

Proposed Stockton Fort Wallace Site Planning Proposal

Defence Housing Australia

Transport Study Report November 2016



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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 present the transport investigations into the Fort Wallace Range site in support of the rezoning proposal.

Site details are:

	Fort Wallace
Title	Lots 100 & 101 DP1152115
Area	31.75ha
Council	Newcastle
Existing Land use Zoning	SP2 Infrastructure

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 around 100 development lots may be achievable on the Fort Wallace site. This yield is being tested as part of the current investigations and is noted here for the purpose of forming a notional understanding of what the impacts may be and what development levels may be possible.

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 on 8 June 2016 at the following locations:
 - i. Nelson Bay Road and Fullerton Street roundabout
 - ii. Nelson Bay Road and Taylor Road (priority control)
 - 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 right turn movements.
- d. Land Use Proposals The notional development yield of 100 lots on the Fort Wallace site has been used for initial testing of traffic generation levels form the subject site.
- e. **Traffic Generation** Forecast traffic flows would be in the order of 156 trips AM and 172 trips PM for the Fort Wallace 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.
- f. Initial Site Access Considerations
 - a. Fort Wallace The existing flow levels on Fullerton Street coupled with the initial predictions of site traffic flows suggest the site will need an intersection configuration with an Auxiliary Left (AUL) turn lane, and a CHannelised Right (CHR[S]) short turn slot to cater for predicted site movements onto and from Fullerton Street.
 - b. Two site access points are shown on the Fort Wallace Draft Indicative Master Plan. While one access is technically acceptable from a traffic capacity perspective, the second access is of benefit in terms of redundancy, allowing emergency vehicle access or evacuation should one access point be blocked.
- g. 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.
- h. Access Strategy Single site entrance on Fullerton Street developed with a southbound Auxiliary Left lane (AUL), and a CHannelised Right Short turn slot (CHR[S])
- i. Other Considerations -
- j. Internal road design to meet Council road design standards. Carriageways at Local Street, Access Street, Access Place standard.
- k. 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 traffic and transport investigations for the Fort Wallace 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. Provision of one site access intersection with Fullerton Street (second access is optional) to provide turning facilities for the subject site.
- 2. A second site access is proposed which will provide a level of redundancy that is of benefit for emergency vehicle and evacuation access.

The overall conclusion is that given the potential level of future development proposed for the Fort Wallace site at Stockton, the strategy focussing on one site access to Fullerton Street would be technically sufficient to meet Austroads Guidelines, and a two access strategy would provide superior access within minimal impact on the external road system.

The next steps recommended are to seek more detailed engineering advice from The City of Newcastle as to the most appropriate form of road and intersection improvements to service the site.



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 Fort Wallace) is located just a few kilometres north of the Newcastle CBD across the Hunter River on the Stockton Peninsula. The site is comparatively close to Williamtown RAAF Base (approx. 11 to 12 Km by road).

The details of the two sites are:

	Fort Wallace
Title	Lots 100 & 101 DP1152115
Area	31.75ha
Council	Newcastle
Existing Land use Zoning	SP2 Infrastructure

A series of earlier assessments of the site has been prepared over a number of years. As part of this work, notional yields were prepared indicating around 100 development lots may be achievable on the Fort Wallace site. This yield has been 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.

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^{III} 2016 The local context of the site is shown in Figure 2 – Local Context below.





Figure 2 – Local Context Source: architectustm 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 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.



3 Existing Conditions

3.1 Road Network

External Roads

The Fort Wallace site is accessed directly from Fullerton Street to the south of the roundabout controlled intersection with 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

Fullerton Street

Fullerton Street is the main north south sub-arterial route that connects the Stockton Peninsula to Nelson Bay Road. It is the only road connection for the locality. It is built to a two lane two way 'rural' standard in the vicinity of the Fort Wallace site, with sealed shoulders and no kerb and gutter. It is approximately 11 metres width on its approach to the Nelson Bay Road intersection, and narrows to around 9 metres adjacent to the Fort Wallace Gate.





Photo Plate 6 - Fullerton Street- Looking south from the Nelson Bay Road (B63) roundabout



Photo Plate 7 - Existing Fort Wallace Gate - viewed from Fullerton Street





Photo Plate 8 - Fullerton Street- Looking north toward Nelson Bay Road from near Fort Wallace existing entrance



Photo Plate 9 - Fullerton Street- Looking south from near Fort Wallace existing entrance





Photo Plate 10 - Existing dual use path along the Hunter River and running parallel and to the west of Fullerton Street

3.2 Traffic Surveys and Site Observations

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. The surveys utilise video and automated data capture techniques with the ability to monitor both pedestrian and vehicle movements and accumulations at the nominated locations.

