

Appendix J

Traffic impact assessment

ALFORDS POINT ROAD UPGRADE

TRAFFIC AND TRANSPORT ASSESSMENT

Final

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TABLE OF CONTENTS

1. INTRODUCTION	1
2. EXISTING TRANSPORT NETWORK	2
3. EXISTING ROAD NETWORK PERFORMANCE	11
4. DETAILED DESCRIPTION OF PROPOSAL	13
5. TRAFFIC IMPACT ASSESSMENT	14
6. MITIGATION AND MANAGEMENT MEASURES	18
7. CONCLUSIONS AND RECOMMENDATIONS	19
APPENDIX A PEDESTRIAN AND CYCLIST FACILITIES PHOTOGRAPHIC INVENTORY	20
APPENDIX B PEDESTRIAN AND CYCLIST SURVEY RESULTS	24
APPENDIX C VISSIM MODELLING REPORT	25

1. INTRODUCTION

Background

NSW Roads and Maritime Services (RMS) has commissioned SMEC Australia Pty Ltd (SMEC) to prepare a traffic and transport assessment to support the Review of Environmental Factors (REF) for Alfords Point Road Upgrade between Alfords Point Bridge and Brushwood Drive (referred to herein as “the Proposal”).

Project Overview

The widening of Alfords Point Road at the northern approach to Alfords Point Bridge was completed in November 2011. The widening removed the requirement for tidal flow arrangements on Alfords Point Road between Alfords Point Bridge and Clancy Street, Padstow Heights. This widening provided three traffic lanes in each direction between Alfords Point Bridge and Clancy Street, Padstow Heights, which improved congestion issues and travel times for that section of Alfords Point Road.

However, south of Alfords Point Bridge, traffic congestion is still occurring on Alfords Point Road at its interchange with Brushwood Drive. The following was observed:

- + Queuing during the AM peak period on the northbound on-ramp generated by the short merge with Alfords Point Road.
- + Queuing on Brushwood Drive at the T-intersection with the northbound on-ramp during the AM peak period.
- + Queuing at the Fowler Road roundabout and on the southbound off-ramp during the PM peak.

To address traffic congestion on this section of Alfords Point Road between the bridge to Brushwood Drive and improve travel times for the corridor, RMS proposes to upgrade the road to a dual six-lane carriageway. The upgrade also includes:

- + Relocation of the truck inspection bay located on the southbound side of the carriageway approximately 900 metres from southern abutment of Alfords Point Road Bridge to a permanent site below the Old Illawarra overbridge.
- + Re-construct the shared path adjacent to the southbound carriageway.
- + Relocate the existing northbound bus stop south of the existing location.

Site Location

The Proposal is located south of the Georges River, within the Sutherland Shire Local Government Area (LGA) approximately 28 kilometres south of Sydney CBD. Figure 1.1 illustrates the study area.

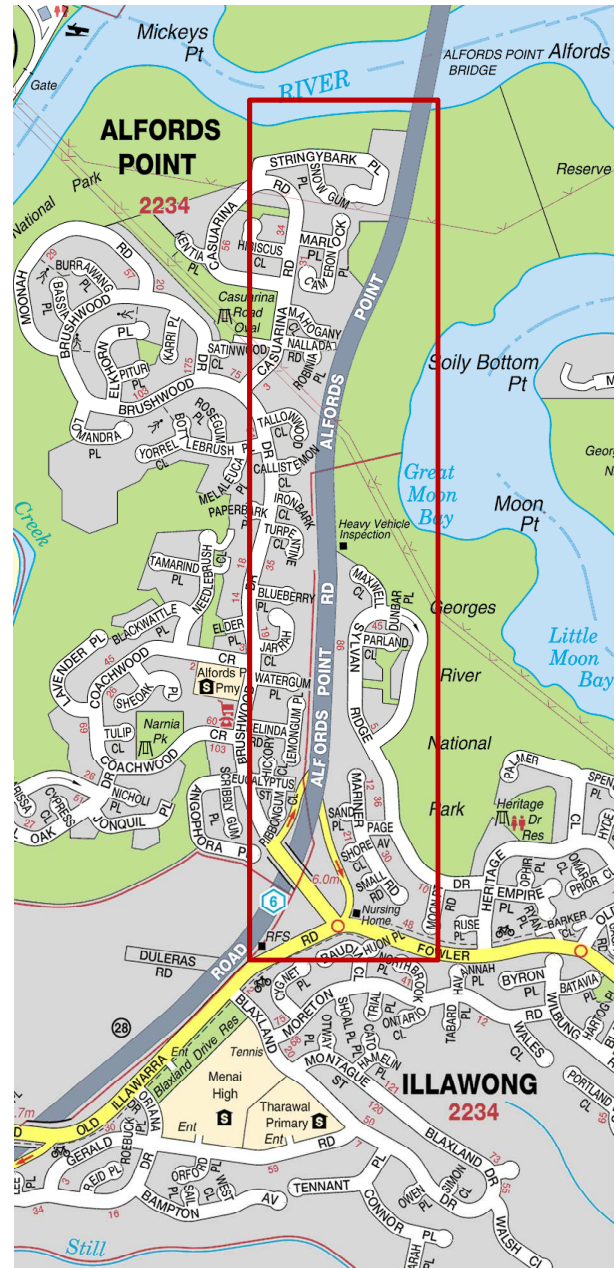


Figure 1.1: Alfords Point Road Upgrade, Site Location

Report Scope

The scope of this report is to:

- + present the findings from the traffic impact assessment for the Proposal to support the REF for the project.
- + provide a construction staging strategy that allows for construction to take place with minimal disruption to traffic flow, public transport, pedestrian and cyclist movements.

The remainder of the report is structured as follows:

- + **Section 2** details the existing transport network, including roads, public transport services, pedestrian and cyclist facilities and freight provisions.
- + **Section 3** summarises the existing road network performance based on the VISSIM modelling conducted by RMS for the Proposal.
- + **Section 4** gives a detailed description of the Proposal, including a description of the preliminary construction staging strategy and potential site office, amenities and stockpile sites.
- + **Section 5** assesses the traffic impacts associated with the Proposal.
- + **Section 6** recommends a package of mitigation measures to minimise the impacts identified in **Section 5**.
- + **Section 7** summarises recommendations and conclusions identified in the preceding sections.

2. EXISTING TRANSPORT NETWORK

Road Network

Functional Road Hierarchy

RMS has defined four road classes in its functional road hierarchy system. These are summarised in **Table 2.1**.

The road network in the study area can be categorised as follows:

- + Arterial Roads:
- + Collector Roads:
- + Local Streets:

Administrative Road Hierarchy

In addition to the functional classification, RMS has an administrative classification for the funding and management of the state's road network. This classification comprises:

- + State Classified Roads (main roads, highways and motorways), which are under the care, control and management of RMS;
- + Regional Roads, which are partly funded by RMS but under the care and control of relevant local councils; and
- + Other Roads, which are under the care and management of relevant local councils.

Within the Study Area, the arterial roads are managed by the RMS. The remaining collector and local streets are under the care and control of Council.

The following sub sections provide detailed descriptions of the key roads within the Study Area.

Table 2.1: Functional Road Hierarchy

Road Class	Description	Through Traffic	Speed Limit (km/h)
Arterial Road	Regional road in urban areas, forming the principal corridors for transport movements. Typical traffic volumes greater than 15,000 vehicles per day (vpd)	Yes	70-100
Sub-arterial Road	Provide links from arterial roads to areas of development or carry traffic from one part of a subregion to all parts of the region. May relieve traffic on arterial roads in some circumstances. Typical traffic volumes between 5,000 and 20,000 vpd	Some	60-80
Collector roads	Provide links to sub-arterial or arterial roads, to the local road system in developed areas. Typical traffic volumes between 2,000 and 10,000 vpd.	Little	40-60
Local Roads	Provide direct vehicular access to the development or development precinct and connect to the collector, sub-arterial or arterial road network. Low volumes, usually less than 2,000 vpd.	No	40

Source: RMS Network Planning Practice Notes and Austroads

Alfords Point Road

Alfords Point Road (Metroad 6) is a state classified road under the care and control of RMS. Within the study area, it comprises a single four-lane carriageway with two lanes in each direction up to the southern abutment of the Alfords Point Bridge. North of the Alfords Point Bridge, Alfords Point Road is a six-lane dual carriageway, with three lanes in each direction.

The posted speed limit on Alfords Point Road is 80 kilometres per hour.

Brushwood Drive

Brushwood Drive is a local road between Fowler Road and the Alfords Point Road on-ramp and a local road northwest of the Alfords Point Road on-ramp, under the care and control of Sutherland Shire Council. It is primarily a two-lane, two way configuration, with a channelised intersection with Alfords Point Road on-ramp and roundabout intersection with Menai Road and Fowler Road.

The posted speed limit on Brushwood Drive is 50 kilometres per hour.

Fowler Road

Fowler Road is a local road under the care and control of Sutherland Shire Council. It is a two-lane, two-way configuration for the majority of its length. Fowler Road has a roundabout intersection with Brushwood Drive and Menai Road.

The posted speed limit on Fowler Road is 50 kilometres per hour.

Menai Road

Menai Road is a local road under the care and control of Sutherland Shire Council. It comprises a two-lane, two-way configuration for the majority of its length and has a posted speed limit of 50 kilometres per hour. Menai Road has a roundabout-controlled intersection with Brushwood Drive and Fowler Road.

Existing Land Uses

The study area generally comprises fully developed low to medium density residential land uses with the following community facilities identified in the surrounding area:

- + Georges River National Park, along the foreshore of the Georges River.
- + Alfords Point Public School and Pre-School, located on Brushwood Drive, west of Alfords Point Road.
- + Illawong Village Shopping Centre and post office, located in Illawong, east of Alfords Point Road.
- + Illawong Community Centre, located in Illawong, east of Alfords Point Road.
- + Blaxland Drive Reserve, located on the corner of Menai Road and Blaxland Drive.
- + Menai High School located on Oriana Drive, Gerald Drive and Blaxland Drive.

Apart from in-fill, the catchment area is fully developed with little opportunity for population and employment growth.

Public Transport

Veolia Transport operates three bus routes within the study area. Table 2.1 summarises these routes and frequencies.

Table 2.1: Existing Bus Routes and Frequencies

Service Description	Frequency (minutes)			
	AM Peak	PM Peak	Off-Peak	Sunday/Public Holiday
M92 (Metrobus) – Parramatta to Sutherland, via Lidcombe, Bankstown, Padstow and Menai	10	10	15	20
962 – Cronulla to Bankstown, via Miranda, Gymea TAFE, Sutherland, Menai, Illawong and Padstow	15 to 20	15	30	60
963 – Menai to Alfords Point, via Illawong and limited services to Padstow Station	Infrequent Service	30	15 to 45	No Services

The key features of public transport services within the study area are:

- + There are no bus stops located on Alfords Point Road or the off-ramp.
- + There is one bus stop located on the Alfords Point Road on-ramp, adjacent to Eucalyptus Street.
- + Bus services to Padstow Station provide connection with Sydney CBD train services during the peak periods.
- + Bus stops within the study area generally do not have shelter and seating provisions.
- + All bus stops within the study area are adjacent to a shared user path.

Figure 2.1 illustrates the existing bus service routes and bus stops within the study area.



Source: NSW Transport Data (RMS, 2012) and site visit conducted by SMEC, 22 March 2012.

Figure 2.1: Existing Bus Routes and Stop Locations

Pedestrian and Cyclist Facilities

An existing off-road path is located on the eastern side of Alfords Point Road. It connects with shared user paths along Old Illawarra Road, Fowler Road and Brushwood Drive. During the site investigation, the majority of shared path users were observed to be recreational / fitness users.

The key pedestrian generators identified in the locality of the project include:

- + Alfords Point Public School and Pre-School, located on Brushwood Drive, west of Alfords Point Road;
- + Illawong Village Shopping Centre and post office, located in Illawong, east of Alfords Point Road;
- + Illawong Community Centre, located in Illawong, east of Alfords Point Road;
- + Blaxland Drive Reserve, located on the corner of Menai Road and Blaxland Drive; and
- + Menai High School located on Oriana Drive, Gerald Drive and Blaxland Drive.

These community facilities are connected to the existing shared path network.

The western side of Alfords Point Road does not allow pedestrian access and comprises dense bush, noise walls or a sheer rock face for the majority of its length. There is a short section of redundant path located on the western side of Alfords Point Bridge, which cannot be accessed by pedestrians. This path does not have any pedestrian or cyclist connectivity to the remainder of the network.

Figure 2.2 illustrates the RMS existing and proposed pedestrian and cyclist network within the study area (Transport Data, RMS, 6 February 2012). Based on the current strategy, road shoulder cyclist provisions are proposed along the Alfords Point Road corridor.

Appendix A includes a photographic inventory of existing pedestrian and cyclist provisions collected during the site investigation.

Pedestrian and Cyclist Survey Results

During the site visit, the review team observed pedestrian and cyclist movements and determined key desire lines for pedestrians and cyclists in order to advise RMS on an appropriate data collection strategy for the corridor. Based on this advice, RMS commissioned TTM Group to conduct pedestrian and cyclist surveys within the study area for the following periods:

- + Thursday 29 and Friday 30 March 2012, from 7am to 11am and from 2pm to 6:30pm

- + Saturday 31 March and Sunday 1 April 2012, from 7am to 3pm

Appendix B includes the results of the pedestrian and cyclist survey. Figure 2.3 illustrates the locations and directions pedestrian and cyclist movements were surveyed. Figures 2.4 and 2.5 illustrate the pedestrian movements and the directions surveyed for the Thursday AM (7:30 to 8:30am) and PM (5:15 to 6:15pm) peak hours, respectively. Thursday pedestrian and cyclist volumes are presented since it represents an average weekday.

