Traffic and Transport Impact Assessment

DRAYTON SOUTH COAL PROJECT

TRAFFIC AND TRANSPORT IMPACT ASSESSMENT

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EXECUTIVE SUMMARY

DC Traffic Engineering was commissioned by Hansen Bailey Environmental Consultants on behalf of Anglo American Metallurgical Coal Pty Ltd to complete a traffic and transport impact assessment for the Drayton South Coal Project (the Project). The purpose of the assessment is to form part of an Environmental Assessment being prepared by Hansen Bailey to support an application for a contemporary Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979* to facilitate the continuation of the existing Drayton Mine by the development of an open cut and highwall coal mining operation and associated infrastructure within the Drayton South area.

Run of mine coal from the Drayton South mining area will be transported by an internal haul road between Drayton South and the existing Drayton Mine. Once processed (via the existing facilities at Drayton Mine) the product coal will be transported by rail to the Port of Newcastle.

The following traffic and transport issues were examined as part of this study:

- Traffic generation implications of the construction phase;
- Traffic generation implications of the operations phase – including a cumulative traffic impact assessment with forecasted growth from other major developments in the surrounding area;
- The realignment of a section of Edderton Road;
- Road safety implications of the Project; and
- Rail traffic generation impacts – including a cumulative rail impact assessment.

A summary of the assessment findings is provided as follows:

Traffic impacts on key intersections during construction

A traffic capacity assessment was carried out for three study intersections for the construction phase of the Project. These were the Thomas Mitchell Drive intersections with:

- Denman Road;
- Drayton Mine Access Road; and
- New England Highway.

The assessment indicated that there is unlikely to be any significant traffic impact at the Denman Road/ Thomas Mitchell Drive, and Thomas Mitchell Drive/ Drayton Mine Access Road intersections due to construction-generated traffic. This was demonstrated through the good levels of service as predicted by the traffic models (A to C for most movements), and marginal increases in the predicted delays at each intersection. As such, there were no identifiable traffic impacts at these two intersections.

The traffic modelling work for the New England Highway/ Thomas Mitchell Drive intersection, indicated that the most significantly affected movement would be the right-turn from Thomas Mitchell Drive to the New England Highway. This had a modelled level of service of F for the PM peak period. The traffic modelling work also indicated that this intersection would also fail to perform satisfactorily over the longer term i.e. during the operations phase.

The construction phase will involve the realignment of approximately 7 km of Edderton Road from its southern end at the Golden Highway intersection. This is in order to pass around the proposed disturbance area associated with the Drayton South open cut mining areas. Although most of the construction works would be “off-line” and would not affect existing traffic on Edderton Road, there will be some tie-in works at the northern and southern ends where the realignment meets the existing alignments of Edderton Road and Golden Highway respectively. To manage traffic access and thoroughfare requirements during the construction of the Edderton Road realignment, it is proposed that traffic control plans be prepared in consultation with Muswellbrook Shire Council and Roads and Maritime Services. These traffic control plans would provide an acceptable traffic management regime to maintain thoroughfare and access along these two roads, whilst providing the required safety conditions for road workers including plant and vehicles entering and egressing from the “off-line” works.

The Golden Highway/ Edderton Road intersection will be relocated 5 km to the west of its current location. Whilst this would increase travel distances by approximately 5 km for traffic travelling from the east, it would shorten travel distances by a similar amount for traffic from the west. As such, the net impact on travel times would be balanced to some degree. The additional 5km distance is equivalent to a travel time of four minutes which is not considered to be significant. Mt Arthur Coal is also planning to realign a section of Edderton Road further north. It is not envisaged that this will have significant impacts to travel times either.

Traffic impacts on key intersections during the peak operations phase

As all product coal would be transported by rail, and all Run-of-Mine coal would only be transported along internal (private) haul roads, the only road traffic generated on public roads would be the movement of workers to and from the Project, as well as service and delivery vehicles.

As the Project is regarded as a continuation of the existing Drayton Mine, the product coal limits would be similar to the existing situation. Furthermore, the servicing and workforce requirements would be similar to the existing operations. As such, there would not be any net changes in traffic generation due to the daily travel requirements of the workforce. As such, the operational phase of the Project is not expected to impact the traffic performance of the surrounding road network.

The cumulative traffic impact assessment showed that collectively, the foreseeable growth in coal mining in the surrounding area is likely to have significant impacts on the road network, particularly on the New England Highway and Denman Road intersections with Thomas Mitchell Drive. In particular, there is likely to be increased pressure on the right-turn movements at these two intersections.

These impacts have been identified in previous studies undertaken in 2009 associated with Mt Arthur Coal's planned expansion. It is also understood that Mt Arthur Coal have made a commitment to upgrade the New England Highway/ Thomas Mitchell Drive, and Denman Road/ Thomas Mitchell Drive intersections to seagull T intersection configurations. As such, this intersection type was also modelled in this assessment. The modelling work indicated that the proposed seagull intersections are appropriate for addressing the foreseeable capacity concerns at these two locations. As such no additional mitigation measures are proposed to address the identified capacity concerns at the Denman Road/ Thomas Mitchell Drive and New England Highway/ Thomas Mitchell Drive intersections.

Traffic impacts on midblock capacity along Thomas Mitchell Drive

An assessment was carried out of the vehicle-kilometres-travelled generated by Drayton South compared with other non-Project-related traffic. Vehicle-kilometres-travelled is a measure of usage of a road as it accounts for both the volume of traffic generated, as well as the distance that that traffic travels along a road. This assessment was carried out for the operations phase of the mine which is considered more critical in terms of long-term impacts on pavement and midblock capacity.

The analysis showed that Drayton South would generate approximately 8.2% of the daily vehicle-kilometres-travelled along Thomas Mitchell Drive. It would also generate approximately 4% of the daily heavy vehicle vehicle-kilometres-travelled along Thomas Mitchell Drive. It should be noted that the figures quoted above related to the percentage of the existing traffic along Thomas Mitchell Drive. It was not possible to accurately account for the growth in vehicle-kilometres travelled for other mining projects due to the lack of daily traffic volume information for those projects. That is, although there was information sourced from other studies on the number of peak hour trips generated, there was no information available on total daily traffic volumes generated. Notwithstanding this, the relative percentage that Drayton South contributes to the overall traffic volumes is likely to reduce as other mining projects progress and generate more traffic whilst Drayton South's traffic generation would be more stagnant.

Road safety impacts

This assessment included an analysis of available crash data for Thomas Mitchell Drive and Edderton Road, as well as route inspections. A number of existing safety hazards were identified. These issues should be referred to Muswellbrook Shire Council and Roads and Maritime Services for consideration.

The Edderton Road realignment would offer an improved route providing better horizontal and vertical geometry compared to the existing alignment. However, the following mitigation/ management measures are recommended:

- The design for the Edderton Road realignment should be developed in consultation with Muswellbrook Shire Council and Roads and Maritime Services.
- The design and construction of the road should be subjected to an appropriate schedule of road safety audits with particular attention on the transition between old and new infrastructure.

Rail network impacts

This assessment has concluded that the Project will not increase the maximum daily number of rail movements along the Antiene Rail Spur.

The Australian Rail Track Corporation (ARTC, 2009) provides a detailed review of the existing deficiencies on the Hunter Valley coal corridor. They describe a number of deficiencies as well as proposed network upgrades. Whilst the Australian Rail Track Corporation (2009) recommendations are not formal mitigation measures recommended in this assessment, they do highlight the need for ongoing liaison between Anglo American and Australian Rail Track Corporation regarding the scheduled roll out of rail network infrastructure improvements. A number of neighbouring coal mine projects will also need to be involved in the consultative process.

As such, it is recommended that Anglo American continue to liaise with the Australian Rail Track Corporation and neighbouring mines regarding the roll out of Australian Rail Track Corporation's initiatives. The purpose of this would be to inform the planning and design process.

DRAYTON SOUTH COAL PROJECT
TRAFFIC AND TRANSPORT IMPACT ASSESSMENT

1 INTRODUCTION

DC Traffic Engineering Pty Ltd has been commissioned by Hansen Bailey Environmental Consultants (Hansen Bailey) on behalf of Anglo American Metallurgical Coal Pty Ltd (Anglo American) to undertake a Traffic and Transport Impact Assessment for the Drayton South Coal Project (the Project). The purpose of this assessment is to form part of an Environmental Assessment (EA) being prepared by Hansen Bailey to support an application for a contemporary Project Approval under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to facilitate the continuation of the existing Drayton Mine by the development of an open cut and highwall coal mining operation and associated infrastructure within the Drayton South area.

In October 2011, the NSW Government repealed Part 3A of the EP&A Act. However, clause 2 of Schedule 6A of the EP&A Act states that a Project is a transitional Part 3A Project if the Director-General's Environmental Assessment Requirements (EARs) were issued less than 2 years before the repeal of Part 3A. The EARs for the Project were issued in August 2011, two months prior to the repeal date. Therefore, the provisions of Part 3A will continue to apply to the Project.

The scope of work completed by DC Traffic Engineering for this assessment included:

- Assess the traffic generation implications of the construction phase of the Project;
- Assess the traffic generation implications of the operations phase of the Project – including a cumulative traffic impact assessment with forecasted growth from other major developments in the surrounding area;
- Identify impacts associated with the proposed realignment of Edderton Road;
- Assess the road safety implications of the Project;
- Assess the rail traffic generation impacts – including a cumulative rail impact assessment; and
- Recommend mitigation measures to address the identified impacts.

1.1 PROJECT DESCRIPTION

Drayton Mine is managed by Anglo Coal (Drayton Management) Pty Ltd which is owned by Anglo American. Drayton Mine commenced production in 1983 and currently holds Project Approval 06_0202 (approved 1 February 2008) to provide predominantly steaming coal to export and domestic markets at a maximum of 8 Million tonnes per annum (Mtpa) of Run-of-Mine (ROM) coal. Drayton Mine's Project Approval expires in 2017.

The Project will allow for the continuation of mining at Drayton Mine by the development of open cut and highwall mining operations within the Drayton South mining area while continuing utilising the existing infrastructure and equipment from Drayton Mine.

The Project is located approximately 10 km north west of the village of Jerrys Plains and approximately 13 km south of the township of Muswellbrook in the Upper Hunter Valley of New South Wales (NSW). The Project is predominately situated within the Muswellbrook Shire Local Government Area (LGA), with the south west portion falling within the Singleton LGA. Figure 1 illustrates the location of the Project. The Project is located within close proximity to two thoroughbred horse studs, two power stations and several existing coal mines.

The Project will extend the life of Drayton Mine by a further 27 years ensuring the continuity of employment for its workforce, the ongoing utilisation of its infrastructure and the orderly rehabilitation of Drayton Mine's completed mine areas.

Anglo American is seeking Project Approval under Part 3A of the *Environmental Planning and Assessment (EP&A) Act 1979* to facilitate the extraction of coal by both open cut and highwall mining methods within Exploration Licence (EL) 5460 for a period of 27 years. The Project Application Boundary (Project Boundary) is shown on Figure 1.

The Project generally comprises:

- The continuation of the operations of the Drayton Mine as presently approved with minor additional mining areas within the East, North and South Pits;
- The development of an open cut and highwall mining operation extracting up to 7 Mtpa of Run of Mine (ROM) coal over a period of 27 years;
- The utilisation of the existing Drayton Mine workforce and equipment fleet (with an addition of a highwall miner and coal haulage fleet);
  - The Drayton Mine fleet consists of a dragline, excavators, fleet of haul trucks, dozers, graders, water carts and associated supporting equipment.
- The use of Drayton Mine's existing voids for rejects and tailings disposal and water storage to allow for the optimisation of the Drayton Mine final landform;
- The utilisation of the existing Drayton Mine infrastructure including the Coal Handling and Preparation Plant (CHPP), rail loop and associated loadout infrastructure, workshops, bath houses and administration offices;
- The construction of a transport corridor between Drayton South and Drayton Mine;
- The utilisation of the Antiene Rail Spur off the Main Northern Railway to transport product coal to the Port of Newcastle for export (120 km haul distance by rail);
- The realignment of a section of Edderton Road; and
- The installation of water management and power reticulation infrastructure for Drayton South.

All access to the Project will continue to be via the existing Drayton Mine Access Road off Thomas Mitchell Drive and will use the private transport corridor to travel between Drayton Mine and Drayton South. An emergency entry/ exit will be required to be developed and maintained off Edderton Road for health and safety purposes only.

The conceptual layout of the Project is shown in Figure 2.

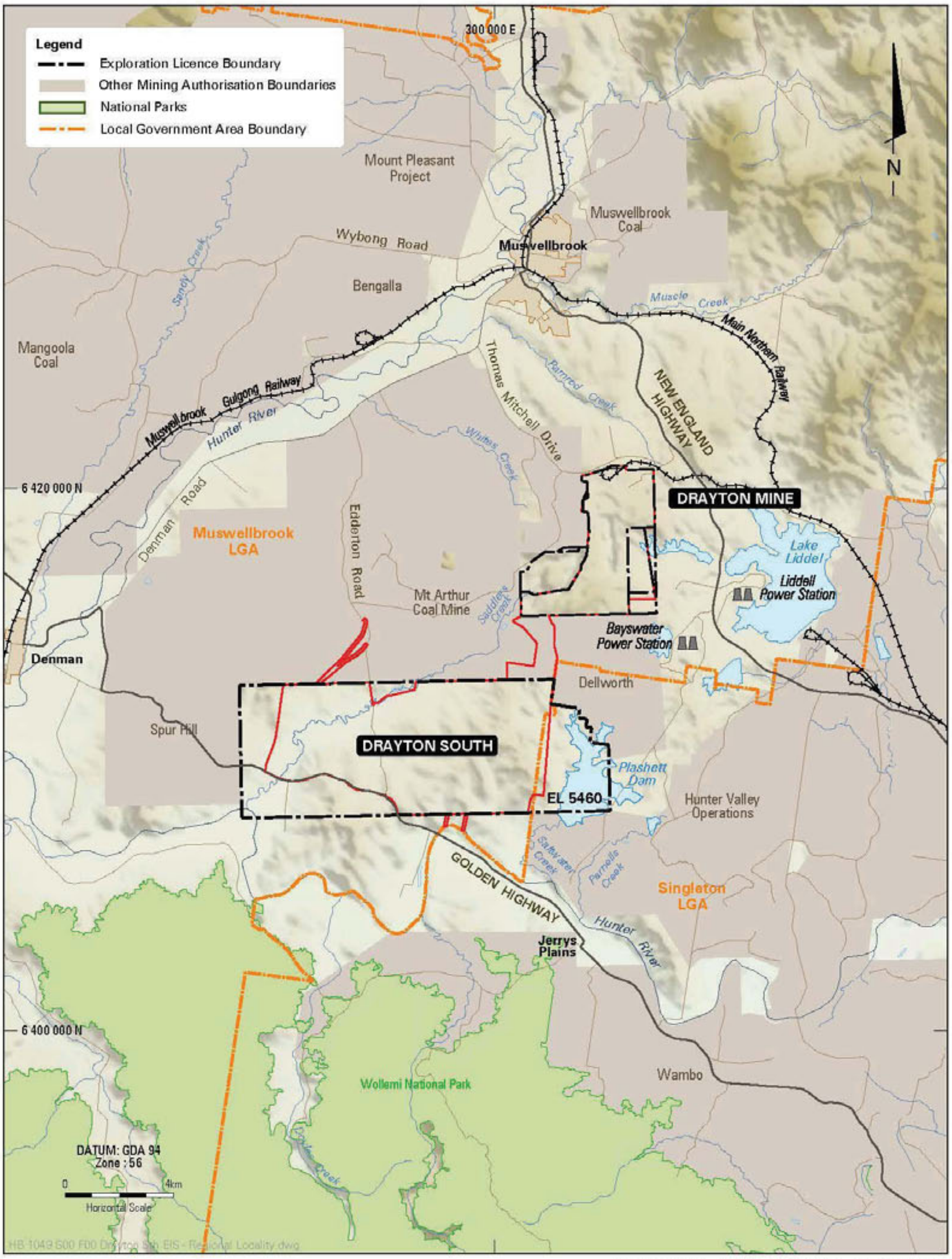
Drayton Mine will continue to operate under and in accordance with the existing Project Approval 06_0202 and there will be a transitional period when Drayton Mine and Drayton South will operate concurrently.

1.2 RELATED STUDIES

The studies which are to be read in conjunction with this assessment include the following:

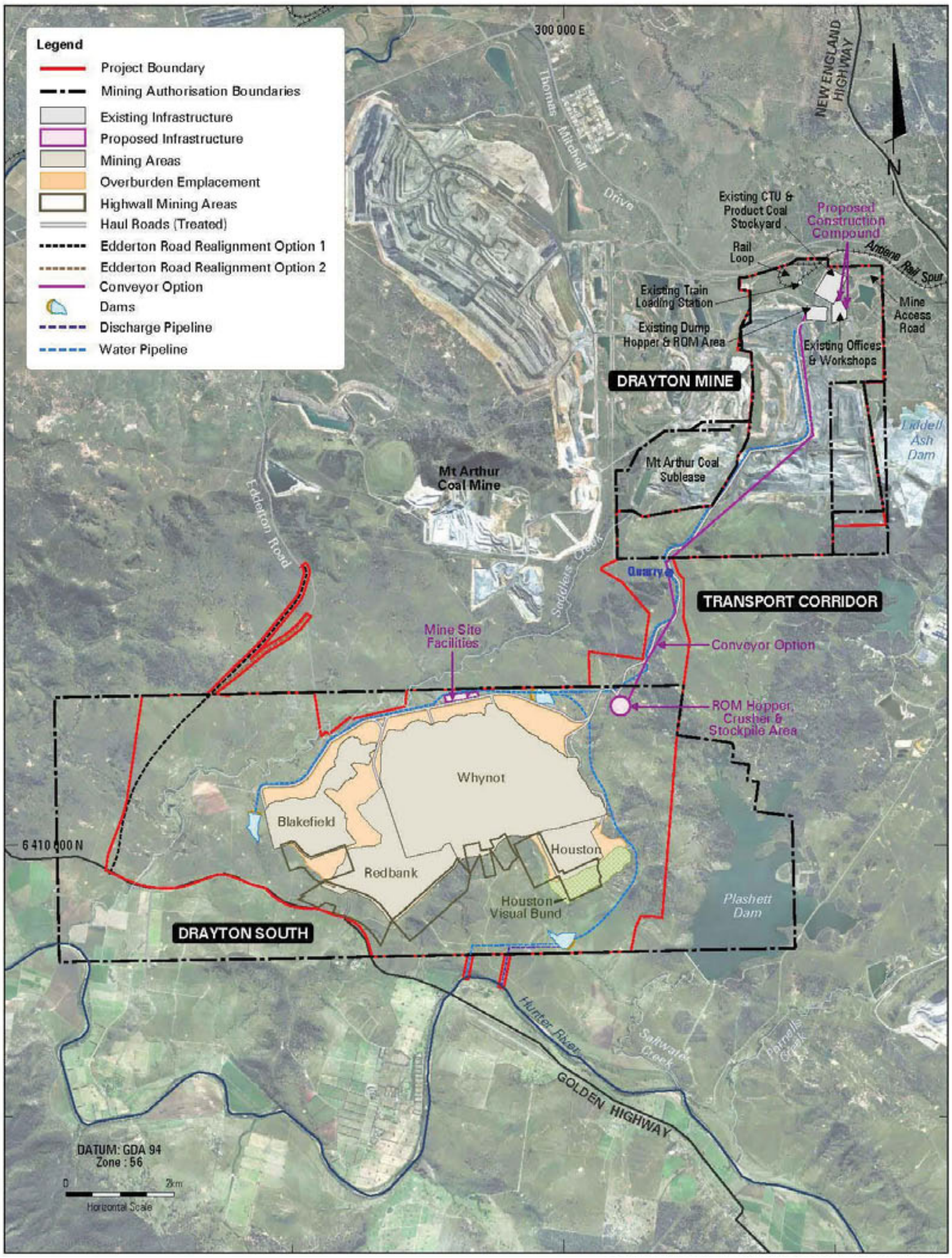
- The EA social impact assessment; and
- The EA acoustics impact assessment.

Figure 1 Regional Locality Plan



(Source: Hansen Bailey, 2011a)

Figure 2 Conceptual Project Layout



Provided by Hansen Bailey.

2 EXISTING CONDITIONS

2.1 EXISTING ROAD NETWORK

Drayton Mine is located approximately 13 km south of Muswellbrook and 120 km north west of Newcastle in NSW. The regional road network in the vicinity of the Project is shown in Figure 1. Vehicular access to Drayton Mine is via the private Drayton Mine Access Road which runs south west off Thomas Mitchell Drive. Thomas Mitchell Drive runs between the New England Highway (to the north east) and Denman Road (to the north west). Edderton Road runs between Denman Road (to the north) and the Golden Highway (to the south). Part of Edderton Road is located within the Project Boundary and as such is proposed to be realigned as part of the Project (see Figure 2).

A map of the surrounding road network is provided in Figure 1.

2.1.1 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. However, NSW Roads and Maritime Services (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 as such acts as a detour route when there are incidents on the Pacific Highway.

The New England Highway passes to the east of the Project Boundary and runs in a north west to south easterly direction. 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 (see Plate 1). Near the Liddell and Bayswater Power Stations, the New England Highway is a four-lane divided road with limited access. Further south near 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 100 km/h route for most of its length except for sections passing through towns.

The New England Highway carries approximately 14,000 vehicles/day (RTA, 2004).

Plate 1 New England Highway

Note: View looking south towards the intersection with Thomas Mitchell Drive.

2.1.2 Denman Road

Denman Road is a State Road under the care and jurisdiction of RMS and provides a link between the New England Highway at Muswellbrook, and the Golden Highway at Denman. The road passes to the north of the Project Boundary and follows the approximate north east to south westerly direction of the Hunter River (to the north of the road).

Denman Road is a two-lane undivided road with a 7 to 9 m sealed width (see Plate 2). There is localised pavement widening at key intersections to accommodate turn lanes. The route is signposted as a 100 km/h route to the west and 80 km/h to the east of Bengalla Link Road respectively.

Denman Road carries approximately 9,000 vehicles/day in the section near Muswellbrook and 4,000 vehicles/day near Bengalla Link Road (TPK, 2006). Hansen Bailey (2009) stated that Denman Road carries approximately 6,700 vehicles/day and 3,900 vehicles/day to the east and west of Thomas Mitchell Drive respectively. Heavy vehicles make up 12% to 19% of all traffic.

Plate 2 Denman Road

Note: View looking northbound towards Thomas Mitchell Drive.

2.1.3 Golden Highway

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

The Golden Highway runs on a south east to north west alignment to the south of the Project Boundary. It is predominately a two-lane-two-way configuration with a 7 to 9 m sealed width including a 1 m 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. The route is typically signposted as a 100 km/h zone except when travelling through towns, which are 60 km/h zones.

The land surrounding the Golden Highway in the immediate vicinity of the Project Boundary includes coal mines, vineyards and horse breeding studs (see Plate 3). The highway also passes through the Jerrys Plains township.

Plate 3 Golden Highway

Note: View looking westbound at Coolmore stud.

The Golden Highway carries approximately 2,600 vehicles/day in the section north west of Jerrys Plains (RTA, 2004).

