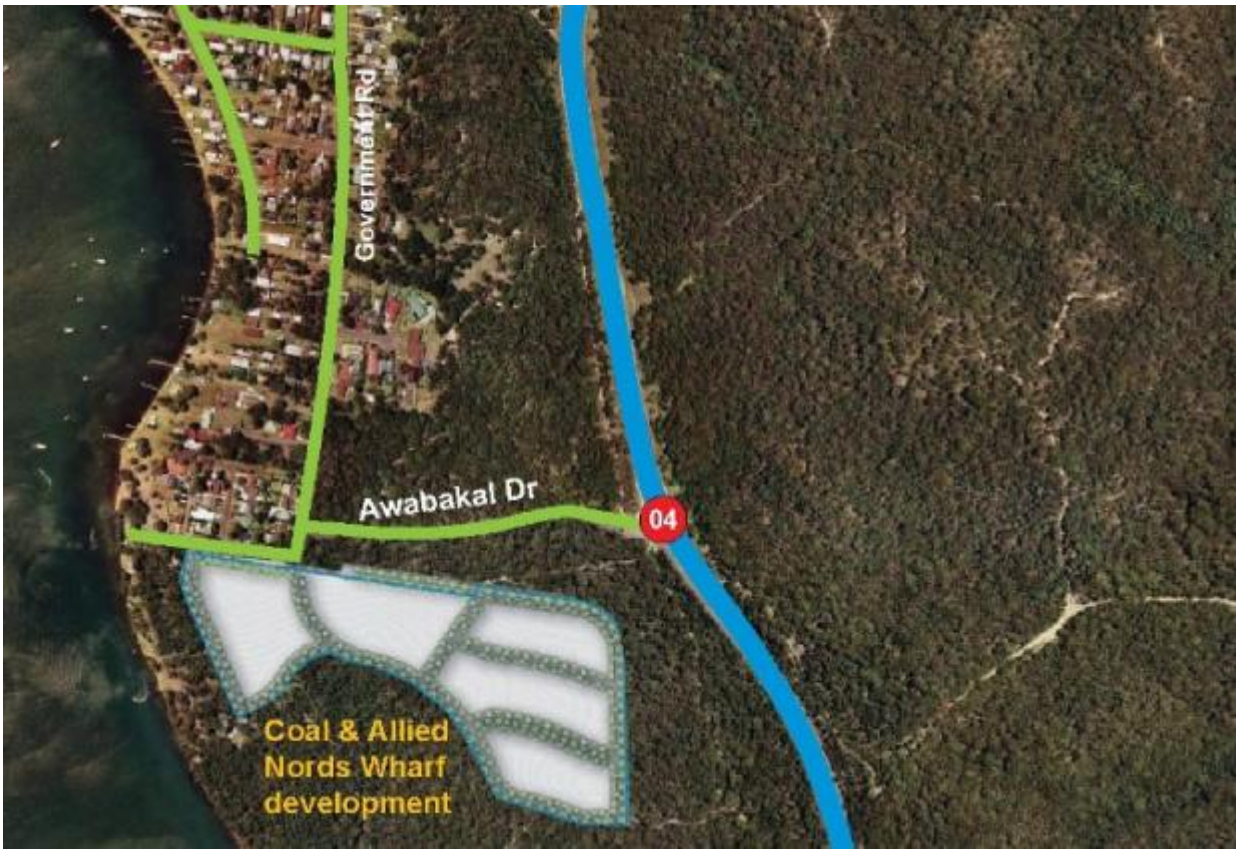
Coal & Allied Industries Limited

Lower Hunter Lands Project

Nords Wharf

Traffic and Transport



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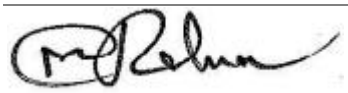
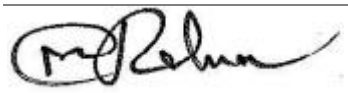
Checker	Mukit Rahman	
Approver	Mukit Rahman	

Report No F0014-AA001459-AAR-06_NW_FINAL

Date October 2010

Final Report

CONTENTS

1 Introduction

1.1 Background

It is proposed that the entire Coal & Allied Industries Limited (Coal & Allied) owned Nords Wharf site be rezoned/listed as a 'State Significant Site' (SSS) in Schedule 3 of State Environmental Planning Policy (Major Development). A draft Schedule 3 listing will be prepared with the Concept Plan Application.

The Concept Plan for a residential subdivision and conservation land transfer of the Nords Wharf site will apply to the entire 127 ha Nords Wharf site. The key parameters for the future development of the site are as follows:

- Dedication of 116.6 ha of conservation land to the New South Wales Government (NSWG) that is identified in the Lower Hunter Regional Strategy and Lower Hunter Regional Conservation Plan, comprising approximately 92% of the Nords Wharf site.
- Maximum dwelling yield of 90 dwellings over 10.18 ha.
- Indicative development staging. Depending on market forces, it may be decided to release the dwellings in 3-4 stages of 25-30 dwellings each.
- The provision of associated infrastructure.
- Torrens title subdivision and boundary realignment of the Nords Wharf site. The Torrens title subdivision and boundary realignment of Coal & Allied land will enable land 116.6ha in area that is owned by Coal & Allied to be excised and dedicated to NSWG for conservation purposes.

Approval will not be sought under the Concept Plan for a specific lot or road layout. An indicative lot layout will indicate how the maximum dwelling yield of 90 dwellings could be achieved on the site.

Similarly, approval will not be sought under the Concept Plan for subdivision or construction of individual houses. However, the desired future character of the proposed concept plan will be included in Urban Design Guidelines. Urban Design Guidelines will be prepared to inform the Concept Plan in respect of urban form, built form, open space and landscape, access and movement and visual impact for the site.

It is proposed to dedicate land for conservation purposes via a Voluntary Planning Agreement (VPA) between Coal & Allied and the NSWG in accordance with s.93F of the Environmental Planning & Assessment Act, 1979 (EP&A Act).

The proposed Concept Plan and a Plan showing the proposed development areas and conservation areas is included in the Environmental Assessment (EA) prepared by Urbis.

1.2 Director General's Requirements

The Director-General's Requirements (DGRs) for the subject land were issued on the 19th of August 2010 and are summarised as follows:

(1) Prepare a Traffic Study in accordance with RTA's *Guide Traffic Generating Developments* that includes (but is not limited to) the following:

a) An identification of all relevant vehicular traffic routes and intersection for access to/from the area;

b) Current traffic counts for all of the above traffic routes and intersections;

c) The anticipated vehicular traffic generated from the proposed development and associated trip distribution on the road network;

d) Consideration of the traffic impact on the existing and proposed intersections and the capacity of the local and classified road network to safely and efficiently cater for the additional vehicular traffic generated;

e) An analysis of the cumulative traffic and transport impacts of the development taking into consideration other proposed developments;

f) Details of necessary road network infrastructure upgrades required to maintain existing levels of service both on the local and classified road network;

g) An intersection analysis, using SIDRA or similar traffic model, as well as a micro simulation model to determine the need for intersection and mid block capacity upgrades and to ensure traffic signal coordination;

h) Proposed pedestrian and cycleway access within and to the site that connects to all relevant transport services, nearby settlements, and other key off-site locations having regard to the *NSW Planning Guidelines for Walking and Cycling* (2004), and the *NSW Bike Plan* (2010);

i) Timing of delivery of proposed transport infrastructure including road and intersection upgrades, pedestrian and cycle paths, and public transport infrastructure; and

j) Consideration of impacts on existing property access.

(2) Assess the proposal against the objectives of the Integrating Land Use and Transport policy package.

Coal & Allied commissioned Hyder Consulting Pty Ltd (Hyder) to carry out the traffic study to address the DGR's and examine the traffic and transport issues associated with the concept plan of the subject site. Hyder met with the RTA on 17 September 2010 and discussed issues and traffic works in relation to the above DGR's requirement. Hyder has consulted the following state and local government planning policies and instruments that may apply for the subject site:

a) RTA's *Guide Traffic Generating Developments, 2002.*

b) *NSW Coastal Design Guidelines.* The Minister for Planning has issued a Direction under section 117 of the Environmental Planning and Assessment Act 1979 to all local councils in the coastal zone regarding the Coastal Design Guidelines 2003.

c) *Central Coast Regional Strategy*, NSW Department of Planning 2008. The Strategy represents an agreed NSW Government position on the future of the Central Coast. The Central Coast Regional Strategy applies to the period 2006-2031 and will be reviewed every five years.

d) *Lower Hunter Regional Strategy, NSW department of Planning 2006.* The Lower Hunter Regional Strategy plans for approximately 160,000 additional people by 2031. Future additional residential development is planned for the Wyee, Nords Wharf, Gwandalan and parts of Catherine Hill Bay, which are in and to the north of Central Coast Region. The Lower Hunter will continue to provide jobs for residents of the Central Coast and vice versa. The Lower Hunter Regional Strategy applies to the period 2006-2031 and will be reviewed every five years.

e) The RTA and Lake Macquarie City Council's response to DGR's requirements for the subject site issued in July 2010.

f) *The Integrating Land Use & Transport Planning Policy Package (ILUT),* NSW Department of Urban Affairs and Planning, 2002. The ILUT provides a framework for State Government agencies, councils and developers to integrate land use and transport planning at the regional and local levels. The ILUT is designed to increase access to services and improve the choice of transport available.

g) *NSW Planning Guidelines for Walking and Cycling,* NSW Government, 2004;

h) NSW Bike Plan, NSW Government 2010.