The key findings from the pedestrian and cyclist surveys include:

- + Pedestrian and cyclist volumes along Alfords Point Road are negligible, with up to five movements combined per hour in both the AM and PM peak periods.
- + The number of cyclists using the northern section of Alfords Point Road shared user path towards the south of the bridge is low (three cyclists per hour during the PM peak period). This is likely to be attributed to cyclists travelling home from work or exercising after work. The majority of the cyclists observed appear to be experienced riders wearing cycling gear and are not considered casual riders.
- + During weekends, the informal path from Alfords Point Road to below the southern bridge abutment and Georges River National Park is primarily used by anglers. However, the volume of pedestrians accessing this area on the eastern side of Alfords Point Road is only up to five pedestrians per day.
- + During weekends, organised exercise groups were observed to use the Alfords Point Road shared user path.
- + The pedestrian and cyclist volumes along Fowler Road and Old Illawarra Road / Menai Road are higher than Alfords Point Road pedestrian and cyclist volumes, which could be attributed to the pedestrian generators such as bus stops, Menai High School, Blaxland Drive Reserve and Illawong village centre, which are located along this corridor.
- + During the site investigation, the pedestrians and cyclists along the corridor were observed to be recreational users utilising the path for exercise. This was confirmed by the pedestrian and cyclist surveyors commissioned by RMS.
- + No pedestrians were observed crossing Alfords Point Road to access the western side of the corridor.



Figure 2.2: Existing and Proposed Pedestrian and Cyclist Network

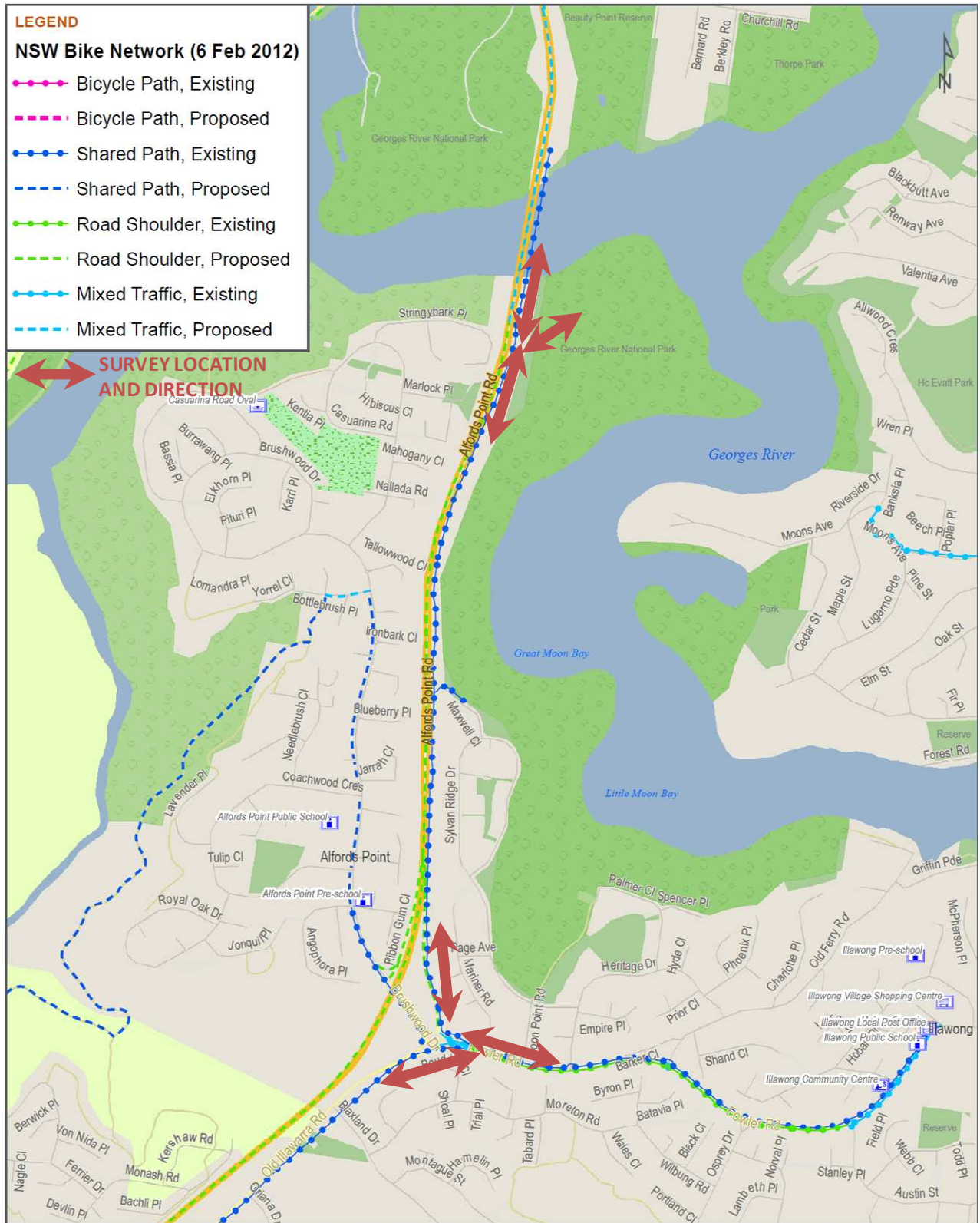
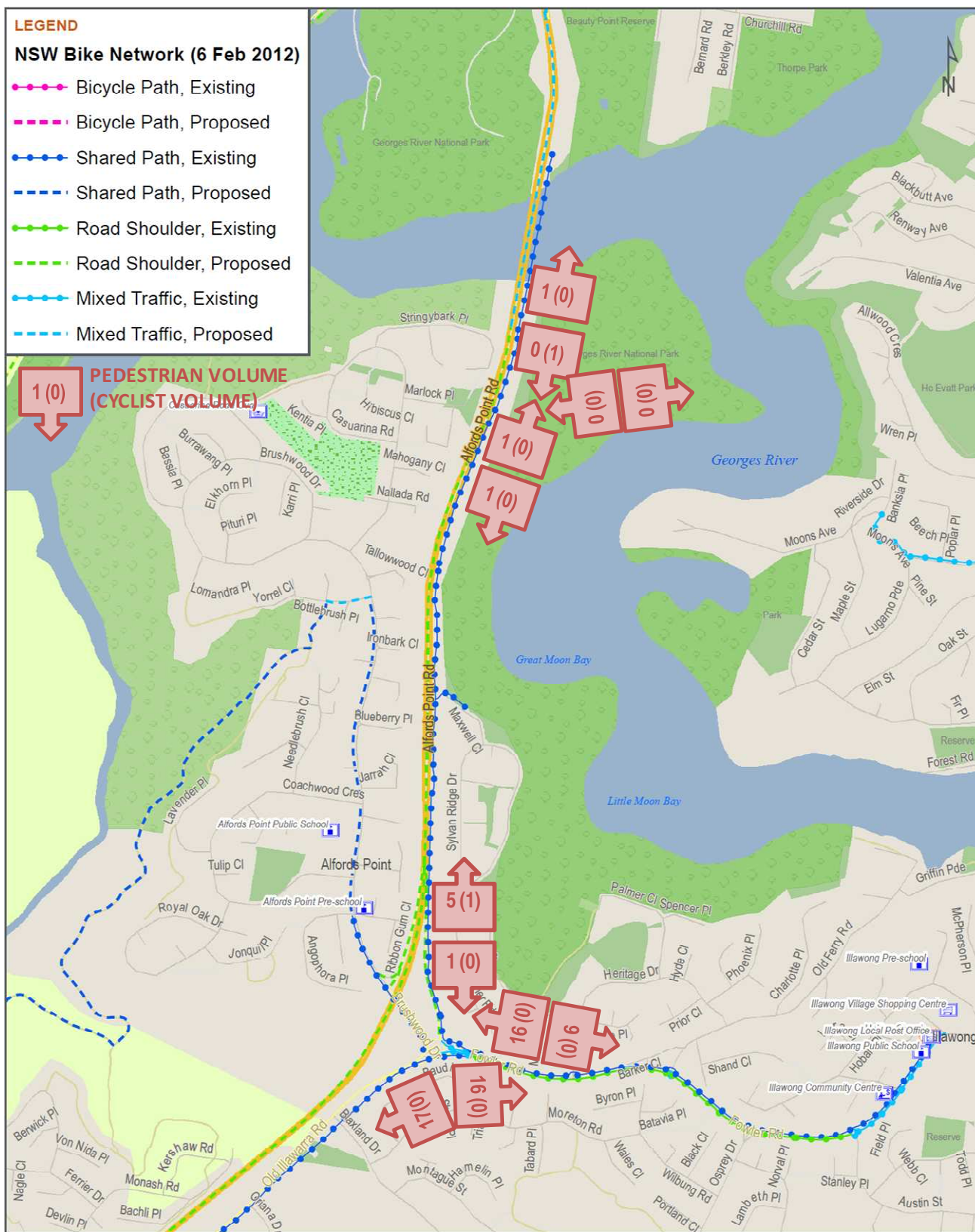
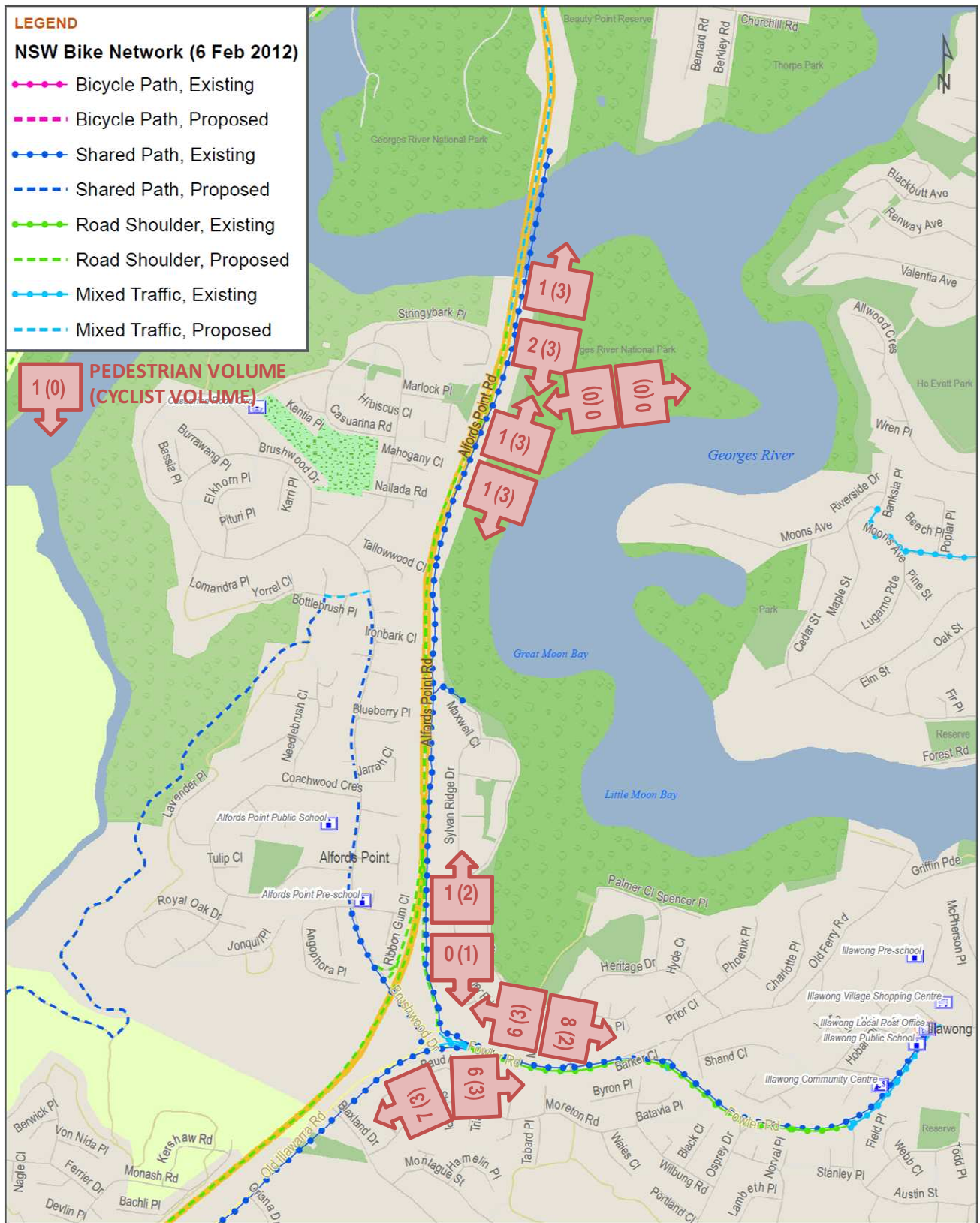


Figure 2.3: Pedestrian Survey Locations



Source: Pedestrian and cyclist surveys conducted by TTM Group, Thursday 29 March 2012.

Figure 2.4: AM Peak Hour (7:30 to 8:30am) Pedestrian and Cyclist Volumes



Source: Pedestrian and cyclist surveys conducted by TTM Group, Thursday 29 March 2012.

Figure 2.5: PM Peak Hour (5:15 to 6:15pm) Pedestrian and Cyclist Volume

Freight Transport

There is a heavy vehicle inspection / parking bay located on the southbound side of Alfords Point Road approximately 900 metres from southern abutment of Alfords Point Road Bridge. During the site investigation conducted on 22 March 2012, parked heavy vehicle trailers were observed within the inspection bay, as depicted in **Figure 2.7**. The daily proportion of heavy vehicles on Alfords Point Road is 1.6% for the northbound direction and 1.2% for the southbound direction (RMS count station 42.001, 10 May to 24 October 2012).



Source: SMEC, 22 March 2012.

Figure 2.7: Heavy Vehicle Inspection Bay

3. EXISTING ROAD NETWORK PERFORMANCE

Intersection Analysis

The existing intersection performance was determined using the VISSIM models prepared by RMS. A summary of results is provided in **Table 3.1**.

