APPENDIX G

Traffic and transport assessment

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XSTRATA MANGOOLA – MODIFICATION 6

TRAFFIC AND TRANSPORT IMPACT ASSESSMENT

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MANGOOLA COAL PROJECT - MODIFICATION 6

Traffic and Transport Impact Assessment

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CONTENTS

EXECUTIVE SUMMARY

Background and purpose of project

Xstrata Mangoola operates the Mangoola Coal Project in accordance with Project Approval 06_0014 (PA06_0014) granted under Part 3A of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). This approval has been modified previously through identified efficiencies.

Xstrata Mangoola is seeking approval from the Minister for Planning and Infrastructure (or the Planning Assessment Commission (PAC) under delegation) to further modify Mangoola Coal's project approval under section 75W of the EP&A Act. The key modification sought is an increase in the rate of extraction from 10.5 million tonnes per annum (Mtpa) run-of-mine (ROM) coal to 13.5 Mtpa ROM coal to more effectively utilise capacity at the coal handling and preparation plant (CHPP). This modification is referred to as Modification 6 (the "proposed modification") and includes the following key aspects:

- Increase in equipment numbers to support increased mining intensity (though the operation will remain a truck and shovel/excavator operation);
- Increase in employee numbers to support additional equipment and operational needs. Up to 150 additional employees, employed over the next few years to meet peak operational capacity and continue safe and efficient operation of the operation. Additionally, up to 90 full time equivalent contractors are considered in this assessment;
- Amendment to blasting conditions relating to maximum instantaneous charge (MIC) and frequency of blasting to allow greater flexibility and to assist with dust and fume management. Xstrata Mangoola will not seek to modify blasting limits in the community;
- Re-define one temporary ROM stockpile to a permanent (life of mine) ROM stockpile;
- Utilisation of suitable mined waste rock for on-site gravel production. Up to 50,000 tonnes of gravel may be crushed annually for use on site. No gravel will be taken from site; and
- Discharge of saline water to the Hunter River under the Hunter River Salinity Trading Scheme (HRSTS).

The purpose of this Traffic and Transport Impact Assessment is to support the proposed modification by assessing road traffic impacts due to operational changes to the mine as a result of the proposed increase in employee numbers. Consideration is also given to rail traffic impacts, with consideration of competing demands for rail movements due to neighbouring mines, although no increase the approved daily average or maximum traffic movements is proposed.

Study methodology

The following methodology was used to complete this Traffic and Transport Impact Assessment:

- *Review of background documents:* A review of background studies and traffic assessments was carried out to understand the context of the modification, the existing road network and traffic constraints as well as the likely traffic generation and distribution implications of the proposed modification.
- *Traffic surveys:* Turning movement counts were carried out at 14 intersections across the Mangoola Coal Project study area. Midblock traffic tube counts were also undertaken for sections of Wybong Road East, Bengalla Link Road and Thomas Mitchell Drive. These were used to (i) identify the existing peak periods, and (ii) establish traffic volumes for the base case conditions.

- *Traffic generation and distribution:* With regard to traffic generation, traffic volumes were forecast through a *first principles* approach considering changes to employment numbers, and assumed vehicle occupancies. These traffic volumes were distributed to several access routes based on end-destination location, directness of route and standard of the road.
- *Traffic modelling:* Traffic impacts were quantified using the SIDRA intersection performance simulation software. By preparing base case and future case models, a gap analysis was undertaken to identify the likely changes to traffic performance, and whether there are likely to be any major traffic impacts due to the proposed modification.
- *Rail network impacts and strategies:* An ARTC 2012 Strategy report identified a number of constraints as well as improvement strategies for addressing capacity issues in the rail network. This is a comprehensive assessment of the cumulative impact of coal production and transportation from the Hunter, Gunnedah Basin and Western Coalfields and was developed through consultation with the coal mining and coal transport logistics industries. The individual coal production forecasts used to determine future rail network improvements were based on information known in 2012.

Study findings – road traffic

The following scenarios were modelled in order to assess the likely road traffic impacts of the proposed modifications:

- **Base case:** The base case traffic volumes consisted of the traffic volumes as surveyed in October 2011, and the anticipated increase in operational traffic due to another modification (Modification 4) which has been approved but which had not yet commenced at the time of the surveys.
- **Post-modification (Modification 6):** This includes the base case volumes plus the traffic that would be generated by the proposed modification (operational traffic only).
- **"Do nothing" scenario:** This is a hypothetical scenario which accounts for the foreseeable traffic growth due to neighbouring coal projects but where the proposed modification does not proceed.
- **Cumulative traffic impact assessment:** This scenario accounted for both the foreseeable traffic growth from neighbouring coal projects as well as the traffic generated by Modification 6. An assessment was only carried out for the 0600-0700h assessment period as this was a common peak period for all relevant coal projects, and was also the peak period according to the October 2011 traffic surveys.

The post-Modification traffic scenarios were modelled through SIDRA for four nominated key intersections. Separate SIDRA models were prepared for the 0600-0700h and 1645-1745h assessment periods. The 0600-0700h period was identified as the AM peak period associated with the various coal mines in the surrounding region. It also captures the traffic associated with the shift change at Xstrata Mangoola. The 1645-1745h period was identified, through the October 2011 surveys as a prominent PM peak. It was conservatively assumed that for the PM period, the peak traffic movement from the proposed modification coincided with this period. This was in order to assess a worst case scenario.

The proposed modification would generate approximately 139 additional vehicles in the 0600-0700h period, and 139 additional vehicles in the 1645-1745h period compared with the traffic volumes that would be generated under the current approved operations.

When compared with the existing 2011 base case models, these SIDRA models did not indicate any significant road traffic impact due to the proposed modification. There was some degree of queuing generated in some of the intersection approaches (typically associated with turning movements). However, generally there is sufficient storage capacity within those approaches. In

light of the model outputs for the proposed modification, there were no mitigation or management measures proposed.

An analysis was also carried out for a hypothetical future “do nothing” scenario which accounted for foreseeable traffic growth due to neighbouring coal projects. This assessment showed that the Denman Road/ Thomas Mitchell Drive intersection is likely to deteriorate in performance. This is primarily due to the high volumes of right-turning traffic from Denman Road to Thomas Mitchell Drive. This indicated that even without the proposed modification traffic, this intersection is likely to require an upgrade to account for regional traffic growth generated by the neighbouring coal industry. It should be noted that under Project Approval 09_0062 (Schedule 3, Condition 47), BHP Billiton are obligated to upgrade this intersection by the end of 2019. The SIDRA assessments carried out in this traffic and transport impact assessment, indicate that these proposed upgrades should be brought forward to address the capacity impacts imposed by regional traffic growth.

Study findings – rail traffic

Mangoola Coal has approval for a daily maximum of 20 train movements (ie. including both inbound and outbound trains). No increase is proposed to this maximum generation rate. Expansion proposals to neighbouring mines would generate an additional 10 train movements per day along the Main Northern Railway Line. All mines are likely to allow 24h train-loading and dispatch operations.

As stated previously, ARTC (2012) identified rail network constraints and improvement strategies which were based on forecast cumulative growth in coal production in the Hunter, Gunnedah Basin and Western Coalfields. It is recommended that Xstrata Mangoola continue to liaise with ARTC regarding ongoing refinement of coal production forecasts as well as proposed modes of transport. These will assist ARTC in refining the rail movement forecasts and hence the improvement strategies.

1 INTRODUCTION

1.1 BACKGROUND

Xstrata Mangoola Pty Limited (Xstrata Mangoola) operates the Mangoola Coal open cut coal mine (Mangoola Coal), located approximately 20 kilometres (km) west of Muswellbrook and 10 km north of Denman (refer to Figure 1.1). Project approval 06_0014 (PA 06_0014) for Mangoola Coal was granted in June 2007 under Part 3A of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act). References to PA 06_0014 in this document refer to the project approval as modified, dated 22 June 2012. Operations at Mangoola Coal approved under PA 06_0014 are referred to herein as the 'current operations'.

Xstrata Mangoola, a wholly owned subsidiary of Xstrata Coal (NSW) Pty Limited (XCN), purchased Mangoola Coal (formerly the Anvil Hill Project) in late 2007. Xstrata Mangoola was granted a mining lease on 20 November 2008 and, after a construction period, commenced mining operations in September 2010.

1.2 SCOPE OF MODIFICATION PROJECT

Xstrata Mangoola is seeking approval from the Minister for Planning and Infrastructure (or the Planning Assessment Commission (PAC) under delegation) to further modify PA 06_0014 under section 75W of the EP&A Act. The key modification sought is an increase in the rate of extraction from 10.5 million tonnes per annum (Mtpa) run-of-mine (ROM) coal up to a maximum of 13.5 Mtpa ROM coal to more effectively utilise capacity at the coal handling and preparation plant (CHPP). Associated with this change are the following key aspects:

- Increase in equipment numbers to support increased mining intensity (though the operation will remain a truck and shovel/excavator operation);
- Increase in employee numbers to support additional equipment and operational needs. Up to 150 additional employees, employed over the next few years to meet peak operational capacity and continue safe and efficient operation of the mine. Additionally, up to 90 full time equivalent contractors are considered in this assessment;
- Amendment to blasting conditions relating to maximum instantaneous charge (MIC) and frequency of blasting to allow greater flexibility and to assist with dust and fume management. Xstrata Mangoola will not seek to modify blasting limits in the community;
- Re-define one temporary ROM stockpile to a permanent (life of mine) ROM stockpile;
- Utilisation of suitable mined waste rock for on-site gravel production. Up to 50,000 tonnes of gravel may be crushed annually for use on site. No gravel will be taken from site; and
- Discharge of saline water to the Hunter River under the Hunter River Salinity Trading Scheme (HRSTS).

The changes sought form Modification 6 to PA 06_0014 and hereafter will be referred to as the 'proposed modification'.

The proposed modification will be undertaken within the approved project disturbance boundary, and achieved through relatively minor alterations to site infrastructure with expected minimal environmental consequences beyond the current approval. No increase or extension to the approved project disturbance boundary is sought.

EMGA Mitchell McLennan (EMM) has been engaged to prepare an environmental assessment to support the proposed modification. The purpose of this Traffic and Transport Impact

Assessment is to identify and assess road and rail traffic and transport impacts due to the proposed modification.

The existing daily maximum of 20 rail movements (including inbound and outbound movements) will be sustained as part of this Project. However, the rail network impacts have been discussed in light of growing competing rail movement demands from other coal mines.

1.3 DIRECTOR-GENERAL'S REQUIREMENTS AND SCOPE OF STUDY

The Director General's Requirements (DGRs) of relevance to the assessment of traffic and transport impacts are as follows:

- A detailed assessment of the [proposed modification] on the capacity, efficiency and safety of the road and rail networks; and
- A description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road and rail.

A breakdown of these study elements is provided in Table 1-1.

Table 1-1 Study elements as outlined in the DGRs and reference to relevant section in report.

Study element (from DGRs)	Reference to report section and commentary (where necessary).
Assessment of the capacity and efficiency of the road network	This Traffic and Transport Impact Assessment provides an assessment of road traffic impacts due to operational changes to the mine including the proposed increase in staff numbers. This is assessed in Section 4.0 and includes the following scenarios: ▪ **Base case:** The base case traffic volumes consisted of the traffic volumes as surveyed in October 2011, and the anticipated increase in operational traffic due to another modification (Modification 4) which has been approved but which had not yet commenced at the time of the surveys. ▪ **Post-modification (Modification 6):** This includes the base case volumes plus the traffic that would be generated by the proposed modification (operational traffic only). ▪ **"Do nothing" scenario:** This is a hypothetical scenario which accounts for the foreseeable traffic growth due to neighbouring coal projects but where the proposed modification does not proceed. ▪ **Cumulative traffic impact assessment:** This scenario accounted for both the foreseeable traffic growth from neighbouring coal projects as well as the traffic generated by the proposed modification. An assessment was only carried out for the 0600-0700h assessment period as this was a common peak period for all relevant coal projects, and was also the surveyed AM peak period according to the October 2011 traffic surveys.
Assessment of the safety of the road network.	Section 4.2.5.
Assessment of the capacity, efficiency and safety of the rail network	Section 5.0
Measures that would be required to maintain/ improve capacity and efficiency of the road network.	Section 6.0
Measures that would be required to improve/ maintain safety of the road network.	Section 4.2.5.
Measures that would be required to improve/ maintain the capacity, efficiency and safety of the rail network.	Section 5.0

2 EXISTING ROAD NETWORK AND TRAFFIC CONDITIONS

2.1 EXISTING ROAD NETWORK CONDITIONS

The Mangoola Coal Project (the Project) is located near the town of Wybong, to the south of Wybong Road approximately 16 kilometres (km) east of the Golden Highway and 20km west of Muswellbrook in the Upper Hunter Region of New South Wales (NSW).

The road network surrounding the Project consists of the following key roads:

- Wybong Road
- Bengalla Link Road
- Denman Road
- Thomas Mitchell Drive
- New England Highway
- Golden Highway

Other local roads include Mangoola Road, Wybong Post Office (PO) Road, Reedy Creek Road, Roxburgh Road, Castlerock Road, Ridgelands Road and Yarraman Road.

These are shown in Figure 2-1 and are described in more detail in Sections 2.1.1 to 2.1.7

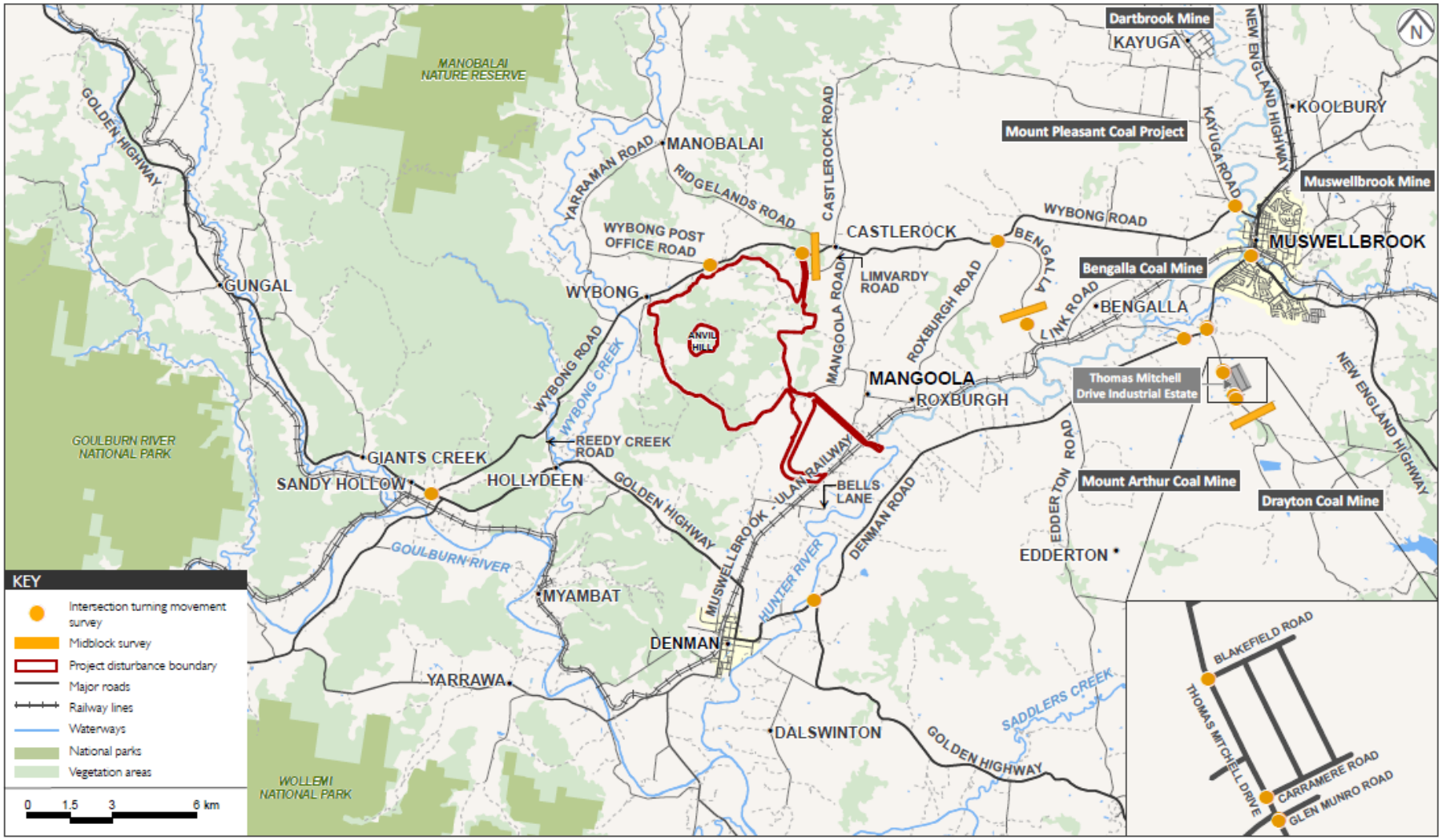

Figure 2-1 Locality map with surrounding road network

2.1.1 WYBONG ROAD

Wybong Road is a rural collector road that runs in an approximate east-west alignment between the Golden Highway at Sandy Hollow, and Kayuga Road, to the west of the Muswellbrook town centre (Figure 2-1). It falls under the jurisdiction of Muswellbrook Shire Council (MSC).

Figure 2-2 Wybong Road East, approximately 3.5km west of Bengalla Link Road (looking east).

This road is generally a two-lane-two-way (2L2W) road (Figure 2-2). With regard to the Mangoola Coal, Wybong Road is considered to consist of three discrete sections as described below:

- **Wybong Road West:** The 16km section between the Golden Highway at Sandy Hollow and the Northern Access Road to the Project. Heavy vehicle traffic generated by the Project are not permitted to use this section of Wybong Road.
- **Wybong Road East:** The 7km section between the Northern Access Road to the Project and the start of the Bengalla Link Road (see Figure 2-3). This is the preferred access route to the Project. It is also the approved route for heavy vehicle traffic generated by the mine.
- **Wybong Road, between Bengalla Link Road and Kayuga Road:** This 10km section leads to the northern end of the Muswellbrook town centre via Kayuga Road. Heavy vehicle traffic generated by the Project are not permitted to use this road.

Xstrata Mangoola has carried out substantial upgrades to Wybong Road East as part of PA 06_0014. This included widening the road formation to an 8.5m sealed width (two 3.25m lanes, and two 1.0m shoulders), provision of edge and centrelines, upgrades to guardrails and bridge barriers, and signage improvements. The route is signposted as a 100km/h speed zone. Wybong Road East has also been facilitated with a number of bus bays (including a formal pullover area at Castlerock Road).

In addition to the reconstruction of Wybong Road East, Xstrata Mangoola has also carried out the following safety improvements on Wybong Road:

- Enhanced signage, particularly on substandard curves.
- Installation of new safety barriers, including approach barriers at Sandy Creek and Spring Creek bridges.
- Upgrade of the Golden Highway/ Wybong Road intersection, including realignment of the Wybong Road approach.

- Realignment of Wybong Road at its intersection with Bengalla Link Road. The realignment work has adjusted the intersection priority so that Wybong Road East extends directly into Bengalla Link Road.
- Provision of a new intersection at Wybong Road/ Northern Access Road, as the primary access to the mine.
- Xstrata Mangoola have also made contributions to the maintenance of Wybong Road West.

Wybong Road contains intersections with a number of local roads including Reedy Creek Road, Yarraman Road, Wybong PO Road, Mangoola Road, Roxburgh Road, Ridgelands Road and Castlerock Road. A brief description of these roads is provided in Section 2.1.7.

2.1.2 BENGALLA LINK ROAD

Bengalla Link Road is a 2L2W undivided rural road that connects Denman Road (south-west of Muswellbrook) with Wybong Road East (Figure 2-3). This road falls under the jurisdiction of Muswellbrook Shire Council.

This route was constructed in two stages. The initial stage, a 6.3km section between Denman Road and the Bengalla Mine, was constructed in 1997 as part of Bengalla Mine construction phase. The second stage, a 3.5km section between Bengalla Mine and Wybong Road East was completed in 2009 in accordance with the Muswellbrook Western Roads Strategy (Figure 2-3).

Figure 2-3 Bengalla Link Road, looking south towards the access to Bengalla Mine.

This road is signposted as a 100km/h speed zone at its southern end, and 80km/h at its northern end. It is of strategic importance as a long-term access route to Bengalla Mine, Mt. Pleasant Mine (which is approved but not yet commenced), and the Project.

Bengalla Link Road links directly into the eastern end of Wybong Road East. It is used as the primary access route for traffic generated by the Project. This is especially the case for heavy vehicles which are not permitted to use Wybong Road West (ie. section between Northern Access Road and Golden Highway) or the section of Wybong Road between Bengalla Link Road and Kayuga Road.

The southern end of Bengalla Link Road meets Denman Road at a T intersection. This intersection was also upgraded by Xstrata Mangoola to include an indented left-turn lane and an acceleration lane for left turning traffic into and out of Bengalla Link Road respectively. Streetlighting was also provided at the intersection as part of these works.

2.1.3 DENMAN ROAD

Denman Road is a State Road under the care and jurisdiction of NSW Roads and Maritime Services (RMS) and provides a link between the New England Highway at Muswellbrook, and the Golden Highway at Denman (Figure 2-1). The road passes to the south of the Mangoola Coal and follows the approximate north-east to south-westerly alignment of the Hunter River.

Denman Road is a 2L2W road with a 7 to 9m sealed width (Figure 2-4). There is localised pavement widening at key intersections to accommodate turn lanes. The route is signposted as an 80km/h speed zone to the east of Bengalla Link Road and 100km/h to the west of Bengalla Link Road.

Figure 2-4 Denman Road, looking east towards Thomas Mitchell Drive

Denman Road is used by Mangoola Coal traffic in a number of ways. Traffic heading south towards the New England Highway would use Denman Road to access Thomas Mitchell Drive. Traffic heading to Muswellbrook town centre and areas to the north of Muswellbrook could also use Denman Road to access the New England Highway at Muswellbrook. This is especially the case for heavy vehicles which are restricted from using the one-lane bridge on Kayuga Road. Some Mangoola Coal traffic would also use Denman Road to access the Golden Highway to destinations between Singleton and Merriwa.

2.1.4 THOMAS MITCHELL DRIVE

Thomas Mitchell Drive is an 11km local road linking Denman Road to the north and the New England Highway to the east. This road is under the jurisdiction of MSC. It attracts a significant volume of traffic travelling between Denman and the New England Highway as it bypasses the longer main road alternatives through the Muswellbrook town centre.

Thomas Mitchell Drive is a 2L2W configuration with an approximate 7m sealed width (Figure 2-5). There are two railway overbridges along the route – associated with the railway spur to the MAC. These bridges impose a vertical clearance restriction to a maximum of 5.5m.

Thomas Mitchell Drive provides access to the Thomas Mitchell Drive Industrial Estate (also referred to as the Muswellbrook Industrial Park) at its northern end between Denman Road and Glen Munro Road (Figure 2-1). It also provides access to MAC and Drayton Mine. The road is signposted as an 80km/h zone through the industrial estate and 100km/h for the remaining section between Glen Munro Road and the New England Highway.

Figure 2-5 Thomas Mitchell Drive, looking south towards railway overbridge at MAC

2.1.5 NEW ENGLAND HIGHWAY

The New England Highway is a major highway providing a link between Newcastle and Brisbane via the regional centres of Muswellbrook, Tamworth, Armidale and Glen Innes. As an Auslink route, the primary funding source for route improvements comes from the Australian Government. RMS manages the route on behalf of the Australian Government.

As an Auslink route, it is a freight route of strategic national importance, particularly in servicing road freight movement between Sydney and Brisbane. The highway offers a parallel inland alternative to the Pacific Highway, and also acts as a detour route when there are incidents on the Pacific Highway.

The New England Highway passes in a general north west to south-westerly alignment approximately 18km east of Mangoola Coal (from the Northern Access Road). To the south of the Muswellbrook town centre, the route is a two-lane undivided configuration with indented turning lanes/ deceleration lanes at key intersections. Near the Liddell and Bayswater Power Stations, the New England Highway is a four-lane divided road with limited access points which was a result of the construction of the two power stations. Further south near the villages of Ravensworth and Camberwell, the road reverts back to a two-lane undivided road with the occasional overtaking lane provided on steep graded sections. The route is signposted as a 100km/h speed zone for most of its length except where it is reduced in sections passing through towns and villages.

The New England Highway would be used by Mangoola Coal traffic to access areas to the north and south of Muswellbrook.

2.1.6 GOLDEN HIGHWAY

The Golden Highway is a State Road under the jurisdiction of RMS and provides a regional east-west link between the New England Highway, Singleton and Dubbo (Figure 2-1).

The Golden Highway runs on a south-east to north-west alignment to the south of Mangoola Coal. It is predominantly a 2L2W configuration with a 7 to 9m sealed width including a 1m sealed shoulder. With the exception of the Golden Highway/ Putty Road grade-separated intersection, most side roads meet the Golden Highway as at-grade intersections (with roads intersecting at the same level). The route is typically signposted as a 100km/h zone except when travelling through towns and villages, which are 50km/h or 60km/h zones.

The Ulan Railway Line crosses Golden Highway as a railway level crossing to the north of the township of Denman. This is an actively controlled crossing with standard signage assemblies for both road approaches including high visibility RAILWAY CROSSING regulatory and warning signs. Flashing lights are used to control road and rail movements at the crossing. A sufficient number of flashing signal units has been provided. ARTC monitors all railway level crossings of their rail lines in NSW and have entered Railway Crossing Interface Agreements with the roads authorities for each crossing. As such, the ongoing monitoring and management obligations of ARTC, RMS and Muswellbrook Council with regard to this railway level crossing are detailed in the Interface Agreement for this crossing.

2.1.7 OTHER LOCAL ROADS

A brief description of the other local roads is provided as follows:

Reedy Creek Road

This is a 1.5km local road joining Wybong Road and The Golden Highway near Sandy Hollow. There are signs in place prohibiting use of this road by Mangoola Coal traffic. Exceptions apply if the trip has an origin or destination within this road.

Yarraman Road

This is a 9km local road that extends from Wybong Road at its southern end, to Ridgelands Road at its northern end.

Wybong PO Road

This is a 4.5km east-west road extending from Yarraman Road to Wybong Road. Its eastern end meets Wybong Road approximately 3.5km east of Mangoola Coal's Northern Access Road.

Ridgelands Road

This local road provides a link between Wybong Road at its southern end, and the township of Bunnan at its northern end.

An auxiliary lane treatment (AUR) is provided for right-turning traffic from Wybong Road to Ridgelands Road. This consists of a short additional lane allowing through traffic to pass around any queued westbound traffic waiting for a gap to turn right.

There is approximately 240m of safe intersection sight distance (SISD) between traffic on Wybong Road to the west of the intersection, and traffic at the hold line of the Ridgelands Road approach. This SISD exceeds the minimum requirement of 234m from Austroads (2009).

There is approximately 160m of SISD between traffic approaching from the east and traffic at the hold line of the intersection. This is less than the required 234m specified by Austroads (2009). A cluster of trees on the southern side of Wybong Road immediately opposite Castlerock Road is the sight limiting feature. It is noted that this vegetation is within private property. A warning sign has been provided to advise drivers of the two successive intersections at Ridgelands Road and Castlerock Road and as such, there are no further mitigation measures recommended.

The entering sight distance (ESD) from Ridgelands Road towards traffic to the east and west of the intersection is greater than the minimum five second gap as required from Austroads (2009).

Castlerock Road

This is a 20km local road that commences at Wybong Road at its south-western end and Kayuga Road at its eastern end. From Wybong Road it commences as a north-south road for approximately 6km, then turns to the east and extends towards North Muswellbrook.

An auxiliary lane treatment (AUR) is provided for right-turning traffic from Wybong Road to Castlerock Road. This consists of a short additional lane allowing through traffic to pass around any queued westbound traffic waiting for a gap to turn right.

There is approximately 160m of SISD between Wybong Road traffic approaching from the west and traffic at the hold line of the intersection. This SISD is less than the 234m requirement from Austroads (2009). The sight limiting features are the three trees on the inside of the curve. However, these are all within private property. A warning sign has been provided to advise drivers of the two successive intersections at Ridgelands Road and Castlerock Road and as such, there are no further mitigation measures recommended.

There is approximately 330m of SISD between traffic approaching from the east and traffic at the hold line of the intersection. This exceeds the required 234m specified by Austroads (2009).

The entering sight distance (ESD) from Castlerock Road towards traffic to the east and west of the intersection is greater than the minimum five second gap as required from Austroads (2009).

Xstrata Mangoola have provided a formal “off-road” bus stop at this location to improve bus and pedestrian safety.

There are signs in place prohibiting the use of this road by Mangoola Coal traffic. Exceptions apply if there is a local destination within this road.

Mangoola Road

This is a 15km local road extending from Wybong Road in the north, to the Golden Highway at Denman. It runs in a north-south alignment to the east of Mangoola Coal. Its southern end runs parallel to the Ulan Railway Line.

A basic (BAR) intersection configuration is provided for right-turning traffic from Wybong Road to Mangoola Road. This consists of a widened sealed shoulder allowing through traffic to pass around any queued westbound traffic waiting for a gap to turn right. This meets the Austroads (2009) requirement.

The Wybong Road/ Mangoola Road intersection is on a crest vertical curve and has more than 340m of SISD between traffic on Wybong Road and traffic at the hold line of the Mangoola Road approach. This SISD exceeds the minimum requirement of 234m from Austroads (2009). Although the crest vertical curve continues to the east of this intersection, Mangoola Road approaches the intersection from a higher grade and hence provides an improved SISD sight line.

The entering sight distance (ESD) from Mangoola Road towards traffic to the east and west of the intersection is greater than the minimum five second gap as required from Austroads (2009).

A warning sign has been provided to the west of the intersection to advise motorists of the side road junction. There are also signs in place prohibiting use of this road by traffic generated by the Mangoola Coal Mine. Exceptions apply if there the trip has an origin or destination within this road.

There are two railway level crossings on Mangoola Road. These are located 1.6km and 4.5km north of Golden Highway and are both passively controlled with STOP signs. This is an appropriate form or control in light of the traffic volumes along this road and the sightlines available.

Roxburgh Road

This is an 8km local road providing a link between Bengalla Link Road at its north-eastern end, and Mangoola Road at its south-western end. Originally this road extended a further 0.5km to the north and terminated at Wybong Road. However, with the completion of the Bengalla Link Road Stage 2 extension (from Bengalla Coal Mine to Wybong Road) and associated realignment of Wybong Road, Roxburgh Road now terminates at Bengalla Link Road. There are signs in place prohibiting use of this road by traffic generated by the Mangoola Coal Mine. Exceptions apply if there the trip has an origin or destination within this road.

2.2 EXISTING TRAFFIC CONDITIONS

2.2.1 TRAFFIC SURVEY DETAILS

Intersection turning movement traffic surveys were carried out in October 2011 at the following locations (refer also to Figure 2-6):

- Golden Highway/ Wybong Road, Sandy Hollow.
- Wybong Road/ Wybong PO Road, Wybong.
- Wybong Road/ Northern Access Road (to Xstrata Mangoola), Wybong.
- Wybong Road/ Bengalla Link Road, Bengalla.
- Kayuga Road/ Wybong Road, Muswellbrook.
- Golden Highway/ Denman Road, Denman.
- Denman Road/ Bengalla Link Road, Muswellbrook.
- New England Highway/ Thomas Mitchell Drive, Muswellbrook.
- Denman Road/ Thomas Mitchell Drive, Muswellbrook*.
- New England Highway/ Sydney Street (Denman Road), Muswellbrook.
- Bengalla Link Road/ Bengalla Mine Access Road, Bengalla.
- Thomas Mitchell Drive/ Blakefield Road, Muswellbrook*.
- Thomas Mitchell Drive/ Carramere Road, Muswellbrook*.
- Thomas Mitchell Drive/ Glen Munro Road, Muswellbrook*.

The purpose of these surveys was to determine the current traffic volumes in the area and the key locations across the network which would require further assessment as part of this Traffic and Transport Impact Assessment.

The turning movement surveys were carried out between 0600-0900h and 1600-1900h. All sites with the exception of those with asterisks above were surveyed on Thursday 13 October 2011. The four sites marked with asterisks were surveyed on Tuesday 18 October 2011.

The following midblock tube counts were also carried out as part of this project:

- Wybong Road, 1 km west of Bengalla Link Road.
- Bengalla Link Road, north of the Bengalla Mine Access Road.
- Thomas Mitchell Drive, east of the Industrial Estate.

These surveys consist of pneumatic tubes placed across the roadway in midblock sections located away from intersecting roads. The tubes detect and record the number of vehicle axles that pass over the survey point. These axle counts are converted to vehicle counts through pre-

determined “rules” for defining vehicle types based on the spacing between successive axle records.

These three survey locations were specifically selected so that the hourly traffic profiles could be identified for each of these routes. This was used to identify the peak traffic periods which were then assessed as part of this Traffic and Transport Impact Assessment.

The tube counts collected data over a 24-hour, seven day continuous period between 13-19 October 2011. The counts included a breakdown by direction, day of week, and hour of day. The surveyed traffic conditions were representative of normal mine operating (and production) conditions. All traffic survey locations are shown in Figure 2-6.

Details of a 2013 verification traffic survey have also been provided in Section 2.2.2. This included a midblock tube survey between 4-10 February 2013 at the following locations:

- Bengalla Link Road, north of the Bengalla Mine Access Road.
- Thomas Mitchell Drive, east of the Industrial Estate.

An additional midblock tube survey was carried out on the section of Wybong Road, 150m west of Ridgelands Road during the week between 4-10 February 2013. This was for the purpose of forecasting heavy vehicle volumes for the post-Modification period.

Further midblock tube surveys were called out on all approaches to the Wybong Road/ Northern Access Road intersection in the week between 8-14 May 2013. This was for the purpose of determining the relative proportion of vehicles on Wybong Road that are generated by Mangoola Coal Mine.

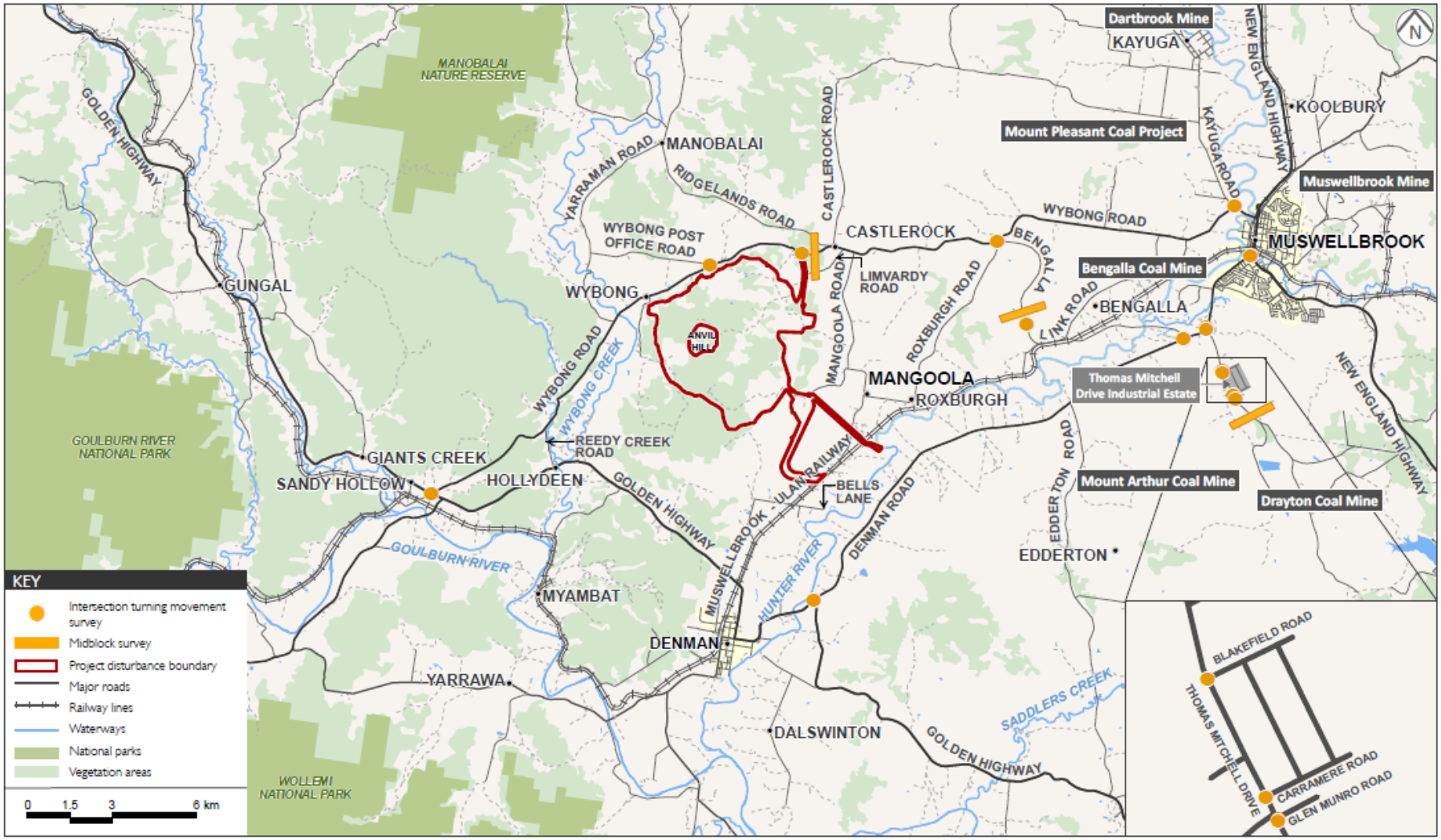

Figure 2-6 Traffic survey locations

2.2.2 ADOPTED PEAK PERIODS FOR TRAFFIC MODEL

Table 2-1 shows the weekday peak periods that were observed in the review of intersection and midblock traffic survey data:

Table 2-1 Peak periods observed from the traffic surveys

Survey location	Morning peak	Peak vehicle movements*	Afternoon peak	Peak vehicle movements*
Intersections				
Golden Highway/ Wybong Road	0800-0900h	162	1700-1800h	184
Wybong Road/ Wybong PO Road	0630-0730h	49	1715-1815h	71
Wybong Road/ Northern Access Road	0615-0715h	140	1715-1815h	131
Wybong Road/ Bengalla Link Road	0600-0700h	149	1715-1815h	153
Kayuga Road/ Wybong Road	0600-0700h	104	1700-1800h	172
Golden Highway/ Denman Road	0800-0900h	333	1645-1745h	382
Denman Road/ Bengalla Link Road	0600-0700h	642	1615-1715h	710
New England Highway/ Thomas Mitchell Drive	0600-0700h	1298	1645-1745h	1073
Denman Road/ Thomas Mitchell Drive	0600-0700h	1138	1600-1700h	892
New England Highway/ Sydney Street	0800-0900h	1523	1630-1730h	1079
Bengalla Link Road/ Bengalla Mine Access Road	0600-0700h	141	1645-1745h	244
Thomas Mitchell Drive/ Blakefield Road	0600-0700h	845	1600-1700h	569
Thomas Mitchell Drive/ Carramere Road	0600-0700h	615	1600-1700h	427
Thomas Mitchell Drive/ Glen Munro Drive	0600-0700h	580	1600-1700h	336
Midblocks				
Wybong Road midblock - Eastbound	0600-0700h	63	1600-1700h	57
Wybong Road midblock - Westbound	0600-0700h	70	1700-1800h	78
Bengalla Link Road midblock - Northbound	0600-0700h	49	1700-1800h	67
Bengalla Link Road midblock – Southbound	0600-0700h	60	1600-1700h	44
Thomas Mitchell Drive midblock – Northbound/ Westbound	0600-0700h	239	1700-1800h	162
Thomas Mitchell Drive midblock – Southbound/ Eastbound	0600-0700h	290	1500-1600h	135

* Peak vehicle movements have been expressed in vehicles/hour. For intersection survey locations, these are the number of vehicles entering the intersection per hour.

Morning peak

- Nine out of the 14 intersections surveyed indicated that the morning peak period is between 0600-0700h. This is based on the total volume of vehicles entering the intersection. Furthermore, all intersections along the Bengalla Link Road-Denman Road-Thomas Mitchell Drive route had maximum AM volumes during this hour. This period is regarded as the morning peak period for journey to work trips to the various coal mines including Drayton Mine, MAC, Bengalla Mine and the Project.
- The period between 0800-0900h was also observed to be a high volume period with three out of the 14 intersections experiencing peak volumes during this hour. These intersections were all on the main arterial road network (New England Highway/Sydney Road, Golden Highway/ Wybong Road, and Golden Highway/ Denman Road). This period is regarded as the morning peak for "nine to five" office workers and journey-to-school trips.
- The midblock tube counts confirmed that the morning peak for the Wybong Road-Bengalla Link Road-Denman Road-Thomas Mitchell Drive route was between 0600-0700h. As stated above, the major land uses along this route are coal mines with mining shifts generally starting at 0700h.

Afternoon peak

- The afternoon peak was more spread out over a longer period, which is expected due to the separate times for end of school, end of work for "nine-to-fivers", end of work for coal mine staff, and end of work for industrial workers.
- Three out of the four intersections surveyed along Wybong Road experienced a peak period between 1715-1815h. The fourth intersection, the Golden Highway/ Wybong Road intersection, had a peak period between 1700-1800h.
- As identified above, the intersections involving arterial roads appeared to be influenced by "nine-to-five" work travel patterns. The New England Highway/ Thomas Mitchell Drive, Golden Highway/ Denman Road, and Golden Highway/ Wybong Road intersections all experienced afternoon peak periods between 1645-1800h.
- The midblock tube counts identified the following:
  - The peak period for the northbound/westbound direction along the Wybong Road-Bengalla Link Road-Denman Road-Thomas Mitchell Drive route (ie. travelling towards the Project) was between 1700-1800h.
  - The peak period for the southbound/eastbound direction along the Wybong Road-Bengalla Link Road-Denman Road-Thomas Mitchell Drive route (ie. travelling south-east from the Project) was between 1600-1700h (note that Thomas Mitchell Drive actually had a peak volume between 1500-1600h but with only marginally higher traffic volumes compared with the 1500-1600h period).

Adopted peak periods for assessment

Based on the above analysis, the following weekday periods were assessed as part of the traffic impact assessment for the proposed modification:

- AM peak: The adopted peak period is between 0600-0700h.
- PM peak: The adopted peak period is between 1645-1745h as this is the period which captures the greatest overlap between the separate peak periods observed at each survey location. Although it does not strictly coincide with the end of day shift and start of night shift for the Project, the adoption of this period as an assessment period would provide a more conservative analysis due to the reduced residual capacity on the network during this period.

2013 verification traffic surveys

Appreciating that the initial traffic surveys were carried out in 2011, Xstrata Mangoola commissioned a verification traffic survey in February 2013. The objective of this survey was to verify, through a smaller sample of survey locations, that the traffic conditions in early 2013 have not significantly changed since 2011. Such a verification assessment would then confirm that the surveyed 2011 traffic volumes were still valid and appropriate as measures of existing traffic conditions for this study.

The verification survey involved a midblock tube survey between 4-10 February 2012 at two of the three original midblock survey locations, ie.

- Bengalla Link Road, north of the Bengalla Mine Access Road.
- Thomas Mitchell Drive, east of the Industrial Estate.

Table 2-2 shows the comparison between the 2011 survey results and the 2013 survey results. The verification involved firstly comparing the daily traffic volumes from the 2011 and 2013 surveys to determine the degree of correlation. This assessment showed that there was less than 5% change in the surveyed daily traffic volumes which indicates a good correlation.

Table 2-2 also includes two other comparisons that were used in the verification process. These were of the three-hour periods including the identified peak period for each location as noted in Table 2-1, plus the one hour before and the one hour after this peak hour. The inclusion of the one-hour time buffer either side of the identified peak hour was necessary as some drivers may have (as a once-off occurrence) travelled earlier or later than usual during the week of the 2013 survey. As such, this was a more appropriate assessment compared with an assessment of the peak hours alone.

Table 2-2 Results of verification traffic survey conducted between 4-10 February 2013(figures in number of vehicles).

Road segment	Time period	2011	2013	% change	<15% yes/no
Bengalla Link Road - northbound	Daily weekday traffic	538	534	-1	yes
	0500-0800h weekday	129	131	2	yes
	1600-1900h weekday	137	131	-4	yes
Bengalla Link Road - southbound	Daily weekday traffic	535	514	-4	yes
	0500-0800h weekday	141	160	13	yes
	1500-1800h weekday	124	105	-15	yes
Thomas Mitchell Drive - eastbound	Daily weekday traffic	1979	1988	0.5	yes
	0500-0800h weekday	662	696	5.1	yes
	1400-1700h weekday	386	356	-7.8	yes
Thomas Mitchell Drive - westbound	Daily weekday traffic	2009	2005	-0.2	yes
	0500-0800h weekday	503	499	-0.8	yes
	1600-1900h weekday	464	506	9.1	yes

As shown in Table 2-2, there is a good correlation between the 2011 and 2013 midblock tube surveys for Bengalla Link Road and Thomas Mitchell Drive. In most cases, there is 15% or less change between the new surveyed volumes and the old surveyed volumes which was regarded as a good correlation. As such, the more substantial traffic volume dataset from the 2011 survey is regarded as valid and appropriate for this study.

As stated in Section 2.2.1, a series of midblock tube surveys was also carried out on all approaches to the Wybong Road/ Northern Access Road intersection in the week between 8-14 May 2013. These results are further discussed in Section 4.2.2.

2.2.3 TRAFFIC SURVEY RESULTS

The traffic survey results for the two assessment periods (ie. 0600-0700h and 1645-1745h) are shown in Figures 2-7 and 2-8 respectively.

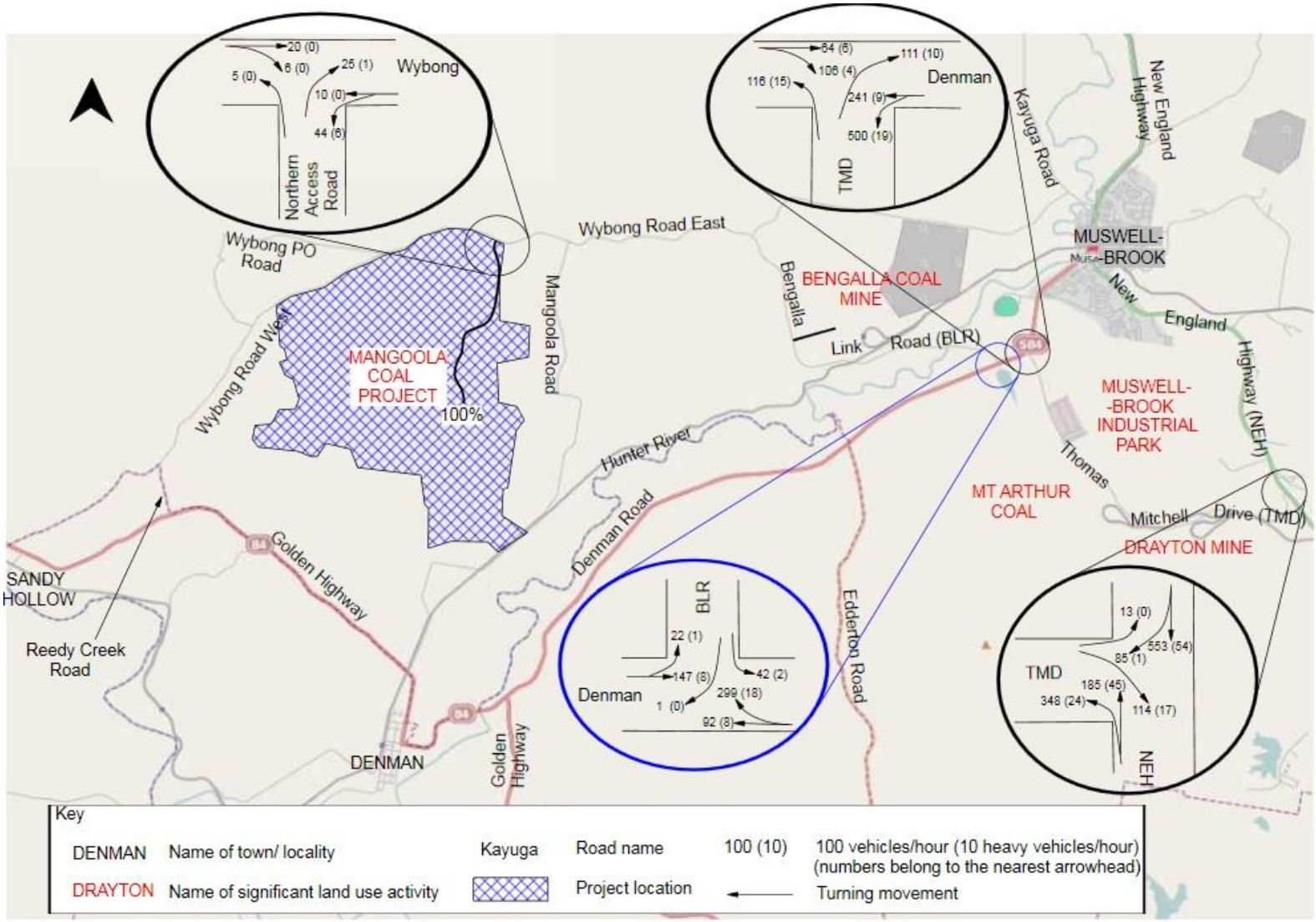

Figure 2-7 Surveyed traffic volumes 0600-0700h weekday.