Traffic Survey data was collected at two locations on Nelson Bay Road, at Fullerton Street and Taylor Road. The survey data is included in **Appendix C – Traffic Survey Data**.

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 the technical capacity of this 4 lane dual carriageway arterial road.
- 2. Traffic flows along Fullerton Street were also observed as being well within the technical capacity of this 2 way 2 lane sub arterial (truck collector/) road.
- 3. Operation of the Nelson Bay Road / Fullerton Road Roundabout is very good, with SIDRA intersection modelling indicating an very high Level of Service (Los) of 'A' on the Austroads scale of 'A' to 'F'.
- 4. Parking is minimal on the main traffic routes approaching the subject site.
- 5. Bus movements along the local street network were observed, on Fullerton Street, and on Nelson Bay Road, Vardon Road and Rankin Road to the north of the subject site.

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

3.3 Cycling Facilities

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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 has been sourced for review for the NSW RMS Crash Database. Summary information is provided in **Appendix D** to this report.

The data covers 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 Rod 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.



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 220 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 Fort Wallace 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 Fort Wallace

The details of the Fort Wallace Site are:

Table 4-1 Fort Wanace Site Description				
	Fort Wallace			
Title	Lots 100 & 101 DP1152115			
Area	31.75ha			
Council	Newcastle			
Existing Land use Zoning	SP2 Infrastructure			
Potential Residential Dwellings	100 lots			
Proposed Site Access	Via direct connection to Fullerton Street			

A series of earlier assessments of the site were prepared over a number of years. As part of this work, notional yields were prepared indicating around 100 lots may be achievable on the Fort Wallace. 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. It should be noted also 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 Access, Trip Distribution and Assignment Assumptions

It is proposed to access the Fort Wallace site point using the existing site access location on Fullerton Street, and with a second access point to Fullerton Street to the north between the existing site entrance and the Nelson Bay Road Roundabout. The fundamental assignment and distribution of trips irrespective of the local road assignments has been assumed as follows:

Fort Wallace

Assignment of Trips

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

Directional Distribution

- a. 80% northbound via Fullerton Road
 - a. 50% northbound via Nelson Bay Road
 - b. 50% westbound via Stockton Bridge
- b. 20% southbound via Fullerton Street

4.3 Traffic Generation

Table 4–3 – Applied Traffic Generation Rates presents the traffic generation characteristics of the two sites under consideration.

Masterplan	AM Peak	AM Peak	PM Peak	PM Peak Trips	Comments
Component	Generation	Trips	Generation	(vph)	
Fort Wallace	0.71	7 IN 64 OUT	0.78	70 IN 8 OUT	

Table 4-3 – Future Traffic Generation Assumptions

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



5 Existing Network Performance

5.1 Road Network

Traffic volume data for the project has been 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 traffic survey indicate that during the surveyed morning AM peak commute period (7.00 to 8.00 AM) the two-way traffic flow along Nelson Bay Road north of Fullerton Street 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 north of Fullerton Street 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 Wednesday 8th June 2016 traffic data is presented in **Table 5.1 – Existing Traffic Volumes** below.

Road	Location	Peak Period	Peak flow ⁽¹⁾	Mid-Block Road Capacity	Level of Service	
Nelson Bay	North of	AM peak	861 N/B 1055 S/B	900 (one-way) ⁽³⁾ 1400 (one-way) ⁽⁴⁾	A B	
Road	Taylor Road	PM peak	1260 N/B 714 S/B	900 (one-way) ⁽⁴⁾ 1400 (one-way) ⁽⁴⁾	B A	
Nelson Bay	North of	AM peak	864 N/B 1060 S/B	900 (one-way) ⁽⁴⁾ 1400 (one-way) ⁽⁴⁾	A B	
Road	Street	PM peak	1284 N/B 720 S/B	1400 (one-way) ⁽⁴⁾ 900 (one-way) ⁽⁴⁾	B A	
Nelson Bay	West of	AM peak	761 E/B 1388 W/B	900 (one-way) ⁽⁴⁾ 1400 (one-way) ⁽⁴⁾	A B	
Road	Street	Street	PM peak	1502 E/B 807W/B	1400 (one-way) ⁽⁴⁾ 900 (one-way) ⁽⁴⁾	C A
Fullerton	South of	AM peak	299 N/B 268 S/B	380 (one-way) ⁽²⁾ 600 (one-way) ⁽²⁾	B	
Street	Rd	PM peak	324 N/B 445 S/B	380 (one-way) ⁽²⁾ 600 (one-way) ⁽²⁾	B C	

Table 5.1 – Existing Traffic Volumes

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)



Table 5.1 demonstrates that the roads serving as the main access routes for the subject site will 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 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 Fullerton Street it can be seen that the level of service for road users is 'A'.