Table 3.1: Existing Intersection Performance, 2011

Intersection	Peak	Level of Service	Average Delay (sec)	Average Queue Length (m)
Alfords Point Road On-Ramp / Brushwood Drive	AM	F	110.8	97
	PM	A	0.9	0
Alfords Point Road Off-Ramp / Fowler Road / Brushwood Drive	AM	F	156.2	125
	PM	C	32.4	33

The key findings from the intersection analysis are:

- + During the AM peak, both intersections operate an unacceptable Level of Service.
- + During the AM peak at the Alfords Point Road on-ramp and Brushwood Drive intersection, vehicles from the south-east Brushwood Drive approach experience average delays of approximately 110 seconds and queue lengths of approximately 97 metres.
- + During the AM peak, a significant number of vehicles travel from Fowler Road to Brushwood Drive, which causes significant delays for vehicles travelling from the Menai Road approach.
- + During the AM peak, the queue lengths experienced at the Alfords Point Road off-ramp / Fowler Road / Brushwood Drive intersection (average queue length of 125 metres and maximum queue length of 650 metres) are likely to impact southbound through traffic on Alfords Point Road.
- + During the PM peak, both intersections operate at an acceptable Level of Service of C or better. However, vehicles travelling from the Alfords Point Road off-ramp approach experience significant delays and average queue lengths of approximately 106 metres. These queue lengths can extend beyond the length of the off-ramp storage and back

onto Alfords Point Road causing interruption to through traffic on Alfords Point Road.

Local Road Analysis

The performance of the key local roads is dependent on the operation of the intersections analysed in the previous subsection.

Main Alignment Analysis

The existing performance of the main alignment was determined using the VISSIM models prepared by RMS. A summary of results is provided in Table 3.2. The Level of Service was assessed on Alfords Point Road, approximately 500 metres north of Brushwood Drive.

Table 3.2: Existing Main Alignment Performance, 2011

Peak	Direction	Traffic Volume	Volume/ Capacity Ratio	Level of Service
AM	Northbound	4,006	1.08	E
	Southbound	1,438	0.39	B
PM	Northbound	1,327	0.36	B
	Southbound	3,803	1.03	E

Source: RMS, 10 August 2012

The capacity assumed for this analysis is 1,850 vehicles per hour per lane and the Level of Service is based on Table 4.4 of the *Guide to Traffic Management, Part 3: Traffic Studies and Analysis* (AUSTROADS, 2009).

A site investigation was conducted during the AM peak period on Thursday 22 March 2012. Significant queuing was observed on the northbound on ramp, which is attributed to the merge into two lanes.

The VISSIM modelling conducted by RMS indicates that north of the northbound on-ramp merge, Alfords Point Road is operating at an acceptable Level of Service.

Figures 3.1, 3.2 and 3.3 depict some of the observations during the site investigation.



Source: SMEC, 22 March 2012.

Figure 3.1: AM Peak Traffic at Alfords Point Road On Ramp



Source: SMEC, 22 March 2012.

Figure 3.2: AM Peak Traffic Merging from Alfords Point Road On Ramp



Source: SMEC, 22 March 2012.

Figure 3.3: AM Peak Northbound Traffic

Crash Data Analysis

RMS provided crash data for Alfords Point Road for the four-year period ending 2010. The crash data revealed that 62 crashes were recorded during this period within the 3.06-kilometre section of Alfords Point Road, with the majority (69.4%) of crashes are characterised as rear-end collisions. A significant number of these rear-end collisions occurred at merge points at the on-ramp merge and south of Alfords Point Bridge, with details as follows:

- + Nine rear-end crashes occurred at the merge of the northbound on-ramp, six of which involved more than two vehicles.
- + Five rear-end crashes occurred south of Alfords Point Bridge in the northbound direction and one in the southbound direction. Three of these rear-end collisions involved more than two vehicles.

4. DETAILED DESCRIPTION OF PROPOSAL

Overview of Proposal

The preferred option was modelled using VISSIM and involves:

- + Widening of Alfords Point Road to six lanes (three lanes in each direction) between Alfords Point Bridge and Alfords Point Road Ramps to Brushwood Drive.
- + Widening the Alfords Point Road off-ramp by extending the right lane to 350 metres, providing additional capacity on approach to the Fowler Road / Menai Road / Brushwood Drive / Alfords Point Road off-ramp roundabout.
- + Relocating the existing truck inspection bay located on the southbound side of Alfords Point Road approximately 900 metres from southern abutment of Alfords Point Road Bridge to a permanent site below the Old Illawarra overbridge.

Preliminary Construction Staging Strategy

RMS has prepared a preliminary construction staging strategy for the proposed upgrade. The staging strategy is based on a site investigation to determine the opportunities and constraints for staging and identify potential stockpile and site compound locations.

The preliminary construction staging strategy involves the following three stages:

- + **Stage 1:** Widening of the off-ramp on the western side of the existing off-ramp and construction of two additional lanes plus a shoulder on the eastern side of the existing Alfords Point Road southbound carriageway, north of the off-ramp diverge (approximate Station 1360). Minor widening of the on-ramp south of the existing gore area. Existing capacity maintained with two lanes in each direction on Alfords Point Road, one lane on the off-ramp with existing deceleration length.
- + **Stage 2:** Shift traffic onto the widened section of the off-ramp. Construction of two lanes plus a shoulder on eastern side of Alfords Point Road southbound carriageway between Station 1360 and the off-ramp. Existing capacity maintained with two lanes in each direction on Alfords Point Road, one lane on the off-ramp with existing deceleration length.

- + **Stage 3:** Shift traffic onto the newly constructed lanes and shoulder on the eastern side of Alfords Point Road and construct median works. Existing capacity maintained with two lanes in each direction on Alfords Point Road, one lane on the off-ramp with shortened deceleration length and lengthened second lane on the approach to the roundabout.

Additional features of the construction staging strategy include:

- + RMS' Traffic Management Centre (TMC) would accept a 60 km/h works speed zone and 40 km/h works speed zone outside peak periods.
- + Night works would be accepted by RMS' TMC to avoid queues during peak periods.
- + 3.1-metre traffic lanes assumed for the construction staging strategy.
- + The shoulder and off-road cycleway would not be removed concurrently during construction staging.
- + Provisions for cyclists and pedestrians during construction will be investigated further by RMS.
- + Access to the Energy Australia easement would be maintained during construction.

The following locations have been identified for the site compound and stockpiles:

- + Site office and amenities under the southern abutment of the Alfords Point Bridge adjacent to the southbound carriageway. Access and egress would be via the existing ramp access.
- + Site offices and amenities at the existing heavy vehicle inspection bay.
- + Site offices and / or stockpiles adjacent to the northbound carriageway, between Old Illawarra Road and Alfords Point Road, adjacent to Maxwell Drive
- + Site offices and / or stockpiles between the off-ramp and the southbound carriageway, under the Brushwood Drive overpass, which would require some vegetation clearance. Access and egress would be via the off-ramp or the Alfords Point Road southbound carriageway.
- + Site offices and amenities within the proposed heavy vehicle inspection bay located below the Old Illawarra overbridge.

5. TRAFFIC IMPACT ASSESSMENT

Levels of Service

Level of Service is a basic performance parameter assigned to an intersection based on average delay. For signalised and roundabout intersections, Level of Service is based on the average delay to all vehicles passing through the intersection. For priority-controlled intersections Level of Service is based on the average delay for the worst approach. The RMS Level of Service criteria is provided below in Table 5.1.

Table 5.1: RMS Level of Service Criteria

Level of Service	Average Delay (Sec)	Stop, Give Way or Yield Signs	Traffic Signals and Roundabout
A	<14	Good operation	Good operation
B	15 to 28	Acceptable delays and spare capacity	Good operation with acceptable delays and spare capacity
C	29 to 42	Satisfactory but accident study required Satisfactory	Satisfactory
D	43 to 56	Near capacity, crash study required	Operating near capacity
E	57 to 70	At capacity, requires other control mode	At capacity, at signals, incidents will cause excessive delays
F	> 70	At capacity with long delays	At capacity with long delays

Construction Traffic Generation

Construction is anticipated to commence in 2016. It is estimated that construction of the proposal would take approximately 18 months. Standard work hours are likely to be 7:00am to 5:00pm on Monday to Friday and 7:00am to 1:30pm on Saturdays. In order to minimise disruption to general traffic some night work may be required.

Based on similar road upgrades, it is anticipated that at the peak construction phase up to 15 heavy vehicle movements would be generated by the proposal. These additional heavy vehicle movements would be negligible and are likely to be dispersed within the current daily traffic volumes on Alfords Point Road.

During the construction period, traffic would be managed in the following ways:

- + Access to the site compound would be located directly off the existing Alfords Point Road carriageway where possible, minimising increased traffic volumes on the local road network, particularly heavy vehicle movements associated with the transportation of construction equipment and materials.
- + Right turns into the site compound from Alfords Point Road and right turns out of the site compound onto Alfords Point Road would not be permitted. Heavy vehicles coming from the south along Alfords Point Road will be required to continue to the Clancy Street exit and turn right onto Henry Lawson Drive before continuing along Alfords Point Road.
- + Traffic control, such as contra-flow arrangements could be used, where appropriate, maintaining existing peak period capacity on Alfords Point Road.
- + Construction and delivery vehicles entering or leaving the site compound and stockpile sites would do so via Alfords Point Road under traffic control. These movements would be restricted to non-peak traffic periods where practical.
- + Disruption to road users and third parties during construction would be minimised through detailed construction staging plans.
- + All property accesses would be maintained throughout construction.
- + Bus services would be maintained and provided for at all times to ensure no disruption to current services.
- + Appropriate traffic management strategies would be detailed in the Construction Environmental Management Plan (CEMP).

Operational Traffic Generation

The proposal will not generate additional traffic. Forecast traffic volumes assume a global 0.5% annual traffic growth rate, which is derived from the RMS' EMME/2 Strategic Traffic Model. This will result in an increase in demand by 2.5%, 7.5% and 12.5% in years 2016, 2026 and 2036, respectively.

Forecast bus volumes are based on existing timetable information.

Intersection Analysis

Tables 5.1 and 5.2 summarise the intersection performance without the Proposal for 2016 and 2026 traffic volumes, respectively.

Table 5.1: Intersection Performance, 2016 (without Alfords Point Road Upgrade)

Intersection	Peak	Level of Service	Average Delay (sec)	Average Queue Length (m)
Alfords Point Road On-Ramp / Brushwood Drive	AM	F	140.7	119
	PM	A	0.9	0
Alfords Point Road Off-Ramp / Fowler Road / Brushwood Drive	AM	F	192.8	149
	PM	C	41.3	63

Source: RMS VISSIM modelling, December 2011

Table 5.2: Intersection Performance, 2026 (without Alfords Point Road Upgrade)

Intersection	Peak	Level of Service	Average Delay (sec)	Average Queue Length (m)
Alfords Point Road On-Ramp / Brushwood Drive	AM	F	201.5	181
	PM	A	1.0	0
Alfords Point Road Off-Ramp / Fowler Road / Brushwood Drive	AM	F	248.4	170
	PM	D	46.3	97

Source: RMS VISSIM modelling, December 2011

Based on the VISSIM modelling conducted by RMS, the operation of the intersections is summarised as follows:

- + Both intersections analysed operate at an unacceptable Level of Service of F during the AM peak period for 2016 and 2026.
- + The intersection of Alfords Point Road on-ramp and Brushwood Drive operates at a good Level of Service of A during the PM peak period.
- + The intersection of Alfords Point Road off-ramp, Fowler Road and Brushwood Drive operates at an acceptable Level of Service of D during the PM peak period. However, significant queue lengths are experienced by vehicles on the Alfords Point Road off-ramp, which could impact southbound through traffic on Alfords Point Road.

Tables 5.3 and 5.4 summarise the intersection performance with the Proposal for 2016 and 2026 traffic volumes respectively.

Table 5.3: Intersection Performance, 2016 (with Alfords Point Road Upgrade, Preferred Option)

Intersection	Peak	Level of Service	Average Delay (sec)	Average Queue Length (m)
Alfords Point Road On-Ramp / Brushwood Drive	AM	A	3.5	0
	PM	A	0.9	0
Alfords Point Road Off-Ramp / Fowler Road / Brushwood Drive	AM	A	4.3	0
	PM	B	20.5	15

Source: RMS VISSIM modelling, May 2012

Table 5.4: Intersection Performance, 2026 (with Alfords Point Road Upgrade, Preferred Option)

Intersection	Peak	Level of Service	Average Delay (sec)	Average Queue Length (m)
Alfords Point Road On-Ramp / Brushwood Drive	AM	A	4.0	0
	PM	A	1.0	0
Alfords Point Road Off-Ramp / Fowler Road / Brushwood Drive	AM	A	4.6	1
	PM	B	27.7	27

Source: RMS VISSIM modelling, May 2012

The proposed road upgrades will operate at an acceptable Level of Service of D or better for traffic volumes forecast for 2016 and 2026.

Local Road Analysis

The performance of the key local roads is dependent on the operation of the intersections analysed in the previous subsection.

Modelled Network Performance

An assessment of the modelled network performance was conducted to determine the impacts of the Proposal. Tables 5.5 and 5.6 summarise the network performance statistics under 2026 AM and PM peak forecast traffic volumes, respectively.

Table 5.5: Modelled Network Performance Statistics, 2026 AM Peak

Performance Parameter	Do Nothing	With Proposal
Average Vehicle Speed (km/h)	27.6	64.3
Average Vehicle Delay (sec)	130.5	5.9
Average Number of stops per vehicle	2.69	0.08

Table 5.6: Modelled Network Performance Statistics, 2026 PM Peak

Performance Parameter	Do Nothing	With Proposal
Average Vehicle Speed (km/h)	48.5	58.1
Average Vehicle Delay (sec)	38.4	19.0
Average Number of stops per vehicle	1.08	0.40

The results of the modelled network performance analysis indicate:

- + The Proposal provides significant network benefits in the future, particularly in the AM peak.
- + The Proposal will increase average vehicle speeds in 2026 by 40 km/h and 10 km/h in the AM and PM peaks, respectively.
- + The Proposal will significantly reduce average vehicle delay (over 125 seconds per vehicle in AM peak alone).
- + The Proposal will significantly reduce average stops per vehicle.