2.1.4 Thomas Mitchell Drive

Thomas Mitchell Drive is an 11 km local road linking Denman Road to the north and the New England Highway to the east which is under the jurisdiction of Muswellbrook Shire Council (MSC). Although not intended for large-scale use as a through road, Thomas Mitchell Drive attracts a significant volume of traffic travelling between Denman and the New England Highway. This route effectively bypasses the longer and slower moving main road alternatives through the Muswellbrook town centre.

Thomas Mitchell Drive is a two-lane-two-way configuration with an approximate 7 m sealed width. There are two railway overbridges along the route – both associated with the section of the Antiene Rail Spur between the Drayton rail loop junction and Mt Arthur Coal (see Plate 4). The minimum vertical clearance along the route is 5.5 m.

Thomas Mitchell Drive provides access to the Muswellbrook Industrial Estate at its northern end between Denman Road and Glen Munro Road. It also provides direct access to Mt Arthur Coal and Drayton Mine, and is used as a key access route to other mines such as Mangoola and Bengalla. The road is signposted as an 80 km/h zone to the north of and 100 km/h to the south of Glen Munro Road.

Hansen Bailey (2009) reported that Thomas Mitchell Drive carries approximately 4,400 vehicles/day at its western end, and 2,500 vehicles/day at its eastern end. Heavy vehicles make up between 16% to 26% of all traffic.

Plate 4 Thomas Mitchell Drive

Note: View looking southbound towards the Antiene Rail Spur (Mt Arthur Coal rail overbridge).

Hunter Valley Energy Coal Pty Ltd (HVEC) are obligated to carry out further improvements to Thomas Mitchell Drive as part of their Open Cut Consolidation Project at Mt Arthur Coal. Item 47 (Schedule 3) of Project Approval 09_0062 requires HVEC to "fund the upgrade of Thomas Mitchell Drive, as outlined in the RTA's *Review of Thomas Mitchell Drive Route Assessment*" (Department of Planning, 2010, p17). This will involve the following improvement works:

- Upgrade of the Denman Road/ Thomas Mitchell Drive intersection to a seagull configuration with an indented right-turn lane for access into Thomas Mitchell Drive, a protected acceleration lane for right-turns out of Thomas Mitchell Drive, and retention of the existing left-turn deceleration lane on Denman Road;
- Upgrade of the New England Highway/ Thomas Mitchell Drive intersection to a seagull configuration with right-turn and left–turn deceleration and acceleration lanes on the New England Highway; and
- An upgraded T intersection at the Mt Arthur Coal Access Road with a channelised right turn configuration (CHR or Austroads type C intersection).

2.1.5 Edderton Road

Edderton Road is a 15 km local rural road linking the Golden Highway to Denman Road. It is located approximately 10 km west of Jerrys Plain and approximately 8 km south of Muswellbrook. It is under the care and jurisdiction of MSC.

Edderton Road has a two-lane-two-way configuration with no line marking and no sealed shoulders. The sealed width is generally less than 6 m and the pavement has significant patching. Saddlers Creek crosses the route as a floodway approximately 3.5 km north of the Golden Highway. This has resulted in a deep sag vertical curve and associated advanced warning signs (see Plate 5). Edderton Road has a load limit of 14 t with signs placed at both ends. This is appropriate with regard to the pavement condition, road alignment and width.

Edderton Road carries approximately 760 vehicles/day at its northern end (as surveyed in May 2011) and 680 vehicles/day at its southern end (as surveyed in February 2012) with heavy vehicles making up approximately 19% of all traffic. As a result of the load limit, most of these are single unit rigid trucks.

Plate 5 Edderton Road

Note: View looking north at Saddlers Creek floodway.

Edderton Road partially lies within the Project Boundary. As such, approximately 7 km of the southern-most section is proposed to be realigned. The proposed realignment of Edderton Road is shown on Figure 2 and has been described further in Section 5.2.

Edderton Road also runs through the western portion of Mining Lease (ML) 1358, which is held by Mt Arthur Coal. Mt Arthur Coal holds an approval to realign approximately 6 km of the northern-most section of this road (including its intersection with Denman Road). This is currently scheduled to take place in 2019.

2.1.6 Drayton Mine Access Road

The Drayton Mine Access Road is a private road providing access between Thomas Mitchell Drive (approximately 1 km west of the New England Highway) and Drayton Mine. It is a rural road with a two-lane-two-way configuration and a posted speed limit of 60 km/h (see Plate 6). The Drayton Mine Access Road extends from Thomas Mitchell Drive for a distance of 1.5 km at which point it terminates at the Drayton Mine administration building and car park.

Plate 6 Drayton Mine Access Road

Note: View looking south.

2.2 KEY INTERSECTIONS

2.2.1 New England Highway/ Thomas Mitchell Drive

The New England Highway/ Thomas Mitchell Drive intersection is a give-way controlled T intersection with Thomas Mitchell Drive as the western and terminating approach. The intersection is a channelised right-turn configuration (CHR or Austroads type C intersection). A 150 m indented right-turn lane, and a 150 m left-turn lane have been provided in the New England Highway northern and southern approaches respectively. Thomas Mitchell Drive provides two lanes in approach to the intersection for exclusive left-turns and right-turns.

A gap acceptance sight distance equivalent to 12 to 15 seconds of travel at 100 km/h is available from the hold line of the Thomas Mitchell Drive approach to oncoming traffic from the south (Plate 7). This is considered acceptable for judging gaps for left and right turn movements. The corresponding gap acceptance sight distance towards oncoming traffic from the north was measured at 15 seconds which is also considered acceptable.

Plate 7 New England Highway near intersection

Note: View looking south from the Thomas Mitchell Drive hold line.

The Thomas Mitchell Drive approach is on a right-hand horizontal curve on a downhill grade. New England Highway and Thomas Mitchell Drive are signposted as 100 km/h speed zones in the vicinity of this intersection. As such warning signs including REDUCE SPEED and T-INTERSECTION AHEAD have been installed. Street lighting is also provided at this intersection.

HVEC are obligated to carry out further improvements to this intersection as part of their Open Cut Consolidation Project at Mt Arthur Coal (Department of Planning, 2010).

2.2.2 Denman Road/ Thomas Mitchell Drive

The Denman Road/ Thomas Mitchell Drive intersection is a give-way controlled T intersection with Thomas Mitchell Drive as the southern and terminating approach. The intersection provides an auxiliary lane (AUR or Austroads type B intersection) which allows through traffic in the northbound direction of Denman Road to pass around queued traffic waiting to turn right (see Plate 8). The intersection also provides an indented left-turn deceleration lane and a short left-turn acceleration lane.

Plate 8 **Denman Road near intersection**

Note: View looking north towards Thomas Mitchell Drive (right-hand side).

The gap acceptance sight distances from the Thomas Mitchell Drive approach towards oncoming traffic on Denman Road from the north and south are considered acceptable.

There is a box culvert on the southern side of the intersection which passes under the Thomas Mitchell Drive approach. Although guardrail protection is provided on the south western side of the intersection, it has not been provided on the south eastern side of the intersection. As such, there is an exposed 1.5 m vertical drop off to the base of the culvert.

Denman Road is signposted as a 100 km/h speed zone, whilst Thomas Mitchell Drive is 80 km/h in the approach to the intersection.

Street lighting is provided at this intersection and the poles are slip based structures.

Hansen Bailey (2009) reported that the Denman Road/ Thomas Mitchell Drive intersection was upgraded in 2004 as part of the Mount Pleasant Mine Project. EMGA Mitchell McLennan (2010b) stated that these upgrades included improvements to the intersection channelisation to increase storage length for right-turners.

Furthermore, HVEC are obligated to carry out further improvements to this intersection as part of their Open Cut Consolidation Project at Mt Arthur Coal. This will involve an upgrade to a seagull T-intersection configuration with indented right-turn and left-turn deceleration lanes for access onto Thomas Mitchell Drive, as well as a protected right-turn acceleration lane for entry onto Denman Road. These improvements are to be carried out by the end of 2019 (Department of Planning, 2010).

2.2.3 Thomas Mitchell Drive/ Drayton Mine Access Road

The Thomas Mitchell Drive/ Drayton Mine Access Road intersection is located 1 km west of the New England Highway intersection. It is a *give-way* controlled T intersection with the Drayton Mine Access Road as the southern and terminating approach. The intersection is a channelised right turn and channelised left turn facility (CHR/CHL or Austroads type C intersection) with indented left and right turning lanes on Thomas Mitchell Drive.

The Drayton Mine Access Road has a left-hand horizontal curve in approach to Thomas Mitchell Drive (see Plate 9). The horizontal curve appears to be the result of a re-configuration of the intersection to re-assign priority to the Thomas Mitchell Drive approaches. Previously the western approach was the terminating approach. A single approach lane is provided in the Drayton Mine Access Road which is separated from the adjacent departure lane by a raised median.

Plate 9 Thomas Mitchell Drive near intersection

Note: View looking westbound towards Drayton Mine Access Road (left-hand side of photo).

Thomas Mitchell Drive is a 100 km/h speed zone, and Drayton Mine Access Road is a 60 km/h zone in approach to this intersection.

2.3 EXISTING TRAFFIC CONDITIONS

2.3.1 RMS traffic surveys

RTA (2004) 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:

- Station 05.244: New England Highway, at the southern boundary of the Muswellbrook built up area.

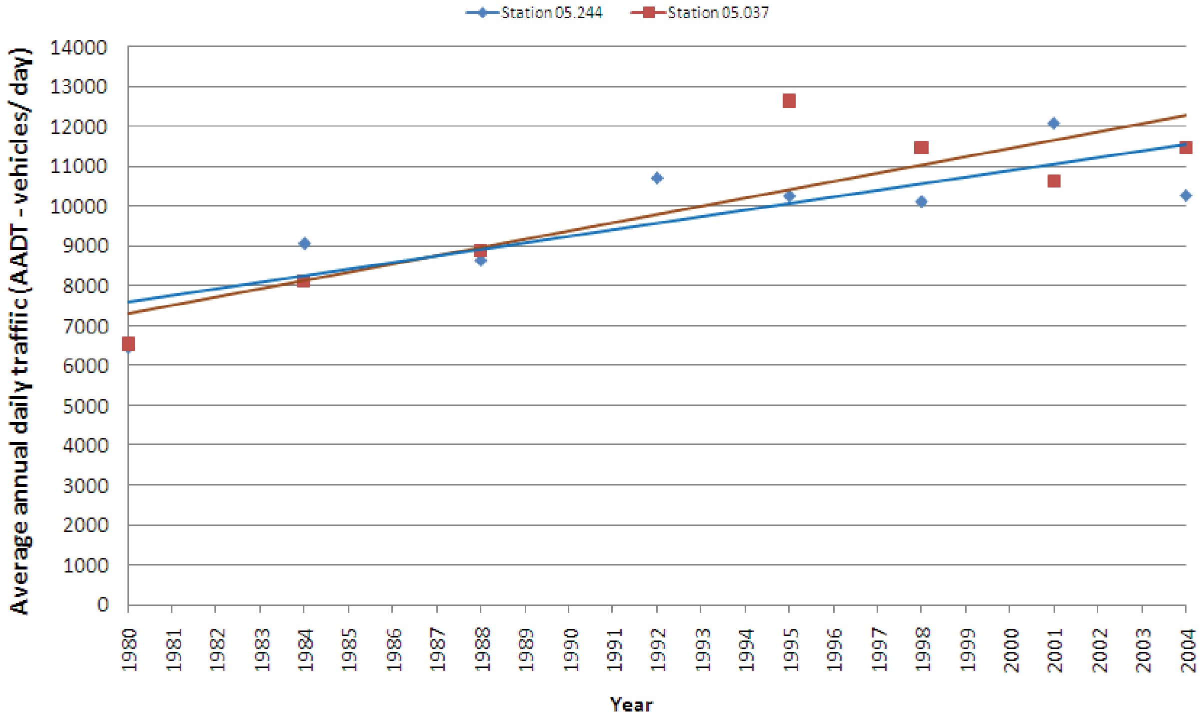
- Station 05.037: New England Highway at Foy Brook Bridge to the north of Singleton.
- Station 05.484: Golden Highway at the Hunter River Bridge.

RTA (2004) provides traffic volume counts for these locations for the following years: 1980, 1984, 1988, 1992, 1995, 1998, 2001 and 2004.

Figure 3 shows the traffic volumes surveyed for the two New England Highway counting stations. The graph shows that the traffic volumes were similar for both sites. In 1980, the New England Highway carried approximately 7,500 vehicles/day, which later 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. As such, the traffic modelling work described in Section 4 has also adopted an annual growth rate of 2.5% per annum to account for changes in the background (non-Project related) traffic for future test case scenarios.

Figure 3 Traffic volumes (AADT) surveyed along the New England Highway



(Source: RTA, 2004).

RMS also supplied more recent data for the period from 2005 to 2009 for counting station 05.244 on the New England Highway. Table 1 shows the traffic volumes for each of these years in axle pairs. 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.

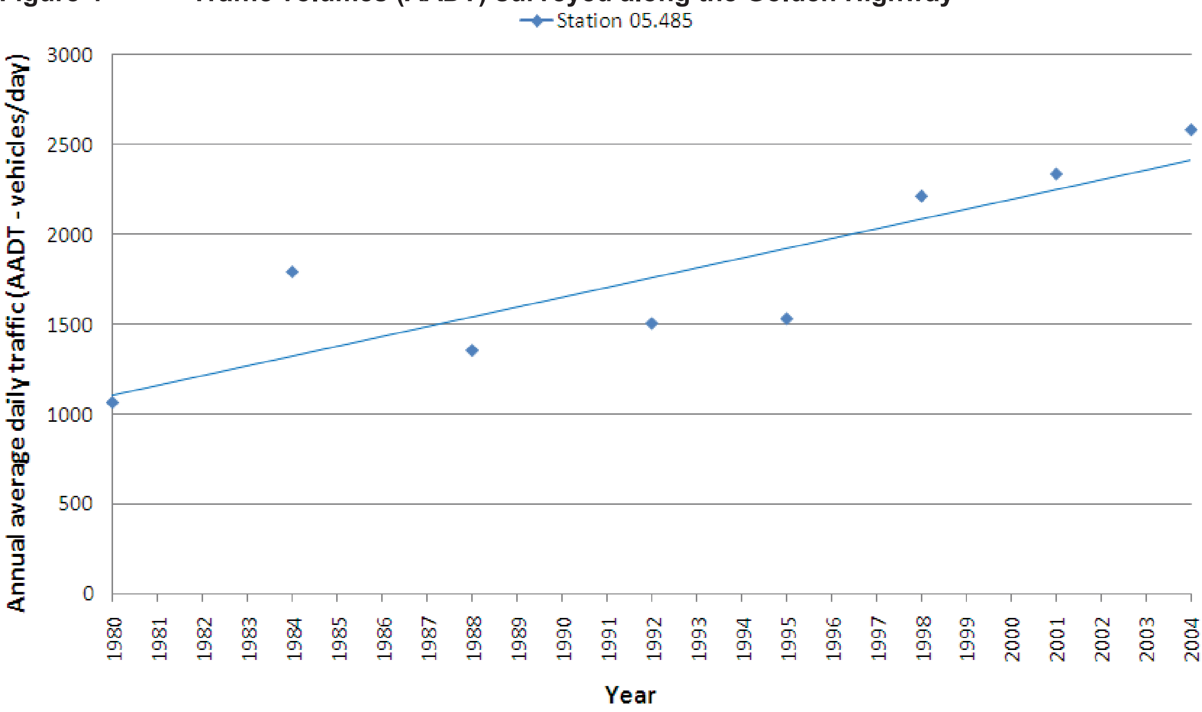
Table 1 Traffic data for counting station 05.244

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

Data in Table 1 supports the earlier findings (from Figure 3) regarding the adopted 2.5% per year growth rate in background traffic on the New England Highway. It should be noted that the data in Figure 3 is in vehicles/day (and not axle pairs/day) and is therefore the more appropriate basis for estimating traffic growth.

Figure 4 shows the traffic volumes surveyed for the counting station on the Golden Highway. In 1980, approximately 1,100 vehicles/day travelled along this section of the highway, which later increased to approximately 2,400 vehicles/day by 2004. This is equivalent to a growth rate of approximately 4.9% per year on the Golden Highway.

Figure 4 Traffic volumes (AADT) surveyed along the Golden Highway



(Source: RTA, 2004).

2.3.2 Other traffic surveys

In May 2011, additional traffic volume surveys were carried out for this study. These included:

- Turning movement survey for the Denman Road/ Thomas Mitchell Drive intersection for the AM and PM peak periods;

- Turning movement survey for the Thomas Mitchell Drive/ Drayton Mine Access Road intersection for the AM and PM peak periods;
- Turning movement survey for the New England Highway/ Thomas Mitchell Drive intersection for the AM and PM peak periods; and
- 24 hour, 14-day midblock tube survey counting number of vehicles along Edderton Road.

In February 2012, the following additional surveys were undertaken:

- 24 hour, 7-day midblock tube surveys for the approaches and departures to the Golden Highway/ Edderton Road intersection; and
- Turning movement survey for the Golden Highway/ Edderton Road intersection for the period between 1400h and 1700h, which contained the highest volume hours of the day as identified in the midblock tube surveys.

The highest AM and highest PM hourly volumes for all three Thomas Mitchell Drive intersections are shown in Figures 5 and 6 respectively.

Figure 5 Existing AM peak hour volumes surveyed along Thomas Mitchell Drive (May, 2011)

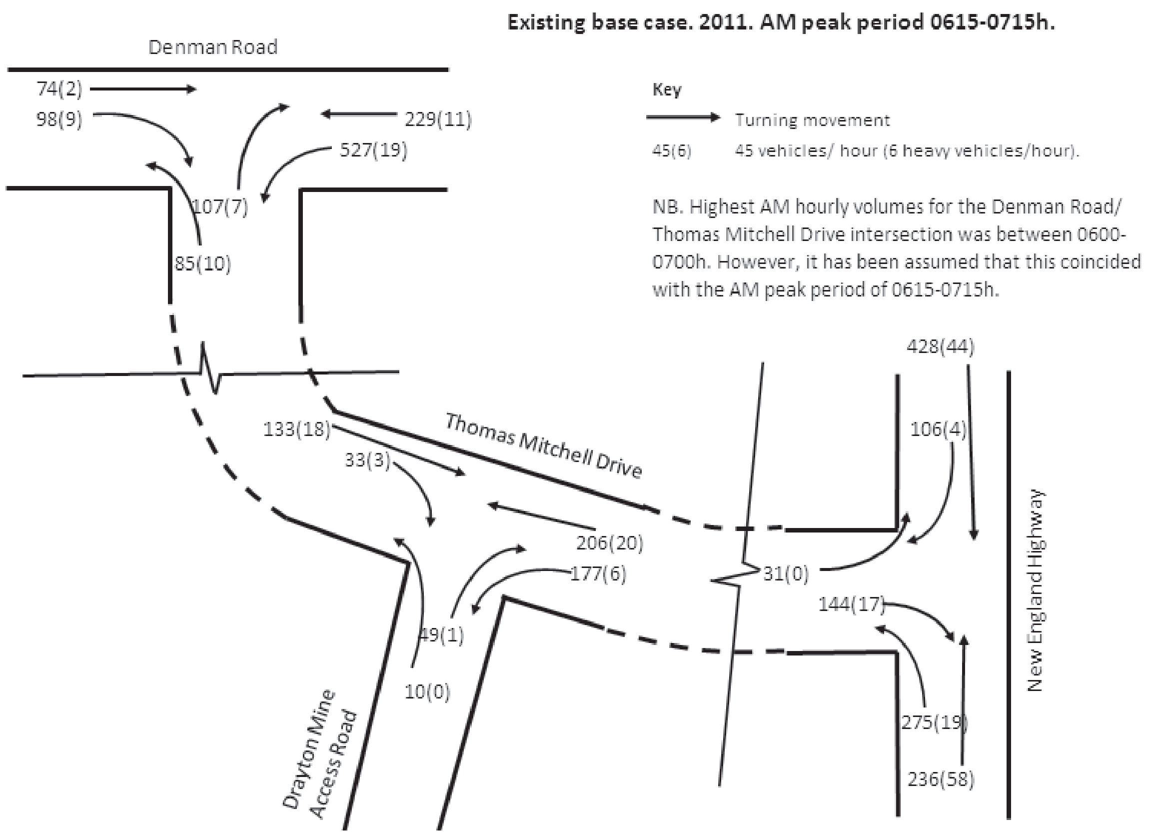


Figure 6 Existing PM peak hour volumes surveyed along Thomas Mitchell Drive (May, 2011)