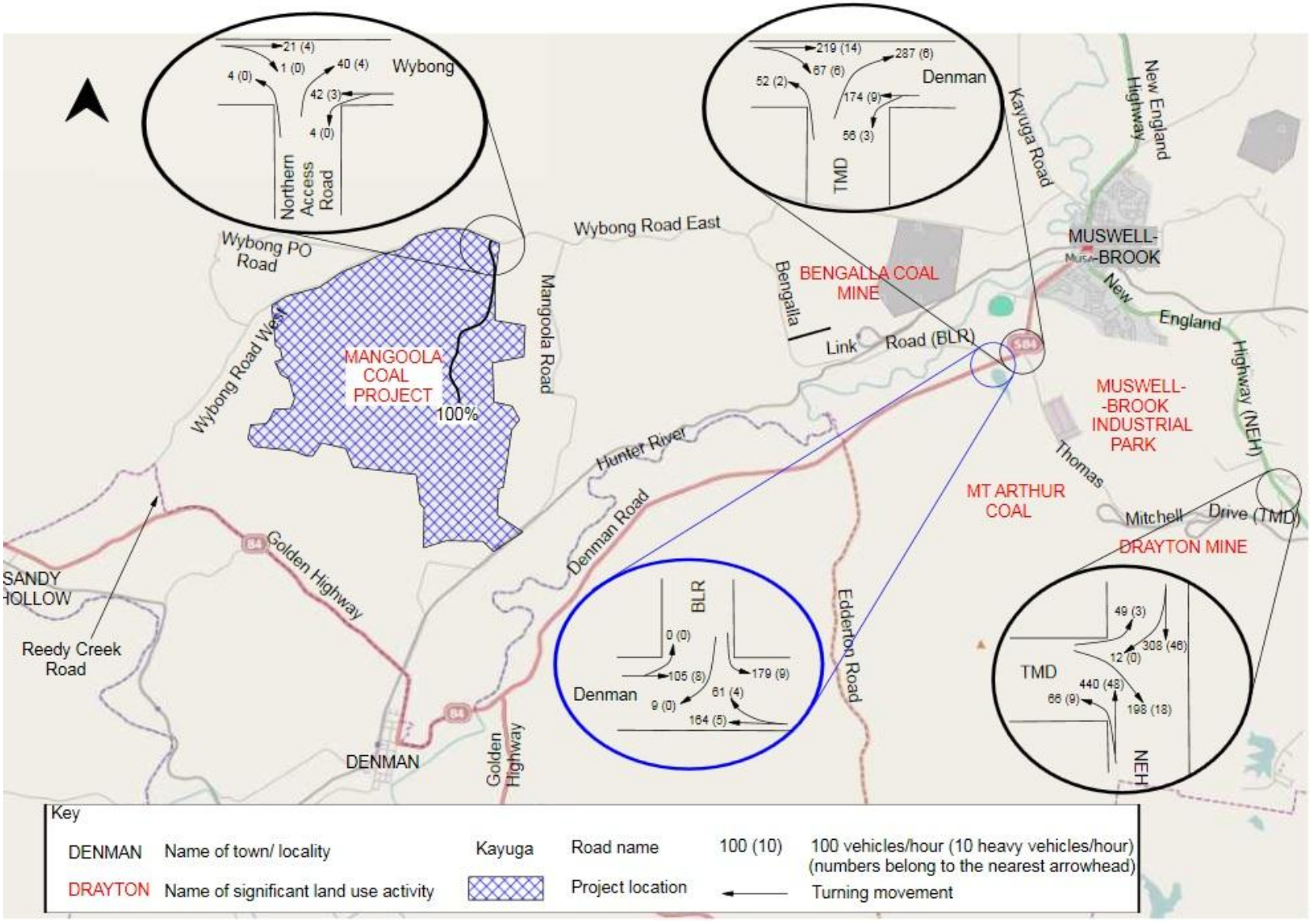

Figure 2-8 Surveyed traffic volumes 1645-1745h weekday.

2.2.4 ADOPTED GROWTH RATE FOR BACKGROUND TRAFFIC

RMS provides traffic volume data for the New England Highway and Golden Highway in the form of annual average daily traffic (AADT) volumes. AADT is the bi-directional traffic volume expressed in vehicles/day.

The following traffic counting stations are located in close proximity to the Project (Figure 2-9):

- Station 05.244: New England Highway, at the southern boundary of the Muswellbrook built up area. Data presented on Figure 2-9 indicates that this site had an AADT of 10,269 vehicles/day in 2004.
- Station 05.037: New England Highway at Foy Brook Bridge to the north of Singleton. Data presented on Figure 2-9 indicates that this site had an AADT of 11,472 vehicles/day in 2004.

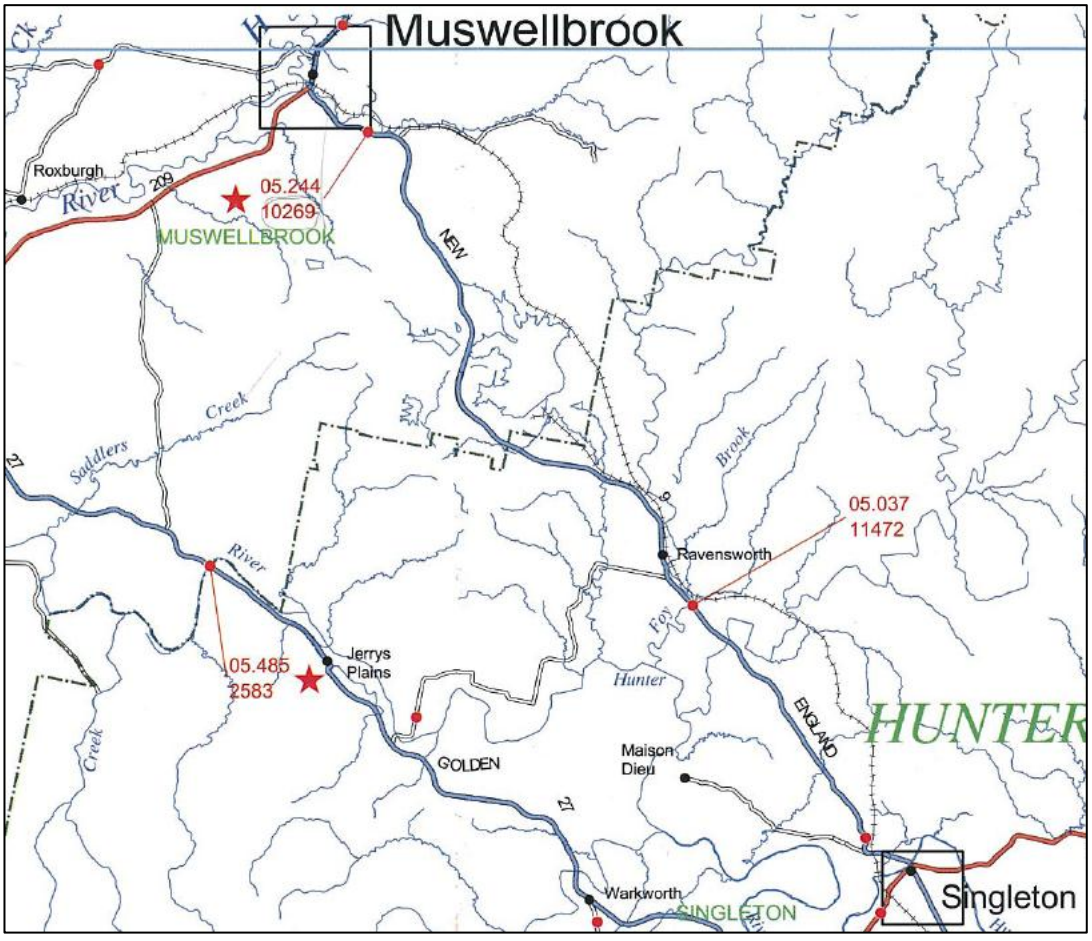

Figure 2-9 Location of RMS traffic counts. Source: RTA (2004)

Figure 2-10 shows the traffic volumes surveyed for the two New England Highway counting stations. The graph shows that the AADT volumes were similar for both sites. In 1980, the New England Highway carried approximately 7,500 vehicles/day, which increased to approximately 12,000 vehicles/day by 2004. This data showed that traffic volumes increased by approximately 2.5% per annum over the 24 year period between 1980 and 2004.

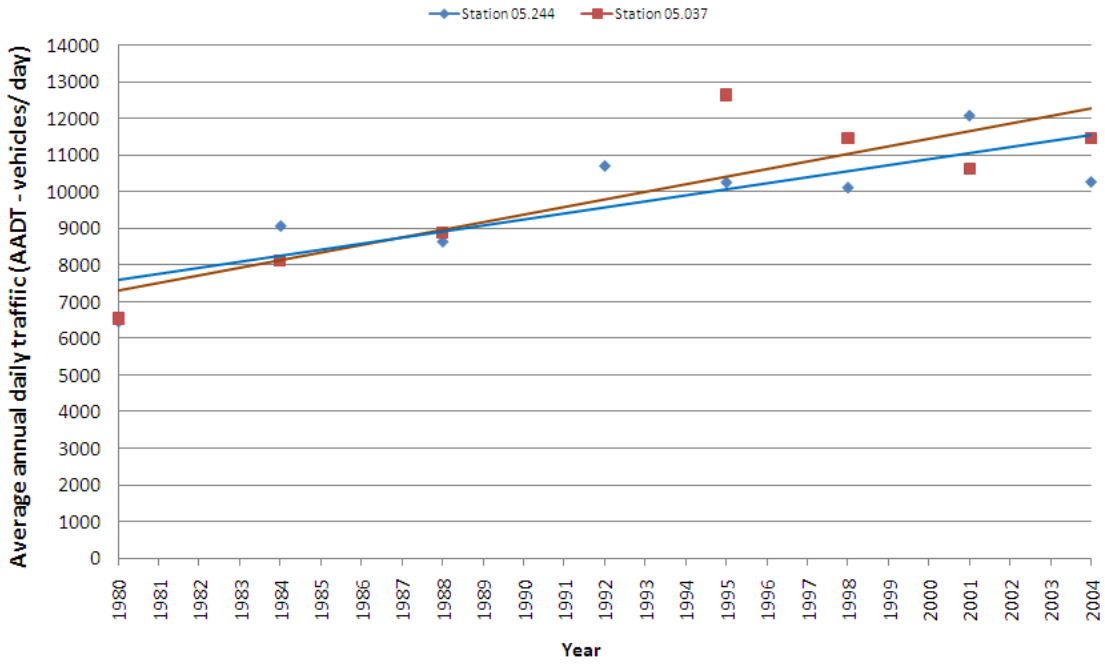

Figure 2-10 Traffic volumes (AADT) surveyed along the New England Highway (RTA, 2004a).

More recent data, in the form of axle pairs per day was sourced from RMS for the period from 2005 to 2009 for counting station 05.244 (see Table 2-3). It should be noted that the conversion from axle pairs to vehicle numbers is dependent on the volume of heavy vehicles as a proportion of all vehicles, and the average number of axle pairs per heavy vehicle. However, assuming that the relative breakdown in light and heavy vehicles has remained consistent over these years, the change in axle pair-based traffic volumes can be used to determine traffic growth trends. This more recent data confirms that an average traffic growth rate of 2.7% per year has been experienced between 2005 and 2009.

Table 2-3 More recent traffic data for counting station 05.244 (axle pairs/day)

Year	2005	2006	2007	2008	2009
Traffic volume (Axle pairs/ day)	10,335	10,481	10,809	11,152	11,489

This more recent data in Table 2-3 supports the earlier data (from Figure 2-10) showing a 2.5% per year growth rate in background traffic. It should be noted that the data in Figure 2-10 is in vehicles/day (and not axle pairs/day) and is therefore the more appropriate basis for estimating traffic growth.

The growth in background traffic (that is, the traffic not related to Mangoola Coal) could be a result of two possible sources:

- Growth in *through* traffic due to the increase in transport demand. This is usually driven by increased population, employment and mobility, as well as potential changes in route choice following various road upgrade projects.
- Growth in *local* traffic due to land use development, including expansion/modification of existing land uses within the study area.

The use of the average annual growth rate of 2.5% generalises traffic growth by assuming that this rate, which was the historic trend in traffic growth, includes growth in both local and through traffic volumes. It is not valid to assume that traffic will continue to grow at this rate over the long

term as that would result in exponential and hence unsustainable traffic growth. Even without conditions placed on each development, the build up of traffic in this manner will eventually mean that traffic congestion itself will limit any further growth. As such, it is only acceptable to assume that the historic growth rate is applied over a short term planning horizon. In these respects, it has been assumed that a maximum of five year's worth of background traffic growth at the 2.5% per annum rate would be experienced. This equates to 13% growth in background traffic for future case scenarios assessed.

Another method of predicting growth in background traffic is to consider the traffic generation potential of all land uses individually including known changes to those land uses. Whilst this may be more substantiated than using the historic growth rate, it is a very onerous exercise as it needs consideration of all land uses associated with *through* trips as well as *local* trips. Regional through trips could be influenced by a large geographical area and hence a very high number of land uses. Despite, this there is still merit in considering land use changes within the study area to inform the likely growth in background traffic generated by *local* traffic. This Traffic and Transport Impact Assessment has considered known and approved expansion plans associated with neighbouring coal mine projects including the recently approved MAC, a modification to Bengalla Mine as well as the soon to commence Mount Pleasant Coal Project. As coal mines are a significant land use in the surrounding area, they would have a high degree of influence over growth in local trips.

As both the historic growth trend (2.5% per annum), and knowledge of foreseeable traffic growth due to other coal projects were used to determine the growth in background traffic (traffic not related to Mangoola Coal), there is some risk of double counting, ie. a substantial volume of the growth determined by applying 2.5% growth per year would also include growth associated with expansion of existing coal mines or development of new coal projects. This is further justification for only applying five year's worth of growth at the 2.5% rate.

2.2.5 EXISTING TRIP DISTRIBUTION

Light vehicle trip distribution

The suburb of residence for existing staff members employed at Mangoola Coal has been reviewed as part of this assessment to identify likely trip distributions generated by the current workforce. The location of residence were broadly categorised into the regions shown in Table 2-4. This table also provides assumptions on likely access route. This was based on consideration of:

- The standard of the roads available.
- The speed limit and travel time implications of each route.
- Imposed restrictions and existing nominated route – eg. the Wybong Road East-Bengalla Link Road is the preferred access route to the Project, and there are access restrictions in place for Reedy Creek Road, Mangoola Road, Roxburgh Road, Ridgelands Road and Castlerock Road[1].

[1] Signs are in place at each end of these roads to prohibit use of the roads by mine-related traffic.

Table 2-4 Light vehicle trip distribution regions

Region	Access route (note i)	% of workforce
Scone, Aberdeen and further north	Wybong Road, Kayuga Road and New England Highway to the north.	14.9%
Muswellbrook CBD North	Wybong Road, Kayuga Road and New England Highway to the south for a portion of traffic (associated with North Muswellbrook).	20.2%
Muswellbrook CBD South	Wybong Road East, Bengalla Link Road, Denman Road (Sydney Road).	20.6%
Singleton and New England Highway South	Wybong Road East, Bengalla Link Road, Denman Road, Thomas Mitchell Drive, and New England Highway to the south.	16.2%
Denman	Wybong Road East, Bengalla Link Road, Denman Road to the west.	12.2%
Sandy Hollow, Merriwa and further west	Wybong Road West, Golden Highway to the west.	7.3%
Golden Highway South (ie. Warkworth, Mt. Thorley, Jerrys Plains)	Wybong Road East, Bengalla Link Road, Denman Road, Golden Highway to the south.	6.8%

Notes: (i) Access routes are described in the outbound direction from the Project.

Figure 2-11 shows the percentage distribution of light vehicle traffic to each of these regions. All figures have been stated as a percentage of all light vehicle traffic generated by Mangoola Coal. These percentage distributions will also be applied to the additional light vehicle trips generated by Modification 6.

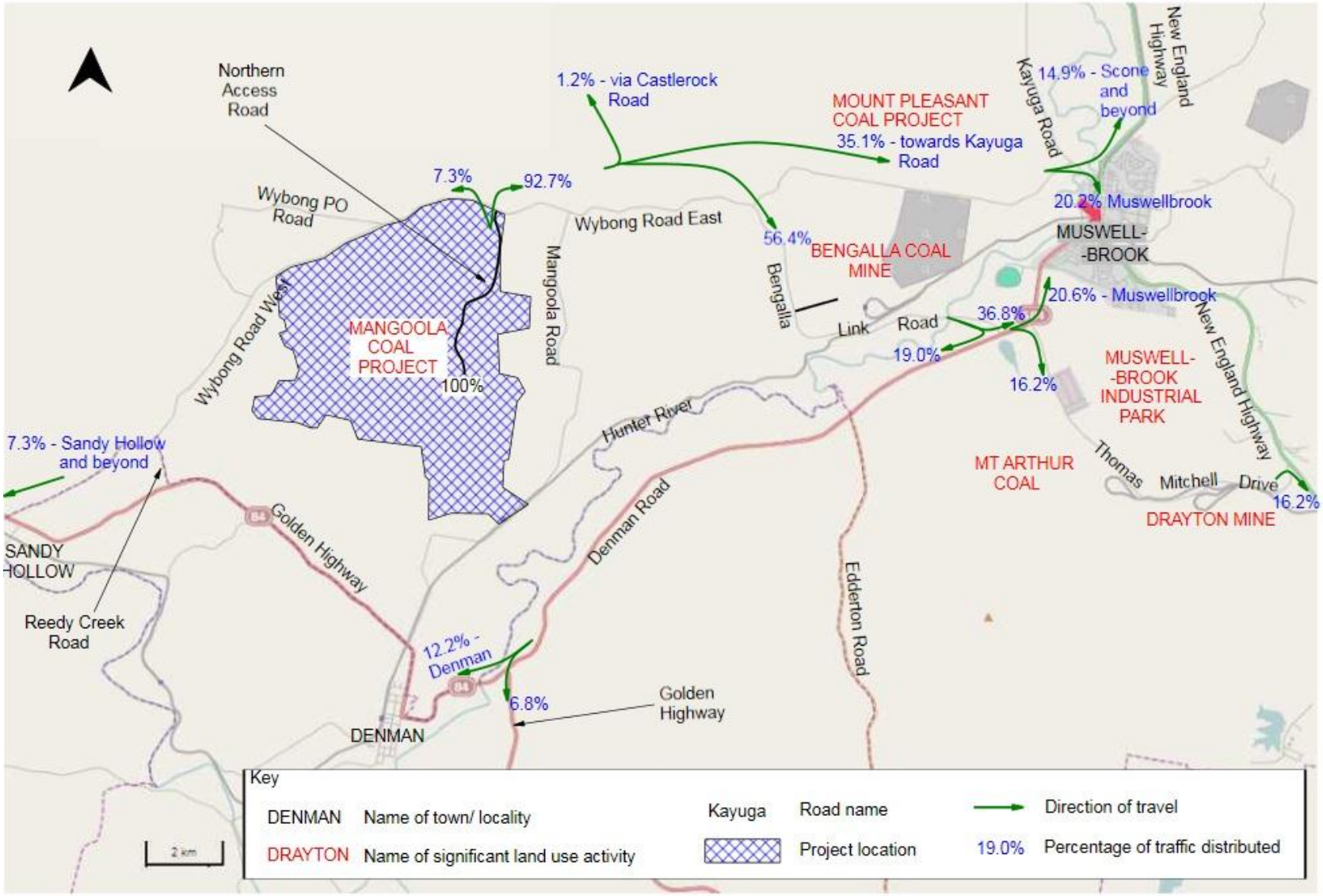

Figure 2-11 Light vehicle trip distribution by broad region.

Heavy vehicle distribution

The proposed modification is unlikely to generate significant volumes of heavy vehicles during the nominated peak periods. However, there may be a growth in heavy vehicle traffic due to the growth in background traffic. In these cases, the following heavy vehicle distribution assumptions were used which are based on the access routes adopted by Mangoola Mine.

All heavy vehicles generated by the Project are required to use Wybong Road East and Bengalla Link Road. The sections of Wybong Road between (i) Golden Highway and Northern Access Road (ie. Wybong Road West) and (ii) Bengalla Link Road and Kayuga Road, are not permitted to be used by heavy vehicle traffic generated by the Project.

From the Denman Road/ Bengalla Link Road intersection, the following routes are currently available:

- **Muswellbrook CBD, Scone and further north:** Denman Road (Sydney Road), and New England highway to the north.
- **Singleton and New England Highway South:** Denman Road, Thomas Mitchell Drive, and New England Highway to the south.
- **Sandy Hollow, Merriwa and further west:** Denman Road, Golden Highway to the west.
- **Golden Highway South:** Denman Road, Golden Highway to the south-east.

2.3 EXISTING ROAD SAFETY PERFORMANCE

RMS provided crash data for the following roads:

- Wybong Road, between Golden Highway, Sandy Hollow and Kayuga Road, Muswellbrook.
- Denman Road/ Sydney Road, between Golden Highway, Denman and New England Highway, Muswellbrook.
- Thomas Mitchell Drive, between Denman Road, West Muswellbrook and the New England Highway, South Muswellbrook.

Crash data was provided for each of the roads for the five year period from 1 January 2006 to 31 December 2010. This is the latest five-year period for which there is fully validated (non-provisional) crash data. Crash data was not supplied for Bengalla Link Road as this road was extended from Bengalla Mine to Wybong Road during the dataset period. An insufficient time period has elapsed to establish a crash trend.

The existing road safety performance of each of the routes listed above has been established by considering the crash rate in *crashes per million-vehicle-kilometres-travelled* (MVKT). MVKT is generally accepted as a unit of *crash exposure*. This is because crash exposure/ opportunity increases as the length of the trip (in kilometres) increases. Also, crash *opportunity* increases as the traffic volumes increase. The expression of crash rates per MVKT is also a way of normalising crash rates making roads more comparable to each other.

Table 2-5 provides the crash rates for each route as well as the input parameters for the crash rates. As there was no crash data provided for Bengalla Link Road, it has been assumed that this would have a similar crash rate to Denman Road.

Table 2-5 Crash rates by route

Wybong Road - Golden Highway to Kayuga Road	
Number of crashes	24
Number of years in crash dataset	5
Traffic volume (AADT in vehicles/day) - Note 1	1220
Length (km)	34
Crash rate (crashes/MVKT)	**0.32**

Denman Road - Golden Highway to New England Highway	
Number of crashes	53
Number of years in crash dataset	5
Traffic volume (AADT in vehicles/day) - Note 2	4000
Length (km)	22
Crash rate (crashes/MVKT)	**0.33**

Thomas Mitchell Drive - Denman Road to New England Highway	
Number of crashes	28
Number of years in crash dataset	5
Traffic volume (AADT in vehicles/day) - Note 3	3190
Length (km)	11
Crash rate (crashes/MVKT)	**0.44**

Notes:
(1) The traffic volume for Wybong Road was determined from the October 2011 tube surveys.
(2) An average traffic volume of 4,000 vehicles/day was assumed for the length of Denman Road. The traffic volume at the Muswellbrook end was measured to be 8,860 vehicles/day in 2004 (RTA, 2004a). However, this section is within a highly urbanised area and has a large traffic catchment including Thomas Mitchell Drive Industrial Area, and Bengalla Link Road. As such, it was not considered to be representative of the entire route which is predominantly a rural road.
(3) The traffic volume for Thomas Mitchell Drive was determined from the October 2011 tube surveys.

The crash rates of 0.32 crashes/ MVKT and 0.33 crashes/MVKT for Wybong Road and Denman Road respectively are typical of rural roads. This is closely aligned with RTA (2004b) which stated that the average crash rate for a two-lane-two-way rural road is 0.33 crashes/MVKT. Both roads are considered to be predominantly rural roads characterised by a low frequency of driveways and intersections, (and hence an associated lower exposure to multiple vehicle crash conflicts), relatively lower traffic volumes, and less interrupted traffic flow conditions.

Thomas Mitchell Drive experienced a substantially higher crash rate of 0.44 crashes/MVKT. This is most likely a result of the higher number of crash conflicts associated with side roads and major property accesses. These include the three access roads feeding the Muswellbrook Industrial Estate (Blakefield Road, Glen Munro Road, and Carramere Road), Drayton Mine Access Road, and the accesses to MAC.

3 BASE CASE TRAFFIC CONDITIONS

The base case conditions are considered to be the traffic conditions prior to implementation of the proposed modification. These serve as a benchmark for comparison for all other scenarios. For the purpose of this Traffic and Transport Impact Assessment, the base case is regarded as comprising the following:

- The traffic volumes surveyed and shown in Figures 2-7 and 2-8.
- The traffic generated by other modifications which had not yet commenced at the time of the October 2011 traffic surveys. These are described in Section 3.1.

3.1 ADDITIONAL TRAFFIC TO BE INCLUDED IN BASE CASE

The October 2011 traffic surveys do not capture the traffic generation that would result from a recently approved modification (Modification 4). The following information was used to determine the additional traffic generated by Modification 4:

- The permanent operational workforce would increase from 240 to 300 persons as a result of Modification 4, ie. an increase in workforce by 60 permanent staff members. For this Traffic and Transport Impact Assessment, it has been assumed that 70% (42 persons) of the additional workers will travel to the site during the 0600-0700h assessment period, and leave the site during the 1645-1745h assessment period. It was also assumed that the remaining 30% (18 persons) would travel to site during the 1645-1745h assessment period, and leave the site during the 0600-0700h assessment period. A conservative vehicle occupancy rate of one person per vehicle was assumed. (PB, 2011).
- An increase in contractor workforce of 71 persons. It also assumed that 70% (50 persons) of these would enter the site during the 0600-0700h period, and also leave the site during the 1645-1745h assessment period. It was assumed that the remaining 30% would have more scattered arrival and departure times which would not coincide with the assessment periods.
- Modification 4 would commence in 2012 and as such, one year's worth of background traffic growth at the 2.5% p.a rate (as discussed in Section 2.2.3) has been accounted for. Note that background traffic growth was not applied to the turning movements into and out of Mangoola Coal as mine-related traffic growth would be accounted for by the individual traffic volume forecasts described in this report.
- The construction traffic generated as part of Modification 4 (electricity transmission line relocation) was not included in the base case as it only represents a relatively short period and is unlikely to affect the longer term operational phase of the proposed modification. The operational traffic from Modification 4 is a more relevant inclusion with respects to the base case conditions.

Figures 3-1 and 3-2 show the traffic volumes (in vehicles/hour) that need to be added to the surveyed volumes in order to make up the base case traffic conditions for the two nominated assessment periods 0600-0700h and 1645-1745h respectively. Separate traffic volumes have been provided for all vehicles, as well as heavy vehicles only.

As stated above, a conservative vehicle occupancy rate of one person per vehicle was assumed for workers and contractors accessing the site. In reality this could be up to 1.15 persons per vehicle accounting for the percentage of the workforce that car pool to work. This would result in a reduction in the project-related inbound volumes during the 0600-0700h assessment period

from 92 to 80 vehicles/hour, and a corresponding reduction in outbound volumes for the same period of from 18 to 16 vehicles/hour.

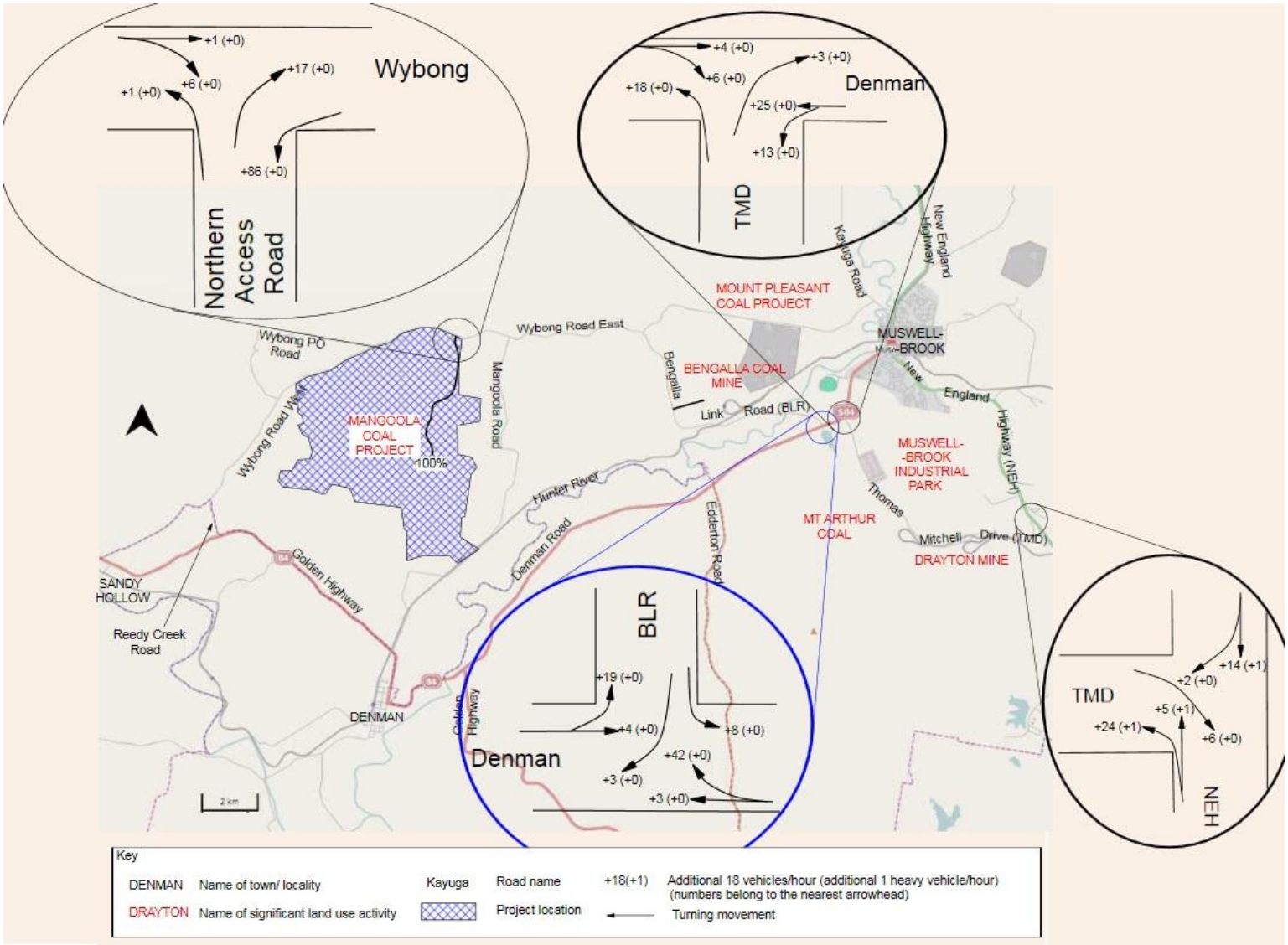

Figure 3-1 Additional traffic volumes to be included in the 0600-0700h base case (traffic generation from Modification 4).

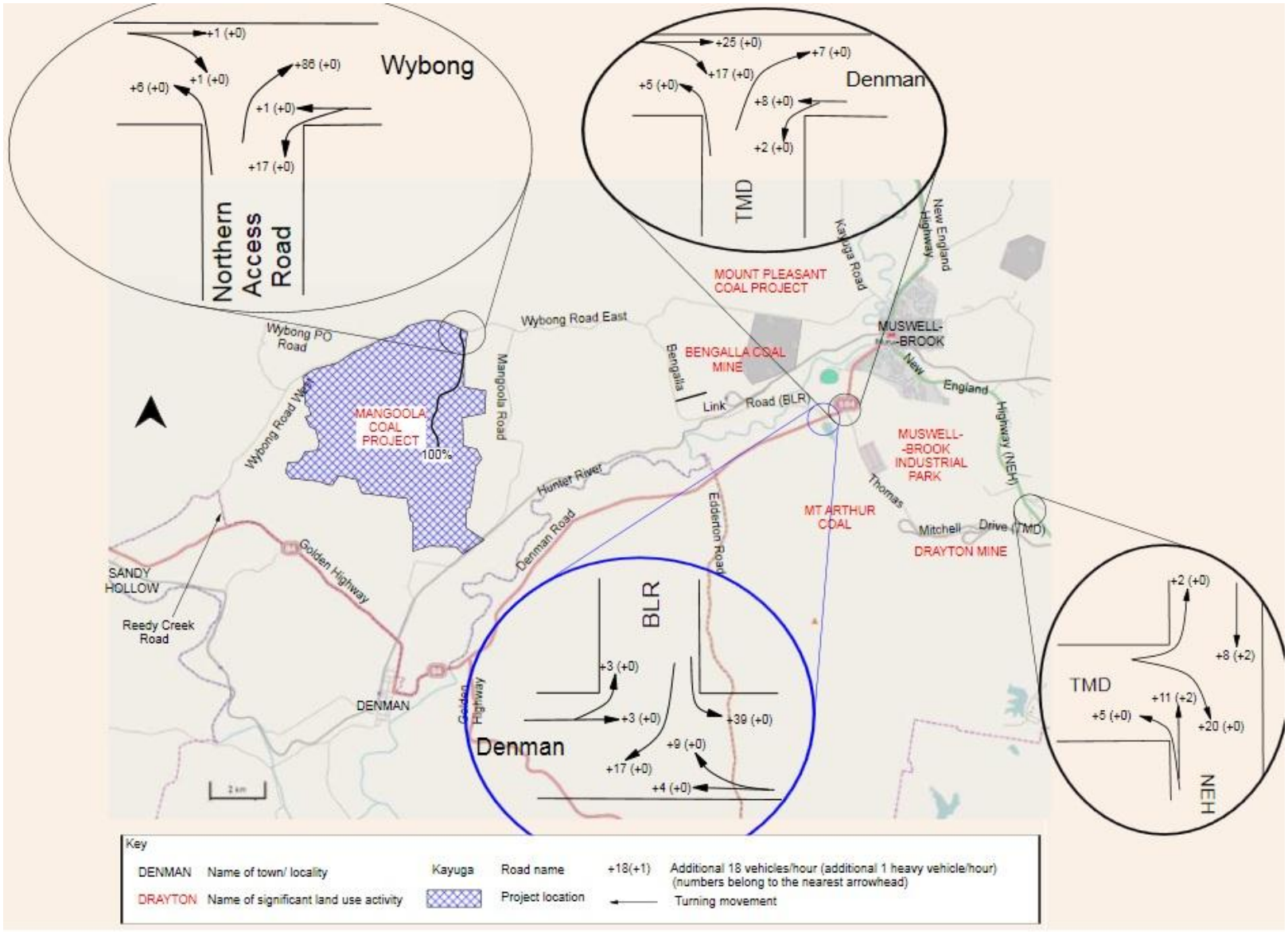

Figure 3-2 Additional traffic volumes to be included in the 1645-1745h base case (traffic generation from Modification 4).

3.2 STUDY INTERSECTIONS

All roads used between the start and end of a generated trip could be potentially impacted by that trip. However, it is not practical to account for the full geographic extent between the start and end of journeys in this manner. Rather, a more appropriate approach is to identify key points along those routes which will serve as indicators of traffic impact over the wider study area.

On this basis, this Traffic and Transport Impact Assessment has adopted the study intersections with respects to assessment of traffic capacity impacts:

- **Wybong Road/ Northern Access Road:** This is the main access from the external public road network to Mangoola Coal.
- **Denman Road/ Bengalla Link Road:** This is the access point to/from the Bengalla Link Road-Wybong Road route. It is also the first intersection (from Mangoola Coal) which provides access to the Main Road network (Denman Road). Inclusion of this intersection as a study intersection captures traffic heading to Muswellbrook South, traffic heading to New England Highway South region (via Thomas Mitchell Drive), and traffic heading to Denman and the Golden Highway between Denman and Singleton. Although the intersection was constructed as part of the original southern portion of Bengalla Link Road, it was also upgraded by Xstrata Mangoola with additional turn lanes and streetlighting.
- **Denman Road/ Thomas Mitchell Drive:** The inclusion of this intersection would capture the traffic heading to New England Highway South, as well as those heading to Muswellbrook CBD via Denman Road (Sydney Road). Under Condition 47 of Project Approval 09_0062, BHP Billiton is obligated to upgrade this intersection to the satisfaction of RMS by the end of December 2019 (Department of Planning, 2010).
- **New England Highway/ Thomas Mitchell Drive:** This is a strategic intersection for all coal mines in the Wybong, Bengalla and South Muswellbrook areas. Thomas Mitchell Drive provides an attractive alternative route to the more congested route through the Muswellbrook CBD. BHP Billiton will be upgrading this intersection to a seagull configuration as part of Condition 47 of Project Approval 09_0062 (Department of Planning, 2010). As the works are scheduled for completion in the first quarter of 2013, this Traffic and Transport Impact Assessment has considered the new intersection configuration to be part of the base case road network condition.

3.3 MODELLED BASE CASE TRAFFIC CONDITIONS - INTERSECTIONS

The base case traffic conditions at the study intersections were modelled using the SIDRA intersection performance simulation software. In the case of non-signalised intersections, SIDRA determines the likely queues and delays that would be experienced in non-priority traffic movements based on gap availability and gap acceptance requirements. The traffic performance of a priority-controlled intersection is dependent on:

- The type of intersection control (and the gap-acceptance implications of traffic regulations);
- The volume of traffic required to enter a priority traffic stream; and
- The volume of traffic in the priority traffic stream.

The base case conditions were determined by adding the traffic volumes as surveyed in October 2011 to the additional traffic that would be generated by Modification 4 (which commenced in 2012 and hence was not captured at the time of the traffic surveys).

Separate SIDRA models were developed for each of the three assessment periods for the four key intersections described in Section 3.2. The traffic volume build-up for the 0600-0700h assessment period was determined by adding the surveyed volumes from Figure 2-7 to the additional volumes in Figure 3-1. Similarly, the input traffic volumes for the 1645-1745h assessment period were also determined by adding the surveyed volumes from Figure 2-8 to the additional volumes in Figure 3-2. The SIDRA model outputs for the base case have been provided in Table 3-1.

Table 3-1 SIDRA outputs for the base case

Intersection	Period	Degree of saturation (DoS)	Average intersection delay (sec/ vehicle)	Level of Service (LoS)	Maximum queue length (m)
Wybong Road/ Northern Access Road	0600-0700h	0.076	10.7	A	1.5
	1645-1745h	0.130	8.5	A	4.6
Denman Road/ Bengalla Link Road	0600-0700h	0.380	8.4	A	17.4
	1645-1745h	0.249	7.1	A	9.7
Denman Road/ Thomas Mitchell Drive	0600-0700h	0.299	10.8	B	9.7
	1645-1745h	0.481	8.8	B	25.0
New England Highway/ Thomas Mitchell Drive**	0600-0700h	0.325	6.0	B	4.5
	1645-1745h	0.261	4.6	B	7.8

Notes: *The performance indicators (DoS, delay, LoS and queue length) have been described in Appendix B.
** The base case conditions included assessment of this intersection as a seagull configuration.

The model outputs in Table 3-1 indicate that the Wybong Road/ Northern Access Road intersection would operate at a good level of service (LoS) of A/B under the base case conditions. This is also reflected by degree of saturation (DoS) all less than 0.15 which means that less than 15% of the available intersection capacity would be required to service the base case traffic demands. The modelled maximum queue length of 4.6m would be in the Northern Access Road approach to the intersection. The SIDRA model outputs for the base case conditions have also been provided in Section 4 alongside the model outputs for the future case scenarios.

The Denman Road/ Bengalla Link Road intersection would carry relatively more traffic compared with the Wybong Road/ Northern Access Road intersection. This is reflected in slightly higher DoS and maximum queue lengths in the order of 17.4m for the right-turn from Denman Road to Bengalla Link Road. However, the LoS remain in the A/B range which indicates that the intersection would perform satisfactorily under the base case traffic conditions.

The Denman Road/ Thomas Mitchell Drive intersection would perform at a good LoS (LoS B as predicted by the traffic models) during the base case conditions. Almost 50% of the available capacity at the intersection would be required to service the PM peak demands (as shown by the DoS of 0.481 during the 1645-1745h period). Furthermore, the maximum queue lengths for the right-turn from Thomas Mitchell Drive to Denman Road East were predicted to be in the order of 25m. This is due to the forecasted volume of right-turning traffic (more than 300

vehicles/ hour), the through traffic volumes on Denman Road (more than 400 vehicles per hour) and the minimum gap acceptance requirements for this movement.

The New England Highway/ Thomas Mitchell Drive intersection would perform at a good LoS (LoS B as predicted by the traffic models) under the base case conditions. This was indicated by the model outputs for DoS (all below 0.4 or 40%), and average delays all under 10 seconds per vehicle.

3.3.1 SURVEYED TRAFFIC CONDITIONS - MIDBLOCKS

Table 3-2 shows the peak traffic volumes (in vehicles/hour/lane) for Wybong Road, Bengalla Link Road and Thomas Mitchell Drive as sourced from the three midblock traffic surveys carried out for this assessment.

Table 3-2 Peak midblock traffic volumes as well as volume/capacity ratios

Midblock section and period	Nominal capacity (veh/ hour/ lane)	AM peak (veh/hour)	V/C ratio (AM)	PM peak (veh/hour)	V/C ratio (PM)
Wybong Road, 1 km west of Bengalla Link Road - Eastbound	1320	63	0.048	57	0.043
Wybong Road, 1 km west of Bengalla Link Road - Westbound	1320	70	0.053	78	0.059
Bengalla Link Road, north of Bengalla Mine Access Road - Northbound	1350	49	0.036	67	0.050
Bengalla Link Road, north of Bengalla Mine Access Road - Southbound	1350	60	0.044	44	0.033
Thomas Mitchell Drive, east of the Industrial Estate – Northbound/ Westbound	1350	239	0.18	162	0.12
Thomas Mitchell Drive, east of the Industrial Estate – Southbound/ Eastbound	1350	290	0.21	135	0.10

Note: V/C is the volume to capacity ratio. This is similar to the Degree of Saturation (DoS) performance indicator for intersections.

Austroads (1988)[2] state that the capacity for a significant length of single traffic lane for uninterrupted traffic flow conditions can be calculated by using the following equation:

$$C = (1800 \times f_w) / (1 + P_{HV} (E_{HV} - 1))$$

Where

C = capacity in vehicles/hour

[2] The Austroads *Guide to Traffic Engineering Practice Part 2 – Roadway Capacity* has been superseded. However, the referenced information is still considered valid as it is based on well-established traffic capacity theory.

f_w = adjustment factor for narrow lanes and lateral clearances. This study has adopted a factor of 0.9 based on a minimum lane width of 3.2m and where there is a lateral clearance of 2m on each side of the road (sourced from a table within Austroads (1988)).

P_{HV} = the proportion of heavy vehicles in the traffic stream, expressed as a decimal[3].

E_{HV} = the average passenger car equivalents for heavy vehicles. This study has adopted a factor of 4.0 for moderate grades.

Using the above formula, the nominal midblock capacity (in vehicle/hour/lane) was determined for the midblocks on Wybong Road, Bengalla Link Road, and Thomas Mitchell Drive. Table 3-2 shows that the capacity for each route is between 1300 and 1400 vehicles/hour/lane.

The performance of a midblock is indicated by the peak volume of each lane expressed as a ratio of the overall capacity that is available. This is referred to as the volume to capacity (V/C) ratio and is similar to the DoS calculated for intersections. Table 3-2 shows that under the base case conditions, the midblock sections of Wybong Road, Bengalla Link Road and Thomas Mitchell Drive are all likely to perform satisfactorily. The V/C ratio for Wybong Road and Bengalla Link Road would be less than 0.06 which means the peak traffic volumes would use less than 6% of the available capacity.

The V/C ratio for Thomas Mitchell Drive is as high as 0.21 in the AM peak which means the demand traffic volumes under the base case conditions would use 21% of the available midblock capacity.

[3] A heavy vehicle proportion of 0.075 was adopted for Wybong Road based on the comparison of heavy vehicles versus all vehicles at (i) the Wybong Road/Bengalla Link Road intersection, and (ii) the Northern Access Road/ Wybong Road intersection (only traffic using Wybong Road East).

A heavy vehicle proportion of 0.066 was adopted for Bengalla Link Road based on a comparison of the heavy vehicles versus all vehicles to the east of Bengalla Mine.

A heavy vehicle proportion of 0.067 was adopted for Thomas Mitchell Drive based on a comparison of heavy vehicles versus all vehicles to the east of Drayton Mine Access Road.

4 TRAFFIC GENERATION IMPLICATIONS OF THE PROJECT

4.1 OVERVIEW

The following scenarios were assessed as part of the operational phase of the proposed modification:

- Traffic impacts due to the longer term operation phase of the proposed modification. This scenario is described in Section 4.2.
- A future cumulative impacts scenario including the collective traffic generation from the proposed modification, as well as foreseeable traffic growth due to other coal mining projects in the surrounding area. This scenario is described in Section 4.3.
- A future "do nothing" scenario which includes the foreseeable traffic growth due to other coal mining projects in the surrounding area, but where the proposed modification does not proceed. This scenario only functions as a means to differentiate between impacts attributable to the proposed modification in isolation, compared with the proposed modification along with other foreseeable traffic growth. This scenario is described in Section 4.3.4.

4.2 PROPOSED MODIFICATION

Traffic volumes that would be experienced during the operational phase of the proposed modification would include:

- The base case traffic volumes (refer to Section 3.1).
- An increase in operational workforce (see Section 4.2.1) including:
  - An increase in permanent workforce from 300 to 450 positions.
  - An increase in contractor workforce by 90 additional contractors.
- An increase in heavy vehicle traffic, mostly in non-peak periods (see Section 4.2.2)
- Five year's of growth in background traffic at 2.5% p.a (see Section 4.2.3).

As stated previously, although this modification will include the crushing of 50,000 tonnes of gravel per year, all of this material will be used on site and will not generate any gravel transport movements on the external road network. Additionally, this will reduce the amount of gravel to be imported to site via public road from off-site resources.

4.2.1 OPERATIONAL WORKFORCE

The current operational workforce is spread across four shift areas; production crews, coal handling and preparation plant (CHPP) crews, trade crews and operational staff. These shift areas are shown in Table 4-1.

Table 4-1 Existing operational conditions

Workforce	Days	Day shift	Night shift
Production	Seven days a week	0630-1830h	1830-0630h
CHPP	Seven days a week	0630-1830h	1830-0630h
Trades	Seven days a week	0630-1830h	1830-0630h
Operational staff	Monday to Friday	0730-1630h	-
		0630-1500h	-

The proposed modification would result in an increase from 300 to 450 full-time equivalent (FTE) employees. This increase by 150 positions has been assumed to be spread across four work shifts over a two-day period (ie. two shifts per day – 0630-1830h and 1830-0600h respectively). Accordingly, there would be 75 additional persons working over the combined two shifts of day one, and the other 75 persons working over the combined two shifts of day two. Furthermore, it has been assumed that 70% of the workers would report to work in the day shift, and the other 30% for the night shift. This is a conservative assumption to reflect worst-case conditions, as there is less spare network capacity during the day time.

The proposed modification will also require an additional 90 contractors to access the site each day. Similar to Section 3.1, it has been assumed that 70% (63 persons) of these new contract positions would generate inbound trips during the 0600-0700h assessment period, and outbound movements during the 1645-1745h assessment period. It has been assumed that the remaining 30% of contractors would have more scattered arrival and departure times.

A vehicle occupancy rate of one person per vehicle has been conservatively assumed for all workers (including contractors).

Using these assumptions, the following traffic generation implications were accounted for in the traffic model scenarios for the proposed modification:

- 116 workers (ie. 70% of FTEs plus 70% of contractors) would travel to the site between the 0600-0700h assessment period.
- 23 workers (ie. 30% of FTEs) would travel from the site between the 0600-0700 assessment period.
- 23 workers (ie. 30% of FTEs) would travel to the site between the 1645-1745 assessment period.
- 116 workers (ie. 70% of FTEs plus 70% of contractors) would travel from the site between the 1645-1745 assessment period.

Based on these assumptions, the proposed modification would therefore generate approximately 139 additional vehicles in the 0600-0700h period, and 139 additional vehicles in the 1645-1745h period compared with the traffic volumes that would be generated under the current approved operating conditions.

As previously noted, the assumed vehicle occupancy rate of one person per vehicle is conservative. In reality, considering the routine nature of the work shifts with fixed start and end times, a higher occupancy rate would probably be observed. As a comparison, an occupancy rate of 1.15 persons per vehicle would result in a reduction in the above figures to 121 vehicles/ hour (from 139 vehicles/hour).

These workforce movements would be distributed in a similar manner to Figure 2-11 (ie. it is assumed that future workforce would reside in the same suburbs in approximately the same proportions as the existing workforce).

4.2.2 HEAVY VEHICLE TRAFFIC GENERATION

Midblock traffic volume counts in the approaches to the Wybong Road/ Northern Access Road intersection were collected over the seven-day period between Wednesday 8 May 2013 and Tuesday 14 May 2013. The purpose of this survey was to determine the relative proportion of heavy vehicles along Wybong Road that are generated by Mangoola Coal Mine. This would then be regarded as a representation of the pre-Modification traffic conditions. The locations of these counters are as follows:

- Site 1: Northern Access Road immediately south of its intersection with Wybong Road.

- Site 2: Northern Access Road approximately 400m south of Wybong Road.
- Site 3: Wybong Road, 600m west of its intersection with Northern Access Road.
- Site 4: Wybong Road, 400m east of its intersection with Northern Access Road.

These sites are shown in Figure 4-1.