The existing performance of the main alignment in terms of Level of Service was determined using the VISSIM models prepared by RMS. A summary of results without and with the upgrade is provided in Tables 5.7 and 5.8, respectively.

Table 5.7: Main Alignment Performance without Alfords Point Road Upgrade, Preferred Option 2016

Peak	Direction	Volume/ Capacity Ratio	Level of Service
AM	Northbound	1.08	E
	Southbound	0.40	B
PM	Northbound	0.36	B
	Southbound	1.04	E

Source: RMS, 10 August 2012

Table 5.8: Main Alignment Performance with Alfords Point Road Upgrade, Preferred Option

Peak	Direction	Volume/ Capacity Ratio	Level of Service
2016 AM	Northbound	0.77	D
	Southbound	0.26	A
2016 PM	Northbound	0.25	A
	Southbound	0.70	D
2026 AM	Northbound	0.80	D
	Southbound	0.27	A
2026 PM	Northbound	0.25	A
	Southbound	0.73	D

Source: RMS, 10 August 2012

The capacity assumed for this analysis is 1,850 vehicles per hour per lane and the Level of Service is based on Table 4.4 of the *Guide to Traffic Management, Part 3: Traffic Studies and Analysis* (AUSTROADS, 2009).

The key findings from the analysis of the main alignment Level of Service are:

- + Without the Alfords Point Road Upgrade the main alignment in the peak direction is likely to operate at Level of Service E in 2016, which is approaching capacity.
- + With the Alfords Point Road Upgrade (preferred option) the Level of Service for the main alignment in the peak direction is likely to improve to Level of Service D, which is an acceptable Level of Service.

Under existing conditions, between 2006 and 2010, nine rear-end crashes occurred at the merge of the

northbound on-ramp, six of which involved more than two vehicles. The removal of the northbound on-ramp merge is likely to reduce the number of rear-end collisions experienced as a result of the merge.

Pedestrians and Cyclists

There will be no impacts to pedestrians and cyclists during the operational phase of the Proposal. During construction, there may be impacts to pedestrian and cyclist access resulting from the temporary closure of the existing off-road path.

Public Transport

There will be no impacts to public transport services during the operational phase of the Proposal. Capacity will be maintained during construction and public transport services will not be impacted significantly.

6. MITIGATION AND MANAGEMENT MEASURES

Construction Phase

ROAD NETWORK

A Construction Traffic Management Plan would be prepared prior to construction and included in the CEMP. The plan would include measures to minimise construction vehicle impacts on the surrounding local road network, such as restrictions on vehicle delivery times, ensuring construction traffic is minimised during general traffic peak periods.

Construction staging would be developed to maintain existing peak flow capacity.

PUBLIC TRANSPORT

There are no significant impacts anticipated for existing public transport services during the construction stage. Existing bus services would be maintained and construction staging will maintain flow capacity along Alfords Point Road to minimise disruption to bus operations.

PEDESTRIAN AND CYCLIST FACILITIES

Pedestrian and cyclist access would be maintained during construction and appropriate protection would be installed to separate pedestrians and cyclists from works areas. Measures to maintain pedestrian and cyclist access to the existing community facilities will be incorporated in the Construction Traffic Management Plan and the CEMP. Where existing pedestrian and cyclist facilities are impacted by construction, alternative routes would be investigated.

Operational Phase

ROAD NETWORK

The proposal would improve capacity issues on Alfords Point Road and the Alfords Point Road off-ramp. Therefore, no mitigation and management measures are required.

ASSET MANAGEMENT / MAINTENANCE

The ultimate design is to provide removable barriers to be installed in locations determined by RMS, to allow for temporary cross-overs and potential for contra-flow during maintenance works, particularly for maintenance of cuttings. The cross-overs are likely to be designed for a 40 km/h design speed.

The RMS project team is required to liaise with the RMS Asset Management Team to confirm the requirements for maintenance and locations for removable barriers.

PUBLIC TRANSPORT

The existing public transport provisions, such as bus stops will not be impacted by the proposal. Based on existing public transport conditions, there is not a requirement to provide bus stops along Alfords Point Road and the off-ramp.

PEDESTRIAN AND CYCLIST FACILITIES

The existing pedestrian and cyclist network provides appropriate connectivity with the key trip generators within the study area. The existing off-road path along Alfords Point Road has sufficient capacity to accommodate pedestrian and cyclist volumes along the corridor. All bus stops within the study area are located along adequate pedestrian and cyclist provisions.

7. CONCLUSIONS AND RECOMMENDATIONS

Traffic congestion is currently experienced on Alfords Point Road at its interchange with Brushwood Drive as a result of:

- + Extensive queuing during the AM peak period on the northbound on-ramp caused by merging traffic from the northbound on-ramp onto Alfords Point Road
- + Queuing on Brushwood Drive at the T-intersection with the northbound on-ramp during the AM peak period.
- + Extensive queuing at the Fowler Road roundabout and on the southbound off-ramp during the PM peak.

To address traffic congestion on the section of Alfords Point Road between the southern abutment of the bridge to Brushwood Drive and improve travel times for the corridor, RMS proposes to upgrade the road to a dual six-lane carriageway.

VISSIM modelling conducted by RMS indicates that with the proposed upgrade, the key intersections, local roads and Alfords Point Road operate at an acceptable Level of Service of C or better under forecast traffic volumes for 2016 and 2026.

Crash data analysis indicates that a significant number of crashes are attributed the rear-end collisions, at the northbound merge at the Alfords Point Road on-ramp. The number of rear-end crashes are likely to be reduced by the construction of the proposal, which includes the removal of the northbound merge.

Existing pedestrian and cyclist volumes along Alfords Point Road are negligible, with up to five pedestrians and cyclists (combined) per hour in both the AM and PM peak periods. Pedestrian and cyclist facilities and bus operations would not be impacted by the proposal. The preliminary construction staging strategy will maintain pedestrian and cyclist access where possible and minimise disruption to public transport services.

It is recommended that a Construction Traffic Management Plan is prepared prior to construction and included in the CEMP. The plan would include measures to minimise construction vehicle impacts on the surrounding local road network, such as restrictions on vehicle delivery times, ensuring construction traffic is minimised during general traffic peak periods.

Based on the findings of this study, it is recommended that Alfords Point Road is upgraded to three lanes in each direction and the Alfords Point Road off-ramp is widened to provide additional capacity at the approach to the roundabout at the Alfords Point Road off-ramp / Fowler Road / Menai Road / Brushwood Drive intersection.

APPENDIX A

PEDESTRIAN AND CYCLIST FACILITIES PHOTOGRAPHIC INVENTORY



Figure A1: Shared user path, Brushwood Drive, looking west

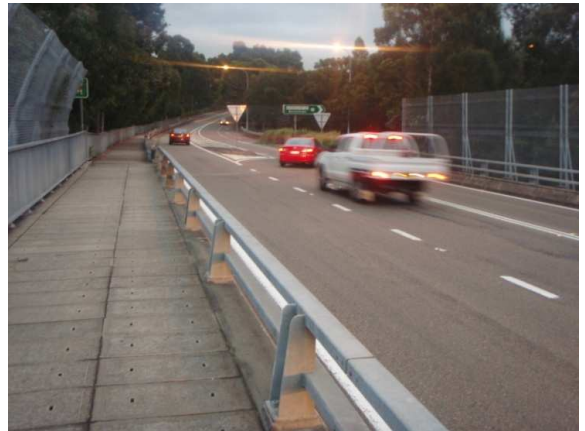


Figure A2: Shared user path, Brushwood Drive overpass, looking west



Figure A3: Shared user path, Alfords Point off-ramp, looking north



Figure A4: Shared user path, Alfords Point off-ramp, looking north



Figure A5: Shared user path, eastern side of Alfords Point Road, looking north



Figure A6: Shared user path, eastern side of Alfords Point Road, looking north



Figure A7: Shared user path, eastern side of Alfords Point Road, looking north



Figure A8: Shared user path to Maxwell Close residential area, eastern side of Alfords Point Road, looking east



Figure A9: Shared user path to Maxwell Close residential area, eastern side of Alfords Point Road, looking east



Figure A10: Shared user path, eastern side of Alfords Point Road, looking north



Figure A11: Shared user path, eastern side of Alfords Point Road, north of truck stopping bay, looking north



Figure A12: Shared user path, eastern side of Alfords Point Road, southern bridge abutment, looking north



Figure A13: Shared user path, eastern side of Alfords Point Road, southern bridge abutment, looking north



Figure A14: Shared user path, eastern side of Alfords Point Road, southern bridge abutment, looking north



Figure A15: Shared user path, eastern side of Alfords Point Road, Alfords Point Bridge, looking south



Figure A16: Path, eastern side of Alfords Point Road, to under southern bridge abutment, looking north



Figure A17: Path, eastern side of Alfords Point Road, to under southern bridge abutment, looking west



Figure A18: Path, southern side of Menai Road, looking west

APPENDIX B

PEDESTRIAN AND CYCLIST SURVEY RESULTS

TTM Data

Location: Brushwood Dr / Menai Rd Roundabout

Suburb: Alford's Point

Date: Thursday, 29 March 2012

Survey Duration: 0700-1100 AM || 1400-1830 PM

Weather: Overcast

Notes 1:

Notes 2:

Time 15 min line start	Location 1						Section Total	Location 2						Section Total	Location 3						Section Total	Totals				
	Northbound			Southbound				Eastbound			Westbound				Eastbound			Westbound								
	Peds	Cyclists	Total	Peds	Cyclists	Total	Peds	Cyclists	Total	Peds	Cyclists	Total	Peds	Cyclists	Total	Peds	Cyclists	Total	Peds	Cyclists	Total					
7:00	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	2	0	0	0	2	0	0	2	4	
7:15	1	1	2	0	0	0	2	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	6	
7:30	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	3	
7:45	1	0	1	1	0	0	1	0	1	2	0	0	0	3	0	0	3	0	0	2	1	0	0	1	3	
8:00	4	1	5	1	0	1	6	0	6	5	0	0	3	4	0	0	5	0	0	3	4	0	4	7	12	
8:15	0	0	0	0	0	0	0	1	0	1	0	0	0	6	0	0	11	5	10	0	10	0	10	15	32	
8:30	0	0	0	0	0	0	0	0	1	0	0	0	0	6	0	0	7	0	0	6	2	0	2	8	15	
8:45	0	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	5	0	0	6	0	0	0	0	9	
9:00	0	0	0	0	0	0	0	4	0	0	0	0	0	3	0	0	3	0	0	3	6	1	7	16	17	
9:15	0	0	0	0	2	1	3	2	0	0	0	0	2	4	0	0	2	0	0	2	1	0	1	0	3	9
9:30	0	0	0	0	0	0	0	4	0	0	0	0	1	5	1	0	1	0	0	1	4	0	4	5	13	
9:45	0	0	0	0	0	0	0	1	0	0	0	0	2	3	0	0	2	0	0	2	1	0	1	0	3	6
10:00	0	0	0	0	0	0	0	2	0	0	0	0	3	5	3	0	3	1	0	1	0	0	1	0	1	4
10:15	3	0	3	0	0	0	3	0	0	0	0	0	1	0	1	0	1	0	0	1	3	0	3	4	5	10
10:30	0	0	0	0	0	0	0	2	1	3	1	0	0	1	4	1	0	0	0	1	2	0	2	3	10	3
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2
TOTAL	11	2	13	5	1	6	19	28	1	29	33	0	33	62	3	52	33	0	33	40	1	41	74	185	185	465
AM Peak	5	1	6	1	0	1	7	9	0	9	16	0	16	25	15	25	15	0	16	17	0	17	33	47	87	87
14:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:15	0	1	1	0	0	0	1	1	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:45	1	1	2	0	0	0	2	4	0	4	1	2	2	6	1	2	3	2	1	2	1	1	2	4	12	12
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	2	3	2	2	4	7	12	2	14	15	4	19	33	15	4	19	21	7	28	47	38	47	85	85	85
PM Peak	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



TTM Data

Location: Brushwood Dr / Menai Rd Roundabout

Suburb: Alford's Point

Date: Friday, 30 March 2012

Survey Duration: 0700-1100 AM || 1400-1830 PM

Weather: Overcast

Notes 1:

Notes 2:

