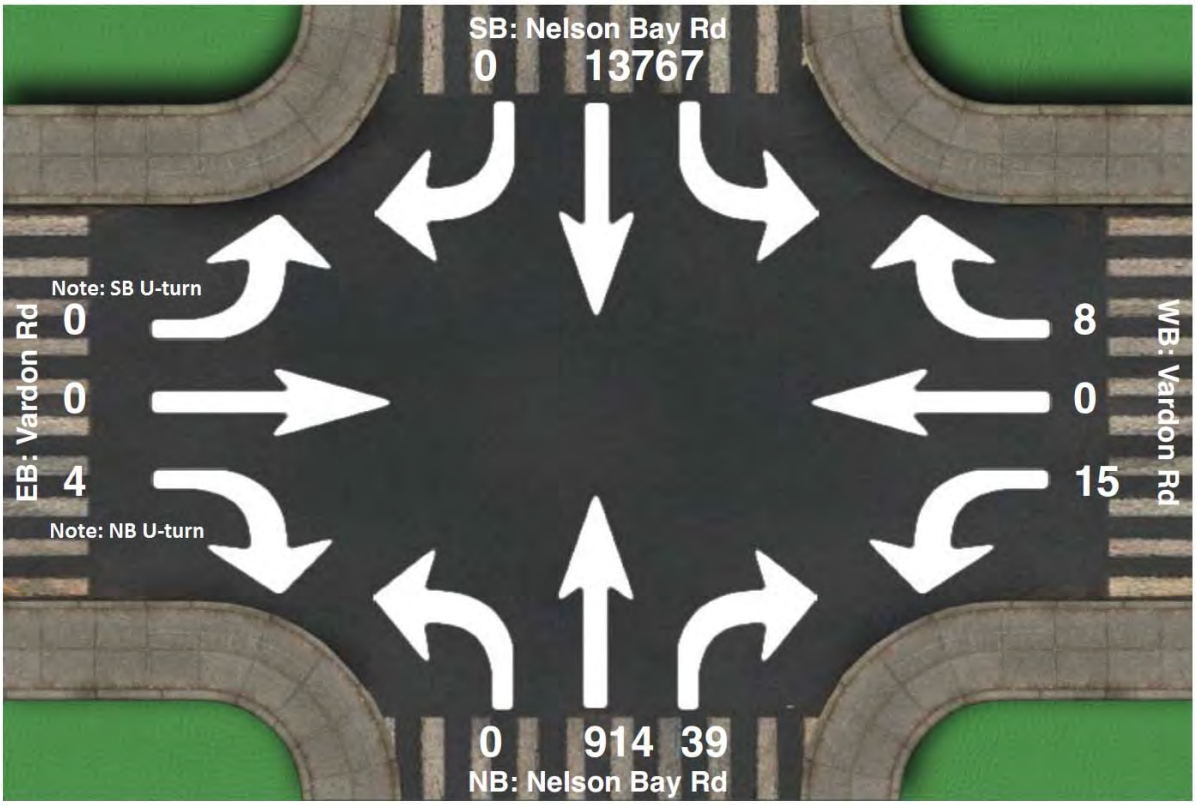
Time		North Approach Nelson Bay Rd			East Approach Taylor Rd			South Approach Nelson Bay Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	1	0	0	0	0	0	0	2
7:15	7:30	0	0	0	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0	0	0	1
7:45	8:00	0	0	0	0	0	0	0	0	2
8:00	8:15	0	1	0	0	0	0	0	0	0
8:15	8:30	0	0	0	0	0	0	0	0	0
8:30	8:45	0	0	0	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	9	0	0	1
9:00	9:15	0	0	0	0	0	0	0	0	1
9:15	9:30	0	0	0	0	0	0	0	0	1
9:30	9:45	0	0	0	0	0	0	0	0	1
9:45	10:00	0	1	0	0	0	0	0	0	0
14:00	14:15	0	0	0	0	0	0	0	0	0
14:15	14:30	0	2	0	0	0	0	0	0	1
14:30	14:45	0	0	0	0	0	0	0	0	1
14:45	15:00	0	0	0	0	0	0	0	0	0
15:00	15:15	0	1	0	0	0	0	0	0	0
15:15	15:30	0	1	0	0	0	0	0	0	0
15:30	15:45	0	0	0	0	0	0	0	0	0
15:45	16:00	0	1	0	0	0	0	0	0	0
16:00	16:15	0	1	0	0	0	0	0	0	2
16:15	16:30	0	0	0	0	0	0	0	0	0
16:30	16:45	0	1	0	0	0	0	0	0	1
16:45	17:00	0	1	0	0	0	0	0	0	1