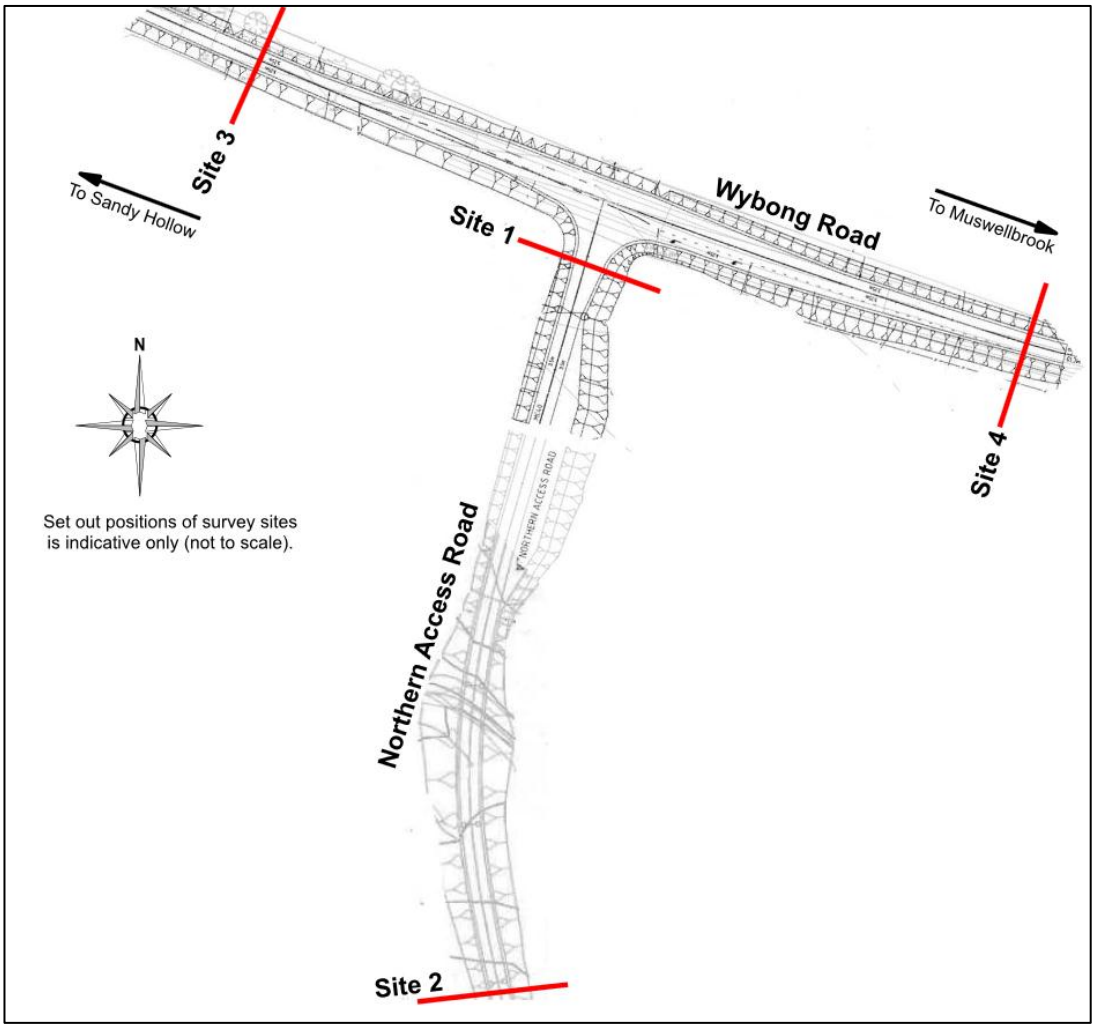

Figure 4-1 Location of traffic survey sites (tube counters) in the May 2013 survey.

The tube counters collected axle counts over a continuous 24 hour/day, seven-day period. The axle counts were then used to classify the counts into the standard 12-class vehicle classification system used by Austroads.

The turning movement counts collected on 13 October 2011 were used to supplement the tube traffic volume surveys described above. This was for the purpose of understanding the relative proportion of *through* traffic versus turning traffic in the Wybong Road approaches to the intersection, and hence the proportion of heavy vehicle traffic on Wybong Road that is generated by Mangoola Coal Mine.

Figure 4-2 shows the percentage (in decimal) distribution of traffic from each intersection approach that exhibited each of the allowable turning movements at the intersection (as obtained from the 13 October 2011 survey). These percentage distributions were then applied to the tube counts collected between 8-14 May 2013.

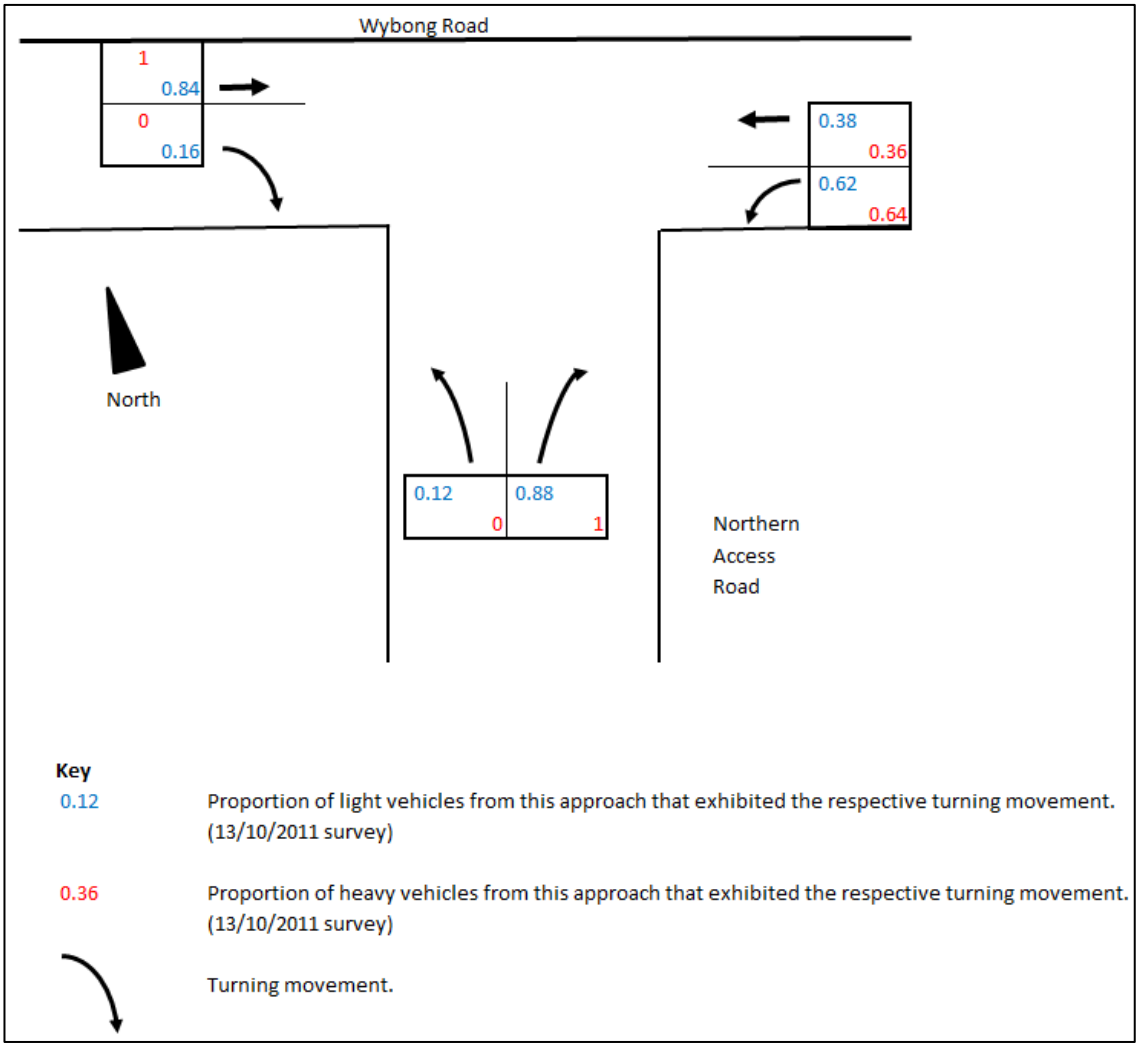

Figure 4-2 Percentage (decimal) distribution of traffic from each intersection approach attributed to each turning movement (from the turning movement survey on 13 October 2011).

Figure 4-3 shows the average number of vehicles per day as collected through the May 2013 midblock counters (see green arrows). The traffic volumes (in vehicles/day) have been shown for light vehicles (blue font) and heavy vehicles (red font).

Figure 4-3 also shows the derived turning movements at the Wybong Road/ Northern Access Road intersection. These were derived by applying the relative proportion from Figure 4-2 to the traffic volumes as recorded from the upstream tube counters. The turning movements are shown by the black arrows, and the derived turning movements are bordered by a black box. Similar to previous, the figures in blue font are light vehicles, and those in red font are heavy vehicles.

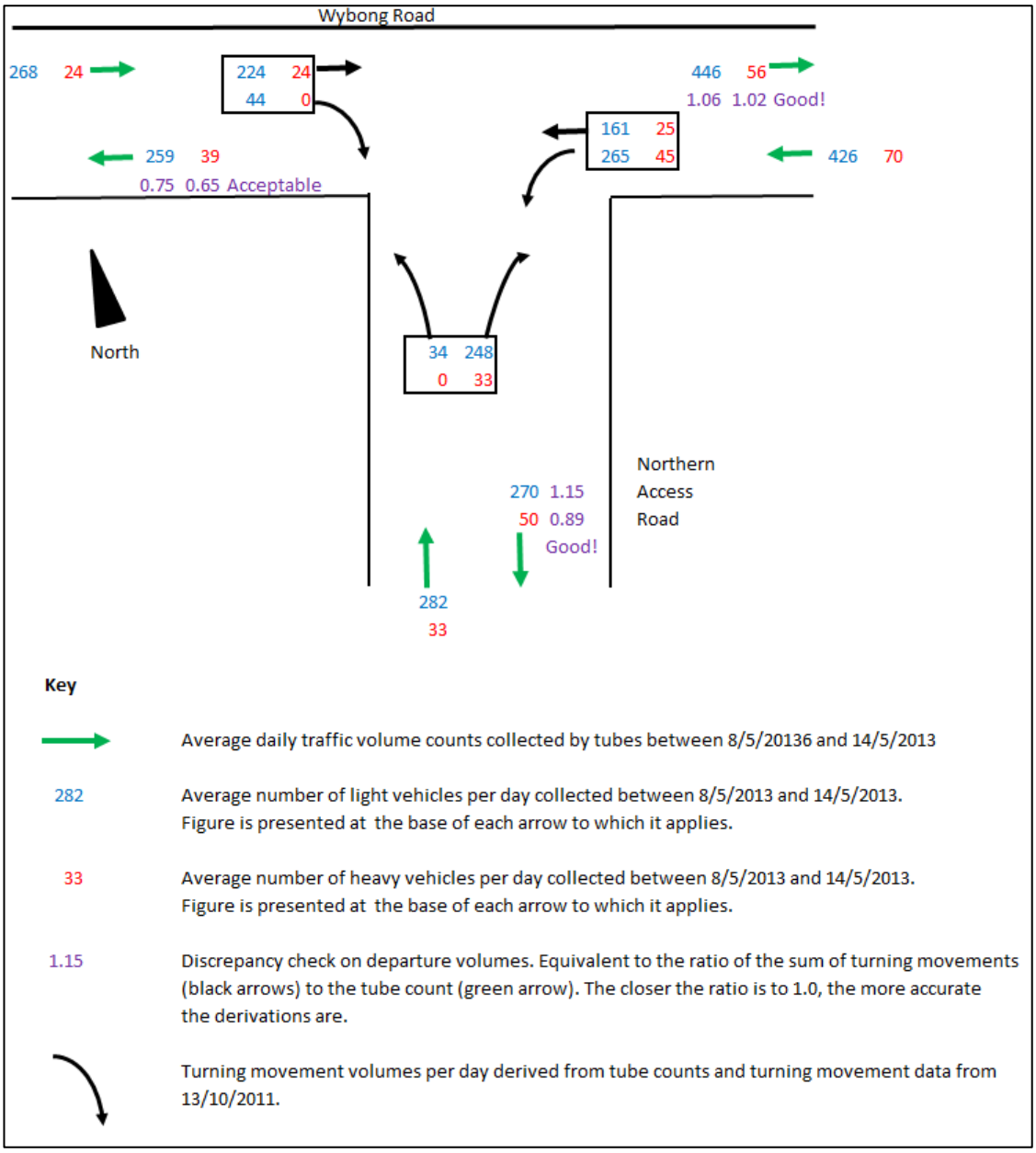

Figure 4-3 Derivation of turning movement volumes.

A discrepancy check was carried out to determine the degree to which the two datasets matched up ie. the midblock tube counts (green arrows) collected from the May 2013 survey, and the derived turning movement counts using the October 2011 turning movement survey. The volumes of traffic departing from the intersection were analysed in this regard. The figures in purple are the ratio of the sum of the derived turning movements making up that departure volume, and the actual surveyed departure volume. The closer this ratio is to 1.0, the more accurate the derivations are.

Figure 4-3 shows the following results for heavy vehicles:

- Of the 70 westbound heavy vehicles per day in the Wybong Road eastern approach, 45 (64%) of these are generated by Mangoola Coal Mine, and 25 (36%) of these are generated by other land uses to the west of Mangoola Coal Mine.

- Of the 24 eastbound heavy vehicles per day on the Wybong Road western approach, 0 (0%) of these are generated by Mangoola Coal Mine, and 24 (100%) are generated by other land uses to the east of Mangoola Coal Mine.
- Furthermore, of the 56 heavy vehicles travelling eastbound to the east of the intersection, 33 (59%) are generated by Mangoola Coal Mine.

In these respects, the above analysis indicates that of the heavy vehicle volumes on Wybong Road to the east of the Northern Access Road, between 59-65% of these are generated by Mangoola Coal Mine. Applying the 65% proportion to the 126 heavy vehicle movements per day on this section of Wybong Road, it can be concluded that 82 heavy vehicle movements per day are generated by Mangoola Coal Mine.

At present, Xstrata Mangoola has approval to extract up to 10.5Mtpa run of mine (ROM) coal. Xstrata Mangoola currently imports gravel to site for blast stemming and other uses associated with mining activity. During the survey week between 8-14 May 2013, there were a total of 72 heavy vehicle movements (approximately 10 movements per day) associated with the transportation of gravel to Mangoola Coal. Under Modification 6 it is proposed that gravel will be produced on site from waste rock for site use. This will reduce the number of gravel deliveries to site as long as the site can produce its own gravel of a suitable quality. Although gravel truck deliveries to site are expected to substantially reduce if Modification 6 is approved due to onsite gravel production, the gravel truck counts have been considered in the traffic assessment for Modification 6 as a conservative approach to modelling traffic generated by the site.

Assuming a pro rated relationship between the number of trucks and the intensity of the mining program, the 13.5Mtpa ROM extraction rate under the proposed Modification would equate to 107 heavy vehicle movements per day (which includes two heavy vehicle movements per day for potable water supply).

This assessment has considered an additional 25 heavy vehicle movements would be generated each day (difference between 107 and 82 heavy vehicle movements per day). These movements would mostly occur outside the peak traffic periods of 0600-0700h and 1645-1745h[4]. As such, no additional heavy vehicles have been added to the traffic capacity assessment for these two assessment periods. Furthermore, these would not have a material impact on the road network as it would equate to an additional vehicle every 45 minutes in each direction (on average).

4.2.3 BACKGROUND TRAFFIC GROWTH

Section 2.2.4 discussed the two methods for forecasting growth in background traffic. Essentially, the application of a historic growth rate results in exponential growth in background traffic and as such is not appropriate for forecasting traffic changes over the long-term. As such, it was assumed that there would only be an additional five year's worth of growth in the background traffic at the annual rate of 2.5% (ie. increase by a factor of 1.13). This means the assessment year adopted for all future cases (including the "do nothing" option) is 2017.

4.2.4 MODELLED OUTPUTS

Figures 4-4 and 4-5 show the additional traffic volumes generated by the proposed modification and background traffic growth as described in Section 4.2.1. These volumes need to be added to the base case in order to provide the total traffic volumes for each turning movement.

[4] Note that Mangoola Coal Mine has restrictions on heavy vehicle movements to and from the mine between the 0630-0830h and 1530-1630h periods in response to school bus operations.

The SIDRA model outputs for the proposed modification have been summarised in Table 4-2. They have also been provided in Table 4-3 alongside the SIDRA results for the base case to allow for a comparison between the two scenarios.

The traffic volume build up (and hence input volumes for the SIDRA models) of each of the assessment scenarios was determined as follows:

- 0600-0700h assessment period: Input volumes derived by adding the surveyed volumes in Figure 2-7, the additional traffic to make up the base case as shown in Figure 3-1 and the proposed modification traffic in Figure 4-4.
- 1645-1745h assessment period: Input volumes derived by adding traffic volumes from Figure 2-8, Figure 3-2 and Figure 4-5.

Table 4-3 also provides an interpretation of the likely traffic impacts as determined through the models.

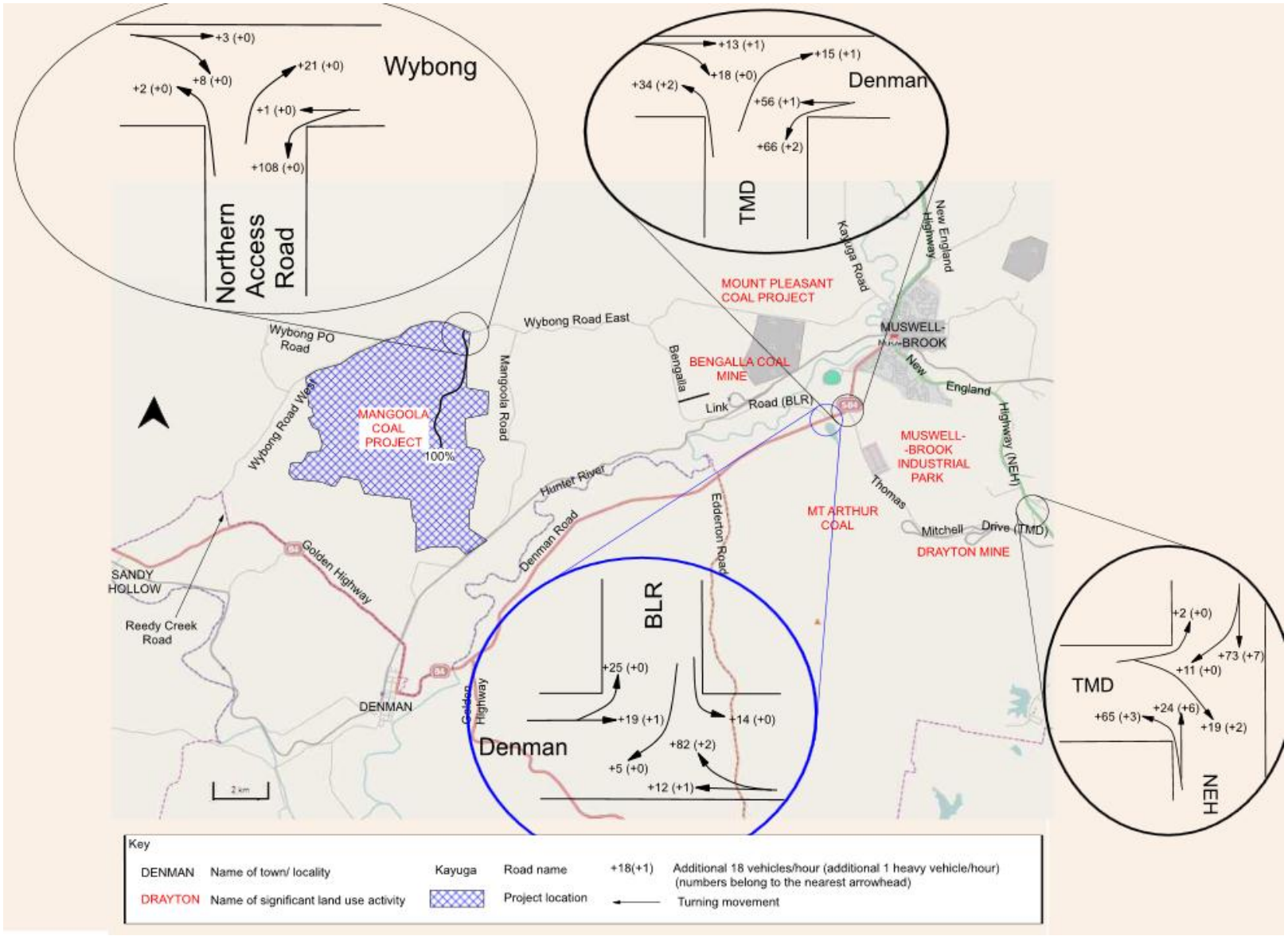

Figure 4-4 Additional traffic generated by the proposed modification (including five year growth in background traffic)- 0600-0700h weekdays.

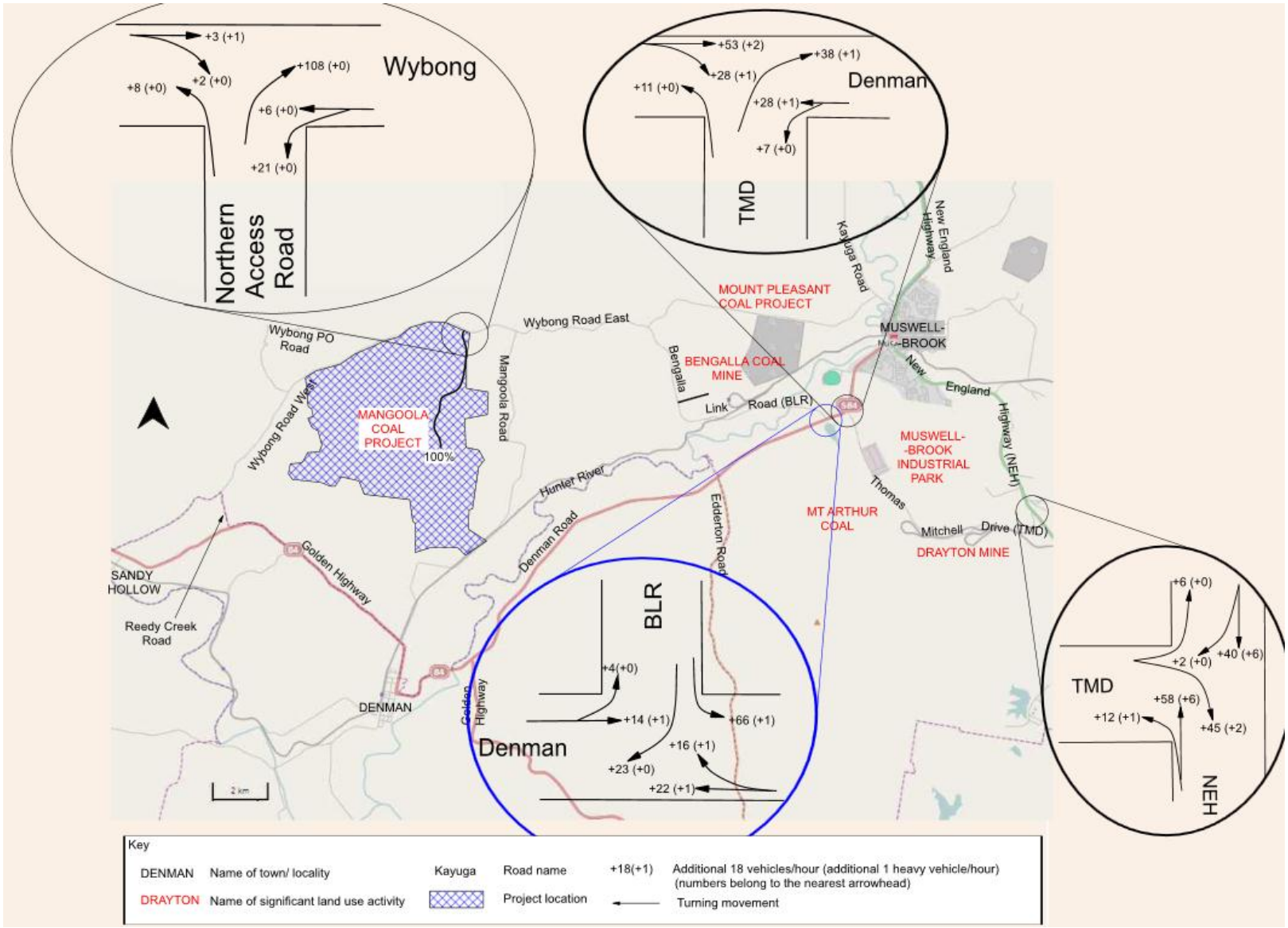

Figure 4-5 Additional traffic generated by the proposed modification (including five year growth in background traffic)- 1645-1745h weekdays.

4.2.5 TRAFFIC IMPACTS ASSOCIATED WITH THE PROPOSED MODIFICATION

Table 4-2 shows a summary of the SIDRA outputs for each of the study intersections for the proposed modification.

Table 4-2 SIDRA outputs for the proposed modification.

Intersection	Period	Degree of saturation (DoS)	Average intersection delay (sec/ vehicle)	Level of Service (LoS)	Maximum queue length (m)
Wybong Road/ Northern Access Road	0600-0700h	0.137	11.2	A	2.0
	1645-1745h	0.245	9.6	A	7.6
Denman Road/ Bengalla Link Road	0600-0700h	0.498	9.5	B	26.1
	1645-1745h	0.353	7.8	A	12.0
Denman Road/ Thomas Mitchell Drive	0600-0700h	0.392	11.6	B	11.9
	1645-1745h	0.627	10.0	B	31.1
New England Highway/ Thomas Mitchell Drive	0600-0700h	0.367	6.3	B	5.6
	1645-1745h	0.294	4.9	B	10.7

The SIDRA model outputs shown above indicate that the Wybong Road/ Northern Access Road intersection would perform satisfactorily under the proposed modification conditions. This is indicated by the DoS being less than 0.30 for all assessment periods (ie. less than 30% of the overall intersection capacity would be required to cater for the prevailing demands).

The model outputs for the Denman Road/ Bengalla Link Road also showed that the intersection would perform satisfactorily with sufficient spare capacity. This is indicated by the DoS being less than 0.50 for all assessment periods (ie. less than 50% of the overall intersection capacity would be required to cater for the prevailing demands). The existing intersection includes indented left and right turn lanes for movements into Bengalla Link Road, as well as an acceleration lane for left-turn egress movements from Bengalla Link Road. This capacity supply is a major factor the satisfactory (modelled) performance.

The model for the 1645-1745h assessment period indicated that the Denman Road/ Thomas Mitchell Drive intersection would experience maximum queue lengths of 31.1m in the Thomas Mitchell Drive approach. This is largely due to the 349 vehicles/hour turning right from Thomas Mitchell Drive to Denman Road East and the significant volumes of opposing traffic including 221 vehicles/hour in the Denman Road westbound direction, and 313 vehicles/hour in the Denman Road eastbound direction.

The model for the New England Highway/ Thomas Mitchell Drive intersection indicated that this intersection would perform satisfactorily under its seagull configuration. This was indicated by LoS of B for all assessment periods and maximum queue lengths less than 15m.

The SIDRA model outputs have also been provided in Table 4-3 alongside the model results for the base-case scenario. The purpose of showing these model results side-by-side is to allow for comparison between the two scenarios for both the intersection as a whole as well as for each individual turning movement. An interpretation has also been provided in this table to explain the results.

Table 4-3 SIDRA model outputs for the (i) Base-case and (ii) the future case with Mangoola's proposed modification.

<table>
<tr><th>Intersect-ion and peak period</th><th>Base case

(includes the October 2011 surveyed volumes as well as the operation traffic from other project approvals which had not yet commenced at the time of the surveys).</th><th>With proposed modification

(includes base-case volumes, plus 5 years of background growth at 2.5% p.a, plus the traffic generation due to the proposed modification).</th><th>Comments</th></tr>
<tr><td>Wybong / NAR

0600-0700h</td><td>
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South: Northern Access Road</td></tr>
<tr><td>1</td><td>L</td><td>6</td><td>0.0</td><td>0.047</td><td>11.8</td><td>LOS A</td><td>0.2</td><td>1.5</td><td>0.21</td><td>0.66</td><td>62.0</td></tr>
<tr><td>3</td><td>R</td><td>44</td><td>2.4</td><td>0.047</td><td>11.9</td><td>LOS A</td><td>0.2</td><td>1.5</td><td>0.21</td><td>0.69</td><td>62.3</td></tr>
<tr><td>Approach</td><td></td><td>51</td><td>2.1</td><td>0.047</td><td>11.9</td><td>LOS A</td><td>0.2</td><td>1.5</td><td>0.21</td><td>0.68</td><td>62.2</td></tr>
<tr><td colspan="12">East: Wybong Road East</td></tr>
<tr><td>4</td><td>L</td><td>137</td><td>4.6</td><td>0.076</td><td>12.5</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.75</td><td>64.8</td></tr>
<tr><td>5</td><td>T</td><td>11</td><td>0.0</td><td>0.005</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>147</td><td>4.3</td><td>0.076</td><td>11.6</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.70</td><td>66.7</td></tr>
<tr><td colspan="12">West: Wybong Road West</td></tr>
<tr><td>11</td><td>T</td><td>22</td><td>0.0</td><td>0.016</td><td>0.3</td><td>LOS A</td><td>0.1</td><td>0.7</td><td>0.18</td><td>0.00</td><td>88.4</td></tr>
<tr><td>12</td><td>R</td><td>13</td><td>0.0</td><td>0.016</td><td>12.4</td><td>LOS A</td><td>0.1</td><td>0.7</td><td>0.25</td><td>0.96</td><td>65.8</td></tr>
<tr><td>Approach</td><td></td><td>35</td><td>0.0</td><td>0.016</td><td>4.7</td><td>LOS A</td><td>0.1</td><td>0.7</td><td>0.20</td><td>0.35</td><td>79.5</td></tr>
<tr><td>All Vehicles</td><td></td><td>233</td><td>3.2</td><td>0.076</td><td>10.7</td><td>NA</td><td>0.2</td><td>1.5</td><td>0.08</td><td>0.64</td><td>67.3</td></tr>
</table>
</td><td>
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South: Northern Access Road</td></tr>
<tr><td>1</td><td>L</td><td>8</td><td>0.0</td><td>0.075</td><td>12.2</td><td>LOS A</td><td>0.3</td><td>2.0</td><td>0.29</td><td>0.67</td><td>61.6</td></tr>
<tr><td>3</td><td>R</td><td>66</td><td>1.6</td><td>0.075</td><td>12.2</td><td>LOS A</td><td>0.3</td><td>2.0</td><td>0.29</td><td>0.70</td><td>61.9</td></tr>
<tr><td>Approach</td><td></td><td>75</td><td>1.4</td><td>0.075</td><td>12.2</td><td>LOS A</td><td>0.3</td><td>2.0</td><td>0.29</td><td>0.70</td><td>61.8</td></tr>
<tr><td colspan="12">East: Wybong Road East</td></tr>
<tr><td>4</td><td>L</td><td>251</td><td>2.5</td><td>0.137</td><td>12.4</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.75</td><td>64.8</td></tr>
<tr><td>5</td><td>T</td><td>12</td><td>0.0</td><td>0.006</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>262</td><td>2.4</td><td>0.137</td><td>11.8</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.72</td><td>66.0</td></tr>
<tr><td colspan="12">West: Wybong Road West</td></tr>
<tr><td>11</td><td>T</td><td>25</td><td>0.0</td><td>0.026</td><td>0.5</td><td>LOS A</td><td>0.1</td><td>0.9</td><td>0.20</td><td>0.00</td><td>86.1</td></tr>
<tr><td>12</td><td>R</td><td>25</td><td>0.0</td><td>0.026</td><td>12.8</td><td>LOS A</td><td>0.1</td><td>0.9</td><td>0.34</td><td>0.82</td><td>65.0</td></tr>
<tr><td>Approach</td><td></td><td>51</td><td>0.0</td><td>0.026</td><td>6.6</td><td>NA</td><td>0.1</td><td>0.9</td><td>0.27</td><td>0.41</td><td>74.9</td></tr>
<tr><td>All Vehicles</td><td></td><td>387</td><td>1.9</td><td>0.137</td><td>11.2</td><td>NA</td><td>0.3</td><td>2.0</td><td>0.09</td><td>0.67</td><td>66.1</td></tr>
</table>
</td><td>This analysis showed that there is marginal difference between the modelled base-case condition and the traffic impacts of the proposed modification. This is reflected in the small differences between average intersection delay (10.7 to 11.2 seconds/vehicle) and maximum queue length (1.5m to 2.0m).

This analysis shows that the proposed modification is not likely to have significant impacts on the Wybong Road/ Northern Access Road intersection.</td></tr>
<tr><td>Wybong / NAR

1645-1745h</td><td>
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South: Northern Access Road</td></tr>
<tr><td>1</td><td>L</td><td>11</td><td>0.0</td><td>0.130</td><td>11.7</td><td>LOS A</td><td>0.6</td><td>4.6</td><td>0.19</td><td>0.66</td><td>62.1</td></tr>
<tr><td>3</td><td>R</td><td>133</td><td>3.2</td><td>0.130</td><td>11.9</td><td>LOS A</td><td>0.6</td><td>4.6</td><td>0.19</td><td>0.69</td><td>62.4</td></tr>
<tr><td>Approach</td><td></td><td>143</td><td>2.9</td><td>0.130</td><td>11.9</td><td>LOS A</td><td>0.6</td><td>4.6</td><td>0.19</td><td>0.69</td><td>62.3</td></tr>
<tr><td colspan="12">East: Wybong Road East</td></tr>
<tr><td>4</td><td>L</td><td>22</td><td>0.0</td><td>0.012</td><td>12.2</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.75</td><td>64.8</td></tr>
<tr><td>5</td><td>T</td><td>45</td><td>7.0</td><td>0.024</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>67</td><td>4.7</td><td>0.024</td><td>4.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.25</td><td>86.3</td></tr>
<tr><td colspan="12">West: Wybong Road West</td></tr>
<tr><td>11</td><td>T</td><td>23</td><td>18.2</td><td>0.012</td><td>0.2</td><td>LOS A</td><td>0.1</td><td>0.6</td><td>0.13</td><td>0.00</td><td>92.4</td></tr>
<tr><td>12</td><td>R</td><td>2</td><td>0.0</td><td>0.012</td><td>12.2</td><td>LOS A</td><td>0.1</td><td>0.6</td><td>0.16</td><td>1.58</td><td>66.7</td></tr>
<tr><td>Approach</td><td></td><td>25</td><td>16.7</td><td>0.012</td><td>1.2</td><td>LOS A</td><td>0.1</td><td>0.6</td><td>0.13</td><td>0.13</td><td>89.9</td></tr>
<tr><td>All Vehicles</td><td></td><td>236</td><td>4.9</td><td>0.130</td><td>8.5</td><td>NA</td><td>0.6</td><td>4.6</td><td>0.13</td><td>0.50</td><td>70.1</td></tr>
</table>
</td><td>
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South: Northern Access Road</td></tr>
<tr><td>1</td><td>L</td><td>19</td><td>0.0</td><td>0.245</td><td>11.9</td><td>LOS A</td><td>1.1</td><td>7.6</td><td>0.25</td><td>0.66</td><td>61.8</td></tr>
<tr><td>3</td><td>R</td><td>246</td><td>1.7</td><td>0.245</td><td>12.0</td><td>LOS A</td><td>1.1</td><td>7.6</td><td>0.25</td><td>0.69</td><td>62.1</td></tr>
<tr><td>Approach</td><td></td><td>265</td><td>1.6</td><td>0.245</td><td>12.0</td><td>LOS A</td><td>1.1</td><td>7.6</td><td>0.25</td><td>0.69</td><td>62.1</td></tr>
<tr><td colspan="12">East: Wybong Road East</td></tr>
<tr><td>4</td><td>L</td><td>44</td><td>0.0</td><td>0.024</td><td>12.2</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.75</td><td>64.8</td></tr>
<tr><td>5</td><td>T</td><td>52</td><td>6.1</td><td>0.028</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>96</td><td>3.3</td><td>0.028</td><td>5.6</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.35</td><td>81.4</td></tr>
<tr><td colspan="12">West: Wybong Road West</td></tr>
<tr><td>11</td><td>T</td><td>26</td><td>20.0</td><td>0.015</td><td>0.2</td><td>LOS A</td><td>0.1</td><td>0.6</td><td>0.16</td><td>0.00</td><td>90.5</td></tr>
<tr><td>12</td><td>R</td><td>4</td><td>0.0</td><td>0.015</td><td>12.3</td><td>LOS A</td><td>0.1</td><td>0.6</td><td>0.20</td><td>1.37</td><td>66.8</td></tr>
<tr><td>Approach</td><td></td><td>31</td><td>17.2</td><td>0.015</td><td>1.9</td><td>NA</td><td>0.1</td><td>0.6</td><td>0.17</td><td>0.19</td><td>86.9</td></tr>
<tr><td>All Vehicles</td><td></td><td>392</td><td>3.2</td><td>0.245</td><td>9.6</td><td>NA</td><td>1.1</td><td>7.6</td><td>0.18</td><td>0.57</td><td>67.3</td></tr>
</table>
</td><td>This analysis showed that there is marginal difference between the modelled base-case condition and the traffic impacts of the proposed modification. This is reflected in the small differences between average intersection delay (8.5 to 9.6 seconds/vehicle).

This analysis shows that the proposed modification is not likely to have significant impacts on the Wybong Road/ Northern Access Road intersection.</td></tr>
<tr><td>Denman/ BLR

0600-0700h</td><td>
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">East: Denman Road (E)</td></tr>
<tr><td>5</td><td>T</td><td>100</td><td>8.4</td><td>0.054</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>80.0</td></tr>
<tr><td>6</td><td>R</td><td>359</td><td>5.3</td><td>0.380</td><td>13.3</td><td>LOS A</td><td>2.4</td><td>17.4</td><td>0.43</td><td>0.75</td><td>61.1</td></tr>
<tr><td>Approach</td><td></td><td>459</td><td>6.0</td><td>0.380</td><td>10.4</td><td>LOS A</td><td>2.4</td><td>17.4</td><td>0.33</td><td>0.59</td><td>64.1</td></tr>
<tr><td colspan="12">North: Bengalla Link Road</td></tr>
<tr><td>7</td><td>L</td><td>53</td><td>4.0</td><td>0.060</td><td>13.6</td><td>LOS A</td><td>0.3</td><td>2.0</td><td>0.29</td><td>0.70</td><td>62.8</td></tr>
<tr><td>9</td><td>R</td><td>4</td><td>0.0</td><td>0.060</td><td>13.2</td><td>LOS A</td><td>0.3</td><td>2.0</td><td>0.29</td><td>0.81</td><td>63.1</td></tr>
<tr><td>Approach</td><td></td><td>57</td><td>3.7</td><td>0.060</td><td>13.6</td><td>LOS A</td><td>0.3</td><td>2.0</td><td>0.29</td><td>0.71</td><td>62.8</td></tr>
<tr><td colspan="12">West: Denman Road (W)</td></tr>
<tr><td>10</td><td>L</td><td>43</td><td>2.4</td><td>0.024</td><td>11.5</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.74</td><td>63.3</td></tr>
<tr><td>11</td><td>T</td><td>159</td><td>5.3</td><td>0.084</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>80.0</td></tr>
<tr><td>Approach</td><td></td><td>202</td><td>4.7</td><td>0.084</td><td>2.5</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.16</td><td>75.3</td></tr>
<tr><td>All Vehicles</td><td></td><td>718</td><td>5.4</td><td>0.380</td><td>8.4</td><td>NA</td><td>2.4</td><td>17.4</td><td>0.24</td><td>0.48</td><td>66.7</td></tr>
</table>
</td><td>
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">East: Denman Road (E)</td></tr>
<tr><td>5</td><td>T</td><td>113</td><td>8.4</td><td>0.061</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>80.0</td></tr>
<tr><td>6</td><td>R</td><td>445</td><td>4.7</td><td>0.498</td><td>14.7</td><td>LOS B</td><td>3.6</td><td>26.1</td><td>0.53</td><td>0.84</td><td>59.2</td></tr>
<tr><td>Approach</td><td></td><td>558</td><td>5.5</td><td>0.498</td><td>11.7</td><td>NA</td><td>3.6</td><td>26.1</td><td>0.42</td><td>0.67</td><td>62.2</td></tr>
<tr><td colspan="12">North: Bengalla Link Road</td></tr>
<tr><td>7</td><td>L</td><td>67</td><td>3.1</td><td>0.089</td><td>14.1</td><td>LOS A</td><td>0.3</td><td>2.3</td><td>0.34</td><td>0.71</td><td>62.0</td></tr>
<tr><td>9</td><td>R</td><td>9</td><td>0.0</td><td>0.089</td><td>13.8</td><td>LOS A</td><td>0.3</td><td>2.3</td><td>0.34</td><td>0.85</td><td>62.3</td></tr>
<tr><td>Approach</td><td></td><td>77</td><td>2.7</td><td>0.089</td><td>14.0</td><td>LOS A</td><td>0.3</td><td>2.3</td><td>0.34</td><td>0.73</td><td>62.1</td></tr>
<tr><td colspan="12">West: Denman Road (W)</td></tr>
<tr><td>10</td><td>L</td><td>69</td><td>1.5</td><td>0.038</td><td>11.4</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.74</td><td>63.3</td></tr>
<tr><td>11</td><td>T</td><td>179</td><td>5.3</td><td>0.095</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>80.0</td></tr>
<tr><td>Approach</td><td></td><td>248</td><td>4.2</td><td>0.095</td><td>3.2</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.21</td><td>74.0</td></tr>
<tr><td>All Vehicles</td><td></td><td>883</td><td>4.9</td><td>0.498</td><td>9.5</td><td>NA</td><td>3.6</td><td>26.1</td><td>0.29</td><td>0.54</td><td>65.0</td></tr>
</table>
</td><td>This analysis showed that there is marginal difference between the modelled base-case condition and the traffic impacts of the proposed modification. This is reflected in the small differences between average intersection delay (8.4 to 9.5 seconds/vehicle).

Although the maximum queue length for the right turn from Denman Road to Bengalla Link Road increases from 17.4m to 26.1m, it is noted that the right-turn bay is currently 150m long. Therefore, the entire queue would be accommodated within the indented right-turn bay with little risk of overflow queuing. Furthermore, the residual 124m length exceeds the minimum 70m deceleration length as specified in RTA (1999).</td></tr>
</table>

Abbreviations from Table 3-1:(i) NAR: Northern Access Road; (ii) BLR: Bengalla Link Road; (iii) TMD: Thomas Mitchell Drive; (iv) NEH: New England Highway

Intersect-ion and peak period	Base case *(includes the October 2011 surveyed volumes as well as the operation traffic from other project approvals which had not yet commenced at the time of the surveys).*	With proposed modification *(includes base-case volumes, plus 5 years of background growth at 2.5% p.a, plus the traffic generation due to the proposed modification).*	Comments
Denman/ BLR **1645-1745h**	**Movement Performance - Vehicles** Mov ID | Turn | Demand Flow veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h East: Denman Road (E) 5 T 177 3.0 0.092 0.0 LOS A 0.0 0.0 0.00 0.00 80.0 6 R 74 5.7 0.079 12.8 LOS A 0.4 2.7 0.33 0.71 61.6 Approach 251 3.8 0.092 3.8 LOS A 0.4 2.7 0.10 0.21 73.0 North: Bengalla Link Road 7 L 229 4.1 0.249 13.4 LOS A 1.3 9.7 0.27 0.70 62.9 9 R 27 0.0 0.249 13.0 LOS A 1.3 9.7 0.27 0.79 63.2 Approach 257 3.7 0.249 13.3 LOS A 1.3 9.7 0.27 0.71 63.0 West: Denman Road (W) 10 L 3 0.0 0.002 11.3 LOS A 0.0 0.0 0.00 0.73 63.3 11 T 114 7.4 0.061 0.0 LOS A 0.0 0.0 0.00 0.00 80.0 Approach 117 7.2 0.061 0.3 LOS A 0.0 0.0 0.00 0.02 79.4 All Vehicles 624 4.4 0.249 7.1 NA 1.3 9.7 0.15 0.38 69.6	**Movement Performance - Vehicles** Mov ID | Turn | Demand Flow veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h East: Denman Road (E) 5 T 200 3.2 0.105 0.0 LOS A 0.0 0.0 0.00 0.00 80.0 6 R 91 5.8 0.103 13.2 LOS A 0.4 2.8 0.38 0.74 61.3 Approach 291 4.0 0.105 4.1 NA 0.4 2.8 0.12 0.23 72.5 North: Bengalla Link Road 7 L 299 3.5 0.353 13.7 LOS A 1.7 12.0 0.32 0.71 62.6 9 R 52 0.0 0.353 13.4 LOS A 1.7 12.0 0.32 0.82 62.9 Approach 351 3.0 0.353 13.7 LOS A 1.7 12.0 0.32 0.72 62.6 West: Denman Road (W) 10 L 7 0.0 0.004 11.3 LOS A 0.0 0.0 0.00 0.73 63.3 11 T 128 7.4 0.069 0.0 LOS A 0.0 0.0 0.00 0.00 80.0 Approach 136 7.0 0.069 0.6 NA 0.0 0.0 0.00 0.04 78.7 All Vehicles 777 4.1 0.353 7.8 NA 1.7 12.0 0.19 0.42 68.7	This analysis showed that there is marginal difference between the modelled base-case condition and the traffic impacts of the proposed modification. This is reflected in the small differences between average intersection delay (7.1 to 7.8 seconds/vehicle) and maximum queue length (9.7m to 12.0m). This analysis shows that the proposed modification is not likely to have significant impacts on the Denman Road/ Bengalla Link Road intersection.
Denman/ TMD **0600-0700h**	**Movement Performance - Vehicles** Mov ID | Turn | Demand Flow veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h South East: Thomas Mitchell Drive 21 L 141 11.2 0.242 16.8 LOS B 1.2 9.1 0.57 0.90 46.5 23 R 120 8.6 0.246 18.2 LOS B 1.2 9.0 0.65 0.92 55.5 Approach 261 10.1 0.246 17.5 LOS B 1.2 9.1 0.61 0.91 51.6 North East: Denman Road (N) 24 L 540 3.7 0.299 12.5 LOS A 0.0 0.0 0.00 0.75 52.3 25 T 280 3.4 0.147 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 Approach 820 3.6 0.298 8.2 LOS A 0.0 0.0 0.00 0.50 68.9 South West: Denman Road (S) 31 T 72 8.6 0.039 0.0 LOS A 1.3 9.7 0.00 0.00 100.0 32 R 118 3.6 0.275 20.8 LOS B 1.3 9.7 0.71 0.95 53.1 Approach 189 5.6 0.276 12.9 LOS B 1.3 9.7 0.44 0.59 66.0 All Vehicles 1271 5.2 0.299 10.8 NA 1.3 9.7 0.19 0.59 63.9	**Movement Performance - Vehicles** Mov ID | Turn | Demand Flow veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h South East: Thomas Mitchell Drive 21 L 177 10.1 0.341 18.8 LOS B 1.5 11.7 0.65 0.95 43.8 23 R 136 8.5 0.330 20.9 LOS B 1.4 10.3 0.73 0.97 52.7 Approach 313 9.4 0.341 19.7 LOS B 1.5 11.7 0.68 0.96 48.5 North East: Denman Road (N) 24 L 609 3.6 0.337 12.5 LOS A 0.0 0.0 0.00 0.75 52.3 25 T 339 3.1 0.177 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 Approach 948 3.4 0.337 8.0 NA 0.0 0.0 0.00 0.48 69.7 South West: Denman Road (S) 31 T 85 8.6 0.046 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 32 R 137 3.8 0.392 24.8 LOS B 1.6 11.9 0.80 1.00 48.9 Approach 222 5.7 0.392 15.3 NA 1.6 11.9 0.49 0.61 62.4 All Vehicles 1483 5.0 0.392 11.6 NA 1.6 11.9 0.22 0.60 62.6	This analysis showed that there is marginal difference between the modelled base-case condition and the traffic impacts of the proposed modification. This is reflected in the small differences between average intersection delay (10.8 to 11.6 seconds/vehicle) and maximum queue length (9.7m to 11.9m). This analysis shows that the proposed modification is not likely to have significant impacts on the Denman Road/ Thomas Mitchell Drive intersection.
Denman/ TMD **1645-1745h**	**Movement Performance - Vehicles** Mov ID | Turn | Demand Flow veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h South East: Thomas Mitchell Drive 21 L 60 3.5 0.063 12.7 LOS A 0.3 2.1 0.32 0.70 51.6 23 R 309 2.0 0.481 17.3 LOS B 3.5 25.0 0.65 0.99 55.8 Approach 369 2.3 0.480 16.6 LOS B 3.5 25.0 0.59 0.94 55.4 North East: Denman Road (N) 24 L 61 5.2 0.034 12.6 LOS A 0.0 0.0 0.00 0.75 52.3 25 T 192 4.9 0.101 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 Approach 253 5.0 0.101 3.0 LOS A 0.0 0.0 0.00 0.18 88.8 South West: Denman Road (S) 31 T 257 5.7 0.192 1.2 LOS A 1.6 11.6 0.30 0.00 82.8 32 R 88 7.1 0.192 14.7 LOS B 1.6 11.6 0.44 1.03 65.8 Approach 345 6.1 0.192 4.7 LOS B 1.6 11.6 0.33 0.26 78.3 All Vehicles 967 4.4 0.481 8.8 NA 3.5 25.0 0.35 0.50 69.5	**Movement Performance - Vehicles** Mov ID | Turn | Demand Flow veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | 95% Back of Queue Distance m | Prop. Queued | Effective Stop Rate per veh | Average Speed km/h South East: Thomas Mitchell Drive 21 L 72 2.9 0.078 12.9 LOS A 0.3 2.0 0.35 0.72 51.4 23 R 349 2.1 0.627 21.0 LOS B 4.4 31.1 0.76 1.09 52.1 Approach 421 2.3 0.627 19.6 LOS B 4.4 31.1 0.69 1.03 52.0 North East: Denman Road (N) 24 L 68 4.6 0.038 12.6 LOS A 0.0 0.0 0.00 0.75 52.3 25 T 221 4.8 0.117 0.0 LOS A 0.0 0.0 0.00 0.00 100.0 Approach 289 4.7 0.117 3.0 NA 0.0 0.0 0.00 0.18 89.0 South West: Denman Road (S) 31 T 313 5.4 0.247 1.5 LOS A 1.7 12.6 0.32 0.00 81.4 32 R 118 6.3 0.247 15.1 LOS B 1.7 12.6 0.50 1.02 65.3 Approach 431 5.6 0.247 5.2 NA 1.7 12.6 0.37 0.28 76.8 All Vehicles 1141 4.2 0.627 10.0 NA 4.4 31.1 0.39 0.53 67.4	This analysis showed that there is marginal difference between the modelled base-case condition and the traffic impacts of the proposed modification. This is reflected in the small differences between average intersection delay (8.8 to 10.0seconds/vehicle). The model predicted maximum queue lengths of 31.1m (increase from 25m) for the right turn movement from Thomas Mitchell Drive to Denman Road. However, this approach to the intersection includes a 140m indented left-turn lane with the through lane continuing to form the right-turn lane. That is, effectively, there is 140m of right-turn storage available before the right-turn stream blocks access to the left-turn lane. As the maximum modelled queue lengths leave a residual length of 108m, there is adequate storage length available to maintain safe and efficient operation of this intersection approach.