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

Table 5.2 - Orban Road peak nour nows per direction	Table 5.2 - L	Jrban Road	peak hour flows	per direction
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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 the Fort Wallace site is proposed to maintain its existing access onto Fullerton Street, and possibly a second access also to Fullerton Street to the north and closer to the roundabout controlled intersection with Nelson Bay Road.

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.

|--|

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 the site access priority junction. Essentially, traffic would be required to slow down to negotiate turns with little if any delay for the through traffic movements.



Operation of Nelson Bay Road Roundabout

The higher order interactions that are part of the road network providing access to the subject site are the Nelson Bay Road intersection with the roundabout controlled junction with Fullerton Street. For the Nelson Bay Road / Fullerton Road roundabout, SIDRA⁷ Intersection modelling indicates a good level of service of "A" on all approaches.

Liaison with the road authorities has been sought, but has not been completed at this time. This liaison should be completed before finalising the traffic investigations. It is an important step in the approval process to confirm the requirements of Council as the local road authority with regard to its current access strategy for the Stockton peninsula.

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



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 taking the additional site movements into accounts is presented in Table 6.1 – Forecast Mid-Block Traffic Volumes below.

Road	Location	Peak Period	Peak flow ⁽¹⁾	Mid-Block Road Capacity	Level of Service
		AM neak	887 N/B	900 (one-way) ⁽³⁾	А
Nelson Ba	/ North of		1058 S/B	1400 (one-way) ⁽⁴⁾	В
Road	Taylor Road		1263 N/B	900 (one-way) (4)	В
		PM peak	742 S/B	1400 (one-way) ⁽⁴⁾	А
			890 N/B	900 (one-way) ⁽⁴⁾	А
Nelson Ba	North of	AIVI peak	1063 S/B	1400 (one-way) ⁽⁴⁾	В
Road	Fullerton		1287 N/B	1400 (one-way) ⁽⁴⁾	В
		PM peak	748 S/B	900 (one-way) ⁽⁴⁾	А
			764 E/B	900 (one-way) (4)	А
Nelson Ba	West of	AM peak	1414 W/B	1800 (one-way) ⁽⁴⁾	С
Road	Fullerton		1530 E/B	1800 (one-way) ⁽⁴⁾	С
		PM peak	811 W/B	900 (one-way) ⁽⁴⁾	А
			351 N/B	380 (one-way) ⁽²⁾	В
Fullerton	South of	AM peak	274 S/B	600 (one-way) ⁽²⁾	В
Street	Rd		331 N/B	380 (one-way) (2)	В
		Рій реак	501 S/B	600 (one-way) ⁽²⁾	С

Table 6.1 -	 Forecast 	Mid-Block	Traffic	Volumes
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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)

Table 6.1 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 only change indicated is on Nelson Bay Road where the AM level of Service is predicted to be LoS 'C' which is till well within acceptable urban flow conditions.

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 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'.

On Fullerton Street the mid bock flow conditions are forecast to exhibit no discernible change in Level of Service.

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.

6.2 Intersection Performance



Intersection performance have been re-tested here as part of the future site access considerations. The operation of Nelson Bay Road / Fullerton Street roundabout has been tested to demonstrate the potential future intersection performance. The results of the SIDRA analysis indicate the Nelson Bay Road / Fullerton Street roundabout intersection will continue to operate at satisfactory service levels with no discernible change in operational performance.

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

6.3 Intersection Design

The traffic flow analysis outlined previously demonstrates that there are no technical capacity grounds for requiring intersection control beyond the most basis of priority controlled junctions. The Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads 2009) provides guidance on the warrants for various auxiliary lane treatments at intersections. **Figure 6.1** below illustrates the principles for a design speed of less than 100 kph. The posted speed limit on Boomerang Drive in the vicinity of the subject site is 60 kph. The warrants relate turn treatments to a combination of major road traffic volume and turning volumes.

For the existing traffic flows on Fullerton Street an Auxiliary Left turn treatment (AUL) and a short CHannelised Right Turn Treatment (CHR(S)) is the required treatment, assuming a nominal exiting flow (10 vph) from the subject site.