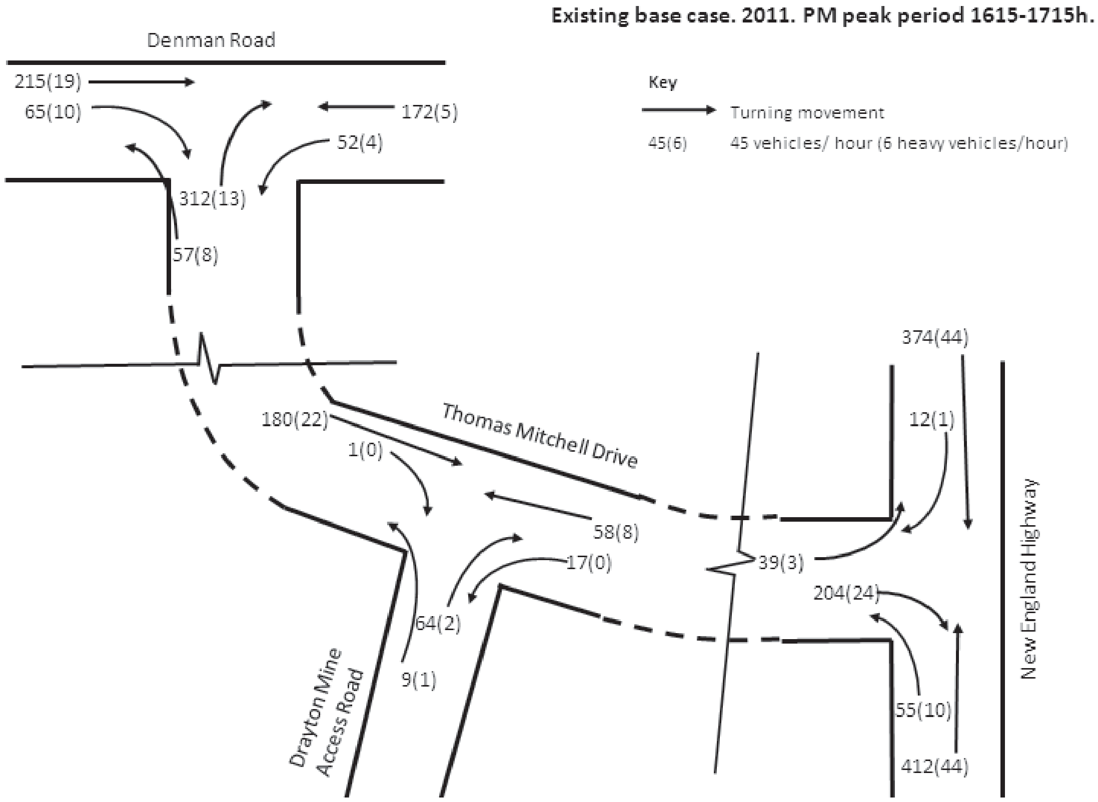


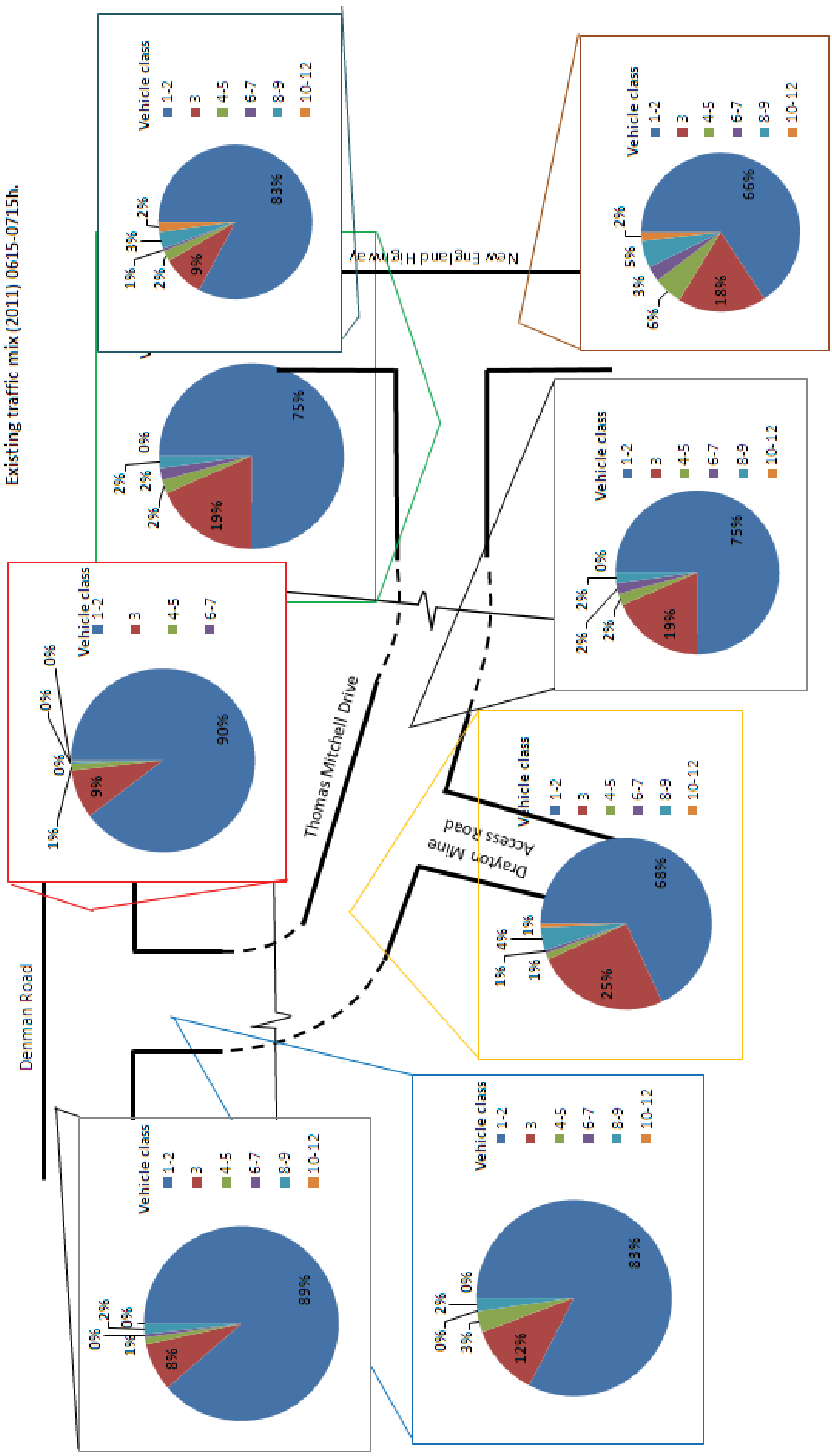
Figure 7 shows the traffic volume composition for each of the approaches to the intersections at Denman Road/ Thomas Mitchell Drive, Thomas Mitchell Drive/ Drayton Mine Access Road, and New England Highway/ Thomas Mitchell Drive for the AM period between 0615h and 0715h. The traffic composition has been defined using the 12 standard Austroads vehicle classes (as described in Appendix A). Generally, classes 1 and 2 refer to light vehicles; class 3 is a single unit rigid truck with two axles; classes 4 and 5 refer to a single unit rigid truck with three axles; classes 6 and 7 refer to articulated trucks and buses with three or four axles; classes 8 and 9 refer to articulated trucks with five to six axles where the vehicle is no greater than 19.0 m; and classes 10 to 12 refer to B-doubles and road trains. Classes 3 to 12 are considered to be heavy vehicles.

Figure 7 shows that heavy vehicles made up approximately 10% to 11% of the Denman Road traffic which entered the intersection with Thomas Mitchell Drive during the hour from 0615h to 0715h. Furthermore, the majority of these (9%) were rigid trucks from Austroads classes 3 to 5. The vehicle composition was more varied along Thomas Mitchell Drive with heavy vehicles making up between 17% and 32% of all traffic. Approximately 15% to 26% of the traffic along Thomas Mitchell Drive was made up of rigid trucks, with articulated trucks making up between 5% to 7%.

Figure 7 also shows that heavy vehicles made up approximately 17% to 34% of traffic in the New England Highway approaches to the intersection at Thomas Mitchell Drive between 0615h and 0715h. It should be noted that there are several factors that can affect the percentage split of heavy vehicles. For example, an increase in the proportion of heavy vehicles could be due to an increase in heavy vehicle volumes relative to all other traffic, or alternatively a decrease in volumes of light vehicle traffic.

Figure 8 shows the corresponding information for the PM period between 1615h and 1915h. Similar to the AM case, between 9% and 10% of traffic on Denman Road were heavy vehicles. Between 12% and 30% of traffic along Thomas Mitchell Drive were heavy vehicles with rigid trucks (Austroads classes 3 to 5) being the most common type making up 11% to 21% of the total traffic volumes. During this period, there were less heavy vehicles on the New England Highway by proportion, with these making up between 15% and 16% of all traffic entering the New England Highway/ Thomas Mitchell Drive intersection.

Figure 7 Traffic volume composition for AM period (0615h to 0715h)



Note: Figures refer to volumes entering each intersection.

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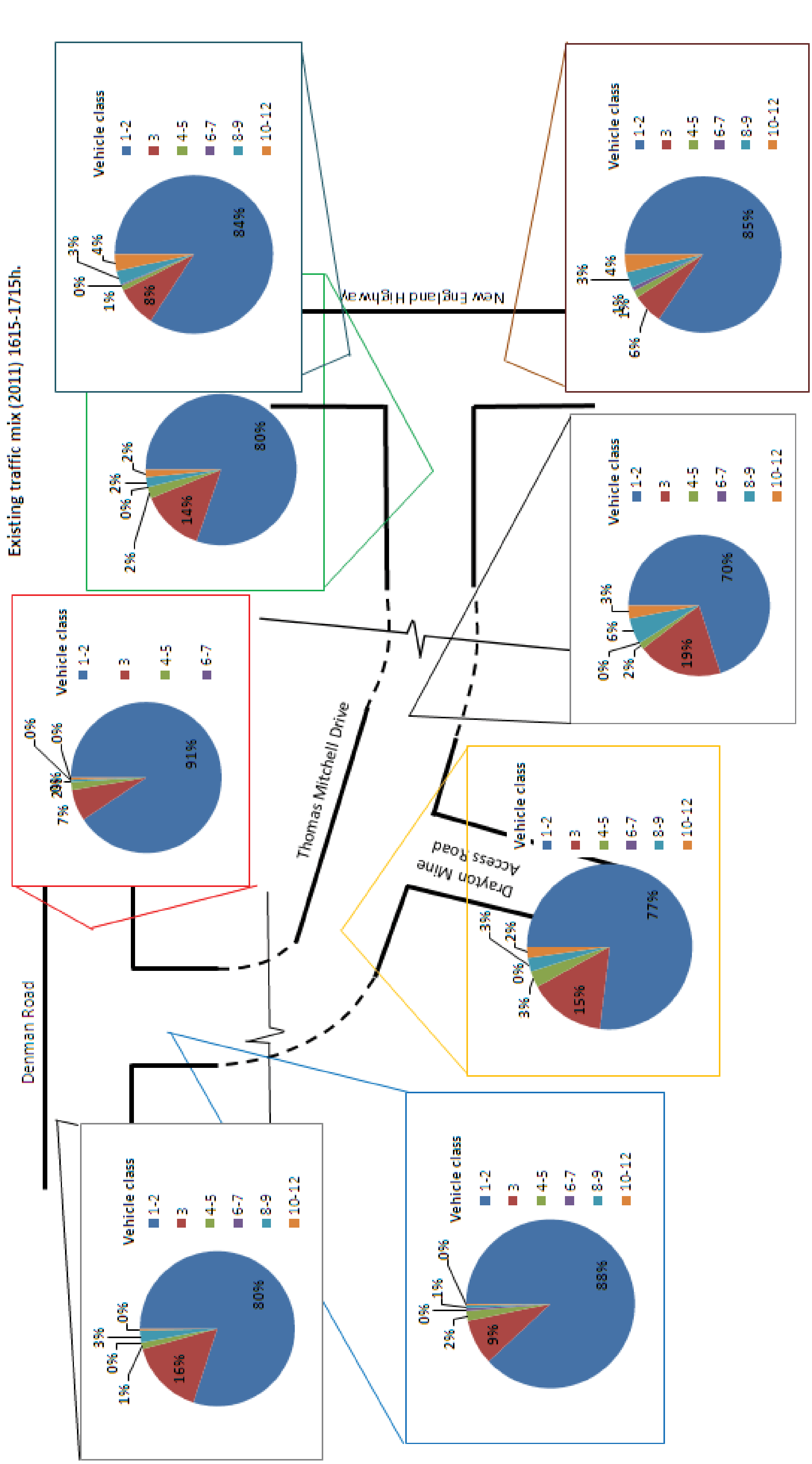
Figure 8 Traffic volume composition for PM survey period (1615h to1915h)



Note: Figures refer to volumes entering each intersection

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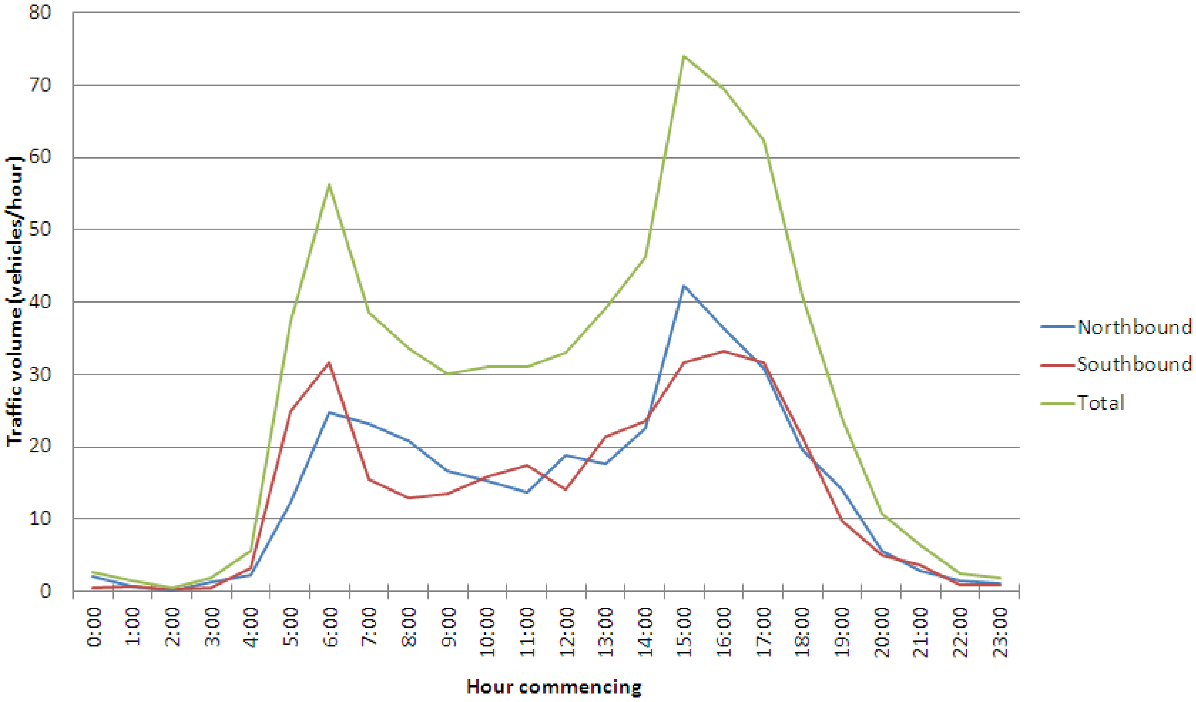
The midblock tube survey carried out on Edderton Road immediately north of the Golden Highway revealed that there is an average of 620 vehicles/day using this road with heavy vehicles making up 14% of all vehicles. Figure 9 shows an hourly distribution of traffic for each direction as well as both directions combined.

Figure 9 Existing traffic volumes by hour along Edderton Road (6-12 February 2012)



2.4 EXISTING RAIL NETWORK CONDITIONS

Product coal from the Project will be transported to the Port of Newcastle by rail via the Main Northern Rail Line, which is the principal rail line in the Hunter Valley coal rail network. This line extends in a south east direction. The rail network is shown in Figure 10.

The ARTC (2009) provides a broad snapshot of the existing conditions on the Hunter Valley coal rail network. It emphasises that in addition to the capacity of the rail network, the real capacity of the coal supply chain is dependent on every stage of delivery within that supply chain. That is, the individual production rates of each coal mine governs their stockpiling and train loading requirements; the train loading requirements drives the demand for trains; the generated train traffic drives the network capacity improvements; and the network capacity improvements (and hence increased delivery to the port) drives the demand for increased coal handling capacity at the port.

Notwithstanding the inter-related nature of the individual delivery stages within the overall coal supply chain, the following key points were identified from the ARTC (2009) report with regard to existing rail infrastructure and operational constraints.

2.4.1 Rail network and fleet conditions and constraints

Key rail network and fleet limitations include the following:

- The Hunter Valley coal 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;
- The section of the network between Muswellbrook and Newcastle is currently limited to a maximum axle load of 30 t (gross mass of 120 t per wagon). Trains servicing the Project will have an average payload of 85 t of product coal per wagon;
- The fleet which currently services the network consists of (i) 17 trains of 91 x 120 t wagons, (ii) four trains of 74 x 120 t wagons, (iii) three trains of 72 x 100 t wagons, and (iv) five trains of 42 x 100 t wagons; and
- The Antiene Rail Spur is the 9.4 km line that branches off the Main Northern Railway Line and services coal loading needs of Drayton Mine and Mt Arthur Coal. This spur contains a railway level crossing at Antiene Railway Station Road, located approximately 35m north east of Hebden Road. One major constraint is the limited storage length (approximately 1,000 m) between the Antiene Junction and the railway level crossing at Antiene Railway Station Road. A train exceeding 1,000 m in length which is stopped at the junction, would block the railway level crossing at Antiene Railway Station Road. Condition 14 of Mt Arthur Coal's Project Approval 06_0091 (Department of Planning, 2008) states that Mt Arthur Coal "shall implement all reasonable and feasible measures to avoid blocking the railway crossing on Antiene Railway Station Road subject to the satisfaction of the Director General."

2.4.2 Operations conditions and constraints

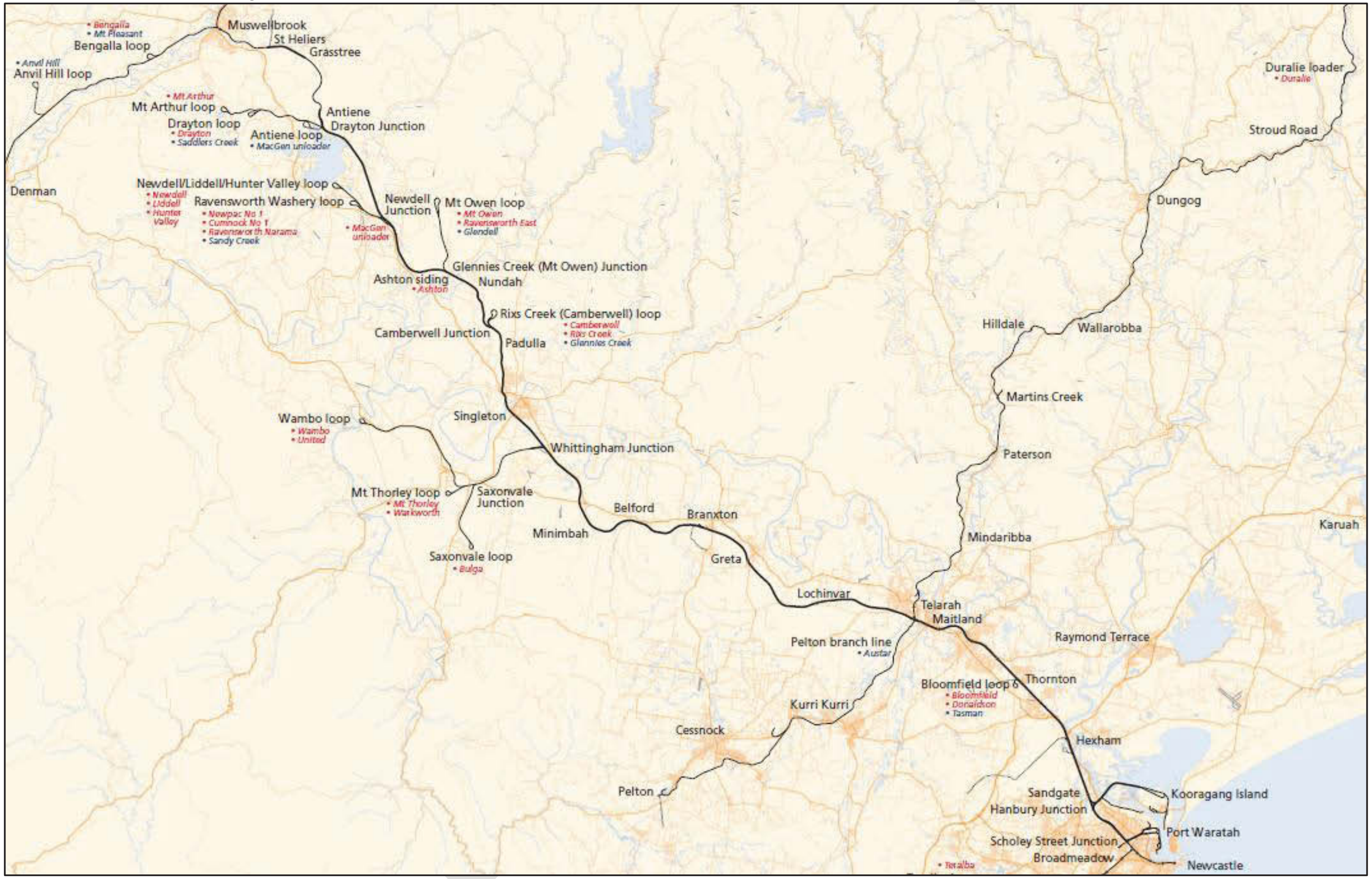
Key rail network operational limitations include the following:

- Trains with 120 t wagons are restricted to 60 km/h when loaded and 80 km/h when empty;
- At present the theoretical export coal capacity of the Hunter Valley rail network is approximately 189 Mtpa, however, the practical delivery capacity is approximately 95 Mtpa as this accounts for maintenance downtime, surge volume and system reliability;
- The coal-handling capacity of the Port of Newcastle was estimated to be 97 Mtpa in 2008 and a number of proposed upgrades to the port are expected to increase the capacity to 200 Mtpa by the end of 2013. Coal export demands are expected to exceed this capacity;
- Currently, there are 12 trains per direction per day between Muswellbrook and Newcastle; and
- Steep grades along the network include the Allandale Bank (near Greta), the Minimbah Bank and the Numbah Bank (north of Singleton). The Minimbah and Numbah Banks have a minimum headway within the range of 14 and 16 minutes

between loaded coal trains. The minimum headway on the Allandale Bank has been reduced to eight minutes in conjunction with improved signaling works.

- The operational/ capacity constraints and high volume of train conflicts at key junctions including:
  - The junction of the Muswellbrook-Ulan Line and the Gunnedah Basin Line at Dartbrook;
  - The junction of the Main North Railway Line and the North Coast Railway Line (passenger line to Brisbane) at Maitland;
  - The junction of the Main North Railway Line and the Mt Thorley/ Bulga coal loading loops at Whittingham; and
  - The junction of the Main North Railway Line and the Liddell/Newdell and Ravensworth coal loading loops at Newdell.

Figure 10 Hunter Valley Coal Rail Network, Muswellbrook to Newcastle



Source: ARTC, 2006

3 TRAFFIC GENERATION

3.1 TRAFFIC GENERATION DURING THE CONSTRUCTION PHASE

3.1.1 Traffic generated by construction personnel

Table 2 shows the breakdown in construction personnel required for each stage of the construction program. As seen, the workforce size peaks at 369 persons/day in month 11. This is anticipated to be September 2014 assuming a construction commencement in November 2013. Over the entire construction phase, there would be an average of 126 persons reporting to site each day. Table 2 also shows the breakdown of the construction workforce by work location, that is, work sites accessed via the Drayton Mine Access Road, as well as the works along Edderton Road. This information was used as part of the trip generation and distribution inputs to the traffic modelling work described in Section 4.

The construction works within the Project Boundary would involve both day and night shifts. Table 2 shows a breakdown of construction personnel accessing these work sites by day and night shift. The Edderton Road realignment works would only be carried out in day shifts with the shifts commencing at 0700h and ending at 1700h.

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Table 2 Construction workforce breakdown

Date	2013		2014												2015												2016		
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**
Site establishment																													
Site establishment (including project management team)	10	10	10	10	10	10	14	14	14	14	14	14	14	12	12	8	8	8	8	4	4	4							
Upgrade/establish construction access roads		20	10	10	4	4	4	4																					
Temporary facilities																													
Site services																													
Power – HV		6	6	6	6	6	6	6	6	12	12	20	20	6															
Power – Drayton South								6	6	6	12	12	12	6															
Water (pumps & pipework)								12	12	12	12	20	20	8	4														
Telecommunications		4	4	4										6	6	6	6												
Internal haul road and light vehicle road																													
Construct haul road (3 faces)				40	40	40	40	40	40	40	40	40	40	20	20														
Internal haul road/conveyor crossover							40	40	40	40	40																		
Construct last section of haul road														20	20	20	20	20											
Drayton South																													
MIA construction								20	40	60	60	40	40	60	60	40	40												
Dam construction								10	15	15	15	15	15																
Open cut preparation																													
Mine clearing													30	30	30	30													
Drill and blast													20	20	20	20													
Box Cut Whynot														40	40	40	40												
Boxcut Blakefield														40	40	40	40												
Mining equipment																													
Fit sound attenuation											4	4	4	4	4	4	4	4	4	4									
Equipment assembly										10	10	10	10	10	10														
CHPP																													
Raw coal system construction			4	4	6	6	24	24	40	40	40	16																	
Rejects and CHPP upgrades			2	2	4	6	16	20	20	20	40	8																	
Product coal system upgrades			2	2	4	4	20	20	40	40	20	8																	
Train load out system upgrades			4	4	4	4	4	4	16	16	40	16	16																
Edderton Road																													
Construct Edderton Road		6	15	15	15	15	15	15	15	15	10																		
Dragline relocation																							40	46	80	80	80	40	20
Drayton South production																													
Total manning per day	10	46	57	97	93	95	183	235	304	340	369	223	241	282	266	208	158	32	12	8	4	4	40	46	80	80	80	40	20
Total manning/day accessing via Drayton	10	40	42	82	78	80	168	220	289	325	359																		
Sub-total dayshift	10	40	42	82	78	80	168	220	289	285	290	217	241	282	266	208	158	32	12	8	4	4	40	40	60	60	60	30	16
Sub-total nightshift										40	69	6												6	20	20	20	10	4

Manning accessing via Edderton Road (no Drayton Mine access) - Edderton Road construction works only		6	15	15	15	15	15	15	15	15	10																		
Deliveries to site/ month	25	40	60	60	70	170	230	260	270	270	260	230	170	120	100	80	40	40	10	10	20	20	40	60	20	20	20	20	20

Source: Anglo American 2011a

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3.1.2 Heavy vehicle construction traffic

Table 2 shows the number of deliveries to site during the construction phase in *visits* per month. Each visit has been assumed to be by truck. The term *visits* has been used as each visit would generate two trips – an inbound laden trip followed by an outbound non-laden trip. Table 2 shows that the number of truck visits would peak in month 9 and 10 of the construction program where up to 270 truck visits would be generated per month.