Hyder has prepared this traffic and transport report to respond to the key issues associated with the Nords Wharf Concept Plan for the development of 90 dwellings.

1.3 Study area

Figure 1-1 shows study area in the context of site access and local road network. The Nords Wharf site is located at the southern end of the Nords Wharf township, which is situated on the eastern shore of Crangan Bay of Lake Macquarie. The existing township of Nords Wharf is characterised by long narrow dwellings, some with direct water access.

Nords Wharf supports a small community of approximately 870 persons. The site is ideally located in close proximity to the Pacific Highway which is the major transportation corridor to Newcastle, Sydney and the North Coast.

Swansea, approximately 10 kilometres north of the site, is the closest town centre, providing shopping and business services. Morriset to the south west is identified as an emerging major regional centre which provides a wider focal point of employment, business, higher order retailing, professional services and other sub-regional functions. Access into the proposed Nords Wharf development site is primarily from the Pacific Highway via Awabakal Drive.

1.4 Study objectives

The purpose of the traffic study is to assess existing traffic patterns, undertake traffic projections for the study area and to conduct an evaluation of the traffic implications of the proposed Nords Wharf development on the road network. Key specific purposes were to:

- Address the Director-General's Requirements (DGRs) specifically for Traffic and Transport;
- Assess the overall impact of the proposed residential development on the road network and all relevant vehicular traffic routes and intersections;
- Identify key access points for the proposed development from both traffic and road safety perspective;
- Determine the capacity of key intersections providing access & egress for the proposed development;
- Predict and assess the additional traffic generated from the proposed Nords Wharf development based on the RTA's Guide to Traffic Generating Developments (2002); and
- Cumulative traffic impact of proposed development at Catherine Hill Bay considering potential development of the Rose Group zoned sites.

Figure 1-1 Study area network showing Coal & Allied Nords Wharf Development

1.5 Approach to traffic investigation

This traffic report was prepared to examine the impact on the road network from the proposed 90 dwellings at the Nords Wharf site. Cumulative impact was also assessed based on the potential lot yield on the Rose Group zoned sites and Coal & Allied proposed developments at Catherine Hill Bay, Nords Wharf and Gwandalan. In assessing the traffic impact from 90 dwellings, Hyder considered the broader traffic assumptions, impact on road network and the implications of the traffic generation on the Pacific Highway intersection performance based on the cumulative impact. Hyder evaluated the traffic impact in the following areas:

- Additional development trips from 90 dwellings;

- Model assumptions and scenarios;
- Impact on regional road network and intersection operation for all three scenarios;
- Impact of traffic from the Coal & Allied Nords Wharf site. This is documented as Scenario S2;
- Cumulative traffic impact. This is documented as Scenario S3;
- Impact of holiday traffic;
- Concept plan assessment; and
- Management and mitigation.

Table 1-1 below summarises the key developments which are assumed in the traffic assessment.

Table 1-1 Key development assumptions

		Concept Plan/Zoned Land
Developers	**Sites**	**No of dwellings**
Coal & Allied	Catherine Hill Bay	222
Coal & Allied	Gwandalan	415 residential dwellings +208 dwellings (retirement village)+2800m^2 GFA of retail
Coal & Allied	Nords Wharf	90
Rose Group	Catherine Hill Bay	Potential yield of 600 residential dwellings
Rose Group	Gwandalan	Potential yield of 187 residential dwellings
Totals		**1,722**

The following points are noted from Table 1.1:

- Residential development of 90 dwellings at Nords Wharf site;
- Full development at Coal & Allied Nords Wharf site could occur by 2011. In the instance of delays to Nords Wharf development; the study has assessed the cumulative traffic impact at key intersections with the Pacific Highway up to year 2018.
- Assumptions in association with the potential development of the Rose Group zoned sites; and
- Cumulative impact was assessed from 1,722 dwellings including potential Rose Group zoned sites.

1.6 Report structure

This report has the following structure:

- Section 1: Introduction- background of the study area, traffic study process and objectives of this study.
- Section 2: Key transport indicators- provide a review of the road network, land use, journey to work data, public transport network and usage, road hierarchy and traffic data service and results.
- Section 3: Impact assessment- describes the impacts on regional and local road network from the proposed development at Nords Wharf.
- Section 4: Summary of findings

2 Key transport indicators

2.1 Road hierarchy and network

The RTA Road Design Guide defines the functional road hierarchy in urban area to establish a consistent basis for traffic management. There are four levels of road and their functions are stated as below:

- Arterial roads – predominantly carry through traffic from one region to another, forming principal avenues of communication for urban traffic movements;
- Sub Arterial Roads – connect the arterial road to areas of development and carry traffic directly from one part of a region to another. They may also relieve traffic on arterial roads in some circumstances;
- Collector Roads – connect the sub-arterial roads to the local road system in developed areas; and
- Local Roads – are the sub-divisional roads within a particular developed area. These are used solely as local access roads.

The key roads provide access to the proposed Nords Wharf development site are summarised in Table 2-1.

Table 2-1 Road hierarchy in and around subject site

Road Names	Road Hierarchy	Characteristics
Pacific Highway	Arterial	The Pacific Highway is the main arterial route in the vicinity of the subject area, providing access to Newcastle to the north, and connection to the Sydney-Newcastle Freeway (F3) to the south. Near the site, the Pacific Highway is a four-lane divided highway. It has a sign posted speed limit of 100 km/h.
Awabakal Drive	Local	Awabakal Drive is a two lane undivided road and has a sign posted speed limit of 80 km/h close to the Highway and 50 km/h approaching the town.
Government Road	Local	Government Road provides north-south access between Awabakal Drive and the Nords Wharf township. There is no sign posted speed limit but the general 50km/h urban speed limit should apply.
Branter Road	Local	Branter Road is a local street connecting with Government Road. It provides access to a boat ramp on its western end.

2.1.1 Key Intersections

The key intersection related to the Coal & Allied Nords Wharf development is noted in Table 2-2.

Table 2-2 Key Intersection

ID	Intersection	Control Type and Characteristics
I-1	Pacific Highway/Awabakal Drive	Sign controlled T-junction with provided turning bays on Pacific Highway

2.2 Demographic

The Census 2006 data indicates that Nords Wharf has a population of 870 persons. There are a small number of social infrastructure services in Nords Wharf including a pre-school, primary school, a local shop, community hall, Church, several pocket parks and a boat ramp.

Nords Wharf forms a small part of travel zone (TZ 3353, see Figure 2-1) defined by the Census Journey to Work (JTW) 2006. This travel zone also constitutes work trip information for Catherine Hill Bay and Cams Wharf areas. The JTW data indicates that about 94 percent of work trips were made by private car followed by 3 percent by bus. Walking, cycling and other forms of travel accounted for about 3 percent of all work trips. The JTW data showed that about 15% of people did not travel (or unstated trips) on the Census day. The unstated trips are not included in the mode share estimation as stated above.