Time 15 min line start	Location 1				Section Total	Location 2				Section Total	Location 3				Section Total	Totals
	Northbound		Southbound			Eastbound		Westbound			Eastbound		Westbound			
	Peds	Cyclists	Total	Peds		Cyclists	Total	Peds	Cyclists		Total	Peds	Cyclists	Total		
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30	0	1	1	0	0	1	0	1	5	1	6	7	5	0	5	3
7:45	0	0	3	3	6	4	0	4	2	2	4	8	5	3	8	0
8:00	0	0	0	0	0	2	0	2	4	0	4	6	2	0	2	5
8:15	0	0	0	0	0	0	0	0	0	0	0	3	4	0	0	7
8:30	0	0	0	2	2	4	0	4	5	0	5	9	4	0	4	2
8:45	0	0	0	0	0	4	0	4	0	1	1	5	7	1	0	1
9:00	0	0	0	0	0	5	0	5	2	0	2	7	0	0	2	2
9:15	0	0	0	0	0	3	0	3	4	0	4	7	3	0	3	1
9:30	0	0	0	0	0	4	0	4	1	0	1	5	6	0	6	1
9:45	0	0	0	0	0	4	0	4	5	0	5	9	1	0	1	2
10:00	0	0	0	0	0	3	0	3	0	0	0	3	4	0	0	4
10:15	0	0	0	0	0	0	1	1	3	0	3	4	0	1	3	0
10:30	1	0	1	0	2	1	0	1	1	0	1	2	0	0	2	2
10:45	1	0	2	0	3	2	0	2	0	0	2	2	1	0	1	3
TOTAL	1	2	3	2	6	37	1	38	31	9	40	77	33	3	46	10
AM Peak	0	1	1	3	5	7	0	7	16	3	13	24	13	0	13	37
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	0	0	2	0	2	0	0	2	2	2	0	0	2
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
15:15	1	0	1	0	2	1	0	0	0	0	9	9	0	5	0	5
15:30	0	0	0	0	0	1	0	1	4	0	4	5	1	0	1	4
15:45	0	0	0	0	0	2	0	2	0	0	2	2	0	2	1	0
16:00	0	0	0	1	1	0	0	0	3	1	4	4	0	1	2	3
16:15	0	1	1	0	2	0	2	2	2	0	2	4	1	2	4	6
16:30	0	0	0	0	0	1	1	2	1	0	1	3	1	0	0	1
16:45	0	0	0	0	0	3	0	3	0	0	3	1	0	0	0	1
17:00	0	0	0	1	1	1	0	1	0	1	1	2	1	0	2	3
17:15	0	0	0	1	1	0	0	0	2	1	3	3	2	1	3	6
17:30	0	0	0	0	0	1	0	1	0	0	1	2	0	0	0	3
17:45	2	0	2	0	4	2	0	2	5	0	7	12	4	0	4	11
18:00	0	0	0	0	0	0	5	0	5	0	5	10	3	0	3	7
18:15	0	0	0	0	0	1	0	1	2	0	2	3	0	2	0	2
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
PM Peak	0	1	1	0	2	3	0	3	16	1	17	20	3	1	4	12
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3	22	40	6	46	68	19	3	87
TOTAL	3	1	4	1	2	3	19	3								



TTM Data

Location: Brushwood Dr / Menai Rd Roundabout

Suburb: Alford's Point

Date: Saturday, 31 March 2012

Survey Duration: 0700-1100 AM || 1400-1830 PM

Weather: Overcast

Notes 1: Higher pedestrian volumes due to what appeared to be organised groups

Notes 2:

Time 15 min line start	Location 1					Section Total					Location 2					Section Total					Location 3					Section Total	Totals
	Northbound		Southbound			Total	Eastbound		Westbound			Total	Eastbound		Westbound			Total	Eastbound		Westbound			Total			
	Peds	Cyclists	Peds	Cyclists	Total		Peds	Cyclists	Peds	Cyclists	Total		Peds	Cyclists	Peds	Cyclists	Total		Peds	Cyclists	Peds	Cyclists	Total				
7:00	1	0	1	0	0	2	2	0	2	7	0	7	9	1	0	1	4	0	4	5	15						
7:15	0	1	0	0	2	2	3	6	0	3	2	5	11	7	0	7	0	0	0	7	21						
7:30	0	0	0	0	0	0	3	0	3	5	0	5	8	3	0	3	0	0	3	6	14						
7:45	1	0	1	0	0	1	3	0	3	1	0	1	4	2	0	2	0	2	0	2	9						
8:00	1	3	4	0	3	3	7	4	0	4	7	0	7	11	3	1	4	7	1	8	30						
8:15	0	0	0	3	0	3	3	1	0	1	4	0	4	5	1	0	1	3	0	3	12						
8:30	0	0	0	2	0	2	3	0	3	4	0	4	7	5	0	5	2	0	2	7	16						
8:45	0	0	0	0	0	0	1	0	1	4	0	4	5	2	0	2	0	4	0	4	11						
9:00	0	0	0	0	0	0	0	1	0	1	2	4	6	2	0	2	4	0	4	15							
9:15	3	0	3	1	0	1	4	4	0	4	3	0	7	4	1	5	4	0	4	9	20						
9:30	0	0	1	0	0	1	3	0	3	0	0	0	3	5	0	5	1	0	1	6	10						
9:45	1	0	1	0	0	1	4	0	4	5	0	5	9	4	0	4	3	0	3	7	17						
10:00	0	0	0	2	2	2	1	0	1	6	0	6	7	2	0	2	10	0	10	12	21						
10:15	1	0	1	0	0	1	1	0	1	0	0	0	1	2	0	2	3	1	4	6	8						
10:30	0	0	0	0	1	1	2	0	2	1	0	1	3	3	0	3	1	2	5	9	9						
10:45	0	0	0	0	0	0	4	0	4	0	0	0	4	4	0	4	0	0	0	4	8						
11:00	0	0	0	0	0	0	3	2	5	2	0	2	7	3	2	5	2	0	2	7	14						
11:15	0	0	0	0	0	0	2	0	2	0	2	2	4	2	0	2	0	2	2	4	8						
11:30	0	0	0	0	0	0	0	0	0	3	0	3	0	0	0	0	0	0	0	0	3						
11:45	1	2	3	0	0	6	3	0	0	0	0	0	3	0	0	4	3	2	3	7	14						
12:00	0	1	1	0	2	2	3	0	0	0	0	1	1	1	0	2	2	1	2	4	8						
12:15	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	0	1	2	2						
12:30	0	0	0	0	0	0	4	6	0	4	0	4	10	4	4	8	4	3	7	15	29						
12:45	2	2	4	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	1						
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
13:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
13:45	0	0	0	0	0	0	1	0	1	0	1	1	2	4	0	4	2	2	4	8	10						
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1						
14:15	0	0	0	0	0	0	0	0	0	0	1	1	2	4	0	4	2	0	2	4	8						
14:30	0	0	0	0	0	0	0	0	0	1	0	1	2	2	1	1	2	0	0	2	4						
14:45	0	0	0	0	0	0	1	1	2	0	0	0	2	1	1	1	2	0	0	2	4						
TOTAL	3	5	8	1	5	6	14	3	17	12	4	16	33	13	15	13	13	10	23	56	103						
PM Peak	2	3	5	0	2	2	7	6	0	6	6	6	12	5	7	12	5	9	21	40	40						



TTM Data

Location: Brushwood Dr / Menai Rd Roundabout

Suburb: Alford's Point

Date: Sunday, 1 April 2012

Survey Duration: 0700-1100 AM || 1400-1830 PM

Weather: Overcast

Notes 1: Higher pedestrian volumes due to what appeared to be organised groups

Notes 2:

Time 15 min line start	Location 1				Section Total	Location 2				Section Total	Location 3				Section Total						
	Northbound		Southbound			Eastbound		Westbound			Eastbound		Westbound								
	Peds	Cyclists	Total	Peds		Cyclists	Total	Peds	Cyclists		Total	Peds	Cyclists	Total		Peds	Cyclists	Total			
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
7:15	0	4	4	5	0	5	4	9	0	6	6	15	0	0	6	1	0	1	7	31	
7:30	0	0	0	1	1	1	0	1	2	0	2	3	2	0	2	0	0	0	2	6	
7:45	0	0	0	4	2	6	0	0	0	2	2	3	2	0	2	0	2	5	13		
8:00	0	2	2	8	0	10	3	1	4	5	1	6	10	3	0	3	0	0	3	23	
8:15	5	3	8	1	2	10	0	1	1	4	1	5	6	1	1	0	1	0	1	2	18
8:30	0	0	0	2	2	4	2	1	0	1	0	1	3	0	3	0	0	0	3	6	14
8:45	1	0	1	1	0	2	5	0	5	0	1	0	6	2	0	1	0	0	2	3	19
9:00	0	1	1	2	0	2	3	2	3	2	0	2	5	3	1	4	0	0	0	4	12
9:15	1	0	1	6	1	7	8	2	0	2	5	1	6	8	1	0	0	0	0	1	17
9:30	2	2	4	0	0	0	4	2	2	4	0	0	4	0	2	2	0	0	0	2	10
9:45	0	2	2	2	1	3	5	4	2	6	2	1	3	9	4	0	0	0	4	18	
10:00	0	1	1	0	0	1	5	1	6	0	0	0	6	5	1	6	0	0	0	6	13
10:15	0	0	0	1	0	1	8	0	8	1	1	2	10	6	0	0	0	0	0	6	17
10:30	0	2	2	0	0	2	4	0	0	0	2	0	2	2	3	0	0	0	0	3	9
10:45	0	0	0	0	0	0	5	0	5	0	0	0	5	0	0	0	0	0	0	0	5
11:00	2	4	2	0	0	2	6	2	3	5	2	0	2	7	0	2	0	0	0	2	15
11:15	0	2	4	0	0	2	4	2	4	0	0	0	4	0	0	0	0	0	0	0	8
11:30	0	0	0	2	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
11:45	0	0	0	0	0	0	6	0	0	0	0	0	6	0	0	0	0	0	0	0	6
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	0	1	1	1	2	0	2	0	0	2	2	0	2	1	0	1	3	6
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:45	0	0	0	2	0	2	2	3	2	5	2	0	2	7	3	0	3	2	0	5	14
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	2	4
13:45	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	1	2
14:00	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	1	2
14:15	0	0	0	1	0	1	1	2	0	3	0	0	3	0	1	1	0	0	0	2	2
14:30	0	0	0	0	0	0	0	2	0	2	0	0	2	3	1	2	0	0	0	3	6
14:45	0	0	0	0	0	0	0	3	0	3	0	0	3	3	0	3	0	0	0	3	6
TOTAL	4	4	8	7	1	3	18	17	11	28	7	0	7	35	12	6	18	3	0	3	72
PM Peak	0	0	0	2	1	3	5	2	7	2	0	2	9	5	3	0	5	3	0	8	20



TTM Data

Location: Alford's Point Rd at Bridge

Suburb: Alford's Point

Date: Thursday, 29 March 2012

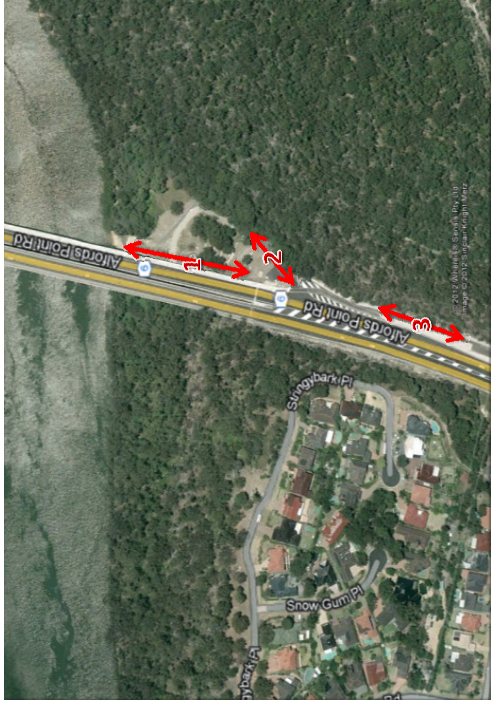
Survey Duration: 0700-1100 AM || 1400-1830 PM

Weather: Overcast

Notes 1: Main reason for access to area 2 was for fishing

Notes 2:

Time 15 min line start	Location 1						Section Total	Location 2						Section Total	Location 3						Section Total	Totals	
	Northbound			Southbound				Northbound			Southbound				Northbound			Southbound					
	Peds	Cyclists	Total	Peds	Cyclists	Total	Peds	Cyclists	Total	Peds	Cyclists	Total	Peds	Cyclists	Total	Peds	Cyclists	Total	Peds	Cyclists	Total		
7:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7:30	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	1	2	3	
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8:15	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8:30	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9:15	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9:30	2	0	2	2	0	2	4	0	0	0	0	0	0	0	0	2	2	0	2	0	2	4	
9:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10:00	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	1	2	3	
10:15	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10:30	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	2	
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	4	2	6	4	2	6	12	6	0	0	0	0	0	0	0	4	2	6	4	2	6	12	
AM Peak	0	1	1	0	1	2	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	4	
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15:00	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15:15	0	1	1	1	0	1	2	0	0	0	0	0	0	0	0	1	1	2	2	2	4	4	
15:30	0	1	1	0	1	2	0	0	0	0	0	0	0	0	0	1	0	1	1	2	4	4	
15:45	0	0	0	0	0	0	0	0	0	0	2	0	2	2	0	0	0	0	0	0	0	0	
16:00	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17:00	0	1	1	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17:15	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17:45	0	3	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
18:00	1	0	1	0	0	1	2	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	
18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	1	6	7	5	5	10	17	0	0	0	2	0	2	2	2	1	6	7	1	6	7	14	33
PM Peak	0	2	2	2	1	3	5	0	0	0	2	0	2	0	2	0	2	0	2	0	2	4	11



TTM Data

Location: Alford's Point Rd at Bridge
Suburb: Alford's Point
Date: Friday, 30 March 2012
Survey Duration: 0700-1100 AM || 1400-1830 PM
Weather: Overcast
Notes 1: Main reason for access to area 2 was for fishing
Notes 2:

Time 15 min line start	Location 1					Location 2					Location 3					Section Total		Totals
	Northbound		Southbound		Section Total	Northbound		Southbound		Section Total	Northbound		Southbound		Section Total			
	Peds	Cyclists	Total	Peds		Cyclists	Total	Peds	Cyclists		Total	Peds	Cyclists	Total				
7:00	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1	1	2	
7:15	0	3	3	1	2	5	0	0	0	0	0	0	3	3	1	2	10	
7:30	0	1	1	0	0	1	0	0	0	0	0	0	1	1	0	0	2	
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9:15	1	0	1	0	1	9	1	0	0	0	0	1	0	0	0	0	2	
9:30	0	2	2	0	2	0	0	0	0	0	0	0	1	1	2	2	4	
9:45	0	1	1	0	1	2	0	0	0	0	0	0	2	0	2	4	4	
10:00	0	1	1	0	1	2	0	0	0	0	0	1	0	1	1	2	4	
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	1	7	8	3	4	2	18	0	0	0	0	0	2	0	2	1	30	
AM Peak	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	1	2	
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14:45	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2	
15:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15:45	0	0	0	1	1	15	0	0	0	0	0	0	0	0	1	1	2	
16:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16:15	0	1	1	0	1	2	0	0	0	0	0	1	0	1	1	2	4	
16:30	0	0	0	1	1	1	0	0	0	0	0	0	0	1	1	2	4	
16:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17:00	1	1	2	2	3	18	0	0	0	0	0	0	0	0	0	0	6	
17:15	2	4	6	0	6	12	0	0	0	0	0	2	1	2	3	6	18	
17:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
18:15	2	0	2	0	1	3	0	0	0	0	0	2	0	2	0	2	5	
18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
TOTAL	4	8	12	4	6	10	19	0	0	0	0	4	5	9	4	18	37	
PM Peak	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	2	