Figure 6.1 Warrants for turn treatments on major roads at unsignalised intersections

(Design Speed < 100kph)

Source: Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads 2009)

If the existing + development traffic flows on Fullerton Drive are applied at the rates calculated above, and with one site access only, then the form of the intersection required is a short CHannelised Right Turn Treatment (CHR(S)) coupled with a CHannelised Left Turn Treatment (CHL). If the alternative access strategy include the 2 proposed access junctions planned for the subject site, the combination of intersection controls recommended would be as follows:



- a) North Access Short CHannelised Right Turn Treatment (CHR(S)) coupled with a CHannelised Left Turn Treatment (CHL)
- b) South Access Short CHannelised Right Turn Treatment (CHR(S)) coupled with an Auxiliary Left turn treatment (AUL)

The need for short channelised right turn treatment is driven largely by the Fullerton Street flows, even though the level of site traffic turning right into the site is anticipated to be quite small. The difference in the left turn treatments is based on the assumption that most (if not all) left turn traffic entering the subject site would do so at the first opportunity, the north access point.

The conclusion drawn here is that one site access point is sufficient to deal with traffic capacity issues. The form and function of the second access point should be reviewed and discussed with the road authorities to determine its role, as either an unrestricted public access point, or possibly as a gated emergency site access for evacuation and emergency service uses.

Figures 6.2, 6.3 and **Figure 6.4** illustrate the basic concepts for right and left turn treatments. Given the adjacent off road cycle facilities on the west side of Fullerton Street it is not expected that on road facilities would be required.



Source: Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads 2009)





Figure 6.3 Basic Auxiliary Left-turn treatment (BAL)

Source: Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads 2009)



Figure 6.4 Channelised Urban Auxiliary Left-turn treatment (AUL/CHL) – (Cycle Lane optional) Source: Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads 2009)



6.4 Recommended Access Strategy

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

The functional class of a road will determine 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: FORT WALLACCE SITE

Having regard for the anticipated road authority issues based on the results of analysis conducted to the Austroads and RMS Guidelines, consideration has been given to the range of possible access arrangements for the subject sites.

- a) Upgrade site access / Fullerton Road intersection to short turn slot CHR (S) and Auxiliary left lane priority junctions to suit the adopted access strategy.
- b) Should a two access strategy be preferred then the combination of junctions could be:
 - North Access Short CHannelised Right Turn Treatment (CHR(S)) coupled with a CHannelised Left Turn Treatment (CHL)
 - South Access Short CHannelised Right Turn Treatment (CHR(S)) coupled with an Auxiliary Left turn treatment (AUL)

The form and function of a second access point should be reviewed and discussed with the road authorities to determine its role, as either an unrestricted public access point, or possibly as a gated emergency site access for evacuation and emergency service uses.



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 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 traffic flows on Nelson Bay Rd & Fullerton St are well within capacity limits of road of their function and construction standard.
- b. Intersections have been assessed as operating at satisfactory service levels, the Fullerton Street / Nelson Bay Road roundabout is built to a high urban arterial road standard.
- c. A cycle path is provided along the Hunter River foreshore from Stockton Bridge to Stockton Ferry terminal.
- d. Existing Ferry services link Stockton to the Newcastle CBD with regular scheduled services.
- e. Existing bus services also connect Stockton and Fern Bay to Newcastle, and north to Newcastle Airport.

Proposed Development

- f. Additional traffic generation associated with the Fort Wallace site is 100 dwellings
- g. The Rifle Range site development has been taken into consideration in this assessment.
- h. Access is proposed from Fullerton Street via priority controlled intersections

Future Performance

- i. Future flow conditions on Nelson Bay Road and Fullerton Street are forecast to remain well within technical capacity limits for the function and standard of construction of the road. There is no discernible difference in existing and forecast "with development flows.
- j. The Fullerton Street / Nelson Bay Road roundabout has been assessed under future flow conditions as maintaining operation at satisfactory service levels.

ACCESS RECOMMENDATIONS:

In view of the conditions of the local roads and performance of the intersection of Nelson Bay Road /Fullerton Street the following recommendations are made for improvements to support the development proposal:

a) A single site access is sufficient, incorporating a Short CHannelised Right Turn Treatment (CHR(S)) coupled with a CHannelised Left Turn Treatment (CHL)

For the alternative access strategy which includes two (2) proposed access junctions planned for the subject site, the combination of intersection controls recommended would be as follows:

- b) North Access (CHR(S)) treatment coupled with a (CHL) Treatment
- c) South Access (CHR(S)) Treatment (CHR(S)) coupled with an Auxiliary Left turn treatment (AUL)

The need for short channelised right turn treatment is driven largely by the Fullerton Street flows, even though the level of site traffic turning right into the site is anticipated to be quite small. The difference in the left turn treatments is based on the assumption that most (if not all) left turn traffic entering the subject site would do so at the first opportunity, the north access point.

