Wallarah 2 Coal Project
Traffic Impact Study

June, 2008

Wyong Areas Coal Joint Venture

Parsons Brinckerhoff Australia Pty Limited ABN 80 078 004 798

Ernst & Young Centre,
Level 27, 680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001
Australia
Telephone +61 2 9272 5100
Facsimile +61 2 9272 5101
Email sydney@pb.com.au

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Author: Kelly Yoon, Sam Black

Signed:

Reviewer: Blake Xu

Signed:

Approved by: Wendy Adam

Signed:

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1. Background

The Wallarah No. 2 Coal Project (W2CP) is located within the western area of the Wyong Coal Development Area. The proposed mine site is located within the local government area of Wyong Shire Council. Wyong Areas Coal Joint Venture (WACJV), a major partner in the joint venture, is proposing to extract coal from the W2CP mine at a rate of five million tonnes per annum for a period of approximately 40 years.

All coal produced is anticipated to be transported by rail via a new rail loop to be constructed to the north, either to the Port Newcastle for export to overseas or used by domestic power stations also served by rail. Therefore, road based traffic movements would primarily be generated by the construction activity and the workforce, deliveries and service vehicles when the mine is in operation.

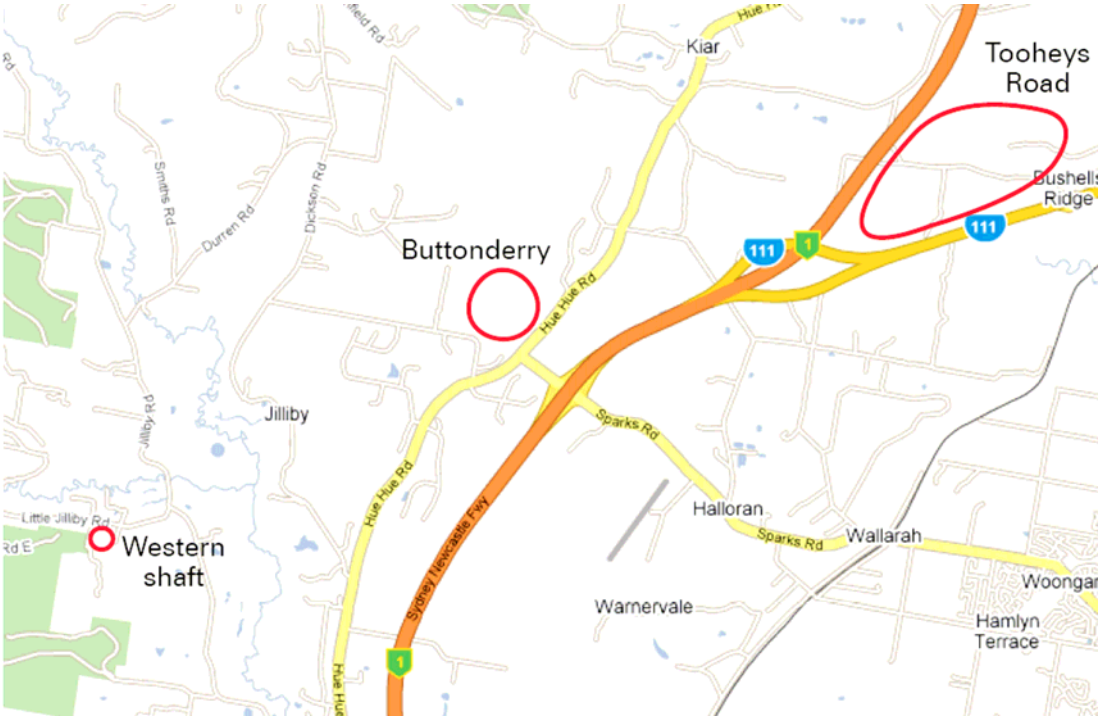
Parsons Brinckerhoff Australia Pty Ltd (PB) has been commissioned by WACJV to prepare a traffic and transport impact report to accompany the main environmental assessment (EA). The EA, and the various specialist reports, would be considered by the consent authorities during assessment of the proposed coal mine. This report assesses the forecast traffic and transport impacts likely to arise from the proposed mine construction and operation scenarios.

2. Existing conditions

2.1 Site description

The study area concerned is shown in the locality plan in Figure 2-1 and is located directly north of Wyong and west of Blue Haven. During the operations phase, the mine will consist of two key sites, Tooheys Road and Buttonderry. The Tooheys Road site is situated in Bushells Ridge between the F3 Freeway, which is the main route between Sydney and Newcastle, and the Motorway Link Road, which links the F3 to the Pacific Highway for travel to the Lake Macquarie area. The Buttonderry site is located to the west of Hue Hue Road, which leads between Wyong and Wyee, just to the north of its intersection with Sparks Road, which is the main connection between the Toukley / Gorokan area to the F3. Both sites are located within future industrial and employment precincts.

An additional area will be required for future mine ventilation, referred to as the Western Shaft Site, and it is located off Little Jilliby Road to the south west of the Buttonderry site. This site will be accessed via Hue Hue Road, Jilliby Road and Little Jilliby Road near the Wyong State Forest and will be required around mining year 10.



Source: Google maps

Figure 2-1: Locality plan

2.2 Existing road network and traffic conditions

2.2.1 History of local traffic patterns

Historical traffic data for key roads in the vicinity of the proposed mine sites were obtained from the RTA *Traffic Volume Data for Hunter and Northern Regions* (2004). Table 2-1 summarises the annual average daily traffic (AADT) for three RTA counting stations nearby the proposed sites.

Table 2-1: Summary of daily traffic volumes (AADT) on nearby roads

RTA station ID	Location	Year				Annual growth (95-04)
		1995	1998	2001	2004	
05.302*	Motorway Link Rd (MR675), south of Pacific Hwy	10,615	12,240	14,283	16,130	5.77%
05.642	Wyee Rd (MR454), east of Toronto Rd at railway bridge	5,816	6,295	6,503	7,391	3.01%
05.514	Wyee Rd (MR454) at Wyee Creek bridge	4,867	5,716	6,011	6,695	4.17%
05.165	Sparks Rd (MR509), east of Pacific Hwy	17,056	17,722	19,114	22,168	3.33%

* - RTA station 05.302 is a permanent station counting in axle pairs until 1998 and counting in vehicles from 2001

Table 2-1 contains the results from four RTA permanent counting sites. They have all recorded a consistent increase in traffic volumes between 1995 and 2004. The average annual increase between 1995 and 2004 was approximately 4.06% per annum. This percentage will be used for calculating the future background traffic growth for the construction and post-development scenarios.

Hourly traffic volume for one week period (16-22 August 2004) was also available at RTA permanent count station at Motorway Link Road, south of Pacific Highway. Figure 2-2 shows the hourly profile of the average weekday traffic by direction.

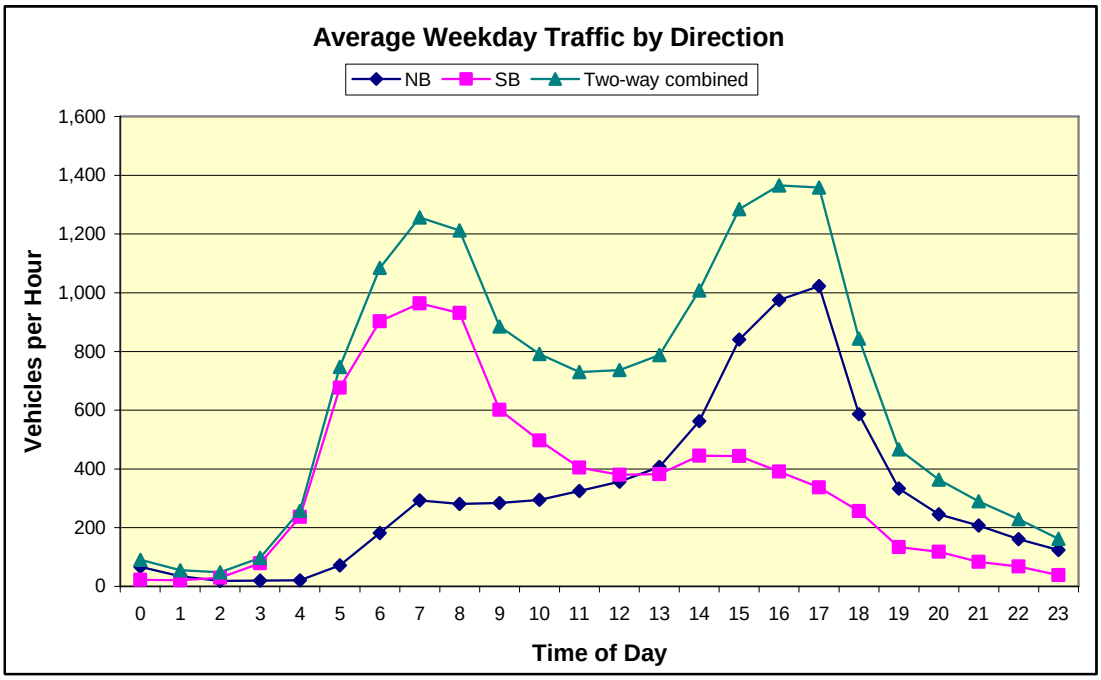


Figure 2-2: Average weekday traffic by direction on Motorway Link Road, south of Pacific Highway at Doyalson

Figure 2-2 shows that there are two distinct peak periods of 6:00AM to 9:00AM, and 3:00PM to 6:00PM. These peak periods coincide with the surveyed periods for the intersection turning movements.

2.2.2 Mid-block traffic counts

Mid block counts were undertaken at three key locations for a continuous seven-day period between 24 November 2006 and 1 December 2006. The tube counts produce 24 hour traffic profiles and traffic composition using vehicle classes defined by *Austroads*. The counts were conducted at the following locations:

- Hue Hue Road, north of Sparks Road
- Hue Hue Road at Sydney-Newcastle Freeway overpass
- Bushells Ridge Road at Sydney-Newcastle Freeway overpass.

At three locations, the two-way peak hour traffic flow for an average weekday generally occurred from 8:00AM to 9:00AM and 3:00PM to 4:00PM. Peak hour volumes are summarised in Table 2-2.

Table 2-2: Average weekday peak hour volumes at three key locations

Location	Morning peak hour			Afternoon peak hour		
	NB/EB	SB/WB	2-way	NB/EB	SB/WB	2-way
Hue Hue Rd, north of Sparks Rd	86 (5.5%)	154 (10.2%)	240 (15.7%)	158 (10.0%)	115 (7.6%)	273 (17.6%)
Hue Hue Rd at Sydney-Newcastle Fwy overpass	70 (5.9%)	102 (9.1%)	173 (15.0%)	135 (11.3%)	94 (8.4%)	229 (19.7%)
Bushells Ridge Rd at Sydney-Newcastle Fwy overpass	6 (6.6%)	6 (6.8%)	13 (13.4%)	8 (8.7%)	16 (8.3%)	24 (17.1%)

NOTE: Percentages in brackets indicate the peak hour traffic as a percentage of the daily traffic

At Hue Hue Road, north of Sparks Road, the average weekday traffic (AWT) volume was 3,085 vehicles per day (vpd). The classification count shows that of the 3,085 vehicles:

- 62 percent (or 1,903 vehicles) were light vehicles including cars, vans, car towing boat, etc (Classes 1 and 2)
- 35 percent (or 1,071 vehicles) were rigid trucks and buses (Classes 3, 4 and 5)
- 3 percent (or 108 vehicles) were articulated trucks with three to six axles (Classes 6, 7, 8 and 9)
- less than 1 percent (or 3 vehicles) were B-Doubles including road trains (Classes 10, 11 and 12).