TTM Data

Location: Alford's Point Rd at Bridge

Suburb: Alford's Point

Date: Saturday, 31 March 2012

Survey Duration: 0700-1100 AM || 1400-1830 PM

Weather: Overcast

Notes 1: Higher pedestrian volumes due to what appeared to be organised groups

Notes 2: Main reason for access to area 2 was for fishing

Time 15 min line start	Location 1				Location 2				Location 3				Section Total	Section Total	Totals	
	Northbound		Southbound		Northbound		Southbound		Northbound		Southbound					
	Peds	Cyclists	Total	Peds	Cyclists	Total	Peds	Cyclists	Total	Peds	Cyclists	Total				
7:00	1	2	3	1	0	1	4	0	0	0	0	0	0	0	2	6
7:15	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	2
7:30	1	0	1	0	0	0	1	0	0	0	0	0	0	0	1	2
7:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00	0	2	2	0	0	0	2	0	0	0	0	0	0	1	2	2
8:15	1	0	1	2	0	0	3	0	0	0	0	0	0	1	1	3
8:30	0	0	0	1	0	0	1	0	0	0	0	0	0	1	3	4
8:45	0	0	0	2	0	0	2	1	0	0	0	0	0	2	3	5
9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:45	1	0	1	0	0	0	1	0	0	0	0	0	0	1	0	2
10:00	6	0	6	2	0	0	8	0	0	0	0	0	0	2	3	11
10:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:30	1	0	1	1	0	0	2	0	0	0	0	0	0	1	1	3
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	2
11:30	0	0	0	4	0	0	4	0	0	0	0	0	0	3	0	7
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	2	1	3	2	0	0	5	0	0	0	0	0	0	2	5	10
12:30	0	3	3	0	0	0	3	0	0	0	0	0	0	3	6	9
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0	3
13:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:30	0	0	0	0	0	0	0	4	2	0	2	6	0	0	6	6
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	0	0	1	1	2	2	0	0	0	0	0	0	0	0	2
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	5	7	8	1	9	15	4	0	4	5	9	3	2	13	38
PM Peak	2	5	7	2	0	3	9	0	0	4	3	0	3	2	5	21



TTM Data

Location: Alford's Point Rd at Bridge

Suburb: Alford's Point

Date: Sunday, 1 April 2012

Survey Duration: 0700-1100 AM || 1400-1830 PM

Weather: Overcast

Notes 1: Higher pedestrian volumes due to what appeared to be organised groups

Notes 2: Main reason for access to area 2 was for fishing

Time 15 min line start	Location 1				Location 2				Location 3				Section Total	Totals	
	Northbound		Southbound		Northbound		Southbound		Northbound		Southbound				
	Peds	Cyclists	Total	Cyclists	Peds	Total	Cyclists	Total	Peds	Total	Cyclists	Total			
7:00	0	0	2	0	0	0	0	0	0	0	2	0	2	2	4
7:15	2	0	2	0	0	0	0	0	0	3	0	0	0	2	4
7:30	3	0	3	3	0	0	0	0	0	0	3	3	0	3	6
7:45	5	1	6	1	0	1	0	0	0	5	1	6	1	7	12
8:00	8	0	8	0	2	2	10	0	0	0	8	0	2	2	14
8:15	0	0	0	1	2	2	0	0	0	0	1	1	2	2	4
8:30	0	0	0	5	6	6	0	0	0	0	0	5	1	6	7
8:45	1	0	1	0	0	0	0	0	0	1	1	3	0	3	4
9:00	0	0	0	3	4	4	0	0	0	0	1	3	0	3	4
9:15	0	0	0	2	2	2	0	0	0	0	0	2	2	2	4
9:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
9:45	2	0	2	0	0	0	0	0	0	2	0	2	0	2	4
10:00	2	2	4	2	0	2	6	0	0	2	2	4	0	4	10
10:15	0	0	0	1	2	3	0	0	0	0	0	1	2	3	6
10:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0
11:15	0	2	2	0	1	3	0	0	0	0	2	2	0	2	4
11:30	0	1	1	0	0	1	0	0	0	0	1	1	1	3	5
11:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15	0	0	0	1	1	3	0	0	0	0	0	0	0	0	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	1	1	5
12:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13:15	0	0	0	1	0	1	0	0	0	0	0	0	1	1	2
13:30	0	1	1	0	0	0	1	0	1	1	2	0	0	2	4
13:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14:30	0	2	2	0	0	0	5	0	0	0	0	0	0	0	3
14:45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	6	8	1	2	3	11	4	4	4	8	4	2	6	33
PM Peak	0	0	0	0	1	3	0	0	0	0	0	1	1	1	5



APPENDIX C

VISSIM MODELLING REPORT



Transport
Roads & Maritime
Services

Brushwood Drive / Alfords Point Road

Alfords Point

VISSIM modelling

Transport Planning Section

May 2012

1. Background

Alfords Point Road interchange with Brushwood Drive experiences heavy congestion in the morning peak. Extensive queuing is building up along the Alfords Point Road northbound On-Ramp, extending from the merge towards Brushwood Drive. Significant queues form also along Brushwood Drive at the T-Junction and at the Fowler Road approach to the roundabout. As a result, access from surrounding suburbs to Alfords Point Road is very difficult. To address those problems, Alfords Point Road is currently planning to widen to 6 lanes (3 lanes each way).

Infrastructure Development has commissioned Transport Planning to undertake micro-simulation modelling in order to investigate whether further Brushwood Road improvement is needed to mitigate occurring congestion.

2. Modelling Scope

The modelling covers road network surrounding the crossing of Alfords Point Road with Brushwood Drive. It includes the Brushwood Road T-Junction with the Alfords Point Road On-Ramp and Roundabout at the crossing of Brushwood Road with Alfords Point Road Off-Ramp, Fowler Road and Illawarra Road. The extent of the modelled network is shown in Figure 1.



Figure 1: the extent of the modelled network.

Overall 16 models have been tested. Those models covers: three network options, four demand scenarios (2011, 2016, 2026 and 2036) and two peak periods (AM and PM).

3. Network Options

Three networks options have been modelled:

Base Case

This option represent an existing network, including

- Brushwood Drive T-junction with the Alfords Point Road On-Ramp
- Roundabout at crossing of Brushwood Drive, Alfords Point Road Off-Ramp, Fowler Road and Illawarra Road

Option 1

This option consisting

- Widening of Alfords Point Road to 6 lanes (3 lanes each way) between Alfords Point Bridge and Alfords Point Road Ramps to Brushwood Drive.

Option 2

This option is based on Option 1, and consists

- Network as in Option 1.
- Modifying Alfords Point Road Off-Ramp by extending the right lane to 350m.

Details of above network options are shown in attachment A.

4. Modelling Methodology

Micro-simulation modelling package – VISSIM has been identified as the preferred modelling tool for this project. It is especially suitable for modelling of roundabouts, traffic demand responsive signals and evaluation of intersection layouts.

Traffic signals were modelled as operating under vehicle actuated (demand responsive) control to replicate the RMS's traffic control practice in Sydney. Micro-simulation models were set to run in each peak period for one peak hour plus a 30-minutes "warm up" period.

Prior to micro simulation, SIDRA modelling has been undertaken to determine proposed improvements or proposed intersection layouts, which were then further tested, modified and refined in micro simulation.

Modelled 2011 (existing) traffic was estimated from traffic counts: intersection turning counts. Modelled demand was subdivided into three categories of vehicles: cars, heavy vehicles (HV) and buses.

Future traffic demand was estimated applying annual growth rate of 0.5% derived from EMME Strategic Traffic Model. It means that the existing (2011) traffic was increased by 2.5%, 7.5% and 12.5% in year 2016, 2026 and 2036 respectively.

5. Data

Traffic counts and queue observation were arranged for both Fowler Road/Brushwood Drive and Alfords Point Road on-ramp/Brushwood Drive intersections. Traffic counts were conducted in both morning (6:00 – 10:00) and afternoon (15:00 – 19:00) peaks at intervals of 15 minutes on Thursday, 9 December 2010.

In addition, SCATS count at Alfords Point Road/Old Illawarra Road were also been used for northbound traffic on Alfords Point Road.

6. Modelling Calibration

Traffic flows at intersections and queuing has been calibrated. Modelled turning traffic flows are reasonably matching traffic counts. Queuing at intersections operating under congested traffic is difficult to measure precisely particularly at roundabouts where is difficult to determined where is the end of a queue. Therefore modelled queuing in existing models (2011) were visually compared to existing condition and confirmed with traffic management team who had local traffic knowledge. Level of Service (LoS) is determined from control delay per vehicle in seconds and based on RMS (RTA) NSW method.

7. Modelling Results

Each model was run 10 times and the reported results shown the average value of those run in Tables 1 and 2 below. More details on intersection movement performance are given in Attachment B.

Options		Intersection							
		Fowler Rd / Brushwood Dr				Alfords Point Rd On Ramp / Brushwood Dr			
		LoS*	^ Avg Delay (Sec/veh)	Avg Queue Length(m)	No. of Stops#	LoS*	^ Avg Delay (Sec/veh)	Avg Queue Length(m)	No. of Stops#
Base Case – 2011	AM	F	156.2	125	3	F	110.8	97	2
Base Case – 2016	AM	F	192.8	149	4	F	140.7	119	3
Base Case – 2026	AM	F	248.4	170	5	F	201.5	181	4
Option 1 – 2016	AM	A	5.8	1	0	A	3.4	0	0
Option 1 – 2026	AM	A	6.2	1	0	A	3.6	0	0
Option 1 – 2036	AM	A	6.7	1	0	A	3.8	0	0
Option 2 – 2016	AM	A	4.3	0	0	A	3.5	0	0
Option 2 – 2026	AM	A	4.6	1	0	A	4.0	0	0

Table 1: Intersection Performance Morning Peak

Alfords Point Road / Brushwood Drive, Alfords Point
VISSIM Modelling

Options		Intersection							
		Fowler Rd / Brushwood Dr				Alfords Point Rd On Ramp / Brushwood Dr			
		LoS*	^Avg Delay (Sec/veh)	Avg Queue Length(m)	No. of Stops#	LoS*	^Avg Delay (Sec/veh)	Avg Queue Length(m)	No. of Stops#
Base Case – 2011	PM	C	32.4	33	1	A	0.9	0	0
Base Case – 2016	PM	C	41.3	63	1	A	0.9	0	0
Base Case – 2026	PM	D	46.3	97	1	A	1.0	0	0
Option 1 – 2016	PM	D	42.9	71	1	A	0.9	0	0
Option 1 – 2026	PM	D	45.4	142	1	A	1.0	0	0
Option 1 – 2036	PM	D	47.9	149	1	A	1.0	0	0
Option 2 – 2016	PM	B	20.5	15	1	A	0.9	0	0
Option 2 – 2026	PM	B	27.7	27	1	A	1.0	0	0

Table 2: Intersection Performance Afternoon Peak

Note:

*Level Of Service (LoS) definitions for vehicles (RTA NSW method) based on DELAY only.

Level of Service Control Delay per vehicle in seconds (d)

A	$d \leq 14.5$
B	$14.5 < d \leq 28.5$
C	$28.5 < d \leq 42.5$
D	$42.5 < d \leq 55$
E	$55 < d \leq 70.5$
F	$70.5 < d$

^ Avg Delay: Average of Delay per vehicle random arrivals to the intersection in seconds.

Number of Stop: Total number of events when a vehicle enters the queue condition.

8. Findings

Key findings may be summarised as follows:

1. Modelling indicates that the insufficient capacity of the merge to Alfords Point Road combine with Alfords Point Road heavy through traffic are key reasons of queuing problems in the morning peak along the On-Ramp and Brushwood Drive. Option 1, the widening of Alfords Point Road to 6 lanes (3 lanes each way), is mitigating the AM peak queuing problems.
2. Option 1 with 2016 PM traffic shows inadequate storage capacity of Alfords Point Road Off-Ramp at approach to the Brushwood Drive. The queue of about 900m (refer to Table B8, attachment B) would extend into Alfords Point Road. Although the Alfords Point Road southbound kerb lane becomes the Off-Ramp lane, the modelling shows that more aggressive drivers - queue jumpers - may block on occasions the through middle lane what may have adverse safety implications.
3. The performance of the roundabout in Base case and Option 1 are similar in 2016 PM and 2016PM. However, the average queue in Option 1 is slightly longer than in the base case because the vehicles are arriving faster from Alfords Point Road.
4. Option 2 under 2016 PM traffic shows that extending the Off-Ramp second lane to approximately 350m (refer to Table B14, attachment B) may reduced queuing problems which are mentioned in Point 2. The Off-Ramp queue would not extend beyond the ramp. However, this would be only a short term improvement. The 2026 PM model shows that the capacity of Alfords Point Road Off-Ramp would reach the limit occasionally and queuing would again extend well into Alfords Point Road.
5. Replacing the Fowler Road roundabout with a signalised intersection could be considered a long term solution. Additional measure may be required for the future traffic.
6. Modelling indicates that the Brushwood Drive Give Way T-junction with Alfords Point Road On-Ramp would have sufficient capacity to carry traffic up to and beyond 2026 but this junction may experience safety problems. The Give Way through eastbound movement will have limited opportunity to filter through priority right turn heavy movement. Further detailed safety investigations may be required, and installing traffic signals can be one of the possible solutions.