Abbreviations from Table 3-1:(i) NAR: Northern Access Road; (ii) BLR: Bengalla Link Road; (iii) TMD: Thomas Mitchell Drive; (iv) NEH: New England Highway

<table>
<tr><th>Intersect -ion and peak period</th><th>Base case

(includes the October 2011 surveyed volumes as well as the operation traffic from other project approvals which had not yet commenced at the time of the surveys).</th><th>With proposed modification

(includes base-case volumes, plus 5 years of background growth at 2.5% p.a, plus the traffic generation due to the proposed modification).</th><th>Comments</th></tr>
<tr><td>NEH/ TMD

(Under seagull config)

0600-0700h</td><td>Stage 1 crossing.
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South: New England Highway (S)</td></tr>
<tr><td>24</td><td>L</td><td>392</td><td>6.7</td><td>0.221</td><td>12.9</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.69</td><td>59.1</td></tr>
<tr><td>25</td><td>T</td><td>200</td><td>24.2</td><td>0.119</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>592</td><td>12.6</td><td>0.221</td><td>8.6</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.46</td><td>72.4</td></tr>
<tr><td colspan="12">North: New England Highway (N)</td></tr>
<tr><td>32</td><td>R</td><td>92</td><td>1.1</td><td>0.063</td><td>13.2</td><td>LOS A</td><td>0.3</td><td>2.0</td><td>0.34</td><td>0.69</td><td>62.3</td></tr>
<tr><td>Approach</td><td></td><td>92</td><td>1.1</td><td>0.063</td><td>13.2</td><td>NA</td><td>0.3</td><td>2.0</td><td>0.34</td><td>0.69</td><td>62.3</td></tr>
<tr><td colspan="12">West: Thomas Mitchell Drive</td></tr>
<tr><td>21</td><td>L</td><td>14</td><td>0.0</td><td>0.007</td><td>13.1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.76</td><td>43.3</td></tr>
<tr><td>23</td><td>R</td><td>126</td><td>14.2</td><td>0.129</td><td>14.9</td><td>LOS B</td><td>0.6</td><td>4.5</td><td>0.53</td><td>0.78</td><td>59.9</td></tr>
<tr><td>Approach</td><td></td><td>140</td><td>12.8</td><td>0.129</td><td>14.7</td><td>LOS B</td><td>0.6</td><td>4.5</td><td>0.48</td><td>0.78</td><td>58.9</td></tr>
<tr><td>All Vehicles</td><td></td><td>823</td><td>11.4</td><td>0.221</td><td>10.1</td><td>NA</td><td>0.6</td><td>4.5</td><td>0.12</td><td>0.54</td><td>68.0</td></tr>
</table>
Stage 2 downstream merge.
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">North: New England Highway (N)</td></tr>
<tr><td>1</td><td>T</td><td>597</td><td>9.7</td><td>0.325</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>597</td><td>9.7</td><td>0.325</td><td>0.0</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td colspan="12">North West: RT acceleration lane TMD</td></tr>
<tr><td>2</td><td>T</td><td>126</td><td>14.2</td><td>0.125</td><td>1.8</td><td>LOS A</td><td>0.4</td><td>3.0</td><td>0.45</td><td>0.16</td><td>84.3</td></tr>
<tr><td>Approach</td><td></td><td>126</td><td>14.2</td><td>0.125</td><td>1.8</td><td>LOS A</td><td>0.4</td><td>3.0</td><td>0.45</td><td>0.16</td><td>84.3</td></tr>
<tr><td>All Vehicles</td><td></td><td>723</td><td>10.5</td><td>0.325</td><td>0.3</td><td>NA</td><td>0.4</td><td>3.0</td><td>0.08</td><td>0.03</td><td>97.1</td></tr>
</table></td><td>Stage 1 crossing.
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South: New England Highway (S)</td></tr>
<tr><td>24</td><td>L</td><td>460</td><td>6.4</td><td>0.259</td><td>12.9</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.69</td><td>59.1</td></tr>
<tr><td>25</td><td>T</td><td>225</td><td>24.3</td><td>0.134</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>685</td><td>12.3</td><td>0.259</td><td>8.7</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.47</td><td>72.0</td></tr>
<tr><td colspan="12">North: New England Highway (N)</td></tr>
<tr><td>32</td><td>R</td><td>103</td><td>1.0</td><td>0.073</td><td>13.3</td><td>LOS A</td><td>0.3</td><td>2.3</td><td>0.37</td><td>0.70</td><td>62.1</td></tr>
<tr><td>Approach</td><td></td><td>103</td><td>1.0</td><td>0.073</td><td>13.3</td><td>NA</td><td>0.3</td><td>2.3</td><td>0.37</td><td>0.70</td><td>62.1</td></tr>
<tr><td colspan="12">West: Thomas Mitchell Drive</td></tr>
<tr><td>21</td><td>L</td><td>16</td><td>0.0</td><td>0.009</td><td>13.1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.76</td><td>43.3</td></tr>
<tr><td>23</td><td>R</td><td>146</td><td>13.7</td><td>0.161</td><td>15.3</td><td>LOS B</td><td>0.7</td><td>5.6</td><td>0.57</td><td>0.82</td><td>59.3</td></tr>
<tr><td>Approach</td><td></td><td>162</td><td>12.3</td><td>0.161</td><td>15.1</td><td>LOS B</td><td>0.7</td><td>5.6</td><td>0.52</td><td>0.82</td><td>58.3</td></tr>
<tr><td>All Vehicles</td><td></td><td>951</td><td>11.1</td><td>0.259</td><td>10.3</td><td>NA</td><td>0.7</td><td>5.6</td><td>0.13</td><td>0.55</td><td>67.6</td></tr>
</table>
Stage 2 downstream merge.
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">North: New England Highway (N)</td></tr>
<tr><td>1</td><td>T</td><td>674</td><td>9.7</td><td>0.367</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>674</td><td>9.7</td><td>0.367</td><td>0.0</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td colspan="12">North West: RT acceleration lane TMD</td></tr>
<tr><td>2</td><td>T</td><td>146</td><td>13.7</td><td>0.157</td><td>2.2</td><td>LOS A</td><td>0.5</td><td>3.8</td><td>0.48</td><td>0.20</td><td>83.2</td></tr>
<tr><td>Approach</td><td></td><td>146</td><td>13.7</td><td>0.157</td><td>2.2</td><td>LOS A</td><td>0.5</td><td>3.8</td><td>0.48</td><td>0.20</td><td>83.2</td></tr>
<tr><td>All Vehicles</td><td></td><td>820</td><td>10.4</td><td>0.367</td><td>0.4</td><td>NA</td><td>0.5</td><td>3.8</td><td>0.09</td><td>0.04</td><td>96.8</td></tr>
</table></td><td>The SIDRA models indicated that there would be very little change in the performance of this intersection between the base case conditions as well as with the additional traffic generated by the proposed Modification. This is indicated by the marginal changes to average delays and maximum queue lengths.</td></tr>
<tr><td>NEH/ TMD

(Under seagull config)

1645-1745h</td><td>Stage 1 crossing.
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South: New England Highway (S)</td></tr>
<tr><td>24</td><td>L</td><td>75</td><td>12.7</td><td>0.044</td><td>13.4</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.70</td><td>59.2</td></tr>
<tr><td>25</td><td>T</td><td>475</td><td>11.1</td><td>0.261</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>549</td><td>11.3</td><td>0.261</td><td>1.8</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.09</td><td>94.2</td></tr>
<tr><td colspan="12">North: New England Highway (N)</td></tr>
<tr><td>32</td><td>R</td><td>13</td><td>0.0</td><td>0.012</td><td>14.2</td><td>LOS A</td><td>0.0</td><td>0.3</td><td>0.49</td><td>0.70</td><td>61.3</td></tr>
<tr><td>Approach</td><td></td><td>13</td><td>0.0</td><td>0.012</td><td>14.2</td><td>NA</td><td>0.0</td><td>0.3</td><td>0.49</td><td>0.70</td><td>61.3</td></tr>
<tr><td colspan="12">West: Thomas Mitchell Drive</td></tr>
<tr><td>21</td><td>L</td><td>54</td><td>5.9</td><td>0.030</td><td>13.4</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.76</td><td>43.3</td></tr>
<tr><td>23</td><td>R</td><td>229</td><td>8.3</td><td>0.222</td><td>14.5</td><td>LOS B</td><td>1.0</td><td>7.8</td><td>0.56</td><td>0.81</td><td>59.8</td></tr>
<tr><td>Approach</td><td></td><td>283</td><td>7.8</td><td>0.222</td><td>14.3</td><td>LOS A</td><td>1.0</td><td>7.8</td><td>0.46</td><td>0.80</td><td>57.8</td></tr>
<tr><td>All Vehicles</td><td></td><td>845</td><td>10.0</td><td>0.261</td><td>6.2</td><td>NA</td><td>1.0</td><td>7.8</td><td>0.16</td><td>0.34</td><td>78.0</td></tr>
</table>
Stage 2 downstream merge.
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">North: New England Highway (N)</td></tr>
<tr><td>1</td><td>T</td><td>333</td><td>15.2</td><td>0.187</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>333</td><td>15.2</td><td>0.187</td><td>0.0</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td colspan="12">North West: RT acceleration lane TMD</td></tr>
<tr><td>2</td><td>T</td><td>229</td><td>8.3</td><td>0.168</td><td>0.8</td><td>LOS A</td><td>0.6</td><td>4.1</td><td>0.33</td><td>0.08</td><td>87.9</td></tr>
<tr><td>Approach</td><td></td><td>229</td><td>8.3</td><td>0.168</td><td>0.8</td><td>LOS A</td><td>0.6</td><td>4.1</td><td>0.33</td><td>0.08</td><td>87.9</td></tr>
<tr><td>All Vehicles</td><td></td><td>562</td><td>12.4</td><td>0.187</td><td>0.3</td><td>NA</td><td>0.6</td><td>4.1</td><td>0.14</td><td>0.03</td><td>94.9</td></tr>
</table></td><td>Stage 1 crossing.
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South: New England Highway (S)</td></tr>
<tr><td>24</td><td>L</td><td>87</td><td>12.0</td><td>0.051</td><td>13.3</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.70</td><td>59.2</td></tr>
<tr><td>25</td><td>T</td><td>536</td><td>11.0</td><td>0.294</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>623</td><td>11.1</td><td>0.294</td><td>1.9</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.10</td><td>94.0</td></tr>
<tr><td colspan="12">North: New England Highway (N)</td></tr>
<tr><td>32</td><td>R</td><td>15</td><td>0.0</td><td>0.015</td><td>14.5</td><td>LOS A</td><td>0.1</td><td>0.4</td><td>0.52</td><td>0.72</td><td>61.1</td></tr>
<tr><td>Approach</td><td></td><td>15</td><td>0.0</td><td>0.015</td><td>14.5</td><td>NA</td><td>0.1</td><td>0.4</td><td>0.52</td><td>0.72</td><td>61.1</td></tr>
<tr><td colspan="12">West: Thomas Mitchell Drive</td></tr>
<tr><td>21</td><td>L</td><td>60</td><td>5.3</td><td>0.034</td><td>13.4</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.76</td><td>43.3</td></tr>
<tr><td>23</td><td>R</td><td>277</td><td>7.6</td><td>0.286</td><td>15.1</td><td>LOS B</td><td>1.4</td><td>10.7</td><td>0.61</td><td>0.87</td><td>59.0</td></tr>
<tr><td>Approach</td><td></td><td>337</td><td>7.2</td><td>0.286</td><td>14.8</td><td>LOS B</td><td>1.4</td><td>10.7</td><td>0.50</td><td>0.85</td><td>57.2</td></tr>
<tr><td>All Vehicles</td><td></td><td>975</td><td>9.6</td><td>0.294</td><td>6.5</td><td>NA</td><td>1.4</td><td>10.7</td><td>0.18</td><td>0.37</td><td>77.1</td></tr>
</table>
Stage 2 downstream merge.
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">North: New England Highway (N)</td></tr>
<tr><td>1</td><td>T</td><td>375</td><td>15.2</td><td>0.211</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>375</td><td>15.2</td><td>0.211</td><td>0.0</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td colspan="12">North West: RT acceleration lane TMD</td></tr>
<tr><td>2</td><td>T</td><td>277</td><td>7.6</td><td>0.208</td><td>1.0</td><td>LOS A</td><td>0.7</td><td>5.2</td><td>0.36</td><td>0.09</td><td>86.8</td></tr>
<tr><td>Approach</td><td></td><td>277</td><td>7.6</td><td>0.208</td><td>1.0</td><td>LOS A</td><td>0.7</td><td>5.2</td><td>0.36</td><td>0.09</td><td>86.8</td></tr>
<tr><td>All Vehicles</td><td></td><td>652</td><td>12.0</td><td>0.211</td><td>0.4</td><td>NA</td><td>0.7</td><td>5.2</td><td>0.15</td><td>0.04</td><td>94.2</td></tr>
</table></td><td>The SIDRA models indicated that there would be very little change in the performance of this intersection between the base case conditions as well as with the additional traffic generated by the proposed Modification. This is indicated by the marginal changes to average delays and maximum queue lengths.</td></tr>
</table>

Abbreviations from Table 3-1:(i) NAR: Northern Access Road; (ii) BLR: Bengalla Link Road; (iii) TMD: Thomas Mitchell Drive; (iv) NEH: New England Highway

4.2.6 ROAD SAFETY IMPLICATIONS OF THE PROPOSED MODIFICATION

Section 2.3 discussed the crash rates experienced on Wybong Road, Denman Road and Thomas Mitchell Drive. From this assessment, the following crash rates were adopted for key routes in the study area:

- Wybong Road: 0.32 crashes/ MVKT
- Bengalla Link Road: 0.33 crashes/ MVKT (similar to Denman Road as there was no crash data provided for Bengalla Link Road).
- Denman Road: 0.33 crashes/ MVKT
- Thomas Mitchell Drive: 0.44 crashes/ MVKT

These crash rates were used to predict the number of crashes that would be generated by the proposed modification due to the increased traffic volumes. Assuming that the crash rates would remain fixed[5], any increase in traffic volumes as a result of the modification, would lead to an increase in MVKT. This would thereby increase the number of crashes.

The predicted increase in crashes due to the additional traffic generated by the proposed modification is shown in Table 4-4. This analysis has broadly assumed that all Mangoola Coal-generated traffic would travel along the Wybong Road-Bengalla Road-Denman Road-Thomas Mitchell Drive route. Although the traffic distribution patterns described in Figure 2-11 suggest that traffic would be more widely distributed to other routes, the general assignment of all traffic to this trunk route was considered an acceptable preliminary measure for predicting the order of increase in crashes.

[5] The assumption that the crash rate remains fixed is reasonable if there are relatively small changes to traffic volumes which is the case in this assessment. This assumes that the function of the road and the traffic conditions in the “after” case are similar to the “before” case. If these are similar, then crash frequency (number) would remain proportional to crash exposure (MVKT). However, if there are larger changes to traffic volumes, the traffic conditions may change to a point where more crash conflicts and crash opportunity in addition to crash exposure. For example, if traffic volumes increase to a point where there is more congestion, then there will be new crash risks introduced (rear-end, intersection crashes).

Table 4-4 Predicted increase in crashes due to the proposed modification.

Wybong Road – Northern Access Road to Bengalla Link Road	
Crash rate (per MVKT)	0.32
Additional traffic generated - employee movements/year	101470
Additional traffic - Five years' traffic growth (per year)	57889
Total traffic volume increase per year	159359
Trip length (km) - Note 1	7
Total increase in MVKT/year	1.12
Total number of new crashes generated per year	**0.36**
Denman Road - Bengalla Link Road to Thomas Mitchell Drive	
Crash rate (per MVKT)	0.33
Additional traffic generated - employee movements/year	101470
Additional traffic - Five years' traffic growth (per year)	189800
Total traffic volume increase per year	291270
Trip length (km)	0.9
Total increase in MVKT/year	0.26
Total number of new crashes generated per year	**0.09**
Bengalla Link Road - Wybong Road to Denman Road	
Crash rate (per MVKT)	0.33
Additional traffic generated - employee movements/year	101470
Additional traffic - Five years' traffic growth (per year)	45125
Total traffic volume increase per year	146595
Trip length (km)	10
Total increase in MVKT/year	1.47
Total number of new crashes generated per year	**0.48**
Thomas Mitchell Drive - Bengalla Link Road to Thomas Mitchell Drive	
Crash rate (per MVKT)	0.44
Additional traffic generated - employee movements/year	101470
Additional traffic - Five years' traffic growth (per year)	151366
Total traffic volume increase per year	252836
Trip length (km) - Note 1	11
Total increase in MVKT/year	2.78
Total number of new crashes generated per year	**1.22**
Grand total number of new crashes generated per year	**2.15**

Notes:
(1) to simplify the analysis, it was assumed that all traffic would travel between the Project and Bengalla Link Road (7km).

The forecast increase in crashes is not considered to be a significant increase. Furthermore, the site induction process and OHS management systems in place all have mechanisms for regulating safe driving practices by workers and contractors (including short term contractors and visitors). Also, as previously stated, a more realistic vehicle occupancy rate of 1.15 persons/ vehicle would generate less trips and hence less overall crash exposure. As such, the above assessment is conservative in these respects.

4.3 POTENTIAL CUMULATIVE TRAFFIC IMPACTS

There are a number of other coal projects within the vicinity of the Mangoola Coal which are likely to modify or expand their operations. Details of these are provided in Section 4.3.1 to 4.3.3. These were used to assess the cumulative traffic impacts in the region. A cumulative traffic impact assessment was carried out for the 0600-0700h assessment period.

4.3.1 MOUNT PLEASANT COAL PROJECT

The Mount Pleasant Coal Project is located to the north of Wybong Road to the east of Bengalla Link Road, approximately 4km west of Muswellbrook. Whilst this project was approved on 19 September 2011, it has not yet commenced any activities. EMGA (2010a) stated that the operational workforce of the Mount Pleasant Coal Project would consist of approximately 360 persons between 2014 and 2019. TPK (2006) further stated that the Mount Pleasant Coal Project would generate 109 inbound and 74 outbound movements in the AM peak period between 0630-0730h, and 74 inbound and 84 outbound movements in the PM peak period between 1830-1930h.

The mining operations would be carried out over 24 hours a day over 12.5 hour rotating shifts. There would be 13 additional one-way truck movements required to access the site each day during the operation phase, consisting of petrol tankers and explosives (ERM, 1997).

A cumulative impact assessment was only carried out for the 0600-0700h assessment period. This is because the staff movements associated with this project are likely to generate additional road traffic movements in the 0600-0700h assessment period, but not the 0800-0900h and 1645-1745h period. Furthermore, AM peak traffic periods generally tend to be sharper with less variability in traffic arrival times. By contrast, PM peaks tend to have more spread out and variable traffic patterns. These traffic generation figures have been included into Figure 4-6.

The traffic generated by the Mount Pleasant Coal Project would most likely be distributed to Bengalla Link Road. This is due to the high standard of the route, as well as the long term proposal to close through connectivity from Wybong Road to North Muswellbrook (Umwelt, 2006). A new road referred to in the EA as the *Northern and Western Road Link* will provide access to the Mt Pleasant Coal Project and will meet Wybong Road as a T intersection (EMGA Mitchell McLennan, 2010a).

4.3.2 MOUNT ARTHUR COAL

MAC is an existing mine located on Thomas Mitchell Drive to the south of the Muswellbrook Industrial Park. On 24 September 2010, approval was granted for the increase in coal production from 28Mtpa to 36Mtpa. In this Traffic and Transport Impact Assessment for the proposed modification, it has been conservatively assumed that there has not yet been any substantial increase in production or employment numbers to date. That is, the October 2011 traffic surveys undertaken as part of this Traffic and Transport Impact Assessment are a closer reflection of the 28Mtpa production yield rather than the 36Mtpa yield.

Hansen Bailey (2009) raised the following issues of relevance to potential traffic growth due to MAC's approved production limits:

- An increase to the operation workforce of 720 full time equivalent positions during the peak operation phase in 2014. 70% of the workforce would travel to the site on any weekday at a vehicle occupancy rate of 1.17 persons/vehicle. Accordingly, 428 additional one-way light vehicle movements would be generated by the site during the peak operation phase in 2014 (assumed to be evenly distributed over two 12-hour shifts). An

additional 20 light vehicle visits would occur each day (assumed to be generated outside the peak periods).

- Traffic generated from MAC would be distributed:
  - 65% to the west towards Denman Road. From there the traffic would be distributed 90% east (towards Muswellbrook) and 10% west (towards Denman) along Denman Road.
  - 35% to the east towards the New England Highway. 100% of this traffic would then be distributed south via the New England Highway.

The generated traffic movements described above have been included in Figure 4-6 as well as the cumulative traffic impact models described in Section 4.3.5.

4.3.3 BENGALLA MINE

Bengalla Mine is located to the north of Denman Road and the north-west of Drayton Mine, with access via Bengalla Link Road. Bengalla Mine Access Road is approximately 6.5 km from Denman Road.

Bengalla Mine was originally approved to operate for a 21 year period from 1996 and producing up to 8.7 Mtpa of ROM coal. Subsequently, four approved modifications have allowed ongoing operations to produce up to 10.7 Mtpa ROM coal. The current operation has a workforce of 400 full time personnel, plus contractors.

Recently in February 2012, Bengalla Mining Company sought development consent to enable mining to continue for an additional 24 year period at a rate of up to 15 Mtpa of ROM coal to be achieved from year 4 onwards. The project is as described in the -*Continuation of Bengalla Mine Background Document- prepared by Hansen Bailey, February 2012* and is anticipated to include a workforce of approximately 900 full time equivalent personnel (plus contractors) at peak production. This represents an increase of 500 additional personnel (plus additional contractors) compared to the existing workforce associated with the production rate of 10.7 Mtpa.

The traffic generated by Bengalla Mine would most likely be distributed to Bengalla Link Road, Denman Road and Thomas Mitchell Drive onwards to the New England Highway. The October 2011 traffic surveys undertaken as part of this Traffic and Transport Assessment would already include the Bengalla Mine traffic associated with the 10.7 Mtpa production rate.

It has been assumed that if approval is granted, production of up to 15 Mtpa will commence in 2017. It has also been assumed that these additional employees would be evenly distributed over two 12-hour shifts and all trips would be distributed southwards to the New England Highway. For the purpose of this assessment, it is further assumed that the number of additional contractors is estimated to be around 100 and evenly distributed over two 12-hour shifts.

These traffic generation figures have been included in Figure 4-6.

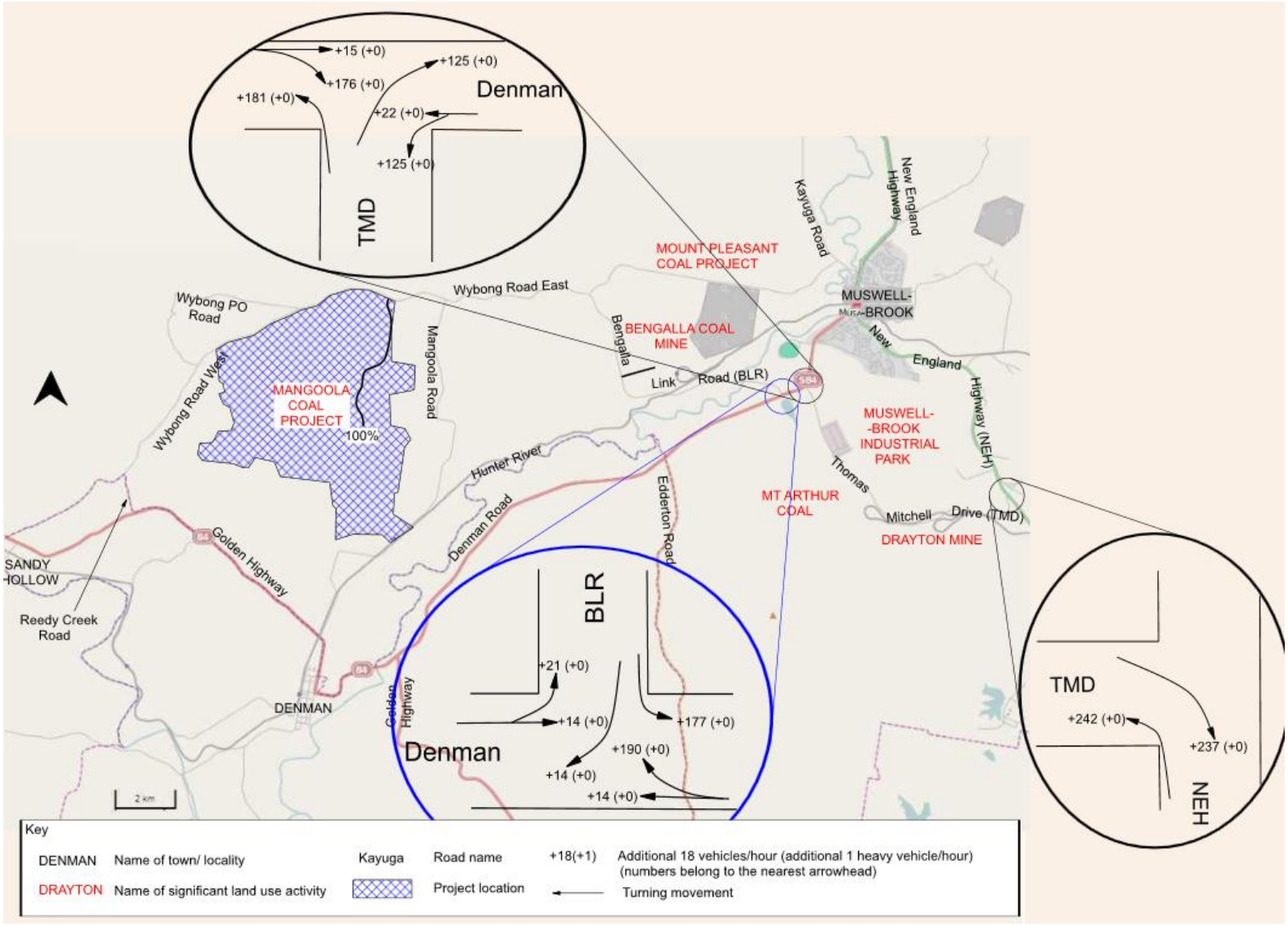

Figure 4-6 Additional traffic generated by other mine expansion projects – 0600-0700h weekdays.

4.3.4 FUTURE "DO NOTHING" CASE

Sections 4.3.1 to 4.3.3 describe some of the future traffic growth due to some foreseeable mine expansion projects in the surrounding region. The future "do nothing" case represents a future case where all of these mine expansion projects proceed (and hence generate additional traffic) but where the proposed modification does not proceed. This scenario has been provided to allow comparison of the cumulative impacts with and without the proposed modification traffic. The difference in outputs between the future "do nothing" model and the cumulative traffic impact model would therefore allow the impacts that are solely attributable to the proposed modification to be isolated.

As described in Section 4.3.1, only the 0600-0700h assessment period has been considered.

The traffic volumes included in the future "do nothing" scenario are as follows:

- Surveyed traffic volumes for the 0600-0700h assessment period.
- Additional traffic due to the operational aspects of the currently approved Project (including modifications that have been approved but not yet commenced) plus one year of traffic growth at 2.5% per year.
- Additional five year's of traffic growth at 2.5% per year to account for growth in background traffic up to the future assessment year of 2017.
- Additional traffic volumes from known other mine expansion projects as detailed in Figure 4-6.

Table 4-5 shows the SIDRA model output for the Denman Road/ Bengalla Link Road, Denman Road/ Thomas Mitchell Drive, and New England Highway/ Thomas Mitchell Drive intersections for the 0600-0700h assessment period.

Table 4-5 SIDRA outputs for future "do nothing" case (0600-0700h) – 2017.

Intersection	Period	Degree of saturation (DoS)	Average intersection delay (sec/ vehicle)	Level of Service (LoS)	Maximum queue length (m)
Denman Road/ Bengalla Link Road	0600-0700h	0.766	13.65	B	71.6
Denman Road/ Thomas Mitchell Drive (as existing config)	0600-0700h	1.305	63.1	F	386
Denman Road/ Thomas Mitchell Drive (as assumed seagull config)	*0600-0700h*	*0.409*	*11.2*	*B*	*16.4*
New England Highway/ Thomas Mitchell Drive*	0600-0700h	0.426	8.5	B	20.2

The SIDRA model results detailed in Table 4-5 indicate that under a "do nothing" scenario, the Denman Road/ Thomas Mitchell Drive intersection is likely to deteriorate significantly in performance. This is indicated by the maximum queue length of 386m and LoS of F for the right turn movement from Denman Road to Thomas Mitchell Drive (compared with a modelled queue length of 9m and LoS of B in the base case).

As stated in Section 3.2, BHP Billiton is obligated to upgrade the Denman Road/ Thomas Mitchell Drive intersection by the end of December 2019. The SIDRA assessment described above indicates that the combined traffic generational impacts from all mining projects may require these intersection upgrades to be brought forward. A preliminary SIDRA assessment on an assumed seagull layout for this intersection indicates that following these upgrades, the intersection performance would be significantly improved. The SIDRA results in these respects have been provided in Table 4-5 and indicate a substantial improvement in DoS (1.305 to 0.409), LoS (F to B), average intersection delay (63.1 seconds/vehicle to 11.2 seconds/ vehicle) and maximum queue length (386m to 16.4m).

4.3.5 INTERSECTION MODEL OUTPUTS FOR THE CUMULATIVE TRAFFIC IMPACT ASSESSMENT

Cumulative traffic models have been undertaken for the following intersections:

- Denman Road/ Bengalla Link Road.
- Denman Road/ Thomas Mitchell Drive.
- New England Highway/ Thomas Mitchell Drive.

The traffic volumes included in the cumulative traffic impact scenario are as follows:

- Surveyed traffic volumes for the 0600-0700h assessment period.
- Additional traffic due to the operational aspects of the currently approved Project not yet accounted for in the surveyed traffic data plus one year of traffic growth at 2.5% per year.
- Additional traffic volumes from known other mine expansion projects as detailed in Figure 4-6.
- Additional traffic volumes due to the proposed modification as shown in Figure 4-4 (which include the additional five year's of traffic growth at 2.5% per year up to the future assessment year of 2017).

The SIDRA model outputs for the cumulative impact scenario are provided in Table 4-6. These have been placed alongside the model outputs for the future "do nothing" case to allow for comparison between the two scenarios. An interpretation of the model results has been provided below for each of the intersections assessed.

Denman Road/ Bengalla Link Road

The cumulative impact case would result in 45 additional right-turning vehicles from Denman Road to Bengalla Link Road per hour compared with the "do nothing" case. These would be opposed by 291 eastbound vehicles per hour. As a result the maximum queue length for this movement would increase from 71.6m to 101.3m. However, it is noted that the existing intersection has 150m of right-turn storage length available. This means the entire queue should be able to be fully stored in the indented turning lane with little risk of queues spilling into the adjacent through lane.

Denman Road/ Thomas Mitchell Drive

The future "do nothing" assessment discussed in Section 4.3.4 already established that the proposed upgrades to this intersection (committed to by BHP Billiton for the year 2019) should be brought forward. This was based on foreseeable future traffic growth from other mines even in the absence of the traffic generated by the Mangoola modification. As such, the assessment of the cumulative future case has only considered this intersection in an assumed seagull layout – ie. not the existing AUR layout.

The assessment confirmed that the intersection, in its upgraded configuration would perform satisfactorily in carrying both the Mangoola modification traffic, as well as the growth in traffic from surrounding coal mines.

New England Highway/ Thomas Mitchell Drive

The New England Highway/ Thomas Mitchell Drive intersection would continue to perform satisfactorily under its recently completed seagull configuration. This is indicated in the SIDRA results in Table 4-6 with maximum queue lengths in the order of 21m (for the right-turn movement from Thomas Mitchell Drive to the New England Highway) and DoS below 0.45 for all intersection approaches (ie. less than 45% of the overall capacity of the intersection would be needed).

Table 4-6 SIDRA model outputs for the (i) future "do nothing" case and (ii) cumulative impact case

<table>
<tr><th>Intersect-ion and peak period</th><th>Future "do nothing" case

(Accounts for known future mine expansion plans but <u>no</u> traffic from the proposed modification).</th><th>Cumulative impact case

(Accounts for known other future mine expansion plans and with proposed modification traffic).</th><th>Comments</th></tr>
<tr><td>Denman/ BLR

0600-0700h</td><td>
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">East: Denman Road (E)</td></tr>
<tr><td>5</td><td>T</td><td>131</td><td>7.3</td><td>0.070</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>80.0</td></tr>
<tr><td>6</td><td>R</td><td>609</td><td>3.6</td><td>0.766</td><td>20.0</td><td>LOS B</td><td>9.9</td><td>71.6</td><td>0.77</td><td>1.18</td><td>53.2</td></tr>
<tr><td>Approach</td><td></td><td>740</td><td>4.3</td><td>0.766</td><td>16.5</td><td>NA</td><td>9.9</td><td>71.6</td><td>0.64</td><td>0.97</td><td>56.2</td></tr>
<tr><td colspan="12">North: Bengalla Link Road</td></tr>
<tr><td>7</td><td>L</td><td>246</td><td>0.9</td><td>0.371</td><td>16.0</td><td>LOS B</td><td>1.9</td><td>13.1</td><td>0.46</td><td>0.77</td><td>58.9</td></tr>
<tr><td>9</td><td>R</td><td>19</td><td>0.0</td><td>0.371</td><td>15.9</td><td>LOS B</td><td>1.9</td><td>13.1</td><td>0.46</td><td>0.88</td><td>59.1</td></tr>
<tr><td>Approach</td><td></td><td>265</td><td>0.8</td><td>0.371</td><td>16.0</td><td>LOS B</td><td>1.9</td><td>13.1</td><td>0.46</td><td>0.78</td><td>58.9</td></tr>
<tr><td colspan="12">West: Denman Road (W)</td></tr>
<tr><td>10</td><td>L</td><td>69</td><td>1.5</td><td>0.038</td><td>11.4</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.74</td><td>63.3</td></tr>
<tr><td>11</td><td>T</td><td>198</td><td>4.8</td><td>0.105</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>80.0</td></tr>
<tr><td>Approach</td><td></td><td>267</td><td>3.9</td><td>0.105</td><td>3.0</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.19</td><td>74.4</td></tr>
<tr><td>All Vehicles</td><td></td><td>1273</td><td>3.5</td><td>0.766</td><td>13.6</td><td>NA</td><td>9.9</td><td>71.6</td><td>0.47</td><td>0.77</td><td>59.7</td></tr>
</table>
</td><td>
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">East: Denman Road (E)</td></tr>
<tr><td>5</td><td>T</td><td>131</td><td>7.3</td><td>0.070</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>80.0</td></tr>
<tr><td>6</td><td>R</td><td>654</td><td>3.4</td><td>0.847</td><td>23.7</td><td>LOS B</td><td>14.1</td><td>101.3</td><td>0.86</td><td>1.37</td><td>49.7</td></tr>
<tr><td>Approach</td><td></td><td>784</td><td>4.0</td><td>0.847</td><td>19.7</td><td>NA</td><td>14.1</td><td>101.3</td><td>0.71</td><td>1.14</td><td>52.7</td></tr>
<tr><td colspan="12">North: Bengalla Link Road</td></tr>
<tr><td>7</td><td>L</td><td>255</td><td>0.8</td><td>0.342</td><td>14.9</td><td>LOS B</td><td>1.6</td><td>11.3</td><td>0.44</td><td>0.76</td><td>60.5</td></tr>
<tr><td>9</td><td>R</td><td>24</td><td>0.0</td><td>0.342</td><td>14.8</td><td>LOS B</td><td>1.6</td><td>11.3</td><td>0.44</td><td>0.87</td><td>60.7</td></tr>
<tr><td>Approach</td><td></td><td>279</td><td>0.8</td><td>0.342</td><td>14.9</td><td>LOS B</td><td>1.6</td><td>11.3</td><td>0.44</td><td>0.77</td><td>60.5</td></tr>
<tr><td colspan="12">West: Denman Road (W)</td></tr>
<tr><td>10</td><td>L</td><td>93</td><td>1.1</td><td>0.050</td><td>11.4</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.74</td><td>63.3</td></tr>
<tr><td>11</td><td>T</td><td>198</td><td>4.8</td><td>0.105</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>80.0</td></tr>
<tr><td>Approach</td><td></td><td>291</td><td>3.6</td><td>0.105</td><td>3.6</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.23</td><td>73.3</td></tr>
<tr><td>All Vehicles</td><td></td><td>1354</td><td>3.3</td><td>0.847</td><td>15.3</td><td>NA</td><td>14.1</td><td>101.3</td><td>0.50</td><td>0.87</td><td>57.5</td></tr>
</table>
</td><td>The cumulative impact case would result in 45 additional right-turning vehicles from Denman Road to Bengalla Link Road per hour compared with the "do nothing" case. These would be opposed by 279 vehicles/hour. As a result the maximum queue length for this movement would increase from 71.6m to 101.3m. However, it is noted that the existing intersection has 150m of right-turn storage length available. As such, the increased queuing in this movement would still be wholly contained within the indented right-turn lane and there would be little impact to the through westbound movement of Denman Road.</td></tr>
<tr><td>Denman/ TMD

(as existing config)

0600-0700h</td><td>
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South East: Thomas Mitchell Drive</td></tr>
<tr><td>21</td><td>L</td><td>351</td><td>5.1</td><td>0.694</td><td>24.1</td><td>LOS B</td><td>5.1</td><td>37.2</td><td>0.82</td><td>1.16</td><td>37.7</td></tr>
<tr><td>23</td><td>R</td><td>271</td><td>4.7</td><td>0.902</td><td>51.8</td><td>LOS D</td><td>8.5</td><td>61.6</td><td>0.97</td><td>1.50</td><td>33.2</td></tr>
<tr><td>Approach</td><td></td><td>621</td><td>4.9</td><td>0.902</td><td>36.2</td><td>LOS C</td><td>8.5</td><td>61.6</td><td>0.88</td><td>1.31</td><td>34.9</td></tr>
<tr><td colspan="12">North East: Denman Road (N)</td></tr>
<tr><td>24</td><td>L</td><td>756</td><td>3.1</td><td>0.416</td><td>12.5</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.75</td><td>52.3</td></tr>
<tr><td>25</td><td>T</td><td>343</td><td>3.1</td><td>0.179</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>1099</td><td>3.1</td><td>0.416</td><td>8.6</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.52</td><td>67.5</td></tr>
<tr><td colspan="12">South West: Denman Road (S)</td></tr>
<tr><td>31</td><td>T</td><td>98</td><td>7.5</td><td>0.053</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>32</td><td>R</td><td>321</td><td>1.6</td><td>1.305</td><td>321.3</td><td>LOS F</td><td>54.4</td><td>386.0</td><td>1.00</td><td>3.10</td><td>7.0</td></tr>
<tr><td>Approach</td><td></td><td>419</td><td>3.0</td><td>1.305</td><td>246.3</td><td>NA</td><td>54.4</td><td>386.0</td><td>0.77</td><td>2.38</td><td>9.3</td></tr>
<tr><td>All Vehicles</td><td></td><td>2139</td><td>3.6</td><td>1.305</td><td>63.1</td><td>NA</td><td>54.4</td><td>386.0</td><td>0.41</td><td>1.11</td><td>24.4</td></tr>
</table>
</td><td>Not modelled – see comments.</td><td>The modelling indicates that intersection is already likely to fail under the future "do-nothing" case even without the proposed modification traffic. The "do-nothing" scenario indicated that the DoS would be 1.305 (demand volumes higher by 30% than the available capacity) and the average intersection delay would be 63.1 seconds/vehicle.

This indicates that the proposed upgrades to this intersection (committed to by BHP Billiton) should be brought forward to address the growth in traffic as generated by the expansion in mining activity in the surrounding region.</td></tr>
<tr><td>Denman/ TMD

(as seagull config)

0600-0700h</td><td>
Stage 1 crossing.
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South East: Thomas Mitchell Drive</td></tr>
<tr><td>21</td><td>L</td><td>349</td><td>5.1</td><td>0.195</td><td>13.4</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.76</td><td>43.2</td></tr>
<tr><td>23</td><td>R</td><td>267</td><td>4.3</td><td>0.409</td><td>19.0</td><td>LOS B</td><td>2.3</td><td>16.4</td><td>0.75</td><td>1.00</td><td>54.3</td></tr>
<tr><td>Approach</td><td></td><td>617</td><td>4.8</td><td>0.409</td><td>15.8</td><td>LOS B</td><td>2.3</td><td>16.4</td><td>0.32</td><td>0.87</td><td>49.7</td></tr>
<tr><td colspan="12">North East: Denman Road (N)</td></tr>
<tr><td>24</td><td>L</td><td>741</td><td>3.1</td><td>0.408</td><td>12.7</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.69</td><td>59.0</td></tr>
<tr><td>25</td><td>T</td><td>339</td><td>3.1</td><td>0.177</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>1080</td><td>3.1</td><td>0.408</td><td>8.7</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.48</td><td>71.4</td></tr>
<tr><td colspan="12">South West: Denman Road (S)</td></tr>
<tr><td>32</td><td>R</td><td>319</td><td>1.7</td><td>0.287</td><td>14.7</td><td>LOS B</td><td>1.4</td><td>10.1</td><td>0.56</td><td>0.82</td><td>60.9</td></tr>
<tr><td>Approach</td><td></td><td>319</td><td>1.7</td><td>0.287</td><td>14.7</td><td>NA</td><td>1.4</td><td>10.1</td><td>0.56</td><td>0.82</td><td>60.9</td></tr>
<tr><td>All Vehicles</td><td></td><td>2016</td><td>3.4</td><td>0.409</td><td>11.8</td><td>NA</td><td>2.3</td><td>16.4</td><td>0.19</td><td>0.65</td><td>61.9</td></tr>
</table>
Stage 2 downstream merge.
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South: RT acceleration lane TMD</td></tr>
<tr><td>2</td><td>T</td><td>267</td><td>4.3</td><td>0.157</td><td>0.2</td><td>LOS A</td><td>0.5</td><td>3.9</td><td>0.15</td><td>0.02</td><td>94.1</td></tr>
<tr><td>Approach</td><td></td><td>267</td><td>4.3</td><td>0.157</td><td>0.2</td><td>LOS A</td><td>0.5</td><td>3.9</td><td>0.15</td><td>0.02</td><td>94.1</td></tr>
<tr><td colspan="12">South West: Denman Road (SW)</td></tr>
<tr><td>1</td><td>T</td><td>96</td><td>7.7</td><td>0.052</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>96</td><td>7.7</td><td>0.052</td><td>0.0</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>All Vehicles</td><td></td><td>363</td><td>5.2</td><td>0.157</td><td>0.1</td><td>NA</td><td>0.5</td><td>3.9</td><td>0.11</td><td>0.01</td><td>95.7</td></tr>
</table>
</td><td>
Stage 1 crossing.
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South East: Thomas Mitchell Drive</td></tr>
<tr><td>21</td><td>L</td><td>367</td><td>4.9</td><td>0.205</td><td>13.3</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.76</td><td>43.2</td></tr>
<tr><td>23</td><td>R</td><td>267</td><td>4.3</td><td>0.422</td><td>19.4</td><td>LOS B</td><td>2.3</td><td>16.9</td><td>0.76</td><td>1.01</td><td>53.9</td></tr>
<tr><td>Approach</td><td></td><td>635</td><td>4.6</td><td>0.422</td><td>15.9</td><td>LOS B</td><td>2.3</td><td>16.9</td><td>0.32</td><td>0.87</td><td>49.3</td></tr>
<tr><td colspan="12">North East: Denman Road (N)</td></tr>
<tr><td>24</td><td>L</td><td>741</td><td>3.1</td><td>0.408</td><td>12.7</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.69</td><td>59.0</td></tr>
<tr><td>25</td><td>T</td><td>362</td><td>2.9</td><td>0.189</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>1103</td><td>3.1</td><td>0.408</td><td>8.5</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.47</td><td>72.0</td></tr>
<tr><td colspan="12">South West: Denman Road (S)</td></tr>
<tr><td>32</td><td>R</td><td>322</td><td>1.6</td><td>0.300</td><td>15.0</td><td>LOS B</td><td>1.5</td><td>11.0</td><td>0.58</td><td>0.84</td><td>60.4</td></tr>
<tr><td>Approach</td><td></td><td>322</td><td>1.6</td><td>0.300</td><td>15.0</td><td>NA</td><td>1.5</td><td>11.0</td><td>0.58</td><td>0.84</td><td>60.4</td></tr>
<tr><td>All Vehicles</td><td></td><td>2060</td><td>3.3</td><td>0.422</td><td>11.8</td><td>NA</td><td>2.3</td><td>16.9</td><td>0.19</td><td>0.65</td><td>62.0</td></tr>
</table>
Stage 2 downstream merge.
Movement Performance - Vehicles
<table>
<tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr>
<tr><td colspan="12">South: RT acceleration lane TMD</td></tr>
<tr><td>2</td><td>T</td><td>267</td><td>4.3</td><td>0.158</td><td>0.2</td><td>LOS A</td><td>0.5</td><td>3.9</td><td>0.15</td><td>0.02</td><td>94.0</td></tr>
<tr><td>Approach</td><td></td><td>267</td><td>4.3</td><td>0.158</td><td>0.2</td><td>LOS A</td><td>0.5</td><td>3.9</td><td>0.15</td><td>0.02</td><td>94.0</td></tr>
<tr><td colspan="12">South West: Denman Road (SW)</td></tr>
<tr><td>1</td><td>T</td><td>101</td><td>7.3</td><td>0.054</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>Approach</td><td></td><td>101</td><td>7.3</td><td>0.054</td><td>0.0</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr>
<tr><td>All Vehicles</td><td></td><td>368</td><td>5.1</td><td>0.158</td><td>0.1</td><td>NA</td><td>0.5</td><td>3.9</td><td>0.11</td><td>0.01</td><td>95.6</td></tr>
</table>
</td><td>This assessment indicates that the upgraded intersection (assumed to be a seagull configuration) would be effective in addressing the traffic demands from increased mining activity in the surrounding region. This is indicated by the SIDRA outputs under the future "do nothing" scenario. Under this scenario, there would be significantly improved performance with regard to DoS (1.305 to 0.409), LoS (F to B), average intersection delay (63.1 seconds/vehicle to 11.2 seconds/ vehicle) and maximum queue length (386m to 16.4m) compared with the assessment for the existing intersection configuration (above).