The traffic modelling work in Section 4 has accounted for the truck traffic generated by the Project and has assumed that truck deliveries would be distributed over an average of 22 days per month.

3.2 TRAFFIC GENERATION DURING THE OPERATION PHASE

As Drayton South is essentially a continuation of the existing Drayton Mine, there are no proposed changes to the existing workforce. Even in the transitional period where both operations will run concurrently, there will not be a significant increase in workforce.

Drayton Mine currently has 530 full time employees and contractors. This workforce will continue to be relied upon throughout the operational phase of the Project.

The traffic surveys described in Section 2.3.2 were undertaken in May 2011, which was regarded as typical of the operational conditions of Drayton Mine. As such there is not expected to be any significant traffic generation during the Project's operations phase above these figures. Furthermore, all employees will continue to access the site through the existing Drayton Mine Access Road and would have day and night shift start times of 0700h and 1900h.

3.3 TRAFFIC GENERATION FROM NEIGHBOURING MINES AND PROJECTS

There are a number of other coal projects within the vicinity of the Project. These include coal projects at Mangoola, Bengalla, Mt Arthur Coal, and Mount Pleasant. Mangoola, to the south of Wybong Road, has recently commenced mining operations and is now in year 2 of the mine plan. Bengalla, to the east of Bengalla Link Road, is in the production phase. Mt Arthur Coal, to the west of Drayton Mine, is also in production phase and was granted Project Approval 09_0062 for the proposed consolidation of the mine allowing them to produce up to 36 Mtpa. Mount Pleasant, located on Wybong Road to the east of Bengalla Link Road, has received Project Approval, but has not yet commenced any activities.

These coal projects are further described in Sections 3.3.1 to 3.3.4.

3.3.1 Mangoola

Mangoola (previously known as Anvil Hill) was approved in 2007 and is now an operating mine located on Wybong Road approximately 16km east of the Golden Highway. Project Approval 06_0014 allows mining activities to take place up to 2028.

During 2006, TPK reported on traffic and road safety issues associated with Mangoola. The following issues raised by TPK (2006) are relevant to the Project:

- All product coal will be transported by rail via a rail loading loop connecting to the Muswellbrook-Newcastle railway line.
- There would be 240 mine staff employed during the operation phase, consisting of 227 shift workers and 13 day workers. There would be 2 x 12 hour shifts per weekday. All day employees would commence work at the same time as the day shift workers and 30% of the day employees would leave at the end of the day shift. Approximately 25% of the shift workers would work in any one shift.
- A high car sharing rate equivalent to 1.25 persons/vehicle was assumed.
- Approximately 20 visitors per day and 10 service vehicles per day (as well as the corresponding departure movements) was assumed.
- Approximately 70% of traffic would be distributed towards Muswellbrook via Denman Road, 10% would be distributed to Denman via Denman Road, and 20% would be distributed towards Singleton and beyond via Thomas Mitchell Drive.
- Approximately 75 inbound movements and 50 departure movements would be generated in the AM peak hour from 0630h to 0730h, whilst 50 inbound and 56 outbound movements would be generated during the PM peak hour from 1830h to 1930h.
- All operation traffic would access the mine via Denman Road, Bengalla Link Road, and Wybong Road.

3.3.2 Mount Pleasant

The Mount Pleasant is located to the north of Wybong Road approximately 4 km west of Muswellbrook. While this project has been granted a Project Approval until 2020, it has not yet commenced any activities. During 2010 as part of a Modification, EMGA (2010a) advised the following:

- The operations workforce of Mount Pleasant would consist of approximately 360 persons between 2014 and 2019, including 192 mining staff, 14 technical services staff, 70 maintenance staff, 64 coal preparation staff and 15 administrative staff. An 80% car usage factor was applied in the EMGA Mitchell McLennan (2010a) study. ERM (1997) indicated that 25% of employees would travel south towards Singleton via Thomas Mitchell Drive. TPK (2006) also stated that Mount Pleasant would generate 109 inbound and 74 outbound movements in the AM peak period between 0630h and

0730h, and 74 inbound and 84 outbound movements in the PM peak period between 1830h and 1930h.

- The mining operations would be carried out over 24 hours a day over 12.5 hour rotating shifts.
- There would be 13 additional truck visits required to access the site each day during the operations phase, consisting of petrol tankers and explosives (ERM, 1997).
- A 5.2 km section of Castlerock Road within the Mount Pleasant site would need to be closed and replaced by the Mount Pleasant Northern Link Road.
- A proposed closure of a 4.1 km section of Wybong Road, and the extension of Bengalla Link Road to Wybong Road could potentially result in traffic re-distribution to the Bengalla Link Road. This could have some cumulative traffic impacts on the Project’s study area since this traffic is also likely to use Thomas Mitchell Drive.

3.3.3 Mt Arthur Coal

Mt Arthur Coal is an existing mine located to the immediate west of Drayton Mine. During 2009, a traffic impact assessment was undertaken by Hansen Bailey (Hansen Bailey, 2009) as part of the Mt Arthur Coal Consolidation Project which included a number of modifications to the existing operations. The following issues raised by Hansen Bailey (2009) are relevant to the Project:

- The Mt Arthur Coal Consolidation Project would result in an increased coal production from 28 to 36 Mtpa ROM coal.
- There is a proposed realignment of approximately 6 km of the northern-most section of Edderton Road (including its intersection with Denman Road). This is currently scheduled to take place in 2019.
- Increase in rail haulage capacity from 19 to 27 Mtpa. Although the maximum number of trains movements per day (i.e. 24 movements including both inbound and outbound movements) will remain the same, there will be more days per year when this would apply.
- An increase to the operation workforce of 720 full time equivalent positions (total of 1420) would be expected in 2014. Similarly, 70% of the workforce would travel to the site on any weekday at a vehicle occupancy rate of 1.17 persons/vehicle. As such, 428 light vehicle visits would be generated per weekday 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. Accounting for the return trips, this equates to 896 light vehicles movements per day.
- Traffic generated from Mt Arthur Coal would be distributed 65%/35% to the west/east respectively. At the Denman Road end, the generated traffic would be distributed 90%/10% to the east (Muswellbrook)/west (Denman) respectively. At the New England Highway end, 100% of the generated traffic would be distributed to the south.

3.3.4 Bengalla

Bengalla Mine is located to the east of Bengalla Link Road and north of Denman Road. The mining operations commenced in 1995 and operates under a number of licences. Under the current approvals, mining operations can continue up to and including 2017.

In 2006, there were a total of 230 staff members employed at the Bengalla Mine. This increased to 250 employees as a result of a modification which resulted in an increase in extraction limits from 8.7 Mtpa to 10.7 Mtpa (ROM coal).

4 ROAD TRAFFIC IMPACTS

4.1 CONSTRUCTION TRAFFIC VOLUME BUILD UP

The information provided in Section 3.1 was used to forecast the number of trips per hour that would be generated during the peak construction phase of the Project. The traffic was distributed in a similar manner to that described in Section 3.3.3. The number of trips generated per hour for the AM and PM peak periods during the peak construction phase are shown in Figures 11 and 12 respectively. The numbers shown in these figures is the volume of traffic that would be generated by the Project and which need to be added to the background traffic as well as any growth in background traffic between 2011 (survey year) and 2014 (peak construction phase).

Figure 11 Forecast traffic generation from the construction phase of the mine – AM peak

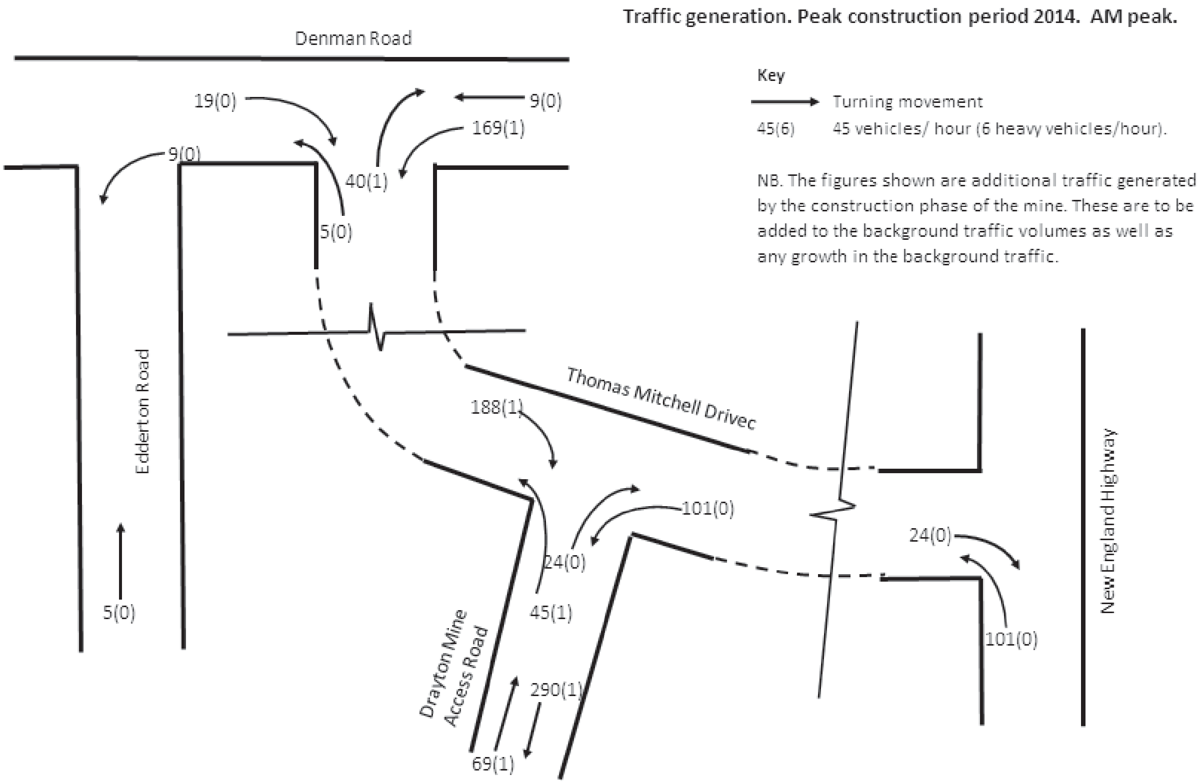
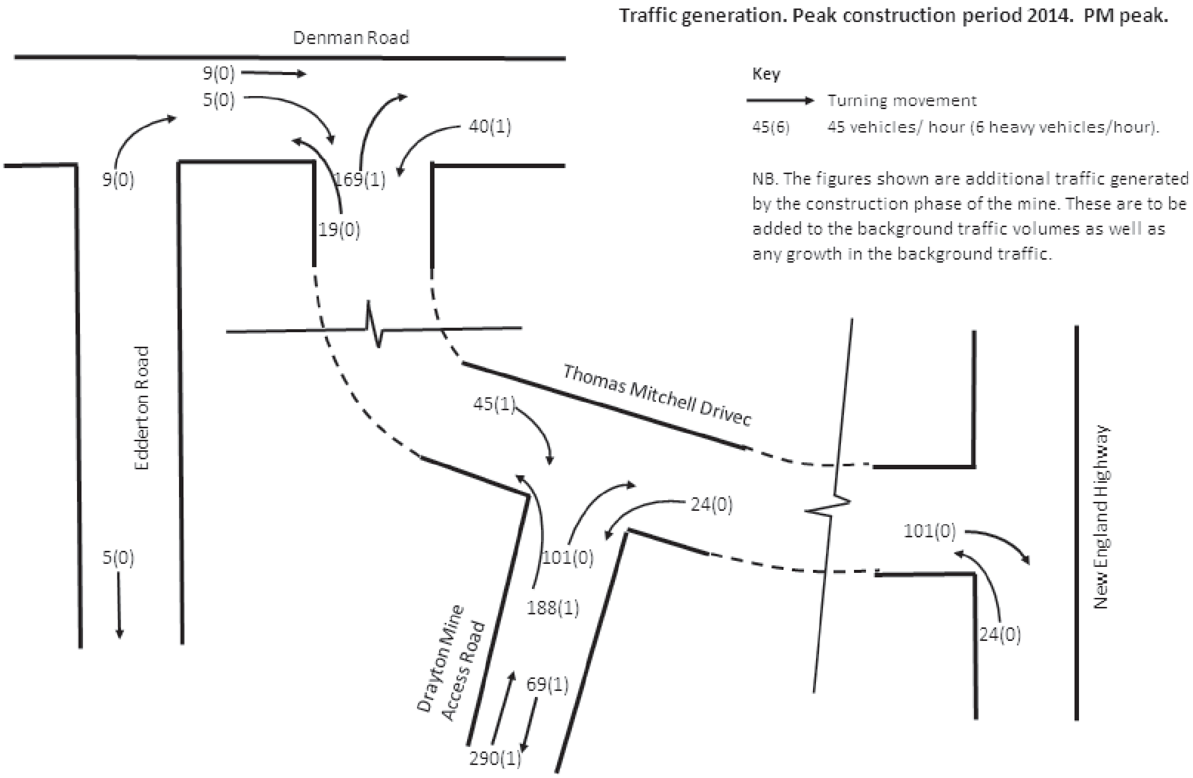


Figure 12 Forecast traffic generation from the construction phase of the mine - PM peak



The traffic volumes generated by the peak construction phase (from Figures 11 and 12) were then included in the traffic volume build up for the three study intersections, namely, the Denman Road/ Thomas Mitchell Drive, New England Highway/Thomas Mitchell Drive, and the Thomas Mitchell Drive/ Drayton Mine Access Road intersections. The following equation summarises the method of determining the total traffic that would be generated during the construction phase of the Project:

Surveyed traffic volume (Figures 5 and 6)	+	3 years worth of traffic growth at 2.5% p.a (to increase background traffic volumes from 2011 to 2014).	+	Construction traffic generation (Figures 11 and 12).	=	Total traffic volume generated

Using this equation, the total traffic volume generated (total traffic volume build-ups) at each intersection was determined. These have been shown in Tables 3 to 8.

The traffic volume build-ups were then used as input values for the SIDRA intersection performance simulation models described in Section 4.3.

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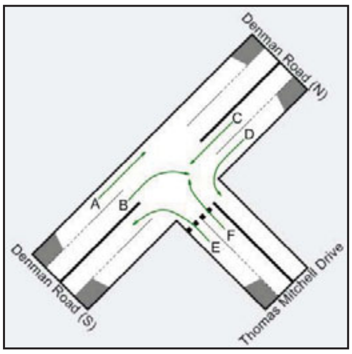
Table 3 Denman Road/ Thomas Mitchell Drive intersection: Traffic volume build-up for peak construction phase (AM peak, 2014)

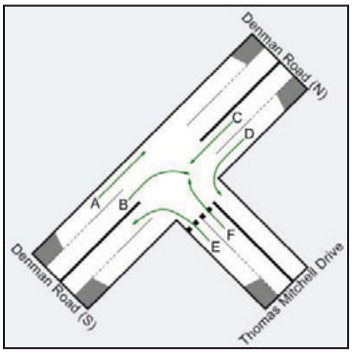
Turning movement code		AM peak volume	Plus growth in background traffic (note i)	Plus construction traffic (note ii)	Total
A		74 (2)	6 (0)	0 (0)	80 (2)
B		98 (9)	8 (1)	19 (0)	125 (10)
C		229 (11)	18 (1)	9 (0)	256 (12)
D		527 (19)	42 (2)	169 (1)	738 (22)
E		85 (10)	7 (1)	5 (0)	97 (11)
F		107 (7)	9 (1)	40 (1)	156 (9)



Notes:
(i) Assumed annual growth of 2.5% pa applies to background traffic as determined in Section 2.3.1. That is, x1.08
(ii) Construction traffic as determined in Figure 11.

Table 4 Denman Road/ Thomas Mitchell Drive intersection: Traffic volume build-up for peak construction phase (PM peak, 2014)

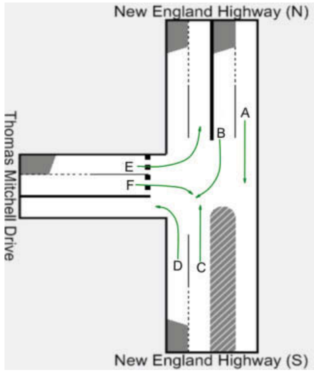
Turning movement code		PM peak volume	Plus growth in background traffic (note i)	Plus construction traffic (note ii)	Total
A		215 (19)	18 (1)	9 (0)	242 (20)
B		65 (10)	5 (1)	5 (0)	75 (11)
C		172 (5)	14 (0)	0 (0)	186 (5)
D		52 (4)	4 (0)	40 (1)	96 (5)
E		57 (8)	5 (1)	19 (0)	81 (9)
F		312 (13)	25 (1)	169 (1)	506 (15)



Notes:
(i) Assumed annual growth of 2.5% pa applies to background traffic as determined in Section 2.3.1. That is, x1.08
(ii) Construction traffic as determined in Figure 12.

Table 5 New England Highway/ Thomas Mitchell Drive intersection: Traffic volume build-up for peak construction phase (AM peak, 2014)

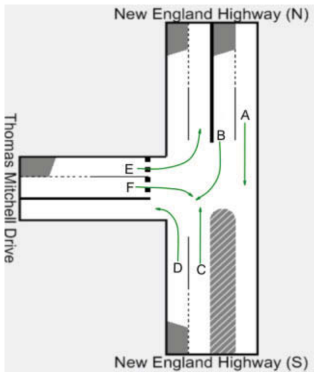
Turning movement code	AM peak volume	Plus growth in background traffic (note i)	Plus construction traffic (note ii)	Total
A	428 (44)	34 (4)	0 (0)	462 (48)
B	106 (4)	8 (0)	0 (0)	114 (4)
C	236 (58)	19 (5)	0 (0)	255 (63)
D	275 (19)	22 (2)	101 (0)	398 (21)
E	31 (0)	2 (0)	0 (0)	33 (0)
F	144 (17)	12 (1)	24 (0)	180 (18)



Notes:
(i) Assumed annual growth of 2.5% pa applies to background traffic as determined in Section 2.3.1. That is, x1.08
(ii) Construction traffic as determined in Figure 11.

Table 6 New England Highway/ Thomas Mitchell Drive intersection: Traffic volume build-up for peak construction phase (PM peak, 2014)

Turning movement code	PM peak volume	Plus growth in background traffic (note i)	Plus construction traffic (note ii)	Total
A	374 (44)	30 (4)	0 (0)	404 (48)
B	12 (1)	1 (0)	0 (0)	13 (1)
C	412 (44)	33 (4)	0 (0)	445 (48)
D	55 (10)	4 (1)	24 (0)	83 (11)
E	39 (3)	3 (0)	0 (0)	42 (3)
F	204 (24)	16 (2)	101 (0)	321 (26)



Notes:
(i) Assumed annual growth of 2.5% pa applies to background traffic as determined in Section 2.3.1. That is, x1.08
(ii) Construction traffic as determined in Figure 12.

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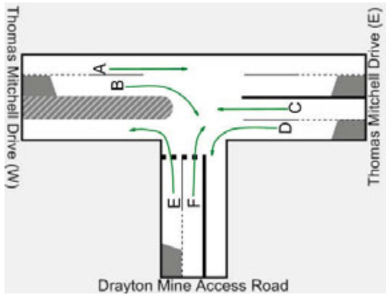
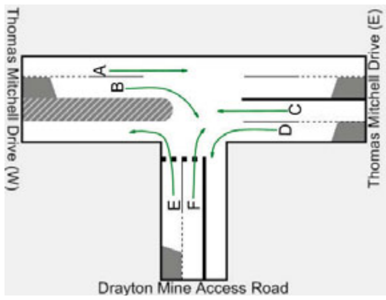
Table 7 Thomas Mitchell Drive/ Drayton Access Road intersection: Traffic volume build-up for peak construction phase (AM peak, 2014)

Turning movement code	AM peak volume	Plus growth in background traffic (note i)	Plus construction traffic (note ii)	Total	
A	133 (18)	11 (1)	0 (0)	144 (19)	
B	33 (3)	0 (0)	188 (1)	221 (4)	
C	206 (20)	16 (2)	0 (0)	222 (22)	
D	177 (6)	0 (0)	101 (0)	278 (6)	
E	10 (0)	0 (0)	45 (1)	55 (1)	
F	49 (1)	0 (0)	24 (0)	73 (1)	

Notes:
(i) Assumed annual growth of 2.5% pa applies to background traffic as determined in Section 2.3.1. That is, x1.08
(ii) Construction traffic as determined in Figure 9.

Table 8 Thomas Mitchell Drive/ Drayton Access Road intersection: Traffic volume build-up for peak construction phase (PM peak, 2014)

Turning movement code	PM peak volume	Plus growth in background traffic (note i)	Plus construction traffic (note ii)	Total	
A	180 (22)	14 (2)	0 (0)	194 (24)	
B	1 (0)	0 (0)	45 (1)	46 (1)	
C	58 (8)	1 (0)	0 (0)	59 (8)	
D	17 (0)	0 (0)	24 (0)	41 (0)	
E	9 (1)	0 (0)	188 (1)	197 (2)	
F	64 (2)	0 (0)	101 (0)	165 (2)	

Notes:
(i) Assumed annual growth of 2.5% pa applies to background traffic as determined in Section 2.3.1. That is, x1.08
(ii) Construction traffic as determined in Figure 10.

4.2 OPERATION TRAFFIC VOLUME BUILD UP

As stated in Section 3.2, the operational phase of the Project will not generate any increase in road traffic above what is already experienced.

The following conservative measures have been taken in determining the traffic volume build up for the operational phase:

- This assessment has assumed a 2.5% p.a. growth in background traffic over a 15-year period based on historical growth trends. In the absence of any other significant regional traffic generators other than coal mines in the surrounding area, much of this growth would have been due to expansions in individual coal projects over the years. Therefore, the continued application of the 2.5% p.a. growth rate for forecasting growth in background traffic would, to a large extent, include future growth in coal extraction and production.
- The SIDRA traffic models described in Section 4.3 have conservatively used a 95% peak flow factor. That is, the models have assumed that the average flow rate over a whole hour is only 95% of the maximum flow experienced at any one time within that hour. By doing so, the model increases the input traffic volumes by 5% to account for the maximum flow rates.
- Not all workers would travel to and from work at the same time. It is highly likely that these additional staff numbers would be distributed over several shifts.