The conclusion drawn here is that one site access point is sufficient to deal with traffic capacity issues.

The form and function of the second access point should be reviewed and discussed with the road authorities to determine its role, as either an unrestricted public access point, or possibly as a gated emergency site access for evacuation and emergency service uses.

7.2 Conclusion

The conclusion drawn here is that the proposed site access arrangements for the Fort Wallace site will provide a very high quality of access for the subject site. One site access point is sufficient to deal with traffic capacity issues. It is recommended that the form and function of a second access point should this be pursued be reviewed and discussed with the road authorities to determine its role, as either an unrestricted public access point, or possibly as a gated emergency site access for evacuation and emergency service uses.

The overall conclusion is that the proposed access arrangements for the Fort Wallace site redevelopment are satisfactory and the planning proposal is therefore recommended on traffic and transport grounds.



Appendix A. Fort Wallace Draft Indicative Master Plan



Source: Architectus 2016

BTF2016093 DHA FW Transport Study Rev04.docx



Appendix B. Newcastle Cycling Map



BTF2016093 DHA FW Transport Study Rev04.docx



Appendix C. Public Transport Maps





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 05 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 Wooworths, Maitland Road 41 Maitland Road

42 Newcastle Station Coach Terminal 20





Appendix D. Crash History



May 2016

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														SF
Hunter Region		New	castle LG	Α		St	ockton					Nelson Bay Rd						
717007 P 03/07/2010	Sat	14:25	at	FULLERTON ST	RDB	CR∖	/ Fine	Dry	80 2	CAR	F81	W in FULLERTON ST	10 Proceedir	ng in lane	N	0	0	
E41773328			Da	aylight	RUM:	10 (Cross traffic			TRK	M28	S in NELSON BAY RD	50 Proceedin	ig in lane				
Hunter Region		New	castle LG	Α		St	ockton					Nelson Bay Rd						
717500 P 12/07/2010	Mon	12:20	10 m S	FULLERTON ST	RDB	CR\	/ Fine	Dry	80 2	LOR	M67	S in NELSON BAY RD	40 Proceedin	ng in lane	N	0	0	
E41570045			Da	aylight	RUM:	30 I	Rear end			CAR	F65	S in NELSON BAY RD	40 Proceedin	ig in lane				
Hunter Region		Port	Stephens	LGA		Fe	rn 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 Proceedin	ng in lane	N	0	0	
E41907766			Da	aylight	RUM:	30 I	Rear end			WAG	F47	S in NELSON BAY RD	Unk Proceedin	ng in lane				
Hunter Region		New	castle LG	A		St	ockton					Fullerton St						
740774 P 01/02/2011	Tue	08:50	555 m S	NELSON BAY RD	2WY	CR∖	/ Fine	Dry	70 1	WAG	M40	S in FULLERTON ST	55 Proceedin	ng in lane	N	0	0	F
E376143391			Da	aylight	RUM:	81 (Off left/rt bnd=:	>obj		Utility	pole							
Hunter Region		New	castle LG	A		Ko	ooragang					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 Proceedin	ng in lane	N	0	0	
E44524077			Dar	rkness	RUM:	66 (Object on road			Other	non fix	ked object						
Hunter Region		New	castle LG	Α		St	ockton					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 ri	ght	I	0	2	
E44540221			Da	aylight	RUM:	21 I	Right through			CAR	F71	S in NELSON BAY RD	20 Proceedin	ig in lane				
Hunter Region		New	castle LG	Α		St	ockton					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 Proceedir	ig in lane	I	0	1	
E654664490			Da	aylight	RUM:	71 (Off rd left => ol	oj		Utility	pole							
Hunter Region		New	castle LG	A		St	ockton					Fullerton St						
770833 P 04/10/2011	Tue	12:00	560 m S	NELSON BAY RD	2WY	CR∖	/ Fine	Dry	70 1	M/C	F43	N in FULLERTON ST	70 Pull out op	oposite	I	0	1	S
E46401051			Da	aylight	RUM:	51 (Out of control of	otake										
Hunter Region		New	castle LG	Α		Ko	ooragang Isl	а				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 Proceedin	ng in lane	I	0	2	
E46808741			Dar	rkness	RUM:	71 (Off rd left => of	oj		CAR	546	N in GREENLEAF RD	0 Parked					
										PED	F18 M10	GREENLEAF RD	Lie/sit on	carriageway				
										1 20	10113			oamagoway				