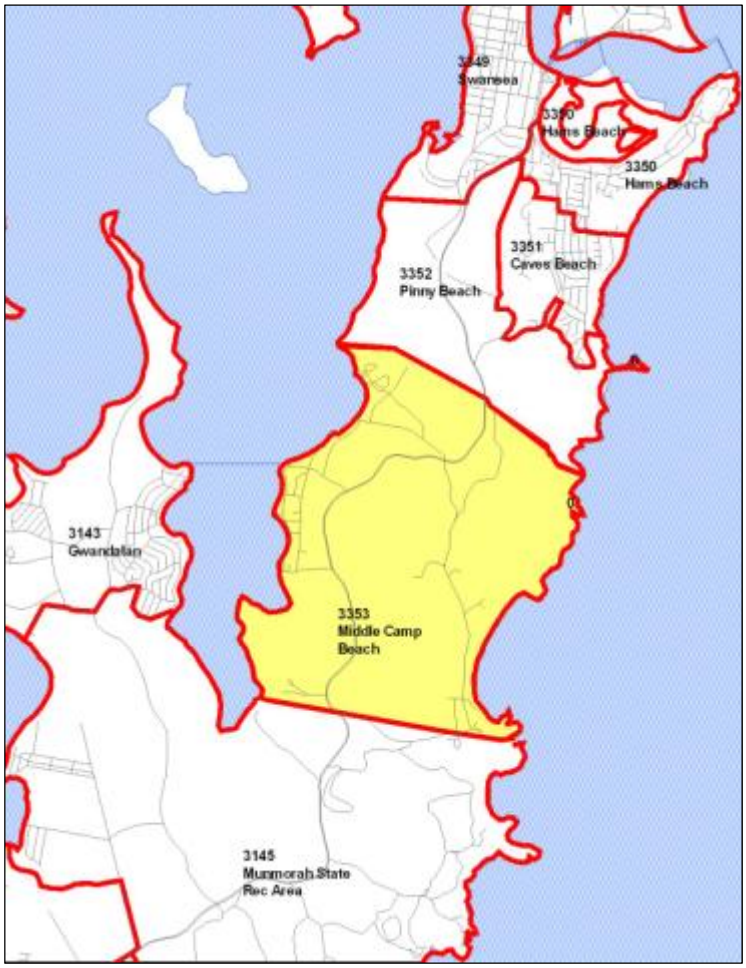


Figure 2-1 Travel zone boundaries, 2006 Bureau of Transport Statistics

2.3 Public transport network and use

2.3.1 Bus services

Nords Wharf is serviced directly by Busways Route 99 which runs from Lakehaven Shopping Centre and Swansea. It calls at Gwandalan, Nords Wharf and Catherine Hill Bay. However not all localities are visited by all services. At present there are five services to Nords Wharf in each direction on weekdays and two services on weekends. The services generally commence after 09:00 and end before 16:00 and are therefore more suited for shopping or school children than for commuting.

Figure 2-2 shows bus routes serving Nords Wharf. Route 99 travels along Awabakal Drive and would therefore provide public transport access for Coal & Allied Nords Wharf development. The operator of Busways was contacted regarding upgrades to the service. Busways advised that bus services were continually under review and that more frequent services would be considered as additional residential development occurs in Gwandalan, Nords Wharf and Catherine Hill Bay.

2.3.2 Rail services

The nearest rail station to Nords Wharf is approximately 24 km away at Wyee, on the Newcastle and Central Coast line. Commuters wanting to use the rail service would need to drive or cycle to the station. From Wyee passengers can travel to Gosford or Wyong on the Central Coast, Sydney, or Newcastle. Train services are provided over 24 hours and at weekends. Weekday day time/commuter services are shown in Table 2-3.

Table 2-3 Train Frequency

Time Period	Trains Wyee to Newcastle	Trains Wyee to Central
06:00-09:00	6	5
09:00-16:00	7	7
16:00-19:00	7	6

Figure 2-2 Busways existing bus route map serving Catherine Hill Bay, Gwandalan and Nords Wharf (*source:www.131500.com.au)*

2.4 Pedestrian and cyclist network

In Nords Wharf, all local roads and streets are designated as shared cycling and pedestrian usage. Regional arterials like the Pacific Highway are also designated as shared vehicular and cycling routes.

2.5 Parking

Currently no parking restrictions are in place on either side of Awabakal Drive in the vicinity of subject site.

2.6 Historical traffic growth

Historical traffic data on the Pacific Highway was obtained from the RTA Hunter Region. Table 2-4 shows recorded traffic volumes from 1995 to 2010 on the Pacific Highway, approximately seven kilometres north of Awabakal Drive, Nords Wharf (RTA

station number 05.002), Swansea. Annual traffic growth rates on the Pacific Highway over the last 15 years are summarised in Table 2-5.

Table 2-4 Historical traffic data (AADT) on Pacific Highway

		Year of Counts									
Station	**Road**	**1995**	**1998**	**2001**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009***	**2010***
05.002	Pacific Highway (5 km north of Flowers Drive)	13,346	13,948	14,771	15,732	15,472	15,130	15,458	15,647	15,644	16,193

*Note: 2009 and 2010 volumes are provisional Average Daily Traffic (ADT) provided by the RTA (data sample is smaller than one complete year).

Table 2-5 Annual traffic growth rates

Road	RTA Count station	Annual Average Growth			
		Between 1995-2001	Between 2001-2006	Between 2007-2010	average for 15 years 1995-2010
Pacific Highway (5 km north of Flowers Drive)	05.002	▲ 1.7 %	▲ 0.4 %	▲ 1.6 %	▲ 1.3 %

The following observations are noted from historical traffic data presented in Tables 2-4 and 2-5.

- Between 1995 and 2001 traffic on the Pacific Highway has grown from 13,300 to 14,700, an annual growth rate of 1.7% per annum.
- The growth rate reduced significantly between 2001 and 2006 to only 0.4% per annum. In fact, traffic reduced between 2005/2006 compared to 2004 data.
- Between 2007 and 2010 traffic growth on the Pacific Highway was 1.6% per annum;
- On average, in the last 15 years, from 1995 to 2010, traffic growth was 1.3% per annum;
- A conservative estimate of 2% per annum for background traffic growth on the Pacific Highway was assumed as a future proof for intersection modelling.;

2.7 Crash data analysis

This assessment is based on the crash data supplied by the RTA for the six year period from October 2004 to June 2010 including the provisional data. Crash data between November 2009 and June 2010 is provisional.

Crash data between 2004 and 2010 indicates that the majority of crashes (about 146) occurred on the Pacific Highway from Mine Camp Road to Chain Valley Bay Road (see Table 2-6, below). Of that three fatal crashes were recorded on the Pacific Highway. No crashes were recorded on Awabakal Drive between Pacific Highway and Government Road. Three crashes (non injury type) were recorded at Pacific Highway/ Awabakal Drive intersection. One crash (injury type) is recorded on Government Road.

Table 2-6 Summary of the crash data for the period from 10/2004 to 6/2010

Location	Total Number of Crashes	Fatal Crashes	Injury Crashes	Non Injury Crashes	Casualties		
					Killed	Injured	Total
Pacific Highway from Mine Camp Road to Chain Valley Bay Road	146 (100%)	3 (2.1 %)	54 (37 %)	89 (61 %)	3	80	83
Awabakal Drive	0	0	0	0	0	0	0
Government Road	1	0	1	0		1	0

Note: Crash occurred at intersections are also included in the Table 2-6.

Figure 2-3 shows number of crashes by crash type. The data showed that "off road on curve (hit object) crashes dominated with 92 crashes (63 percent) on the Pacific Highway. No pedestrians were involved in any crashes.

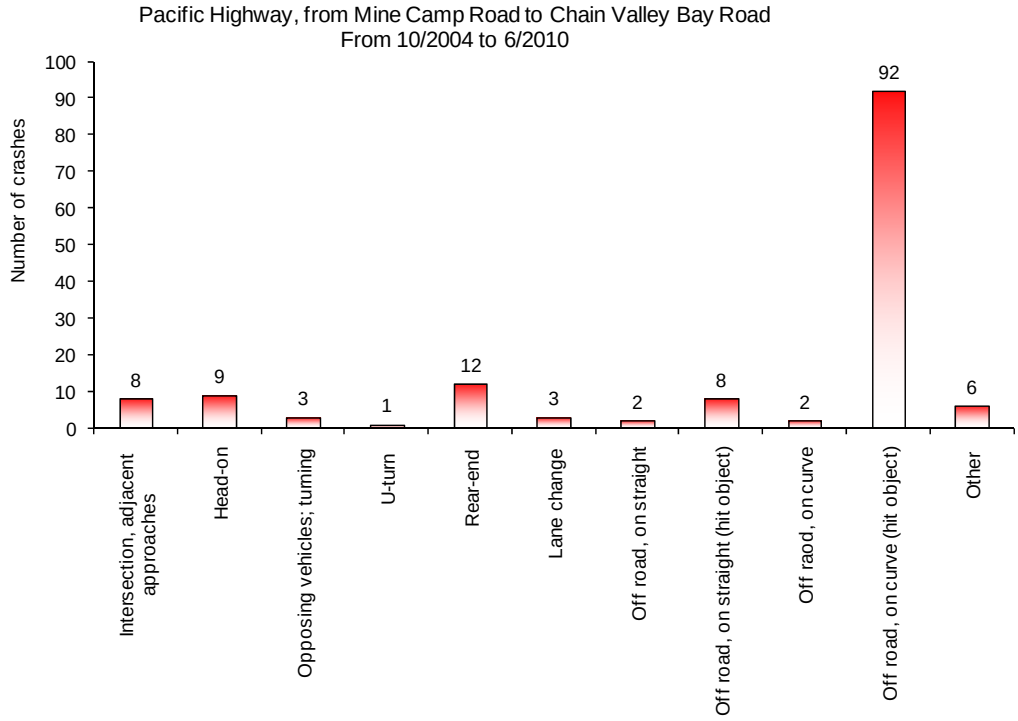


Figure 2-3 Pacific Highway-Number of crashes per crash movement (10/2004-6/2010)

Figure 2-4, Figure 2-5 and Figure 2-6 show crash locations visually along the Pacific Highway, Awabakal Drive and Government Road respectively. Crash data on Pacific Highway (see Figure 2-3) shows that, in general, crashes occurred along the full length between Mine Camp Road and Chain Valley Bay Road but are more concentrated on curve sections of Pacific Highway and other traffic conflicting areas, for instance at intersections. The additional traffic generated by the proposed 90 dwellings at Nords Wharf is unlikely to have any significant impact on the current crash rate or severity of crashes on the Pacific Highway in the vicinity of Nords Wharf.