The analysis showed Class 3 vehicles (two axle truck or bus) are significantly higher southbound, ie 53 percent of southbound daily traffic is of Class 3 vehicles, whereas heave vehicles are only 5 percent of northbound traffic.

The average weekday traffic by vehicle class (using *Austroads* classification) for northbound, southbound and two-way combined traffic on Hue Hue Road, north of Sparks Road are presented graphically in Figure 2-3, Figure 2-4 and Figure 2-5, respectively.

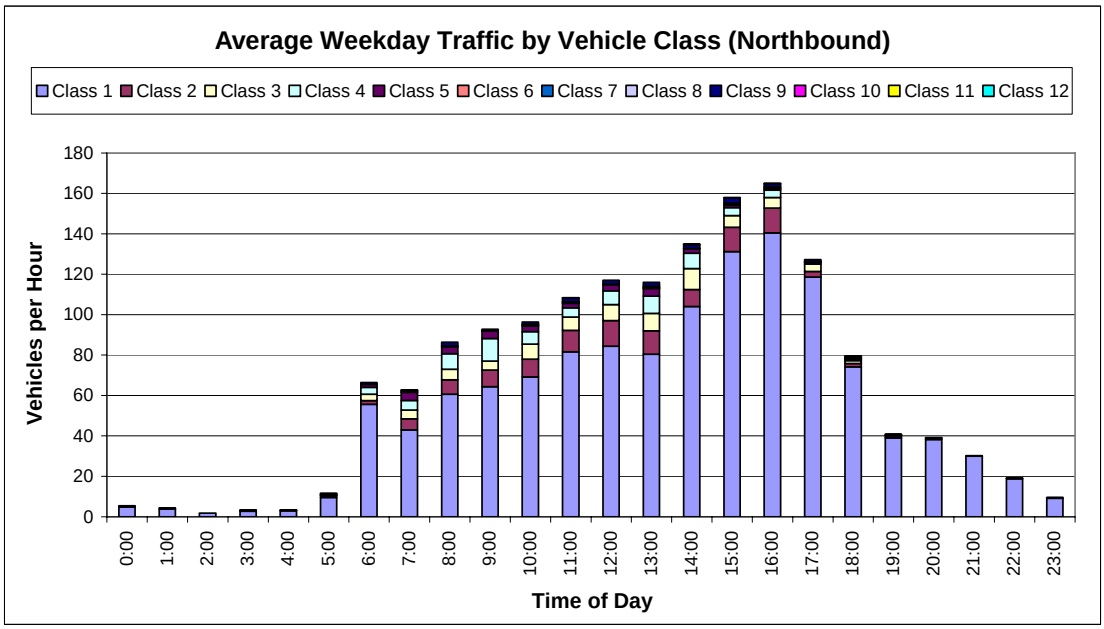


Figure 2-3: Average weekday traffic by vehicle class (northbound) on Hue Hue Road, north of Sparks Road

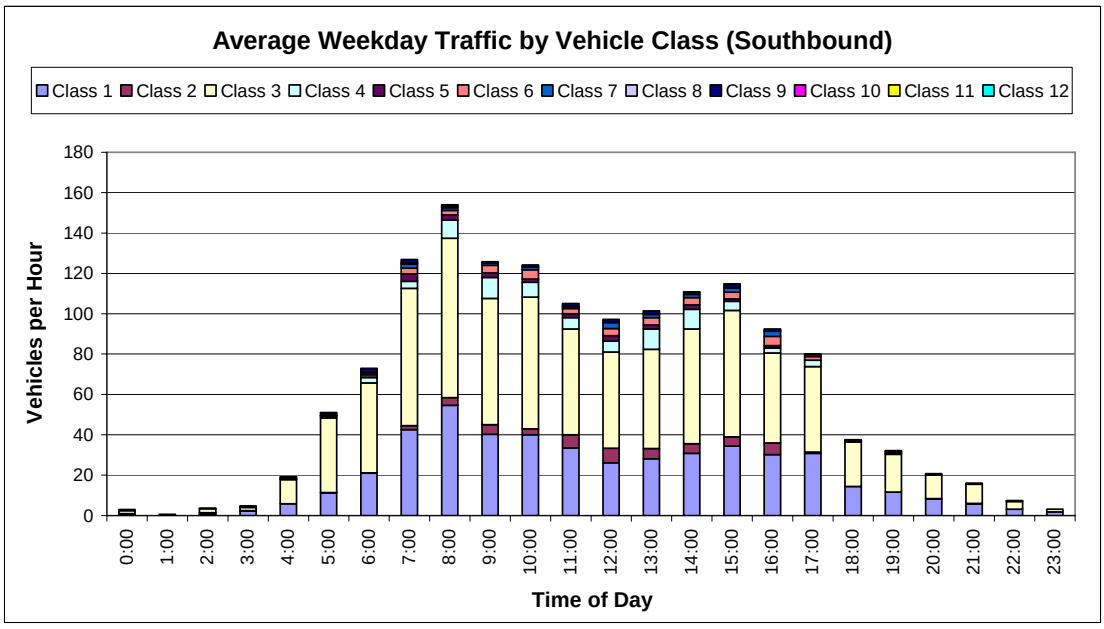


Figure 2-4: Average weekday traffic by vehicle class (southbound) on Hue Hue Road, north of Sparks Road

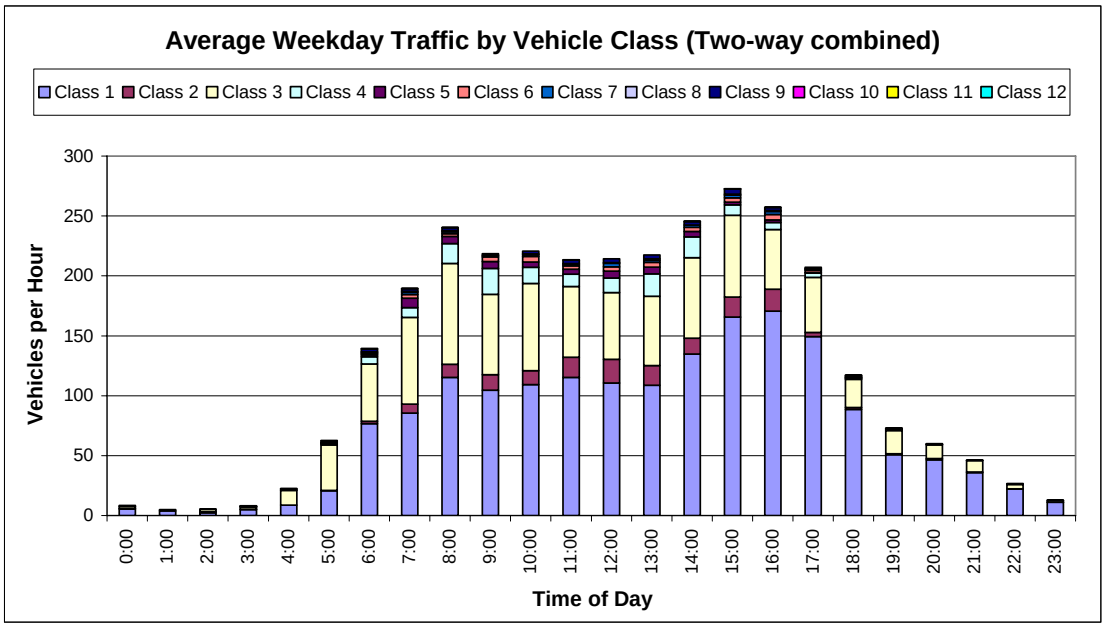


Figure 2-5: Average weekday traffic by vehicle class (two-way combined) on Hue Hue Road, north of Sparks Road

At Hue Hue Road at Sydney-Newcastle Freeway overpass, the average weekday traffic (AWT) volume is 2,318 vpd. The classification count shows that of the 2,318 vehicles:

- 91 percent (or 2,101 vehicles) were light vehicles including cars, vans, car towing boat, etc (Classes 1 and 2)
- 8 percent (or 176 vehicles) were rigid trucks and buses (Classes 3, 4 and 5)
- 2 percent (or 39 vehicles) were articulated trucks with three to six axles (Classes 6, 7, 8 and 9)
- less than 1 percent (or 2 vehicles) were B-Doubles including road trains (Classes 10, 11 and 12).

The vehicle compositions are similar in both directions.

The average weekday traffic by vehicle class for eastbound, westbound and two-way combined traffic on Hue Hue Road at Sydney-Newcastle Freeway overpass are presented graphically in Figure 2-6, Figure 2-7 and Figure 2-8, respectively.

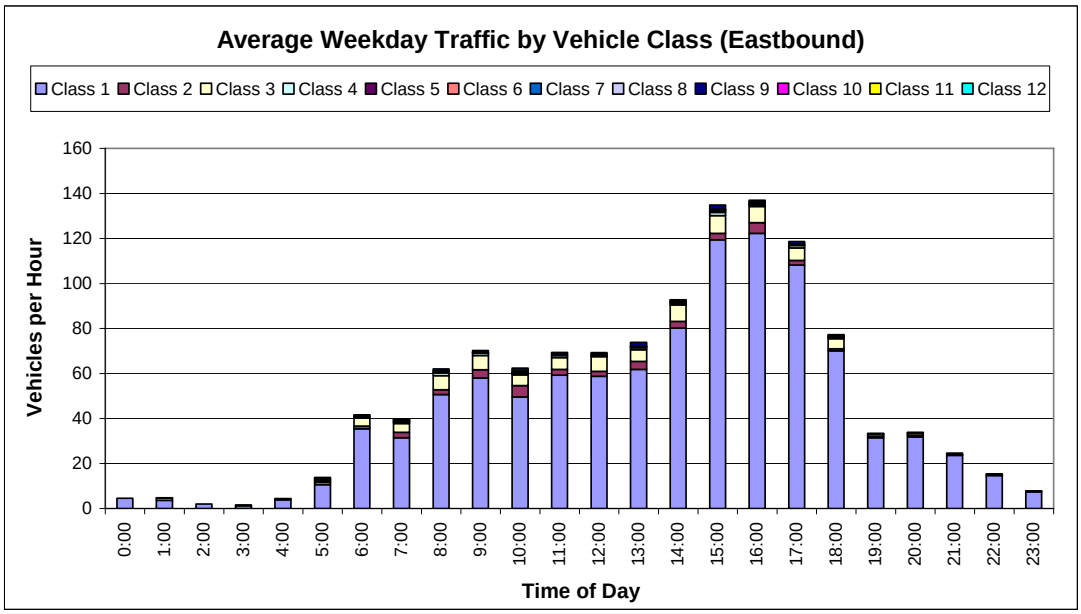


Figure 2-6: Average weekday traffic by vehicle class (eastbound) on Hue Hue Road at Sydney-Newcastle Freeway overpass