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
	1	Natural Lighting														SF
Hunter Region 789179 P 02/03/2012 E91173101	Newca Fri 04:50 70	astle LGA 00 m W FULLERTON ST Darkness	DIV RUM:	Stoc STR 73 Off	kton Raining rd rght => obj	Wet	60 1	CAR Fence	F57 e (prior	Nelson Bay Rd E in NELSON BAY RD to 2014)	60 Proceeding in	lane	I	0	1	
Hunter Region 787317 P 14/03/2012 E47407445	Newca Wed 05:30 44	astle LGA 00 m N FULLERTON ST Darkness	DIV RUM:	Stoc STR 71 Off	Fine Fine rd left => obj	Dry	70 1	WAG Utility	M57 pole	Nelson Bay Rd S in NELSON BAY RD	60 Proceeding in	lane	I	0	1	
Hunter Region 811301 P 11/09/2012 E50837287	Newca Tue 05:33	astle LGA at STOCKTON BDGE Dawn	DIV RUM:	Stoc CRV 30 Rea	kton Fine ar end	Dry	80 4	4WD VAN 4WD CAR	M24 M38 M34 F61	Nelson Bay Rd W in NELSON BAY RD W in NELSON BAY RD W in NELSON BAY RD W in NELSON BAY RD	50 Proceeding in 50 Proceeding in 50 Proceeding in 50 Proceeding in	lane lane lane lane	Ν	0	0	
Hunter Region 836620 P 15/05/2013 E51252036	Newca Wed 10:00	astle LGA at FULLERTON ST Daylight	RDB RUM:	Stoc CRV 10 Cro	Fine Fine	Dry	70 2	CAR CAR	M62 F19	Nelson Bay Rd W in FULLERTON ST S in NELSON BAY RD	30 Proceeding in 50 Proceeding in	lane lane	Ν	0	0	
Hunter Region 857191 P 29/10/2013 E53018456	Newca Tue 16:45 10	astle LGA 00 m E CORMORANT ROAD OP Daylight	DIV RUM:	Kool STR 71 Off	ragang Overcast rd left => obj	Wet	80 1	CAR Fence	F38 e (prior	Teal St E in TEAL ST to 2014)	90 Proceeding in	lane	Ν	0	0	S
Hunter Region 1009025 P 24/01/2014 E460723191	Newca Fri 20:10	astle LGA at FULLERTON ST Darkness	TJN RUM:	Stoc CRV 87 Off	kton Overcast Ift/Ift bnd=>ob	Wet	70 1	CAR Utility	M64 pole	Nelson Bay Rd N in NELSON BAY RD	80 Proceeding in	lane	I	0	1	S
Hunter Region 1010672 P 04/02/2014 E53628132	Newca Tue 07:40	astle LGA at STOCKTON BDGE Daylight	DIV RUM:	Koor STR 71 Off	Fine Fine	Dry	80 1	CAR Bridge	MU	Nelson Bay Rd W in NELSON BAY RD	65 Proceeding in	lane	Ν	0	0	
Hunter Region 1014048 P 09/03/2014 E188434897	Newca Sun 18:50 50	astle LGA 00 m S FULLERTON ST Daylight	DIV RUM:	Kooi STR 30 Rei	ragang Fine ar end	Dry	80 2	CAR CAR	M31 M57	Nelson Bay Rd W in NELSON BAY RD W in NELSON BAY RD	40 Proceeding in 0 Stationary	lane	Ν	0	0	
Hunter Region 1022452 P 17/04/2014 E54257614	Newca Thu 14:45	astle LGA at STOCKTON CENTRE ENT Daylight	2WY RUM:	Stoc STR 47 Em	:kton Fine herging from di	Dry rive	70 2	CAR 4WD	M52 M68	Fullerton St W in FULLERTON ST S in FULLERTON ST	10 Forward from 55 Proceeding in	drive Iane	Ν	0	0	