Pedestrians Crossing

Time		Approach Nelson B		st Approach Taylor		Approach Nelson B	
Period Start	Period End	Westbound	Eastbound	orthboun	outhboun	Westbound	Eastbound
7:00	7:15	0	0	0	0	0	0
7:15	7:30	0	0	0	0	0	0
7:30	7:45	0	0	0	0	0	0
7:45	8:00	0	0	3	2	0	0
8:00	8:15	0	2	0	0	0	0
8:15	8:30	0	0	1	0	0	0
8:30	8:45	0	0	0	0	0	0
8:45	9:00	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	0
9:15	9:30	0	0	0	0	0	0
9:30	9:45	0	0	0	0	0	0
9:45	10:00	0	0	0	1	0	0
14:00	14:15	0	0	0	0	0	0
14:15	14:30	0	0	0	0	0	0
14:30	14:45	0	2	0	0	0	0
14:45	15:00	0	0	1	0	0	0
15:00	15:15	0	2	0	0	0	1
15:15	15:30	0	0	0	0	0	0
15:30	15:45	0	0	0	0	0	1
15:45	16:00	0	0	0	0	0	0
16:00	16:15	0	0	2	1	0	0
16:15	16:30	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0
16:45	17:00	0	1	0	0	0	0

Intersection Peak Hour

Location: Nelson Bay Rd at Vardon Rd, Fern Bay
GPS Coordinates:
Date: 2016-10-27
Day of week: Thursday
Weather: O'cast
Analyst: JMW



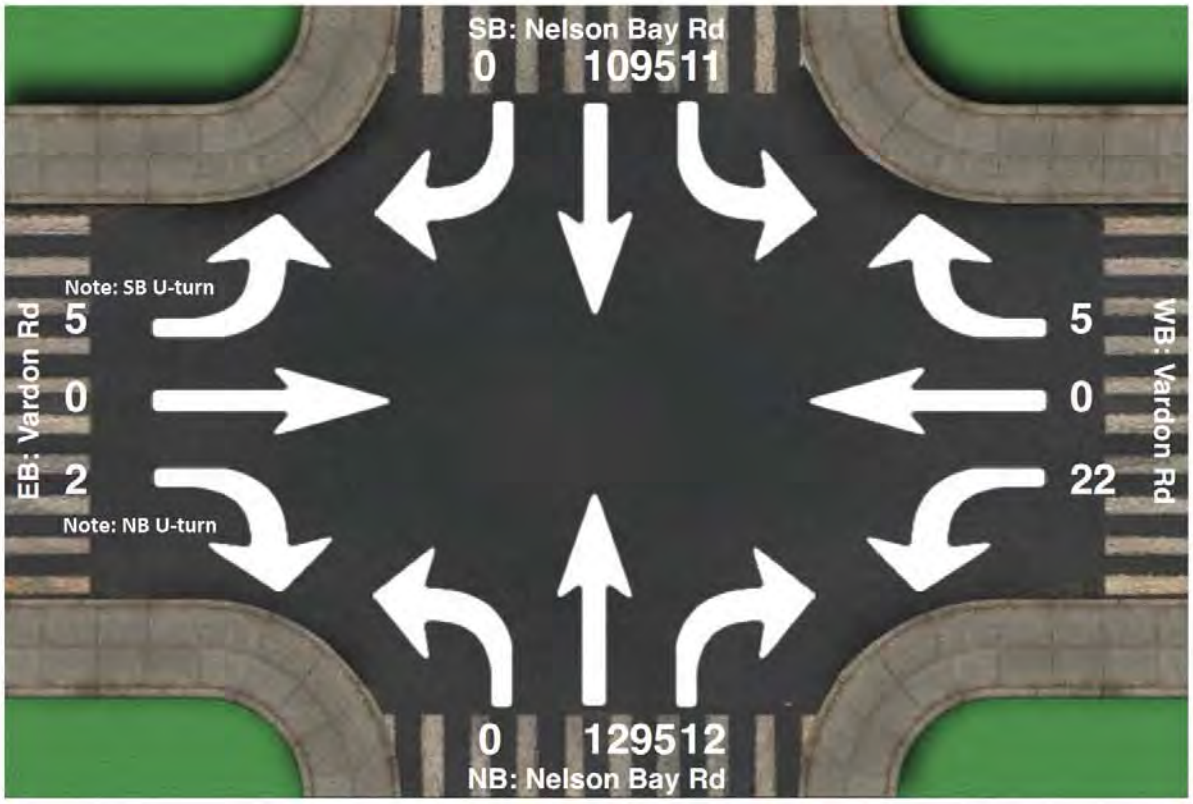
Intersection Peak Hour

07:15 - 08:15

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	7	1376	0	15	0	8	0	914	39	0	0	4	2363
Factor	0.29	0.84	0.00	0.31	0.00	0.22	0.00	0.75	0.54	0.00	0.00	0.17	0.85
Approach Factor	0.85			0.32			0.78			0.17			