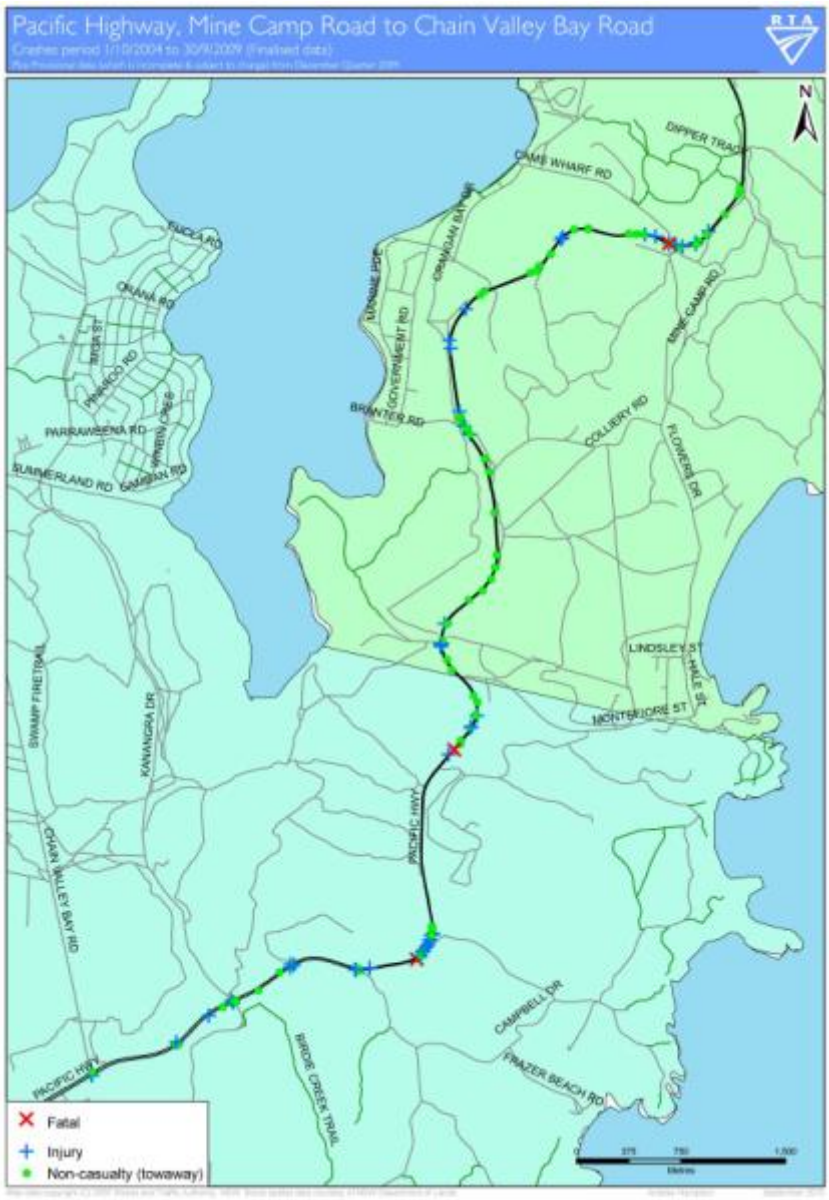


Figure 2-4 Pacific Highway, spatial distribution of crashes (10/2004 to 6/2010)

Figure 2-5 Awabakal Drive, crash record from 10/2004 to 6/2010

Figure 2-6 Government Road, crash record from 10/2004 to 6/2010

2.8 Traffic data

Coal & Allied previously commissioned traffic count for all key roads and intersections for the Southern Estates. These counts were undertaken in July 2007. Between 2007 and 2010 there was no significant change in the land use in and around the study area. Between 2007 and 2010, local traffic movements (in/out) at Flowers Drive, Montefiore Street, Nords Wharf Road, Awabakal Drive and Kanangra Drive are unlikely to have changed. With RTA's concurrence, 2007 traffic counts have been used to update traffic volumes to year 2010. Extrapolation of the 2007 traffic data was undertaken using the historical traffic growth on the Pacific Highway. Traffic volumes for year 2010 were extrapolated from 2007 using a 2 percent growth per annum. It is expected that daily traffic profile, hourly traffic profile and proportion of heavy vehicles derived from 2007 counts will maintain similar traffic patterns in year 2010.

In the following sections, the estimated 2010 traffic volumes on the Pacific Highway are noted, where appropriate.

In 2007, for this study area, following traffic surveys were carried out:

- Mid-block tube count for periods of at least a week; and
- Intersection turning movement count during morning and afternoon peak periods.

One site was selected for mid-block traffic counts (see Table 2-7):

Table 2-7 Mid-block traffic survey locations

ID	Location	Survey Period
M-2	Pacific Highway, south of Awabakal Drive	From 17July 2007 to 23July 2007

From this count data all vehicles were then classified into the twelve Austroads standard vehicle classes. Similar to midblock count, one location was selected for peak period intersection counts as follows (see Table 2-8):

Table 2-8 Intersection survey locations

ID	Location	Survey Period
I-4	Pacific Highway/Awabakal Drive	Friday, 20 July 2007

The intersection survey was fully classified turning counts, conducted for both AM (7am to 10am) and PM (3pm to 6pm) peaks on Friday 20 July 2007 being the critical day found from other survey locations in this corridor. The following sections provide a summary of traffic results based on counts undertaken in 2007.

2.8.1 Average weekday and weekend traffic

Daily traffic volumes for the key roads were calculated (see Table 2-9 below) for an average weekday (5 days) and an average weekend (2 days) traffic. Traffic volumes are derived from the mid-block survey conducted during a 'typical' week, i.e. not during school holidays.

Table 2-9 Daily traffic volumes on key roads

Site ID	Road sections	Average Weekday (Counts)	Average Weekend (Counts)	Traffic Changes (Weekend)
M-2	Pacific Hwy, south of Awabakal Dr	13,800	11,000	-20%

Below points are noted from Table 2-9 traffic results:

- During 2007, Pacific Highway carried approximately 13,800 vehicles per day during a weekday.
- In 2010, traffic volume on Pacific Highway is estimated at approximately 14,600 vehicles per day. This represents about an 800 vehicle increase in three years. This increase is unlikely to change traffic performance which was determined from 2007 counts.
- Weekend traffic is about 20% lower than weekday traffic. The data suggests Pacific Highway in this section carries high commuter demand between Central Coast and Newcastle.
- Weekday traffic on this section is about 10% lower than annual average daily traffic (AADT) on the Pacific Highway near Swansea (see Table 2-4 for AADT data).

2.8.2 Daily traffic profiles

Figure 2-7 shows the variations of traffic profile over one week period on the Pacific Highway. The data in Figure 2-7 indicates that traffic on the Pacific Highway is relatively constant. Peak traffic occurred on Friday.

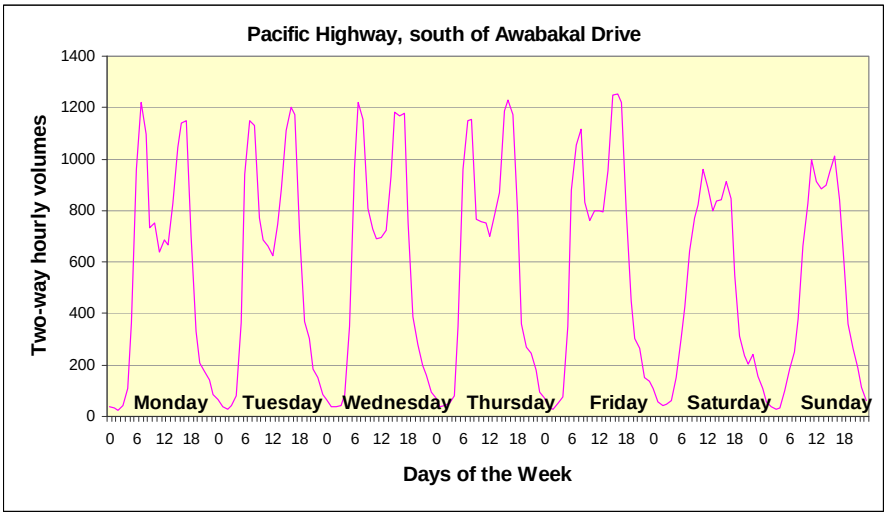


Figure 2-7 Daily variation of traffic volumes

2.8.3 Hourly variations

Figure 2-8 shows the hourly traffic volumes on weekday by directional of travel. The data showed morning peak on the Pacific Highway occurred between 8 am and 9 am and afternoon peak between 3 pm and 4 pm respectively.