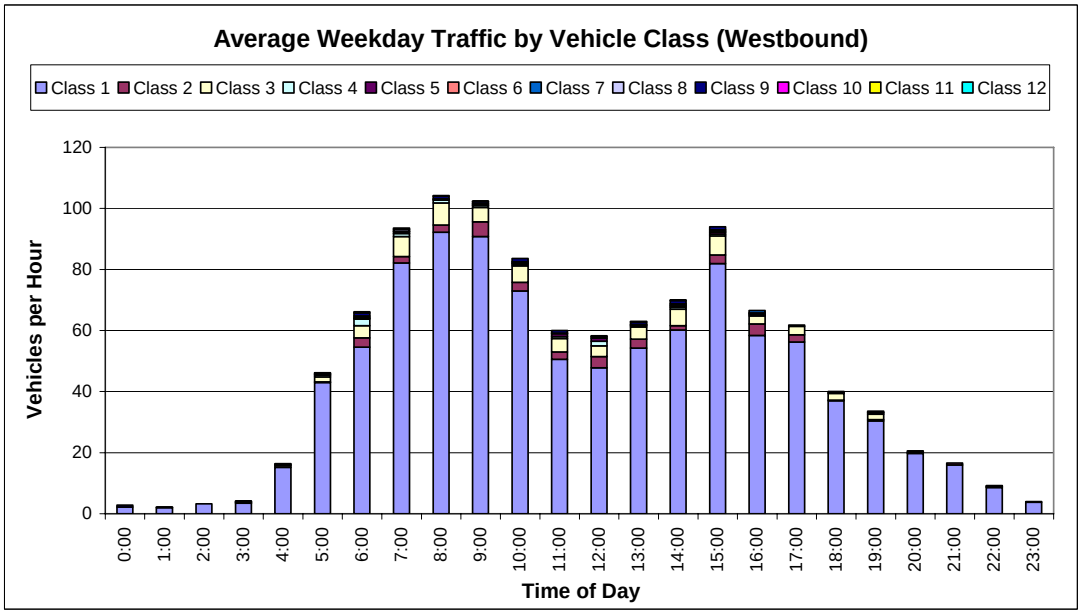


Figure 2-7: Average weekday traffic by vehicle class (westbound) on Hue Hue Road at Sydney-Newcastle Freeway overpass

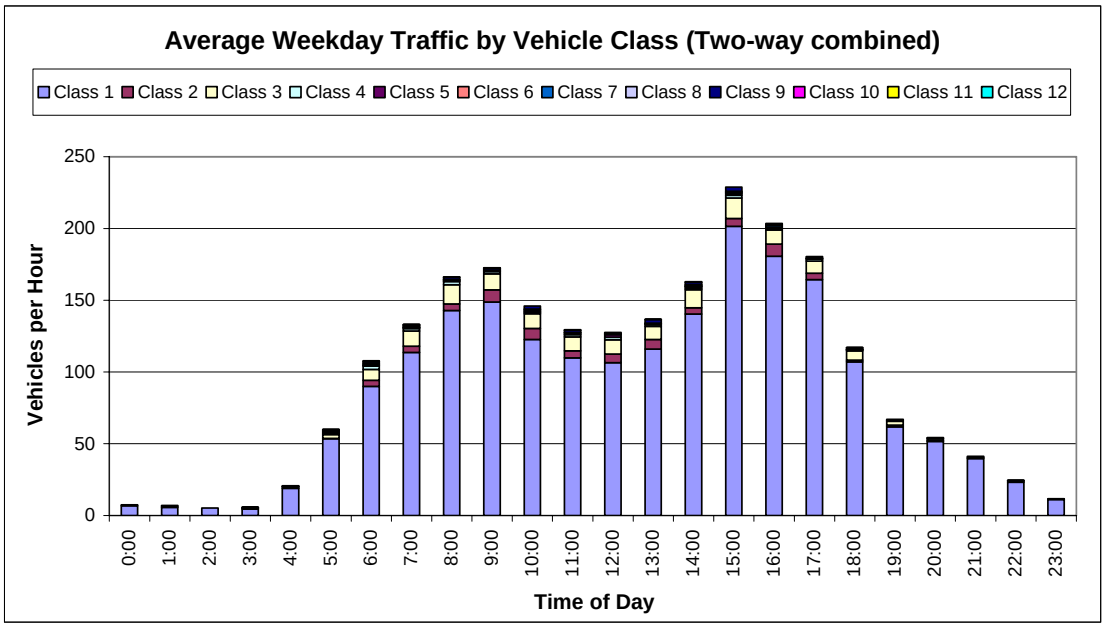


Figure 2-8: Average weekday traffic by vehicle class (two-way combined) on Hue Hue Road at Sydney-Newcastle Freeway overpass

At Bushells Ridge Road at Sydney-Newcastle Freeway overpass, the average weekday traffic (AWT) volume is 187 vpd. The classification count shows that of the 187 vehicles:

- 78 percent (or 146 vehicles) were light vehicles including cars, vans, car towing boat, etc (Classes 1 and 2)
- 20 percent (or 38 vehicles) were rigid trucks and buses (Classes 3, 4 and 5)
- 2 percent (or 3 vehicles) were articulated trucks with three to six axles (Classes 6, 7, 8 and 9)
- none were B-Doubles (Classes 10, 11 and 12).

The vehicle compositions are similar in both directions. However, it should be noted that Class 3 vehicles (two axle truck or bus) have the second highest number of vehicle count through the day in both directions after Class 1 vehicles (passenger cars).

The average weekday traffic by vehicle class for eastbound, westbound and two-way combined traffic on Bushells Ridge Road at Sydney-Newcastle Freeway overpass are presented graphically in Figure 2-9, Figure 2-10 and Figure 2-11, respectively.

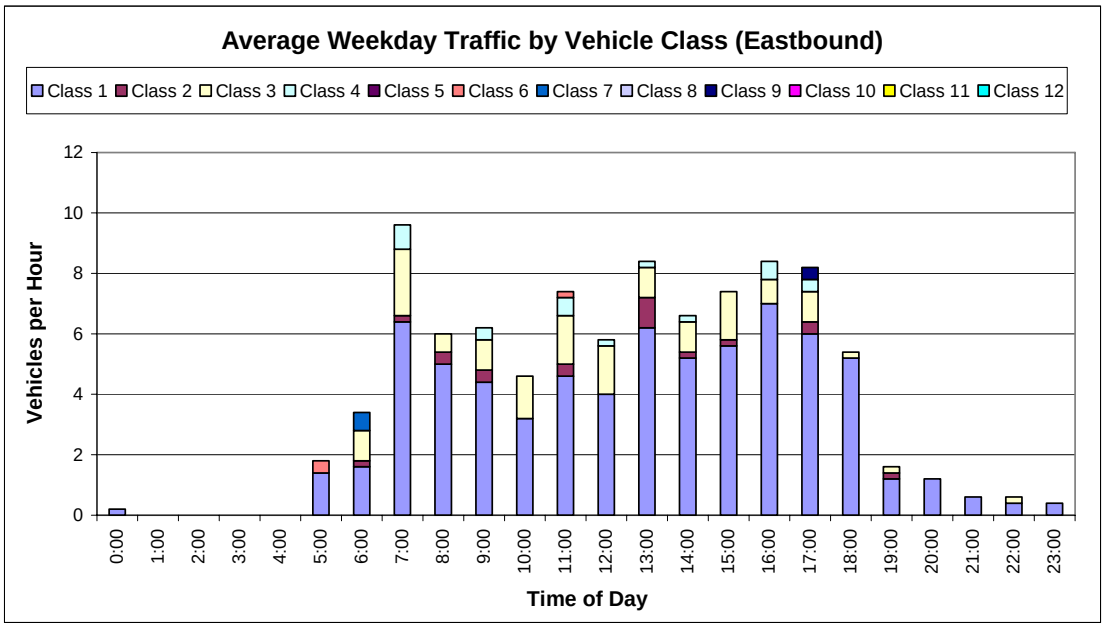


Figure 2-9: Average weekday traffic by vehicle class (eastbound) on Bushells Ridge Road at Sydney-Newcastle Freeway overpass

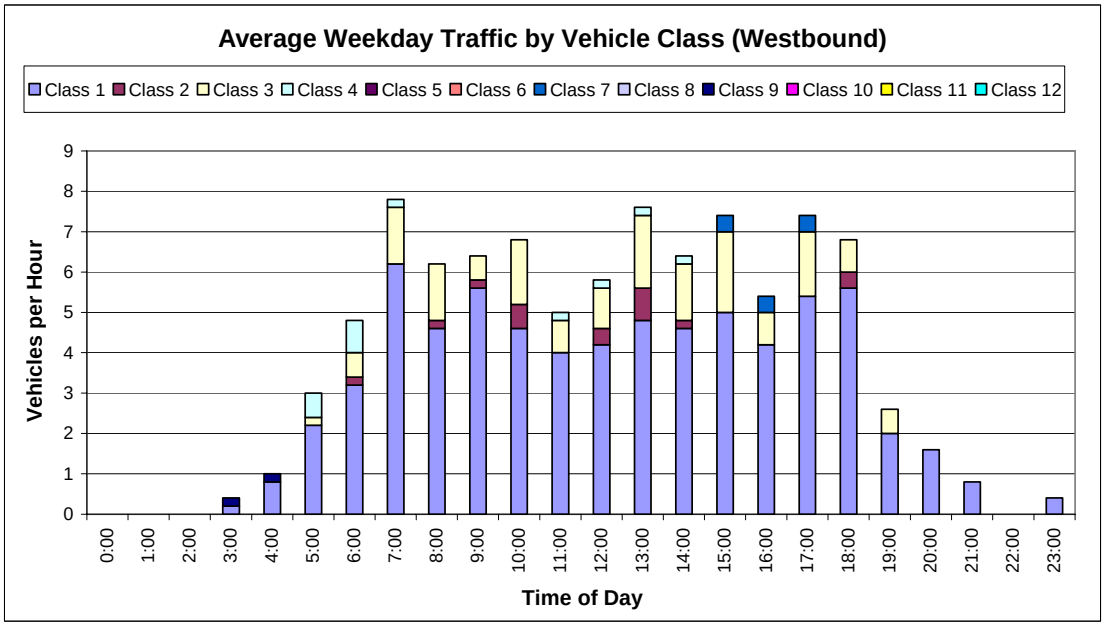


Figure 2-10: Average weekday traffic by vehicle class (westbound) on Bushells Ridge Road at Sydney-Newcastle Freeway overpass