Intersection Peak Hour

Location: Nelson Bay Rd at Vardon Rd, Fern Bay
GPS Coordinates:
Date: 2016-10-27
Day of week: Thursday
Weather: O'cast
Analyst: JMW



Intersection Peak Hour

16:10 - 17:10

	SouthBound			Westbound			Northbound			Eastbound			Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Vehicle Total	11	1095	0	22	0	5	0	1295	12	5	0	2	2447
Factor	0.23	0.87	0.00	0.37	0.00	0.21	0.00	0.84	0.50	0.42	0.00	0.17	0.86
Approach Factor	0.87			0.32			0.84			0.58			

Appendix F. Traffic Modelling Summaries

Modelling Scenarios Tested

1. Existing junction layouts, Existing Traffic Flows
2. Existing junction layouts, With Development Traffic Flows
3. Alternate (Signal) control, Taylor Road, With Development Traffic Flows

LANE LEVEL OF SERVICE

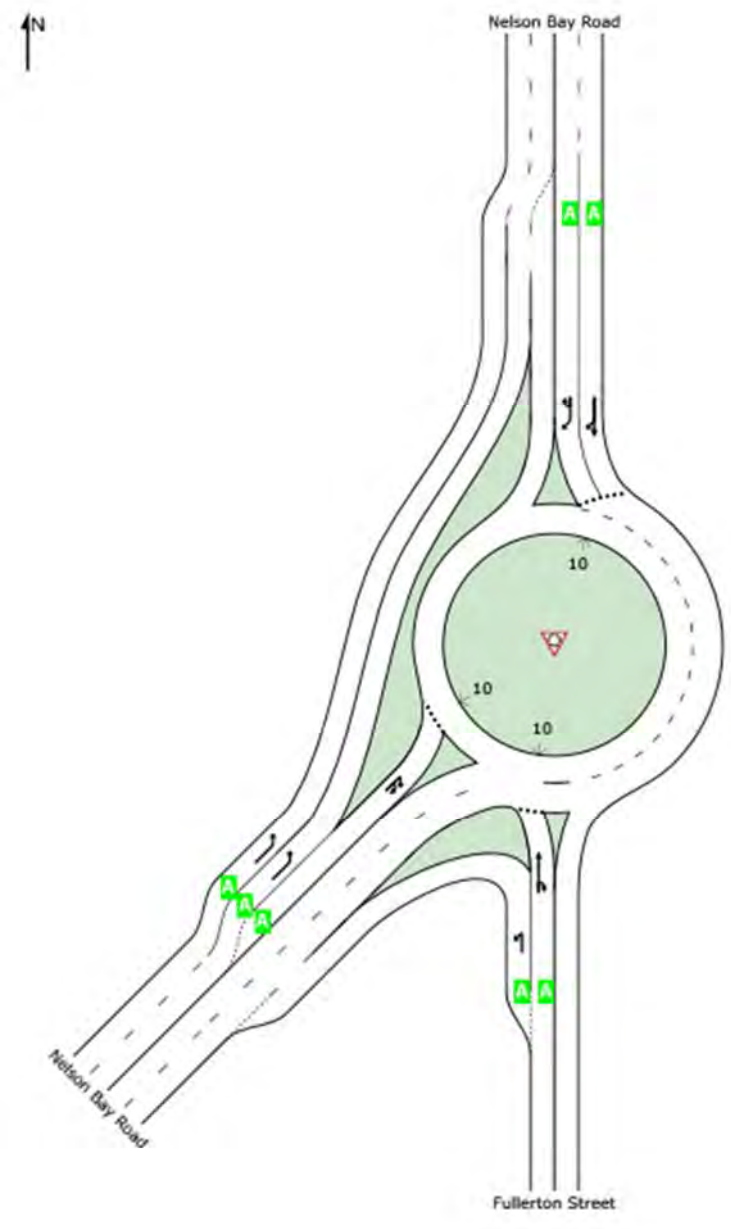
Lane Level of Service

Site: 101 [Nelson Bay Rd & Fullerton St - AM+RR+FW+BG1.5]