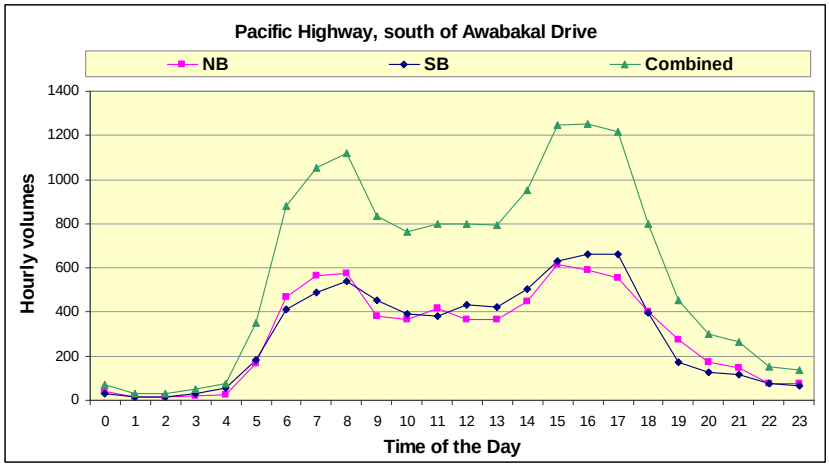


Figure 2-8 Hourly traffic variation at key roads

Table 2-10 summarised traffic data for Friday for both AM and PM peak hour.

Table 2-10 AM and PM peak hour volumes on key roads (Friday)

		2007 (Counts)					
Site ID	Road sections	AM Peak (8 to 9am)			PM Peak (3 to 4pm)		
		NB/EB	SB/WB	Total (2-way)	NB/EB	SB/WB	Total (2-way)
M-2	Pacific Hwy, south of Awabakal Dr	580	540	1,120	620	630	1,250

The data in Table 2-10 indicates that:

- During 2007, Peak hour traffic on the Pacific Highway was between 1,120 and 1,250 vehicles per hour.
- In 2010, traffic volume on Pacific Highway is estimated at approximately 1,190 to 1,330 vehicles per hour during AM and PM peak periods respectively. In hourly terms, this represents about a 70 to 80 vehicle increase in three years. This increase is unlikely to change traffic performance which was determined from 2007 counts.
- The notional capacity of a 4 lane Pacific Highway can be 5,000 vehicles per hour assuming 1,250 vehicles per lane. This suggests the Pacific Highway has spare capacity for further growth.

2.8.4 Heavy vehicles

According to AUSTROADS vehicle classification system, heavy vehicles include trucks with two or more axles, buses, semi-trailers and B-doubles (classification categories 3-12). Table 2-9 below shows the number of heavy vehicles recorded during the morning (8:00 am – 9:00 am) and afternoon (3:00 pm – 4:00 pm) peak hours and over the entire day. The numbers in parentheses contain the percentage of heavy vehicles of the total volume on that road.

Table 2-11 Heavy vehicles (2-way) on key roads (Friday)

Site ID	Road sections	AM Peak	PM Peak	Daily
M-2	Pacific Hwy, south of Awabakal Dr	100 (9%)	90 (8%)	1,200 (8%)

The heavy vehicle data from Table 2-11 showed the following patterns:

- The heavy vehicle data recorded in 2007 showed that Pacific Highway carried about 1,200 heavy vehicles per day.
- On Pacific Highway, the heavy vehicle proportion was about 8% to 9% of total traffic. This trend is consistent with the heavy vehicle proportion on other state roads (between 8% and 12 %).

2.8.5 Intersection turning volumes

Intersection turning movement data were key inputs to the SIDRA intersections capacity analysis. This data also provided traffic distribution at the local level.

Figure 2-9 presents recorded turning movements in 2007 at Pacific Highway/Awabakal Drive intersection for both AM (8 am - 9am) and PM (3 pm - 4 pm) traffic conditions. Turning movement data were counted during Friday peak travel conditions.

Figure 2-10 presents estimated 2010 turning movements at the same intersection for both AM (8:00-9:00) and PM (15:00-16:00).

Figure 2-9 Intersection turning volumes for the AM and PM peak hours in 2007

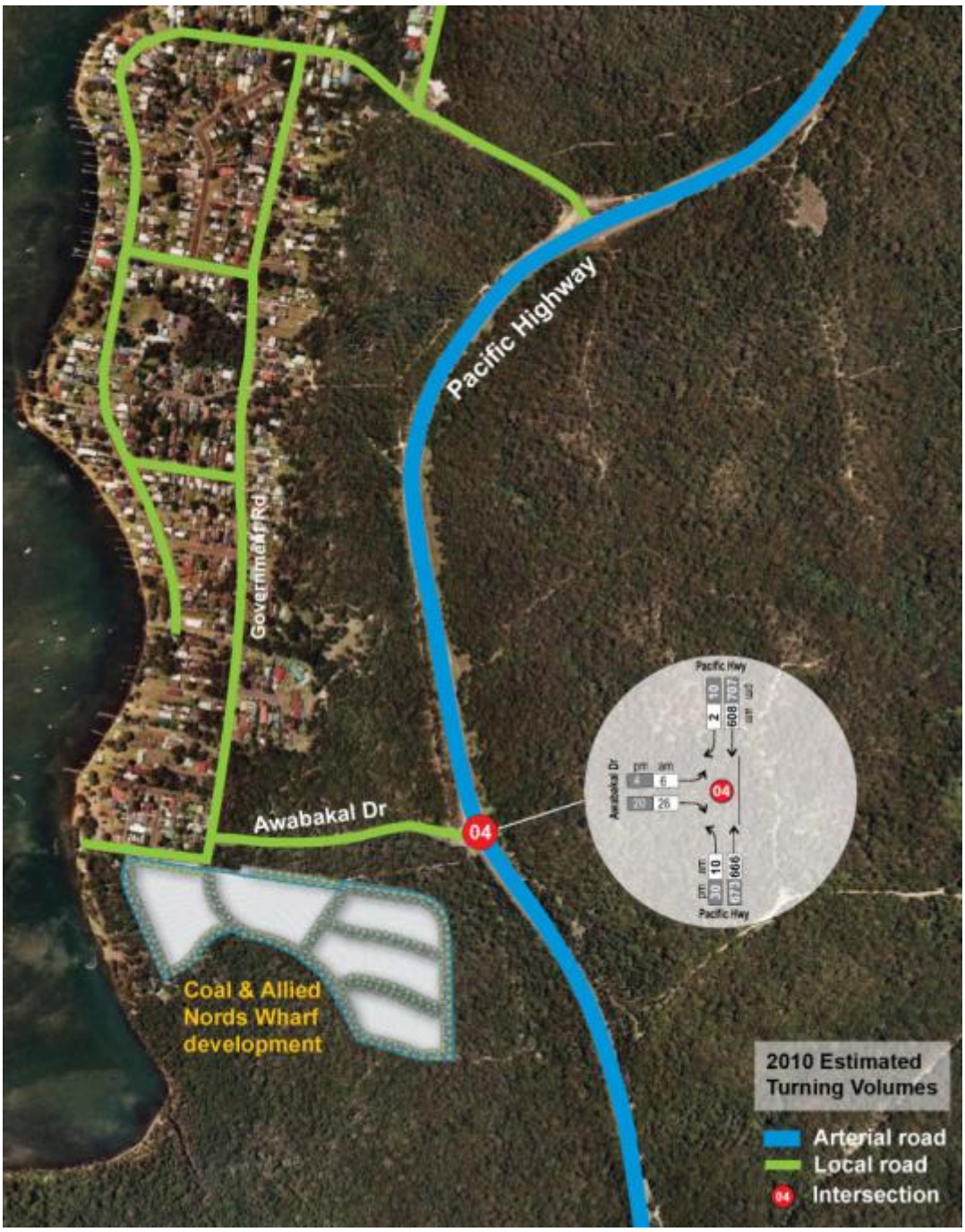


Figure 2-10 2010 Estimated intersection turning volumes for the AM and PM peak hours

2.9 Road network capacity

Hyder used SIDRA traffic modelling software for assessing intersection performance. As per DGR's requirement, the need for a micro-simulation (Paramics) model for the subject site was discussed with the RTA. With RTA's concurrence, micro-simulation model (Paramics) was not required. SIDRA modelling was adequate for the subject site.

Assessment Criteria of Intersection

The standard intersection analysis program is SIDRA, which analyses the performance of single intersections and can thus determine the impact of a number of development options. For the assessment of this development's traffic impact, the four accepted measures of performance have been considered, which are:

- Level of Service (LoS);
- Degree of Saturation;
- Average Delay; and
- Maximum Queue Length.

These four measures are discussed below.