However, as described in Section 3.3, other neighbouring mines and projects are proposing to establish or expand their operations and hence increase staffing levels. Figure 13 provides a summary of the additional traffic generated by Mount Pleasant, Mangoola and Mt Arthur Coal during the AM peak (i.e. the hour capturing inbound traffic for start of day shift and outbound traffic for end of night shift). The PM peak (i.e. capturing inbound traffic for the start of night shift and the outbound traffic for the end of the day shift) is shown in Figure 14 and is simply assumed to be the “mirror image” of that shown in Figure 13.

Figure 13 Additional traffic volumes that would be generated by neighbouring mine projects (AM peak)

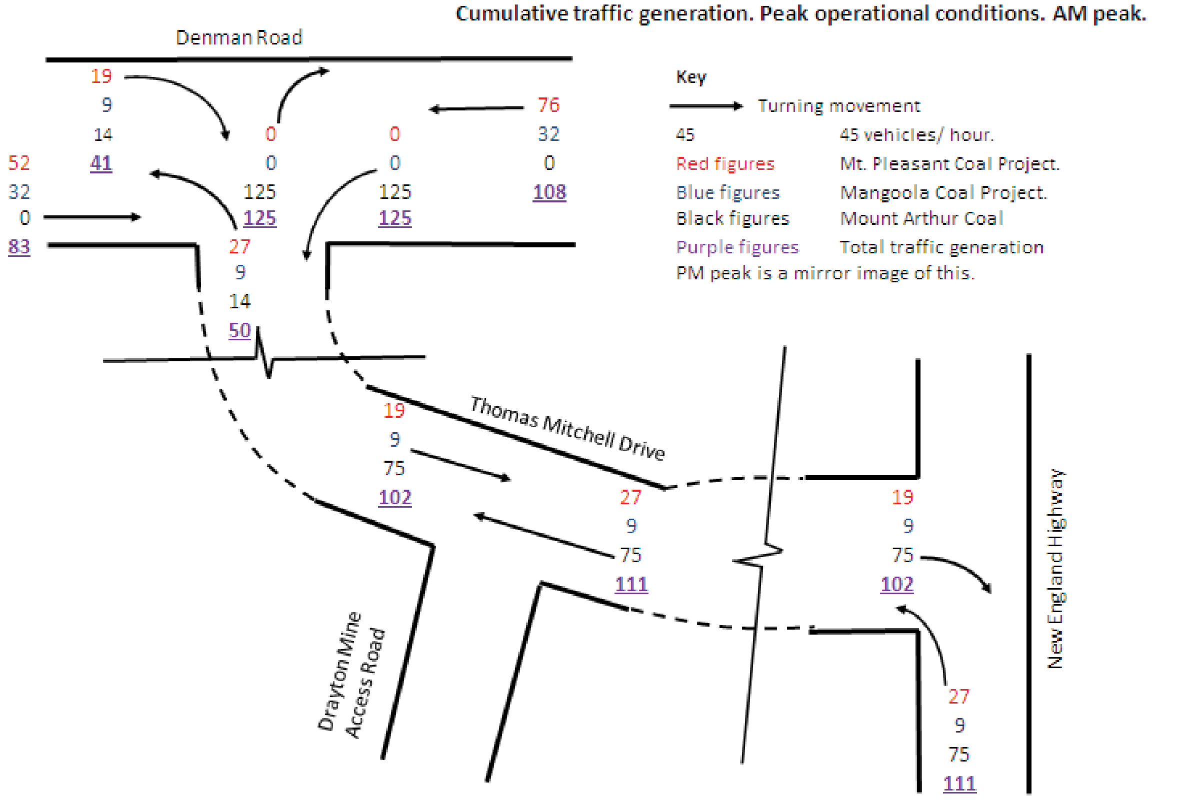
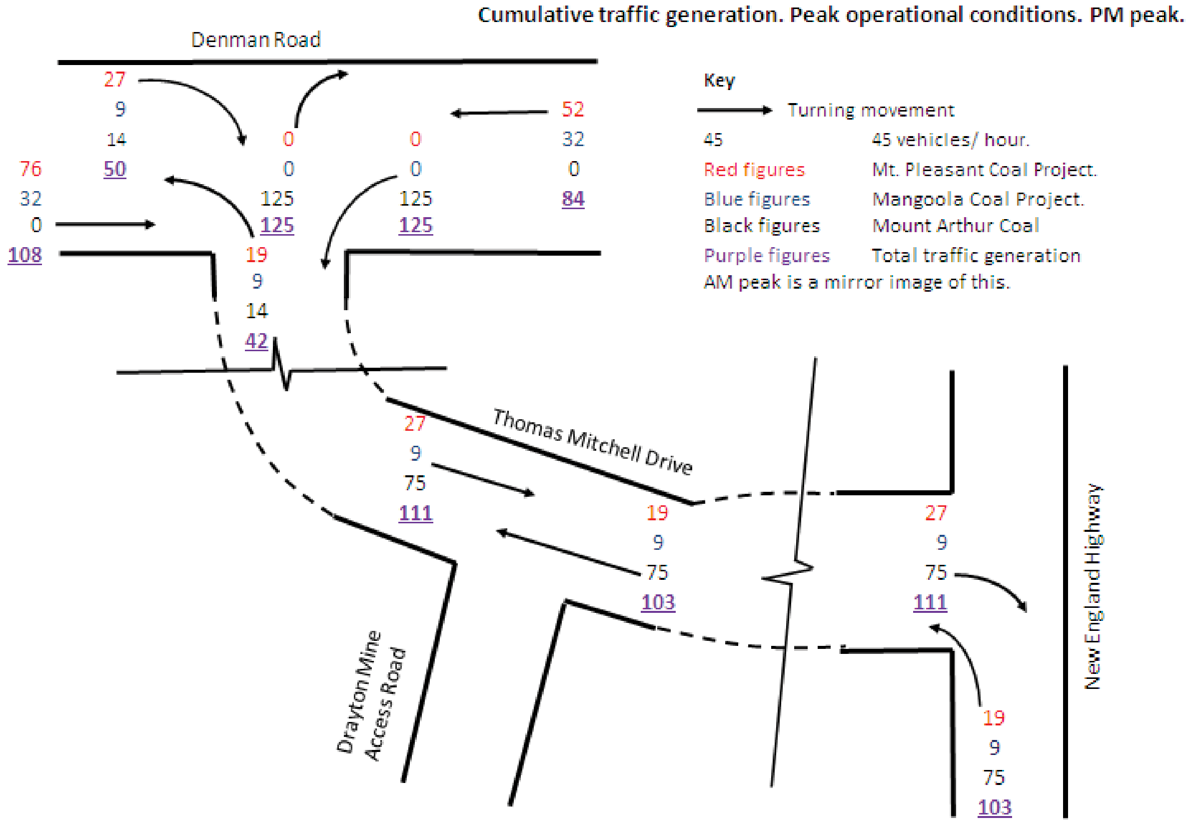


Figure 14 Additional traffic volumes that would be generated by neighbouring mine projects (PM peak)



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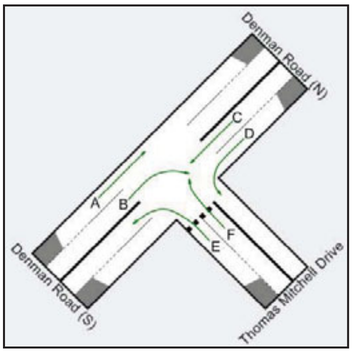
The additional traffic generation as shown in Figures 13 and 14 were added to the background traffic as well as an assumed growth in background traffic to provide the input traffic volumes for the SIDRA intersection performance simulation modelling described in Section 4.3. The traffic volume build up for the operations phase of the mine for the AM and PM peak periods are provided in Tables 9 to 12.

Table 9 Denman Road/ Thomas Mitchell Drive intersection: Traffic volume build-up for operations phase (AM peak, year 15 - 2028)

Turning movement code		AM peak volume	Plus growth in background traffic (note i)	Plus cumulative traffic (note ii)	Total
A		74 (2)	33 (1)	83 (0)	190 (3)
B		98 (9)	44 (4)	41 (0)	183 (13)
C		229 (11)	103 (5)	108 (0)	440 (16)
D		527 (19)	237 (9)	125 (0)	889 (28)
E		85 (10)	38 (5)	50 (0)	173 (15)
F		107 (7)	48 (3)	125 (0)	280 (10)



Notes:

(i) Assumed annual growth of 2.5% pa applies to background traffic as determined in Section 2.3.1. Assumed that the peak operations phase for all three mines would be year 15. This means background traffic volumes would be multiplied by 1.45.

(ii) Cumulative traffic from Figures 13 and 14.

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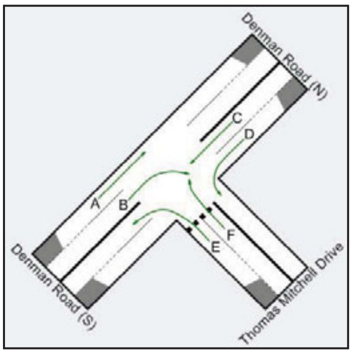
Table 10 Denman Road/ Thomas Mitchell Drive intersection: Traffic volume build-up for operations phase (PM peak, year 15 - 2028)

Turning movement code	PM peak volume	Plus growth in background traffic (note i)	Plus cumulative traffic (note ii)	Total
A	215 (19)	97 (9)	108 (0)	420 (28)
B	65 (10)	29 (5)	50 (0)	144 (15)
C	172 (5)	77 (2)	84 (0)	333 (7)
D	52 (4)	23 (2)	125 (0)	200 (6)
E	57 (8)	2 (4)	42 (0)	101 (12)
F	312 (13)	140 (6)	125 (0)	577 (19)



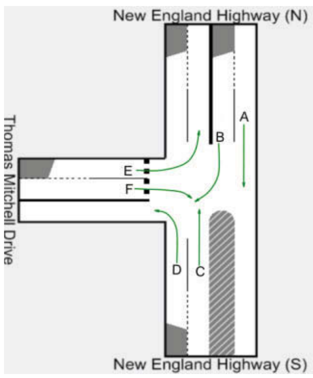
Notes:

(i) Assumed annual growth of 2.5% pa applies to background traffic as determined in Section 2.3.1. Assumed that the peak operational period for all three mines would be year 15. This means background traffic volumes would be multiplied by 1.45.

(ii) Cumulative traffic from Figures 13 and 14.

Table 11 New England Highway/ Thomas Mitchell Drive intersection: Traffic volume build-up for operations phase (PM peak, year 15 - 2028)

Turning movement code	AM peak volume	Plus growth in background traffic (note i)	Plus cumulative traffic (note ii)	Total
A	428 (44)	192 (20)	0 (0)	620 (64)
B	106 (4)	48 (2)	0 (0)	154 (6)
C	236 (58)	106 (26)	0 (0)	342 (84)
D	275 (19)	124 (9)	111 (0)	510 (28)
E	31 (0)	14 (0)	0 (0)	45 (0)
F	144 (17)	65 (8)	102 (0)	311 (25)



Notes:

(i) Assumed annual growth of 2.5% pa applies to background traffic as determined in Section 2.3.1. Assumed that the peak operational period for all three mines would be year 15. This means background traffic volumes would be multiplied by 1.45.

(ii) Cumulative traffic from Figures 13 and 14.

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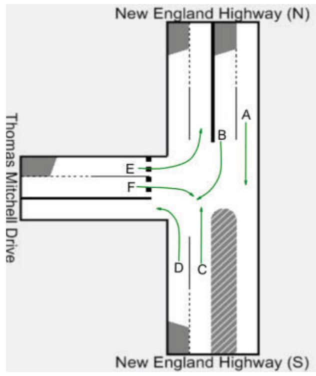
Table 12 New England Highway/ Thomas Mitchell Drive intersection: Traffic volume build-up for operations phase (PM peak, year 15 - 2028)

Turning movement code		PM peak volume	Plus growth in background traffic (note i)	Plus cumulative traffic (note ii)	Total
A		374 (44)	168 (20)	0 (0)	542 (64)
B		12 (1)	5 (0)	0 (0)	17 (1)
C		412 (44)	185 (20)	0 (0)	597 (64)
D		55 (10)	25 (5)	103 (0)	183 (15)
E		39 (3)	18 (1)	0 (0)	57 (4)
F		204 (24)	92 (10)	111 (0)	407 (34)



Notes:
(i) Assumed annual growth of 2.5% pa applies to background traffic as determined in Section 2.3.1. Assumed that the peak operations phase for all three mines would be year 15. This means background traffic volumes would be multiplied by 1.45.
(ii) Cumulative traffic from Figures 13 and 14.

4.3 INTERSECTION PERFORMANCE ASSESSMENT AND IMPROVEMENT MEASURES

4.3.1 Intersection performance assessment

The traffic impacts due to the peak construction and operation phases were modelled using the SIDRA intersection performance simulation software. Separate SIDRA models were prepared for the peak construction and operation phases and for the three study intersections under their current configurations. The results of the SIDRA models are provided in Table 13. Appendix B provides an explanation of the key traffic performance indicators – level of service (LoS), degree of saturation (DoS), average delay and maximum queue length.

The SIDRA outputs for the Denman Road/ Thomas Mitchell Drive intersection, under its current configuration, indicate that by the peak operation period, the right-turn movements into and out of Thomas Mitchell Drive would perform at a poor level of service (F). The right-turn movement from Denman Road to Thomas Mitchell Drive would experience maximum queue lengths greater than 200m in the AM peak. Similarly, the right-turn movement from Thomas Mitchell Drive to Denman Road would experience queue lengths greater than 350m. The proposed upgrade of this intersection as described in Section 4.3.2 will alleviate this problem.

The number of right-turning vehicles from Thomas Mitchell Drive to Denman Road (north) would increase from 113 vehicles/hour in the 2011 AM peak, to 295 vehicles/hour during the peak operation phase. Furthermore, the volume of conflicting traffic would also increase which limits the available gaps needed by the right turners. The total number of through vehicles on Denman Road (northern and southern) approaches would increase from approximately 320 vehicles/hour in the AM peak of the 2011 base case, to approximately 660 vehicles/hour during the peak operation phase. A similar impact would be experienced for the PM peak period.

It should be emphasised that only a small proportion of the total traffic entering the intersection would be generated by the Project. Figure 5 shows that of the 1,122 vehicles/hour entering the Denman Road/ Thomas Mitchell Drive intersection in the 2011 base case AM peak period, only 43 (4%) are generated by Drayton Mine. Furthermore, in the peak operations phase, most of the additional traffic is due to the planned expansions of other surrounding mining projects.

The SIDRA outputs also show that the right-turn movement from Thomas Mitchell Drive to the New England Highway, under the current intersection configuration, would perform at a poor level of service (F) in both AM and PM peaks during the peak operation phase. The model predicts that the queue lengths in excess of 900m would be experienced in the western approach to this intersection for the peak operation phase compared with queues in the order of 20m to 30m during the 2011 base case. The proposed upgrade of this intersection as described in Section 4.3.2 will alleviate this problem.

Figure 5 indicates that at present, only 226 (18%) of the total 1220 vehicles entering the New England Highway/ Thomas Mitchell Drive intersection during the AM peak period are associated with Drayton Mine. Furthermore, this would reduce to 16% when accounting for the traffic volume increases from other mines as shown in Figure 14. This demonstrates that Drayton South will have a reduced relative impact on that intersection’s performance compared with the forecast traffic growth from other mining projects.

It is understood that Mt Arthur Coal have committed to upgrading the Denman Road/ Thomas Mitchell Drive and the New England Highway/ Thomas Mitchell Drive intersections to seagull configurations with a channelised right turn bay into Thomas Mitchell Drive, as well as an acceleration lane for right-turns out of Thomas Mitchell Drive. Section 4.3.2 quantifies the traffic performance of the intersection with the upgrades implemented.

Table 13 SIDRA model outputs for the existing base case, peak construction period and peak operations phase

Intersection and peak period | Condition: Base case condition (2011) / Peak construction condition (2014). / Peak operation condition (year 15 – 2028)

Denman/ Thomas Mitchell – AM peak

Base case condition (2011)

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	89	11.0	0.149	16.2	LOS B	0.7	5.2	0.54	0.86	47.5
23	R	113	6.5	0.211	16.9	LOS B	1.0	7.2	0.61	0.90	56.8
Approach		202	8.9	0.211	16.6	LOS B	1.0	7.2	0.57	0.88	53.6
North East: Denman Road (N)											
24	L	555	3.6	0.306	12.5	LOS A	0.0	0.0	0.00	0.75	52.3
25	T	241	4.6	0.127	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		796	4.0	0.306	8.7	LOS A	0.0	0.0	0.00	0.52	67.1
South West: Denman Road (S)											
31	T	78	2.7	0.041	0.0	LOS A	1.2	8.8	0.00	0.00	100.0
32	R	103	9.2	0.245	20.9	LOS B	1.2	8.8	0.70	0.94	53.4
Approach		181	6.4	0.245	11.9	LOS B	1.2	8.8	0.40	0.54	68.4
All Vehicles		1179	5.2	0.306	10.5	NA	1.2	8.8	0.16	0.59	64.3

Peak construction condition (2014).

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	102	11.3	0.206	18.0	LOS B	0.9	7.2	0.62	0.90	45.0
23	R	164	5.6	0.382	20.8	LOS B	2.1	15.5	0.74	0.99	52.5
Approach		266	7.9	0.382	19.7	LOS B	2.1	15.5	0.69	0.95	50.3
North East: Denman Road (N)											
24	L	777	3.0	0.427	12.4	LOS A	0.0	0.0	0.00	0.75	52.3
25	T	269	4.7	0.142	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		1046	3.4	0.427	9.2	LOS A	0.0	0.0	0.00	0.56	64.9
South West: Denman Road (S)											
31	T	84	2.5	0.044	0.0	LOS A	2.3	17.3	0.00	0.00	100.0
32	R	132	8.0	0.442	28.2	LOS B	2.3	17.3	0.84	1.02	45.9
Approach		216	5.9	0.442	17.2	LOS B	2.3	17.3	0.51	0.62	59.9
All Vehicles		1528	4.5	0.442	12.2	NA	2.3	17.3	0.19	0.64	60.5

Peak operation condition (year 15 – 2028)

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	182	8.7	0.537	26.8	LOS B	3.2	24.0	0.84	1.06	35.6
23	R	295	3.6	1.298	315.4	LOS F	50.7	366.0	1.00	3.32	8.1
Approach		477	5.5	1.298	205.2	LOS F	50.7	366.0	0.94	2.46	10.0
North East: Denman Road (N)											
24	L	936	3.1	0.515	12.5	LOS A	0.0	0.0	0.00	0.75	52.3
25	T	463	3.6	0.243	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		1399	3.3	0.515	8.3	LOS A	0.0	0.0	0.00	0.50	68.4
South West: Denman Road (S)											
31	T	200	1.6	0.104	0.0	LOS A	27.4	203.8	0.00	0.00	100.0
32	R	193	7.1	1.182	239.3	LOS F	27.4	203.8	1.00	2.15	9.2
Approach		393	4.3	1.184	117.4	LOS F	27.4	203.8	0.49	1.05	18.5
All Vehicles		2268	3.9	1.298	68.6	NA	50.7	366.0	0.26	1.01	23.5

Denman/ Thomas Mitchell – PM peak

Base case condition (2011)

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	14.0	0.069	13.7	LOS A	0.3	2.5	0.33	0.71	51.6
23	R	328	4.2	0.478	16.8	LOS B	3.6	26.0	0.63	0.98	56.6
Approach		388	5.7	0.478	16.4	LOS B	3.6	26.0	0.58	0.94	56.1
North East: Denman Road (N)											
24	L	55	7.7	0.031	12.8	LOS A	0.0	0.0	0.00	0.75	52.3
25	T	181	2.9	0.095	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		236	4.0	0.095	3.0	LOS A	0.0	0.0	0.00	0.17	69.2
South West: Denman Road (S)											
31	T	226	6.6	0.168	1.3	LOS A	1.4	10.8	0.30	0.00	62.8
32	R	68	15.4	0.168	15.4	LOS B	1.4	10.8	0.44	1.07	65.9
Approach		295	10.4	0.168	4.6	LOS B	1.4	10.8	0.33	0.25	70.7
All Vehicles		919	6.6	0.478	9.1	NA	3.6	26.0	0.35	0.52	69.1

Peak construction condition (2014).

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	85	11.1	0.099	13.7	LOS A	0.5	3.5	0.36	0.73	51.4
23	R	533	3.0	0.847	26.7	LOS B	13.1	93.7	0.86	1.40	47.1
Approach		618	4.1	0.847	24.9	LOS B	13.1	93.7	0.79	1.31	47.5
North East: Denman Road (N)											
24	L	101	5.2	0.056	12.6	LOS A	0.0	0.0	0.00	0.75	52.3
25	T	196	2.7	0.102	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		297	3.5	0.102	4.3	LOS A	0.0	0.0	0.00	0.26	64.1
South West: Denman Road (S)											
31	T	255	8.3	0.197	1.8	LOS A	1.8	13.4	0.34	0.00	81.0
32	R	79	14.7	0.197	16.1	LOS B	1.8	13.4	0.51	1.07	65.2
Approach		334	9.8	0.197	5.2	LOS B	1.8	13.4	0.38	0.25	77.1
All Vehicles		1248	5.5	0.847	14.7	NA	13.1	93.7	0.49	0.78	59.6

Peak operation condition (year 15 – 2028)

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	106	11.9	0.162	15.6	LOS B	0.8	5.8	0.51	0.83	48.3
23	R	607	3.3	1.781	734.9	LOS F	175.7	1264.9	1.00	6.60	3.7
Approach		714	4.6	1.783	627.8	LOS F	175.7	1264.9	0.93	5.74	4.0
North East: Denman Road (N)											
24	L	211	3.0	0.116	12.4	LOS A	0.0	0.0	0.00	0.75	52.3
25	T	351	2.1	0.182	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		561	2.4	0.182	4.7	LOS A	0.0	0.0	0.00	0.28	82.5
South West: Denman Road (S)											
31	T	442	6.7	0.410	4.8	LOS A	5.8	43.1	0.49	0.00	74.2
32	R	152	10.4	0.410	21.2	LOS B	5.8	43.1	0.84	1.10	59.0
Approach		594	7.6	0.410	9.0	LOS B	5.8	43.1	0.58	0.28	70.1
All Vehicles		1868	4.9	1.781	244.1	NA	175.7	1264.9	0.54	2.37	9.5

New England/ Thomas Mitchell – AM peak

Base case condition (2011)

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: New England Highway (S)											
4	L	289	6.9	0.164	13.2	LOS A	0.0	0.0	0.00	0.76	59.2
5	T	248	24.6	0.148	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		536	15.1	0.164	7.1	LOS A	0.0	0.0	0.00	0.41	77.3
North: New England Highway (N)											
11	T	451	10.3	0.246	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	112	3.8	0.184	17.1	LOS B	0.8	6.1	0.56	0.89	52.1
Approach		562	9.0	0.246	3.4	LOS B	0.8	6.1	0.11	0.18	88.9
West: Thomas Mitchell Drive											
1	L	33	0.0	0.044	15.1	LOS B	0.2	1.4	0.46	0.77	54.8
3	R	152	11.8	0.500	29.7	LOS C	2.8	21.7	0.84	1.04	49.6
Approach		184	9.7	0.500	27.1	LOS C	2.8	21.7	0.78	0.99	50.2
All Vehicles		1284	11.6	0.500	8.3	NA	2.8	21.7	0.16	0.39	75.7

Peak construction condition (2014).