The cumulative case assessment indicates that the additional traffic volumes generated by the Mangoola modification would have little impact on the intersection's performance. This is demonstrated by the marginal changes to the model outputs between the "do nothing" and cumulative cases.</td></tr>
</table>

<table>
<tr><th>Intersect -ion and peak period</th><th>Future “do nothing” case

(Accounts for known future mine expansion plans but <u>no</u> traffic from the proposed modification).</th><th>Cumulative impact case

(Accounts for known other future mine expansion plans and with proposed modification traffic).</th><th>Comments</th></tr>
<tr><td>NEH/ TMD

0600-0700h</td><td>Stage 1 crossing.
Movement Performance - Vehicles<table><tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr><tr><td colspan="12">South: New England Highway (S)</td></tr><tr><td>24</td><td>L</td><td>694</td><td>4.2</td><td>0.385</td><td>12.8</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.69</td><td>59.0</td></tr><tr><td>25</td><td>T</td><td>225</td><td>24.3</td><td>0.134</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr><tr><td>Approach</td><td></td><td>919</td><td>9.2</td><td>0.385</td><td>9.6</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.52</td><td>68.6</td></tr><tr><td colspan="12">North: New England Highway (N)</td></tr><tr><td>32</td><td>R</td><td>103</td><td>1.0</td><td>0.073</td><td>13.3</td><td>LOS A</td><td>0.3</td><td>2.3</td><td>0.37</td><td>0.70</td><td>62.2</td></tr><tr><td>Approach</td><td></td><td>103</td><td>1.0</td><td>0.073</td><td>13.3</td><td>NA</td><td>0.3</td><td>2.3</td><td>0.37</td><td>0.70</td><td>62.2</td></tr><tr><td colspan="12">West: Thomas Mitchell Drive</td></tr><tr><td>21</td><td>L</td><td>15</td><td>0.0</td><td>0.008</td><td>13.1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.76</td><td>43.3</td></tr><tr><td>23</td><td>R</td><td>392</td><td>5.1</td><td>0.426</td><td>16.4</td><td>LOS B</td><td>2.8</td><td>20.2</td><td>0.67</td><td>0.98</td><td>57.2</td></tr><tr><td>Approach</td><td></td><td>406</td><td>4.9</td><td>0.426</td><td>16.3</td><td>LOS B</td><td>2.8</td><td>20.2</td><td>0.65</td><td>0.98</td><td>56.9</td></tr><tr><td>All Vehicles</td><td></td><td>1428</td><td>7.4</td><td>0.426</td><td>11.8</td><td>NA</td><td>2.8</td><td>20.2</td><td>0.21</td><td>0.66</td><td>63.6</td></tr></table>Stage 2 downstream merge.
Movement Performance - Vehicles<table><tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr><tr><td colspan="12">North: New England Highway (N)</td></tr><tr><td>1</td><td>T</td><td>672</td><td>9.7</td><td>0.366</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr><tr><td>Approach</td><td></td><td>672</td><td>9.7</td><td>0.366</td><td>0.0</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr><tr><td colspan="12">North West: RT acceleration lane TMD</td></tr><tr><td>2</td><td>T</td><td>392</td><td>5.1</td><td>0.368</td><td>2.5</td><td>LOS A</td><td>1.5</td><td>11.0</td><td>0.52</td><td>0.26</td><td>82.1</td></tr><tr><td>Approach</td><td></td><td>392</td><td>5.1</td><td>0.368</td><td>2.5</td><td>LOS A</td><td>1.5</td><td>11.0</td><td>0.52</td><td>0.26</td><td>82.1</td></tr><tr><td>All Vehicles</td><td></td><td>1063</td><td>8.0</td><td>0.368</td><td>0.9</td><td>NA</td><td>1.5</td><td>11.0</td><td>0.19</td><td>0.09</td><td>93.0</td></tr></table></td><td>Stage 1 crossing.
Movement Performance - Vehicles<table><tr><th>Mov ID</th><th>Turn</th><th>Demand Flow veh/h</th><th>HV %</th><th>Deg. Satn v/c</th><th>Average Delay sec</th><th>Level of Service</th><th>95% Back of Queue Vehicles veh</th><th>95% Back of Queue Distance m</th><th>Prop. Queued</th><th>Effective Stop Rate per veh</th><th>Average Speed km/h</th></tr><tr><td colspan="12">South: New England Highway (S)</td></tr><tr><td>24</td><td>L</td><td>715</td><td>4.1</td><td>0.396</td><td>12.8</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.69</td><td>59.0</td></tr><tr><td>25</td><td>T</td><td>225</td><td>24.3</td><td>0.134</td><td>0.0</td><td>LOS A</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.00</td><td>100.0</td></tr><tr><td>Approach</td><td></td><td>940</td><td>9.0</td><td>0.396</td><td>9.7</td><td>NA</td><td>0.0</td><td>0.0</td><td>0.00</td><td>0.53</td><td>68.4</td></tr><tr><td colspan="12">North: New England Highway (N)</td></tr><tr><td>32</td><td>R</td><td>103</td><td>1.0</td><td>0.073</td><td>13.3</td><td>LOS A</td><td>0.3</td><td>2.3</td><td>0.37</td><td>0.70</td><td>62.1</td></tr><tr><td>Approach</td><td></td><td>103</td><td>1.0</td><td>0.073</td><td>13.3</td><td>NA</td><td>0.3</td><td>2.3</td><td>0.37</td><td>0.70</td><td>62.1</td></tr><tr><td colspan="12">West: Thomas Mitchell Drive</td></tr><tr><td>21</td><td>L</td><td>16</td><td>0.0</td><td>0.009</td><td>13.1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0.76</td><td>43.3</td></tr><tr><td>23</td><td>R</td><td>396</td><td>5.1</td><td>0.435</td><td>16.6</td><td>LOS B</td><td>2.9</td><td>20.9</td><td>0.68</td><td>0.99</td><td>57.1</td></tr><tr><td>Approach</td><td></td><td>412</td><td>4.9</td><td>0.435</td><td>16.4</td><td>LOS B</td><td>2.9</td><td>20.9</td><td>0.65</td><td>0.98</td><td>56.7</td></tr><tr><td>All Vehicles</td><td></td><td>1455</td><td>7.2</td><td>0.435</td><td>11.9</td><td>NA</td><td>2.9</td><td>20.9</td><td>0.21</td><td>0.67</td><td>63.5</td></tr></table>Stage 2 downstream merge.
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</table>

Abbreviations from Table 4-6:

- NAR: Northern Access Road
- BLR: Bengalla Link Road
- TMD: Thomas Mitchell Drive
- NEH: New England Highway

4.3.6 MIDBLOCK ANALYSIS FOR THE CUMULATIVE TRAFFIC IMPACT ASSESSMENT

Section 3.3.1 presented the results of the midblock traffic impact assessment for the traffic volumes as surveyed in October 2011. Table 4-7 shows the corresponding values for the cumulative traffic impact scenario.

Table 4-7 Peak midblock traffic volumes as well as volume/capacity ratios (0600-0700h assessment period).

Midblock section and period	Nominal capacity (veh/ hour/ lane)	AM peak (veh/hour)	V/C ratio (AM)
Wybong Road, 1 km west of Bengalla Link Road - Eastbound	1320	91	0.07
Wybong Road, 1 km west of Bengalla Link Road - Westbound	1320	262	0.20
Bengalla Link Road, north of Bengalla Mine Access Road - Northbound	1350	747	0.55
Bengalla Link Road, north of Bengalla Mine Access Road - Southbound	1350	279	0.21
Thomas Mitchell Drive, east of the Industrial Estate – Northbound/ Westbound	1350	818	0.61
Thomas Mitchell Drive, east of the Industrial Estate – Southbound/ Eastbound	1350	412	0.31

Notes:
(i) V/C is the volume to capacity ratio. This is similar to the Degree of Saturation (DoS) performance indicator for intersections.
(ii) The midblock volumes were derived by the sum of the relevant turning movements as used in SIDRA rather than as a build up from the previous midblock traffic volumes. This was due to some noted discrepancies between the surveyed midblock volumes and the surveyed corresponding turning movements that would make up those midblock volumes.

Although there would be significant increases in midblock traffic volumes, the above analysis confirms that this traffic could be absorbed into the system without impacting the midblock traffic performance. The V/C ratios in all cases remain at or below 0.60 indicating that only 60% of the available midblock capacity would be used by the demand traffic volumes. This also means that there is more than 40% residual capacity along each of the roads even with the new traffic added. As the subject roads are all rural roads with little flow metering effects (ie. very little use of traffic signals), the traffic flow is likely to be uninterrupted and hence would not have a high degree of bunching. The relatively even spacing between traffic units and uniform arrival rates further confirms that there should not be any midblock capacity issues with the full extent of traffic volume generation under the cumulative traffic impact scenario.

This analysis confirms that it is the intersections, rather than the midblocks, which are the more critical factor governing overall traffic performance in the surrounding network.

5 RAIL NETWORK PERFORMANCE AND SAFETY IMPLICATIONS

5.1 HUNTER VALLEY RAIL NETWORK – EXISTING CONDITIONS

The Hunter Valley Rail Network (Figure 5-1) is the critical transport system involved in the movement of product coal from the Hunter Valley, Gunnedah Basin and Ulan region to the Port of Newcastle for export.

The terminus of this rail network is at the Port of Newcastle where there are three coal loader terminals – PWCS Carrington (CCT), PWCS Kooragang Island (KCT) and NCIG Kooragang Island. From Newcastle, the rail line extends to the north-west, generally along the New England Highway corridor passing through Maitland, Branxton, Singleton and Muswellbrook. From Muswellbrook, the rail line splits into two branches with one branch extending north-west towards Gunnedah and Boggabri, and the other extended to the west towards Ulan.

The Hunter Valley Rail Network consists of a dedicated double track line between the Port of Newcastle and Maitland; and a shared double track line from Maitland to Muswellbrook; and a shared single track towards Ulan (ARTC, 2011). This network falls under the jurisdiction of the Australian Rail Track Corporation (ARTC).

Product coal from Mangoola Coal is to be transported to this rail network via a rail loop which connects into the Muswellbrook-Ulan Railway Line approximately 15km west of Muswellbrook (rail chainage 304km). The product coal would then be moved eastbound towards the Muswellbrook Junction, and then south-eastward towards the Port of Newcastle.

ARTC (2011) had identified capacity constraints along the section of the Ulan Line between the Mangoola Loop and Muswellbrook. This was due to the increase in coal production which is the main source of rail traffic along this line. This has since been addressed with the construction of a 2km passing loop between railway chainage 293.1km to 293.3km. This passing loop was completed and opened to rail traffic in August 2011.

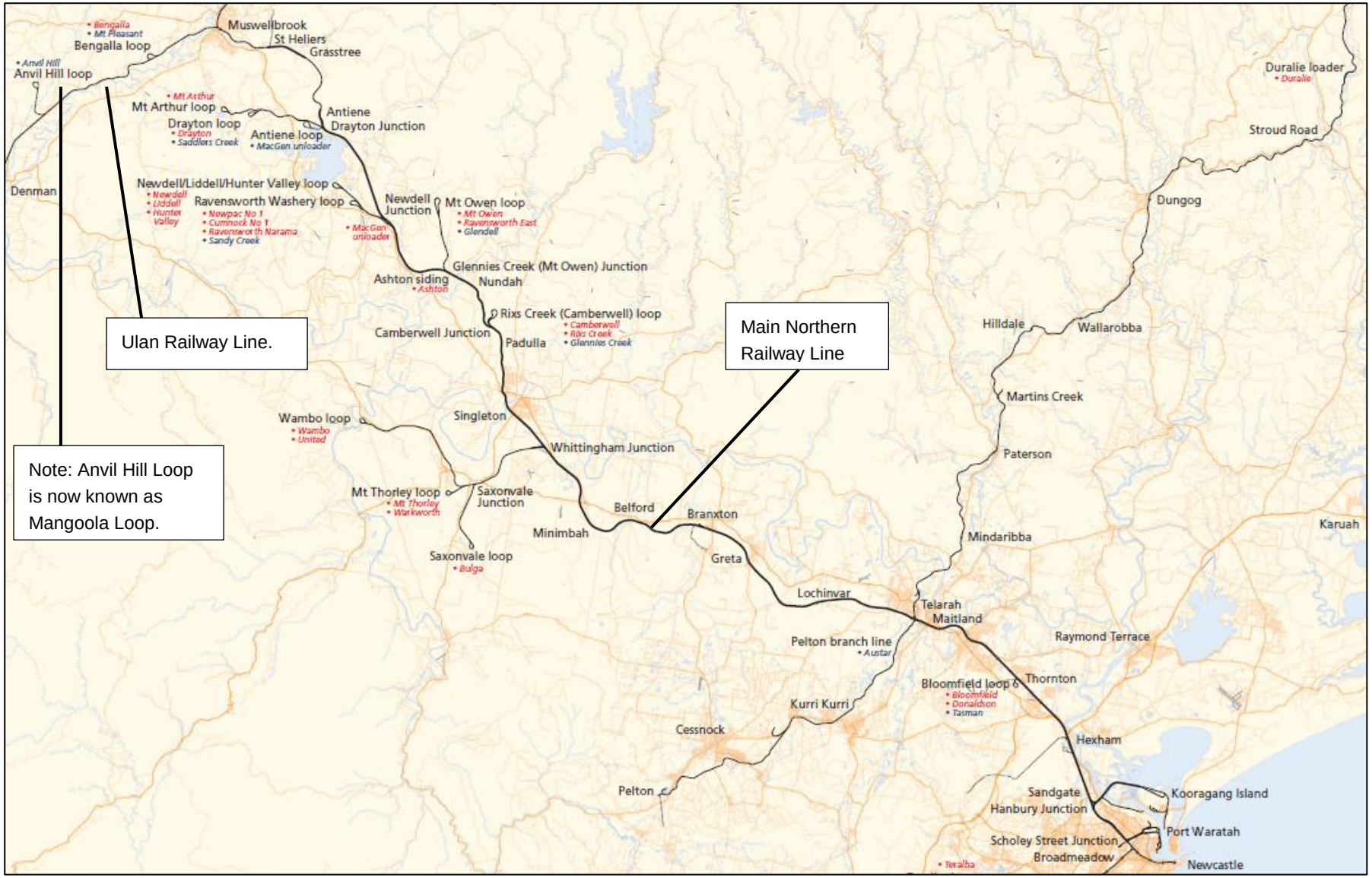

Figure 5-1 Section of Hunter Valley Rail Network between the Project and the Port of Newcastle (ARTC, 2009)

5.2 RAIL TRAFFIC GENERATION BY MANGOOLA COAL

The proposed modification will result in a maximum rate of coal extraction of 13.5Mtpa. Assuming an approximate 80% conversion rate from ROM to product yield, this would result in 10.8Mtpa of product coal per year.

All product coal is intended to be transported by rail to the Port of Newcastle. Mangoola Coal has approval for a daily maximum of 20 train movements (including both inbound and outbound trips). No increase is proposed to the approved daily maximum train movements.

5.3 RAIL TRAFFIC GENERATION FROM OTHER MINE EXPANSION PROJECTS

5.3.1 DRAYTON SOUTH

Drayton South is a continuation project from the existing Drayton Coal Project. As such, it is not expected to generate any more train movements compared with the existing situation.

5.3.2 MOUNT ARTHUR COAL

Hansen Bailey (2009) reported that the MAC consolidation project would result in an increase in rail haulage from 19Mtpa to 27Mtpa of product coal. Although the existing approval to generate up to 24 train movements per day (which also accounts for empty inbound direction) would not change, the number of days per year that would generate 24 train movements/day would increase. Consequently, this assessment has assumed there will be no increase to the maximum daily number of trains generated from MAC.

5.3.3 BENGALLA MINE MODIFICATION

It is understood that all product coal leaving the Bengalla Mine is transported via the Ulan Rail Line into Muswellbrook where it joins the Main Northern Rail Line. From here the coal is either transported to Liddell or Bayswater Power Stations or to the Port of Newcastle for export. Bengalla Mine's existing approval allows loading and transport of coal 24 hours per day, seven days a week (Hansen Bailey, 2006).

An increase in annual production from 10.7Mtpa to 15Mtpa ROM coal is proposed at Bengalla Mine. The increase in production will increase the number of train visits generated from 1,400 one-way movements per year to 1950 one-way movements per year at the peak mining period. The present average of 4.5 one-way train movements per day is likely to increase to 6.3 one-way train movements per day. This means the total number of movements would increase by 4 per day when accounting for the empty inbound train movements.

5.3.4 MOUNT PLEASANT COAL PROJECT

EMGA Mitchell McLennan (2010a) reported that the Mount Pleasant Coal Project would produce 10.5 Mtpa of ROM coal. Product coal would be transported by rail to the Port of Newcastle using 9000 tonne trains. The product coal would be loaded to rail wagons either via a new railway loop from the Ulan Line (to the west of the Bengalla Mine loop), or alternatively, it

would be conveyed to the existing railway loop at Bengalla Mine. A total of six train movements would be generated per day (including the empty inbound movements).

5.4 CUMULATIVE RAIL NETWORK IMPACTS AND MANAGEMENT MEASURES

The cumulative impact of the proposed modification with other known mine developments including Bengalla Mine, MAC, and Mount Pleasant Coal Project would result in an additional 5 one-way train movements per day (or 10 train movements). These are summarised in Table 5-1.

Table 5-1 Summary of additional train traffic generation (above existing conditions)

Project	Additional one-way train movements/ day	Additional train movements/ day
Mangoola Coal	0	0
Drayton South	0 (same as existing)	0 (same as existing)
MAC	0	0
Bengalla Mine	2	4
Mt. Pleasant Project	3	6
Total additional trains	**5**	**10**

The ARTC's (2009, 2011 and 2012) *2012-2021 Hunter Valley Corridor Capacity Strategy Consultation Document* provides a broad snapshot of the existing conditions on the Hunter Valley coal rail network. This document is regularly updated with coal production (and hence transportation) forecasts from the Hunter Valley, Gunnedah Basin and Ulan corridor which are determined through consultation with the coal mining industry.

ARTC also describe a number of rail network deficiencies as well as proposed network upgrades. The proposed upgrades were made as a strategic response to the forecast increase in coal production in the Hunter Valley. To a large extent, these forecasts accounted for foreseeable increases in coal production, including those at the four coal projects described in Section 5.3. Of relevance to Mangoola Coal, the 2011 ARTC document had identified a capacity constraint along the section of the rail line between Mangoola and Muswellbrook Junction. As a result of this finding, this section has now been addressed through the construction of a 2km passing loop between railway chainage 293.1km and 293.3km. This was completed in August 2011.

ARTC (2012) has identified the following rail network deficiencies which are relevant to coal transportation from the Project to the port. The improvements as recommended by ARTC have been described below.

- The Allandale Bank (near Greta), the Minimbah and Nundah Banks (north of Singleton) which have minimum headways of up to 14-16 minutes between loaded coal trains. ARTC (2012) recommended that a third railroad be constructed on the Nundah Bank. It also reported that the Maitland-Minimbah Third Track Project has commenced construction and when completed, this will effectively address both the Minimbah and Allandale Banks.
- The Maitland Junction (junction of passenger line to Brisbane): The ARTC (2012) Strategy does not make any recommendations for improving this junction other than saying that this junction should be subject to further analysis.

- The Muswellbrook Junction will continue to be monitored with a view to upgrading this junction to address capacity concerns as coal volumes increase from both Western and Gunnedah Basin Coal Fields (ARTC, 2012)

The network upgrade recommendations made by ARTC are not considered mitigation measures for this study. Rather, they are described in this report to highlight the need for ongoing liaison between Xstrata Mangoola and ARTC regarding the scheduled roll out of rail network infrastructure improvements. This is essential to enable ARTC to continue to refine their coal production forecasts. A number of neighbouring coal mine projects will also need to be involved in the consultation process. These may include Drayton Coal Project, Bengalla Mine, Mount Pleasant Project and MAC.

As the above initiatives have already been proposed in the *Hunter Valley Corridor Capacity Strategy Consultation Document* with these being progressively programmed for upgrade, there are no other mitigation measures proposed for addressing the rail network deficiencies. However, it is recommended that Xstrata Mangoola continue to liaise with the ARTC and neighbouring mines regarding the roll out of these initiatives. This would enable ARTC to inform its planning and design process.

6 CONCLUSIONS

Completed road improvements

Xstrata Mangoola has already carried out substantial upgrades to the surrounding road network. This includes widening Wybong Road, between Mangoola Coal and Bengalla Link Road, to a 8.5m sealed width (two 3.25m lanes, and two 1.0m shoulders), provision of edge and centrelines, upgrades to guardrails and bridge barriers, signage improvements, and provision of bus stopping facilities.

In addition to the reconstruction of Wybong Road East, Xstrata Mangoola has also carried out the following safety improvements on Wybong Road:

- Enhanced signage, particularly on substandard curves.
- Installation of new safety barriers, including approach barriers at Sandy Creek and Spring Creek bridges.
- Upgrade of the Golden Highway/ Wybong Road intersection, including realignment of the Wybong Road approach.
- Realignment of Wybong Road at its intersection with Bengalla Link Road. The realignment work has adjusted the intersection priority so that Wybong Road East extends directly into Bengalla Link Road.
- Provision of a new intersection at Wybong Road/ Northern Access Road, as the primary access to the mine.
- Xstrata Mangoola has also made contributions to the maintenance of Wybong Road West.

Xstrata Mangoola has also carried out improvements to the intersection of Denman Road and Bengalla Link Road including a left-turn lane and a left-turn acceleration lane on Denman Road, and streetlighting.

Road traffic impacts

This Traffic and Transport Impact Assessment has considered the traffic generation potential of the proposed modification. The traffic conditions on the surrounding road network will also include traffic generation associated with other aspects of the Mangoola Coal's operations which are approved but which had not yet commenced at the time of this assessment.

The traffic generation scenarios associated with the proposed modification were modelled through SIDRA using four study intersections. Separate SIDRA models were prepared for the 0600-0700h and 1645-1745h assessment periods. When compared with the base-case models, the SIDRA models did not indicate significant road traffic impacts due to the proposed modification. There was some degree of queuing generated in some of the intersection approaches (typically associated with turning movements). However, there is generally sufficient storage capacity within those approaches. In light of the model outputs for the proposed modification, no mitigation or management measures are recommended.

An analysis was also carried out for a hypothetical future "do nothing" scenario which accounted for foreseeable traffic growth due to neighbouring coal projects. This assessment showed that the Denman Road/ Thomas Mitchell Drive intersection is likely to deteriorate in performance. This is primarily due to the high volumes of right-turning traffic from Denman Road to Thomas Mitchell Drive. This indicated that even without the proposed modification traffic, this intersection is likely to require an upgrade to account for regional traffic growth generated by the neighbouring coal industry. It should be noted that under Project Approval 09_0062, BHP Billiton are obligated to upgrade this intersection by the end of 2019. The SIDRA assessments

carried out in this traffic and transport impact assessment, indicate that these proposed upgrades should be brought forwards to address the capacity impacts imposed by regional traffic growth.

Rail traffic impacts

Mangoola Coal has approval for a daily maximum of 20 trains. No increase is proposed to this maximum generation rate. Furthermore, expansion proposals to neighbouring mines would generate an additional 10 train movements per day. All mines are likely to allow 24-hour train-loading and dispatch operations.

ARTC (2012) identified rail network constraints and improvement strategies which were based on forecast cumulative growth in coal production in the Hunter Valley, Gunnedah Basin and Ulan Region. To a large extent the forecasts used to develop these strategies accounted for growth in coal mining activity, particularly with this Project as well as the Mount Pleasant Coal Project. It is recommended that Xstrata Mangoola continues to liaise with the ARTC with regard to changes to coal production forecasts as well as proposed modes of transport. This will assist ARTC in refining the rail movement forecasts and hence the improvement strategies.

7 REFERENCES

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Umwelt (2006) *Anvil Hill Project - Environmental Assessment*.

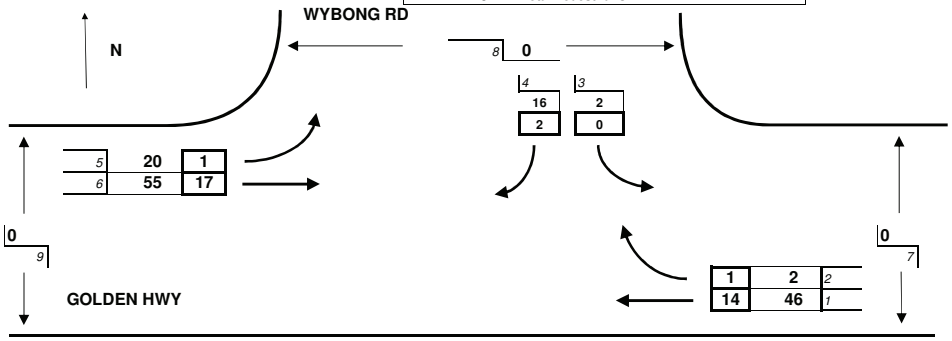
APPENDIX A: 2011 TRAFFIC SURVEY RESULTS

13/10/2011 - GOLDEN HWY / WYBONG RD, SANDY HOLLOW

9:00 <<< HOUR ENDING **Thursday**

Quality Surveys

Summary:	GOLDEN HWY / WYBONG RD
127	Total Light Vehicles
35	Total Heavy Vehicles
0	Total Pedestrians



46	Light Vehicles
14	Heavy Vehicles

13/10/2011 - GOLDEN HWY / WYBONG RD, SANDY HOLLOW

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
06:15	1	1	1	0	3	3	9		0	0	0
06:30	3	0	0	1	7	8	19		0	0	0
06:45	3	0	2	2	4	10	21		0	0	0
07:00	11	2	2 <	0	9	12	36	85	0	0	0
07:15	3	2 <	1 <	2	2	14	24	100	0	0	0
07:30	7	0 <	0 <	2	9 <	7	25	106	0	0	0
07:45	5	0 <	0	3	3	7	18	103	0	0	0
08:00	9	0	0	1	4	9	23	90	0	0	0
08:15	16	0	0	6	3	11	36	102	0	0	0
08:30	8	0	0	2	6	14	30	107	0	0	0
08:45	10	2	1	3	8	15	39	128	0	0	0
09:00	12 <	0	1	5 <	3	15 <	36	141 <	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	2	0	0	0	0	1	3	
06:30	3	0	0	0	0	2	5	
06:45	4	0	0	0	0	3	7	
07:00	2	0	0	0	0	0	2	17
07:15	4	0	0	0	0	2	6	20
07:30	0	0	1 <	0	0	2	3	18
07:45	0	0	0 <	0	0	1	1	12
08:00	2	0	0 <	0	1	6	9	19
08:15	9	1 <	0 <	0	0	3	13	26
08:30	0	0 <	0	0	1 <	4	5	28
08:45	2	0 <	0	1	0 <	4 <	7	34
09:00	3 <	0 <	0	1 <	0	6 <	10	35 <

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	3	1	1	0	3	4	12	
06:30	6	0	0	1	7	10	24	
06:45	7	0	2	2	4	13	28	
07:00	13	2	2	0	9	12	38	102
07:15	7	2 <	1	2	2	16	30	120
07:30	7	0 <	1 <	2	9 <	9	28	124
07:45	5	0 <	0	3	3	8	19	115
08:00	11	0	0	1	5	15	32	109
08:15	25	1	0	6	3	14	49	128
08:30	8	0	0	2	7	18	35	135
08:45	12	2	1	4	8	19	46	162
09:00	15 <	0	1	6 <	3	21 <	46	176 <

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

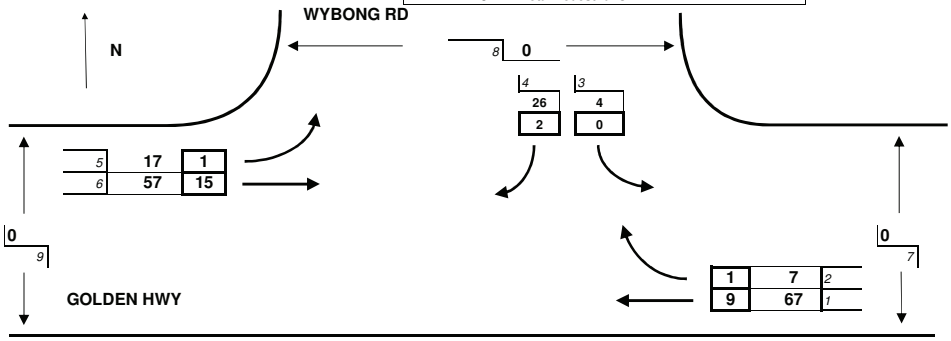
13/10/2011 - GOLDEN HWY / WYBONG RD, SANDY HOLLOW

18:00 <<< HOUR ENDING **Thursday**

Summary:

GOLDEN HWY / WYBONG RD	
156	Total Light Vehicles
28	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



67	Light Vehicles
9	Heavy Vehicles

13/10/2011 - GOLDEN HWY / WYBONG RD, SANDY HOLLOW

Light Vehicles

	1	2	3	4	5	6	15 MIN HOUR		7	8	9
16:15	12	0	0	5	4	18	39		0	0	0
16:30	23	0	0	8	7	15	53		0	0	0
16:45	15	1	2	3	3	11	35		0	0	0
17:00	13	2	1	7	3	12	38	165	0	0	0
17:15	14	1	1	4	3	13	36	162	0	0	0
17:30	18	1	1 <	6	4	18	48	157	0	0	0
17:45	18	2	1	8	3	15 <	47	169	0	0	0
18:00	17 <	3	1	8 <	7	11	47	178 <	0	0	0
18:15	12	1	1	4 <	4 <	6	28	170	0	0	0
18:30	7	0	0	5	2	8	22	144	0	0	0
18:45	13	4 <	0	7	2	13	39	136	0	0	0
19:00	7	0	1	3	2	7	20	109	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	15 MIN HOUR	
16:15	1	0	0	0	0	4	5	
16:30	4	0	0	0	0	2	6	
16:45	2	1	1	0	1	1	6	
17:00	2	0 <	0 <	0	0	3	5	22
17:15	1	0 <	0 <	1	1 <	3	6	23
17:30	4	0 <	0 <	0	0 <	2	6	23
17:45	3 <	1 <	0	1 <	0	7 <	12	29 <
18:00	1	0 <	0	0 <	0	3 <	4	28
18:15	2 <	0 <	0	0	0	3 <	5	27
18:30	3	0 <	0	0	1	0	4	25
18:45	2	0	0	0	0	0	2	15
19:00	0	0	0	0	0	2	2	13

All Vehicles

	1	2	3	4	5	6	15 MIN HOUR	
16:15	13	0	0	5	4	22	44	
16:30	27	0	0	8	7	17	59	
16:45	17	2	3	3	4	12	41	
17:00	15	2	1	7	3 <	15	43	187
17:15	15	1	1	5	4 <	16	42	185
17:30	22	1	1 <	6	4	20	54	180
17:45	21	3	1	9	3	22 <	59	198
18:00	18 <	3 <	1	8 <	7 <	14	51	206 <
18:15	14	1 <	1	4	4 <	9	33	197
18:30	10	0	0	5	3	8	26	169
18:45	15	4 <	0	7	2	13	41	151
19:00	7	0	1	3	2	9	22	122

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - WYBONG RD / WYBONG POST OFFICE RD, WYBONG

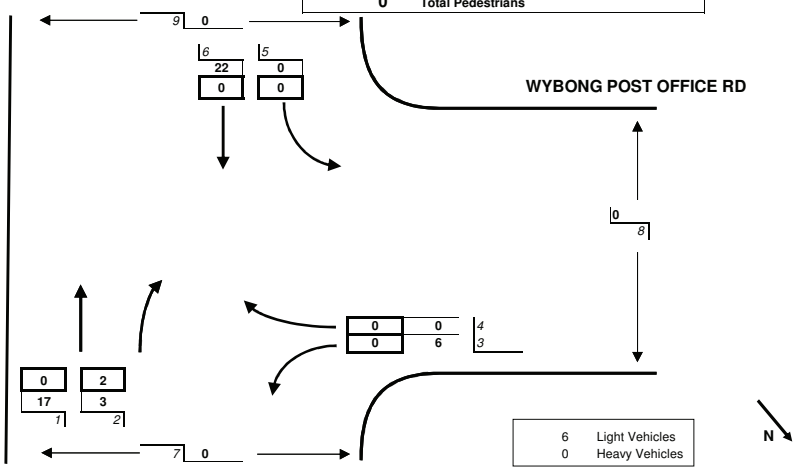
7:30 <<< HOUR ENDING **Thursday**

Quality Surveys

Summary:

WYBONG RD / WYBONG POST OFFICE RD

47	Total Light Vehicles
2	Total Heavy Vehicles
0	Total Pedestrians



13/10/2011 - WYBONG RD / WYBONG POST OFFICE RD, WYBONG

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
06:15	1	0	1	0	0	3	5		0	0	0
06:30	1	0	0	0	0	4	5		0	0	0
06:45	3	0	2	0	0	8	13		0	0	0
07:00	7	1	1	0	0	6	15	38	0	0	0
07:15	3	1	2	0	0	7	13	46	0	0	0
07:30	4 <	1	1 <	0	0	1	7	48 <	0	0	0
07:45	0	1 <	0	0	0	7	8	43	0	0	0
08:00	1	0	1	0	0	2	4	32	0	0	0
08:15	4	1	2	0	0	9	16	35	0	0	0
08:30	4	0	0	0	0	5	9	37	0	0	0
08:45	2	0	2	0	0	4	8	37	0	0	0
09:00	1	0	1	0	0	10 <	12	45	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	0	0	0	0	0	0	0	
06:30	0	0	0	0	0	0	0	
06:45	0	0	0	0	0	0	0	
07:00	0	1	0	0	0	0	1	1
07:15	0	1 <	0	0	0	0	1	2
07:30	0	0 <	0	0	0	0	0	2
07:45	0	0 <	1 <	0	0	0	1	3
08:00	0	0	0 <	0	0	0	0	2
08:15	0	1	0 <	0	0	1	2	3
08:30	1	0	0 <	0	0	2 <	3	6 <
08:45	0	0	0	0	0	0 <	0	5
09:00	1 <	0	0	0	0	0 <	1	6 <

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	1	0	1	0	0	3	5	
06:30	1	0	0	0	0	4	5	
06:45	3	0	2	0	0	8	13	
07:00	7	2	1	0	0	6	16	39
07:15	3	2	2	0	0	7	14	48
07:30	4 <	1	1 <	0	0	1	7	50
07:45	0	1 <	1	0	0	7	9	46
08:00	1	0	1	0	0	2	4	34
08:15	4	2	2	0	0	10	18	38
08:30	5	0	0	0	0	7	12	43
08:45	2	0	2	0	0	4	8	42
09:00	2	0	1	0	0	10 <	13	51 <

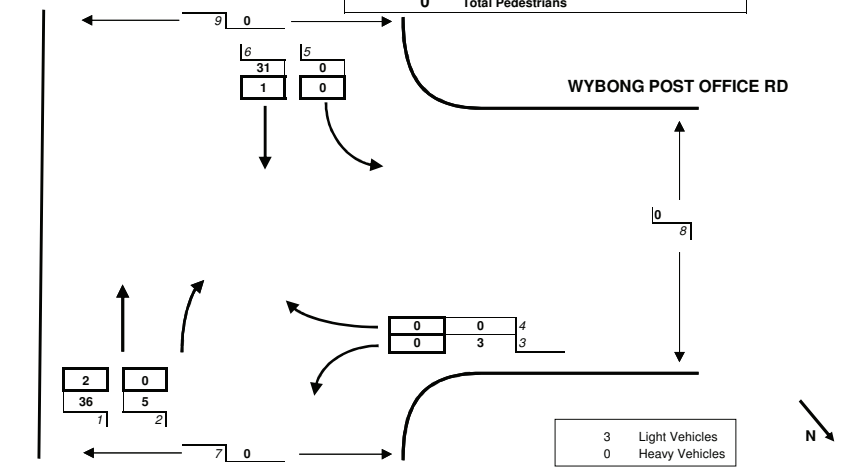
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - WYBONG RD / WYBONG POST OFFICE RD, WYBONG

18:15 <<< HOUR ENDING **Thursday**

Summary:	WYBONG RD / WYBONG POST OFFICE RD
70	Total Light Vehicles
1	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - WYBONG RD / WYBONG POST OFFICE RD, WYBONG

Light Vehicles

	1	2	3	4	5	6	15 MIN HOUR		7	8	9
16:15	7	4	0	0	0	4	15		0	0	0
16:30	4	1	1	0	0	3	9		0	0	0
16:45	6	2	0	0	0	6	14		0	0	0
17:00	6	3 <	0	0	0	4	13	51	0	0	0
17:15	7	1	0	0	0	5	13	49	0	0	0
17:30	13	1	0	0	0	5	19	59	0	0	0
17:45	11	1	0	0	0	5	17	62	0	0	0
18:00	7 <	0	2	0	0	12	21	70	0	0	0
18:15	5	3	1 <	0	0	9 <	18	75 <	0	0	0
18:30	9	0	0 <	0	0	3	12	68	0	0	0
18:45	4	1	0 <	0	0	2	7	58	0	0	0
19:00	9	0	0	0	0	3	12	49	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	15 MIN HOUR	
16:15	0	1	0	0	0	0	1	
16:30	0	0	0	1	0	0	1	
16:45	2	0	0	0	0	2	4	
17:00	0	0 <	0	0 <	0	0	0	6
17:15	1	0	0	0 <	0	1 <	2	7
17:30	2 <	0	0	0	0	0 <	2	8 <
17:45	0	0	0	0	0	1	1	5
18:00	0	0	0	0	0	0	0	5
18:15	0	0	0	0	0	0	0	3
18:30	0	0	0	0	0	1	1	2
18:45	0	0	0	0	0	1	1	2
19:00	0	0	0	0	0	0	0	2

All Vehicles

	1	2	3	4	5	6	15 MIN HOUR	
16:15	7	5	0	0	0	4	16	
16:30	4	1	1	1	0	3	10	
16:45	8	2	0	0	0	8	18	
17:00	6	3 <	0	0 <	0	4	13	57
17:15	8	1	0	0 <	0	6	15	56
17:30	15	1	0	0	0	5	21	67
17:45	11	1	0	0	0	6	18	67
18:00	7 <	0	2	0	0	12	21	75
18:15	5	3	1 <	0	0	9 <	18	78 <
18:30	9	0	0 <	0	0	4	13	70
18:45	4	1	0 <	0	0	3	8	60
19:00	9	0	0	0	0	3	12	51

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

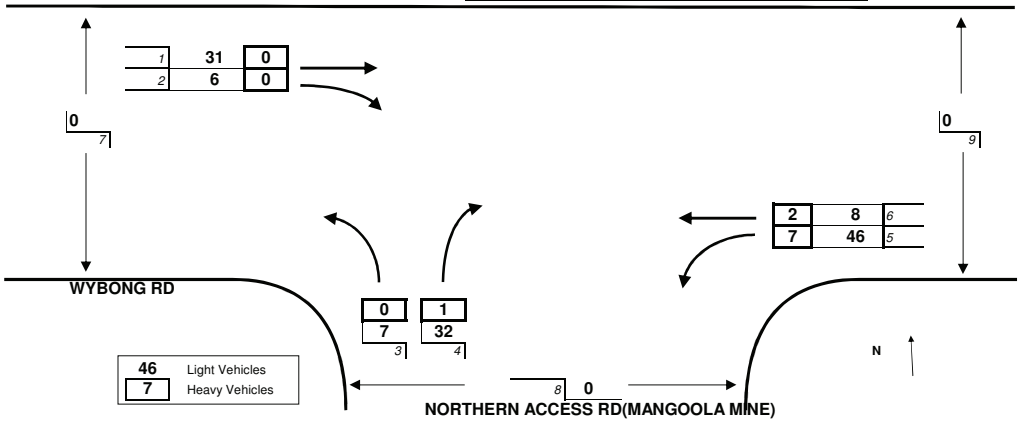
13/10/2011 - WYBONG RD / NORTHERN ACCESS RD(MANGOOLA MINE), WYBONG

7:15 <<< HOUR ENDING **Thursday**

Summary:

WYBONG RD / NTH ACCESS MANGOOLA	
130	Total Light Vehicles
10	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - WYBONG RD / NORTHERN ACCESS RD(MANGOOLA MINE), WYBONG

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
06:15	1	0	0	0	0	2	3		0	0	0
06:30	5	3	0	2	15	2	27		0	0	0
06:45	8	2	0	1	13	3	27		0	0	0
07:00	6	1 <	5	21	10	2	45	102	0	0	0
07:15	12 <	0 <	2 <	8 <	8 <	1	31	130 <	0	0	0
07:30	2	0	0 <	0	5	5 <	12	115	0	0	0
07:45	10	1	0 <	2	8	1	22	110	0	0	0
08:00	2	0	0	2	5	1	10	75	0	0	0
08:15	9	0	0	1	1	3	14	58	0	0	0
08:30	6	0	0	2	4	4	16	62	0	0	0
08:45	6	0	0	1	2	2	11	51	0	0	0
09:00	8	0	0	0	9	1	18	59	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	0	0	0	0	0	0	0	
06:30	0	0	0	0	3	0	3	
06:45	0	0	0	1	2	0	3	
07:00	0	0	0	0	1	1	2	8
07:15	0	0	0	0	1 <	1	2	10
07:30	0	0	0	0	1	0	1	8
07:45	0	0	0	2 <	0	0	2	7
08:00	1	0	0	0 <	0	0	1	6
08:15	1	0	0	0 <	1	1	3	7
08:30	2 <	0	0	0 <	2	1	5	11 <
08:45	0 <	0	0	0	1	1 <	2	11 <
09:00	0	0	0	0	0	0 <	0	10

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	1	0	0	0	0	2	3	
06:30	5	3	0	2	18	2	30	
06:45	8	2	0	2	15	3	30	
07:00	6	1 <	5	21	11	3	47	110
07:15	12	0 <	2 <	8 <	9 <	2	33	140 <
07:30	2	0	0 <	0	6	5 <	13	123
07:45	10	1	0 <	4 <	8	1	24	117
08:00	3	0	0	2	5	1	11	81
08:15	10	0	0	1	2	4	17	65
08:30	8	0	0	2	6	5	21	73
08:45	6	0	0	1	3	3 <	13	62
09:00	8 <	0	0	0	9	1 <	18	69

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

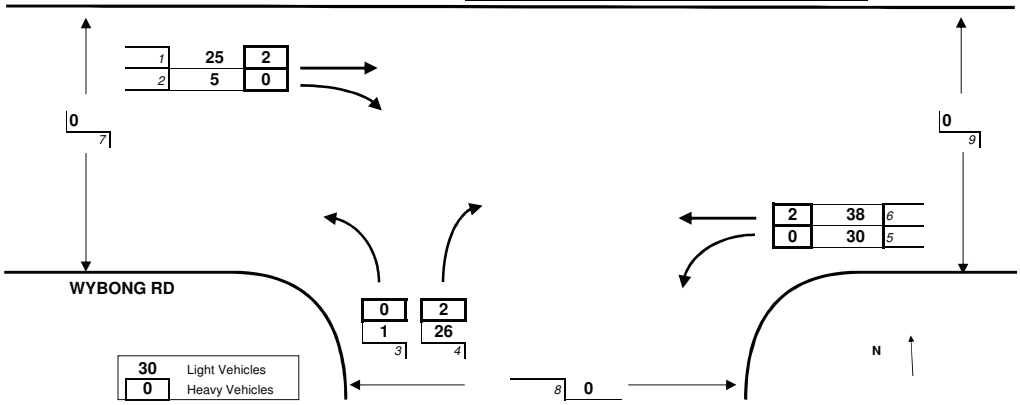
13/10/2011 - WYBONG RD / NORTHERN ACCESS RD(MANGOOLA MINE), WYBONG

18:15 <<< HOUR ENDING **Thursday**

Summary:

WYBONG RD / NTH ACCESS MANGOOLA	
125	Total Light Vehicles
6	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - WYBONG RD / NORTHERN ACCESS RD(MANGOOLA MINE), WYBONG

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR	Pedestrians 7	8	9
16:15	5	0	0	9	0	8	22		0	0	0
16:30	4	0	0	5	0	5	14		0	0	0
16:45	7	0	0	8	1	9	25		0	0	0
17:00	4	0	1	9	0	7	21	82	0	0	0
17:15	6	0	2	10	0	6	24	84	0	0	0
17:30	5	0	0	10 <	1	15	31	101	0	0	0
17:45	2	1	1	7	3	11 <	25	101	0	0	0
18:00	10	0	0	5	16	5	36	116	0	0	0
18:15	8 <	4	0	4	10	7	33	125 <	0	0	0
18:30	4	1 <	0	5	3 <	9	22	116	0	0	0
18:45	2	0	0	4	0	5	11	102	0	0	0
19:00	3	0	10 <	18	0	3	34	100	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
16:15	0	0	0	0	0	1	1	
16:30	0	0	1	2	0	0	3	
16:45	0	0	0	0	0	1	1	
17:00	2	0	0 <	2	0	0	4	9
17:15	0	0	0 <	1 <	0	1	2	10
17:30	1	0	0	0	0	2 <	3	10
17:45	1 <	0	0	1	0	0	2	11 <
18:00	0	0	0	1	0	0	1	8
18:15	0	0	0	0	0	0	0	6
18:30	0	0	0	0	0	0	0	3
18:45	2	0	0	0	0	0	2	3
19:00	0	0	0	0	0	0	0	2

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
16:15	5	0	0	9	0	9	23	
16:30	4	0	1	7	0	5	17	
16:45	7	0	0	8	1	10	26	
17:00	6	0	1	11	0	7	25	91
17:15	6	0	2	11	0	7	26	94
17:30	6	0	0	10 <	1	17	34	111
17:45	3	1	1	8 <	3	11 <	27	112
18:00	10	0	0	6	16	5	37	124
18:15	8 <	4	0	4	10	7	33	131 <
18:30	4	1 <	0	5	3 <	9	22	119
18:45	4	0	0	4	0	5	13	105
19:00	3	0	10 <	18	0	3	34	102

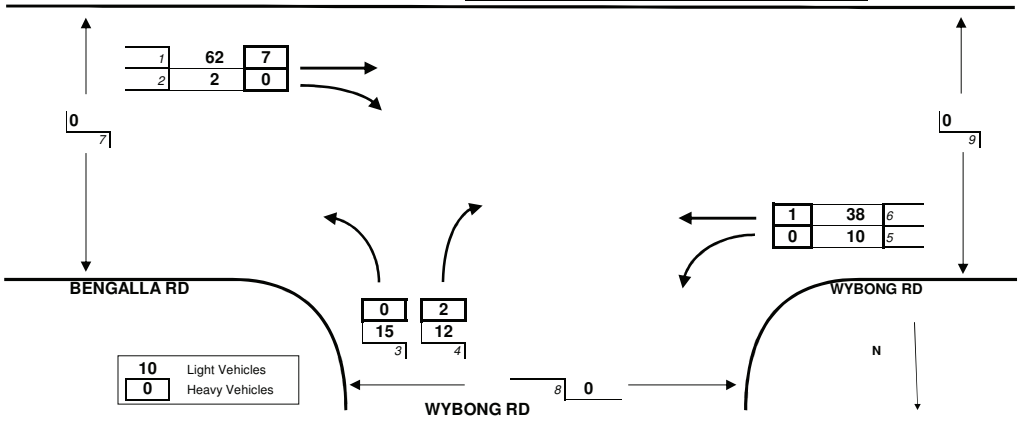
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - WYBONG RD / BENGALLA RD, BENGALLA

7:00 <<< HOUR ENDING **Thursday**

Summary:	WYBONG RD / BENGALLA RD
139	Total Light Vehicles
10	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - WYBONG RD / BENGALLA RD, BENGALLA

Light Vehicles — **Total Vehicles** — **Pedestrians**

	1	2	3	4	5	6	15 MIN HOUR		7	8	9
06:15	23	0	3	6	2	8	42		0	0	0
06:30	15	1	3	1	1	7	28		0	0	0
06:45	10	0	6	3	2	10	31		0	0	0
07:00	14 <	1	3 <	2 <	5	13	38	139 <	0	0	0
07:15	6	0	1	1	9	23	40	137	0	0	0
07:30	9	1	0	2	4	6	22	131	0	0	0
07:45	9	2 <	0	0	7 <	12 <	30	130	0	0	0
08:00	4	0	1	4	2	4	15	107	0	0	0
08:15	2	0	0	2	4	6	14	81	0	0	0
08:30	6	0	0	0	8	8	22	81	0	0	0
08:45	6	0	0	3	4	3	16	67	0	0	0
09:00	6	2	0	0	9 <	6	23	75	0	0	0

Heavy Vehicles — **Total Vehicles**

	1	2	3	4	5	6	15 MIN HOUR	
06:15	2	0	0	0	0	0	2	
06:30	1	0	0	0	0	0	1	
06:45	2	0	0	0	0	1	3	
07:00	2	0	0	2 <	0	0	4	10
07:15	0	0	2 <	0 <	0	0	2	10
07:30	0	0	0 <	0 <	0	1	1	10
07:45	0	0	0 <	0 <	0	3 <	3	10
08:00	0	0	0 <	1	1	0 <	2	8
08:15	4	1 <	0	0	0	0 <	5	11
08:30	0	0 <	0	0	1	1 <	2	12 <
08:45	2	0 <	0	0	1 <	0	3	12 <
09:00	2 <	0 <	0	0	0	0	2	12 <

All Vehicles — **Total Vehicles**

	1	2	3	4	5	6	15 MIN HOUR	
06:15	25	0	3	6	2	8	44	
06:30	16	1	3	1	1	7	29	
06:45	12	0	6	3	2	11	34	
07:00	16 <	1	3 <	4 <	5	13	42	149 <
07:15	6	0	3 <	1	9	23	42	147
07:30	9	1	0	2	4	7	23	141
07:45	9	2 <	0	0	7	15 <	33	140
08:00	4	0	1	5	3	4	17	115
08:15	6	1 <	0	2	4	6	19	92
08:30	6	0	0	0	9	9	24	93
08:45	8	0	0	3	5	3	19	79
09:00	8	2	0	0	9 <	6	25	87

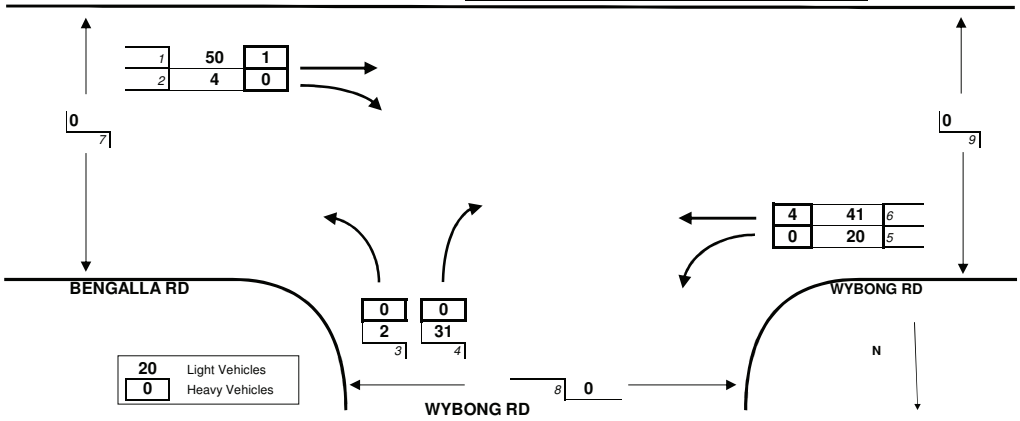
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - WYBONG RD / BENGALLA RD, BENGALLA

18:15 <<< HOUR ENDING **Thursday**

Summary:	WYBONG RD / BENGALLA RD
148	Total Light Vehicles
5	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - WYBONG RD / BENGALLA RD, BENGALLA

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
16:15	4	2	1	8	5	5	25		0	0	0
16:30	4	2	2	9	3	9	29		0	0	0
16:45	6	1	1	5	5	10	28		0	0	0
17:00	5	3	0	4	9	10	31	113	0	0	0
17:15	8	5	3 <	5	9	7	37	125	0	0	0
17:30	11	4 <	0	5	3	7	30	126	0	0	0
17:45	16	0	0	6	6 <	13	41	139	0	0	0
18:00	12	0	1	8	4	10	35	143	0	0	0
18:15	11 <	0	1	12 <	7	11	42	148 <	0	0	0
18:30	5	0	0	4	0	11 <	20	138	0	0	0
18:45	5	0	1	3	1	8	18	115	0	0	0
19:00	3	1	2	1	9	7	23	103	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	0	0	0	1	0	1	2	
16:30	0	0	0	1	0	0	1	
16:45	0	0	0	0	0	2	2	
17:00	1	0	0	0 <	2 <	3	6	11
17:15	1	0	0	1 <	0 <	1	3	12
17:30	1 <	0	0	0	0 <	1 <	2	13 <
17:45	0 <	0	0	0	0 <	1	1	12
18:00	0	0	0	0	0	2	2	8
18:15	0	0	0	0	0	0	0	5
18:30	0	0	0	0	0	0	0	3
18:45	0	0	0	0	2 <	0	2	4
19:00	0	0	0	0	0 <	0	0	2