Level of Service (LoS)

This is a measure of the delay a vehicle suffers in negotiating an intersection. LoS applies to the intersection as a whole and to individual turning movements. Ratings of LoS A to C are in the acceptable range, with E and F considered unacceptable. LoS D may be acceptable in certain circumstances. The standard NSW Level of Service criteria for intersections are summarised in Table 2-12:

Table 2-12 LoS Criteria

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	>70	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing

Source: RTA Guide to Traffic Generating Developments

Degree of Saturation (DoS)

This is the ratio of traffic flow for a particular vehicle movement to the capacity flow for that movement. The highest DoS is the DoS for the intersection.

Average Delay

The average delay is a simple calculation to find the difference between the travel times of vehicles delayed by traffic, compared to the travel time expected if there were no interruptions to the flow through an intersection. This is usually presented as seconds per vehicle.

Maximum Queue Length

The queue length figures used in this assessment are usually calculated as the '95th percentile back of queue.' This is the measure which 95% of all queues are within.

2.9.1 Existing intersection performance

The Pacific Highway/ Awabakal Drive intersection was modelled using SIDRA software for both years 2007 and 2010. The existing layout and traffic control was modelled for Pacific Highway/ Awabakal Drive intersection. Four performance measures detailed above are estimated. LoS results for year 2007 and 2010 are presented in Table 2-13 and Table 2-14 respectively.

Table 2-13 Intersection LoS for 2007 traffic conditions

ID	Intersection Name	Control Type	DOS	Ave Delay (s)	LOS	Queue (veh)
	Morning peak					
I-04	Pacific Hwy-Awabakal Dr	Give-way	0.31	58	E	2
	Evening peak					
I-04	Pacific Hwy-Awabakal Dr	Give-way	0.36	85	F	2

Note: For sign controlled intersections LoS is determined by worst movement (highest delay)

Table 2-14 Intersection LoS for 2010 traffic conditions

ID	Intersection Name	Control Type	DOS	Ave Delay (s)	LOS	Queue (veh)
	Morning peak					
I-04	Pacific Hwy-Awabakal Dr	Give-way	0.38	70	E	2
	Evening peak					
I-04	Pacific Hwy-Awabakal Dr	Give-way	0.46	113	F	2

Note: For sign controlled intersections LoS is determined by worst movement (highest delay)

The worst (highest delays) movements, as per 2010 models, for each intersection are summarised in Table 2-15.

Table 2-15 Movements with the highest delays as per 2010 models

ID	Intersection Name	Control Type	Critical Movements
	Morning peak		
I-04	Pacific Hwy-Awabakal Dr	Give-way	* 26 veh right turn from Awabakal Dr (DoS=0.35; LoS=E); * 2 veh right turn from Pacific Hwy (DoS=0.01; LoS=B);
	Evening peak		
I-04	Pacific Hwy-Awabakal Dr	Give-way	* 20 veh right turn from Awabakal Dr (DoS=0.46; LoS=F); * 10 veh right turn from Pacific Hwy (DoS=0.02; LoS=B);

Key observations from Table 2-14 and Table 2-15 are noted below:

- There was no significant change in the intersections performance results between 2007 and 2010 traffic conditions. Level of Service (LoS) for all modelled intersections, during AM and PM peak periods, remained unchanged;
- The data suggests Pacific Highway/Awabakal Dr intersection has no current capacity problems (DoS<0.5). However, a right turn movement out of Awabakal Drive onto the Pacific Highway experiences between one to two minute delays.

As it can be seen from the result presented in Table 2-15, for the signed controlled intersections LoS is determined by the highest delay experienced by the minor side street traffic out of Awabakal Drive. In this case, intersection LoS could be F but small numbers of traffic are delayed. In general, this intersection does not have a capacity problem except higher delays experienced by the right turn movement out of Awabakal Drive.

3 Impact assessment

3.1 Additional development trips

Peak hour trips for the proposed Nords Wharf development were estimated based on the RTA's trip generation guideline "The Guide to Traffic Generating Developments, RTA, 2002. A conservative trip generation rate for dwellings of 0.85 vehicle trips per peak hour was used. The percentage of internal trips for the Nords Wharf development would be negligible. A yield of 90 dwellings will generate about 77 peak hour trips.

3.2 Access and circulation

The proposed road network for the concept plan consists entirely of local roads. The main connection to the development connects into the existing local road, Government Road at Branter Road. A second connection is also provided into Branter Road further to the west. The Pacific Highway is the major north-south arterial road providing access to the subject site via Awabakal Drive and Nords Wharf Road.

Coal & Allied previously established the broad access management strategy in consultation with the RTA and Lake Macquarie City Council. The agreed access management strategy on the Pacific Highway identified that the following three intersections would require modification (upgrade) to minimise the cumulative impact from both Coal & Allied and potential development of the Rose Group zoned sites. The required proposed upgrades on the Pacific Highway comprised the following modifications:

- Cams Wharf Road/ Flowers Drive: maintain right turn from Pacific Highway to Cams Wharf Road. Ban right turn from Cams Wharf Road onto Pacific Highway. Flowers Drive traffic will be restricted to left in/left out only;
- Awabakal Drive: provide a seagull intersection with full access to Awabakal Drive and traffic signal control on the Pacific Highway northbound and Awabakal Drive (partial signal);
- Montefiore Street: provide a seagull intersection with full access to Montefiore Street and traffic signal control on the Pacific Highway southbound and Montefiore Street.

Figure 3-1 shows the indicative traffic management based on the cumulative traffic assessment.

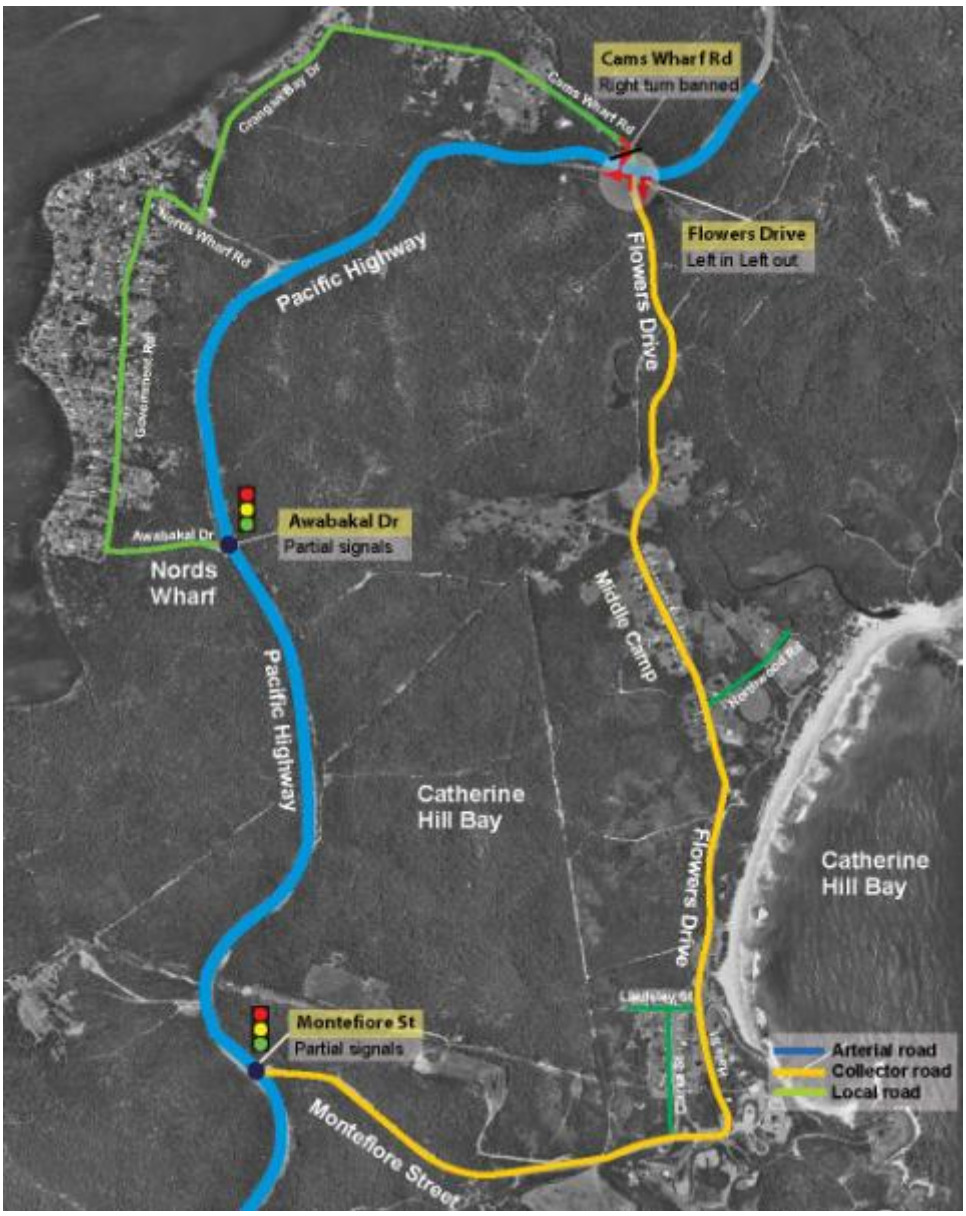


Figure 3-1 Indicative traffic management at key intersections

3.3 Future trip distribution and growth on the Pacific Highway

In assessing the traffic impact from the Nords Wharf site, the following assumptions were built into the spreadsheet traffic model:

- Future traffic distribution to and from Nords Wharf site;
- Traffic distribution to and from other developments which was used in the cumulative assessment. This included the Coal & Allied sites at Middle Camp and Gwandalan, and potential future development of the Rose Group zoned sites at Gwandalan and Catherine Hill Bay;
- Background traffic growth on the Pacific Highway.