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: New England Highway (S)											
4	L	419	5.3	0.234	13.1	LOS A	0.0	0.0	0.00	0.76	59.2
5	T	268	24.7	0.160	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		687	12.9	0.234	8.0	LOS A	0.0	0.0	0.00	0.46	74.5
North: New England Highway (N)											
11	T	486	10.4	0.266	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	120	3.5	0.243	19.3	LOS B	1.2	8.4	0.65	0.93	49.1
Approach		606	9.0	0.266	3.8	LOS B	1.2	8.4	0.13	0.18	87.7
West: Thomas Mitchell Drive											
1	L	35	0.0	0.053	15.8	LOS B	0.2	1.6	0.50	0.80	53.6
3	R	189	10.0	0.737	41.1	LOS C	5.1	38.5	0.93	1.16	41.2
Approach		224	8.5	0.736	37.2	LOS C	5.1	38.5	0.86	1.11	42.2
All Vehicles		1518	10.7	0.737	10.6	NA	5.1	38.5	0.18	0.45	70.5

Peak operation condition (year 15 – 2028)

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: New England Highway (S)											
4	L	537	5.5	0.300	13.1	LOS A	0.0	0.0	0.00	0.76	59.2
5	T	360	24.6	0.214	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		897	13.1	0.300	7.8	LOS A	0.0	0.0	0.00	0.45	74.9
North: New England Highway (N)											
11	T	653	10.3	0.357	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	162	3.9	0.469	26.3	LOS B	2.6	18.7	0.82	1.02	41.3
Approach		815	9.0	0.469	5.2	LOS B	2.6	18.7	0.16	0.20	83.8
West: Thomas Mitchell Drive											
1	L	47	0.0	0.090	17.6	LOS B	0.4	2.7	0.59	0.89	50.9
3	R	327	8.0	2.289	1210.7	LOS F	123.2	921.6	1.00	4.03	2.3
Approach		375	7.0	2.286	1059.9	LOS F	123.2	921.6	0.95	3.63	2.5
All Vehicles		2066	10.4	2.289	195.8	NA	123.2	921.6	0.23	0.93	11.3

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Intersection and peak period | **Base case condition (2011)** | **Peak construction condition (2014).** | **Peak operation condition (year 15 – 2028)**

New England/ Thomas Mitchell — PM peak

Base case condition (2011)

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: New England Highway (S)											
4	L	58	16.2	0.035	14.2	LOS A	0.0	0.0	0.00	0.77	59.2
5	T	434	10.7	0.238	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		492	11.6	0.238	1.7	LOS A	0.0	0.0	0.00	0.09	94.9
North: New England Highway (N)											
11	T	394	11.8	0.217	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	13	8.3	0.020	16.6	LOS B	0.1	0.6	0.50	0.77	53.5
Approach		406	11.7	0.217	0.5	LOS B	0.1	0.6	0.02	0.02	98.3
West: Thomas Mitchell Drive											
1	L	41	7.7	0.062	16.4	LOS B	0.3	2.0	0.49	0.80	53.8
3	R	215	11.8	0.605	29.2	LOS C	4.1	31.3	0.85	1.08	49.9
Approach		256	11.1	0.606	27.2	LOS C	4.1	31.3	0.79	1.04	50.3
All Vehicles		1154	11.5	0.605	6.9	NA	4.1	31.3	0.18	0.28	80.7

Peak construction condition (2014).

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: New England Highway (S)											
4	L	87	13.3	0.051	13.8	LOS A	0.0	0.0	0.00	0.76	59.2
5	T	468	10.8	0.257	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		556	11.2	0.257	2.2	LOS A	0.0	0.0	0.00	0.12	93.2
North: New England Highway (N)											
11	T	425	11.9	0.235	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	14	7.7	0.024	17.1	LOS B	0.1	0.7	0.52	0.79	52.6
Approach		439	11.8	0.235	0.5	LOS B	0.1	0.7	0.02	0.02	98.2
West: Thomas Mitchell Drive											
1	L	44	7.1	0.071	16.8	LOS B	0.3	2.3	0.52	0.83	53.1
3	R	338	8.1	1.000	79.8	LOS F	19.5	145.9	1.00	1.85	26.2
Approach		382	8.0	1.000	72.5	LOS F	19.5	145.9	0.94	1.73	27.3
All Vehicles		1377	10.5	1.000	21.2	NA	19.5	145.9	0.27	0.54	56.8

Peak operation condition (year 15 – 2028)

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: New England Highway (S)											
4	L	193	8.2	0.110	13.3	LOS A	0.0	0.0	0.00	0.76	59.2
5	T	628	10.7	0.345	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		821	10.1	0.345	3.1	LOS A	0.0	0.0	0.00	0.18	89.9
North: New England Highway (N)											
11	T	571	11.8	0.315	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	18	5.9	0.045	20.2	LOS B	0.2	1.3	0.67	0.91	48.1
Approach		588	11.6	0.315	0.6	LOS B	0.2	1.3	0.02	0.03	97.9
West: Thomas Mitchell Drive											
1	L	60	7.0	0.131	19.5	LOS B	0.6	4.2	0.64	0.91	49.2
3	R	428	8.4	2.316	1223.1	LOS F	160.4	1203.2	1.00	4.80	2.2
Approach		488	6.2	2.310	1075.2	LOS F	160.4	1203.2	0.96	4.32	2.4
All Vehicles		1090	10.1	2.316	278.3	NA	160.4	1203.2	0.25	1.20	8.9

Thomas Mitchell/ Drayton Mine Access — AM peak

Base case condition (2011)

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: Drayton Mine Access Road											
1	L	11	0.0	0.012	10.5	LOS A	0.1	0.4	0.38	0.66	48.1
3	R	52	2.0	0.074	11.8	LOS A	0.3	2.4	0.49	0.77	52.5
Approach		62	1.7	0.074	11.6	LOS A	0.3	2.4	0.47	0.75	52.1
East: Thomas Mitchell Drive (E)											
4	L	186	3.4	0.103	12.8	LOS A	0.0	0.0	0.00	0.76	48.6
5	T	217	9.7	0.118	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		403	6.8	0.118	5.9	LOS A	0.0	0.0	0.00	0.35	78.2
West: Thomas Mitchell Drive (W)											
11	T	140	13.5	0.078	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	35	9.1	0.048	15.4	LOS B	0.2	1.6	0.45	0.76	44.4
Approach		175	12.7	0.078	3.1	LOS B	0.2	1.6	0.09	0.15	89.6
All Vehicles		640	7.9	0.118	5.7	NA	0.3	2.4	0.07	0.33	77.0

Peak construction condition (2014).

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: Drayton Mine Access Road											
1	L	58	1.8	0.073	11.2	LOS A	0.3	2.3	0.44	0.73	47.1
3	R	77	1.4	0.154	14.5	LOS B	0.7	4.8	0.62	0.88	49.9
Approach		135	1.6	0.154	13.1	LOS B	0.7	4.8	0.54	0.82	49.1
East: Thomas Mitchell Drive (E)											
4	L	293	2.2	0.160	12.7	LOS A	0.0	0.0	0.00	0.76	48.6
5	T	234	9.9	0.128	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		526	5.6	0.160	7.1	LOS A	0.0	0.0	0.00	0.42	73.4
West: Thomas Mitchell Drive (W)											
11	T	152	13.2	0.084	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	233	1.8	0.352	17.2	LOS B	2.1	15.0	0.59	0.93	41.0
Approach		384	6.3	0.352	10.4	LOS B	2.1	15.0	0.36	0.56	64.2
All Vehicles		1045	5.3	0.352	9.1	NA	2.1	15.0	0.20	0.52	65.4

Peak operation condition (year 15 – 2028)

Operational case not modelled as it would be similar to the base case.

Thomas Mitchell/ Drayton Mine Access — PM peak

Base case condition (2011)

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: Drayton Mine Access Road											
1	L	9	11.1	0.010	9.9	LOS A	0.0	0.3	0.17	0.63	49.6
3	R	67	3.1	0.075	10.3	LOS A	0.3	2.5	0.36	0.69	54.0
Approach		77	4.1	0.075	10.3	LOS A	0.3	2.5	0.34	0.68	53.7
East: Thomas Mitchell Drive (E)											
4	L	18	0.0	0.010	12.6	LOS A	0.0	0.0	0.00	0.76	48.6
5	T	61	13.8	0.034	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		79	10.7	0.034	2.9	LOS A	0.0	0.0	0.00	0.17	89.7
West: Thomas Mitchell Drive (W)											
11	T	189	12.2	0.105	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	1	0.0	0.001	12.7	LOS A	0.0	0.0	0.17	0.67	47.5
Approach		191	12.2	0.105	0.1	LOS A	0.0	0.0	0.00	0.00	99.7
All Vehicles		346	10.0	0.105	3.0	NA	0.3	2.5	0.06	0.19	82.7

Peak construction condition (2014).

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: Drayton Mine Access Road											
1	L	207	1.0	0.209	9.5	LOS A	1.0	6.9	0.21	0.65	49.3
3	R	174	1.2	0.210	10.9	LOS A	1.0	7.4	0.45	0.75	53.3
Approach		381	1.1	0.209	10.2	LOS A	1.0	7.4	0.32	0.69	51.8
East: Thomas Mitchell Drive (E)											
4	L	43	0.0	0.023	12.6	LOS A	0.0	0.0	0.00	0.76	48.6
5	T	62	13.6	0.035	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		105	8.0	0.035	5.2	LOS A	0.0	0.0	0.00	0.31	80.8
West: Thomas Mitchell Drive (W)											
11	T	204	12.4	0.113	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
12	R	48	2.2	0.045	13.0	LOS A	0.2	1.5	0.21	0.69	47.2
Approach		253	10.4	0.113	2.5	LOS A	0.2	1.5	0.04	0.13	90.9
All Vehicles		739	5.3	0.210	6.8	NA	1.0	7.4	0.18	0.45	66.4

Peak operation condition (year 15 – 2028)

Operational case not modelled as it would be similar to the base case.

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4.3.2 Assessment of proposed intersection improvement measures

Denman Road/ Thomas Mitchell Drive intersection

It is understood that Mt Arthur Coal have committed to upgrading the Denman Road/ Thomas Mitchell Drive intersection to a seagull configuration with a channelised right turn bay into Thomas Mitchell Drive, as well as an acceleration lane for right-turns out of Thomas Mitchell Drive. A typical seagull configuration is shown in Figure 15.

The indented nature of the right-turn lane into Thomas Mitchell Drive would mean that any queues that form in this lane would not affect the eastbound through direction of Denman Road. Similarly, the physical separation of the acceleration lane (from the right-turn from Thomas Mitchell Drive) means that right-turning traffic from this approach only need to give way to the westbound through movement and the right-turn movement from Denman Road to Thomas Mitchell Drive. Some assumptions were made regarding the dimensions and lengths of each of the turning lanes for the purposes of the SIDRA assessment.

Figure 15 Typical seagull T intersection configuration with channelization

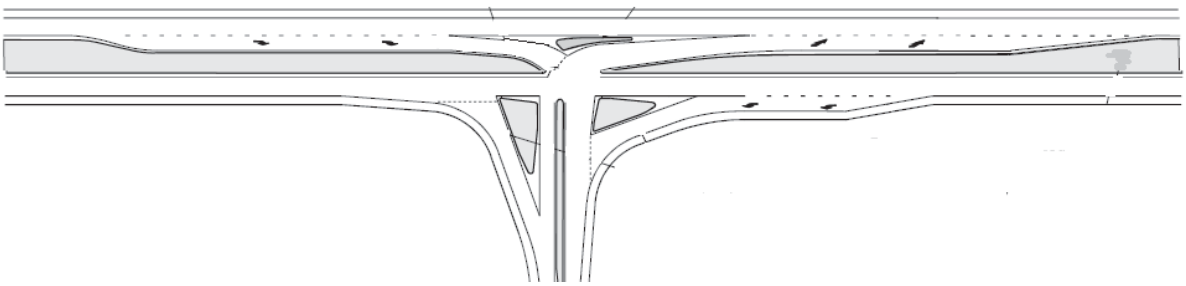


Table 14 shows the SIDRA results for the seagull configuration. It should be noted that the eastbound through movement was not included in this model because there is no interaction of this traffic with the rest of the turning movements at the intersection. This is with the exception of the downstream merge where right-turning traffic from Thomas Mitchell Drive enters the eastbound through traffic stream. The eastbound through movements are predicted to consist of 190 vehicles/hour and 420 vehicles/hour for the AM and PM peaks respectively (in the peak operations phase). These generally offer good absorption capacity for the entering right-turn volumes of 280 vehicles/hour and 577 vehicles/hour.

From Table 14, it is evident that a seagull configuration would be effective in addressing the modelled delay and queuing problems. The maximum queue lengths are in the order of 7 m which is a vast improvement compared with that modelled for the peak operations phase. As Mt Arthur Coal have already committed to the upgrade of this intersection in this manner, there are no further mitigation measures proposed as part of this study.

Table 14 SIDRA results for the proposed seagull configuration for the Denman Road/ Thomas Mitchell Drive intersection

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	182	8.7	0.104	13.6	NA[9]	NA[9]	NA[9]	0.00	0.76	43.2
23	R	295	3.6	0.504	21.2	LOS B	3.7	26.4	0.81	1.06	52.0
Approach		477	5.5	0.504	18.3	LOS B	3.7	26.4	0.50	0.94	49.9
North East: Denman Road (N)											
24	L	936	3.1	0.515	12.7	NA[9]	NA[9]	NA[9]	0.00	0.69	58.9
25	T	463	3.6	0.243	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		1399	3.3	0.515	8.5	LOS A	0.0	0.0	0.00	0.46	72.0
South West: Denman Road (S)											
32	R	193	7.1	0.188	15.2	LOS B	1.1	7.9	0.56	0.81	60.7
Approach		193	7.1	0.187	15.2	LOS B	1.1	7.9	0.56	0.81	60.7
All Vehicles		2068	4.2	0.515	11.4	NA	3.7	26.4	0.17	0.61	64.1

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	106	11.9	0.062	13.7	NA[9]	NA[9]	NA[9]	0.00	0.76	43.3
23	R	607	3.3	0.590	17.0	LOS B	6.6	47.7	0.71	1.05	56.4
Approach		714	4.6	0.590	16.5	LOS B	6.6	47.7	0.61	1.01	55.2
North East: Denman Road (N)											
24	L	211	3.0	0.116	12.6	NA[9]	NA[9]	NA[9]	0.00	0.69	59.1
25	T	351	2.1	0.182	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		561	2.4	0.182	4.7	LOS A	0.0	0.0	0.00	0.26	84.1
South West: Denman Road (S)											
32	R	152	10.4	0.131	14.7	LOS B	0.8	5.7	0.47	0.75	61.5
Approach		152	10.4	0.131	14.7	LOS B	0.8	5.7	0.47	0.75	61.5
All Vehicles		1426	4.4	0.590	11.7	NA	6.6	47.7	0.35	0.69	64.4

Note: Top table is the AM peak and bottom table is the PM peak.

New England Highway/ Thomas Mitchell Drive intersection

It is understood that Mt Arthur Coal have committed to upgrading the New England Highway/ Thomas Mitchell Drive intersection to a seagull configuration with a channelised right turn bay into Thomas Mitchell Drive, as well as an acceleration lane for right-turns out of Thomas Mitchell Drive. A typical seagull configuration is shown in Figure 15.

The SIDRA model results for the seagull concept are shown in Table 15. It should be noted that the southbound through movement was not included in this model because there is no interaction of this traffic with the rest of the turning movements at the intersection. This is with the exception of the downstream end where the right-turn acceleration lane merges with the through carriageway. The southbound through movements are predicted to consist of 620 vehicles/hour and 542 vehicles/hour for the AM and PM peaks respectively (in the peak operations phase). These generally offer good absorption capacity for the entering right-turn volumes of 311 vehicles/hour and 407 vehicles/hour respectively.

From Table 15, it is evident that a seagull intersection would effectively cater for the capacity demands during the peak operations phase. As Mt Arthur Coal have already committed to the upgrade of this intersection in this manner, there are no further mitigation measures proposed as part of this study.

Table 15 SIDRA results for the proposed seagull configuration for the New England Highway/ Thomas Mitchell Drive intersection

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: New England Highway (S)											
24	L	537	5.5	0.300	12.8	NA[9]	NA[9]	NA[9]	0.00	0.69	59.0
25	T	360	24.6	0.214	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		897	13.1	0.300	7.7	LOS A	0.0	0.0	0.00	0.42	75.0
North: New England Highway (N)											
32	R	162	3.9	0.137	14.3	LOS A	0.8	5.7	0.49	0.76	61.4
Approach		162	3.9	0.137	14.3	LOS A	0.8	5.7	0.49	0.76	61.4
West: Thomas Mitchell Drive											
21	L	47	0.0	0.026	13.1	NA[9]	NA[9]	NA[9]	0.00	0.76	43.3
23	R	327	8.0	0.438	18.3	LOS B	3.3	24.8	0.71	1.01	55.3
Approach		375	7.0	0.438	17.7	LOS B	3.3	24.8	0.62	0.98	54.4
All Vehicles		1434	10.5	0.438	11.0	NA	3.3	24.8	0.22	0.60	66.0

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: New England Highway (S)											
24	L	193	8.2	0.110	13.0	NA[9]	NA[9]	NA[9]	0.00	0.69	59.1
25	T	628	10.7	0.345	0.0	LOS A	0.0	0.0	0.00	0.00	100.0
Approach		821	10.1	0.345	3.1	LOS A	0.0	0.0	0.00	0.16	90.0
North: New England Highway (N)											
32	R	18	5.9	0.020	15.5	LOS B	0.1	0.8	0.56	0.75	60.2
Approach		18	5.9	0.020	15.5	LOS B	0.1	0.8	0.56	0.75	60.2
West: Thomas Mitchell Drive											
21	L	60	7.0	0.034	13.5	NA[9]	NA[9]	NA[9]	0.00	0.76	43.3
23	R	428	8.4	0.528	18.6	LOS B	4.7	35.6	0.73	1.05	55.0
Approach		488	8.2	0.529	18.0	LOS B	4.7	35.6	0.64	1.02	54.2
All Vehicles		1327	9.4	0.528	8.7	NA	4.7	35.6	0.24	0.49	72.0

Note: Top table is the AM peak and bottom table is the PM peak.

4.4 MIDBLOCK TRAFFIC VOLUMES ON THOMAS MITCHELL DRIVE

An assessment was carried out of the vehicle-kilometres-travelled (VKT) generated by Drayton South compared with other non-Project-related traffic. VKT is a measure of usage of a road as it accounts for both the volume of traffic generated, as well as the distance that the traffic travels along a road. The following methodology and assumptions were used to determine the VKTs generated by the Project versus that generated by other sources:

- The highest volume hour of the day was determined from the intersection turning movement surveys described in Section 2.3.2. The review of traffic data indicated the following highest volume hours of the day for Thomas Mitchell Drive:
  - Immediately south of Denman Road: 817 vehicles/hour (0600h to 0700h);
  - Immediately west of Drayton Mine Access Road: 382 vehicles/hour (0600h to 0700h); and
  - Immediately east of Drayton Mine Access Road: 565 vehicles/hour (0615h to 0715h).
  - Immediately west of New England Highway: 556 vehicles/hour (0615h to0715h).
- From experience with other coal mining projects in the area, the highest volume hour of the day is typically 15% to 20% of the total daily traffic volume (ADT). This study assumed that the highest volume hour was equivalent to 16% of the ADT. As such, this was used to determine the ADTs for each respective section. These derived volumes are:
  - 5,170 vehicles/day between Denman Road and Glen Munro Road;
  - 2,400 vehicles/day between Glen Munro Road and Drayton Mine Access Road; and
  - 3,500 vehicles/day between Drayton Mine Access Road and New England Highway.
- The percentage of traffic that are heavy vehicles was assumed to be the same as the intersection turning movement surveys described in Section 2.3.2. It should be noted that there were three AM hours surveyed (0600h to 0900h) and three PM hours surveyed (1600h to 1700h). From these, the following heavy vehicle proportions were noted:
  - 11% heavy vehicles between Denman Road and Glen Munro Road;
  - 14% to 17% heavy vehicles between Glen Munro Road and Drayton Mine Access Road; and
  - 12% heavy vehicles between Drayton Mine Access Road and New England Highway.
- It was assumed that the traffic volumes were uniform in the three sections as follows:
  - Between Denman Road and Glen Munro Road (2.7 km);
  - Between Glen Munro Road and Drayton Mine Access Road (7.2 km); and
  - Between Drayton Mine Access Road and New England Highway (1.1 km).
- Using the derived ADTs and the lengths of each planning section, the VKTs for the existing conditions were determined as follows:
  - 13,950 VKTs/day between Denman Road and Glen Munro Road;
  - 17,200 VKTs/day between Glen Munro Road and Drayton Mine Access Road;
  - 3,900 VKTs/day between Drayton Mine Access Road and New England Highway; and
  - For a total of 35,000 VKTs/day along the route.

- Using the heavy vehicle percentages for each of the sections, the following VKTs were determined for heavy vehicle traffic:
  - 1,500 heavy vehicle VKTs/day between Denman Road and Glen Munro Road;
  - 2,950 heavy vehicle VKTs/day between Glen Munro Road and Drayton Mine Access Road;
  - 480 heavy vehicle VKTs/day between Drayton Mine Access Road and New England Highway; and
  - For a total of 5,000 heavy vehicle VKTs/day along the route.
- 665 vehicles were recorded along Drayton Mine Access Road during the six hours of intersection turning movement surveys in May 2011. It was assumed that this volume represented 70% of the total daily traffic volume for Drayton Mine Access Road. This equates to an ADT of 1,000 vehicles/day for Drayton Mine Access Road.
- The intersection turning movement surveys indicated that the relative distribution of Drayton Mine Access Road traffic is 80% to the east and 20% to the west. It was assumed that all traffic would travel to each respective end of Thomas Mitchell Drive, and would not have a destination or origin within another area along Thomas Mitchell Drive. Based on this distribution, the derived ADT for Drayton Mine Access Road, and the road distances to the New England Highway (1.1km) and Denman Road (9.9km), the following VKTs were determined for Drayton South traffic:
  - 2860 VKTs/day; and
  - 200 heavy vehicle VKTs/day based on 7% heavy vehicles (consistent with the turning movement surveys).
- As such, the Project would generate approximately 8.2% of the daily VKTs along Thomas Mitchell Drive. It would also generate approximately 4% of the daily heavy vehicle VKTs along Thomas Mitchell Drive.

It should be noted that the analysis described above is the comparison of VKTs generated by the Project compared with other non-Project-related traffic for the *existing* traffic volumes/conditions. It was not possible to accurately determine the proportion of Project VKTs versus the total traffic volumes generated under the cumulative worst case scenario. This was due to the lack of daily traffic volume information for other mining projects. That is, although there was information sourced from other studies on the number of peak hour trips generated by those other mining projects, there was no information available on total daily traffic volumes generated.