Detailed Crash Report - sorted



Crash No. Data Source Date	Day of Week Time	o E Si D Natural Lighting	ID Feature		Alignment Weather	Surface Condition	Speed Limit No. of Tus	Tu Type/Obj	Age/Sex	Street Travelling	Speed Travelling	Manoeuvre	Degree of Crash	Killed Iniured	Factors
															01
Hunter Region	Newc	astle LGA			Kooragan	g				Teal St					
1038161 P 28/08/2014	Thu 21:00	at GREENLEA	F ROAD TO D	IV S	TR Overc	ast Wet	80 3	CAR	M19	W in TEAL ST	40 Proceeding	g in lane	N	0 0)
E55550975		Darkness	RUM	1: 30	Rear end			CAR	F29	W in TEAL ST	0 Stationary				
								CAR	F17	W in TEAL ST	0 Stationary				
Hunter Region	Port S	Stephens LGA			Fern Bay					Nelson Bay Rd					
1041839 P 07/09/2014	Sun 04:30 1	150 m S TAYLOR RI		IV S	TR Raini	ng Wet	70 2	UTE	UU	S in NELSON BAY RD	70 Proceeding	g in lane	N	0 0) F
E56227779		Darkness	RUM	1: 71	Off rd left	=> obj		CAR		S in NELSON BAY RD	0 Parked foo	tpath			
Report Totals:	Total Crashe	s: 20	Fatal Crashes: 0		Inj	ury 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	•		Contributin	q Factors		Crash Movem	nent			CRASHES 20			CASUALTIES 9		
Car Crash	19	95.0%	Speeding	3 15	5.0%	Intersection, adjacent approache	S	2 [·]	10.0%	Fatal	0	0.0%	Killed	0	0.0%
Light Truck Crash	1	5.0%	Fatique	2 10	0.0%	Head-on (not overtaking)		0	0.0%	Serious inj.	4	20.0%	Seriously inj.	4	44.4%
Rigid Truck Crash	1	5.0%	J			Opposing vehicles; turning		1	5.0%	Moderate inj.	1	5.0%	Moderately inj.	3	33.3%
Articulated Truck Crash	0	0.0%				U-turn		0	0.0%	Minor/Other inj.	1	5.0%	Minor/Other inj.	1	11.1%
'Heavy Truck Crash	(1)	(5.0%)	Weath	ner		Rear-end		52	25.0%	Uncategorised inj.	1	5.0%	Uncategorised in	j. 1	11.1%
Bus Crash	0	0.0%	Fine	15 75	5.0%	Lane change		0	0.0%	Non-casualty	13	65.0%	^ Unrestrained	0	0.0%
"Heavy Vehicle Crash	(1)	(5.0%)	Rain	2 10).0%	Parallel lanes; turning		0	0.0%	Solf Deported Crach	0	0%	^ Belt fitted but not w	orn, No rest	raint
Emergency Vehicle Crash	0	0.0%	Overcast	3 15	5.0%	Vehicle leaving driveway		1	5.0%	Sell Reported Clash		070	fitted to position OR	NO heimet w	orn
Motorcycle Crash	1	5.0%	Fog or mist	0 0).0%	Overtaking; same direction		0	0.0%	Time Group	% of	Dav	Crashes	Casu	alties
Pedal Cycle Crash	0	0.0%	Other	0 0	0.0%	Hit parked vehicle		0	0.0%		70 UI	0 ay	6	2014	1
Pedestrian Crash	1	5.0%	Road Surface	Condition		Hit railway train		0	0.0%	02:00 04:50	5.0%	012.5%	2	2013	0
'Rigid or Artic. Truck " Heavy Tr	uck or ⊢	leavy Bus	Wet	5 00110111011	- 00/	Hit pedestrian		0	0.0%	05:00 - 04:59 2	10.0%	6 0.3%	3	2012	2
# These categories are NOT mu	tually e	xclusive	Wet	5 25	0.0%	Permanent obstruction on road		0	0.0%	05:00 - 05:59 2	10.0%	6 4.2% / 1.2%	6	2011	6
Location Typ	be		Dry	15 /5	0%	Hit animal		0	0.0%	07:00 - 07:59 0	10.09	0 4.2%	3	2010	0
*Intersection	5	25.0%	Snow or ice	0 0).0%	Off road, on straight		0	0.0%	07.00 - 07.59 2 08.00 - 08.50 1	5.0%	0 4.2%			
Non intersection	15	75.0%	Natural L	iahtina		Off road on straight, hit object		7 3	35.0%	00:00 - 00:59	0.00	0 4.270 6 1 2%			
* Up to 10 metres from an inters	ection		_	5 5		Out of control on straight		0	0.0%	10:00 - 10:59 0	5.0%	6 4.270			
			Dawn	1 5	0.0%	Off road, on curve		0	0.0%	11:00 - 11:59 0	0.00	6 4.270			
Collision Ty	ре		Daylight	12 60	0.0%	Off road on curve, hit object		2 ′	10.0%	12:00 - 12:59 3	15.0%	6 4.2%			
Single Vehicle	9	45.0%	Dusk	0 0	.0%	Out of control on curve		0	0.0%	13·00 - 13·59 0	0.0%	6 4.2%			
Multi Vehicle	11	55.0%	Darkness	7 35	5.0%	Other crash type		2 ′	10.0%	14:00 - 14:59 3	15.0%	6 4.2%	McLean Periods	% V	Veek
Deed Classifie						Speed Limit				15:00 - 15:59 0	0.0%	6 4.2%	A 6	30.0%	17.9%
	auon	0.00/	40 km/h or less	0	0.0%	80 km/h zone	9 45.0%			16:00 - 16:59 1	5.0%	6 4 2 %	B 1	5.0%	7.1%
Freeway/Motorway	0	0.0%	50 km/h zone	0	0.0%	90 km/h zone	0.0%			17:00 - 17:59 0	0.0%	6 4.2%	C 6	30.0%	17.9%
State Highway	10	0.0%	60 km/h zone	2	10.0%	5 100 km/h zone	1 5.0%			18:00 - 18:59 1	5.0%	6 4.2%	D 1	5.0%	3.5%
Uner Classified Road	10	80.0%	70 km/h zone	8	40.0%	5 110 km/h zone	0.0%			19:00 - 19:59 0	0.0%	6 4.2%	E	0.0%	3.6%
Unclassified Road	4	20.0%								20:00 - 21:59 3	15.0%	6 8.3%	F 1	5.0%	10.7%
~ 07:30-09:30 or 14:30-17:00	on scho	ool days	~ 40km/h or less	0 0.	.0%	~ School Travel Time Involvement	t 5	5 2	25.0%	22:00 - 24:00 0	0.0%	6 8.3%	G 1	5.0%	7.1%
			Day of th	e Week									H 1	5.0%	7.1%
Monday 1 5.0%	Wedn	esday	2 10.0% Friday	2	10.0%	% Sunday 3 15.0% WEE	KEND	4 2	20.0%	Street Lighting Off/Nil	% of D	Dark		0.0%	12.5%
Tuesday 5 25.0%	Thurs	day	6 30.0% Saturda	y 1	5.0%	% WEEKDAY 16 80.0%				0 of 7 in	Dark	0.0%	J	15.0%	10.7%
1				#Holio	day Pe	riods]						
New Year 0	D.0% I	Easter	1 5.0%	6 Queen's I	BD	0 0.0% Christmas	0 0.0%	6 Ea	aster S	H 2 10.0% Se	ept./Oc	t. SH	1 5.0%		
Aust. Day 1	5.0%	Anzac Da	y 0 0.0%	6 Labour D	ay	0 0.0% January SH	1 5.0%	6 Ju	une/Jul	ly SH 2 10.0% De	ecembe	er 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