4/05/2012

9. Attachments –

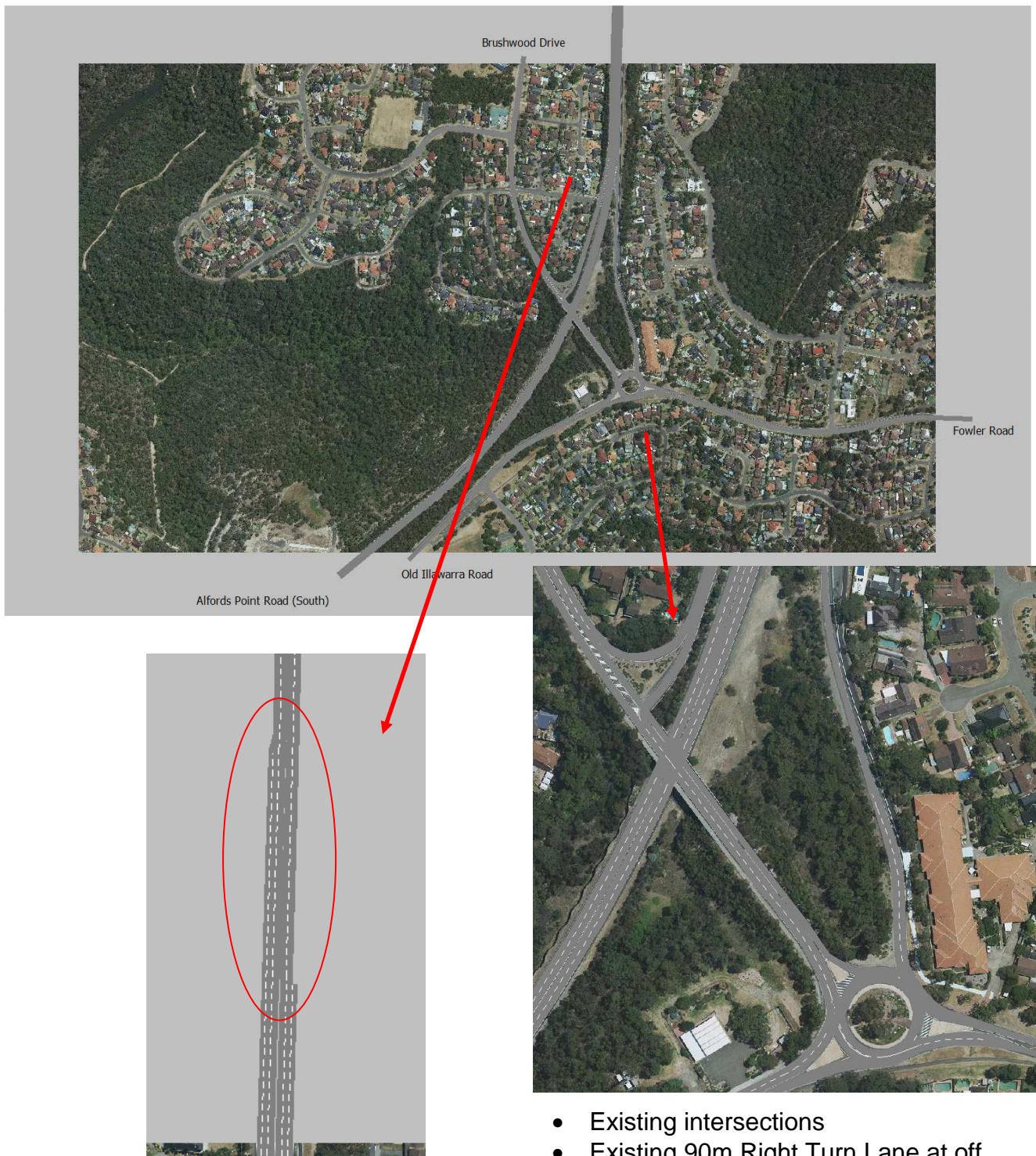
A – Options Layouts

B – Intersection Movement Performance

Attachments A

- Options Layouts

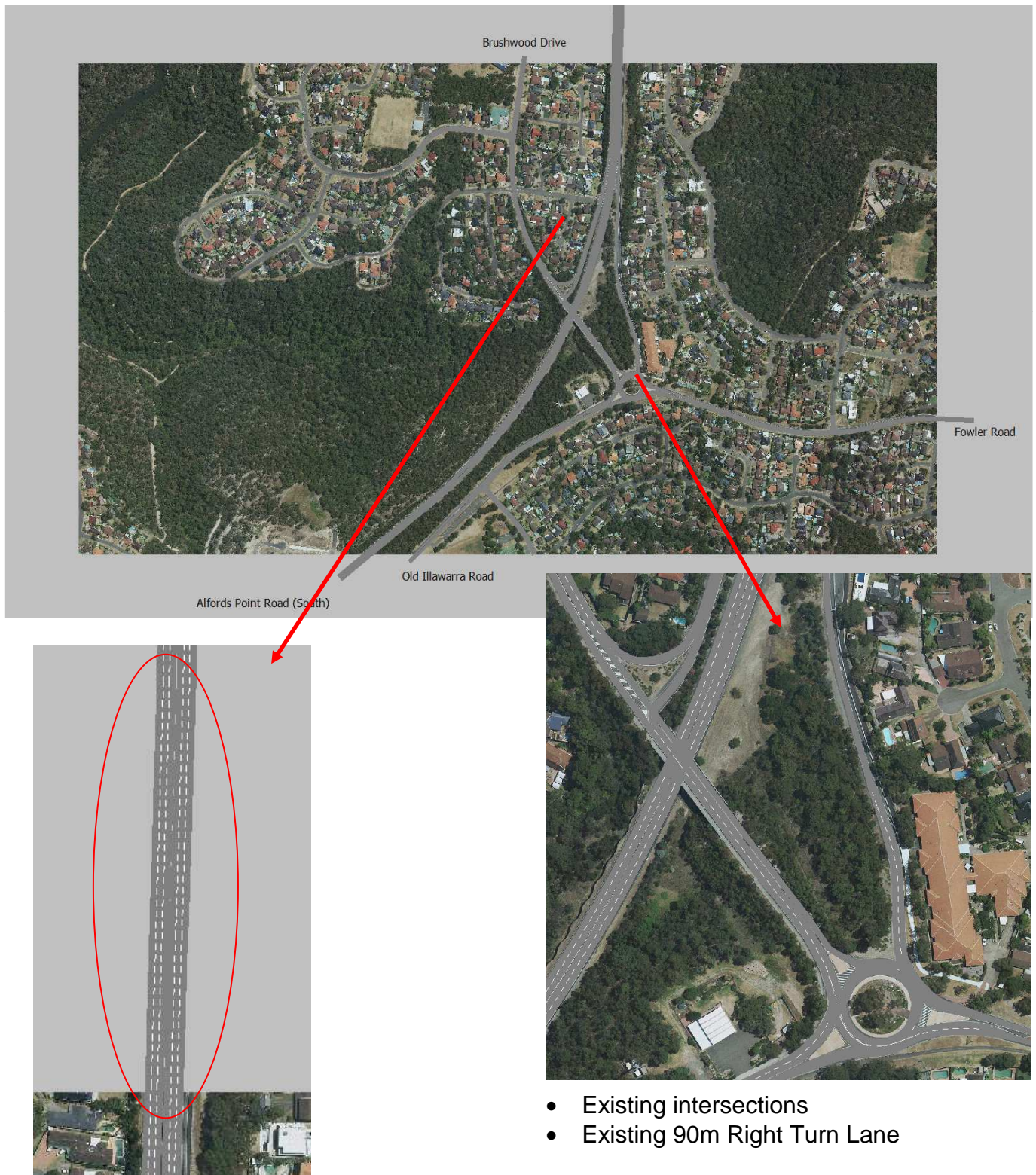
Base Case - Existing Network (2011):



- 2 Lanes each way on Alfords Point Rd
- Merging Lane at Alfords Point Rd On Ramp

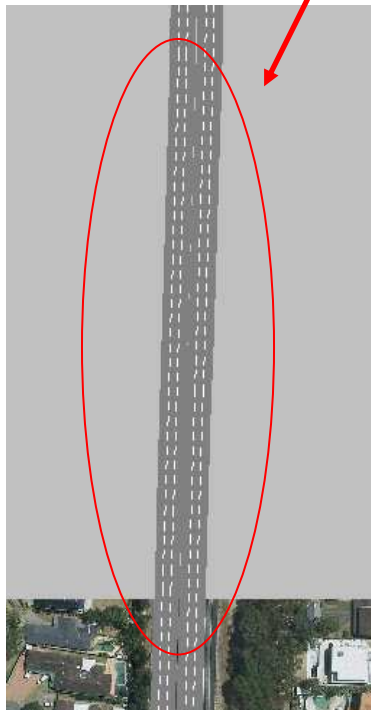
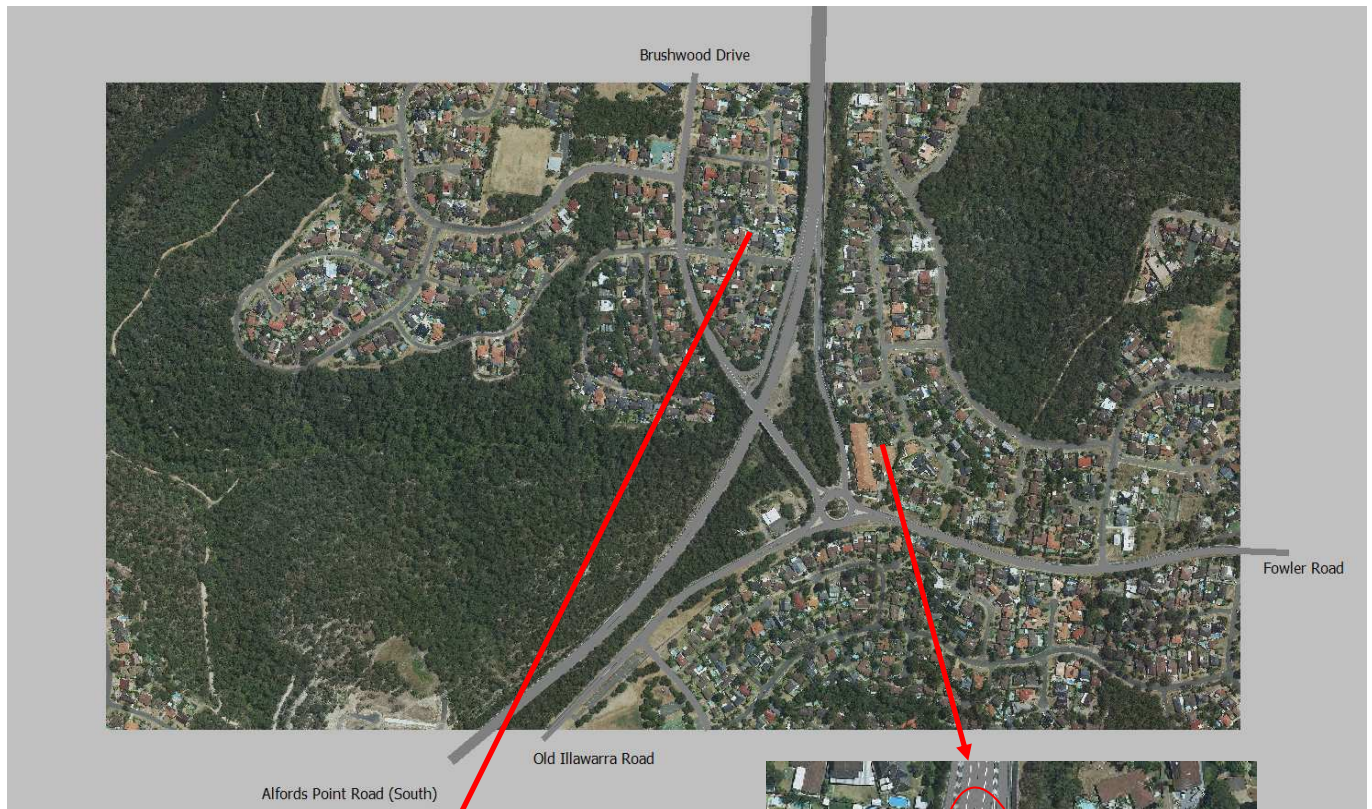
- Existing intersections
- Existing 90m Right Turn Lane at off ramp of Alfords Point Rd

Option 1 – 3 Lanes widening (2016, 2026 & 2036):

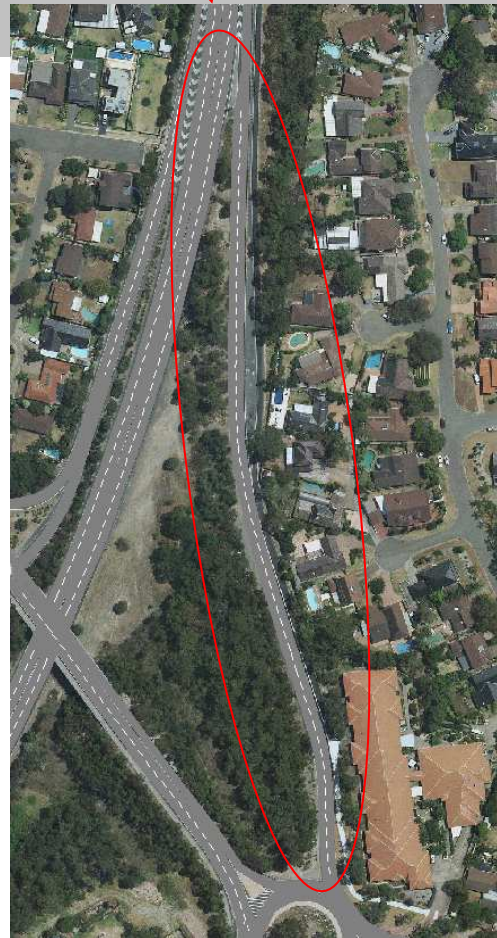


- 3 Lanes each way on Alfords Point Rd
- Merge Lane become third lane at Alfords Pont Rd