DHA Stockton
Roundabout

All Movement Classes

	South	North	Southwest	Intersection
LOS	A	A	A	A



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

LANE LEVEL OF SERVICE

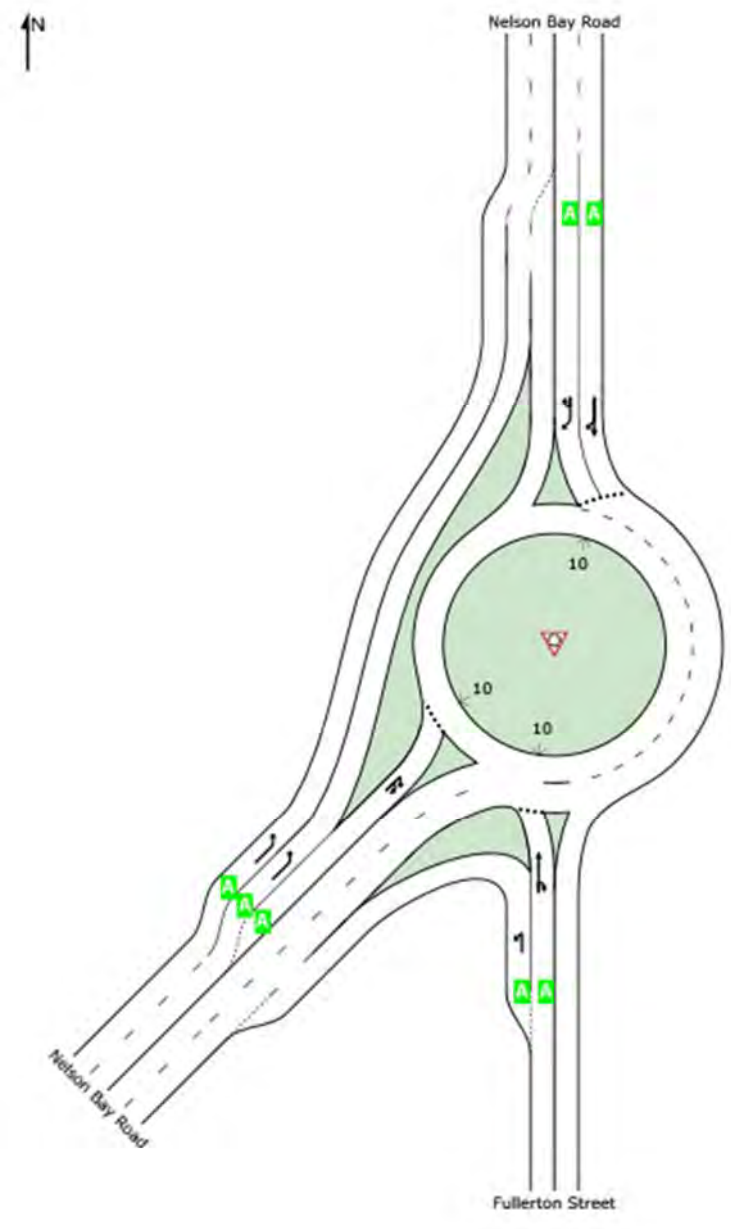
Lane Level of Service

Site: 101 [Nelson Bay Rd & Fullerton St - PM+RR+FW+BG1.5]