OH&S SYSTEM CERTIFIED TO AS/NZS ISO 4801:2001

TURNING MOVEMENT SURVEY Nelson Bay Rd and Fullerton St, Nelson Bay Wednesday, June 8, 2016

Weather:	Overcast
Suburban:	Nelson Bay
Customer:	Better Transport

Surve	y Start
AM:	7:00
PM:	14:00

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

All Vehicles

Tir	Time		North Approach Nelson Bay Rd			proach Ful	lerton St	South App	roach Nels	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 App	roach Nels	on Bay Ro	East Ap	proach Ful	lerton St	South App	roach Nels	on Bay Ro	Peak
Period Start	Period End	U	Т	L	U	R	L	υ	R	Т	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

<u>Graphic</u>

Nelson Bay Rd



Tir	ne	North App	roach Nels	on Bay Ro	East Ap	proach Ful	lerton St	South App	roach Nels	son Bay R
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

Til Til	Time North Approach Nelson Bay Rd				East Ap	East Approach Fullerton St			South Approach Nelson Bay Ro		
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										
Ti	ne	North App	roach Nels	on Bay Ro	East Ap	proach Ful	lerton St	South Approach Nelson Bay R		
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

Tir	ne	North App	roach Nels	on Bay Ro	East Approach Fullerton St South Approach Nelson Bay R					
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

Tir	ne	Approach	Nelson B	st Approac	h Fullertor	Approach	n Nelson B
Period Start	Period End	Vestbound	Eastbound	orthboun	outhboun	Vestbound	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



Appendix F. Traffic Modelling Summary

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	Α	А	А	А



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.

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Organisation: MARK WAUGH PTY LTD (BTF) | Processed: Monday, October 3, 2016 11:29:13 AM

Project: C:\Users\mark.waugh\Documents\WORK\PROJECTS ACTIVE\ACTIVE\BTF201693 DHA Stockton\SIDRA\DHA Stockton.sip7

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	Α	А	А	А



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.

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Organisation: MARK WAUGH PTY LTD (BTF) | Processed: Monday, October 3, 2016 11:31:21 AM

Project: C:\Users\mark.waugh\Documents\WORK\PROJECTS ACTIVE\ACTIVE\BTF201693 DHA Stockton\SIDRA\DHA Stockton.sip7