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	4	2	1	9	5	6	27	
16:30	4	2	2	10	3	9	30	
16:45	6	1	1	5	5	12	30	
17:00	6	3	0	4	11	13	37	124
17:15	9	5	3 <	6	9	8	40	137
17:30	12	4 <	0	5	3	8	32	139
17:45	16	0	0	6	6 <	14	42	151
18:00	12	0	1	8	4	12	37	151
18:15	11 <	0	1	12 <	7	11	42	153 <
18:30	5	0	0	4	0	11 <	20	141
18:45	5	0	1	3	3	8	20	119
19:00	3	1	2	1	9	7	23	105

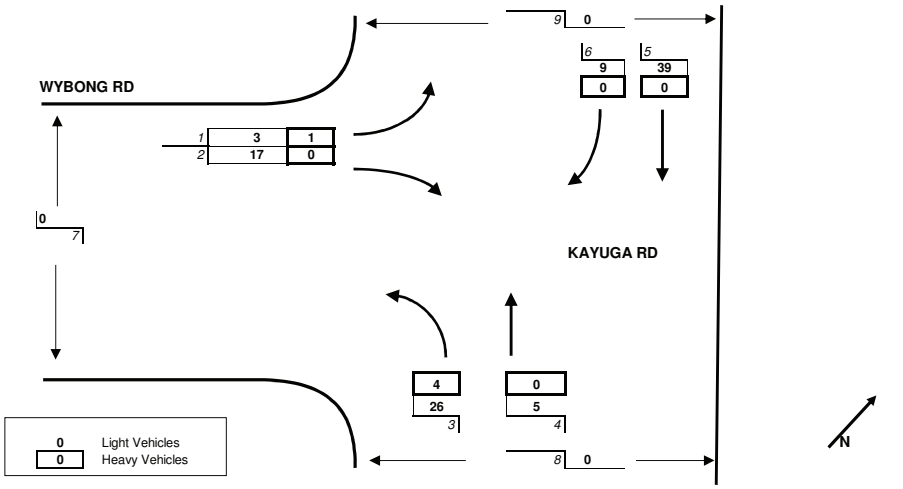
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - KAYUGA RD / WYBONG RD, MUSWELLBROOK

7:00 <<< HOUR ENDING **Thursday**

Quality Surveys

Summary:	KAYUGA RD / WYBONG RD
99	Total Light Vehicles
5	Total Heavy Vehicles
0	Total Pedestrians



13/10/2011 - KAYUGA RD / WYBONG RD, MUSWELLBROOK

	Light Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR	Pedestrians 7	8	9
06:15	1	11	8	0	16	6	42		0	0	0
06:30	0	1	4	1	6	2	14		0	0	0
06:45	1	1	5	2	10	0	19		0	0	0
07:00	1	4	9 <	2	7	1 <	24	99	0	0	0
07:15	1	11	1	2	7	0	22	79	0	0	0
07:30	1	5	5	6	3	1	21	86	0	0	0
07:45	1	7	2	4	1	0	15	82	0	0	0
08:00	1	10 <	0	5	8	2	26	84	0	0	0
08:15	2 <	9	2	5 <	14	3	35	97	0	0	0
08:30	1 <	5	4	2	9	0	21	97	0	0	0
08:45	0	7	5	2	14	1	29	111	0	0	0
09:00	1	12 <	6	3	14 <	0	36	121 <	0	0	0

	Heavy Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
06:15	0	0	0	0	0	0	0	
06:30	0	0	1	0	0	0	1	
06:45	0	0	3	0	0	0	3	
07:00	1	0	0 <	0	0	0	1	5
07:15	1 <	0	0 <	0	0	0	1	6
07:30	0 <	0	0	1 <	0	0	1	6
07:45	0 <	0	1	0 <	3 <	0	4	7
08:00	0	3	0	0 <	0 <	0	3	9 <
08:15	0	0	0	0 <	0 <	0	0	8
08:30	1	0	0	0	0 <	0	1	8
08:45	1 <	1 <	0	0	0	0	2	6
09:00	0 <	0	1	1 <	1	0	3	6

	All Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
06:15	1	11	8	0	16	6	42	
06:30	0	1	5	1	6	2	15	
06:45	1	1	8	2	10	0	22	
07:00	2	4	9 <	2	7	1 <	25	104
07:15	2	11	1	2	7	0	23	85
07:30	1 <	5	5	7	3	1	22	92
07:45	1 <	7	3	4	4	0	19	89
08:00	1	13 <	0	5	8	2	29	93
08:15	2	9	2	5 <	14	3	35	105
08:30	2 <	5	4	2	9	0	22	105
08:45	1 <	8	5	2	14	1	31	117
09:00	1 <	12	7	4	15 <	0	39	127 <

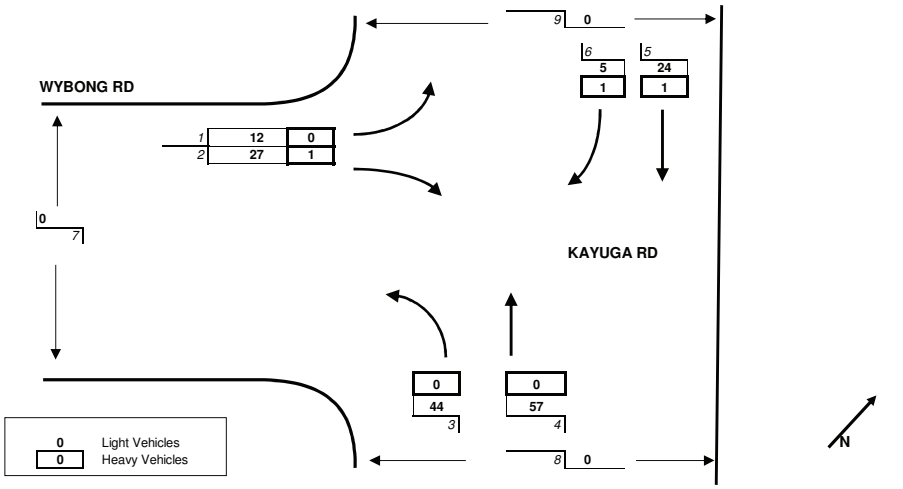
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - KAYUGA RD / WYBONG RD, MUSWELLBROOK

18:00 <<< HOUR ENDING **Thursday**

Quality Surveys

Summary:	KAYUGA RD / WYBONG RD
169	Total Light Vehicles
3	Total Heavy Vehicles
0	Total Pedestrians



13/10/2011 - KAYUGA RD / WYBONG RD, MUSWELLBROOK

	Light Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR	Pedestrians 7	8	9
16:15	0	3	12	29	11	0	55		0	0	0
16:30	2	8	10	5	5	0	30		0	0	0
16:45	2	5	8	10	1	2	28		0	0	0
17:00	4	4	8	8	4	0	28	141	0	0	0
17:15	4	6	5	17	6	2	40	126	0	0	0
17:30	5 <	10	8	12	9	1 <	45	141	0	0	0
17:45	1	6	16	11	1	0	35	148	0	0	0
18:00	2	5	15	17 <	8	2 <	49	169 <	0	0	0
18:15	4	8 <	10 <	5	11	0	38	167	0	0	0
18:30	0	4	4	5	8	0	21	143	0	0	0
18:45	0	2	7	4	8 <	3 <	24	132	0	0	0
19:00	1	6	5	6	5	1	24	107	0	0	0

	Heavy Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
16:15	0	0	0	0	0	0	0	
16:30	0	0	1	0	1	0	2	
16:45	0	0	0	0	0	0	0	
17:00	0	1	0 <	0	0	1	2	4
17:15	0	1 <	0 <	0	1 <	1 <	3	7 <
17:30	0	0 <	0	0	0	0 <	0	5
17:45	0	0 <	0	0	0	0 <	0	5
18:00	0	0	0	0	0	0	0	3
18:15	0	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	0
18:45	0	1	0	0	0	0	1	1
19:00	0	0	0	0	0	0	0	1

	All Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
16:15	0	3	12	29	11	0	55	
16:30	2	8	11	5	6	0	32	
16:45	2	5	8	10	1	2	28	
17:00	4	5	8	8	4	1	30	145
17:15	4	7	5	17	7	3	43	133
17:30	5 <	10	8	12	9	1 <	45	146
17:45	1	6	16	11	1	0	35	153
18:00	2	5	15	17 <	8	2	49	172 <
18:15	4	8 <	10 <	5	11	0	38	167
18:30	0	4	4	5	8	0	21	143
18:45	0	3	7	4	8 <	3	25	133
19:00	1	6	5	6	5	1	24	108

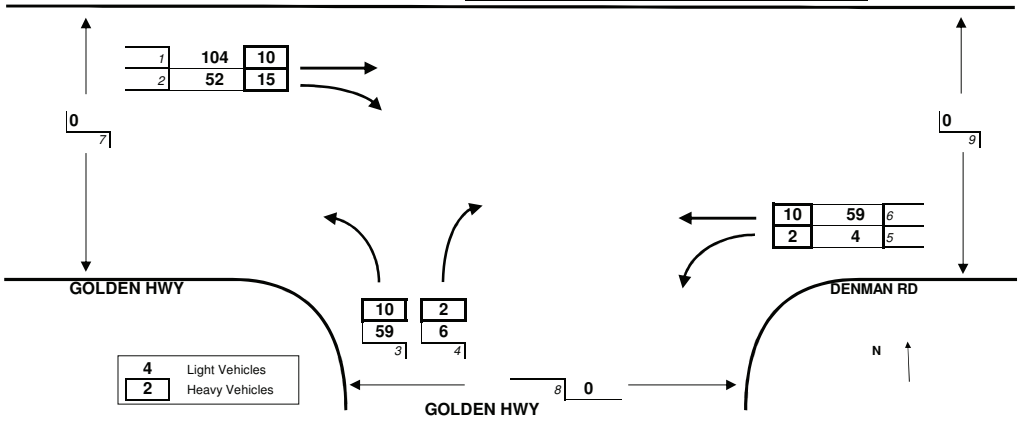
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - GOLDEN HWY / GOLDEN HWY, DENMAN

9:00 <<< HOUR ENDING **Thursday**

Summary:	GOLDEN HWY / GOLDEN HWY
284	Total Light Vehicles
49	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - GOLDEN HWY / GOLDEN HWY, DENMAN

	Light Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
06:15	32	7	4	0	1	2	46		0	0	0
06:30	28	12	3	0	0	9	52		0	0	0
06:45	38	12	7	1	0	12	70		0	0	0
07:00	22 <	13	8	1	0	15	59	227	0	0	0
07:15	17	4	6	0	1	7	35	216	0	0	0
07:30	14	8	9	2	0	6	39	203	0	0	0
07:45	19	7	9	1	1	9	46	179	0	0	0
08:00	19	8	15	1	1	10	54	174	0	0	0
08:15	31	14	18	1	0	17	81	220	0	0	0
08:30	22	10	16	3 <	2 <	18	71	252	0	0	0
08:45	27	12	10 <	1 <	1 <	12	63	269	0	0	0
09:00	24	16 <	15 <	1 <	1 <	12 <	69	284 <	0	0	0

	Heavy Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	1	1	3	1	0	0	6	
06:30	0	1	3	0	0	3	7	
06:45	1	1	1	1	0	1	5	
07:00	2	0	2	1 <	0	3	8	26
07:15	2	1	1	0	0	2	6	26
07:30	2	0	1	0	2	3	8	27
07:45	1	2	2	0	2 <	4	11	33
08:00	6	4	3	2	0 <	5 <	20	45
08:15	6 <	4	3	0	0 <	0	13	52
08:30	0	4	1	0	0	5 <	10	54
08:45	3 <	3 <	3 <	0	2	1	12	55 <
09:00	1	4 <	3 <	2	0	4	14	49

	All Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	33	8	7	1	1	2	52	
06:30	28	13	6	0	0	12	59	
06:45	39	13	8	2	0	13	75	
07:00	24 <	13	10	2	0	18	67	253
07:15	19	5	7	0	1	9	41	242
07:30	16	8	10	2	2	9	47	230
07:45	20	9	11	1	3	13	57	212
08:00	25	12	18	3	1 <	15	74	219
08:15	37	18	21	1	0	17	94	272
08:30	22	14	17	3 <	2	23	81	306
08:45	30	15	13 <	1 <	3	13	75	324
09:00	25	20 <	18 <	3 <	1	16 <	83	333 <

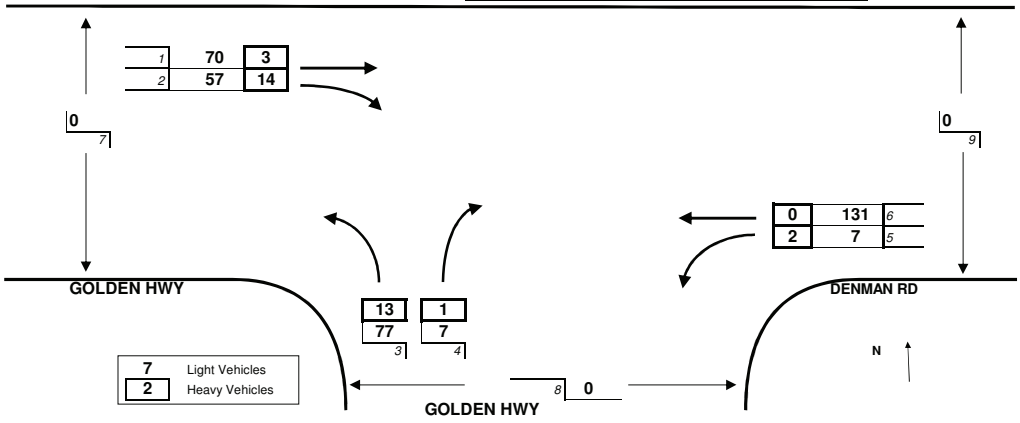
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - GOLDEN HWY / GOLDEN HWY, DENMAN

17:45 <<< HOUR ENDING **Thursday**

Summary:	GOLDEN HWY / GOLDEN HWY
349	Total Light Vehicles
33	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - GOLDEN HWY / GOLDEN HWY, DENMAN

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
16:15	16	13	22	1	1	32	85		0	0	0
16:30	20	14	11	1	0	40	86		0	0	0
16:45	17	15	18	3	3	30	86		0	0	0
17:00	18 <	17 <	13	2	2	30 <	82	339	0	0	0
17:15	14	12	19	2	0	32 <	79	333	0	0	0
17:30	15	11	25	2 <	1	37	91	338	0	0	0
17:45	23	17	20 <	1	4 <	32	97	349 <	0	0	0
18:00	13	15	12	1	0	28	69	336	0	0	0
18:15	13	13	11	0	1	31	69	326	0	0	0
18:30	14	6	7	0	0	25	52	287	0	0	0
18:45	13	9	11	0	1	22	56	246	0	0	0
19:00	4	10	13	1	0	31	59	236	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	1	4	6	1	0	7	19	
16:30	2	2	5	0	1	2	12	
16:45	2	3	2	0	0	0	7	
17:00	0	1	3 <	0 <	0	0 <	4	42 <
17:15	3 <	5	5	0	1 <	0	14	37
17:30	0	2	2	1 <	0	0	5	30
17:45	0	6	3	0 <	1 <	0	10	33
18:00	1	4 <	3	0 <	0 <	0	8	37
18:15	0	1	3	0 <	0	1	5	28
18:30	2	3	1	0	0	1	7	30
18:45	1	2	2	0	0	1	6	26
19:00	0	0	0	0	0	0	0	18

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	17	17	28	2	1	39	104	
16:30	22	16	16	1	1	42	98	
16:45	19	18	20	3	3	30	93	
17:00	18 <	18	16	2	2	30 <	86	381
17:15	17 <	17	24	2	1	32	93	370
17:30	15	13	27	3 <	1	37	96	368
17:45	23	23	23 <	1	5 <	32	107	382 <
18:00	14	19 <	15	1	0	28	77	373
18:15	13	14	14	0	1	32	74	354
18:30	16	9	8	0	0	26	59	317
18:45	14	11	13	0	1	23	62	272
19:00	4	10	13	1	0	31	59	254

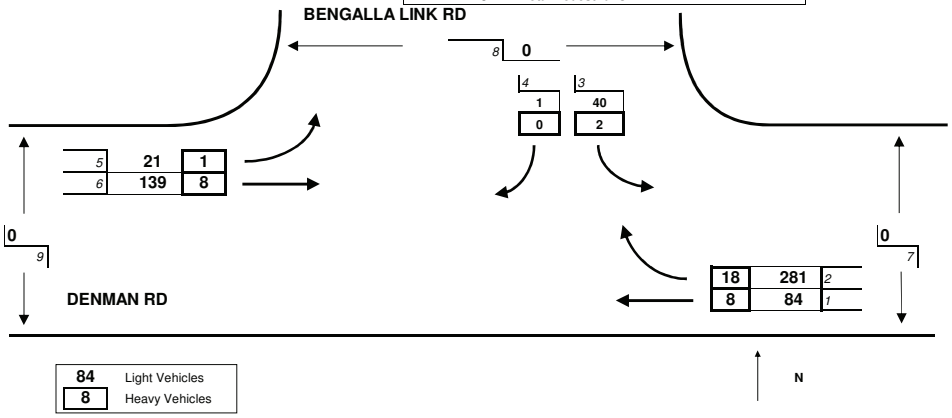
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - DENMAN RD / BENGALLA LINK RD, MUSWELLBROOK

7:00 <<< HOUR ENDING **Thursday**

Summary:	DENMAN RD / BENGALLA LINK RD
605	Total Light Vehicles
37	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - DENMAN RD / BENGALLA LINK RD, MUSWELLBROOK

	Light Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
06:15	21	83	10	0	8	28	150		0	0	0
06:30	21	88	8	1	5	34	157		0	0	0
06:45	30	76	10	0	5	34	155		0	0	0
07:00	12 <	34 <	12	0	3 <	43	104	566 <	0	0	0
07:15	9	31	32	3 <	1	27	103	519	0	0	0
07:30	19	30	40	0	1	30	120	482	0	0	0
07:45	18	20	22	1 <	1	27	89	416	0	0	0
08:00	21	17	16 <	0 <	0	24	78	390	0	0	0
08:15	26 <	18	11	0	0	42	97	384	0	0	0
08:30	18	11	12	0	5	30	76	340	0	0	0
08:45	19 <	15	10	0	2	40	86	337	0	0	0
09:00	14	13	11	1	1	31 <	71	330	0	0	0

	Heavy Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	2	4	2	0	0	1	9	
06:30	0	1	0	0	1	2	4	
06:45	2	9	0	0	0	0	11	
07:00	4	4 <	0	0	0 <	5	13	37
07:15	5	3	0	0	0 <	2	10	38
07:30	4	1	0	0	0	0	5	39
07:45	7	0	1	0	0	3	11	39
08:00	6 <	2	3	0	0	2	13	39
08:15	4	6	0	0	0	8	18	47
08:30	4	3	1	0	0	0	8	50
08:45	4	3	4 <	0	0	1	12	51
09:00	7	2	1	1 <	0	5 <	16	54 <

	All Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	23	87	12	0	8	29	159	
06:30	21	89	8	1	6	36	161	
06:45	32	85	10	0	5	34	166	
07:00	16	38 <	12	0	3 <	48	117	603 <
07:15	14	34	32	3 <	1	29	113	557
07:30	23	31	40	0	1	30	125	521
07:45	25	20	23	1 <	1	30	100	455
08:00	27	19	19 <	0 <	0	26	91	429
08:15	30 <	24	11	0	0	50	115	431
08:30	22	14	13	0	5	30	84	390
08:45	23	18	14	0	2	41	98	388
09:00	21	15	12	2	1	36 <	87	384

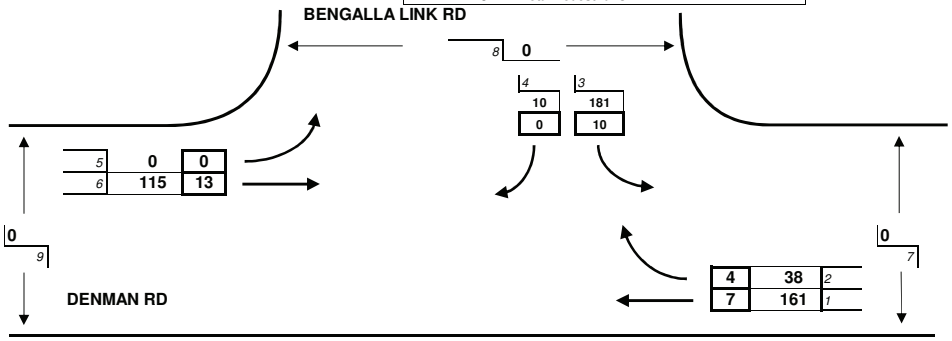
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - DENMAN RD / BENGALLA LINK RD, MUSWELLBROOK

17:15 <<< HOUR ENDING **Thursday**

Summary:	DENMAN RD / BENGALLA LINK RD
676	Total Light Vehicles
34	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - DENMAN RD / BENGALLA LINK RD, MUSWELLBROOK

Light Vehicles — **Total Vehicles** — **Pedestrians**

	1	2	3	4	5	6	15 MIN HOUR		7	8	9
16:15	40	8	27	4	0	27	106		0	0	0
16:30	38	7	43	1	0	32	121		0	0	0
16:45	46	10	28	2	0	35	121		0	0	0
17:00	31	9	45	1	0	20	106	454	0	0	0
17:15	46	12	65 <	6 <	0	28 <	157	505 <	0	0	0
17:30	42 <	12	28	1 <	0	19	102	486	0	0	0
17:45	40	24	32	1	0	30	127	492	0	0	0
18:00	33	13	26	0	0	32	104	490	0	0	0
18:15	33	15	30	0	0	18	96	429	0	0	0
18:30	27	24 <	22	3	0	19	95	422	0	0	0
18:45	37	17	14	1	0	21	90	385	0	0	0
19:00	27	14	12	0	0	25	78	359	0	0	0

Heavy Vehicles — **Total Vehicles**

	1	2	3	4	5	6	15 MIN HOUR	
16:15	2	1	2	0	0	3	8	
16:30	3	0	1	0	0	4	8	
16:45	1	0	3	0	0	7	11	
17:00	2 <	3 <	3	0	0	1 <	9	36 <
17:15	1	1 <	3	0	0	1	6	34
17:30	1	0 <	2 <	0	0	4	7	33
17:45	1	0 <	1	0	0	2	4	26
18:00	1	0	3	0	0	2	6	23
18:15	1	0	0	0	0	1	2	19
18:30	0	0	1	1 <	0	1	3	15
18:45	0	0	0	0 <	0	5	5	16
19:00	1	0	0	0 <	0	2	3	13

All Vehicles — **Total Vehicles**

	1	2	3	4	5	6	15 MIN HOUR	
16:15	42	9	29	4	0	30	114	
16:30	41	7	44	1	0	36	129	
16:45	47	10	31	2	0	42	132	
17:00	33	12	48	1	0	21 <	115	490
17:15	47	13	68 <	6 <	0	29	163	539 <
17:30	43 <	12	30	1 <	0	23	109	519
17:45	41	24	33	1	0	32	131	518
18:00	34	13	29	0	0	34	110	513
18:15	34	15	30	0	0	19	98	448
18:30	27	24 <	23	4	0	20	98	437
18:45	37	17	14	1	0	26	95	401
19:00	28	14	12	0	0	27	81	372

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - NEW ENGLAND HWY / THOMAS MITCHELL DVE, MUSWELLBROOK

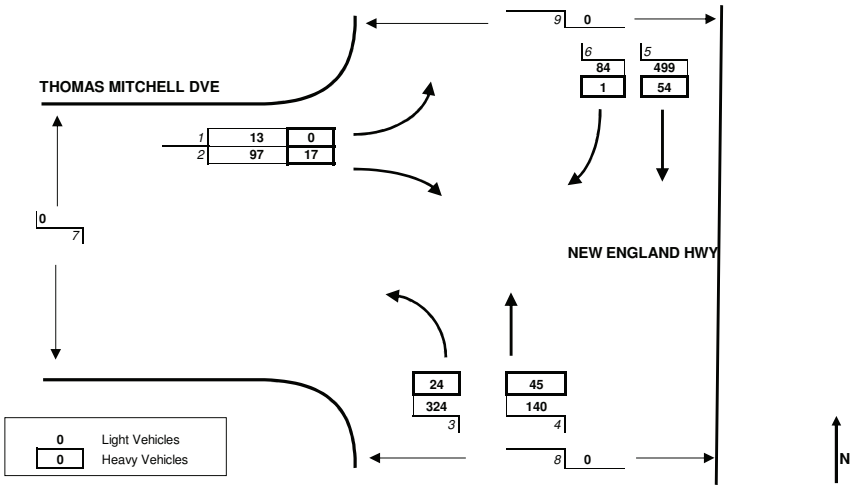
7:00 <<< HOUR ENDING **Thursday**

Summary:

NEW ENGLAND HWY / THOMAS MITCHELL DVE

1157	**Total Light Vehicles**
141	**Total Heavy Vehicles**
0	**Total Pedestrians**

Quality Surveys



13/10/2011 - NEW ENGLAND HWY / THOMAS MITCHELL DVE, MUSWELLBROOK

Light Vehicles — **Total Vehicles** — **Pedestrians**

	1	2	3	4	5	6	15 MIN HOUR		7	8	9
06:15	1	18	96	21	126	12	274		0	0	0
06:30	1	21	85	30	132	20	289		0	0	0
06:45	4	28	74	46	147	30	329		0	0	0
07:00	7	30	69 <	43	94 <	22 <	265	1157 <	0	0	0
07:15	8	26 <	56	74	62	5	231	1114	0	0	0
07:30	2	18	32	78	75	5	210	1035	0	0	0
07:45	2	10	33	87	69	2	203	909	0	0	0
08:00	12 <	20	38	88 <	35	5	198	842	0	0	0
08:15	3	6	47	66	60	3	185	796	0	0	0
08:30	3	10	29	55	68	4	169	755	0	0	0
08:45	0	7	19	63	51	5	145	697	0	0	0
09:00	2	6	15	63	52	1	139	638	0	0	0

Heavy Vehicles — **Total Vehicles**

	1	2	3	4	5	6	15 MIN HOUR	
06:15	0	5	8	14	12	0	39	
06:30	0	2	7	10	9	0	28	
06:45	0	5	5	12	15	0	37	
07:00	0	5	4	9	18	1	37	141
07:15	0	7	7	17	16	1	48	150
07:30	0	5	3	15	11 <	1	35	157
07:45	1	6	2	18	9	1 <	37	157
08:00	0	6	10	15 <	13	0	44	164 <
08:15	2	8 <	7	8	12	0	37	153
08:30	2 <	5 <	8	18	4	0	37	155
08:45	0	5	5 <	16	15	1	42	160
09:00	0	5	6	7	15	1	34	150

All Vehicles — **Total Vehicles**

	1	2	3	4	5	6	15 MIN HOUR	
06:15	1	23	104	35	138	12	313	
06:30	1	23	92	40	141	20	317	
06:45	4	33	79	58	162	30	366	
07:00	7	35	73 <	52	112 <	23 <	302	1298 <
07:15	8	33 <	63	91	78	6	279	1264
07:30	2	23 <	35	93	86	6	245	1192
07:45	3	16	35	105	78	3	240	1066
08:00	12 <	26	48	103 <	48	5	242	1006
08:15	5	14	54	74	72	3	222	949
08:30	5 <	15	37	73	72	4	206	910
08:45	0	12	24	79	66	6	187	857
09:00	2	11	21	70	67	2	173	788

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - NEW ENGLAND HWY / THOMAS MITCHELL DVE, MUSWELLBROOK

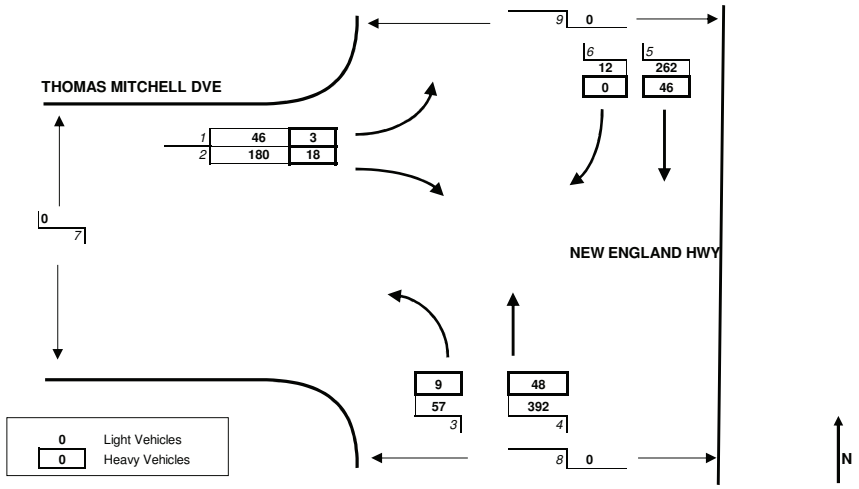
17:45 <<< HOUR ENDING **Thursday**

Summary:

NEW ENGLAND HWY / THOMAS MITCHELL DVE

949	Total Light Vehicles
124	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - NEW ENGLAND HWY / THOMAS MITCHELL DVE, MUSWELLBROOK

	Light Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
16:15	5	49	4	89	69	0	216		0	0	0
16:30	7	50	8	82	83	4	234		0	0	0
16:45	12	40	12	104	69	0	237		0	0	0
17:00	9	42	5	79	56	1	192	879	0	0	0
17:15	19 <	61 <	11	102	57	5	255	918	0	0	0
17:30	5	31	31	111 <	76	5	259	943	0	0	0
17:45	13	46	10	100	73	1	243	949 <	0	0	0
18:00	5	31	20	67	60	1	184	941	0	0	0
18:15	5	29	34 <	60	66	3	197	883	0	0	0
18:30	6	25	10	48	86 <	4	179	803	0	0	0
18:45	6	38	14	53	60	7	178	738	0	0	0
19:00	10	23	9	57	39	6 <	144	698	0	0	0

	Heavy Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	0	2	2	11	14	1	30	
16:30	0	4	3	10	15	0	32	
16:45	1	1	2	14	9	0	27	
17:00	2 <	1	2	9	14 <	0 <	28	117
17:15	0 <	4	4 <	13	9	0	30	117
17:30	0 <	6	2	13 <	8	0	29	114
17:45	1 <	7 <	1	13	15	0	37	124 <
18:00	0	0	3	9	15	0	27	123
18:15	0	4	3	9	9	0	25	118
18:30	0	4	3	11	6	0	24	113
18:45	0	4	0	15	10	1 <	30	106
19:00	0	1	1	5	9	0 <	16	95

	All Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	5	51	6	100	83	1	246	
16:30	7	54	11	92	98	4	266	
16:45	13	41	14	118	78	0	264	
17:00	11	43	7	88	70	1	220	996
17:15	19 <	65 <	15	115	66	5	285	1035
17:30	5	37	33	124 <	84	5	288	1057
17:45	14	53	11	113	88	1	280	1073 <
18:00	5	31	23	76	75	1	211	1064
18:15	5	33	37 <	69	75	3	222	1001
18:30	6	29	13	59	92 <	4	203	916
18:45	6	42	14	68	70	8	208	844
19:00	10	24	10	62	48	6 <	160	793

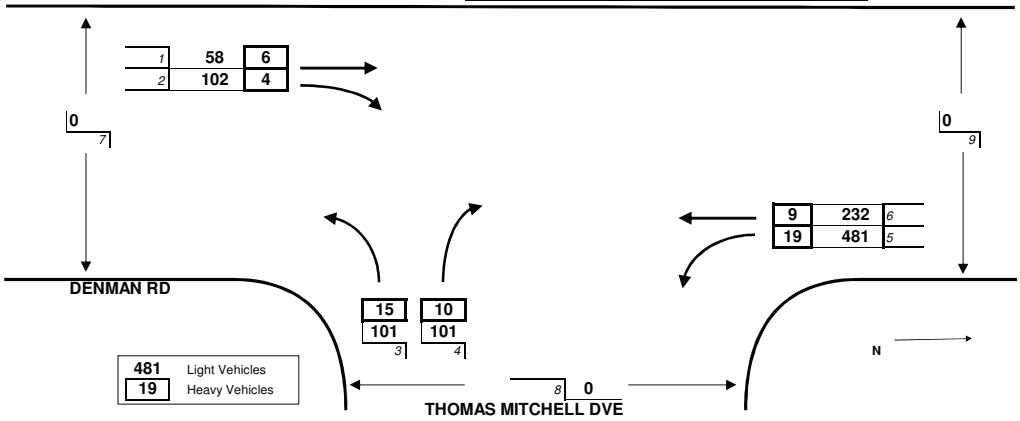
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

13/10/2011 - DENMAN RD / THOMAS MITCHELL DVE, MUSWELLBROOK

7:00 <<< HOUR ENDING **Thursday**

Summary:	DENMAN RD / THOMAS MITCHELL DVE
1075	Total Light Vehicles
63	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - DENMAN RD / THOMAS MITCHELL DVE, MUSWELLBROOK

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
06:15	5	17	21	13	109	54	219		0	0	0
06:30	12	32	28	17	98	78	265		0	0	0
06:45	14	23	34	33	101	63	268		0	0	0
07:00	27	30	18 <	38	173 <	37 <	323	1075 <	0	0	0
07:15	28	25 <	20	36 <	81	15	205	1061	0	0	0
07:30	39	25	12	11	47	32	166	962	0	0	0
07:45	39	10	6	24	44	27	150	844	0	0	0
08:00	42	11	14	17	58	28	170	691	0	0	0
08:15	39	12	19	28	39	24	161	647	0	0	0
08:30	42 <	8	8	17	34	24	133	614	0	0	0
08:45	36	11	10	17	31	19	124	588	0	0	0
09:00	36	10	10	23	35	17	131	549	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	1	0	1	2	5	1	10	
06:30	1	1	1	1	5	1	10	
06:45	1	1	11	4	6	1	24	
07:00	3	2	2	3	3	6	19	63
07:15	1	1	4	3	5	3	17	70
07:30	1	0	1	7	4	5	18	78
07:45	0	3	5	7	6	6 <	27	81
08:00	2	5	7	8	3	3	28	90
08:15	5	3	8	7 <	4	4	31	104
08:30	3	3 <	3	5	5	4	23	109
08:45	2	3 <	6 <	4	12	3	30	112 <
09:00	4 <	2	5	5	6 <	5	27	111

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	6	17	22	15	114	55	229	
06:30	13	33	29	18	103	79	275	
06:45	15	24	45	37	107	64	292	
07:00	30	32	20	41	176 <	43 <	342	1138 <
07:15	29	26 <	24 <	39 <	86	18	222	1131
07:30	40	25	13	18 <	51	37	184	1040
07:45	39	13	11	31	50	33	177	925
08:00	44	16	21	25	61	31	198	781
08:15	44	15	27	35	43	28	192	751
08:30	45 <	11	11	22	39	28	156	723
08:45	38	14	16	21	43	22	154	700
09:00	40	12	15	28	41	22	158	660

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

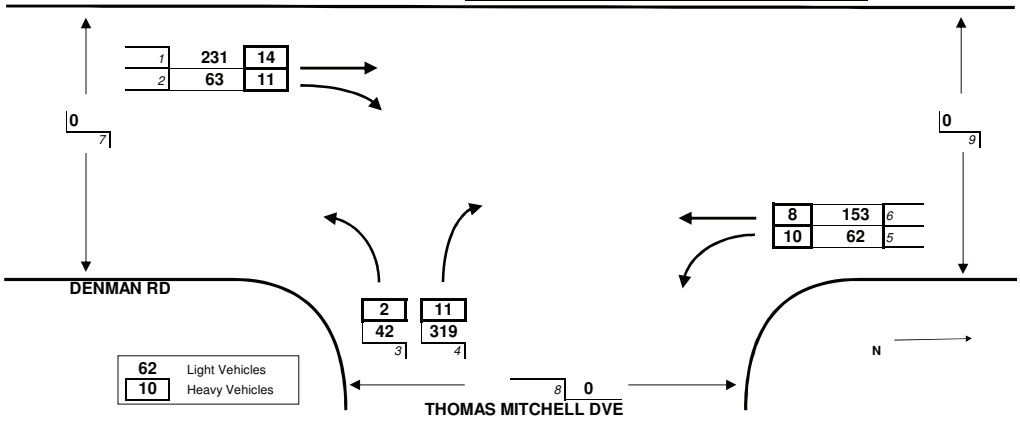
13/10/2011 - DENMAN RD / THOMAS MITCHELL DVE, MUSWELLBROOK

17:15 <<< HOUR ENDING **Thursday**

Summary:

DENMAN RD / THOMAS MITCHELL DVE	
870	Total Light Vehicles
56	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - DENMAN RD / THOMAS MITCHELL DVE, MUSWELLBROOK

	Light Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
16:15	40	11	12	83	19	37	202		0	0	0
16:30	49	19	8	68	18	34	196		0	0	0
16:45	63	7	14	103	18	42	247		0	0	0
17:00	42	25	6	73 <	13	33	192	837	0	0	0
17:15	77 <	12 <	14	75	13	44	235	870 <	0	0	0
17:30	37	15	13	68	13	40	186	860	0	0	0
17:45	49	9	17	65	14	48	202	815	0	0	0
18:00	43	15	8 <	47	36	38 <	187	810	0	0	0
18:15	32	14	14 <	53	32 <	31	176	751	0	0	0
18:30	28	13	8	34	12	44	139	704	0	0	0
18:45	27	8	14	61	4	38	152	654	0	0	0
19:00	29	5	11	47	4	28	124	591	0	0	0

	Heavy Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	4	3	1	6	2	0	16	
16:30	3	1	1	5	4	1	15	
16:45	4	5	0	1	4	1	15	
17:00	4 <	1	1 <	1 <	1 <	4	12	58 <
17:15	3	4 <	0	4	1	2	14	56
17:30	3	1 <	0	0	1	3 <	8	49
17:45	4	0	1	1	0	0	6	40
18:00	5 <	1	1	1	0	0	8	36
18:15	2	2	0	4	2	1	11	33
18:30	1	1	0	0	0	0	2	27
18:45	3	2	0	1	0	2	8	29
19:00	2	0	0	1	0	0	3	24

	All Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	44	14	13	89	21	37	218	
16:30	52	20	9	73	22	35	211	
16:45	67	12	14	104	22	43	262	
17:00	46	26	7	74 <	14	37	204	895
17:15	80 <	16 <	14	79	14	46	249	926 <
17:30	40	16	13	68	14	43	194	909
17:45	53	9	18	66	14	48	208	855
18:00	48	16	9 <	48	36	38 <	195	846
18:15	34	16	14 <	57	34 <	32	187	784
18:30	29	14	8	34	12	44	141	731
18:45	30	10	14	62	4	40	160	683
19:00	31	5	11	48	4	28	127	615

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

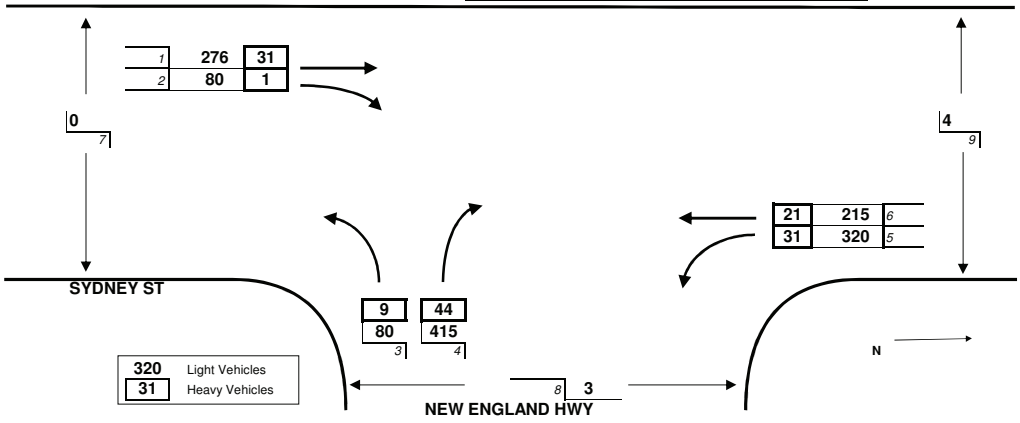
13/10/2011 - SYDNEY ST / NEW ENGLAND HWY, MUSWELLBROOK

9:00 <<< HOUR ENDING **Thursday**

Summary:

SYDNEY ST / NEW ENGLAND HWY	
1386	Total Light Vehicles
137	Total Heavy Vehicles
7	Total Pedestrians

Quality Surveys



13/10/2011 - SYDNEY ST / NEW ENGLAND HWY, MUSWELLBROOK

	Light Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
06:15	22	18	59	20	85	128	332		0	0	0
06:30	26	19	45	25	89	109	313		0	0	0
06:45	41	19	46	34	81	101	322		0	0	0
07:00	31	22	57 <	44	61	133 <	348	1315	0	0	0
07:15	49	28	26	41	56	56	256	1239	0	1	0
07:30	45	20	25	59	58	60	267	1193	0	0	1
07:45	50	22	36	57	47	52	264	1135	0	1	0
08:00	46	24 <	24	84	74	60	312	1099	1	0	0
08:15	62	18	21	104	67	50	322	1165	0	0	1
08:30	67	22	22	85	87	54	337	1235	0	0	1
08:45	77	17	16	106	82	54	352	1323	0	1	1
09:00	70 <	23	21	120 <	84 <	57	375	1386 <	0	2	1

	Heavy Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	1	1	3	5	6	4	20	
06:30	2	3	3	5	7	2	22	
06:45	5	3	1	9	13	2	33	
07:00	2	4 <	1	15	13	5	40	115
07:15	5	1 <	3	7	7 <	3	26	121
07:30	7	0	2	13	7 <	9	38	137
07:45	7	4	4	13 <	5	4	37	141 <
08:00	7	4	2 <	7	8	7	35	136
08:15	7	1	1	15 <	3	4 <	31	141 <
08:30	10 <	0	4 <	6	6	4	30	133
08:45	7 <	0	3	13	7	4	34	130
09:00	7 <	0	1	10	15	9	42	137

	All Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	23	19	62	25	91	132	352	
06:30	28	22	48	30	96	111	335	
06:45	46	22	47	43	94	103	355	
07:00	33	26	58 <	59	74 <	138 <	388	1430
07:15	54	29	29	48	63	59	282	1360
07:30	52	20	27	72	65	69	305	1330
07:45	57	26	40	70	52	56	301	1276
08:00	53	28 <	26	91	82	67	347	1235
08:15	69	19	22	119	70	54	353	1306
08:30	77	22	26	91	93	58	367	1368
08:45	84	17	19	119	89	58	386	1453
09:00	77 <	23	22	130 <	99	66	417	1523 <

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

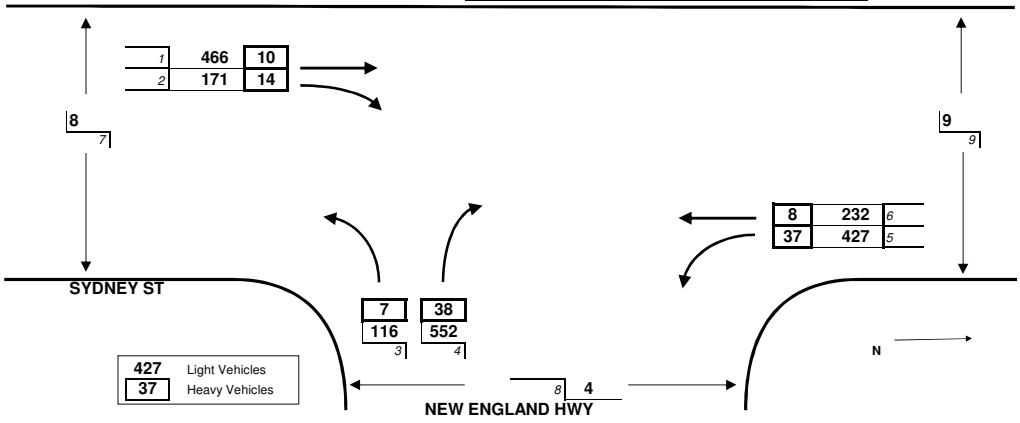
13/10/2011 - SYDNEY ST / NEW ENGLAND HWY, MUSWELLBROOK

17:30 <<< HOUR ENDING **Thursday**

Summary:

SYDNEY ST / NEW ENGLAND HWY	
1964	Total Light Vehicles
114	Total Heavy Vehicles
21	Total Pedestrians

Quality Surveys



13/10/2011 - SYDNEY ST / NEW ENGLAND HWY, MUSWELLBROOK

	Light Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
16:15	104	28	34	129	102	73	470		0	1	3
16:30	93	40	23	123	123	74	476		0	4	3
16:45	135	48	20	142	96	67	508		3	0	1
17:00	117	39	31	138	108	62 <	495	1949	0	0	3
17:15	114	52 <	32	121	111	50	480	1959	4	0	2
17:30	100 <	32	33	151	112	53	481	1964 <	1	4	3
17:45	91	25	30	143 <	111 <	74	474	1930	0	0	1
18:00	78	42	38 <	138 <	102	73	471	1906	1	0	0
18:15	86	26	31	96	96	71	406	1832	2	1	0
18:30	56	26	21	94	108	56	361	1712	1	5	1
18:45	78	36	20	90	92	39	355	1593	0	0	0
19:00	81	21	17	90	68	35	312	1434	0	0	0

	Heavy Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	1	2	0	4	17	4	28	
16:30	7	2	3	11	4	2	29	
16:45	1	2	3	10	13	2	31	
17:00	2	3	0	9	9 <	3 <	26	114
17:15	4	7 <	3 <	10	7	0	31	117 <
17:30	3	2 <	1	9	8	3	26	114
17:45	4	0	1	11	8	3	27	110
18:00	5 <	2	0	11 <	4	2	24	108
18:15	4 <	1	0	4	7	1	17	94
18:30	1	1	0	6	5	0	13	81
18:45	1	1	0	6	6	1	15	69
19:00	4	0	0	9	8	1	22	67

	All Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	105	30	34	133	119	77	498	
16:30	100	42	26	134	127	76	505	
16:45	136	50	23	152	109	69	539	
17:00	119	42	31	147	117	65 <	521	2063
17:15	118	59 <	35	131	118	50	511	2076
17:30	103 <	34	34	160	120	56	507	2078 <
17:45	95	25	31	154	119 <	77	501	2040
18:00	83	44	38 <	149 <	106	75	495	2014
18:15	90	27	31	100	103	72	423	1926
18:30	57	27	21	100	113	56	374	1793
18:45	79	37	20	96	98	40	370	1662
19:00	85	21	17	99	76	36	334	1501

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

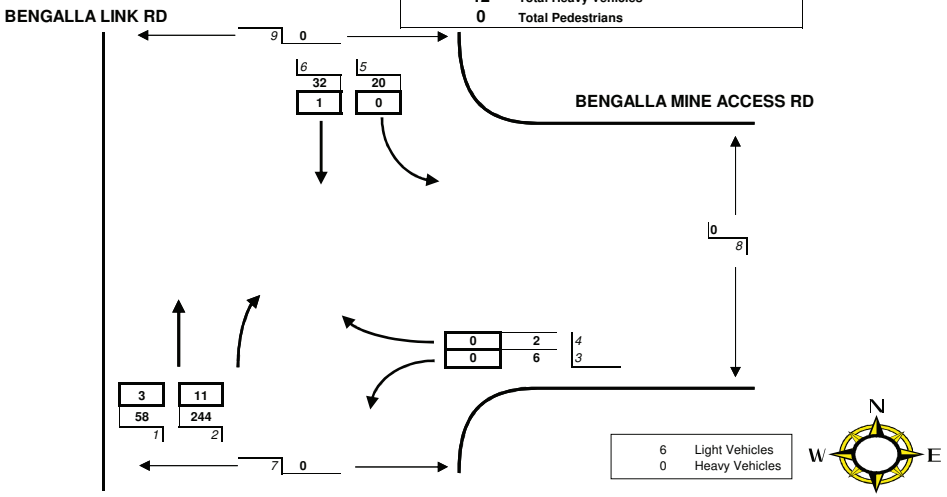
13/10/2011 - BENGALLA LINK RD / BENGALL MINE ACCESS RD, BENGALLA

7:00 <<< HOUR ENDING **Thursday**

Summary:

BENGALLA LINK RD / BENGALL MINE ACCESS RD	
129	Total Light Vehicles
12	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - BENGALLA LINK RD / BENGALL MINE ACCESS RD, BENGALLA

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR	Pedestrians 7	8	9
06:15	24	43	0	1	4	5	77		0	0	0
06:30	10	88	1	0	5	8	112		0	0	0
06:45	12	68	0	1	8	11	100		0	0	0
07:00	12 <	45 <	5	0	3 <	8	73	362 <	0	0	0
07:15	7	20	15	0	3	26	71	356	0	0	0
07:30	9	21	24	1	0	11	66	310	0	0	0
07:45	9	16	14 <	2 <	0	12 <	53	263	0	0	0
08:00	4	12	2	0 <	0	5	23	213	0	0	0
08:15	2	14	3	0 <	0	4	23	165	0	0	0
08:30	6	8	4	0	0	9	27	126	0	0	0
08:45	6	4	3	0	0	6	19	92	0	0	0
09:00	6	8	6	0	0	7	27	96	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
06:15	1	0	0	0	0	0	1	
06:30	1	1	0	0	0	0	2	
06:45	0	2	0	0	0	1	3	
07:00	1	8	0	0	0	0	9	15
07:15	0	1 <	0	0	1	0	2	16
07:30	0	1 <	0	0	0	1	2	16
07:45	0	1	2	0	0	4 <	7	20
08:00	0	0	0	0	0	0 <	0	11
08:15	5	3	1	0	1	0 <	10	19
08:30	0	2	1	0	1 <	0	4	21
08:45	2	1	3	0	0 <	0	6	20
09:00	2 <	1	2 <	0	0 <	0	5	25 <