DHA Stockton
Roundabout

All Movement Classes

	South	North	Southwest	Intersection
LOS	A	A	A	A



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

LANE LEVEL OF SERVICE

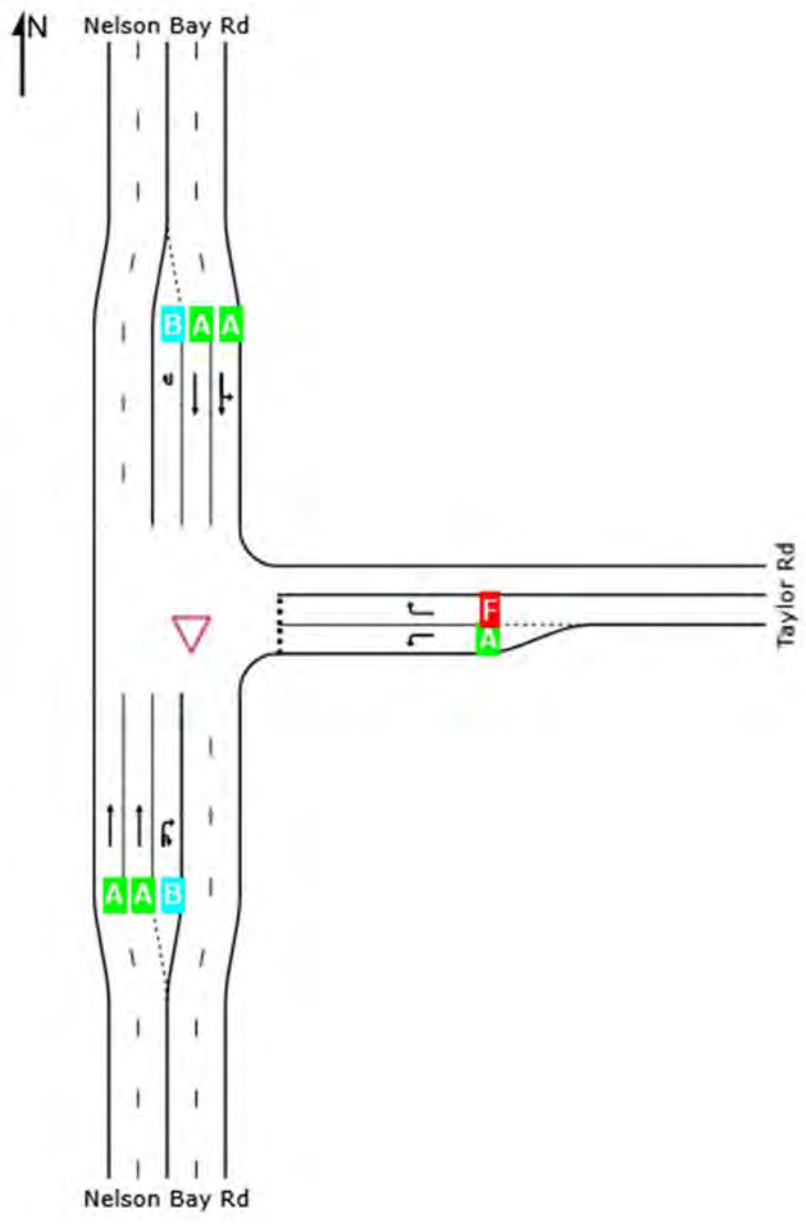
Lane Level of Service

Site: 102 [Nelson Bay Rd & Taylor Rd - AM]

DHA Stockton Taylor
Giveway / Yield (Two-Way)

All Movement Classes

	South	East	North	Intersection
LOS	NA	C	NA	NA



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

LANE LEVEL OF SERVICE

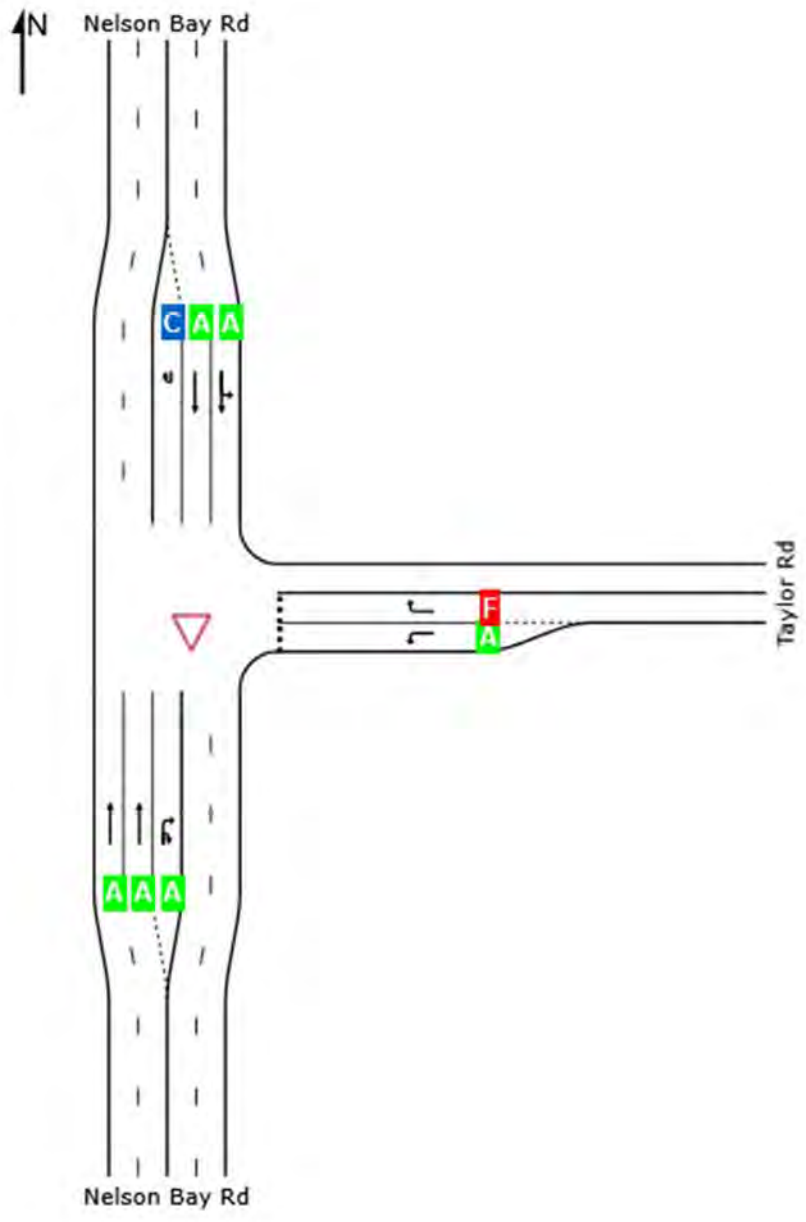
Lane Level of Service

Site: 102 [Nelson Bay Rd & Taylor Rd - PM]