Future traffic distribution from both the Coal & Allied and the Rose Group zoned sites together with background growth on the Pacific Highway, are summarised in Table 3-1. A conservative estimate of 2 percent traffic growth rate per annum on the Pacific

Highway in the next 10 years is appropriate, and is consistent with historical growth observed at RTA's permanent count site two kilometres south of Macquarie Bridge at Swansea.

Table 3-1 Trip distribution and background traffic growth assumptions

Developers	Sites	Model assumptions and data
Coal & Allied	Middle Camp	80 % of new trips are outbound and 20% inbound during AM peak. PM peak will mirror the AM peak pattern; Future horizon year for full development is 2012; 60 % of trips would travel north to/from Newcastle via Pacific Highway/Flowers Drive intersection under existing intersection controls; 40 % of trips would travel south to/from Wyong/Gosford areas via Pacific Highway/Montefiore Street under existing intersection controls;
Coal & Allied	Gwandalan	80 % of new trips are outbound and 20% inbound during AM peak. PM peak will mirror the AM peak pattern; Future horizon year for full development is 2018; 20 % of trips would travel north to/from Newcastle via Pacific Highway/Kanangra Drive Intersection; 80 % of trips would travel south to/from Wyong/Gosford via Pacific Highway/Kanangra Drive intersection;
Coal & Allied	Nords Wharf	80 % of new trips are outbound and 20% inbound during AM peak. PM peak will mirror the AM peak pattern; Future horizon year for full development is 2011; 60 % of trips would travel north to/from Newcastle via Pacific Highway/Awabakal Drive intersection; 40 % of trips would travel south to/from Wyong/Gosford via Pacific Highway/Awabakal Drive Intersection;
Rose Group	Catherine Hill Bay	60 % of trips would travel north to/from Newcastle and would use both the Pacific Highway/Flowers Drive and the Pacific Highway/Montefiore Street intersections under existing intersection controls; 40 % of trips would travel south to/from Wyong/Gosford via Pacific Highway/Montefiore Street under existing intersection controls; Future horizon year for full development is 2018
Rose Group	Gwandalan	During the morning peak, around 70% of total traffic in and out of Gwandalan/Summerland Point is outbound, and in the evening peak, around 65% is inbound; Future horizon year for full development is 2018
-		A conservative estimate of 2% per annum background traffic growth on the Pacific Highway; Peak hour through traffic for holiday period would increase by about 10% above the weekday counts.

In the instance of delays to Nords Wharf development; the study has assessed the cumulative traffic impact at key intersections with the Pacific Highway up to year 2018.

3.4 Future forecast and impact on key intersection

Hyder prepared traffic forecast for following three scenarios:

- S1 represents the base case;
- S2 represents the base case plus Coal & Allied Nords Wharf development traffic;
- S3 cumulative impact considering other potential developments in and around Nords Wharf.

The trip generation rate from a 90 dwelling units yield was applied to scenarios S2 and S3. Table 3-2 summarised assumptions used for three scenarios.

Table 3-2 Scenario description

The scenarios	Description
S1 Base Case	Reflects background traffic growth of 2% per annum on the Pacific Highway.
S2 Development Case	Reflects Base Case (S1) plus proposed full development at Coal & Allied Nords Wharf. This provides impact of Nords Wharf development alone.
S3 Cumulative Case	Reflects Development Case (S2) plus all other proposed developments including Coal & Allied's Gwandalan, Middle Camp sites, and potential development of the Rose Group zoned sites at Catherine Hill Bay and Gwandalan

Intersection performance was reported in terms of degree of saturation (DoS), level of service (LoS), average delay per vehicle and 95th percentile queue length. The results on the Pacific Highway/Awabakal Drive intersection are summarised as follows:

- Table 3-3 shows SIDRA results for the *base case S1*
- Table 3-4 shows SIDRA results for the *development case S2*
- Table 3-5 shows SIDRA results for the *cumulative case S3*

Table 3-3 Intersection performance at Pacific Highway intersection (Base Case S1, background traffic growth)

Site ID	Intersection	Control	2010				Nords Wharf (Base Case S1)			
			DoS	Delays (S)	LoS	Queue (Veh)	DoS	Delays (S)	LoS	Queue (Veh)
	Morning peak									
I-4	Pacific Hwy-Awabakal Dr	Give-way	0.38	70	E	2	0.39	73	F	2
	Evening peak									
I-4	Pacific Hwy-Awabakal Dr	Give-way	0.46	>100	F	2	0.47	>100	F	2

Note: Intersection performance results from background growth (base case) on Flowers Drive, Montefiore Street and Kanangra Drive intersections with Pacific Highway are summarised in Coal & Allied's Gwandalan and Middle Camp traffic reports prepared by Hyder.

Table 3-4 Intersection performance with Nords Wharf full development (Development Case S2)

ID	Intersection	Control	DoS	LoS	Que (veh)	Critical Movements
	AM					
	Pacific Hwy-Awabakal Dr	Give-way	0.78	F	4	* 50 veh right turn from Awabakal Dr (DoS=0.78; LoS=F) * 11 veh right turn from Pacific Hwy (DoS=0.02; LoS=B)
	PM					
	Pacific Hwy-Awabakal Dr	Give-way	0.63	F	3	* 26 vehs right turn from Awabakal Dr (DoS=0.63; LoS=F) * 46 vehs right turn from Pacific Hwy (DoS=0.07; LoS=B)

Table 3-5 Intersection performance with cumulative traffic impact (Cumulative Case S3)

ID	Intersection Name	Control Type	DOS	LOS	Queue (veh)	Critical Movements
	Morning peak					
I-04 AM	Pacific Hwy-Awabakal Dr	Give-way	1.00	**F**	8	50 veh right turn from Awabakal Dr DoS=1.00, LoS=F; 11 veh right turn from Pacific Hwy DoS=0.02, LoS=B;
	Evening peak					
I-04 PM	Pacific Hwy-Awabakal Dr	Give-way	1.00	**F**	6	26 veh right turn from Awabakal Dr DoS=1.00, LoS=F; 46 vehs right turn from Pacific Hwy DoS=0.09, LoS=B;

Capacity analysis for Development Case S2 (Table 3-4) and Cumulative Case S3 (Table 3-5) showed that the Nords Wharf development would increase critical DoS values from 0.39 to 0.78 at the Pacific Highway/ Awabakal Dr intersection suggesting some additional impact. The LoS is predicted F for both pre and post development scenarios. RTA recommended new partial signals at the Pacific Highway/ Awabakal Dr intersection primarily on a safety grounds.

Cumulative impacts are likely to arise from the interaction of the construction and operation of the Coal & Allied site at Nords Wharf with other development proposals planned for the Coal & Allied site at Catherine Hill Bay, Coal & Allied site at Gwandalan and Rose Group sites at both Catherine Hill Bay and Gwandalan.

The combination of these developments would result in impacts on key intersections with the Pacific Highway. The three intersections below would have a significant cumulative impact and would require improvements to operate at a reasonable level of service. They are:

- Pacific Highway/Flowers Drive;
- Pacific Highway/Awabakal Drive; and
- Pacific Highway/Kanangra Drive.

However, it has been assessed that the Pacific Highway/Awabakal Drive intersection upgrading works are triggered by the Coal & Allied development at the Nords Wharf site alone. A new partial signal for the Pacific Highway/Awabakal Drive intersection is recommended on a safety grounds.

The development will be carried out in accordance with the Environmental Assessment Report (EAR) prepared by Urbis and associated plans and supporting reports. Works in kind (WIK) associated with the upgrading of the Awabakal Dr / Pacific Highway intersection will be concurrent with subdivision works to be completed prior to registration of the first stage subdivision.

Figure 3-2 shows preliminary conceptual plan on partial signals at Pacific Highway/Awabakal Drive intersection.

Figure 3-2 Preliminary Conceptual Plan for Partial Signals at Pacific Highway/Awabakal Drive Intersection

3.5 Impact from concept plan

Traffic forecasts are prepared on key access points and internal roads within the subdivision (see Figure 3-3). Table 3-6 shows forecast traffic at key roads with Nords Wharf development traffic.