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
06:15	25	43	0	1	4	5	78	
06:30	11	89	1	0	5	8	114	
06:45	12	70	0	1	8	12	103	
07:00	13 <	53 <	5	0	3 <	8	82	377 <
07:15	7	21	15	0	4 <	26	73	372
07:30	9	22	24	1	0	12	68	326
07:45	9	17	16 <	2 <	0	16 <	60	283
08:00	4	12	2	0 <	0	5	23	224
08:15	7	17	4	0 <	1	4	33	184
08:30	6	10	5	0	1	9	31	147
08:45	8	5	6	0	0	6	25	112
09:00	8	9	8	0	0	7	32	121

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

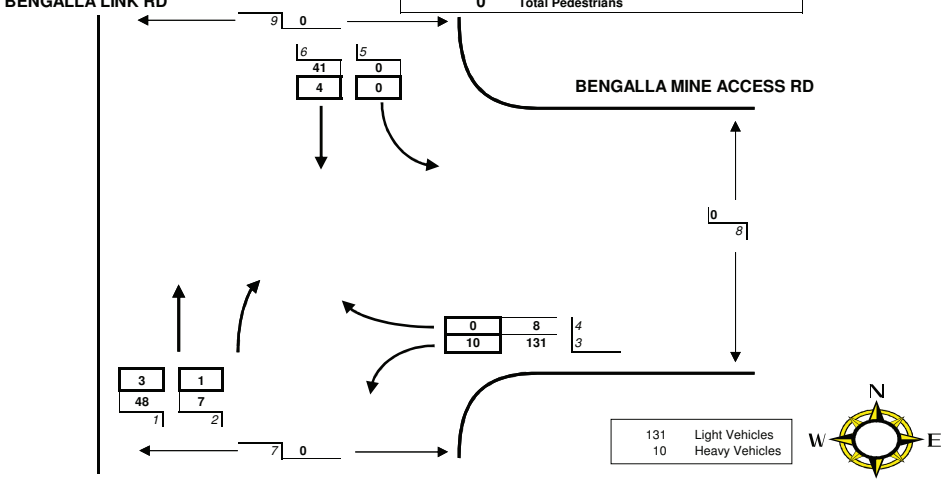
13/10/2011 - BENGALLA LINK RD / BENGALL MINE ACCESS RD, BENGALLA

17:45 <<< HOUR ENDING **Thursday**

Summary:

BENGALLA LINK RD / BENGALL MINE ACCESS RD	
229	Total Light Vehicles
15	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



13/10/2011 - BENGALLA LINK RD / BENGALL MINE ACCESS RD, BENGALLA

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR	Pedestrians 7	8	9
16:15	4	0	14	2	1	3	24		0	0	0
16:30	4	0	26	1	1	12	44		0	0	0
16:45	8	0	21	1	0	8	38		0	0	0
17:00	6	1	36	1	0	12	56	162	0	0	0
17:15	10	1	59 <	4	0	11 <	85	223	0	0	0
17:30	15	2	16	3 <	0	7	43	222	0	0	0
17:45	17	3	20	0	0	11	51	235 <	0	0	0
18:00	11	3	14	0	2	13	43	222	0	0	0
18:15	13 <	2	11	0	0	11	37	174	0	0	0
18:30	5	16	13	1	2	8 <	45	176	0	0	0
18:45	3	16	6	0	1 <	9	35	160	0	0	0
19:00	5	8 <	8	0	1	5	27	144	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
16:15	0	0	2	0	0	0	2	
16:30	0	0	0	0	0	0	0	
16:45	0	0	1	0	0	2	3	
17:00	1	0	3	0	0	2	6	11
17:15	1	1	5	0	0	0	7	16
17:30	1 <	0	1 <	0	0	2 <	4	20 <
17:45	0 <	0	1 <	0	0	0	1	18
18:00	0	1 <	2	0	0	3	6	18
18:15	0	0	1	0	0	1 <	2	13
18:30	0	0	2	0	0	0	2	11
18:45	0	0	0	0	0	0	0	10
19:00	0	0	0	0	0	0	0	4

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
16:15	4	0	16	2	1	3	26	
16:30	4	0	26	1	1	12	44	
16:45	8	0	22	1	0	10	41	
17:00	7	1	39	1	0	14	62	173
17:15	11	2	64 <	4	0	11	92	239
17:30	16	2	17	3 <	0	9	47	242
17:45	17	3	21	0	0	11	52	253 <
18:00	11	4	16	0	2	16	49	240
18:15	13 <	2	12	0	0	12 <	39	187
18:30	5	16	15	1	2	8	47	187
18:45	3	16	6	0	1 <	9	35	170
19:00	5	8 <	8	0	1	5	27	148

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

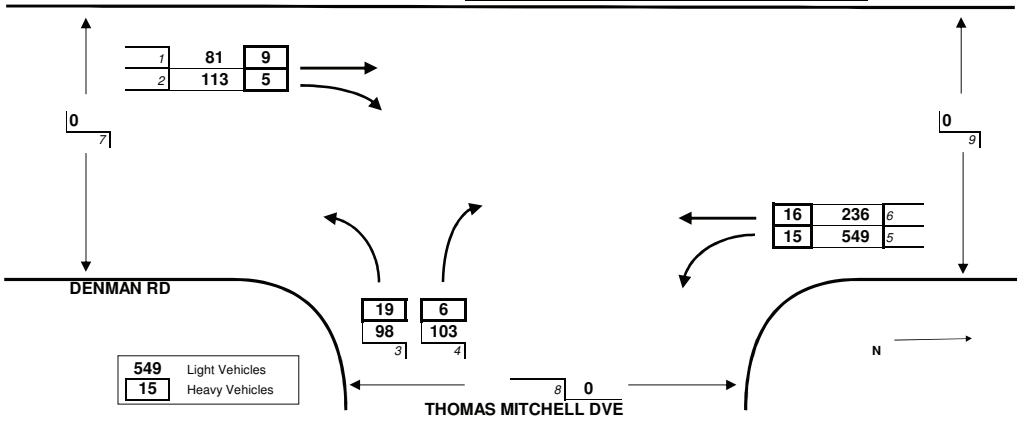
18/10/2011 - DENMAN RD / THOMAS MITCHELL DVE, MUSWELLBROOK

7:00 <<< HOUR ENDING **Tuesday**

Summary:

DENMAN RD / THOMAS MITCHELL DVE	
1180	Total Light Vehicles
70	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



18/10/2011 - DENMAN RD / THOMAS MITCHELL DVE, MUSWELLBROOK

	Light Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
06:15	12	20	19	12	148	60	271		0	0	0
06:30	15	35	29	13	126	80	298		0	0	0
06:45	20	22	26	33	95	68	264		0	0	0
07:00	34	36	24	45	180 <	28 <	347	1180 <	0	0	0
07:15	36	29 <	21 <	31	86	23	226	1135	0	0	0
07:30	31	18	13	19 <	48	26	155	992	0	0	0
07:45	33	14	15	23	44	38	167	895	0	0	0
08:00	37	15	12	20	62	26	172	720	0	0	0
08:15	32	11	10	19	29	23	124	618	0	0	0
08:30	34	7	6	23	22	17	109	572	0	0	0
08:45	37 <	3	9	17	30	21	117	522	0	0	0
09:00	34	6	6	23	42	18	129	479	0	0	0

	Heavy Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	0	0	5	1	3	3	12	
06:30	6	2	2	2	3	2	17	
06:45	2	0	6	3	1	7	19	
07:00	1	3	6	0	8	4	22	70
07:15	1	0	3	6	6	8	24	82
07:30	2	2	1	7	3	4 <	19	84
07:45	2	3 <	9	10	4 <	4	32	97
08:00	2	1	12	11 <	5	1	32	107 <
08:15	3	0	5	5	2	1	16	99
08:30	5	2	2 <	4	5	4	22	102
08:45	6 <	0	4	6	7	1	24	94
09:00	1	1	4	7	5	3	21	83

	All Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
06:15	12	20	24	13	151	63	283	
06:30	21	37	31	15	129	82	315	
06:45	22	22	32	36	96	75	283	
07:00	35	39	30 <	45	188 <	32 <	369	1250 <
07:15	37	29 <	24 <	37	92	31	250	1217
07:30	33	20	14	26 <	51	30	174	1076
07:45	35	17	24	33	48	42	199	992
08:00	39	16	24	31	67	27	204	827
08:15	35	11	15	24	31	24	140	717
08:30	39	9	8	27	27	21	131	674
08:45	43 <	3	13	23	37	22	141	616
09:00	35	7	10	30	47	21	150	562

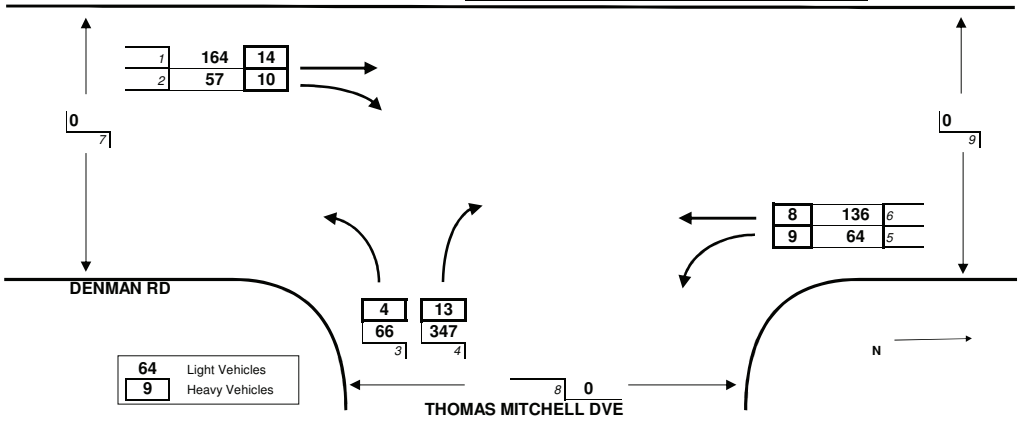
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

18/10/2011 - DENMAN RD / THOMAS MITCHELL DVE, MUSWELLBROOK

17:00 <<< HOUR ENDING **Tuesday**

Summary:	DENMAN RD / THOMAS MITCHELL DVE
834	Total Light Vehicles
58	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



18/10/2011 - DENMAN RD / THOMAS MITCHELL DVE, MUSWELLBROOK

	Light Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
16:15	37	12	19	108	22	33	231		0	0	0
16:30	36	13	13	72	15	26	175		0	0	0
16:45	33	17	14	94	11	33	202		0	0	0
17:00	58	15	20	73 <	16	44	226	834	0	0	0
17:15	58	16 <	14	81	16	36	221	824	0	0	0
17:30	40	13 <	19	56	17	46	191	840 <	0	0	0
17:45	66 <	11	15 <	45	20	43	200	838	0	0	0
18:00	24	10	11	54	27	46 <	172	784	0	0	0
18:15	37	17	12	60	51	36 <	213	776	0	0	0
18:30	24	9	9	62	26 <	43	173	758	0	0	0
18:45	26	7	8	63	6	36	146	704	0	0	0
19:00	23	3	6	60	7	25	124	656	0	0	0

	Heavy Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	2	4	2	2	3	2	15	
16:30	4	2	1	5	3	5	20	
16:45	3	2	1	4	3	0	13	
17:00	5	2 <	0 <	2	0 <	1	10	58 <
17:15	2	2	1	3	1	4 <	13	56
17:30	6 <	1	1	1	1	3	13	49
17:45	1	3	1	6	1	1	13	49
18:00	1	1	0	4	3	2 <	11	50
18:15	1	1	0	2	0	1	5	42
18:30	2	1	1	6 <	0	1	11	40
18:45	6	1	1	1	0	1	10	37
19:00	4	0	0	1	0	1	6	32

	All Vehicles 1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	39	16	21	110	25	35	246	
16:30	40	15	14	77	18	31	195	
16:45	36	19	15	98	14	33	215	
17:00	63	17	20	75 <	16	45	236	892 <
17:15	60	18 <	15	84	17	40	234	880
17:30	46	14	20	57	18	49	204	889
17:45	67 <	14	16 <	51	21	44	213	887
18:00	25	11	11	58	30	48 <	183	834
18:15	38	18	12	62	51	37	218	818
18:30	26	10	10	68	26 <	44	184	798
18:45	32	8	9	64	6	37	156	741
19:00	27	3	6	61	7	26	130	688

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

18/10/2011 - THOMAS MITCHELL DVE / BLAKEFIELD RD, MUSWELLBROOK

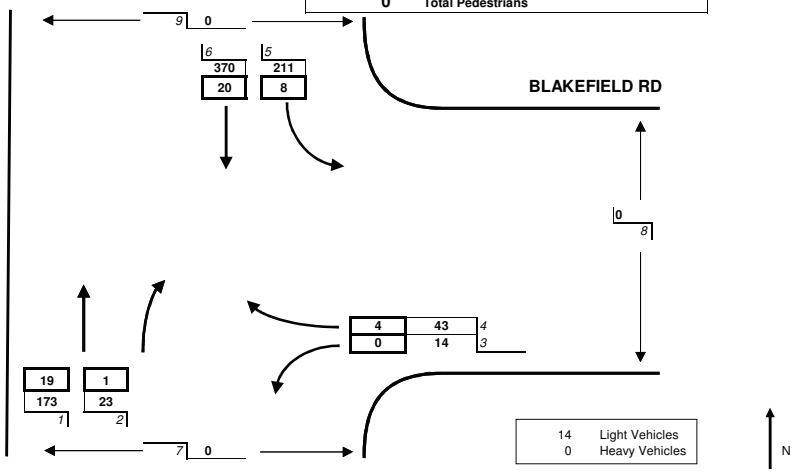
7:00 <<< HOUR ENDING **Tuesday**

THOMAS MITCHELL DVE

Summary:

THOMAS MITCHELL DVE / BLAKEFIELD RD	
812	Total Light Vehicles
33	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



18/10/2011 - THOMAS MITCHELL DVE / BLAKEFIELD RD, MUSWELLBROOK

Light Vehicles — **Total Vehicles** — **Pedestrians**

	1	2	3	4	5	6	15 MIN HOUR		7	8	9
06:15	27	8	2	8	47	120	212		0	0	0
06:30	35	2	1	8	61	85	192		0	0	0
06:45	45	7	4	18	36	75	185		0	0	0
07:00	66	6	7	9	67 <	90 <	245	834 <	0	0	0
07:15	46 <	11	7	9	31	76	180	802	0	0	0
07:30	26	4 <	3	4	15	45	97	707	0	0	0
07:45	24	5	5 <	8	18	46	106	628	0	0	0
08:00	26	4	4	17	30	57	138	521	0	0	0
08:15	24	2	5	8	12	26	77	418	0	0	0
08:30	16	3	3	13	9	19	63	384	0	0	0
08:45	16	9	5	9 <	12	18	69	347	0	0	0
09:00	28	2	8	10	21	26	95	304	0	0	0

Heavy Vehicles — **Total Vehicles**

	1	2	3	4	5	6	15 MIN HOUR	
06:15	7	0	0	0	1	5	13	
06:30	2	0	0	0	1	9	12	
06:45	5	0	0	3	2	1	11	
07:00	5	1	0	1	4	5 <	16	52
07:15	4	0	2	0	3 <	5 <	14	53
07:30	3	0	0	1	0	4	8	49
07:45	7	1	1	1	0	4	14	52
08:00	6	1	0	2	2	7 <	18	54
08:15	6 <	2	1	2	0	1	12	52
08:30	3 <	1	1	3	4	3	15	59
08:45	6	0	1	2 <	1	6	16	61 <
09:00	2	4 <	1 <	2 <	1	5	15	58

All Vehicles — **Total Vehicles**

	1	2	3	4	5	6	15 MIN HOUR	
06:15	34	8	2	8	48	125	225	
06:30	37	2	1	8	62	94	204	
06:45	50	7	4	21	38	76	196	
07:00	71	7	7	10	71 <	95 <	261	886 <
07:15	50 <	11	9	9	34	81	194	855
07:30	29	4 <	3	5	15	49	105	756
07:45	31	6	6 <	9	18	50	120	680
08:00	32	5	4	19	32	64	156	575
08:15	30	4	6	10	12	27	89	470
08:30	19	4	4	16	13	22	78	443
08:45	22	9	6	11 <	13	24	85	408
09:00	30	6	9 <	12	22	31	110	362

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

18/10/2011 - THOMAS MITCHELL DVE / BLAKEFIELD RD, MUSWELLBROOK

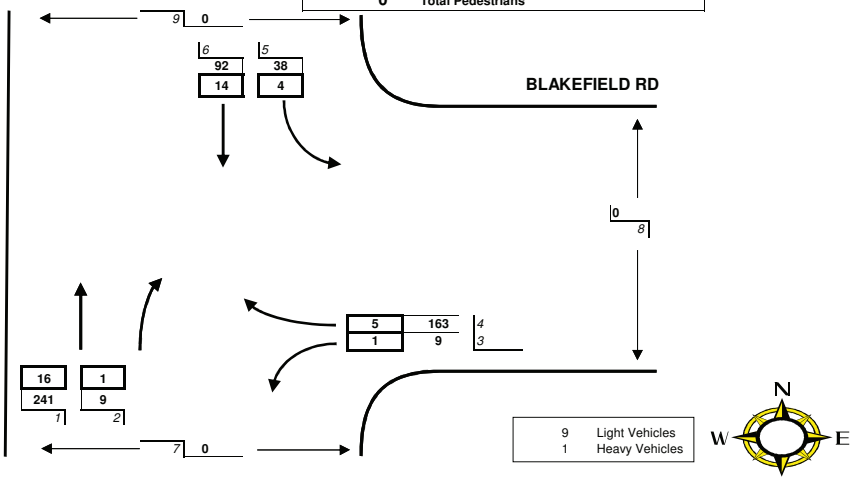
17:00 <<< HOUR ENDING **Tuesday**

THOMAS MITCHELL DVE

Summary:

THOMAS MITCHELL DVE / BLAKEFIELD RD	
544	Total Light Vehicles
25	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



18/10/2011 - THOMAS MITCHELL DVE / BLAKEFIELD RD, MUSWELLBROOK

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR	Pedestrians 7	8	9
16:15	72	3	1	61	16	18	171		0	0	0
16:30	53	1	4	24	10	22	114		0	0	0
16:45	60	2	2	46	5	26	141		0	0	0
17:00	56 <	3	2	32 <	7 <	26	126	552 <	0	0	0
17:15	58	1	1	22	5	21	108	489	0	0	0
17:30	52	1	1	24	8	25	111	486	0	0	0
17:45	40	7 <	6 <	15	2	25	95	440	0	0	0
18:00	45	0	0	18	7	34	104	418	0	0	0
18:15	37	1	3 <	30	7	56	134	444	0	0	0
18:30	55	0	1 <	14	11	32 <	113	446	0	0	0
18:45	58	1	0	12	3	12	86	437	0	0	0
19:00	52	0	0	8	3	7	70	403	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
16:15	2	0	0	0	2	3	7	
16:30	6	0	1	2	2	5	16	
16:45	3	1	0	2	0	3	9	
17:00	5	0 <	0 <	1	0 <	3 <	9	41 <
17:15	2	0 <	0 <	0	1	1	4	38
17:30	2	0 <	0	2	1	2	7	29
17:45	8 <	0	0	2	0	3	13	33
18:00	3	0	0	1	0	3	7	31
18:15	2	0	0	1 <	0	1	4	31
18:30	3	0	0	2 <	0	2	7	31
18:45	0	0	0	1	0	2	3	21
19:00	1	0	0	0	0	0	1	15

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
16:15	74	3	1	61	18	21	178	
16:30	59	1	5	26	12	27	130	
16:45	63	3	2	48	5	29	150	
17:00	61 <	3	2 <	33 <	7 <	29	135	593 <
17:15	60	1	1 <	22	6	22	112	527
17:30	54	1	1	26	9	27	118	515
17:45	48	7 <	6 <	17	2	28	108	473
18:00	48	0	0	19	7	37	111	449
18:15	39	1	3 <	31	7	57	138	475
18:30	58	0	1 <	16	11	34 <	120	477
18:45	58	1	0	13	3	14	89	458
19:00	53	0	0	8	3	7	71	418

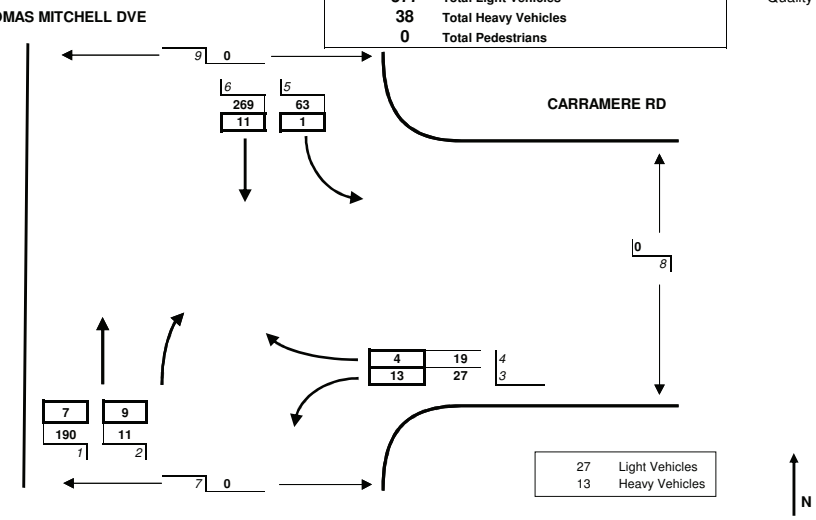
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

7:00 <<< HOUR ENDING Tuesday

Summary:
THOMAS MITCHELL DVE / CARRAMERE RD

577	Total Light Vehicles
38	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



18/10/2011 - THOMAS MITCHELL DVE / CARRAMERE RD, MUSWELLBROOK

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR	Pedestrians 7	8	9
06:15	37	16	5	4	17	98	177		0	0	0
06:30	41	12	5	0	11	73	142		0	0	0
06:45	43	19	10	6	12	50	140		0	0	0
07:00	69	11 <	7	9	23	48 <	167	626 <	0	0	0
07:15	50 <	10	1	6	20	59	146	595	0	0	0
07:30	25	4	10 <	6	11	35	91	544	0	0	0
07:45	22	13	9	6	18 <	24	92	496	0	0	0
08:00	21	7	3	5	10	36	82	411	0	0	0
08:15	21	11	4	4	6	15	61	326	0	0	0
08:30	12	7	6	3	5	7	40	275	0	0	0
08:45	12	3	2	9	10	11	47	230	0	0	0
09:00	16	8	4	13 <	11	19	71	219	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
06:15	3	2	3	1	0	2	11	
06:30	0	2	2	0	1	4	9	
06:45	1	2	5	1	0	1	10	
07:00	3	3	3	2	0	4	15	45
07:15	2	0	3	2	1	6	14	48
07:30	0	4	6	3	1	4	18	57
07:45	3	1	3	6	2	2	17	64
08:00	5	5	2	5 <	1	4	22	71
08:15	9	3	6	1	2 <	4	25	82
08:30	4 <	1	4	1	1 <	5	16	80
08:45	2	6 <	3	1	2 <	6 <	20	83 <
09:00	6 <	1	5 <	1	0	3	16	77

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
06:15	40	18	8	5	17	100	188	
06:30	41	14	7	0	12	77	151	
06:45	44	21	15	7	12	51	150	
07:00	72	14 <	10	11	23	52 <	182	671 <
07:15	52 <	10	4	8	21	65	160	643
07:30	25	8	16 <	9	12	39	109	601
07:45	25	14	12	12 <	20 <	26	109	560
08:00	26	12	5	10	11	40	104	482
08:15	30	14	10	5	8	19	86	408
08:30	16	8	10	4	6	12	56	355
08:45	14	9	5	10	12	17	67	313
09:00	22	9	9	14	11	22	87	296

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

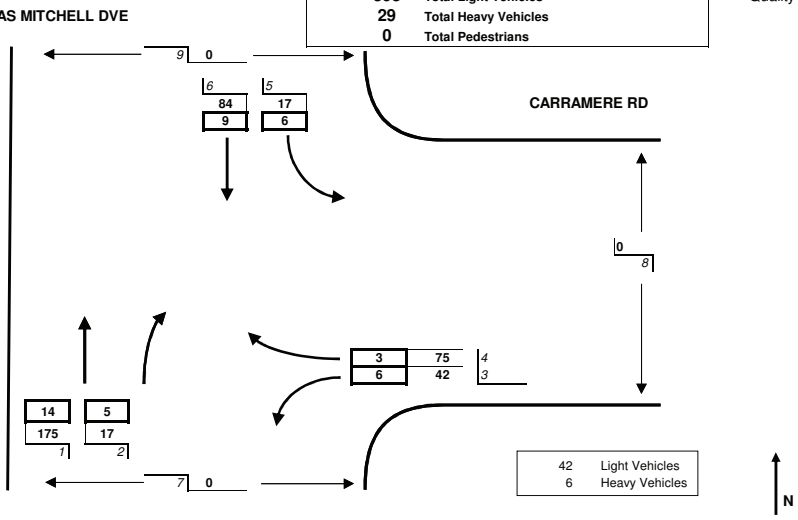
18/10/2011 - THOMAS MITCHELL DVE / CARRAMERE RD, MUSWELLBROOK

17:00 <<< HOUR ENDING **Tuesday**

Summary:

THOMAS MITCHELL DVE / CARRAMERE RD	
398	Total Light Vehicles
29	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



18/10/2011 - THOMAS MITCHELL DVE / CARRAMERE RD, MUSWELLBROOK

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR		Pedestrians 7	8	9
16:15	56	4	14	19	6	13	112		0	0	0
16:30	43	9	16	11	4	22	105		0	0	0
16:45	34	2	4	28	5	23	96		0	0	0
17:00	42	2 <	8 <	17 <	2 <	26	97	410 <	0	0	0
17:15	49	3	9	10	5	17	93	391	0	0	0
17:30	44	1	9	9	4	22	89	375	0	0	0
17:45	41	3	5	6	4	27	86	365	0	0	0
18:00	41	2	3	4	2	32	84	352	0	0	0
18:15	33	3	9	5	2	57	109	368	0	0	0
18:30	47	0	3	8	4	29 <	91	370	0	0	0
18:45	54	1	6	5	4	8	78	362	0	0	0
19:00	48 <	2	2	4	2	5	63	341	0	0 <	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	0	1	2	2	3	0	8	
16:30	6	2	2	0	2	4	16	
16:45	3	1	2	1	0	3	10	
17:00	5	1	0 <	0 <	1 <	2 <	9	43 <
17:15	2	1	0	0	1	0 <	4	39
17:30	2	0	0	0	0	2	4	27
17:45	8 <	0	1	0	1	2	12	29
18:00	2	0	0	1	0	3	6	26
18:15	1	2	0	1	0	1	5	27
18:30	2	0	0	1 <	0	2	5	28
18:45	0	2	0	0 <	0	2	4	20
19:00	0	5 <	0	1 <	0	0	6	20

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN HOUR	
16:15	56	5	16	21	9	13	120	
16:30	49	11	18	11	6	26	121	
16:45	37	3	6	29	5	26	106	
17:00	47	3 <	8 <	17 <	3 <	28	106	453 <
17:15	51	4	9	10	6	17	97	430
17:30	46	1	9	9	4	24	93	402
17:45	49 <	3	6	6	5	29	98	394
18:00	43	2	3	5	2	35	90	378
18:15	34	5	9	6	2	58	114	395
18:30	49	0	3	9	4	31 <	96	398
18:45	54	3	6	5	4	10	82	382
19:00	48	7	2	5	2	5	69	361

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

18/10/2011 - THOMAS MITCHELL DVE / GLEN MUNRO RD, MUSWELLBROOK

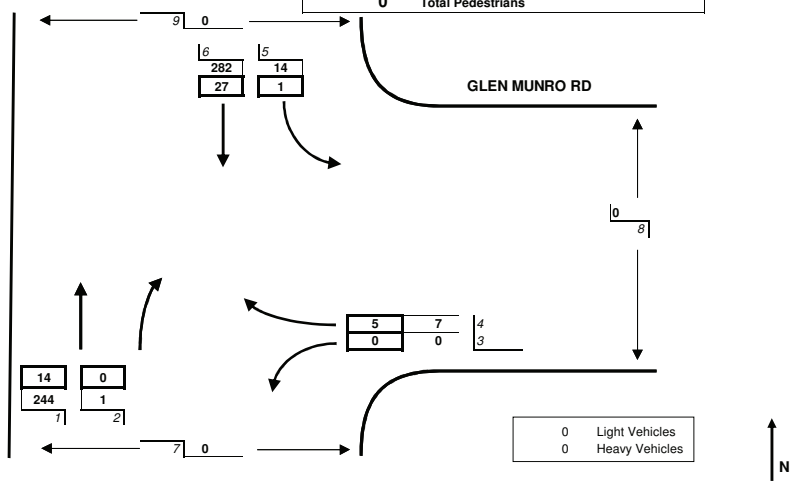
7:00 <<< HOUR ENDING **Tuesday**

THOMAS MITCHELL DVE

Summary:

THOMAS MITCHELL DVE / GLEN MUNRO RD	
547	Total Light Vehicles
33	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



18/10/2011 - THOMAS MITCHELL DVE / GLEN MUNRO RD, MUSWELLBROOK

Light Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR	Pedestrians 7	8	9
06:15	53	1	0	0	1	102	157		0	0	0
06:30	50	0	0	3	4	82	139		0	0	0
06:45	65	0	0	0	6	53	124		0	0	0
07:00	76	0	0	4	3	45 <	128	548 <	0	0	0
07:15	54 <	1	0	1	2	57	115	506	0	0	0
07:30	27	0	0	1	6 <	38	72	439	0	0	0
07:45	34	0	1	0	5	26	66	381	0	0	0
08:00	24	0	1	2	2	34	63	316	0	0	0
08:15	27	1	1 <	5	3	14	51	252	0	0	0
08:30	15	0	0 <	3	2	10	30	210	0	0	0
08:45	17	0	1 <	1	2	12	33	177	0	0	0
09:00	23	1 <	0	3 <	2	18	47	161	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
06:15	5	0	0	2	0	4	11	
06:30	2	0	0	0	0	8	10	
06:45	3	0	0	0	0	6	9	
07:00	4	0	0	3 <	1	9	17	47
07:15	2	0	0	0	0	10	12	48
07:30	5	0	0	0	0	10 <	15	53
07:45	5	0	1 <	0	0	5	11	55
08:00	9	0	0 <	1	1	5	16	54
08:15	12 <	1	0 <	1	0	8	22	64
08:30	5 <	0	0 <	0	3	7	15	64
08:45	5 <	0	1 <	2	2 <	7	17	70
09:00	6	1 <	0 <	2 <	0	8	17	71 <

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
06:15	58	1	0	2	1	106	168	
06:30	52	0	0	3	4	90	149	
06:45	68	0	0	0	6	59	133	
07:00	80 <	0	0	7	4	54 <	145	595 <
07:15	56	1	0	1	2	67	127	554
07:30	32	0	0	1	6 <	48	87	492
07:45	39	0	2	0	5	31	77	436
08:00	33	0	1	3	3	39	79	370
08:15	39	2	1 <	6	3	22	73	316
08:30	20	0	0 <	3	5	17	45	274
08:45	22	0	2 <	3	4	19	50	247
09:00	29	2 <	0	5 <	2	26	64	232

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

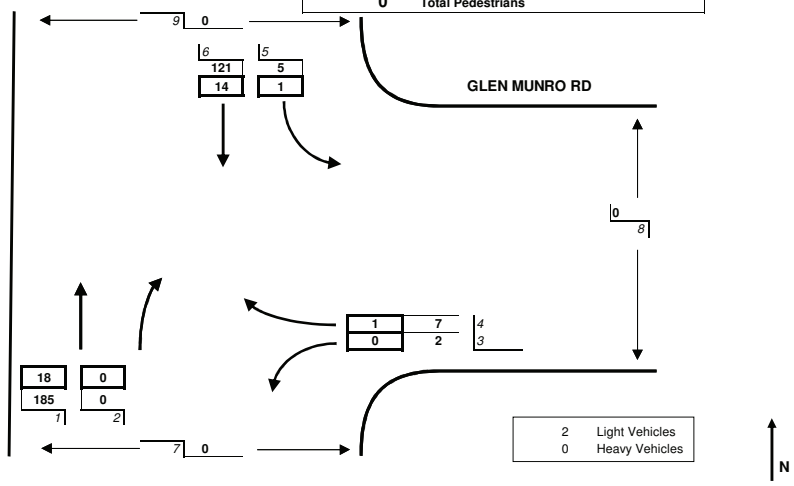
18/10/2011 - THOMAS MITCHELL DVE / GLEN MUNRO RD, MUSWELLBROOK

17:00 <<< HOUR ENDING **Tuesday**

Summary:

THOMAS MITCHELL DVE / GLEN MUNRO RD	
320	Total Light Vehicles
16	Total Heavy Vehicles
0	Total Pedestrians

Quality Surveys



18/10/2011 - THOMAS MITCHELL DVE / GLEN MUNRO RD, MUSWELLBROOK

Light Vehicles **Total Vehicles** **Pedestrians**

	1	2	3	4	5	6	15 MIN	HOUR	7	8	9
16:15	55	2	1	5	1	26	90		0	0	0
16:30	51	0	0	1	2	36	90		0	0	0
16:45	36	0	0	0	1	26	63		0	0	0
17:00	43 <	0 <	1 <	1	1 <	33	79	322	0 <	0 #	0
17:15	51	0	0	1	0	26	78	310	0	0 #	0
17:30	42	2 <	0	3	1	30	78	298	0	0 #	0
17:45	41	0 <	0	3 <	1	31	76	311	0	0 #	0
18:00	43	0 <	0	0	0	35	78	310	0	0 #	0
18:15	35	0 <	0	1	1	65	102	334	0	0 #	0
18:30	46	0	0	1	0	32 <	79	335 <	0	0 #	0
18:45	55	1	0	0	0	14	70	329	0	0 #	0
19:00	49 <	0	0	1	0	7	57	308	0	0 #	0

Heavy Vehicles **Total Vehicles**

	1	2	3	4	5	6	15 MIN	HOUR
16:15	1	0	0	0	0	2	3	
16:30	7	0	0	1	1	5	14	
16:45	4	0	0	0	0	5	9	
17:00	6	0	0	0	0 <	2 <	8	34
17:15	3 <	1	0	0	0 <	0	4	35 <
17:30	2	0	0	0	0	2	4	25
17:45	7	1 <	0	1	0	3	12	28
18:00	2	0 <	0	0	0	3	5	25
18:15	3	0	0	0	0	1	4	25
18:30	2	0	0	0	0	2	4	25
18:45	1	0	0	1	0	2	4	17
19:00	3	0	0	2 <	0	0	5	17

All Vehicles **Total Vehicles**

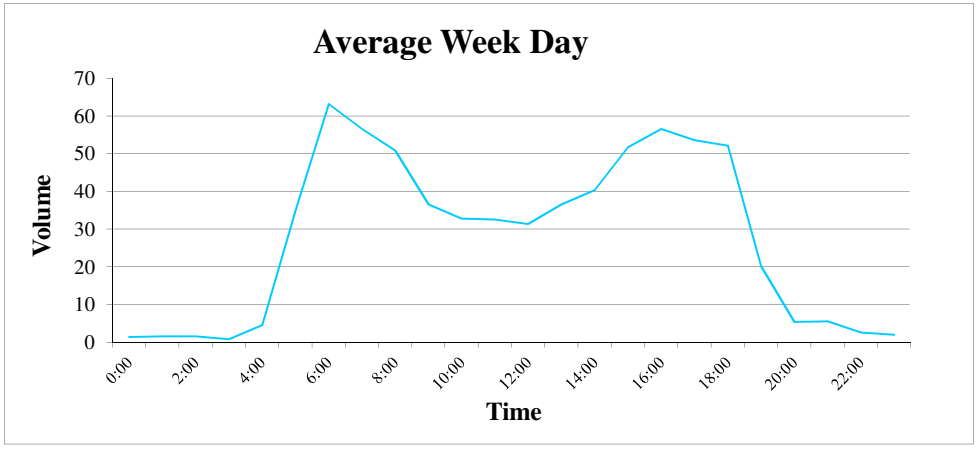
	1	2	3	4	5	6	15 MIN	HOUR
16:15	56	2	1	5	1	28	93	
16:30	58	0	0	2	3	41	104	
16:45	40	0	0	0	1	31	72	
17:00	49 <	0	1 <	1	1 <	35	87	356
17:15	54	1	0	1	0	26	82	345
17:30	44	2	0	3	1	32	82	323
17:45	48	1 <	0	4 <	1	34	88	339
18:00	45	0 <	0	0	0	38	83	335
18:15	38	0	0	1	1	66	106	359
18:30	48	0	0	1	0	34 <	83	360 <
18:45	56	1	0	1	0	16	74	346
19:00	52	0	0	3	0	7	62	325

Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

Tab	Site No	Location	Direction	Week Beginning
1	1908A	WYBONG RD 1 Klm WEST BENGALLA RD <80>	Eastbound	13/10/2011
2	1908A	WYBONG RD 1 Klm WEST BENGALLA RD <80>	Westbound	13/10/2011
3	1908B	BENGALLA RD NORTH OF BENGALLA MINE ACCESS RD <80>	Northbound	13/10/2011
4	1908B	BENGALLA RD NORTH OF BENGALLA MINE ACCESS RD <80>	Southbound	13/10/2011
5	1908C	THOMAS MITCHELL DR EAST OF INDUSTRIAL ESTATE <80>	Eastbound	13/10/2011
6	1908C	THOMAS MITCHELL DR EAST OF INDUSTRIAL ESTATE <80>	Westbound	13/10/2011

Site 1908A WYBONG RD 1 Klm WEST BENGALLA RD <80> **Eastbound**

Day	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*Wed*	*W/Day*	*W/End*	*7 Day*
Time	13-Oct-11	14-Oct-11	15-Oct-11	16-Oct-11	17-Oct-11	18-Oct-11	19-Oct-11	*Ave.*	*Ave.*	*Ave*
0:00	0	3	1	5	2	0	2	1	3	2
1:00	3	1	3	3	0	1	3	2	3	2
2:00	1	1	1	0	2	1	3	2	1	1
3:00	2	0	0	2	0	2	0	1	1	1
4:00	6	7	3	1	2	5	3	5	2	4
5:00	37	36	8	8	26	32	44	35	8	27
6:00	52	54	39	32	74	75	61	63	36	55
7:00	71	51	21	22	55	48	58	57	22	47
8:00	50	50	18	11	48	45	61	51	15	40
9:00	28	39	27	27	28	33	55	37	27	34
10:00	33	29	25	23	31	37	34	33	24	30
11:00	32	36	36	21	31	27	37	33	29	31
12:00	27	41	29	27	27	27	35	31	28	30
13:00	34	50	55	19	37	27	35	37	37	37
14:00	35	41	57	20	25	38	63	40	39	40
15:00	45	55	62	35	43	61	55	52	49	51
16:00	61	51	30	18	55	51	65	57	24	47
17:00	66	50	18	25	50	54	48	54	22	44
18:00	56	52	35	36	44	57	52	52	36	47
19:00	17	20	19	21	17	18	29	20	20	20
20:00	3	6	6	5	8	2	8	5	6	5
21:00	6	5	9	8	8	4	5	6	9	6
22:00	5	4	6	0	2	1	1	3	3	3
23:00	1	1	9	2	0	5	3	2	6	3
Total	**671**	**683**	**517**	**371**	**615**	**651**	**760**	**676**	**444**	**610**

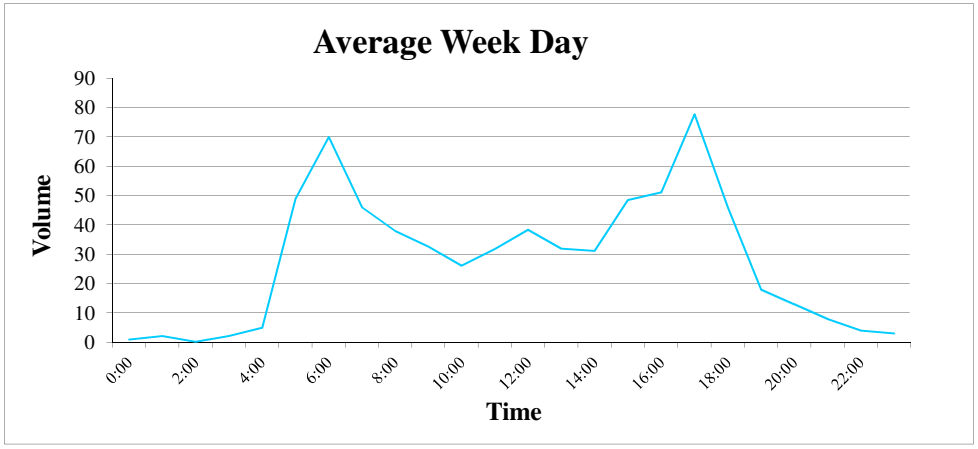


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**75**
PM Peak	5:00 PM	6:00 PM	**66**
		Week Day Average	**676**
		Weekend Day Average	**444**
		7 Day Average	**610**

Site 1908A **WYBONG RD 1 Klm WEST BENGALLA RD <80>** **Westbound**

Day	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*Wed*	*W/Day*	*W/End*	*7 Day*
Time	13-Oct-11	14-Oct-11	15-Oct-11	16-Oct-11	17-Oct-11	18-Oct-11	19-Oct-11	*Ave.*	*Ave.*	*Ave*
0:00	0	1	0	2	0	2	2	1	1	1
1:00	4	1	2	1	1	2	3	2	2	2
2:00	0	0	1	1	0	1	0	0	1	0
3:00	5	2	1	2	0	3	1	2	2	2
4:00	5	10	4	1	2	2	6	5	3	4
5:00	40	54	30	24	51	47	53	49	27	43
6:00	84	58	28	16	51	69	88	70	22	56
7:00	40	57	19	5	32	47	54	46	12	36
8:00	33	40	21	6	40	42	35	38	14	31
9:00	33	24	51	13	40	30	36	33	32	32
10:00	26	31	82	29	21	25	28	26	56	35
11:00	24	39	41	20	28	22	46	32	31	31
12:00	37	42	34	20	37	43	33	38	27	35
13:00	35	39	36	22	16	34	36	32	29	31
14:00	27	34	27	21	30	27	38	31	24	29
15:00	45	52	18	26	46	48	52	49	22	41
16:00	48	56	32	35	51	43	58	51	34	46
17:00	77	59	44	37	74	89	90	78	41	67
18:00	46	53	30	32	43	38	50	46	31	42
19:00	14	17	17	18	21	17	21	18	18	18
20:00	11	13	10	8	11	17	13	13	9	12
21:00	11	11	5	4	4	7	7	8	5	7
22:00	4	7	5	7	4	4	1	4	6	5
23:00	3	6	5	2	0	4	2	3	4	3
Total	**652**	**706**	**543**	**352**	**603**	**663**	**753**	**675**	**448**	**610**

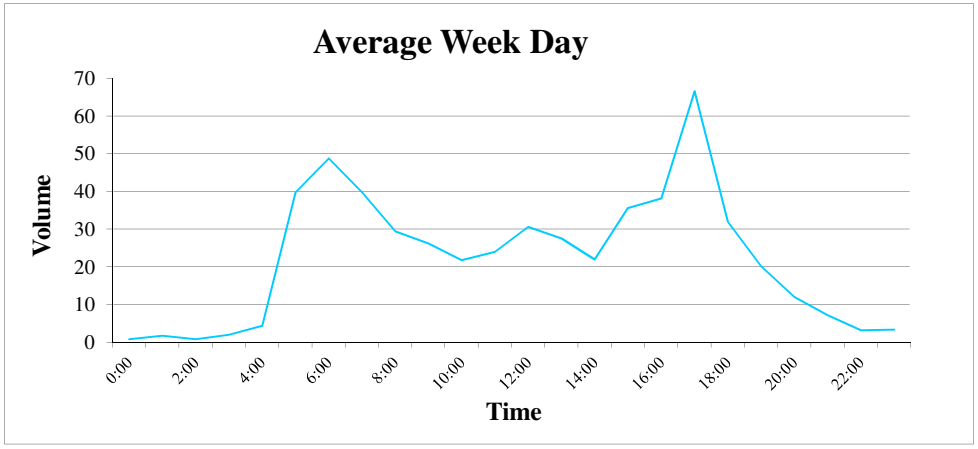


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**88**
PM Peak	5:00 PM	6:00 PM	**90**
		Week Day Average	**675**
		Weekend Day Average	**448**
		7 Day Average	**610**

Site 1908B **BENGALLA RD NORTH OF BENGALLA MINE ACCESS RD <80>** **Northbound**

Day	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*Wed*	*W/Day*	*W/End*	*7 Day*
Time	13-Oct-11	14-Oct-11	15-Oct-11	16-Oct-11	17-Oct-11	18-Oct-11	19-Oct-11	*Ave.*	*Ave.*	*Ave*
0:00	0	1	2	0	0	1	2	1	1	1
1:00	2	1	1	1	1	2	3	2	1	2
2:00	0	0	1	1	0	2	2	1	1	1
3:00	5	2	1	2	0	3	0	2	2	2
4:00	4	9	4	1	2	2	5	4	3	4
5:00	32	49	22	16	40	37	41	40	19	34
6:00	67	34	18	12	37	50	56	49	15	39
7:00	31	56	9	12	29	34	49	40	11	31
8:00	29	29	18	5	29	29	31	29	12	24
9:00	21	26	27	8	31	24	29	26	18	24
10:00	20	22	46	20	14	24	29	22	33	25
11:00	24	34	32	18	22	18	22	24	25	24
12:00	27	34	27	10	32	32	28	31	19	27
13:00	33	32	29	15	12	34	27	28	22	26
14:00	20	18	27	12	24	15	33	22	20	21
15:00	38	37	10	20	29	40	34	36	15	30
16:00	35	33	19	22	51	32	40	38	21	33
17:00	61	51	30	23	64	80	77	67	27	55
18:00	29	38	12	19	26	30	37	32	16	27
19:00	14	22	16	19	24	22	19	20	18	19
20:00	11	9	9	9	13	15	12	12	9	11
21:00	6	10	4	1	6	6	8	7	3	6
22:00	6	5	8	6	2	2	1	3	7	4
23:00	4	5	2	1	1	5	2	3	2	3
Total	**519**	**557**	**374**	**253**	**489**	**539**	**587**	**538**	**314**	**474**

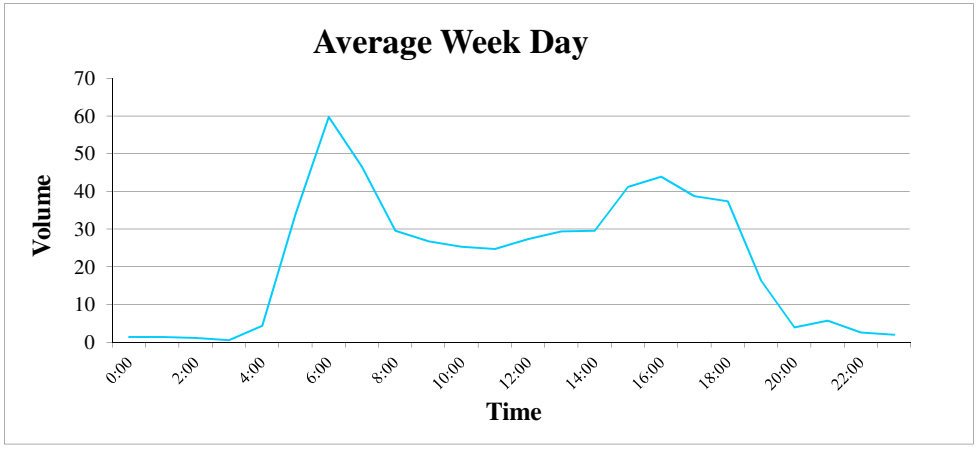


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**67**
PM Peak	5:00 PM	6:00 PM	**80**
		Week Day Average	**538**
		Weekend Day Average	**314**
		7 Day Average	**474**

Site 1908B **BENGALLA RD NORTH OF BENGALLA MINE ACCESS RD <80>** **Southbound**

Day	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*Wed*	*W/Day*	*W/End*	*7 Day*
Time	13-Oct-11	14-Oct-11	15-Oct-11	16-Oct-11	17-Oct-11	18-Oct-11	19-Oct-11	*Ave.*	*Ave.*	*Ave*
0:00	0	2	4	0	2	0	3	1	2	2
1:00	2	1	2	2	0	1	3	1	2	2
2:00	0	1	1	0	1	1	3	1	1	1
3:00	0	0	0	1	1	2	0	1	1	1
4:00	6	5	3	2	3	4	4	4	3	4
5:00	33	35	10	8	25	36	41	34	9	27
6:00	57	50	35	23	55	71	66	60	29	51
7:00	61	35	15	16	52	42	43	47	16	38
8:00	28	31	9	9	24	24	41	30	9	24
9:00	23	31	23	19	20	19	41	27	21	25
10:00	26	18	24	22	29	29	25	25	23	25
11:00	23	28	27	16	24	23	26	25	22	24
12:00	26	39	18	22	22	27	23	27	20	25
13:00	28	38	47	10	26	24	31	29	29	29
14:00	26	29	44	16	17	30	46	30	30	30
15:00	36	43	33	19	34	48	45	41	26	37
16:00	48	40	20	13	43	40	49	44	17	36
17:00	47	37	19	15	33	45	32	39	17	33
18:00	37	35	27	23	36	40	39	37	25	34
19:00	22	12	14	19	14	15	19	16	17	16
20:00	2	5	9	4	4	3	6	4	7	5
21:00	5	6	4	7	6	5	7	6	6	6
22:00	6	4	4	2	2	0	1	3	3	3
23:00	1	1	6	3	1	5	2	2	5	3
Total	**543**	**526**	**398**	**271**	**474**	**534**	**596**	**535**	**335**	**477**