DHA Stockton Taylor
Giveway / Yield (Two-Way)

All Movement Classes

	South	East	North	Intersection
LOS	NA	D	NA	NA



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

LANE LEVEL OF SERVICE

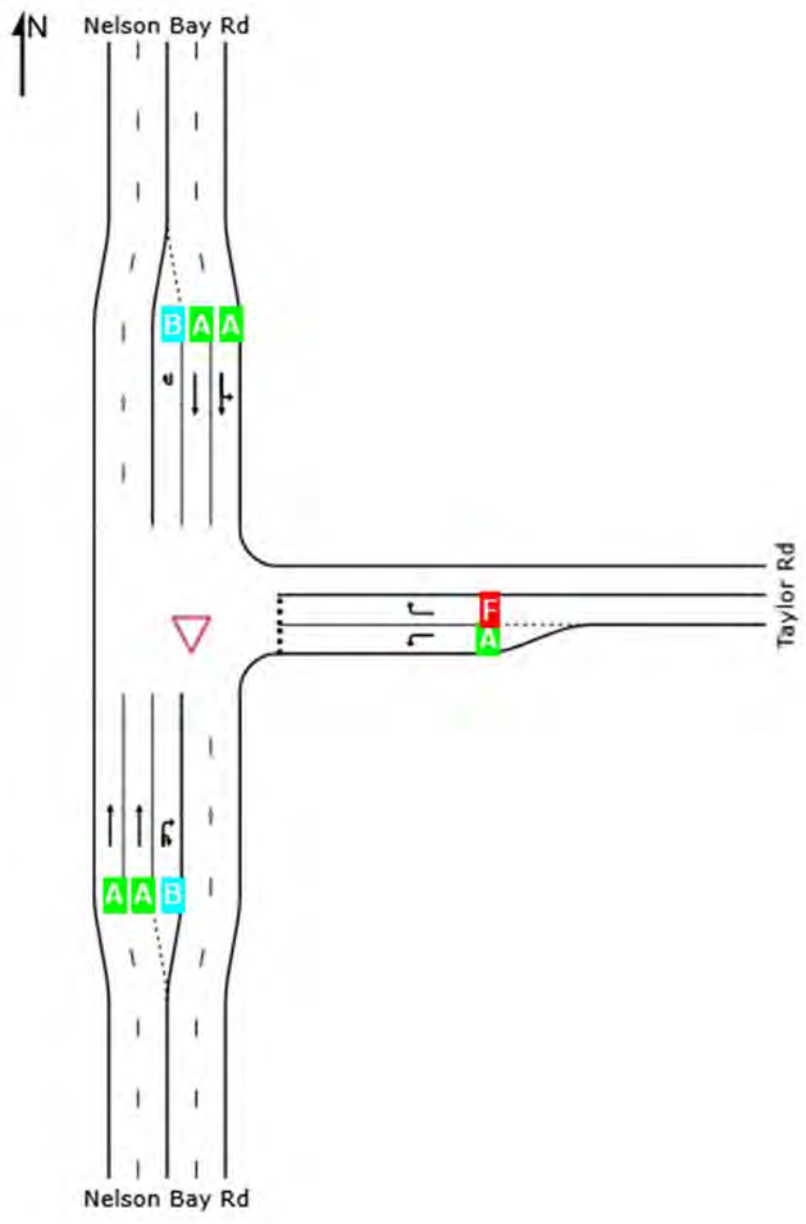
Lane Level of Service

Site: 102 [Nelson Bay Rd & Taylor Rd - AM+RR+FW+BG1.5]

DHA Stockton Taylor
Giveway / Yield (Two-Way)