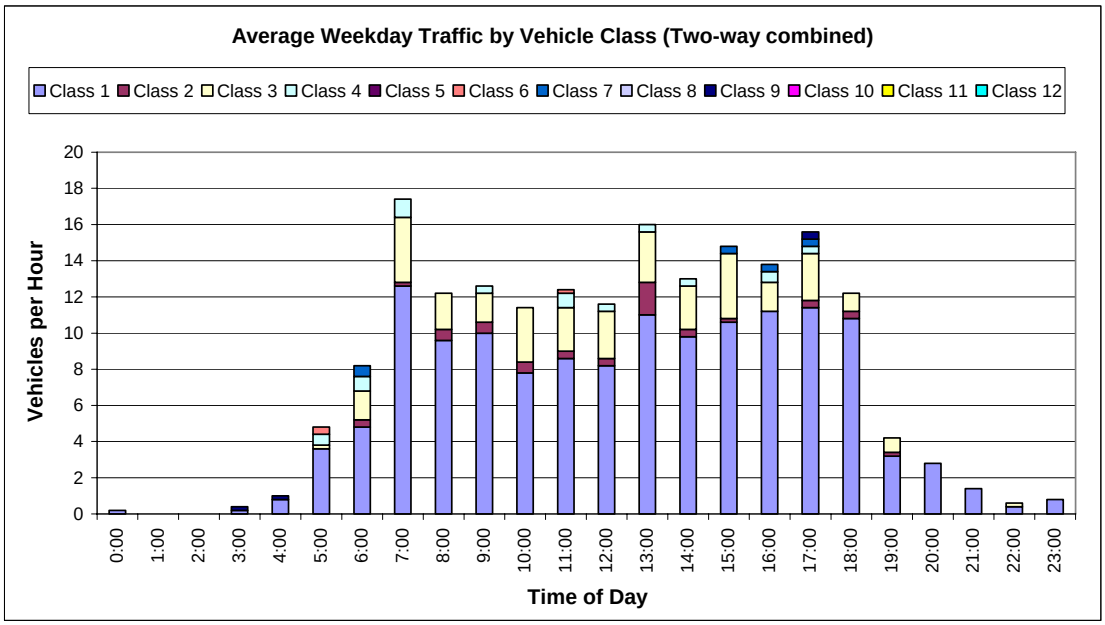


Figure 2-11: Average weekday traffic by vehicle class (two-way combined) on Bushells Ridge Road at Sydney-Newcastle Freeway overpass

2.2.3 Intersection turning movement survey

PB commissioned traffic counts as part of this study at the following intersections:

- Sydney-Newcastle Freeway – Sparks Road interchange
- Sparks Road – Hue Hue Road
- Hue Hue Road – Wyee Road
- Gosford Road – Wyee Road
- Motorway Link – Tooheys Road interchange.

The surveys were conducted during the period of 29 November 2006 and 13 December 2006 for the morning peak (6:00AM to 9:30AM) and the afternoon peak (3:30PM to 7:00PM) at each intersection.

Table 2-3: Traffic survey information at five key intersections

	Intersections	Survey dates	Survey times	Peak hours
	Sydney-Newcastle Fwy / Sparks Rd interchange	13 December 2006	6:00AM – 9:30AM	8:00AM – 9:00AM
			3:30PM – 7:00PM	4:30PM – 5:30PM
	Sparks Rd / Hue Hue Rd	29 November 2006	6:00AM – 9:30AM	8:15AM – 9:15AM
			3:30PM – 7:00PM	4:30PM – 5:30PM
	Hue Hue Rd / Wyee Rd	29 November 2006	6:00AM – 9:30AM	8:15AM – 9:15AM
			3:30PM – 7:00PM	3:30PM – 4:30PM
	Gosford Rd / Wyee Rd	29 November 2006	6:00AM – 9:30AM	7:15AM – 8:15AM
			3:30PM – 7:00PM	3:30PM – 4:30PM
	Motorway Link Rd/ Tooheys Rd interchange	29 November 2006	6:30AM – 10:00AM	7:30AM – 8:30AM
			3:30PM – 7:00PM	4:30PM – 5:30PM

Figure 2-12 shows the morning and afternoon peak hour intersection turning movement volumes at the five key intersections surveyed. The afternoon peak hour movements are shown in parenthesis. The traffic volumes in this figure are in vehicles per hour (vph).

From the survey results, it can be seen that two-way peak hour volumes on Sparks Road are in the order of 500 vph (east of Hue Hue Road) to 1,500 vph (east of Sydney-Newcastle Freeway). Assuming that the peak hour volume is between 8 to 12 percent of the daily volumes, this translates to a daily traffic volume in range of 5,000 vehicles per day (vpd) to 15,000 vpd. The results also indicate that Sparks Road has a dominant peak direction: eastbound in the afternoon peak period and westbound in the morning peak period.

The survey results also indicate that two-way peak hour volumes on Hue Hue Road are in the order of 200 vph to 250 vph, which is equivalent to 2,000 vpd to 2,500 vpd using the same conversion factor from peak hour to daily volume as above. Similar to Sparks Road, the results also indicate that Hue Hue Road has a dominant peak direction: northbound in the afternoon peak period and southbound in the morning peak period.

From the survey results, it can also be seen that two-way peak hour volumes on Wyee Road are in the order of 500 vph to 650 vph, which is equivalent to 5,000 vpd to 6,500 vpd using the same conversion factor from above. This is significantly lower than the expected traffic volume for a main road.

Both Gosford Road and Tooheys Road carry substantially less traffic in the range of 10 vph to 40 vph.

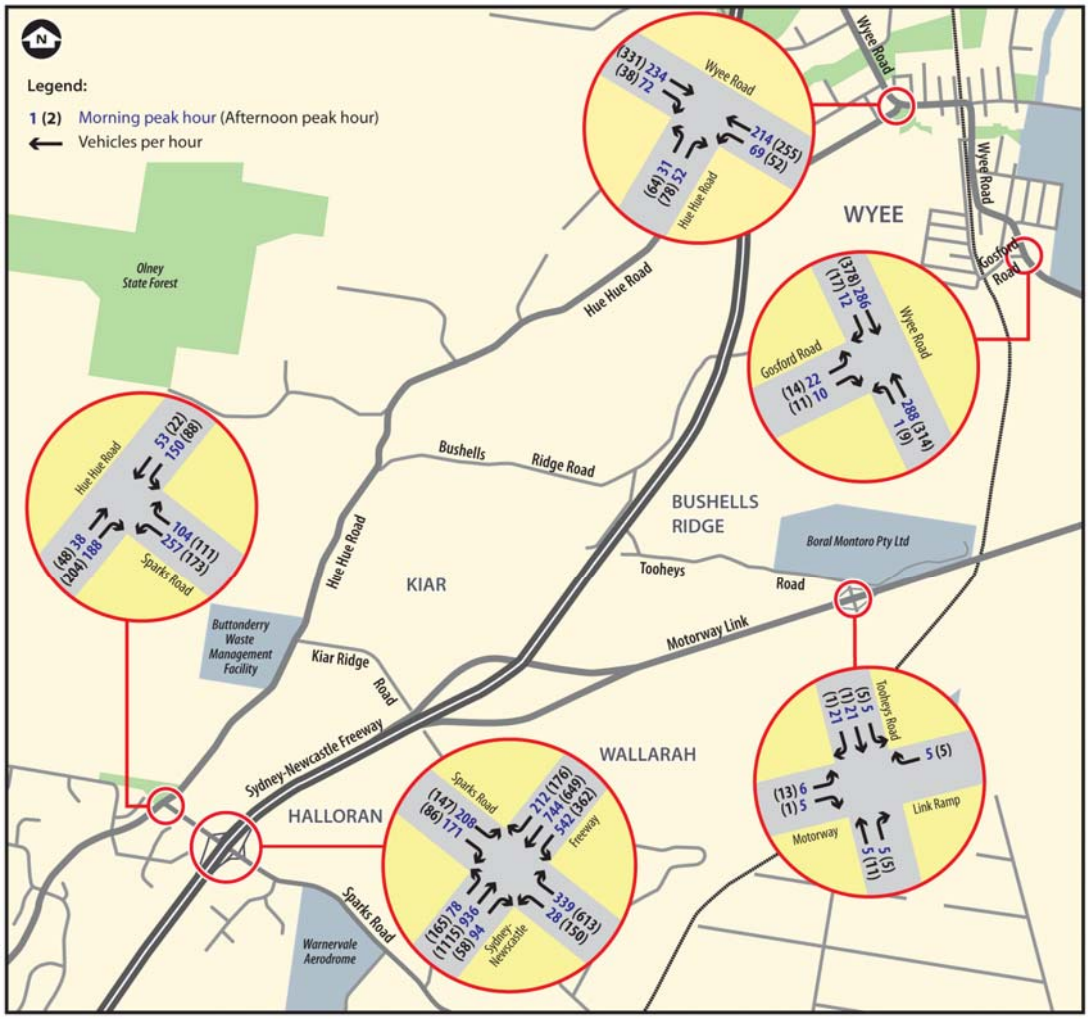


Figure 2-12: Existing peak hour intersection volumes (vph)

3. Proposed development

3.1 The proposal

The Wallarah No. 2 Coal Project (W2CP) is located within the western area of the Wyong Coal Development Area. The proposed mine site is located within the local government area of Wyong Shire Council. WACJV is proposing to extract coal from the W2CP mine at a rate of up to five million tonnes per annum for a period of approximately 40 years.

The mine site would comprise of two site areas – Tooheys Road and Buttonderry sites. The Buttonderry site would be used for the main office facilities and point of access to the mine. The Tooheys Road site would have facilities for the raw coal storage, finished product stock piling, and rail loop and loading infrastructure. Exploratory work indicated that the coal is located approximately 500m below ground level. The coal would be extracted using the longwall mining method involving a series of underground roadways below the Buttonderry site. The coal would then be removed by a conveyor along the drift line bringing the coal to the surface at the Tooheys Road site. The location of the sites can be seen in Figure 2-1.

3.2 Site vehicle access

It is proposed to access the sites via the access points as shown in Table 3-1. The likely routes taken by construction vehicles, employee traffic and delivery and service vehicles during the construction and operating phases are also shown in Table 3-1:

Table 3-1: Site access points and access routes

Site	Main Access Point	Access to / from via			
		North	South	East	West
Tooheys Road	Off Motorway Link Road to Tooheys Road	F3 Freeway, turn back via Sparks Road	F3 Freeway	Motorway Link Road	Bushells Ridge Road and Tooheys Road
Buttonderry	Off Hue Hue Road, directly north of intersection with Sparks Road	Hue Hue Road / F3 Freeway	Hue Hue Road / F3 Freeway	Sparks Road	Sandra Street
Western Shaft (construction phase only)	Off Little Jilliby Road	Jilliby Road	Jilliby Road, Hue Hue Road	Jilliby Road, Hue Hue Road	Little Jilliby Road

3.3 Method of coal transport

It is proposed to transport all coal removed during operation of the mine by rail. Coal will be transported to the north, either to the Port Newcastle for export to overseas, or used by domestic power stations also serviced by rail. Therefore, road based traffic movements would primarily be generated by the construction activity and the workforce, deliveries and service vehicles when the mine is in operation.

4. Projected traffic

4.1 Predicted traffic during construction

For the purpose of traffic assessment, an indicative construction plan and method is outlined in this report for the civil works associated with the surface infrastructure at the sites: Tooheys Road Site, Buttonderry Site, and Western Shaft Site.

It is expected that most spoil excavated during construction will largely remain on-site. The most spoil will be generated at the Tooheys Road site however this will be reused on site. There is the potential for the removal of 13, 660 cubic metres of spoil from the Buttonderry site to the Tooheys Road site over its construction period of 26 months. The Western Shaft, which will not be required until around year 10 of mining, will generate 5600 cubic metres of spoil over its construction period of 60 weeks.