5 ROAD SAFETY

5.1 THOMAS MITCHELL DRIVE

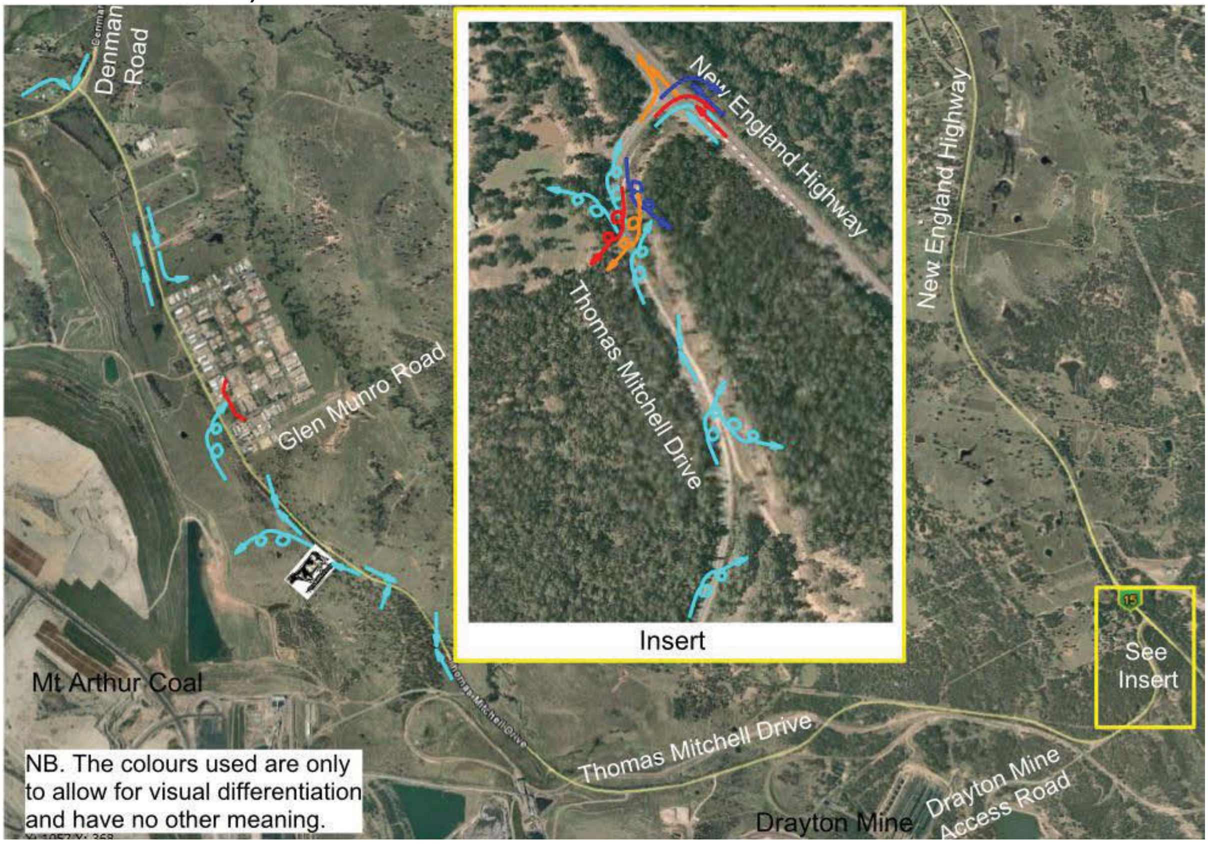
5.1.1 Existing conditions

During the five-year period between 1 July 2005 and 30 June 2010 (the latest five-year period for which there is fully validated crash data), there were a total of 25 crashes on Thomas Mitchell Drive between Denman Road and the New England Highway. The key trends and characteristics of these crashes are as follows:

- Of the 25 crashes, 11 (44%) were injury crashes and 14 (56%) were towaway crashes. The 11 injury crashes resulted in 17 casualties. None of the reported crashes resulted in a fatality;
- The 25 crashes equates to 0.45 crashes/year/km, or 36.1 crashes per 100 million vehicle kilometres travelled (MVKT);
- 13 crashes (52%) crashes involved a heavy vehicle as either the primary vehicle or secondary vehicle involved in the crash;
- Eight crashes (32%) occurred during wet weather conditions;
- 12 crashes (48%) occurred when the road surface was wet;
- 11 crashes (44%) were single vehicle loss-of-control crashes. Six of these crashes involved an impact with a roadside object; and
- The highest risk period of the day was between 0600h and 0800h where a combined total of seven crashes (28%) occurred.

A collision diagram for Thomas Mitchell Drive is shown in Figure 16. This diagram shows the location of all crashes on Thomas Mitchell Drive for the five-year dataset period. This indicates that the highest risk areas for the route is the section of Thomas Mitchell Drive from 0 m to 500 m west of the New England Highway. In this section, there were a total of eight loss-of-control crashes and one head-on crash. A site inspection carried out on 11 April 2011 revealed that this section contains two horizontal curves on approach to the New England Highway intersection. REDUCE SPEED and T INTERSECTION AHEAD warning signs have been provided in recognition of the reduced sight distance due to these horizontal curves. Thomas Mitchell Drive is also on a downhill grade as it approaches New England Highway (see Plate 10).

Figure 16 Collision diagram for Thomas Mitchell Drive (between 1 July 2005 and 30 June 2010)



Note: Arrows indicate direction of travel and nature of collision.

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Plate 10 Thomas Mitchell Drive

Notes: (top) REDUCE SPEED warning sign on left-hand curve approximately 400m west of New England Highway, (middle) T INTERSECTION AHEAD warning sign on right-hand curve approximately 100m west of New England Highway, (bottom) downhill grade on approach to New England Highway.

Other existing safety issues identified during the site visit included:

- An unprotected culvert on the south eastern corner of the Denman Road/ Thomas Mitchell Drive intersection as noted in Section 2.2.2;

- Poor pavement condition with heavy patching throughout the entire section of Thomas Mitchell Drive between Denman Road and New England Highway; and
- Poor line marking and delineation at the Thomas Mitchell Drive/ Drayton Mine Access Road intersection.

As these are existing safety deficiencies, it is recommended that these be referred to MSC for consideration.

5.1.2 Safety risks during the construction phase

As noted in Section 3.1 (Table 2), the construction phase of the project will result in the generation of 2,755 additional truck visits which equates to 5,510 truck trips when accounting for both inbound and outbound directions. This would take place over a 29-month period with a maximum of 540 truck movements per month.

Similar to the findings in Section 4.4, it is unlikely that the construction phase will generate a substantial number of VKTs along Thomas Mitchell Drive, as most of the traffic is likely to come from the New England Highway. As such, the majority of traffic would use the 1.1km section of Thomas Mitchell Drive between New England Highway and Drayton Mine Access Road.

Also noted in Section 3.1, an additional 369 personnel will be travelling to the Project during the construction phase. Most traffic will access and egress the site via the section of Thomas Mitchell Drive between the New England Highway and Drayton Access Road. As such, they would be exposed to the curvilinear section between 0m to 500m west of New England Highway which has experienced a high frequency of loss-of-control crashes.

5.1.3 Impacts during operations phase

As noted in Section 3.2, there would not be any substantial increase in road traffic accessing the site during the operations phase given that the Project is regarded as a continuation of the existing Drayton Mine. As such, there would be negligible net safety impacts other than extending the period over which traffic is generated to and from the site. This includes the continued exposure to the curvilinear section of Thomas Mitchell Drive between 0m and 500 m from New England Highway.

5.2 EDDERTON ROAD

During the five-year period between 1 July 2005 and 30 June 2010 (the latest five-year period for which there is fully validated crash data), there were a total of 12 crashes on Edderton Road between Denman Road and the Golden Highway. The key trends and characteristics of these crashes are as follows:

- Of the 12 crashes, eight (67%) were injury crashes and four (33%) were tow-away crashes. The eight injury crashes resulted in 10 casualties. None of the crashes resulted in a fatality[1];
- The 12 crashes equates to 0.16 crashes/year/km, or 57 per 100MVKT;
- Seven crashes (58%) involved a heavy vehicle as either the primary or secondary vehicle involved in the crash; and
- Eight crashes (67%) were single vehicle loss-of-control crashes. Six of these crashes involved an impact with a roadside object. Road side drains (three) and trees (three) were the most common objects impacted.

A collision diagram for Edderton Road is shown in Figure 17. This diagram shows the location of all crashes on Edderton Road for the five-year dataset period. This indicates that there are no distinct crash clusters but rather than there are route-wide patterns. These include the prominence of loss-of-control crashes along the route and the risk of impact with road side objects.

[1] Although outside the crash dataset period, a fatal crash event occurred on Edderton Road on 5 August 2011. There are limited details available regarding the crash event and this event has not been captured in the fully validated crash dataset.

Figure 17 Collision diagram for Edderton Road (1 July 2005 and 30 June 2010)

Note: Arrows indicate direction of travel and nature of collision.

A site inspection was carried out on 11 April 2011 and revealed a number of safety deficiencies along the route including:

- Poor stopping sight distance from westbound traffic on the Golden Highway towards queued traffic waiting to turn right into Edderton Road. The sight obstruction is due to a crest vertical curve, a horizontal curve, and a cutting slope with little sight bench provided. It is noted that this intersection will be closed down due to the proposed realignment of Edderton Road and the associated relocation of the Golden Highway/ Edderton Road intersection approximately 5km to the west;
- Poor gap acceptance sight distance (equivalent to approximately six seconds of travel at 100km/h) from the “hold line” of Edderton Road towards westbound traffic on the Golden Highway. The RTA’s Road Design Guide states that the minimum acceptable gap acceptance sight distance is five seconds, with a desirable minimum of 14 seconds (RTA, 2000). Similarly, this problem will cease to exist due to the proposed relocation of the Golden Highway/ Edderton Road intersection;
- There is no posted speed limit for the route which means it defaults to the general rural speed limit of 100km/h. There are several safety features which make this route unsuitable for travel at 100km/h as detailed below;
- The pavement seal is of poor quality with
    - (i) a narrow sealed width of 5.7 to 6.3 m and frequent cracked edges and no formalised shoulders; and
    - (ii) heavy patching across the route. The narrow sealed width would increase loss-of-control crash risk as there would be less pavement width available (including the shoulder) for the driver to regain control. Narrow sealed widths also increase the risk of head-on crashes. It is noted that eight of the 12 crashes that occurred on this route during the crash dataset period were loss-of-control or head-on crashes; and
- The Saddlers Creek crossing is via a floodway which contains a deep sag vertical curve (Plate 11). Although there is a DIP advanced warning sign and a 65 km/h advisory speed limit, the vertical geometry of this sag curve makes it unsuitable for travel at 100 km/h. A 35 km/h differential between the speed limit and the advisory speed limit is not considered an acceptable gap. The proposed realignment of Edderton Road will bypass this floodway and would present opportunities for providing an improved alignment.

Plate 11 Edderton Road

Note: Plate shows sag vertical curve and poor pavement condition in approach to the Saddlers Creek floodway.

As noted in the crash data analysis findings (refer also to collision diagram in Figure 17 and example in Plate 12), the route has a high frequency of trees within the clear zone.

Plate 12 Trees in the clear zone

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5.3 ROAD TRAFFIC MITIGATION AND MANAGEMENT MEASURES

5.3.1 Thomas Mitchell Drive

As stated previously, Mt Arthur Coal are committed through Project Approval 09_0062 to carry out upgrades along Thomas Mitchell Drive including converting the intersections with Denman Road and the New England Highway to seagull configurations. Both of the proposed intersection upgrades would also offer improved road safety performance at the intersections by simplifying the decision making requirements for right-turning traffic from the side road. As Mt Arthur Coal has made a commitment to upgrading the intersections in this manner, no further mitigation measures have been recommended.

5.3.2 Proposed Edderton Road realignment

As discussed in Section 2.1.5, the proposed Blakefield and Redbank mining areas will mine through the section of Edderton Road to the south of Saddlers Creek. As such, the Project will include a 7 km realignment of Edderton Road. Approximately 3.6 km of the realigned road will pass through Drayton South, with the remaining portion located within the HVEC – Mt Arthur Coal owned property.

The realignment will pass to the west of the current alignment of Edderton Road and will run in an approximate south west direction where it will meet the Golden Highway approximately 5km west of the existing Golden Highway/ Edderton Road intersection (see Figure 2). The tie-in point to the existing route at the northern end will be located approximately 1 km south of the Edderton Road/ McDonalds Road intersection.

The realigned section of road has been designed in accordance with the RMS Road Design Guide (RTA, 2000) for a typical two-lane, two-way rural road with a design speed of 100 km/h, providing an improved transport route. The road will have 3 m wide lanes, 1.3 m wide shoulders, and 1 m and 2 m wide verges in fill embankment and cut sections respectively. Multiple culvert-under-causeway-type structures will be provided at low points along the road, as required, to satisfy surface hydrology requirements and to provide an improved vertical alignment of the road.

The proposed realignment of Edderton Road will be designed in consultation with MSC. It will complement the already approved realignment of the northern section of Edderton Road being undertaken by HVEC. Discussions will also be held with the RMS regarding the design of the Golden Highway/ Edderton Road intersection as described in Section 5.2.

It is proposed that part of the existing Edderton Road will be maintained as a light vehicle emergency access road for the Project (see Figure 2).

The proposed realignment of Edderton Road will effectively address the following road safety issues identified from the crash data analysis and site inspection:

- The new location of the Golden Highway/ Edderton Road intersection, is in less undulating environment compared with the existing intersection. As seen in Plate 13, the new intersection location will offer improved gap acceptance sight distances from the Edderton Road approach to both eastern and western approaches of the Golden Highway. The site inspection indicated that a gap acceptance sight distance of 10 seconds to 11 seconds (of travel at an approach speed of 100 km/h) towards oncoming traffic from the west would be available. The corresponding sight distance towards traffic from the east would be in excess of 25 seconds. This significantly exceeds the gap acceptance sight distance at the existing intersection which is six seconds. It also exceeds the Road Design Guide (RTA, 2000) absolute minimum sight distance of five seconds, and is closer to the desirable minimum of 14 seconds.

Plate 13 Gap acceptance sight distances from the proposed new Edderton Road

Note: (left) approach towards the east and (right) looking towards the west.

- The new intersection will also offer improved sight lines associated with stopping sight distance (i.e. sight distance required by Golden Highway traffic to see and stop in time to avoid a collision with queued traffic at the intersection), and safe intersection sight distance (i.e. the mutual sight distance required between drivers on adjacent approaches of the intersection).
- The new road will resolve many of the issues along the existing alignment with respect to poor pavement condition. A minimum pavement sealed width of 6.6 m will be provided which is superior to the existing width of 5.7 m to 6.3 m. This will provide improved safety with regard to the passing clearance between opposing vehicles and hence reduced *head-on* crash risk. Furthermore, a 1.3 m unsealed (but traversable) shoulder would be provided outside the edge of seal and would provide more space for errant vehicles to recover. It is noted that four of the 12 crashes in the five-year dataset occurred in the section of Edderton Road that will be bypassed by the realignment. As such, the pavement and shoulder widths proposed for the realignment would have the potential to address these crash risks.

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- The new road realignment will pass to the west of the Saddlers Creek valley and hence will not have similar geometric deficiencies as the existing route's floodway and dip. A tributary of Saddlers Creek will cross the route approximately 1.3 km north of the Golden Highway, but a fill embankment is proposed to remove the sag vertical curve at that location.

The following management measures are recommended to address the road safety issues discussed in this section.

1. The design for the Edderton Road realignment should be developed in consultation with MSC and the RMS; and
2. The design and construction of the road should be subjected to an appropriate schedule of road safety audits with particular attention on the transition between old and new infrastructure.

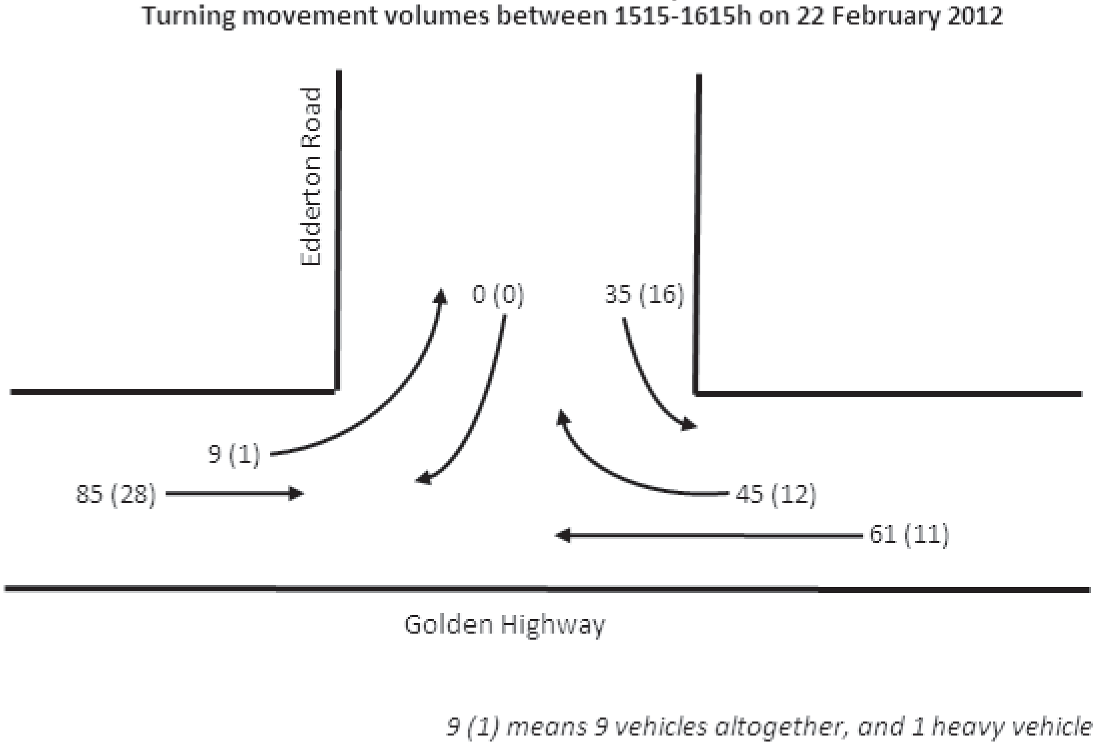
5.3.3 Adequacy of the proposed new Golden Highway/ Edderton Road intersection

As stated in Section 5.2.2, the southern-most 7 km of Edderton Road will be realigned to the west and will result in the relocation of the Golden Highway/ Edderton Road intersection to approximately 5 km west of its current location. The new intersection would be a channelized right turn (CHR) configuration consisting of an indented and protected right-turn lane on the Golden Highway. This intersection will also offer improved sight lines compared with the existing location.

The proposed CHR configuration was assessed for adequacy by considering the traffic volumes at the intersection during the highest volume hours. A series of tube surveys carried out from 6 to 12 February 2012 on each approach of the current intersection indicated that the most common highest volume hour for these approaches was between 1500-1700h. An intersection turning movement survey carried out on 22 February 2012 also confirmed that the highest volume hour was between 1515h and 1615h. The turning movement volumes noted in this hour have been illustrated in Figure 18.

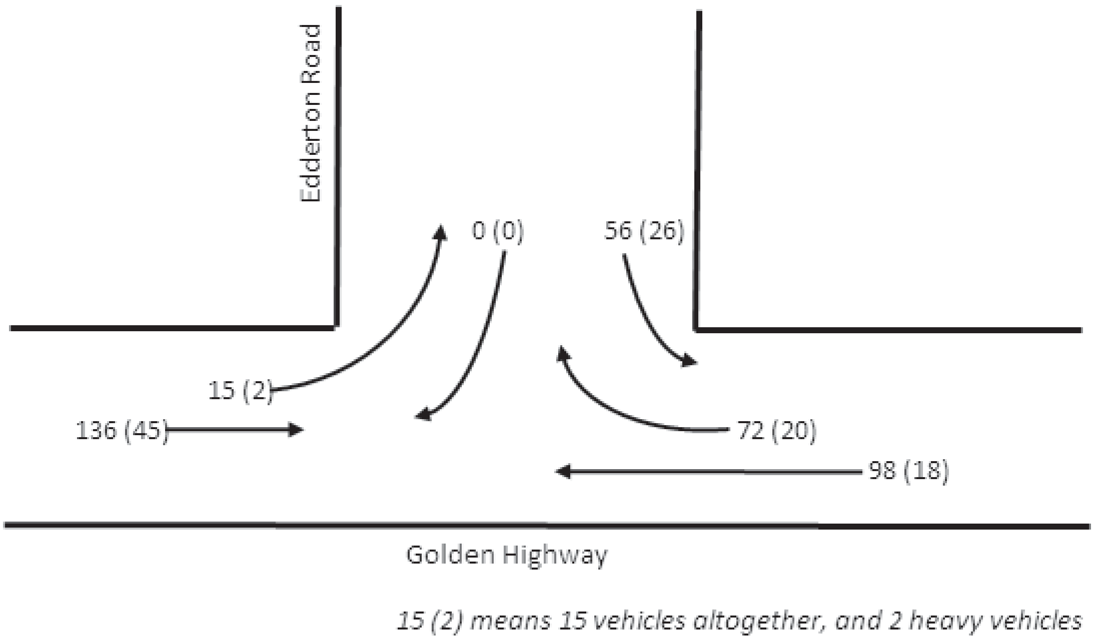
The 24-hour tube count surveys conducted between 6 and 12 February 2012 showed that the midblock traffic volumes for the 1500h to 1600h period (closest time period to the 1515h to1615h highest volume hour noted in the 22 February 2012 turning movement survey) were up to 1.6 times higher than the traffic volumes recorded in the turning movement survey. As such, the volumes in Figure 18 were increased by a factor of 1.6 to serve as a highest case scenario. These adjusted volumes are shown in Figure 19.

Figure 18 Golden Highway/ Edderton Road intersection turning movement volumes between 1515h and 1615h on 22 February 2012



Note: Figures in vehicles/hour.

Figure 19 Golden Highway/ Edderton Road intersection highest case turning movement volumes



Note: With 1.6 adjustment factor applied.