All Movement Classes

	South	East	North	Intersection
LOS	NA	F	NA	NA



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

LANE LEVEL OF SERVICE

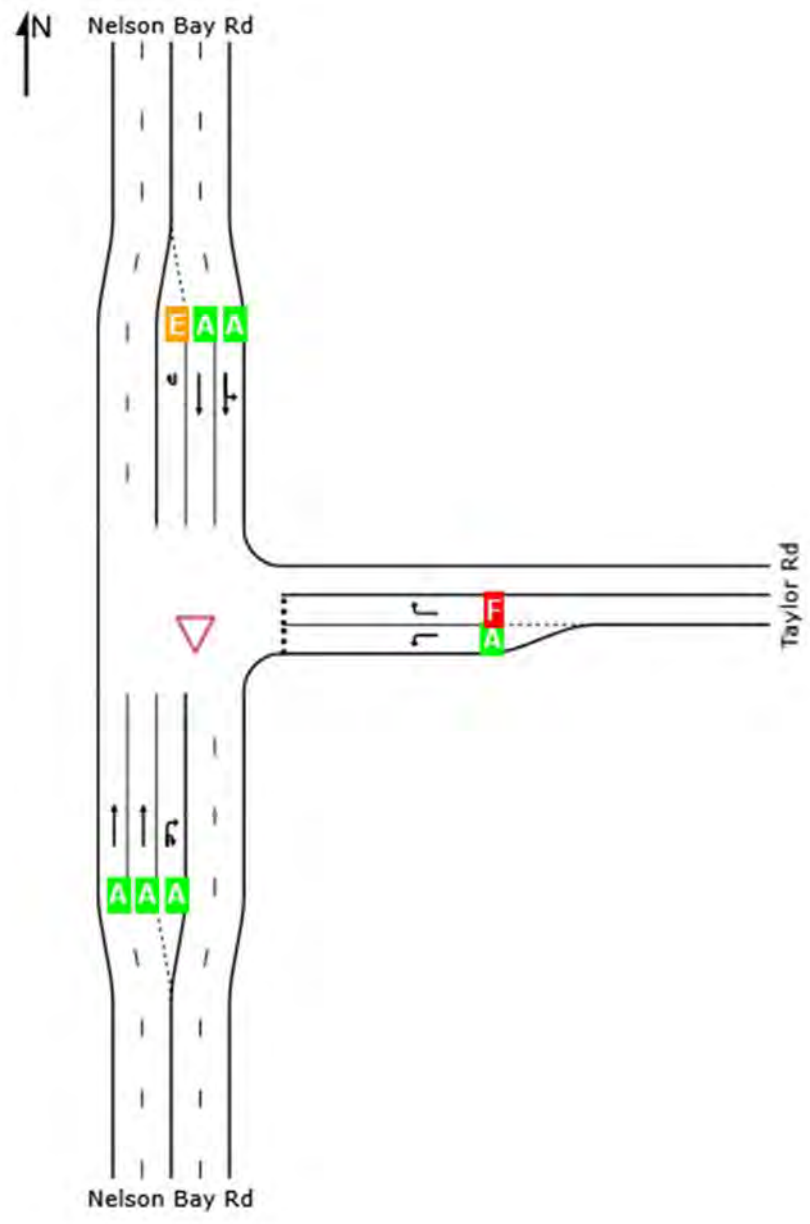
Lane Level of Service

Site: 102 [Nelson Bay Rd & Taylor Rd - PM+RR+FW+BG1.5]

DHA Stockton Taylor
Giveway / Yield (Two-Way)