The worst case concrete pour is expected to be for the construction of the drift invert road slab at the Tooheys Road site. This will require 2000 cubic metres of concrete to be delivered over a 10 week period. This works out at a weekly delivery of 34 concrete trucks per week. For the sake of the analysis it has been assumed that 50 concrete trucks would arrive per week. The estimated construction traffic from each of the three sites for different vehicle types is shown in Table 4-1. It should be noted that whilst the Tooheys Road and Buttonderry sites would be undergoing construction at the same time, the Western shaft site is not expected to be under construction until around year 10 of mining.

Table 4-1: Estimated Construction Traffic

Site	Vehicle Type	Number/ day	Number /day (PCU)*
Tooheys Road	Light (employees)	150	150
	Light (deliveries)	60	60
	Rigid Truck	20	40
	Articulated Truck	20	70
	Total		320
Buttonderry	Light (employees)	75	75
	Light (deliveries)	40	40
	Rigid Truck	10	20
	Articulated Truck	20	70
	Total		205
Western Shaft	Light (employees)	25	25
	Light (deliveries)	10	10
	Rigid Truck	5	10
	Articulated Truck	5	18
	Total		63

*Passenger car units (PCU) are as calculated from Table 4-3.

Equipment and vehicles that potentially would need to be delivered and would be operating on any of the sites during the construction period are as follows:

- 30-45T Excavators, D6-D10 dozers, shotcrete robot, rockbolting machine, flat bed trucks, mobile cranes, haul trucks, concrete trucks, concrete pump truck, roadheader (approx. 300kW power rating), tipper trucks, 15t bogie trucks, graders, 10t vibratory rollers, 815-825 compactor, skidsteer loaders, asphalt pavers, water carts, Tack laying machine, tamping machine, ballast regulator, rail grinding machine, hi-rail excavator with sleeper grabs, forklifts, drill rig.

4.1.1 Tooheys Road site

Construction at the Tooheys Road site is expected to commence in the last quarter of 2009, and take approximately 12 months to complete. Construction elements for the Tooheys Road site can be spilt into the following groups:

- decline tunnel
- civil infrastructure
- rail loop and spur
- administration buildings and facilities
- mine operations dam and reverse osmosis plant.

Construction vehicle traffic would be at the highest intensity during the main earthworks and civil construction as follows:

- access to the work areas would be provided off Tooheys Road and by the existing vehicle gates along the railway corridor
- construction materials such as premix concrete, reinforcement, concrete blocks, ballast, sleepers, pavement materials, portal/culvert/bridge units would be transported to the work areas using trucks, concrete mixers and excavators
- construction vehicle traffic would generally travel by the most direct route; however consideration would be given to RTA road weight restrictions, bridge height clearances and sensitive land uses
- the workforce would arrive in their cars and would park at or near the work area. Traffic movements related to the workforce would be limited to personal journeys (i.e. for lunch) and trips to a trade store for building materials.

4.1.2 Buttonderry site

Construction at the Buttonderry site is expected to commence in the last quarter of 2009, and take approximately 2 years to complete. Construction elements for the Buttonderry Road site can be spilt into the following groups:

- shaft construction
- pit top facilities and associated infrastructure.
- Upgrade of the existing power supply and HV power to the site and other services to the site.

Construction vehicle traffic would be at the highest intensity during the main earthworks and buildings works as follows:

- access to the work areas would be provided off Hue Hue Road
- construction materials such as reinforcement and pre-fabricated units for lining the shaft, pavement gravels and culvert units would be transported to the work areas using trucks.
- the workforce would arrive in their cars and would park at or near the work area. Traffic movements related to the workforce would be limited to personal journeys (i.e. for lunch) and trips to a trade store for building materials.

4.1.3 Western Shaft site

Due to the location of the shaft in relation to the underground workings, the shaft will be constructed at a later date, but some time prior to year 10 of mining when it will be required. Construction is expected to take approximately 60 weeks to complete. Construction would be carried out in the following stages:

Stage 1: Partial upgrade of Brothers Forest Road

Stage 2: Construction of 5m diameter 485m deep concrete lined ventilation shaft

Stage 3: Installation of car winder and erection of associated buildings

Construction traffic would access the work area off Little Jilliby Road. It would be preferable for Brothers Forest Road to be closed whilst it is upgraded and the ventilation shaft is constructed. This would have to be agreed with the relevant authorities.

Excess material from the shaft excavation would have to be taken off site by road. At this stage the destination of this material has not been identified however efforts would be made to minimise the construction traffic on the local road network.

4.1.4 Construction Traffic Management

Traffic Management Plans would be developed for the construction of rail bridges for the new rail spur line crossing over Tooheys Road. The proposed Traffic Management Plans would include the following matters that are outlined in the Roads and Traffic Authority's Procedures for use in the Preparation of a Traffic Management Plan (2001) and the Australian Standard 1742.3 – 2002 Manual of Uniform Traffic Control Devices, Part 3: Traffic Control Devices for Works on Roads:

- a description or detailed plan of the proposed works
- identification and assessment of the expected traffic impacts of the proposed works
- an assessment of impacts to any affected public transport services
- details of all provisions made for emergency vehicles, heavy vehicles, cyclists and pedestrians
- measures to ameliorate the expected impacts.

In addition to the proposed Traffic Management Plans and Traffic Management Reports, it is also proposed that Traffic Control Plans be prepared for all works that would take place in the road or that would affect trafficable areas in accordance with the RTA's Traffic Control at Work Sites Guidelines, 2003 or its future equivalent.

4.2 Predicted traffic during mine operation

All movements of coal from the site would be undertaken by rail. Therefore under normal day-to-day operation, the site would only generate external traffic accessing Hue Hue Road and the Motorway Link Road. The external traffic during operation is expected to be from employee, service and delivery vehicles.

WACJV has provided an initial estimate of the maximum traffic that would be generated by the proposed mine in a typical week through out the life of the mine under the normal day-to-day operation.

4.2.1 Employee traffic

It is anticipated that the two proposed mine sites would generate up to 300 full-time positions. It is assumed that approximately 70% of employment opportunities would be taken by local applicants from the Central coast.

The proposed hours of operation for the coal mine would be 24 hours per day, seven days per week. Shut downs may occur from time to time to allow for major equipment upgrades. On-site employees will likely be rostered over three daily working shifts as shown in Table 4-2.

Table 4-2: Predicted number of staff under normal operation

Shift	Times	Number of staff at sites	
		Buttonderry site	Tooheys Road site
Day	7:00AM to 3:00PM	120	15
Afternoon	3:00PM to 11:00PM	80	5
Evening	11:00PM to 7:00AM	80	3
Total		280	18

NOTE: dayshift includes mine workers and day time staff

None of these shifts would generate significant employee traffic movements on and off the site during traditional traffic peak periods.

4.2.2 Service and delivery traffic

According to the proponent service vehicles and deliveries are expected to be as follows:

- stores deliveries, 3 articulated trucks per week to Buttonderry site and 2 per week to Tooheys Road site
- removal of waste, 1 semi trailer from the Tooheys Road site per week.

However it is expected that there will be a number of smaller delivery and service vehicles operating throughout the week. The analysis in Section 5 considers a worst case scenario of up to 10 service and delivery vehicles arriving in the peak hour.

Heavy vehicles are known to have adverse impact on roadway capacity due to their poorer ability to handle grades, overtaking and acceleration relative to passenger cars. In order to accurately model the traffic impact of the proposed use on this site, and to take into account the impact of heavy vehicles, all heavy vehicles were converted into equivalent passenger car units (PCU) using the factors shown in Table 4-3 below.

Table 4-3: PCU Factors

Vehicle Types	PCU Factors
Light	1.0
Heavy Rigid	2.0
Articulated	3.5
B-Double	4.0

5. Traffic impact and analysis

5.1 Trip generation

During the construction period of the proposed mine sites, it was assumed during the morning peak hour, all inbound trips would be made up of construction workers entering the sites. Similarly during the afternoon peak hour, all outbound trips would be made up of construction workers leaving the sites. The estimated construction vehicle trips for Buttonderry and Tooheys Road sites are 100 vehicles per day (vpd) and 70 vpd, respectively. It was assumed that construction vehicle trips would be made throughout the day and would be equally distributed between 8 hour period. It is estimated that 13 and 9 construction vehicles are assumed to enter and leave the sites during the morning and afternoon peak periods. Table 5-1 shows the number of trips generated by the proposed mine sites during the construction period.

Table 5-1: Inbound and outbound trips during construction period

Mine sites	Morning peak hour			Afternoon peak hour		
	Inbound	Outbound	Total	Inbound	Outbound	Total
Buttonderry site –						
Workforce trips	150	-	150	-	150	150
Construction vehicles	13	13	26	13	13	26
Total	163	13	176	13	163	176
Tooheys Road site –						
Workforce trips	75	-	75	-	75	75
Service vehicles	9	9	18	9	9	18
Total	84	9	93	9	84	93

Traffic generated through the operation of the proposed mine has been estimated on employment trips and service and delivery traffic generated by the development, based on *the RTA Guide to Traffic Generating Developments*. A conservative rate of 1.0 per peak hour was assumed for employment trips, based on the characteristics of the local area and the lack of public transport in the vicinity of the subject sites. It is possible that as the surrounding industrial zone develops in the future, public transport in the area will improve.

Under the normal day-to-day operation, it was assumed during the morning peak hour, all inbound trips would be made up of employees and dayshift mine workers entering the sites and all outbound trips would be of nightshift mine workers leaving the sites. Similarly during the afternoon peak hour, all inbound trips would be made up of afternoon shift mine workers entering the sites and all outbound would be of employees and dayshift mine workers leaving the sites. As a conservative approach, 10 service and delivery vehicles are assumed to enter and leave the sites during the morning and afternoon peak periods. Table 5-2 shows the number of trips generated by the proposed mine sites under the normal day-to-day operation.

Table 5-2: Inbound and outbound trips under normal operation

Mine sites	Morning peak hour			Afternoon peak hour		
	Inbound	Outbound	Total	Inbound	Outbound	Total
Buttonderry site –						
Workforce trips	120	80	200	80	120	200
Service vehicles	10	10	20	10	10	20
Total	130	90	220	90	130	220
Tooheys Road site –						
Workforce trips	15	3	18	5	15	20
Service vehicles	10	10	20	10	10	20
Total	25	13	39	15	25	40

5.2 Trip distribution

5.2.1 Construction condition

During the construction period, it is assumed that the trip distribution of the construction workers would be the same as the distribution of employee trips under the normal day-to-day operation, which is mentioned previously.

For the construction vehicle, the following assumptions have been made for the distribution of the trips in and out of the proposed mine sites.

For Buttonderry site, the construction vehicle trips would be made up of:

- 10% to/from North using Sydney-Newcastle Freeway/Sparks Road/Hue Hue Road
- 20% to/from South using Sydney-Newcastle Freeway/Sparks Road/Hue Hue Road
- 35% to/from East using Sparks Road/Hue Hue Road
- 35% to/from East using Motorway Link/Sparks Road/Hue Hue Road.

For Tooheys Road site, the trips would be made up of:

- 10% to/from North using Sydney-Newcastle Freeway/Motorway Link/Tooheys Road
- 20% to/from South using Sydney-Newcastle Freeway/Motorway Link/Tooheys Road
- 35% to/from East using Sparks Road/ Sydney-Newcastle Freeway/Motorway Link/Tooheys Road
- 35% to/from East using Motorway Link/Tooheys Road.