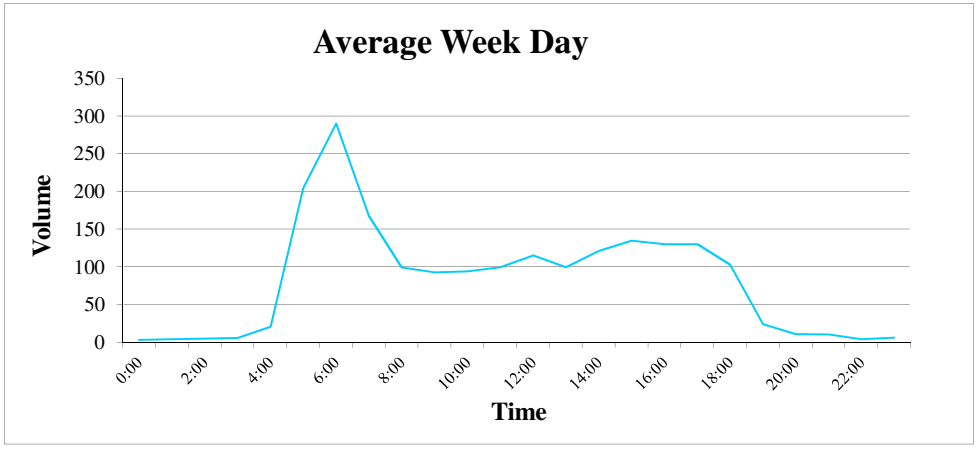


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**71**
PM Peak	4:00 PM	5:00 PM	**49**
		Week Day Average	**535**
		Weekend Day Average	**335**
		7 Day Average	**477**

Site 1908C THOMAS MITCHELL DR EAST OF INDUSTRIAL ESTATE <80> **Eastbound**

Day	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*Wed*	*W/Day*	*W/End*	*7 Day*
Time	13-Oct-11	14-Oct-11	15-Oct-11	16-Oct-11	17-Oct-11	18-Oct-11	19-Oct-11	*Ave.*	*Ave.*	*Ave*
0:00	4	6	2	4	3	2	2	3	3	3
1:00	3	8	7	2	3	1	6	4	5	4
2:00	5	7	7	5	1	5	8	5	6	5
3:00	6	5	2	2	5	7	7	6	2	5
4:00	18	19	8	3	15	31	21	21	6	16
5:00	201	188	61	33	192	221	220	204	47	159
6:00	308	261	113	79	274	310	298	290	96	235
7:00	169	166	29	28	144	178	182	168	29	128
8:00	111	109	23	23	90	90	96	99	23	77
9:00	103	86	32	25	82	89	104	93	29	74
10:00	87	100	38	17	90	102	91	94	28	75
11:00	111	98	28	27	103	90	97	100	28	79
12:00	136	129	33	15	105	101	105	115	24	89
13:00	131	112	32	17	83	91	82	100	25	78
14:00	123	138	32	20	100	128	118	121	26	94
15:00	136	149	30	13	117	135	138	135	22	103
16:00	135	119	36	26	120	148	129	130	31	102
17:00	141	109	46	54	115	126	161	130	50	107
18:00	104	84	84	73	107	120	100	103	79	96
19:00	18	22	10	30	27	28	25	24	20	23
20:00	13	9	11	17	12	10	11	11	14	12
21:00	8	6	4	7	12	15	12	11	6	9
22:00	4	6	8	7	3	2	5	4	8	5
23:00	8	6	1	6	8	5	5	6	4	6
Total	**2083**	**1942**	**677**	**533**	**1811**	**2035**	**2023**	**1979**	**605**	**1586**

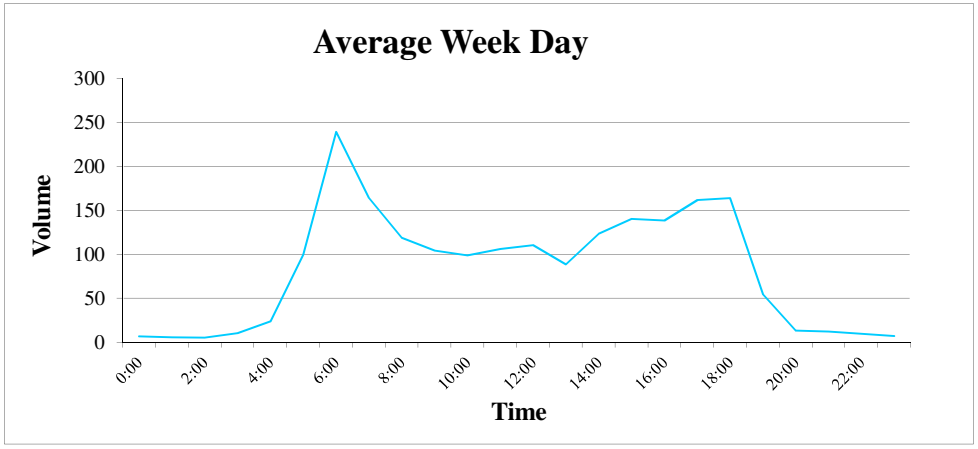


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**310**
PM Peak	5:00 PM	6:00 PM	**161**
		Week Day Average	**1979**
		Weekend Day Average	**605**
		7 Day Average	**1586**

Site 1908C THOMAS MITCHELL DR EAST OF INDUSTRIAL ESTATE <80> **Westbound**

Day	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*Wed*	*W/Day*	*W/End*	*7 Day*
Time	13-Oct-11	14-Oct-11	15-Oct-11	16-Oct-11	17-Oct-11	18-Oct-11	19-Oct-11	*Ave.*	*Ave.*	*Ave*
0:00	9	7	7	3	5	6	8	7	5	6
1:00	6	7	8	1	2	4	9	6	5	5
2:00	4	8	5	2	6	5	4	5	4	5
3:00	13	11	2	3	5	15	8	10	3	8
4:00	25	21	10	5	26	23	25	24	8	19
5:00	99	104	38	21	99	99	97	100	30	80
6:00	247	216	119	110	231	262	241	239	115	204
7:00	160	160	36	30	145	166	191	164	33	127
8:00	143	103	28	9	119	113	117	119	19	90
9:00	108	103	34	14	107	120	84	104	24	81
10:00	111	99	44	14	101	102	81	99	29	79
11:00	120	112	35	25	111	89	99	106	30	84
12:00	132	113	22	21	94	112	102	111	22	85
13:00	104	80	24	16	84	90	86	89	20	69
14:00	119	149	19	27	102	108	141	124	23	95
15:00	138	137	25	22	126	157	143	140	24	107
16:00	126	102	25	25	147	157	160	138	25	106
17:00	174	105	36	18	192	164	175	162	27	123
18:00	159	118	96	80	163	186	194	164	88	142
19:00	49	40	28	38	68	55	61	55	33	48
20:00	17	9	8	9	19	10	12	13	9	12
21:00	7	11	3	6	12	17	14	12	5	10
22:00	9	9	4	11	9	11	10	10	8	9
23:00	9	7	9	6	3	11	6	7	8	7
Total	**2088**	**1831**	**665**	**516**	**1976**	**2082**	**2068**	**2009**	**591**	**1604**



Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**262**
PM Peak	6:00 PM	7:00 PM	**194**
		Week Day Average	**2009**
		Weekend Day Average	**590**
		7 Day Average	**1604**

APPENDIX B: DESCRIPTION OF TRAFFIC MODELLING PERFORMANCE INDICATORS

Level of service (LoS)

The SIDRA intersection simulation software is used to determine the likely traffic performance indicators including level of service (LoS), degree of saturation (DoS), average delay and maximum queue length (represented by 95th percentile queue length). At signalised and roundabout intersections, the LoS critera are related to average intersection delay (seconds per vehicle). At sign controlled intersections (give way and stop), the LoS is based on the average delay (seconds per vehicle) for the worst movement. The following table summarises the intersection LoS criteria.

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 (DoS)

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 0.90. The intersection DoS is based on the movement with the highest ratio.

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 volumes and their corresponding calculated delays and dividing these by the total number of vehicles entering the intersection. At sign controlled intersections, the average delay for the worst movement is usually reported.

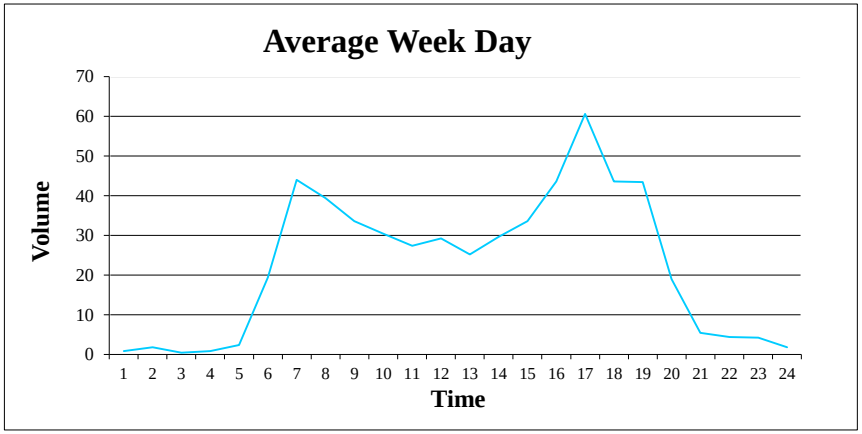
Maximum queue length

Queue length is the number of vehicles waiting at the hold 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. For signalised intersections, it is measured as the number of vehicles per traffic lane at the start of the green period, when the traffic starts moving again after a red signal. The intersection queue length is usually taken from the movement with the longest queue length.

APPENDIX C: 2013 TRAFFIC SURVEY RESULTS

Site Be Wybong Rd, 150m W of Ridgelands Rd — Eastbound

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun	W/Day	W/End	7 Day
Time	4/02/2013	5-Feb-13	6-Feb-13	7-Feb-13	8-Feb-13	9-Feb-13	10-Feb-13	Ave.	Ave.	Ave
0:00	2	1	1	0	0	0	1	1	1	1
1:00	2	2	1	2	2	1	0	2	1	1
2:00	1	0	1	0	0	1	1	0	1	1
3:00	0	1	1	0	2	2	0	1	1	1
4:00	3	0	2	5	2	1	2	2	2	2
5:00	15	19	22	22	19	9	4	19	7	16
6:00	48	30	49	44	49	32	30	44	31	40
7:00	35	46	41	42	33	23	11	39	17	33
8:00	32	32	40	32	32	14	6	34	10	27
9:00	24	37	21	39	31	16	15	30	16	26
10:00	15	33	31	28	30	16	16	27	16	24
11:00	30	26	24	32	34	19	20	29	20	26
12:00	22	25	28	20	31	14	18	25	16	23
13:00	22	32	25	35	34	12	16	30	14	25
14:00	24	24	34	41	45	10	15	34	13	28
15:00	36	58	39	39	46	18	21	44	20	37
16:00	70	56	55	76	46	11	17	61	14	47
17:00	39	37	60	54	28	14	12	44	13	35
18:00	48	43	39	49	38	40	40	43	40	42
19:00	17	24	24	9	21	15	10	19	13	17
20:00	10	5	0	4	8	5	3	5	4	5
21:00	3	3	8	2	6	4	3	4	4	4
22:00	6	8	2	4	1	1	3	4	2	4
23:00	5	0	1	1	2	2	1	2	2	2
Total	**509**	**542**	**549**	**580**	**540**	**280**	**265**	**544**	**273**	**466**



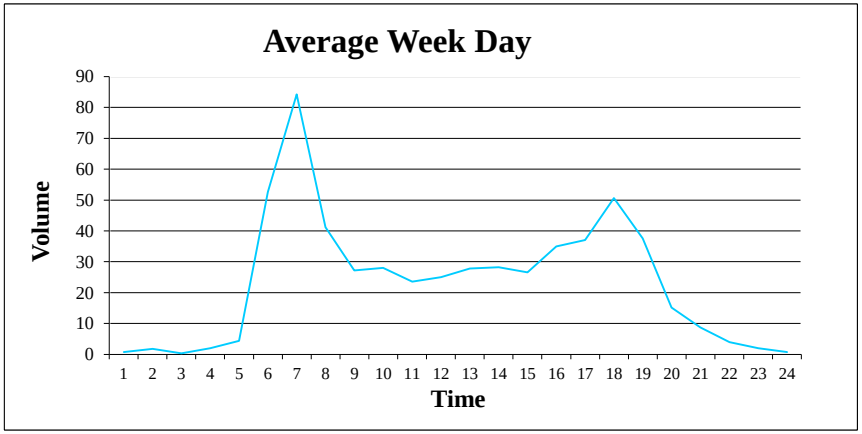
Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**49**
PM Peak	4:00 PM	5:00 PM	**76**
		Week Day Average	**544**
		Weekend Day Average	**273**
		7 Day Average	**466**

Site Be Wybong Rd, 150m W of Ridgelands Rd <100>

Westbound

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun	W/Day	W/End	7 Day
Time	4/02/2013	5-Feb-13	6-Feb-13	7-Feb-13	8-Feb-13	9-Feb-13	10-Feb-13	Ave.	Ave.	Ave
0:00	1	0	0	1	2	3	3	1	3	1
1:00	2	2	2	2	1	1	2	2	2	2
2:00	0	1	0	1	0	0	0	0	0	0
3:00	3	0	4	1	2	3	2	2	3	2
4:00	7	4	2	3	6	4	1	4	3	4
5:00	56	61	47	48	51	20	18	53	19	43
6:00	80	81	88	88	84	23	25	84	24	67
7:00	28	49	37	40	52	6	9	41	8	32
8:00	28	31	23	33	21	4	6	27	5	21
9:00	32	33	28	24	23	14	10	28	12	23
10:00	27	22	26	14	29	13	12	24	13	20
11:00	27	20	16	35	27	19	19	25	19	23
12:00	23	28	38	24	26	24	22	28	23	26
13:00	27	25	31	35	23	20	15	28	18	25
14:00	23	33	24	25	28	19	11	27	15	23
15:00	32	25	33	49	36	19	17	35	18	30
16:00	38	36	46	35	30	16	17	37	17	31
17:00	47	48	50	60	48	35	35	51	35	46
18:00	43	35	40	33	37	30	18	38	24	34
19:00	13	9	16	18	20	15	6	15	11	14
20:00	9	12	7	9	7	2	12	9	7	8
21:00	1	5	2	6	6	2	5	4	4	4
22:00	4	2	0	1	3	4	2	2	3	2
23:00	1	2	0	1	0	1	0	1	1	1
Total	**552**	**564**	**560**	**586**	**562**	**297**	**267**	**565**	**282**	**484**

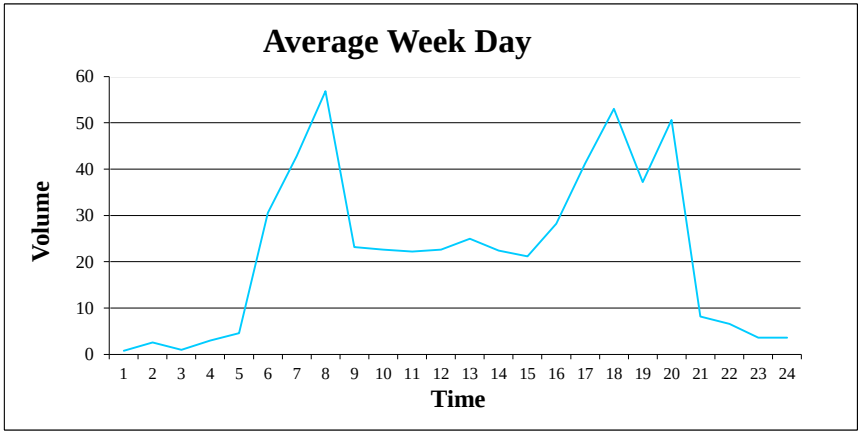


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**88**
PM Peak	5:00 PM	6:00 PM	**60**
		Week Day Average	**565**
		Weekend Day Average	**282**
		7 Day Average	**484**

Site Be Bengalla Link Rd, N of Bengalla Mine Access <100. Northbound

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun	W/Day	W/End	7 Day
Time	4/02/2013	5-Feb-13	6-Feb-13	7-Feb-13	8-Feb-13	9-Feb-13	10-Feb-13	Ave.	Ave.	Ave
0:00	1	0	0	1	2	1	4	1	3	1
1:00	2	4	2	2	3	1	1	3	1	2
2:00	0	2	0	2	1	3	1	1	2	1
3:00	5	1	5	2	2	2	1	3	2	3
4:00	5	4	2	4	8	3	2	5	3	4
5:00	32	31	33	27	30	8	11	31	10	25
6:00	36	40	44	48	46	10	9	43	10	33
7:00	50	63	57	56	58	45	44	57	45	53
8:00	26	35	17	22	16	5	3	23	4	18
9:00	27	23	25	23	15	15	5	23	10	19
10:00	24	17	20	21	29	8	16	22	12	19
11:00	22	19	25	28	19	14	14	23	14	20
12:00	16	20	36	23	30	25	11	25	18	23
13:00	19	20	29	20	24	17	9	22	13	20
14:00	21	21	16	21	27	15	9	21	12	19
15:00	24	17	31	39	30	20	18	28	19	26
16:00	44	46	41	40	35	10	17	41	14	33
17:00	43	48	66	62	46	29	20	53	25	45
18:00	53	30	35	31	37	27	15	37	21	33
19:00	65	56	42	47	43	37	25	51	31	45
20:00	8	12	5	11	5	3	18	8	11	9
21:00	5	7	7	5	9	3	5	7	4	6
22:00	6	3	2	3	4	8	0	4	4	4
23:00	1	7	3	3	4	3	2	4	3	3
Total	**535**	**526**	**543**	**541**	**523**	**312**	**260**	**534**	**286**	**463**

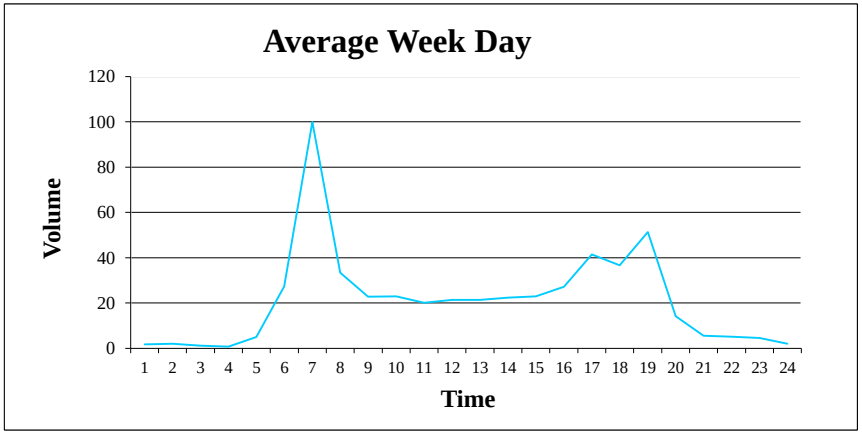


Summary

	from	to	
AM Peak	7:00 AM	8:00 AM	**63**
PM Peak	5:00 PM	6:00 PM	**66**
		Week Day Average	**534**
		Weekend Day Average	**286**
		7 Day Average	**463**

Site Be Bengalla Link Rd, N of Bengalla Mine Access <100. Southbound

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun	W/Day	W/End	7 Day
Time	4/02/2013	5-Feb-13	6-Feb-13	7-Feb-13	8-Feb-13	9-Feb-13	10-Feb-13	Ave.	Ave.	Ave
0:00	3	1	3	1	1	1	0	2	1	1
1:00	1	2	2	2	3	1	1	2	1	2
2:00	1	1	1	2	1	2	1	1	2	1
3:00	2	1	0	0	1	1	3	1	2	1
4:00	4	3	4	7	7	4	2	5	3	4
5:00	21	27	25	35	29	8	7	27	8	22
6:00	94	98	131	93	84	39	39	100	39	83
7:00	41	32	26	39	29	17	8	33	13	27
8:00	20	14	27	28	25	13	11	23	12	20
9:00	18	26	14	31	26	15	16	23	16	21
10:00	13	26	21	22	19	17	11	20	14	18
11:00	23	22	11	23	28	13	22	21	18	20
12:00	15	22	24	22	24	9	14	21	12	19
13:00	17	18	19	30	28	9	18	22	14	20
14:00	16	20	20	26	33	10	7	23	9	19
15:00	22	30	28	27	29	13	9	27	11	23
16:00	46	42	37	50	32	10	11	41	11	33
17:00	39	30	52	36	26	11	14	37	13	30
18:00	44	48	55	53	57	52	57	51	55	52
19:00	17	17	15	8	14	14	9	14	12	13
20:00	6	4	3	6	9	11	1	6	6	6
21:00	5	5	9	2	5	2	3	5	3	4
22:00	9	5	2	5	2	4	3	5	4	4
23:00	3	2	1	4	0	3	0	2	2	2
Total	**480**	**496**	**530**	**552**	**512**	**279**	**267**	**514**	**273**	**445**



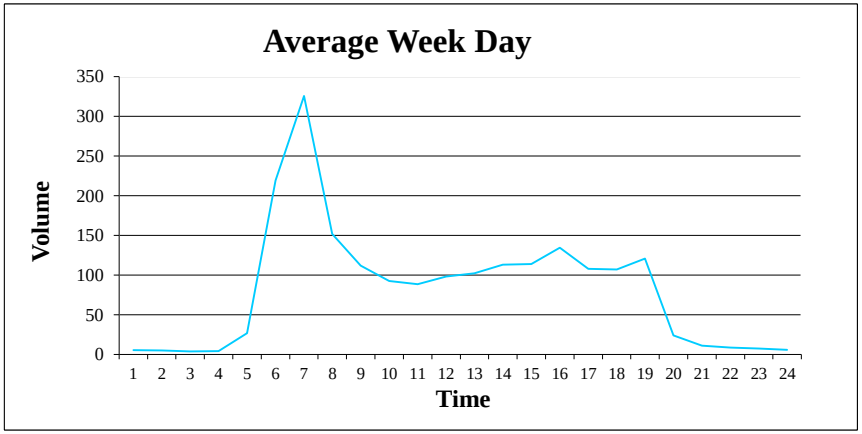
Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**131**
PM Peak	6:00 PM	7:00 PM	**57**
		Week Day Average	**514**
		Weekend Day Average	**273**
		7 Day Average	**445**

Site Be Thomas Mitchell Dr - E of Iindustrial Estate <100>

Eastbound

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun	W/Day	W/End	7 Day
Time	4/02/2013	5-Feb-13	6-Feb-13	7-Feb-13	8-Feb-13	9-Feb-13	10-Feb-13	Ave.	Ave.	Ave
0:00	7	4	6	7	4	6	1	6	4	5
1:00	5	6	2	5	7	7	3	5	5	5
2:00	1	3	7	5	2	5	1	4	3	3
3:00	6	2	4	4	5	1	2	4	2	3
4:00	28	28	24	27	27	12	13	27	13	23
5:00	191	226	229	226	224	90	59	219	75	178
6:00	326	333	343	328	297	126	102	325	114	265
7:00	142	157	144	146	170	36	21	152	29	117
8:00	98	110	104	130	117	27	8	112	18	85
9:00	94	101	86	88	93	18	13	92	16	70
10:00	79	99	83	99	82	29	15	88	22	69
11:00	105	119	92	82	92	19	14	98	17	75
12:00	97	104	91	113	105	20	15	102	18	78
13:00	99	102	110	134	121	16	9	113	13	84
14:00	120	129	99	114	107	23	14	114	19	87
15:00	135	128	155	135	118	13	16	134	15	100
16:00	110	128	104	109	88	15	24	108	20	83
17:00	128	117	109	105	76	57	55	107	56	92
18:00	124	136	115	108	121	98	112	121	105	116
19:00	27	26	18	24	24	12	16	24	14	21
20:00	12	12	12	5	14	6	8	11	7	10
21:00	12	6	6	13	7	4	3	9	4	7
22:00	6	11	11	4	6	5	6	8	6	7
23:00	7	5	4	11	3	6	3	6	5	6
Total	**1959**	**2092**	**1958**	**2022**	**1910**	**651**	**533**	**1988**	**592**	**1589**



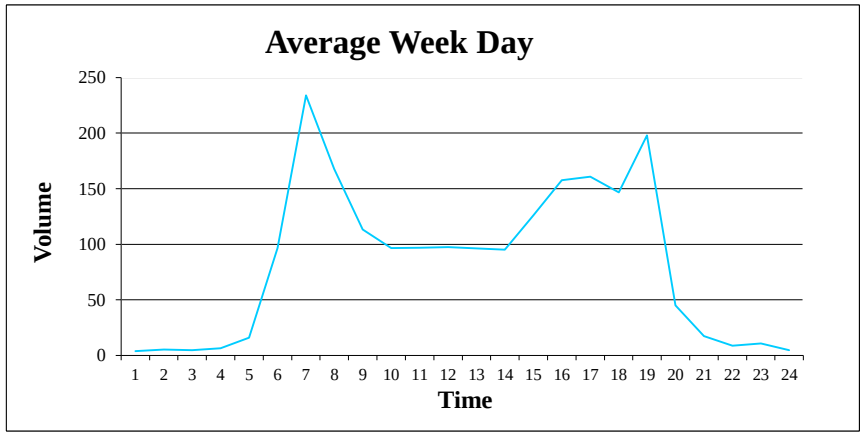
Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**343**
PM Peak	3:00 PM	4:00 PM	**155**
		Week Day Average	**1988**
		Weekend Day Average	**592**
		7 Day Average	**1589**

Site Be Thomas Mitchell Dr - E of Iindustrial Estate <100>

Westbound

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun	W/Day	W/End	7 Day
Time	4/02/2013	5-Feb-13	6-Feb-13	7-Feb-13	8-Feb-13	9-Feb-13	10-Feb-13	Ave.	Ave.	Ave
0:00	1	5	5	4	4	1	3	4	2	3
1:00	5	6	3	8	5	7	2	5	5	5
2:00	5	5	7	2	5	6	2	5	4	5
3:00	8	2	12	3	7	7	5	6	6	6
4:00	16	18	16	15	15	2	1	16	2	12
5:00	108	99	99	94	83	18	10	97	14	73
6:00	246	243	236	239	205	130	138	234	134	205
7:00	170	187	168	167	147	38	7	168	23	126
8:00	121	122	117	103	103	16	9	113	13	84
9:00	100	103	83	104	93	13	11	97	12	72
10:00	94	104	106	83	97	42	14	97	28	77
11:00	120	101	78	101	87	20	17	97	19	75
12:00	99	96	88	112	86	22	18	96	20	74
13:00	76	95	98	101	105	28	13	95	21	74
14:00	117	130	121	120	142	34	15	126	25	97
15:00	160	161	155	167	145	20	12	158	16	117
16:00	167	178	157	164	138	24	25	161	25	122
17:00	155	161	169	160	89	31	25	147	28	113
18:00	208	204	217	196	164	166	132	198	149	184
19:00	46	38	45	47	49	21	28	45	25	39
20:00	16	20	13	18	20	4	13	17	9	15
21:00	8	6	11	14	5	6	6	9	6	8
22:00	12	9	12	11	10	5	11	11	8	10
23:00	4	6	5	6	2	6	5	5	6	5
Total	**2062**	**2099**	**2021**	**2039**	**1806**	**667**	**522**	**2005**	**595**	**1602**

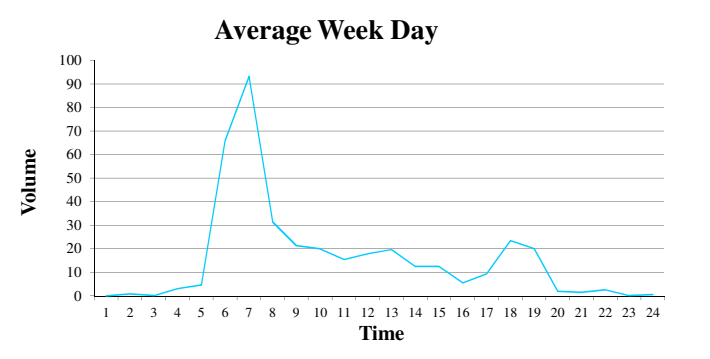


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**246**
PM Peak	6:00 PM	7:00 PM	**217**
		Week Day Average	**2005**
		Weekend Day Average	**595**
		7 Day Average	**1602**

Site 1 Mangoola Access Rd. At Entry gate-Inbound **Northbound**

Day	*Wed*	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*W/Day*	*W/End*	*7 Day*
Time	8-May-13	9-May-13	10-May-13	11-May-13	12-May-13	13-May-13	14-May-13	*Ave.*	*Ave.*	*Ave*
0:00	0	0	0	0	2	0	0	0	1	0
1:00	0	0	2	0	0	1	1	1	0	1
2:00	1	0	0	0	1	0	0	0	1	0
3:00	6	3	0	0	0	3	4	3	0	2
4:00	5	7	2	2	2	5	4	5	2	4
5:00	67	96	51	26	17	55	61	66	22	53
6:00	89	105	93	48	30	76	103	93	39	78
7:00	27	37	30	6	2	30	33	31	4	24
8:00	22	21	16	1	2	20	28	21	2	16
9:00	18	20	20	10	0	18	24	20	5	16
10:00	13	14	6	1	2	19	26	16	2	12
11:00	24	17	16	12	1	20	13	18	7	15
12:00	17	16	23	4	1	25	18	20	3	15
13:00	13	14	15	4	1	11	10	13	3	10
14:00	10	8	12	0	3	24	9	13	2	9
15:00	4	4	6	1	0	7	7	6	1	4
16:00	10	6	9	2	2	7	15	9	2	7
17:00	21	24	19	21	24	29	25	24	23	23
18:00	21	21	21	22	21	19	19	20	22	21
19:00	3	2	1	0	1	1	3	2	1	2
20:00	5	0	0	0	1	3	0	2	1	1
21:00	2	3	4	1	1	1	3	3	1	2
22:00	0	0	0	0	4	0	1	0	2	1
23:00	2	0	0	0	0	0	1	1	0	0
Total	**380**	**418**	**346**	**161**	**118**	**374**	**408**	**385**	**140**	**315**

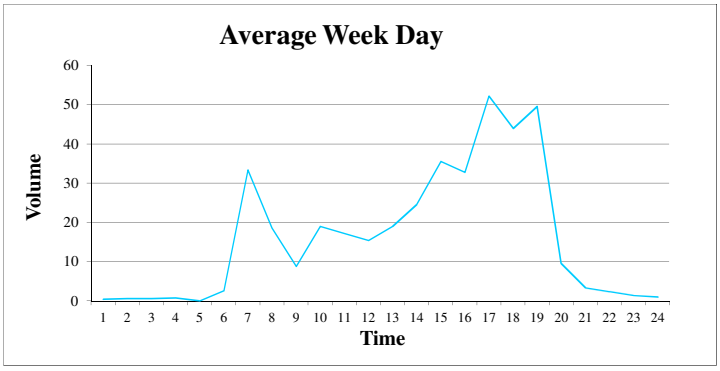


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**105**
PM Peak	5:00 PM	6:00 PM	**29**
		Week Day Average	**385**
		Weekend Day Average	**140**
		7 Day Average	**315**

Site 1 Mangoola Access Rd. At Entry gate-Inbound **Southbound**

Day	*Wed*	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*W/Day*	*W/End*	*7 Day*
Time	8-May-13	9-May-13	10-May-13	11-May-13	12-May-13	13-May-13	14-May-13	*Ave.*	*Ave.*	*Ave*
0:00	0	0	1	0	2	1	0	0	1	1
1:00	0	0	1	0	0	1	1	1	0	0
2:00	0	0	1	0	0	1	1	1	0	0
3:00	0	3	1	0	1	0	0	1	1	1
4:00	0	0	0	0	0	0	0	0	0	0
5:00	0	4	2	3	2	2	5	3	3	3
6:00	29	36	38	28	40	31	33	33	34	34
7:00	25	16	10	15	6	25	17	19	11	16
8:00	8	9	11	2	3	10	6	9	3	7
9:00	14	9	13	5	0	21	38	19	3	14
10:00	11	13	15	7	2	22	25	17	5	14
11:00	11	18	15	5	1	19	14	15	3	12
12:00	11	24	16	23	6	18	26	19	15	18
13:00	24	30	36	10	3	16	17	25	7	19
14:00	20	42	39	1	0	28	49	36	1	26
15:00	39	46	29	0	3	25	25	33	2	24
16:00	56	66	40	1	0	46	53	52	1	37
17:00	52	41	25	1	1	55	47	44	1	32
18:00	43	57	40	44	44	51	57	50	44	48
19:00	13	9	9	7	3	11	6	10	5	8
20:00	7	1	1	0	0	8	0	3	0	2
21:00	3	1	2	1	1	5	1	2	1	2
22:00	1	1	1	0	0	2	2	1	0	1
23:00	1	1	0	0	1	0	3	1	1	1
Total	**368**	**427**	**346**	**153**	**119**	**398**	**426**	**393**	**136**	**320**

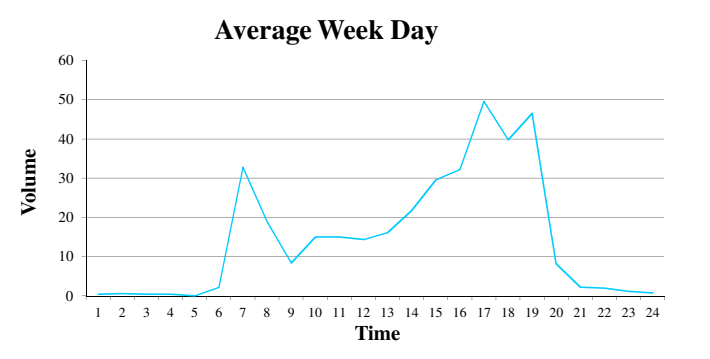


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**38**
PM Peak	4:00 PM	5:00 PM	**66**
		Week Day Average	**393**
		Weekend Day Average	**136**
		7 Day Average	**320**

Site 2 Mangoola access Rd. 400m in from gate **Northbound**

Day	*Wed*	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*W/Day*	*W/End*	*7 Day*
Time	8-May-13	9-May-13	10-May-13	11-May-13	12-May-13	13-May-13	14-May-13	*Ave.*	*Ave.*	*Ave*
0:00	0	0	1	0	2	1	0	0	1	1
1:00	0	0	1	0	0	1	1	1	0	0
2:00	0	0	0	0	0	1	1	0	0	0
3:00	0	1	1	0	1	0	0	0	1	0
4:00	0	0	0	0	0	0	0	0	0	0
5:00	2	2	2	3	2	2	3	2	3	2
6:00	29	34	38	28	38	31	32	33	33	33
7:00	25	17	12	15	6	26	15	19	11	17
8:00	7	9	9	3	3	10	7	8	3	7
9:00	12	8	12	4	0	16	27	15	2	11
10:00	9	13	13	5	2	19	21	15	4	12
11:00	9	16	15	6	2	18	14	14	4	11
12:00	9	22	15	23	4	14	21	16	14	15
13:00	19	26	34	10	3	14	16	22	7	17
14:00	20	31	35	1	0	24	38	30	1	21
15:00	39	46	29	0	2	21	26	32	1	23
16:00	53	65	37	1	0	45	48	50	1	36
17:00	47	41	24	1	1	47	40	40	1	29
18:00	39	52	39	42	44	48	55	47	43	46
19:00	12	9	8	7	3	7	5	8	5	7
20:00	5	1	1	0	0	4	0	2	0	2
21:00	3	1	2	1	1	3	1	2	1	2
22:00	1	1	1	0	0	1	2	1	0	1
23:00	1	1	0	0	1	0	2	1	1	1
Total	**341**	**396**	**329**	**150**	**115**	**353**	**375**	**359**	**133**	**294**

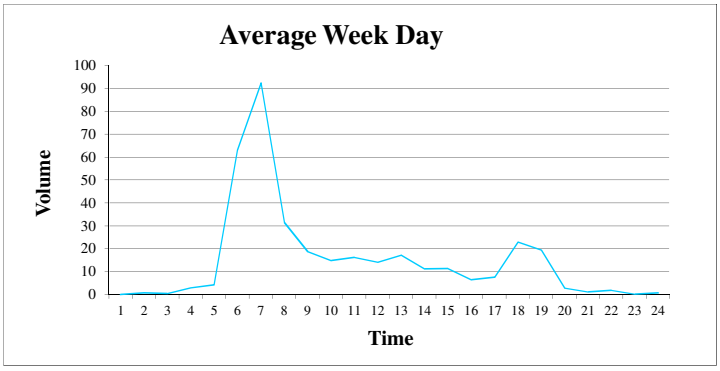


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**38**
PM Peak	4:00 PM	5:00 PM	**65**
		Week Day Average	**359**
		Weekend Day Average	**133**
		7 Day Average	**294**

Site 2 Mangoola access Rd. 400m in from gate **Southbound**

Day	*Wed*	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*W/Day*	*W/End*	*7 Day*
Time	8-May-13	9-May-13	10-May-13	11-May-13	12-May-13	13-May-13	14-May-13	*Ave.*	*Ave.*	*Ave*
0:00	0	0	0	0	2	0	0	0	1	0
1:00	0	0	2	0	0	1	1	1	0	1
2:00	1	1	0	0	1	0	0	0	1	0
3:00	5	3	0	0	0	3	4	3	0	2
4:00	4	7	2	2	2	5	3	4	2	4
5:00	60	94	48	26	17	52	61	63	22	51
6:00	87	102	97	49	30	79	97	92	40	77
7:00	28	36	29	3	2	31	33	31	3	23
8:00	17	19	14	1	2	19	25	19	2	14
9:00	14	15	11	6	0	15	19	15	3	11
10:00	11	13	6	1	2	22	29	16	2	12
11:00	16	18	12	10	1	13	12	14	6	12
12:00	13	16	22	5	1	19	16	17	3	13
13:00	12	9	15	4	1	9	11	11	3	9
14:00	10	7	11	0	3	21	8	11	2	9
15:00	4	6	6	1	0	7	9	6	1	5
16:00	10	6	7	2	2	7	8	8	2	6
17:00	20	23	19	21	24	29	24	23	23	23
18:00	21	20	21	22	22	16	19	19	22	20
19:00	4	3	1	0	1	3	3	3	1	2
20:00	4	0	0	0	1	2	0	1	1	1
21:00	2	1	3	1	1	1	2	2	1	2
22:00	0	0	0	0	1	0	1	0	1	0
23:00	2	1	0	0	1	0	1	1	1	1
Total	**345**	**400**	**326**	**154**	**117**	**354**	**386**	**362**	**136**	**297**

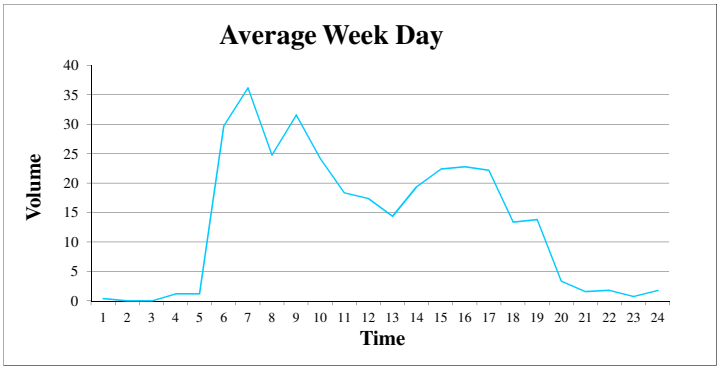


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**102**
PM Peak	5:00 PM	6:00 PM	**29**
		Week Day Average	**362**
		Weekend Day Average	**136**
		7 Day Average	**297**

Site 3 Wybong Rd. 600m W of Mangoola Mine **Eastbound**

Day	*Wed*	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*W/Day*	*W/End*	*7 Day*
Time	8-May-13	9-May-13	10-May-13	11-May-13	12-May-13	13-May-13	14-May-13	*Ave.*	*Ave.*	*Ave*
0:00	0	0	0	2	0	2	0	0	1	1
1:00	0	0	0	2	0	0	0	0	1	0
2:00	0	0	0	0	0	0	0	0	0	0
3:00	2	1	1	2	0	2	0	1	1	1
4:00	0	1	3	4	1	1	1	1	3	2
5:00	27	35	29	17	7	28	30	30	12	25
6:00	37	29	40	18	17	38	37	36	18	31
7:00	26	27	21	10	4	23	27	25	7	20
8:00	30	40	31	14	12	34	23	32	13	26
9:00	26	27	13	29	11	30	25	24	20	23
10:00	22	21	13	19	22	14	22	18	21	19
11:00	21	22	14	20	21	15	15	17	21	18
12:00	13	13	13	13	14	14	19	14	14	14
13:00	17	18	24	6	14	22	16	19	10	17
14:00	22	18	24	11	19	24	24	22	15	20
15:00	14	22	22	9	16	25	31	23	13	20
16:00	24	14	25	14	13	21	27	22	14	20
17:00	6	19	20	13	22	9	13	13	18	15
18:00	15	17	16	7	11	11	10	14	9	12
19:00	3	3	4	4	1	6	1	3	3	3
20:00	1	0	1	2	1	4	2	2	2	2
21:00	1	0	4	2	1	2	2	2	2	2
22:00	1	0	1	2	0	0	2	1	1	1
23:00	1	2	4	2	1	2	0	2	2	2
Total	**309**	**329**	**323**	**222**	**208**	**327**	**327**	**323**	**215**	**292**

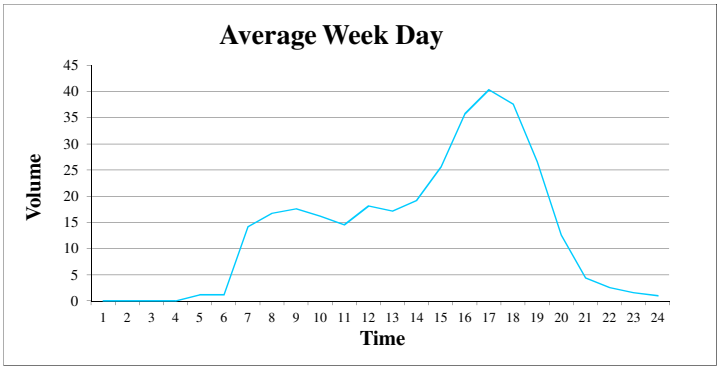


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**40**
PM Peak	3:00 PM	4:00 PM	**31**
		Week Day Average	**323**
		Weekend Day Average	**215**
		7 Day Average	**292**

Site 3 Wybong Rd. 600m W of Mangoola Mine **Westbound**

Day	*Wed*	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*W/Day*	*W/End*	*7 Day*
Time	8-May-13	9-May-13	10-May-13	11-May-13	12-May-13	13-May-13	14-May-13	*Ave.*	*Ave.*	*Ave*
0:00	0	0	0	2	1	0	0	0	2	0
1:00	0	0	0	0	0	0	0	0	0	0
2:00	0	0	0	0	0	0	0	0	0	0
3:00	0	0	0	1	0	0	0	0	1	0
4:00	0	1	1	3	0	1	3	1	2	1
5:00	1	0	0	2	1	3	2	1	2	1
6:00	13	17	17	12	6	12	12	14	9	13
7:00	27	16	15	7	6	16	10	17	7	14
8:00	15	14	17	7	3	17	25	18	5	14
9:00	14	13	19	8	5	16	19	16	7	13
10:00	15	12	14	23	8	17	15	15	16	15
11:00	13	16	17	22	19	22	23	18	21	19
12:00	10	19	14	24	17	20	23	17	21	18
13:00	17	15	26	27	21	19	19	19	24	21
14:00	30	23	23	31	27	26	26	26	29	27
15:00	38	34	36	19	17	40	31	36	18	31
16:00	39	47	38	23	24	30	48	40	24	36
17:00	33	49	34	16	15	40	32	38	16	31
18:00	24	25	26	12	20	31	27	27	16	24
19:00	10	9	18	14	12	11	15	13	13	13
20:00	7	7	1	3	2	2	5	4	3	4
21:00	4	1	4	4	0	1	3	3	2	2
22:00	1	2	3	1	0	1	1	2	1	1
23:00	1	1	1	0	1	2	0	1	1	1
Total	**312**	**321**	**324**	**261**	**205**	**327**	**339**	**325**	**233**	**298**

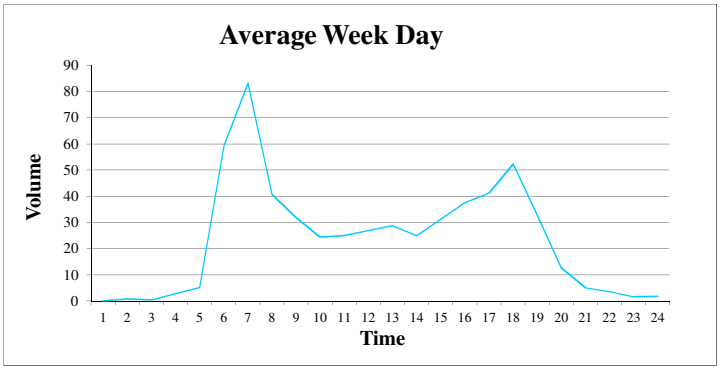


Summary

	from	to	
AM Peak	7:00 AM	8:00 AM	**27**
PM Peak	5:00 PM	6:00 PM	**49**
		Week Day Average	**325**
		Weekend Day Average	**233**
		7 Day Average	**298**

Site 4 Wybong Rd. 400m E of Mangoola mine **Eastbound**

Day	*Wed*	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*W/Day*	*W/End*	*7 Day*
Time	8-May-13	9-May-13	10-May-13	11-May-13	12-May-13	13-May-13	14-May-13	*Ave.*	*Ave.*	*Ave*
0:00	0	0	0	2	3	0	0	0	3	1
1:00	0	0	2	0	0	1	1	1	0	1
2:00	1	1	0	0	1	0	0	0	1	0
3:00	5	3	0	1	0	2	4	3	1	2
4:00	4	7	2	4	1	6	7	5	3	4
5:00	57	85	45	25	16	54	56	59	21	48
6:00	77	97	87	45	25	69	86	83	35	69
7:00	42	43	37	10	8	43	39	41	9	32
8:00	29	26	27	5	3	30	47	32	4	24
9:00	17	24	24	11	5	24	33	24	8	20
10:00	23	21	21	22	11	26	34	25	17	23
11:00	26	25	27	20	19	29	28	27	20	25
12:00	20	31	30	25	16	34	29	29	21	26
13:00	25	23	30	28	21	21	26	25	25	25
14:00	37	30	25	31	29	36	29	31	30	31
15:00	36	35	39	21	16	46	32	38	19	32
16:00	41	48	41	24	26	32	44	41	25	37
17:00	43	60	47	35	38	60	52	52	37	48
18:00	33	29	38	25	29	32	32	33	27	31
19:00	13	10	18	13	14	9	14	13	14	13
20:00	9	6	1	3	2	4	5	5	3	4
21:00	5	1	6	5	1	2	4	4	3	3
22:00	1	2	3	1	2	0	2	2	2	2
23:00	3	2	1	0	1	2	1	2	1	1
Total	**547**	**609**	**551**	**356**	**287**	**562**	**605**	**575**	**322**	**502**

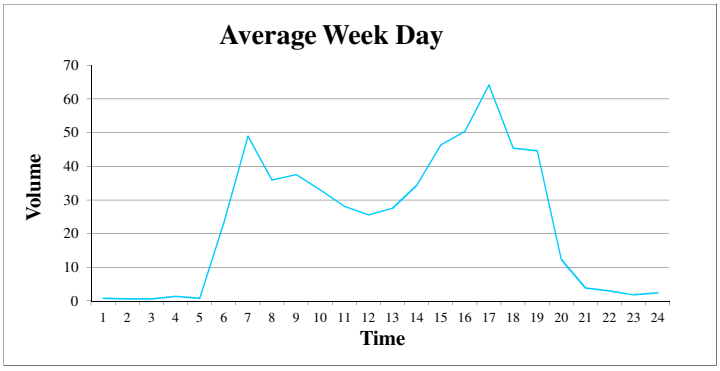


Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**97**
PM Peak	5:00 PM	6:00 PM	**60**
		Week Day Average	**575**
		Weekend Day Average	**322**
		7 Day Average	**502**

Site 4 Wybong Rd. 400m E of Mangoola mine **Westbound**

Day	*Wed*	*Thu*	*Fri*	*Sat*	*Sun*	*Mon*	*Tue*	*W/Day*	*W/End*	*7 Day*
Time	8-May-13	9-May-13	10-May-13	11-May-13	12-May-13	13-May-13	14-May-13	*Ave.*	*Ave.*	*Ave*
0:00	0	0	1	3	2	3	0	1	3	1
1:00	0	0	1	2	0	1	1	1	1	1
2:00	0	0	1	0	0	1	1	1	0	0
3:00	2	2	2	2	1	1	0	1	2	1
4:00	0	0	2	3	0	1	1	1	2	1
5:00	23	25	23	15	7	22	24	23	11	20
6:00	43	44	57	32	44	53	48	49	38	46
7:00	41	32	24	25	9	44	39	36	17	31
8:00	34	48	39	13	15	40	27	38	14	31
9:00	28	31	19	30	11	38	49	33	21	29
10:00	28	28	24	21	24	26	35	28	23	27
11:00	27	29	24	16	22	26	22	26	19	24
12:00	20	34	25	32	17	25	34	28	25	27
13:00	30	41	47	13	15	27	27	34	14	29
14:00	41	47	52	12	18	37	55	46	15	37
15:00	47	62	47	9	18	45	51	50	14	40
16:00	66	75	59	13	12	60	61	64	13	49
17:00	44	47	38	14	20	48	50	45	17	37
18:00	41	49	43	41	43	41	49	45	42	44
19:00	16	14	13	10	5	13	6	12	8	11
20:00	5	0	3	2	1	9	2	4	2	3
21:00	3	0	5	3	2	5	2	3	3	3
22:00	2	1	2	2	0	0	4	2	1	2
23:00	2	3	3	2	2	2	2	2	2	2
Total	**543**	**612**	**554**	**315**	**288**	**568**	**590**	**573**	**302**	**496**



Summary

	from	to	
AM Peak	6:00 AM	7:00 AM	**57**
PM Peak	4:00 PM	5:00 PM	**75**
		Week Day Average	**573**
		Weekend Day Average	**302**
		7 Day Average	**496**