Figure 3-3 Nords Wharf concept plan showing forecast locations (indicative lot layout)

In general, the Coal & Allied development at Nords Wharf will increase peak traffic by between 10 and 80 vehicles per hour depending on the location. Daily traffic would increase by between 90 vehicles per day (vpd) and 810 vpd. The proposed road network for the concept plan consists of local roads. The key access road to the development connects Governement Road at Branter Road. A second access is provided into Branter Road further to the west. Proposed local roads would be designed in compliance with Lake Macquarie City Council's guidelines for local roads. Due to low volume predicted from proposed development a priority control junction at Awabakal Dr/Government Road is expected to provide adequate capacity and satisfactory level of service.

Table 3-6 Existing and future traffic volumes on key roads

Location	Road	Classification	Existing[1]			Existing plus Nords Wharf development traffic-2011			Change due to Nords Wharf development traffic		
			AM	PM	Daily	AM	PM	Daily	AM	PM	Daily
1	Pacific Hwy, south of Awabakal Dr	Arterial	1,120	1,250	14,500	1,240	1,380	15,980	120	130	1480[2]
2	Awabakal Dr, west of Pacific Hwy	Local	50	70	880	130	150	1,690	80	80	810
3*	Government Rd, north of Awabakal Dr	Local	40	60	730	40	60	730	-	-	-
4*	Government Rd, south of Awabakal Dr	Local	5	5	70	85	85	880	80	80	810
5*	Branter Rd, west of Government Rd	Local	5	5	70	15	15	160	10	10	90
6	Access Rd, south of Government Rd	Proposed (local)	-	-	-	70	70	720	70	70	720
7	Access Rd, south of Branter Rd	Proposed (local)	-	-	-	10	10	90	10	10	90
8	Access Rd at location 8	Proposed (local)	-	-	-	50	50	530	50	50	530
9	Access Rd at location 9	Proposed (local)	-	-	-	30	30	270	30	30	270

Note: (1) The existing traffic data shown in Table 3-6 were based on weekday (Friday) traffic. Existing traffic data is as per 2007 counts. (2) The Pacific Highway forecast included development traffic plus background traffic which was grown by 2% per annum up to 2011.

3.6 Non-car modes strategy

Public transport in the Nords Wharf area is limited. The area is serviced directly by Busways Route 99 which runs from Lakehaven Shopping Centre and Swansea. The Busway operator was consulted regarding upgrades to the service. Busways advised that bus services were continually under review and that more frequent services would be considered as additional residential development occurs in Gwandalan, Nords Wharf, Middle Camp and Catherine Hill Bay. Table 3-7 summarises broader assessment of the proposal against the objectives of the Integrating Land Use and Transport policy (ILUT) package.

Table 3-7 ILUT objectives and compliance

ID	ILUT objectives	Compliance
1	Improving access to housing, jobs and services by walking, cycling and public transport	Provision of the pedestrian and cycleway network will be provided to facilitate the movement of pedestrians and cyclist through the development area. Within the development proposal, street network will be designed to provide safe walking routes and bicycle routes that link the site with the existing services and facilities in Nords Wharf. Due to low volume of traffic on local roads, it is expected that cyclist demand could be catered for on –road. The shared use paths provide an incentive for residents to choose cycling as their transport mode, for work or other purposes such as school or recreation. Through the NSW Government's Bike Plan, the Government will work in partnership with local councils communities and business to encourage bike riding growth and safer cycling in New South Wales.
2	Increasing the choice of available transport and reducing dependence on cars;	The concept plan for Nords Wharf proposal will create an environment that is friendly to pedestrians, cyclists and public transport users, including elderly people and people with disabilities. A pedestrian network will be installed to provide for movements of pedestrians throughout the development area. The local roads within the development will be designed to provide safe walking and bicycle routes that link with foreshore, its park and other existing services and facilities in Nords wharf. Due to low volume of traffic on local roads, it is expected that cyclist demand could be catered for on –road.
3	Reducing travel demand including the number of trips generated by development and the distances travelled, especially by car	Pedestrian and cycle routes within the development will connect with existing facilities provided along Awabakal Drive including existing public transport services.

ID	ILUT objectives	Compliance
4	Supporting the efficient and viable operation of public transport services	The existing bus service (Route 99) that runs along the Government Road and Awabakal Road would be able to service the additional demand from this site. A bus stop located at the Awabakal Dr/ Government Rd intersection would service the majority of development within a 400 m walk catchment.
5	Providing for the efficient movement of freight	Not applicable for Nords Wharf site.

4 Summary of findings

This traffic report was prepared to examine the impact on the road network from 90 residential dwellings at Nords Wharf site. In assessing the traffic impact Hyder considered the broader traffic assumptions, and the implications of the additional development traffic on the Pacific Highway intersections performances based on the cumulative impact. Key findings from our investigation are as follows:

- Access to the Nords Wharf investigation area is generally available via Awabakal Drive, Nords Wharf Road, Government Road and Branter Road. The Pacific Highway is the major north-south arterial road providing access to the subject site via Awabakal Drive and Nords Wharf Road.

- 2006 Journey to Work data indicates that journeys to and from work for Nords Wharf residents was predominantly by private car (94%) with Lake Macquarie, Wyong and Newcastle LGAs the principal destinations. Travel by public transport was about 3% of trips, while other modes such as walking or cycling constituted the remaining 3% of trips.

- Crash data from last six years (between 10/2004 and 6/2010) indicated that the majority of crashes occurred on the Pacific Highway. On Government Road only one crash occurred during the same period.

- The recent traffic data suggests most traffic travels to the Nords Wharf development area via Awabakal Drive and Government Road. Awabakal Drive and Government Road carried between 700 and 900 vehicles per day. The data suggests the network has no current capacity problems. However, right turn movement out of Awabakal Drive onto the Pacific Highway experience between one and two minutes delays. .

- The traffic generation from the proposed development of 90 dwellings is predicted to result in a maximum of 77 peak hour vehicles to the surrounding road network. The forecasts indicate that the proposal would result in a small impact in overall traffic generated in the long term on the existing network. The local network, comprising Awabakal Drive and Government Road are expected to accommodate the greatest long-term increase in additional traffic as a result of the full proposal.

- Cumulative impacts are likely to arise from the interaction of the construction and operation of the Coal & Allied site at Nords Wharf with other development proposals planned for the Coal & Allied site at Catherine Hill Bay, Coal & Allied site at Gwandalan and potential for development of the Rose Group sites at both Catherine Hill Bay and Gwandalan. The combination of these developments would result in impacts on key intersections with the Pacific Highway. The three intersections below would have a significant cumulative impact and would require improvements to operate at a reasonable level of service. They are:

    - Pacific Highway/Flowers Drive;
    - Pacific Highway/Awabakal Drive; and
    - Pacific Highway/Kanangra Drive.

However, it has been assessed that the Pacific Highway/Awabakal Drive intersection upgrading works are triggered by the Coal & Allied development at the Nords Wharf site alone. With RTA's concurrence, a new partial signal is recommended at the Pacific Highway/Awabakal Drive intersection from safety ground.

4.1 Director General's Requirements

Table 4-1 Director General's Requirements

DG Requirement	Relevant Report Chapter(s)
(1) Prepare a Traffic Study in accordance with RTA's *Guide Traffic Generating Developments* that includes (but is not limited to) the following:	
a) An identification of all relevant vehicular traffic routes and intersection for access to/from the area;	Chap.2.1 Chap 3,2
b) Current traffic counts for all of the above traffic routes and intersections;	Chap.2.8
c) The anticipated vehicular traffic generated from the proposed development and associated trip distribution on the road network;	Chap.3.1 Chap 3.2 Chap 3.3
d) Consideration of the traffic impact on the existing and proposed intersections and the capacity of the local and classified road network to safely and efficiently cater for the additional vehicular traffic generated;	Chap 3.4
e) An analysis of the cumulative traffic and transport impacts of the development taking into consideration other proposed developments;	Chap.3.4
f) Details of necessary road network infrastructure upgrades required to maintain existing levels of service both on the local and classified road network;	Chap.3.4 Chap 4
g) An intersection analysis, using SIDRA or similar traffic model, as well as a micro simulation model to determine the need for intersection and mid block capacity upgrades and to ensure traffic signal coordination;	Chap 2.9 Chap.3.4
h) Proposed pedestrian and cycleway access within and to the site that connects to all relevant transport services, nearby settlements, and other key off-site locations having regard to the *NSW Planning Guidelines for Walking and Cycling* (2004), and the *NSW Bike Plan* (2010);	Chap.3.6
i) Timing of delivery of proposed transport infrastructure including road and intersection upgrades, pedestrian and cycle paths, and public transport infrastructure; and	Chap. 3.4
j) Consideration of impacts on existing property access.	Chap.3.2, Chap 3.5
(2) Assess the proposal against the objectives of the Integrating Land Use and Transport policy package.	Chap.3.6