5.2.2 Normal day-to-day operation

Under the normal day-to-day operation, the following assumptions have been made for the distribution of the workforce trips in and out of the proposed mine sites.

For Buttonderry site, the trips would be made up of:

- 35% to/from North using Sydney-Newcastle Freeway/Sparks Road/Hue Hue Road
- 30% to/from South using Sydney-Newcastle Freeway/Sparks Road/Hue Hue Road
- 15% to/from East using Sparks Road/Hue Hue Road
- 10% to/from North using Wyee Rd/Hue Hue Road
- 10% to/from South using Hue Hue Road.

For Tooheys Road site, the access to and from the north of the site such as Lake Macquarie is not well served using Sydney-Newcastle Freeway as there is no turnoff at the Motorway Link Road for southbound traffic. The southbound traffic would need to use the Sparks Road ramp then travel northbound on Sydney-Newcastle Freeway to turnoff at Motorway Link to access the Tooheys Road site. This would be the same for outbound traffic to travel to Lake Macquarie using Sydney-Newcastle Freeway.

The trips would be made up of:

- 35% to/from North using Sydney-Newcastle Freeway/Motorway Link/Tooheys Road
- 30% to/from South using Sydney-Newcastle Freeway/Motorway Link/Tooheys Road
- 30% to/from East using Sparks Road/ Sydney-Newcastle Freeway/Motorway Link/Tooheys Road
- 5% to/from North using Wyee Rd/Hue Hue Road/Bushells Ridge Road/Tooheys Road.

Since the estimated number of trips for both the morning and afternoon peak periods are less than 30 vehicular trips per hour for Tooheys Road site, 30% additional trips are assumed to be travelling to and from east of Motorway Link as a conservative approach.

For all service and delivery traffic, it is assumed to use Sydney-Newcastle Freeway to access to and from the proposed mine sites.

5.3 Assessment criteria

The operation of key intersections in the immediate vicinity of the subject site was assessed using the aaSIDRA (SIDRA) intersection simulation software. SIDRA calculates intersection performance measures such as:

- level of service
- degree of saturation
- average delay
- maximum queue length.

Level of Service

Level of service (LoS) is one of the basic performance parameters used to describe the operation of an intersection. The levels of service range from A (indicating good intersection operation) to F (indicating over saturated conditions with long delays and queues). At signalised and roundabout intersections, the LoS criteria are related to average intersection delay (seconds per vehicle). At priority controlled intersections, the LoS is based on the average delay (seconds per vehicle) for the worst movement.

Table 5-1: Level of Service Criteria for Intersections

Level of Service	Average Delay (seconds per vehicle)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and 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	Greater than 71	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; requires other control mode

Source: RTA Guide to Traffic Generating Developments, 2002

Degree of Saturation

Degree of saturation (DoS) is defined as the ratio of demand flow to capacity, and therefore has no unit. As it approaches 1.0, extensive queues and delays could be expected. For DoS greater than 1.0, a small increment in traffic volumes would result in an exponential increase in delays and queue length. For a satisfactory situation, the DoS should be less than the nominated practical degree of saturation, usually 0.9. The intersection DoS is based on the movement with the highest ratio for all types of intersection.

Average Delay

Delay is the difference between interrupted and uninterrupted travel times through the intersection and is measured in seconds per vehicle. The delays include queued vehicles decelerating and accelerating to and/or from stop, as well as delays experienced by all vehicles negotiating the intersection. At signalised and roundabout intersections, the average intersection delay is usually reported and is taken as the weighted average delay by summing the product of the individual movement traffic volume and its corresponding calculated delays and dividing by the total traffic volume at the intersection. At priority controlled intersections, the average delay for the worse movement is usually reported.

Maximum Queue Length

Queue length is the number of vehicles waiting at the stop line and is usually quoted as the 95th percentile back of queue, which is the value below which 95 percent of all observed queue lengths fall. It is measured as the number of vehicles per traffic lane at the start of the green period, when traffic starts moving again after a red signal. The intersection queue length is usually taken from the movement with the longest queue length.

5.4 Intersection analysis results

5.4.1 Existing condition

The performance of the road network is largely governed by the ability of the key intersections of the road network to accommodate the traffic demand. In this regard, the key intersections within the vicinity of the proposed mine sites are as follows:

- Sydney-Newcastle Freeway – Sparks Road interchange
- Sparks Road – Hue Hue Road
- Hue Hue Road – Wyee Road
- Gosford Road – Wyee Road
- Motorway Link – Tooheys Road interchange.

The performance of the intersections was analysed using SIDRA based on the existing surveyed traffic volumes shown in Figure 2-12. The results from the analysis are presented in Table 5-4.

Table 5-2: Existing intersection performance

	Intersection Name	Peak period	Ints Control Type	Ints DOS	Delay (sec)	Ints LOS	Queue (m)
	Sydney-Newcastle Fwy Ramp/Sparks Rd	Morning	Priority	0.47	16	B	25
		Afternoon	Priority	0.75	22	B	80
	Hue Hue Rd/Sparks Rd	Morning	Priority	0.36	10	A	10
		Afternoon	Priority	0.24	10	A	6
	Hue Hue Rd/Wyee Rd	Morning	Priority	0.13	12	A	3
		Afternoon	Priority	0.18	13	A	5
	Wyee Rd/Gosford Rd	Morning	Priority	0.16	12	A	1
		Afternoon	Priority	0.20	13	A	1
	Tooheys Rd/Motorway Link Ramp	Morning	Priority	0.01	9	A	0
		Afternoon	Priority	0.02	9	A	0

From the results shown in Table 5-4, it can be seen that all intersections analysed currently operate at LoS B or better during both morning and afternoon peak periods. Traffic travelling through these intersections can be expected to experience delays in the order of 25 seconds or less at each intersection for both the morning and afternoon peak periods. The majority (all but one) of intersections currently operate with low degree of saturation, less than 0.5 (i.e. there is ample spare capacity) with short queue length, in the order of 10 m or less.

The critical movements at Sydney-Newcastle Freeway ramps/Sparks Road interchange are the right turn movements from northbound and southbound freeway exit ramps to Sparks Road for both the morning and afternoon peak periods. For all other movements at the interchange, the degree of saturation is less than 0.5 with short queue length of 20 m or less and the delays in the order of 25 seconds or less for both the morning and afternoon peak periods.

5.4.2 Future (2016) base condition

To accurately test the traffic impact on the surrounding road network due to the proposed development, intersection analysis is performed for the future (2016) base condition without the generated traffic from the developments. As previously mentioned in Section **Error! Reference source not found.**, the average growth rate on the nearby road is approximately 4% per annum for the previous 10 year period. As a conservative approach a global 4% increase per annum was applied to the surveyed intersection movements and shown in Figure 5-1.

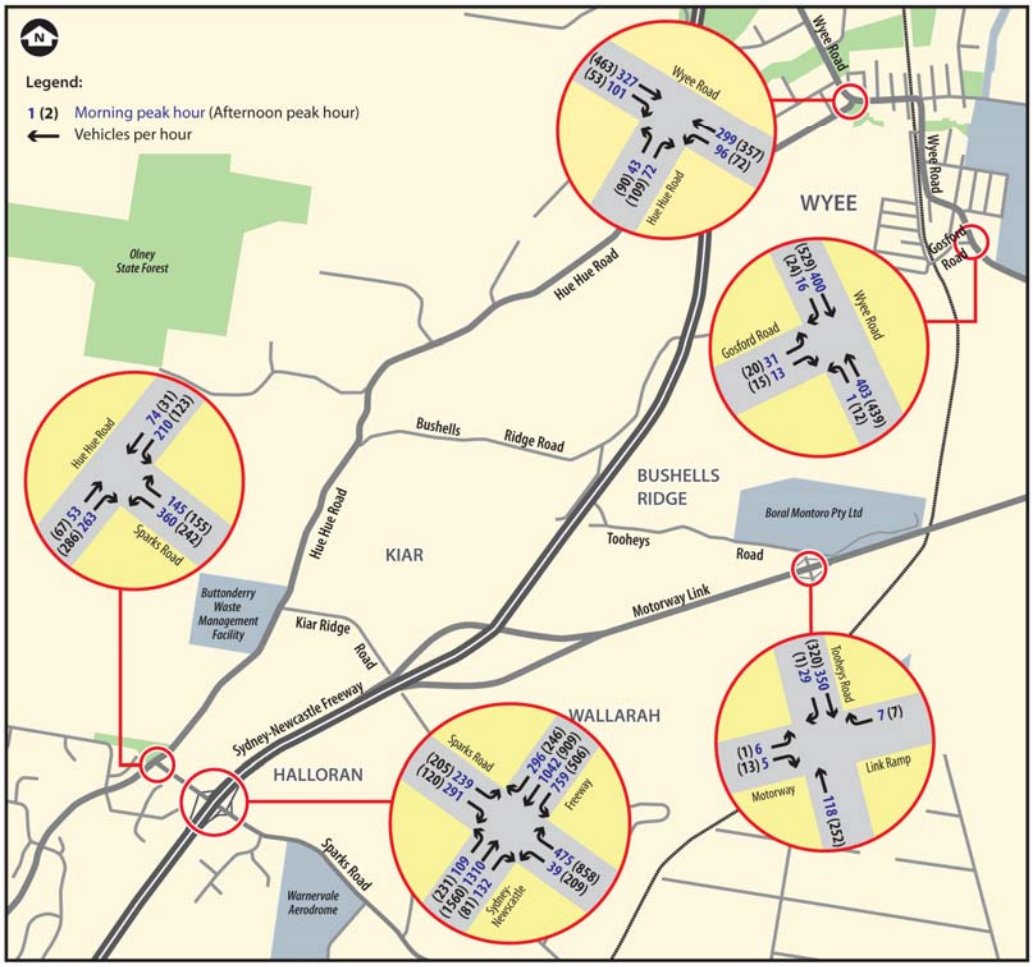


Figure 5-1: Future base (no development) peak hour intersection volumes (vph)

The results from the analysis are presented in Table 5-5.

Table 5-3: Future base (no development) intersection performance

	Intersection Name	Peak period	Ints Control Type	Ints DOS	Delay (sec)	Ints LOS	Queue (m)
	Sydney-Newcastle Fwy Ramp/Sparks Rd	Morning	Priority	0.95	56	D	92
		Afternoon	Priority	> 1.40	>70	F	843
	Hue Hue Rd/Sparks Rd	Morning	Priority	0.52	12	A	21
		Afternoon	Priority	0.34	11	A	9
	Hue Hue Rd/Wyee Rd	Morning	Priority	0.18	15	A	5
		Afternoon	Priority	0.29	18	B	10
	Wyee Rd/Gosford Rd	Morning	Priority	0.22	15	A	1
		Afternoon	Priority	0.29	17	B	1
	Tooheys Rd/Motorway Link Ramp	Morning	Priority	0.02	9	A	0
		Afternoon	Priority	0.02	9	A	1

Intersection analysis result for the future base condition show that all but one intersection would operate at LoS B or better during both the morning and afternoon peak periods. The expected delay at all other intersections are in the order of 20 seconds or less with short queue length, in the order of 25 m or less for both the morning and afternoon peak periods.

It is important to acknowledge that even without the development traffic Sydney-Newcastle Freeway/Sparks Road interchange would operate at LoS F with long delays and queuing during afternoon peak period. Subsequently, Sydney-Newcastle Freeway/Sparks Road interchange would need to be upgraded prior to the year 2016 to accommodate the background traffic growth.