All Movement Classes

	South	East	North	Intersection
LOS	NA	F	NA	NA



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

LANE LEVEL OF SERVICE

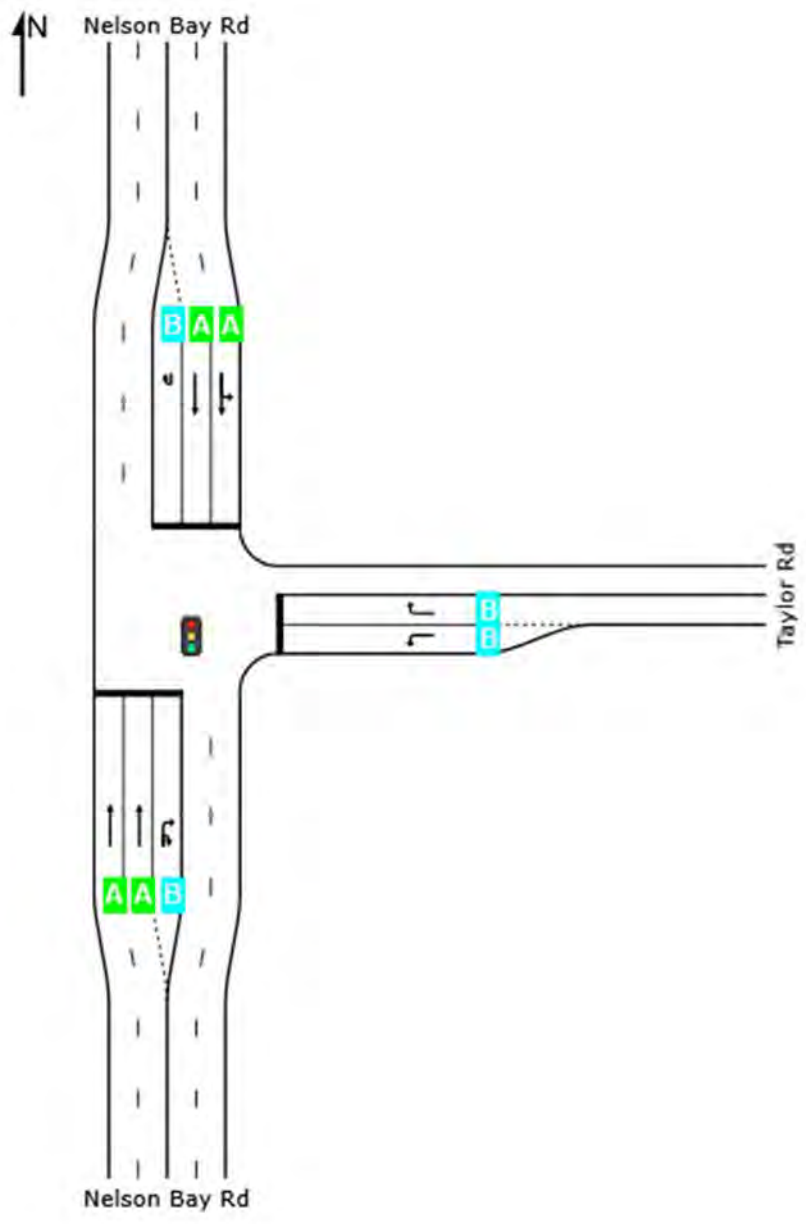
Lane Level of Service

Site: 102v [Nelson Bay Rd & Taylor Rd - AM+RR+FW+BG1.5 - Signals Conversion]

DHA Stockton Taylor
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Practical Cycle Time)

All Movement Classes

	South	East	North	Intersection
LOS	A	B	A	A



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

LANE LEVEL OF SERVICE

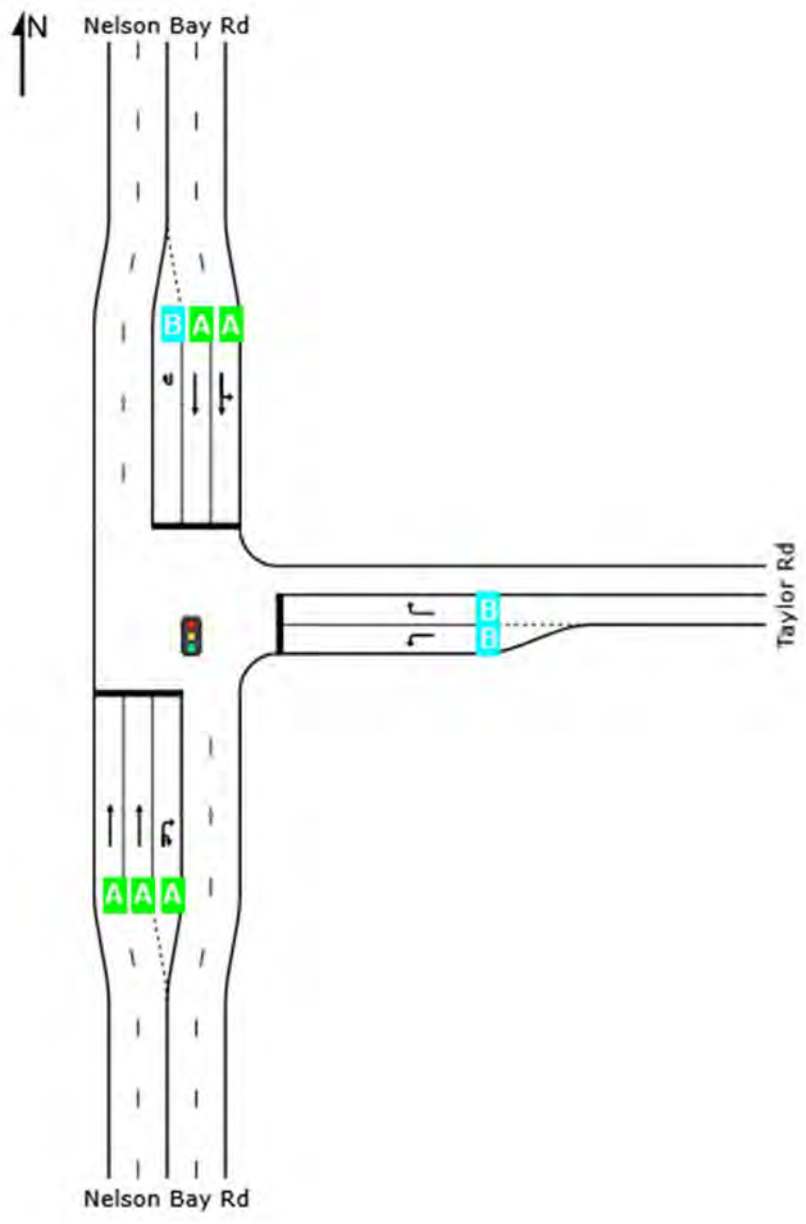
Lane Level of Service

Site: 102v [Nelson Bay Rd & Taylor Rd - PM+RR+FW+BG1.5 - Signals Conversion]

DHA Stockton Taylor
Signals - Fixed Time Isolated Cycle Time = 40 seconds (Practical Cycle Time)

All Movement Classes

	South	East	North	Intersection
LOS	A	B	A	A



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.