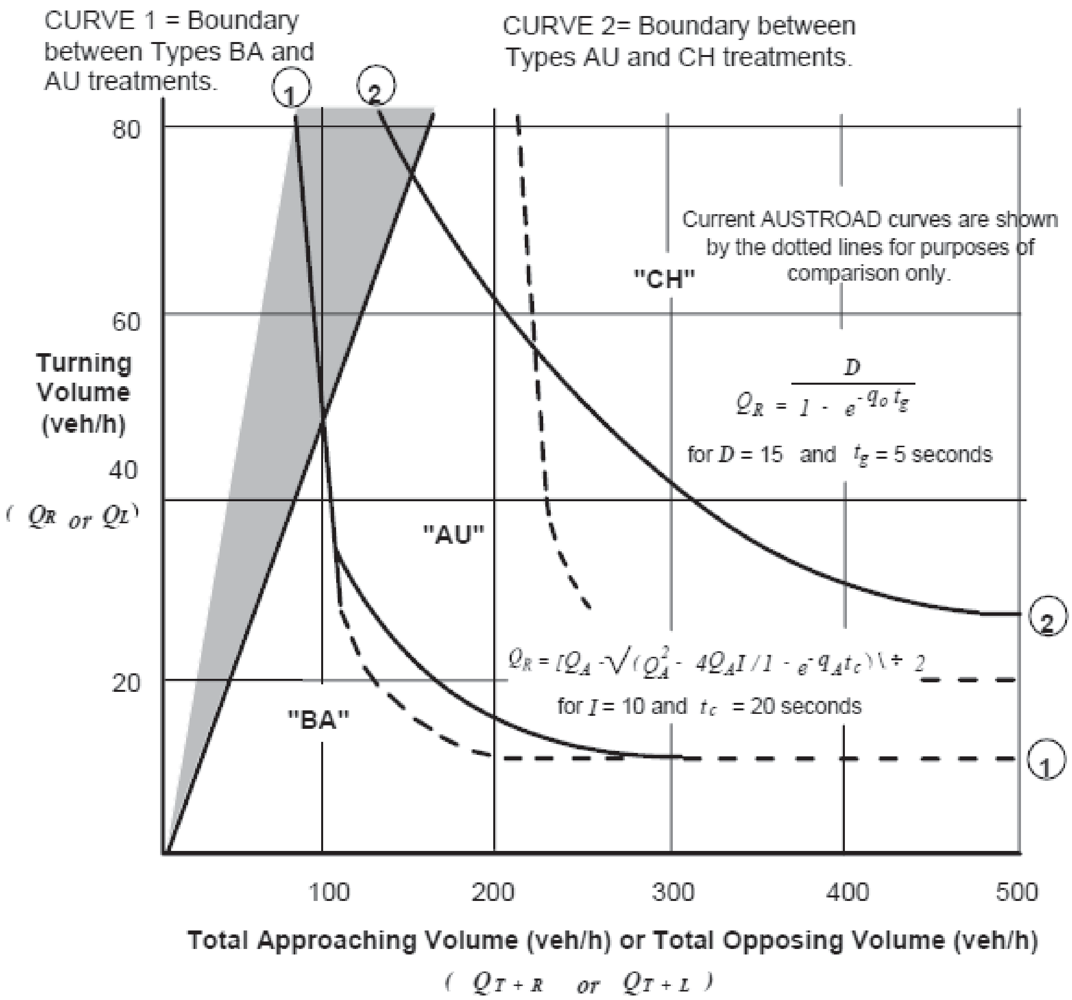
Adequacy with respects to warrants for turning facilities

RTA (2000) provides a chart for determining warrants for rural intersection turning facilities as shown in Figure 20. This chart compares the number of right-turning vehicles (Q_R) to the opposing traffic volume (Q_{T+L}) to then advise on the warrants for either:

(i) A basic right turn (BAR) facility with no formal passing opportunities;
(ii) An auxiliary lane (AUR); or
(iii) A channelised, indented right turn lane (CHR).

From Figure 18, the values for Q_R and Q_{T+L} would be 45 vehicles/hour and 94 vehicles/hour respectively. From Figure 19 (accounting for the 1.6 adjustment factor), these figures would increase to 72 vehicles/hour and 151 vehicles/hour respectively. Both sets of figures have been plotted in Figure 20 as points X and Y respectively.

Figure 20 Warrants for rural turning lane facilities



Source: RTA, 2000

As seen in Figure 20, the assessment of right-turn movements into Edderton Road versus the opposing through and left turn movements on Golden Highway indicate that the intersection should either have a BAR or AUR configuration. As such, the proposed CHR configuration exceeds the minimum warrants in this regard.

Adequacy with respects to absorption capacity and intersection performance

Austroads (1988) describes the concept of *practical absorption capacity* as a means of assessing the likely performance of a priority controlled intersection. Practical absorption capacity refers to the ability of a major road to absorb the traffic entering from the minor road. It considers the prevailing traffic volumes on the major road, as well as the gap acceptance requirements of the traffic of the turning movements from the minor road.

Austroads (1988) indicates that a major road carrying 140 vehicles/hour in each lane (figure conservatively adopted from Figure 19), would be able to absorb an additional 800 vehicles/hour. As this greatly exceeds the turning movement volumes from Edderton Road, this strongly indicates that there is ample spare capacity at this intersection, and there are no further upgrades necessary to meet the traffic volume demands.

5.3.4 Traffic access and thoroughfare during construction

As most of the road construction works associated with the Edderton Road realignment are "off-line", there would be limited impact to the access and thoroughfare along the existing route during construction. The existing route would remain operational until the realigned section is constructed and open to traffic.

The two most critical work locations will be the northern and southern tie-in points. The northern tie-in point, located on Edderton Road approximately 1 km south of McDonalds Road may require some lane/ road occupancy for pavement works and earthworks. Similarly, the southern tie-in point, a new T intersection with the Golden Highway and the realigned section of Edderton Road would also require lane occupancy on the Golden Highway.

To manage the thoroughfare requirements along Edderton Road and the Golden Highway, it is proposed that Traffic Control Plans (TCPs) be prepared in consultation with MSC and RMS. These TCPs would provide an acceptable traffic management measure to maintain thoroughfare and access along these two roads, whilst providing the required safety conditions for road workers including plant and vehicles entering and egressing from the "off-line" works.

5.3.5 Travel times

The realigned section of Edderton Road is similar in road length to the existing section that will be bypassed by the realignment. Furthermore, with improved road geometry and sealed width, it is likely to better operate at the default 100 km/h speed limit. Therefore, there should be minimal impacts (and possibly even an improvement) to the travel time due to the realignment itself. However, as stated above, the new Golden Highway/Edderton Road intersection will be approximately 5 km west of the existing intersection. Edderton Road traffic heading to/from the east along the Golden Highway will therefore be required to travel this extra distance. Conversely, traffic heading to/from the west along the Golden Highway will have their trips shortened by 5 km. This is likely to result in three to four minutes of additional/reduced travel time respectively. This is not considered to be significant and as such, no mitigation measures have been recommended in these respects.

It is acknowledged that Mt Arthur Coal is planning to realign a section of Edderton Road further to the north. This is also unlikely to significantly impact travel times.

6 RAIL NETWORK IMPACTS

The assessment of rail network impacts to the Antiene Rail Spur has considered the cumulative impacts due to the Project (Section 6.1), as well as forecast changes to coal production/transportation from Mt Arthur Coal (Section 6.2).

6.1 DRAYTON SOUTH

Table 16 shows the projected production schedule for the operations phase of the Project. This shows that 2017 is forecast to be the peak production year with 7 Mtpa of ROM coal being extracted. This would yield approximately 5.2 Mtpa of product coal. This is less than the currently approved Drayton Mine.

Consistent with current arrangements, this assessment has assumed that 100 wagon trains will be used to transport the product coal to the Port of Newcastle. Each wagon would have an average carrying payload of 85 t each. As such, the total payload of the train would be 8500 t (8.5 kT). This has been used to determine the number of trains generated per direction per year, as well as per day. Table 16 shows that the mining operations will generate a maximum of two trains per direction per day. This includes two non-laden inbound trains and two laden outbound trains per day.

As the Project is intended to be a continuation of the existing Drayton Mine, it is necessary to consider the existing coal production (and hence transportation) volumes so that the net change in coal haulage is assessed. Although there will be a short period when the two mining operations overlap, as they would be serviced by a similar fixed workforce, it has been assumed that the production volumes will be as if it were one single mining operation working to full capacity.

As stated in Section 1, the existing Drayton Mine has approval to extract up to 8 Mtpa of ROM coal. However, it is the prevailing extraction and hence production rates which are more relevant in assessing the net difference. Anglo American (2010) stated that in 2010, a total of 5.4 Mt of ROM coal was extracted, which yielded 4.77 Mt of saleable coal. Assuming the same average payload per train, this would equate to no more than two trains per direction per haul day. As such, it can be reasonably concluded that the Project will not result in any net increase in coal production or transportation compared with the existing operations.

Table 16 Forecast coal production and likely train volume generation

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
ROM Coal Mined (kT)	5,454	5,439	7,000	7,000	7,000	5,800	5,800	5,800	5,800	5,800	5,800	5,800	5,800	5,800	5,800	5,800
Total Product (kT)	4,300	4,023	5,153	5,232	5,095	4,371	4,423	4,417	4,388	4,451	4,360	4,401	4,370	4,363	4,454	4,431
# Trains Generated/ Yr/ Direction	506	473	606	616	599	514	520	520	516	524	513	518	514	513	524	521
# Trains Generated/Day/Direction	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Year	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
ROM Coal Mined (kT)	5,800	4,400	4,400	4,400	4,400	4,400	3,000	3,000	2,000	1,400	870
Total Product (kT)	4,490	3,374	3,368	3,368	3,358	3,346	2,289	2,312	1,621	1,182	746
# Trains Generated/ Yr/ Direction	528	397	396	396	395	394	269	272	191	139	88
# Trains Generated/Day/Direction	2	2	2	2	2	2	1	1	1	1	1

Source: Anglo American, 2011.

6.2 MT ARTHUR COAL

Hansen Bailey (2009) reported that the Mt Arthur Coal Consolidation Project would result in an increase in rail haulage from 19 Mtpa to 27 Mtpa. They are anticipating an increase from 24 to 38 train movements per day.

6.3 WIDER NETWORK IMPACTS

The *2009-2018 Hunter Valley Corridor Capacity Strategy Consultation Document* (ARTC, 2009) provides a detailed review of the existing deficiencies on the Hunter Valley coal corridor which includes the rail network up to Narrabri and Ulan. This document covers a wide range of deficiencies in the coal supply chain from individual mines to the Port of Newcastle. The movement of coal from the Project would be affected by deficiencies at any point in this supply chain, and it should be acknowledged that the timing of individual/ localised improvements would be governed by collective demands from various customers.

ARTC (2009) describes 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 projects described in Sections 6.1 and 6.2.

6.4 RAIL NETWORK MANAGEMENT MEASURES

The recommendations made by ARTC (2009) in the 2009-2018 *Hunter Valley Corridor Capacity Strategy Consultation Document* are not considered mitigation measures for this study. Rather, they are described in this report to highlight the need for ongoing liaison between Anglo American and ARTC regarding forecast production and how this influences the timing of rail network infrastructure improvements. A number of neighbouring coal mine projects will also need to be involved in the consultative process. These may include Mt Arthur Coal and any future coal projects that would use the Antiene Rail Spur.

ARTC (2009) 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 also been described.

- The Allandale Bank (near Greta), the Minimbah and Numbah Banks (north of Singleton) which have minimum headways of up to 14-16 minutes between loaded coal trains. ARTC (2009) recommended that a third railroad be constructed on the Numbah Bank. It also recommended a third railroad for the section of the network between Minimbah and Maitland, which would effectively address both the Minimbah and Allandale Banks.

- Regarding the Maitland Junction (junction of passenger line to Brisbane), ARTC (2009) does not make any recommendations for improving this junction other than saying that this junction should be subject to further analysis.
- Key junctions with coal loading loops including the Whittingham (Mt Thorley and Bulga), Newdell (Ravensworth, Newdell and Liddell), and Drayton (Drayton and Mt Arthur). ARTC (2009) proposes that both the Newdell and Drayton junctions be upgraded with high-speed (60 km/h) swing-nose turn-outs. ARTC further report that the Whittingham Junction will be effectively treated as part of the Minimbah Bank third road project.

As the above initiatives have already been proposed in the *2009-2018 Hunter Valley Corridor Capacity Strategy Consultation Document* (ARTC, 2009), there are no other mitigation measures proposed for addressing the rail network deficiencies. However, it is recommended that Anglo American continue to liaise with the ARTC and neighbouring mines regarding production forecasts and the roll out of these initiatives. This would be to inform the planning and design process.

7 SUMMARY OF FINDINGS

This assessment has examined the potential traffic and transport impacts associated with the following:

- Road traffic impacts during construction;
- Road traffic impacts on key intersections during the peak operations phase, including the likely cumulative impact of increased coal mine activity in the surrounding area;
- Road traffic impacts on midblock capacity along Thomas Mitchell Drive;
- The impacts of the Edderton Road realignment on travel time and road safety, and its new intersection with the Golden Highway; and
- Rail network impacts.

The assessments have identified the following potential impacts:

7.1 TRAFFIC IMPACTS DURING CONSTRUCTION

During the construction phase, there would be an average of 126 additional persons attending the site each day, with a maximum of 369 at the peak construction phase (month 11 of the construction program). There would also be a maximum of 12 truck movements inbound and 12 truck movements outbound from the site per day during the peak construction phase. This would result in an additional 290 light vehicles travelling to the site and 69 light vehicles travelling from the site during the AM peak hour. Similarly, there would be 69 inbound light vehicles and 290 outbound light vehicles during the PM peak period. There would be one heavy vehicle inbound and outbound in each of those hours based on an assumed uniform arrival rate of trucks.

The only noted traffic impact during the construction phase was the extensive delays (up to 80 seconds per vehicle) experienced by the traffic turning right from Thomas Mitchell Drive to the New England Highway. This was also a noted impact under the cumulative operational conditions which suggests that the need for upgrade is not just confined to construction related traffic only, but more so the growth of traffic in the region.

It is understood that Mt Arthur Coal has made a commitment to upgrading this intersection to a seagull configuration. This study has demonstrated that such an upgrade will be effective in addressing the modelled deficiencies.

To manage traffic access and thoroughfare requirements during the construction of the Edderton Road realignment, it is proposed that traffic control plans (TCPs) be prepared in consultation with MSC and RMS. These TCPs would provide an acceptable traffic management measure to maintain thoroughfare and access along both Edderton Road and the Golden Highway, whilst providing the required safety conditions for road workers including plant and vehicles entering and egressing from the “off-line” works.

7.2 TRAFFIC IMPACTS AT KEY INTERSECTIONS DURING THE PEAK OPERATIONS PHASE

As the peak operations phase is likely to coincide with significant increases in coal mining activity in the surrounding area, there would be substantial traffic volumes entering the Denman Road/ Thomas Mitchell Drive and the New England Highway/ Thomas Mitchell Drive intersections. The traffic modelling work for these two intersections showed that the right-turn movements from Thomas Mitchell Drive to Denman Road and New England Highway is likely to experience substantial increases in delay if the intersections remain as their current configurations.

Mt Arthur Coal has made a commitment to upgrading these two intersections to seagull configurations. The concepts involve providing a channelised right-turn/ deceleration lane for right-turns into Thomas Mitchell Drive, and a protected acceleration lane for right-turns from Thomas Mitchell Drive.

The primary benefit of a seagull configuration in addressing the identified traffic impacts, is that they allow for right-turning traffic from Thomas Mitchell Drive to enter the respective main roads a *two-stage* entry. For example, at the New England Highway/ Thomas Mitchell Drive intersection, rather than having to judge coinciding gaps in both the northbound and southbound traffic streams of New England Highway, drivers from Thomas Mitchell Drive only need to judge one gap at a time. They would cross the northbound traffic stream and enter a protected acceleration lane, where they would accelerate to the target merge speed of 100km/h. They would then enter the southbound traffic stream as a high-speed merge which has considerably less onerous gap acceptance requirements.

These proposed upgrades were also modelled with the results strongly indicating that they would be effective in addressing the noted concerns. Both of the proposed intersection upgrades would also offer improved road safety performance at the intersections by simplifying the decision making requirements for right-turning traffic from the side road. As Mt Arthur Coal has made a commitment to upgrading the intersections in this manner, no further mitigation measures have been recommended.

7.3 TRAFFIC IMPACTS ON MIDBLOCK CAPACITY ALONG THOMAS MITCHELL DRIVE

An assessment was carried out of the VKT generated by Drayton South compared with other non-Project-related traffic. VKT is a measure of usage of a road as it accounts for both the volume of traffic generated, as well as the distance that that traffic travels along a road.

The analysis showed that the Drayton South project would generate approximately 8.2% of the daily VKT along Thomas Mitchell Drive. It would also generate approximately 4% of the daily heavy vehicle VKTs along Thomas Mitchell Drive. It should be noted that the figures quoted above relate to the percentage of the *existing* traffic along Thomas Mitchell Drive. It was not possible to accurately account for the growth in VKTs for other mine expansion projects due to the lack of daily traffic volume information for those projects. That is, although there was information sourced from other studies on the number of peak hour trips generated from other mining projects, there was a lack of information for whole-of-day traffic volumes generated. Notwithstanding this, the relative percentage of Thomas Mitchell Drive traffic that Drayton South generates is likely to reduce as other mine expansion projects ramp up whilst Drayton South's traffic generation would be more stagnant.

7.4 IMPACTS AND BENEFITS OF THE PROPOSED EDDERTON ROAD REALIGNMENT

The southern-most 7 km of Edderton Road will be realigned to the west to allow mining activity to occur. The proposed realignment would offer a number of benefits including:

- Providing a higher standard route alignment (both horizontal and vertical geometry) compared with the existing route. In particular, the deep sag vertical curve and poor pavement at the Saddlers Creek floodway will be bypassed by the realigned route.
- The realigned section of Edderton Road will meet the Golden Highway approximately 5 km to the west of its current location. The new location provides substantially better sight lines between the different intersection approaches. The new intersection will also provide enhanced safety for right-turning traffic from Golden Highway to Edderton Road via an indented turning lane.
- The pavement seal will be increased from the current 5.7 m to 6.3 m to a minimum width of 6.6 m. A further 1.0 m unsealed shoulder will also be provided adjacent to the pavement seal.

The new route alignment will have similar length as the section of Edderton Road that it bypasses. However, as it provides a better alignment, more traffic will be able to travel at the (rural default) speed limit of 100 km/h along this road compared with the speed performance of the current route with substandard geometry. As such, the ability to travel at a faster speed should improve travel times along this portion of Edderton Road.

As the realigned route will meet the Golden Highway approximately 5 km west of its current location, traffic to/from the east will have to travel this additional distance. This would equate to an additional four minutes of travel time which is not regarded as a significant impact due to the relatively low volume of traffic affected. Also, whilst traffic to/from the east would need to travel this extra distance, the traffic from the west would have their trips shortened by this amount. As such, the overall net change is not as pronounced.

As the new alignment will be physically separate from the existing alignment, most of the works could be carried out "off-line" with no impact to the traffic using the existing alignment. The exception is the minor "tie-in" works at the northern and southern end. In particular, the construction of the new intersection on the Golden Highway would need to be staged to minimise traffic disruptions during the construction works. Appropriate TCPs would need to be prepared to address safety concerns for the road users in general, as well as road workers.

The following management measures have been recommended with regard to Edderton Road:

- The design for the Edderton Road realignment should be developed in consultation with MSC and RMS.
- The design and construction of the road should be subjected to an appropriate schedule of road safety audits with particular attention on the transition between old and new infrastructure.

7.5 RAIL NETWORK IMPACTS

As Drayton South is essentially a continuation of the existing Drayton Mine, there would not be any increase in train volumes on the Antiene Spur as a result of the Project. Mt Arthur Coal are anticipating an increase in trains from 24 to 38 train movements per day.

ARTC (2009) provides a detailed review of the existing deficiencies on the Hunter Valley coal corridor. They describe a number of deficiencies as well as proposed network upgrades. Whilst the ARTC (2009) recommendations are not formal mitigation measures recommended in this assessment, they do highlight the need for ongoing liaison between Anglo American and ARTC regarding the production forecasts and how these will influence the timing of rail network infrastructure improvements. A number of neighbouring coal mines and proposed projects will also need to be involved in the consultation process.

As such, it is recommended that Anglo American continue to liaise with the ARTC and neighbouring mines regarding the roll out of these initiatives. This would be to inform the planning and design process.

7.6 ANTIENE RAILWAY STATION ROAD

As Drayton South is essentially a continuation of the existing Drayton Mine, there would not be any increase in train volumes on the Antiene Rail Spur resulting from the Project alone. Furthermore, Condition 14 of Mt Arthur Coal's Project Approval 06_0091 (Department of Planning, 2008) states that Mt Arthur Coal "shall implement all reasonable and feasible measures to avoid blocking the railway crossing on Antiene Railway Station Road subject to the satisfaction of the Director General".

Drayton Mine would need to continue to consult with Mt Arthur Coal to assist them in their endeavours to avoid train queuing across Antiene Railway Station Road.

8 CONCLUSION

The impacts of the Project have been assessed to a level of certainty following a series of field investigations and modeling. When considering the findings of the assessment and the mitigation measures that have been proposed it is considered that the impacts as a result of the Project will be minimal and the existing road network will continue to function adequately. It is also considered that once realigned, the new Edderton Road will be a much safer and improved road. Finally, it has been demonstrated that given that the Project is a continuation of the existing Drayton Mine, there will not be any increase in train volumes on the Antiene Rail Spur as a result of the Project.

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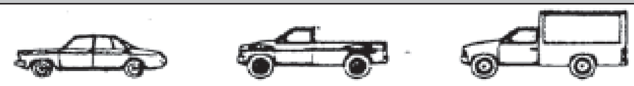
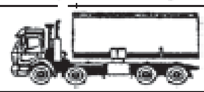
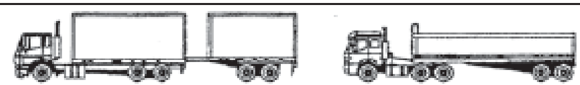
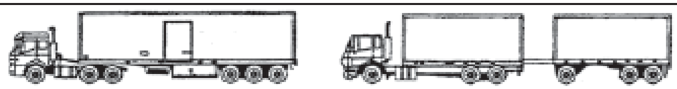
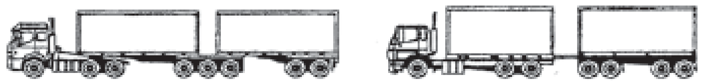
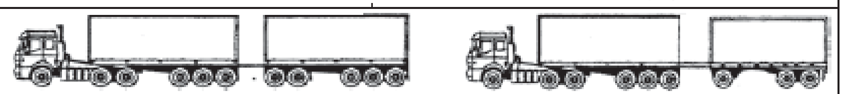
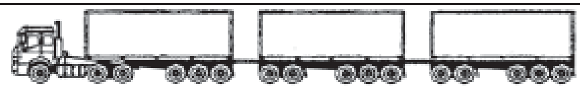
APPENDIX A

Standard Austroads vehicle classification system

Length (indicative)	Axles and Axle Groups		Vehicle Type	AUSTROADS Classification	
Type	Axles	Groups	Typical Description	Class	Typical Configuration
	LIGHT VEHICLES				
Short up to 5.5m		1 or 2	**Short** Sedan, Wagon, 4WD, Utility, Light Van, Bicycle, Motorcycle, etc	1	
	3, 4 or 5	3	**Short - Towing** Trailer, Caravan, Boat, etc	2	
	HEAVY VEHICLES				
Medium 5.5m to 14.5m	2	2	**Two Axle Truck or Bus**	3	
	3	2	**Three Axle Truck or Bus**	4	
	> 3	2	**Four Axle Truck**	5	
Long 11.5m to 19.0m	3	3	**Three Axle Articulated** Three axle articulated vehicle, or Rigid vehicle and trailer	6	
	4	> 2	**Four Axle Articulated** Four axle articulated vehicle, or Rigid vehicle and trailer	7	
	5	> 2	**Five Axle Articulated** Five axle articulated vehicle, or Rigid vehicle and trailer	8	
	≥ 6	> 2	**Six Axle Articulated** Six axle articulated vehicle, or Rigid vehicle and trailer	9	
Medium Combination 17.5m to 36.5m	> 6	4	**B Double** B Double, or Heavy truck and trailer	10	
	> 6	5 or 6	**Double Road Train** Double road train, or Medium articulated vehicle and one dog trailer (M.A.D.)	11	
Large Combination Over 33.0m	> 6	> 6	**Triple Road Train** Triple road train, or Heavy truck and three trailers	12	

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APPENDIX B

Explanation of key traffic 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 95^{th} 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.