5.4.3 Post development condition

Intersection analysis for the five key intersections and the newly created intersections on Hue Hue Road and Tooheys Road are repeated for the post development scenario. The predicted traffic by the proposed mine sites using the trip generation rate and distribution assumptions in Section 5.2.1 are superimposed on the future (2016) base traffic shown in Figure 5-1. Figure 5-2 shows the intersection turning movements for the morning and afternoon peak hours under normal day-to-day conditions.

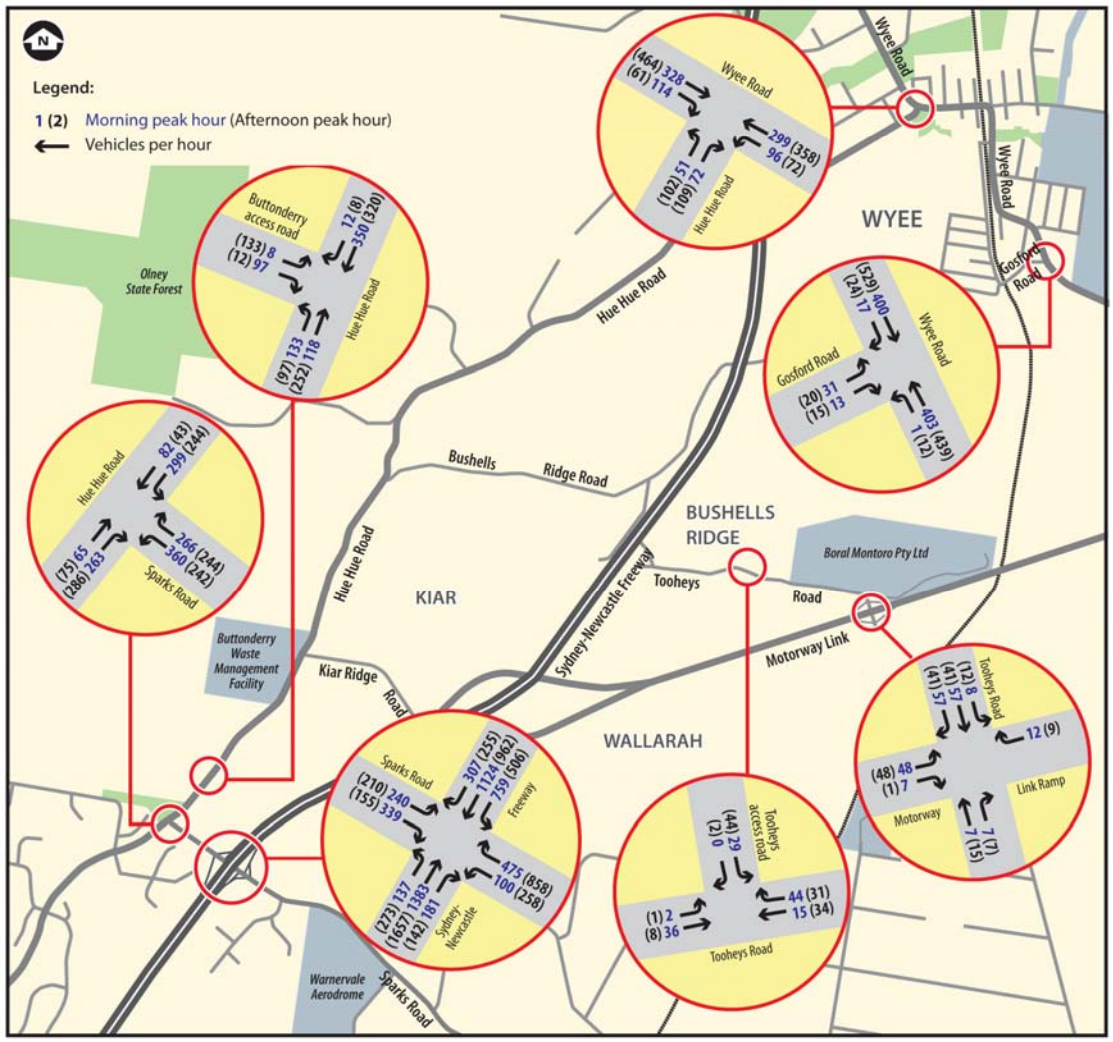


Figure 5-2: Predicted peak hour traffic under normal day-to-day condition (vph)

The intersection analysis results for the post development conditions are summarised in Table 5-6.

Table 5-4: Future intersection performance

	Intersection Name	Peak period	Ints Control Type	Ints DOS	Delay (sec)	Ints LOS	Queue (m)
	Sydney-Newcastle Fwy Ramp/Sparks Rd	Morning	Priority	1.14	>70	F	273
		Afternoon	Priority	> 1.40	>70	F	>1km
	Hue Hue Rd/Sparks Rd	Morning	Priority	0.53	14	A	25
		Afternoon	Priority	0.39	13	A	18
	Hue Hue Rd/Wyee Rd	Morning	Priority	0.18	15	B	5
		Afternoon	Priority	0.30	18	B	10
	Wyee Rd/Gosford Rd	Morning	Priority	0.22	15	A	1
		Afternoon	Priority	0.29	17	B	1
	Tooheys Rd/Motorway Link Ramp	Morning	Priority	0.07	9	A	1
		Afternoon	Priority	0.07	9	A	1
	Hue Hue Rd/Buttonderry Access Rd	Morning	Priority	0.20	12	A	14
		Afternoon	Priority	0.27	14	A	14
	Tooheys Rd/Tooheys Access Rd	Morning	Priority	0.04	9	A	2
		Afternoon	Priority	0.04	9	A	2

Table 5-6 shows that Sydney-Newcastle Freeway/Sparks Road interchange would operate at LoS F with long delays and queuing during both the morning and afternoon peak periods. For both peak periods, the long delay and queue would be experienced at the freeway exit ramps as the through movements along the Sparks Road interchange would exceed 1,300 vehicles per hour (vph) and 1,700 vph for the morning and afternoon peak periods, respectively. As mentioned previously, Sydney-Newcastle Freeway/Sparks Road interchange would need to be upgraded to accommodate both the background traffic growth and the development generated traffic.

From the results shown in Table 5-6, it can be seen that all intersections analysed would operate at LoS B or better during both morning and afternoon peak periods, except for one intersection, Sydney-Newcastle Freeway/Sparks Road. The expected delay at all other intersections are in the order of 20 seconds or less for both the morning and afternoon peak periods. Similar to the existing conditions, the majority (all but one) of intersections currently operate with low degree of saturation, less than 0.55 with short queue length, in the order of 25 m or less.

As can be seen from the results, the newly created intersections formed by the Buttonderry access with Hue Hue Road and Tooheys access with Tooheys Road would operate with LoS A with ample capacity and minimal delays and queue for both peak periods analysed.

5.4.4 Construction conditions

Intersection analysis for the five key intersections and the newly created intersections on Hue Hue Road and Tooheys Road are repeated for the construction phase of the project. The predicted construction traffic by the proposed mine sites using the trip generation rate and distribution assumptions in Section 5.2.1 are superimposed on the future (2010) base traffic. Figure 5-3 show the intersection turning movements for the morning and afternoon peak hours under construction condition.

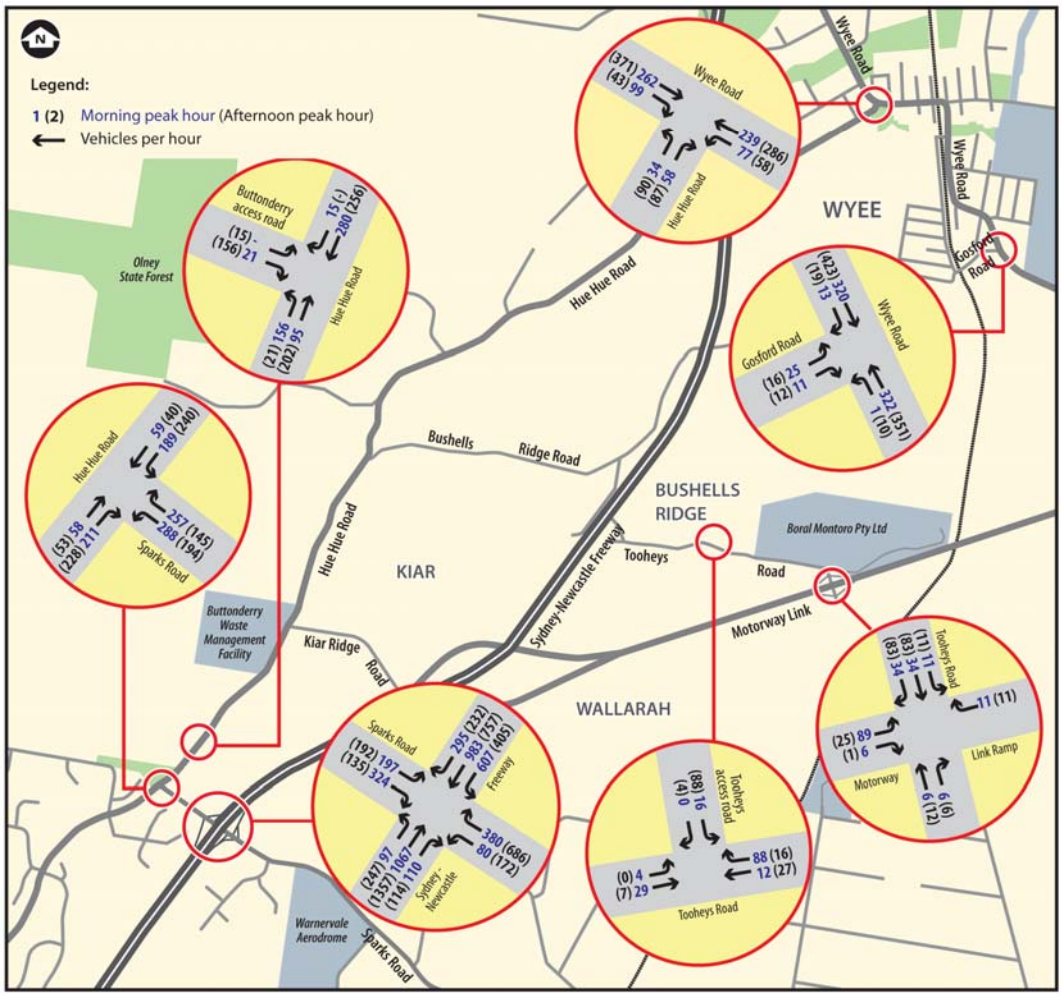


Figure 5-3: Predicted peak hour traffic during construction period (vph)

The intersection analysis results for the construction conditions are summarised in Table 5-7.