Option 2 – Proposed Extension:



- 3 Lanes each way on Alfords Point Rd
- Merge Lane become third lane at Alfords Pont Rd



- Extended 450m Right Turn Lane

Attachments B
- Intersection Movement Performance

• Table B1: Base Case – 2011 AM

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	D	42.8	28	158	0.9
		L	F	81.9	28	158	1.2
	Brushwood Dr (East)	T	F	110.0	167	280	2.7
		L	F	144.7	167	280	3.4
	Intersection		F	110.8	97	291	2.4
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	F	145.7	269	607	2.3
		T	F	193.0	269	606	3.8
	Old Illawarra Road	R	F	240.9	277	518	5.4
		L	F	277.4	277	518	6.4
	Brushwood Dr	T	A	1.8	0	13	0.0
		R	A	11.3	0	13	0.2
	Alfords Pt Rd(Off Ramp)	L	A	4.6	1	33	0.2
		T	B	14.3	1	31	0.3
		R	D	49.0	1	31	1.4
	Intersection		F	156.2	125	618	3.3

• Table B2: Base Case – 2011 PM

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	A	3.0	0	0	0.1
		L	A	3.9	0	0	0.0
	Brushwood Dr (East)	T	A	0.1	0	6	0.0
		L	A	0.1	0	6	0.0
	Intersection		A	0.9	0	6	0.0
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	C	28.5	20	159	1.3
		T	B	24.2	19	158	1.4
	Old Illawarra Road	R	A	9.8	1	43	0.4
		L	A	3.4	1	43	0.1
	Brushwood Dr	T	A	3.4	0	28	0.2
		R	A	7.6	0	28	0.2
	Alfords Pt Rd(Off Ramp)	L	E	56.8	106	648	1.2
		T	D	53.0	105	646	1.0
		R	D	52.0	105	646	1.1
	Intersection		C	32.4	33	648	0.8

• Table B3: Base Case – 2016 AM

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	E	61.5	55	274	1.1
		L	F	137.7	55	274	1.8
	Brushwood Dr (East)	T	F	124.9	183	293	3.1
		L	F	168.9	183	293	4.1
	Intersection		F	140.7	119	340	3.0
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	F	199.7	353	654	2.9
		T	F	256.0	352	653	4.7
	Old Illawarra Road	R	F	274.9	309	521	6.1
		L	F	327.0	309	521	7.2
	Brushwood Dr	T	A	1.7	0	16	0.0
		R	A	11.5	0	16	0.2
	Alfords Pt Rd(Off Ramp)	L	A	5.1	1	45	0.2
		T	B	17.2	1	42	0.3
		R	D	54.9	1	42	1.6
	Intersection		F	192.8	149	654	3.8

• Table B4: Base Case – 2016 PM

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	A	3.1	0	0	0.1
		L	A	3.9	0	0	0.0
	Brushwood Dr (East)	T	A	0.1	0	7	0.0
		L	A	0.1	0	7	0.0
	Intersection		A	0.9	0	7	0.0
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	C	30.4	21	164	1.4
		T	B	25.5	20	163	1.4
	Old Illawarra Road	R	A	9.6	1	42	0.4
		L	A	3.6	1	42	0.1
	Brushwood Dr	T	A	3.5	1	25	0.2
		R	A	7.7	1	25	0.2
	Alfords Pt Rd(Off Ramp)	L	F	78.0	216	930	1.5
		T	F	72.7	214	930	1.2
		R	F	70.1	214	930	1.3
	Intersection		C	41.3	63	931	1.0

• Table B5: Base Case – 2026 AM

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	F	125.9	165	414	2.1
		L	F	246.3	165	414	3.7
	Brushwood Dr (East)	T	F	144.2	197	301	3.5
		L	F	215.0	197	301	5.2
	Intersection		F	201.5	181	414	4.1
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	F	274.2	394	652	3.6
		T	F	341.9	393	651	5.7
	Old Illawarra Road	R	F	349.1	350	520	7.0
		L	F	423.9	350	520	8.8
	Brushwood Dr	T	A	8.9	4	39	0.1
		R	C	28.4	4	39	0.3
	Alfords Pt Rd(Off Ramp)	L	B	17.5	7	91	0.2
		T	D	45.0	8	89	0.5
		R	F	95.4	8	89	2.0
	Intersection		F	248.4	170	652	4.4

• Table B6: Base Case – 2026 PM

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	A	3.1	0	0	0.1
		L	A	4.0	0	0	0.0
	Brushwood Dr (East)	T	A	0.1	0	5	0.0
		L	A	0.1	0	5	0.0
	Intersection		A	1.0	0	5	0.0
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	C	32.2	30	229	1.4
		T	B	27.5	29	228	1.4
	Old Illawarra Road	R	A	10.2	2	46	0.4
		L	A	3.7	2	46	0.1
	Brushwood Dr	T	A	3.6	1	24	0.2
		R	A	7.6	1	24	0.2
	Alfords Pt Rd(Off Ramp)	L	F	89.5	335	1007	1.8
		T	F	84.3	334	1007	1.5
		R	F	83.5	334	1007	1.6
	Intersection		D	46.3	97	1008	1.1

• Table B7: Option 1 – 2016 AM 3 lanes

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	B	14.9	0	0	0.6
		L	A	6.4	0	0	0.0
	Brushwood Dr (East)	T	A	0.0	0	18	0.0
		L	A	0.3	0	18	0.0
	Intersection		A	3.4	0	18	0.1
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	A	5.7	3	55	0.2
		T	A	7.3	3	54	0.4
	Old Illawarra Road	R	A	6.6	0	23	0.3
		L	A	2.7	0	23	0.1
	Brushwood Dr	T	A	1.7	0	14	0.1
		R	A	4.9	0	14	0.0
	Alfords Pt Rd(Off Ramp)	L	A	8.0	1	30	0.2
		T	A	10.7	0	28	0.2
		R	A	9.5	0	28	0.2
	Intersection		A	5.8	1	56	0.2

• Table B8: Option 1 – 2016 PM 3 lanes

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	A	3.0	0	0	0.1
		L	A	3.9	0	0	0.0
	Brushwood Dr (East)	T	A	0.1	0	9	0.0
		L	A	0.1	0	9	0.0
	Intersection		A	0.9	0	9	0.0
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	D	46.3	40	225	1.5
		T	C	39.7	39	224	1.5
	Old Illawarra Road	R	A	9.7	1	41	0.4
		L	A	3.5	1	41	0.1
	Brushwood Dr	T	A	3.4	1	32	0.2
		R	A	7.7	1	32	0.2
	Alfords Pt Rd(Off Ramp)	L	F	74.3	231	877	1.4
		T	E	69.9	230	875	1.2
		R	E	69.0	230	875	1.2
	Intersection		D	42.9	71	877	1.0

• Table B9: Option 1 – 2026 AM 3 lanes

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	B	16.4	0	0	0.7
		L	A	6.4	0	0	0.0
	Brushwood Dr (East)	T	A	0.0	0	18	0.0
		L	A	0.4	0	18	0.0
	Intersection		A	3.6	0	18	0.1
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	A	6.5	4	63	0.2
		T	A	7.9	3	62	0.4
	Old Illawarra Road	R	A	6.6	0	25	0.3
		L	A	2.9	0	25	0.1
	Brushwood Dr	T	A	1.6	0	14	0.0
		R	A	5.0	0	14	0.0
	Alfords Pt Rd(Off Ramp)	L	A	8.4	1	30	0.2
		T	A	10.7	0	28	0.1
		R	A	9.1	0	28	0.1
	Intersection		A	6.2	1	66	0.2

• Table B10: Option 1 – 2026 PM 3 lanes

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	A	3.0	0	0	0.1
		L	A	4.0	0	0	0.0
	Brushwood Dr (East)	T	A	0.1	0	7	0.0
		L	A	0.1	0	7	0.0
	Intersection		A	1.0	0	7	0.0
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	C	32.6	24	167	1.5
		T	C	28.0	23	166	1.6
	Old Illawarra Road	R	A	10.1	2	43	0.4
		L	A	3.7	2	43	0.1
	Brushwood Dr	T	A	3.5	1	21	0.2
		R	A	7.7	1	21	0.2
	Alfords Pt Rd(Off Ramp)	L	F	89.3	503	1009	1.8
		T	F	86.3	502	1008	1.6
		R	F	84.1	502	1008	1.6
	Intersection		D	45.4	142	1009	1.1

• Table B11: Option 1 – 2036 AM 3 lanes

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	B	18.3	0	0	0.7
		L	A	6.7	0	0	0.0
	Brushwood Dr (East)	T	A	0.0	0	16	0.0
		L	A	0.4	0	16	0.0
	Intersection		A	3.8	0	16	0.1
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	A	7.4	5	74	0.3
		T	A	9.0	4	72	0.5
	Old Illawarra Road	R	A	7.1	0	27	0.3
		L	A	3.0	0	27	0.1
	Brushwood Dr	T	A	1.7	0	17	0.0
		R	A	5.0	0	17	0.0
	Alfords Pt Rd(Off Ramp)	L	A	8.3	1	28	0.2
		T	A	10.7	1	25	0.2
		R	A	9.8	1	25	0.1
	Intersection		A	6.7	1	74	0.2

• Table B12: Option 1 – 2036 PM 3 lanes

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	A	3.1	0	0	0.1
		L	A	4.1	0	0	0.0
	Brushwood Dr (East)	T	A	0.1	0	6	0.0
		L	A	0.1	0	6	0.0
	Intersection		A	1.0	0	6	0.0
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	C	30.0	44	233	1.4
		T	B	25.8	43	232	1.4
	Old Illawarra Road	R	A	10.3	2	42	0.4
		L	A	4.0	2	42	0.1
	Brushwood Dr	T	A	3.9	1	28	0.2
		R	A	7.9	1	28	0.2
	Alfords Pt Rd(Off Ramp)	L	F	92.7	516	1011	1.9
		T	F	87.8	515	1011	1.6
		R	F	86.9	515	1011	1.6
	Intersection		D	47.9	149	1011	1.1

• Table B13: Option 2 – 2016 AM Extend Shared Lane

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	B	16.2	0	2	0.7
		L	A	6.3	0	2	0.0
	Brushwood Dr (East)	T	A	0.1	0	14	0.0
		L	A	0.3	0	14	0.0
	Intersection		A	3.5	0	15	0.1
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	A	3.6	1	31	0.1
		T	A	4.9	1	31	0.2
	Old Illawarra Road	R	A	8.1	0	27	0.4
		L	A	3.3	0	27	0.0
	Brushwood Dr	T	A	1.7	0	22	0.0
		R	A	5.2	0	22	0.1
	Alfords Pt Rd(Off Ramp)	L	A	2.9	0	27	0.1
		T	A	4.9	0	27	0.1
		R	A	3.4	0	27	0.1
	Intersection		A	4.3	0	35	0.1

• Table B14: Option 2 – 2016 PM Extend Shared Lane

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	A	2.8	0	0	0.1
		L	A	4.0	0	0	0.0
	Brushwood Dr (East)	T	A	0.1	0	3	0.0
		L	A	0.1	0	3	0.0
	Intersection		A	0.9	0	3	0.0
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	A	12.5	5	70	0.6
		T	A	9.9	5	70	0.7
	Old Illawarra Road	R	A	10.2	2	52	0.4
		L	A	4.9	2	52	0.1
	Brushwood Dr	T	A	3.4	0	23	0.2
		R	A	7.2	0	23	0.2
	Alfords Pt Rd(Off Ramp)	L	C	37.8	55	348	1.0
		T	C	31.8	55	348	0.9
		R	C	30.9	55	348	1.0
	Intersection		B	20.5	15	348	0.6

• Table B15: Option 2 – 2026 AM Extend Shared Lane

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	B	20.1	0	3	0.8
		L	A	6.5	0	3	0.0
	Brushwood Dr (East)	T	A	0.1	0	15	0.0
		L	A	0.3	0	15	0.0
	Intersection		A	4.0	0	16	0.1
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	A	4.0	1	34	0.1
		T	A	5.2	1	34	0.2
	Old Illawarra Road	R	A	8.0	0	28	0.4
		L	A	3.6	0	28	0.0
	Brushwood Dr	T	A	1.9	0	23	0.1
		R	A	5.4	0	23	0.1
	Alfords Pt Rd(Off Ramp)	L	A	3.5	0	27	0.2
		T	A	5.0	0	27	0.1
		R	A	4.1	0	27	0.2
	Intersection		A	4.6	1	38	0.1

• Table B16: Option 2 – 2026 PM Extend Shared Lane

Intersection	Approach / Street	Movement	LOS	Average Delay (Sec/Veh)	Average Queue Length (m)	Average Maximum Queue Length (m)	Average Number of Stops
Brushwood Dr / Alfords Pt Rd On-Ramp	Brushwood Dr (West)	T	A	3.1	0	0	0.1
		L	A	4.0	0	0	0.0
	Brushwood Dr (East)	T	A	0.1	0	3	0.0
		L	A	0.1	0	3	0.0
	Intersection		A	1.0	0	3	0.0
Fowler Rd / Old Illawarra Rd / Alfords Pt Rd Off-Ramp	Fowler Road	L	A	12.9	5	79	0.6
		T	A	10.8	5	79	0.7
	Old Illawarra Road	R	A	10.5	2	65	0.4
		L	A	5.2	2	65	0.1
	Brushwood Dr	T	A	3.5	1	26	0.2
		R	A	7.0	1	26	0.3
	Alfords Pt Rd(Off Ramp)	L	E	58.6	102	442	1.4
		T	D	42.3	102	442	1.1
		R	D	42.2	102	442	1.1
	Intersection		B	27.7	27	442	0.8