Table 5-5: Construction period intersection performance

	Intersection Name	Peak period	Ints Control Type	Ints DOS	Delay (sec)	Ints LOS	Queue (m)
	Sydney-Newcastle Fwy Ramp/Sparks Rd	Morning	Priority	0.75	23	B	46
		Afternoon	Priority	0.89	48	D	145
	Hue Hue Rd/Sparks Rd	Morning	Priority	0.41	12	A	16
		Afternoon	Priority	0.28	11	A	8
	Hue Hue Rd/Wyee Rd	Morning	Priority	0.14	13	A	3
		Afternoon	Priority	0.20	14	A	6
	Wyee Rd/Gosford Rd	Morning	Priority	0.17	13	A	1
		Afternoon	Priority	0.23	14	A	1
	Tooheys Rd/Motorway Link Ramp	Morning	Priority	0.12	9	A	3
		Afternoon	Priority	0.05	9	A	1
	Hue Hue Rd/Buttonderry Access Rd	Morning	Priority	0.17	11	A	11
		Afternoon	Priority	0.25	12	A	9
	Tooheys Rd/Tooheys Access Rd	Morning	Priority	0.07	9	A	3
		Afternoon	Priority	0.07	9	A	3

From the results shown in Table 5-7, it can be seen that all intersections analysed would operate at LoS A during both morning and afternoon peak periods except for one intersection, Sydney-Newcastle Freeway/Sparks Road. The expected delay at all other intersections are in the order of 15 seconds or less for both the morning and afternoon peak periods. Similar to the existing conditions, the majority (all but one) of intersections currently operate with low degree of saturation, less than 0.5 with short queue length, in the order of 20 m or less.

As indicated previously, the critical movements at Sydney-Newcastle Freeway/Sparks Road intersection are turning movements from northbound and southbound exit ramp to Sparks Road. For all other movements, the degree of saturation is less than 0.55 with short queue length of 25 m or less and the delays in the order of 20 seconds or less for both the morning and afternoon peak periods.

As can be seen from the results, the newly created intersections formed by the Buttonderry access with Hue Hue Road and Tooheys access with Tooheys Road would also operate with LoS A with ample capacity and minimal delay and queue during the construction periods.

6. Infrastructure adjustments

6.1 Proposed intersection upgrade

As indicated previously, the Sydney-Newcastle Freeway/Sparks Road interchange would need to be upgraded in order to accommodate the background traffic growth and the anticipated traffic that would be generated by the proposed mine sites.

Table 6-1: Future intersection performance with improvement options

	Intersection Name	Peak period	Ints Control Type	Ints DOS	Delay (sec)	Ints LOS	Queue (m)
	Sydney-Newcastle Fwy Ramp/Sparks Rd	Morning	Roundabout	0.65	25	C	61
		Afternoon	Roundabout	0.62	55	D	59

As can be seen from Table 6-1, the performance of Sydney-Newcastle Freeway/ Sparks Road interchange is improved with the proposed upgrade to a roundabout. The proposed configuration for Sydney-Newcastle Freeway ramps/Sparks Road interchange is shown in Figure 6-1. Under this proposed upgrade, this intersection would operate with LoS C during the morning peak period and with LoS D during the afternoon peak period.

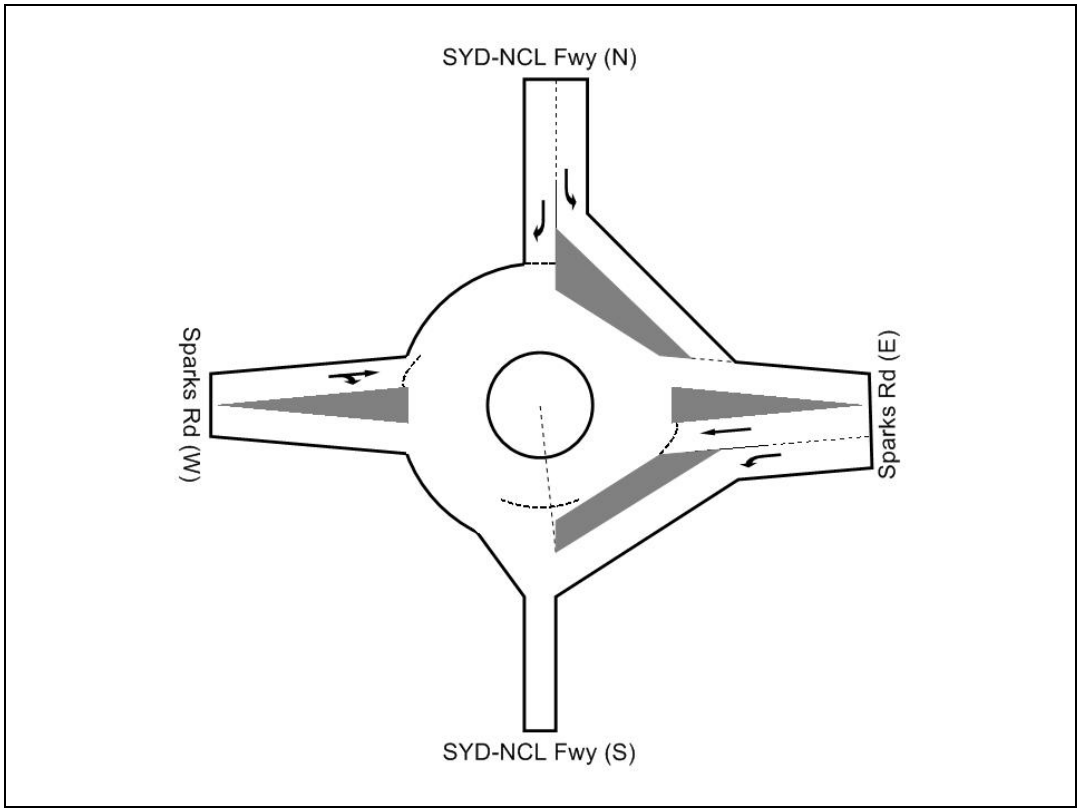
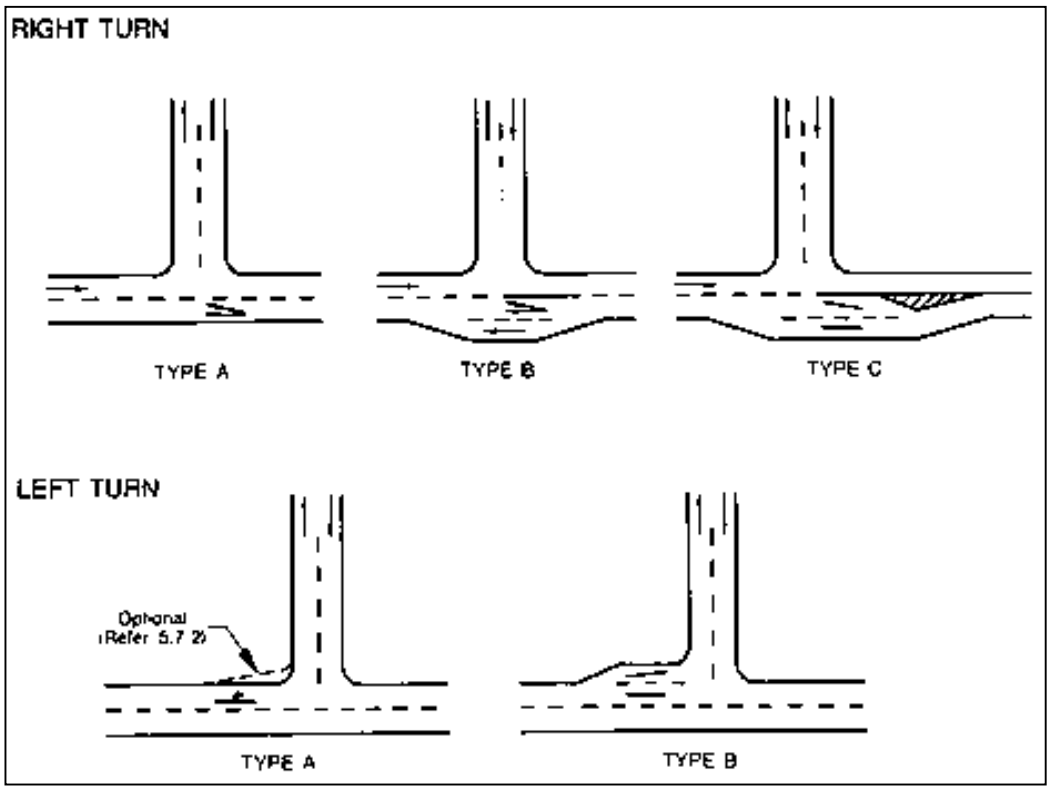


Figure 6-1: Proposed intersection layout for Sydney-Newcastle Freeway/ Sparks Road interchange

6.2 Auxiliary turn lanes

During the construction period and normal day-to-day operation, Hue Hue Road/ Buttonderry site access and Tooheys Road/ Tooheys site access intersections would operate satisfactorily, without the need for an additional turning lane from a capacity perspective. However, it is recommended that for safety and maintenance purposes, the Hue Hue Road intersection with the Buttonderry access be installed as a Type B (Right Turn) intersection as shown in Figure 6-2. Figure 6-2 below presents various rural turning lane treatments available.



Source: AUSTROADS, Intersection at Grade

Figure 6-2: Treatment for rural turn lanes

7. Conclusions

WACJV requested that a traffic impact assessment be conducted for the proposed mine in the western part of the Wyong Coal Development Area. This report has assessed the traffic and transport impacts of the proposed mine construction and operation scenarios.

Overall the site access point intersections (Hue Hue Road at Buttonderry and Tooheys Road/ Motorway Link Road at the Tooheys Road site) would operate satisfactorily, without the need for additional turning lanes from a capacity perspective. This was tested for the construction period and normal day-to-day operation. However a new intersection will need to be created on Hue Hue Road for access to the Buttonderry site and it is recommended for safety and maintenance reasons that this be installed as a rural Type B (Right Turn) intersection which allows for safe passing of right turning traffic.

The results of the traffic analysis for the construction phase of the mine showed:

- all intersections analysed would operate at LoS A during both morning and afternoon peak periods, except for one intersection, Sydney-Newcastle Freeway/Sparks Road, which could expected to fall from LoS B to a LoS D, with a delay of 48 seconds and a queue length of 145 metres in the PM peak, however, this is still performing acceptably
- the expected delay at all other intersections are in the order of 15 seconds or less for both the morning and afternoon peak periods
- the critical movements at Sydney-Newcastle Freeway ramps/Sparks Road intersection are turning movements from northbound and southbound exit ramps to Sparks Road
- the newly created intersections formed by the Buttonderry access with Hue Hue Road and Tooheys access with Tooheys Road would also operate with LoS A with ample capacity and minimal delay and queue during the construction periods.

The results of the traffic analysis for established mine operations were estimated for the year 2016 and PB's traffic performance simulations forecast the following:

- All intersections analysed would operate at LoS A or B during both morning and afternoon peak periods except for one intersection, Sydney-Newcastle Freeway/Sparks Road, which was predicted to operate over capacity resulting in a forecst LoS F with long delays and queuing during both the morning and afternoon peak periods. However, it should be noted that:
  - A high traffic case assumption of a global 4% increase per annum was applied to the surveyed intersection movements
  - the base condition, without the operation of the mine, was also estimated to perform unacceptably at the Sydney-Newcastle Freeway/Sparks Road interchange. Therefore, if the development in question were not to go ahead, the intersection would still face demands beyond its current capacity
  - the views of the RTA need to be sought on any capacity planning it may be considering for the Sydney-Newcastle Freeway/Sparks Road interchange given it is expected to fail by the year 2016, even without the traffic attributable to WACJV activities.