

p r o p o s e d

Mt Arthur

UNDERGROUND PROJECT

Appendix 14



Traffic and Transport Assessment

**TRAFFIC & TRANSPORT IMPACT
ASSESSMENT**

FOR

**MT ARTHUR
UNDERGROUND PROJECT**

AT

MUSWELLBROOK

Ref. 26072r

August, 2007

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EXECUTIVE SUMMARY

Introduction

This report documents the assessment of the traffic and transport impacts of the proposed Mt Arthur Underground Project.

Proposal

The proposal is for Mt Arthur Coal to access coal reserves in the existing mining leases and the adjacent exploration area to the west using underground mining techniques. The concept mine plan predicts a production rate of approximately 8 million tonnes per annum for 21 years. Mt Arthur Coal's existing infrastructure will be used to process the coal and the coal will be transported by the existing rail facility at Mt Arthur Coal. Vehicle access to the mine will be via the existing road access to Mt Arthur Coal from Thomas Mitchell Drive. The proposal will increase the workforce at Mt Arthur with additional operational staff working 3 shifts per day and management and administration staff working on weekdays, with start and finish times occurring between 6.30am and 6pm.

Existing Conditions

An assessment of the existing roads and intersections that provide the principal access to / from Mt Arthur Coal indicate that traffic conditions on the road network and at the intersections are satisfactory. The three (3) principal intersections which are Thomas Mitchell Drive / Mt Arthur Coal Mine Access Road, Thomas Mitchell Drive / Denman Road and Thomas Mitchell Drive / New England Highway have all been upgraded in the last 6 years.

Assessment of Traffic Impacts in Operational Phase

Once operational, the Mt Arthur Underground Project will generate some 322 vehicle trips into and out of Mt Arthur Coal (i.e. 322 in / 322 out) per day at maximum activity levels. Some 30 of these trips into and out of the mine will be heavy vehicles (i.e. 30 in / 30 out).

The peak times for traffic impacts during the operational phase will be 7.15am to 8.15am and 3.15pm to 4.15pm on weekdays, which coincide with the shift time changes at 8am and 4pm. During these periods a total of 184 vehicles are estimated to enter and or exit the Mt Arthur Coal site. The times do not overlap with existing peak traffic generation times for Mt Arthur Coal, which are 6.00am-7.00am and 6.00pm-7.00pm.

An assessment of the impacts of this additional traffic on the principal intersections indicates that the impacts will be satisfactory and the road network including the intersections will continue to operate at a satisfactory level of service.

In terms of cumulative impacts, the peak hours for the Mt Arthur Coal proposal may in part overlap with the shift time changes for the future mines at Mt Pleasant and Anvil Hill, during the 7.15am-8.15am period. The cumulative impacts will be the

most significant at the principal intersections on the road network. An assessment of the cumulative impacts of all three mines during this period indicates that traffic conditions will remain satisfactory at the principal intersections and all intersections will continue to operate at a satisfactory level of service.

While Mt Arthur Coal does not currently expect that the shift times for the underground project will overlap with the shift times of the existing open cut mine operations, an alternative scenario has been examined where shift times do overlap for the 6.00am - 7.00am and 6.00pm – 7.00pm periods.

The assessment of this scenario, which also includes the cumulative impacts of the full traffic generation of the future Mt Pleasant and Anvill Hill mines, indicates that traffic conditions at the principal intersections will remain satisfactory during these periods.

Assessment of Traffic Impacts in Construction Phase

Construction of Mt Arthur Underground Mine is expected to take 2 years. During the construction phase of the Underground Project, employment levels will peak in the second year. At this time it is expected that up to 420 vehicle trips will be made into and out of the mine on a weekday (i.e. 420 in / 420 out) including 20 heavy vehicles (i.e. 20 in / 20 out).

Peak hours during construction are expected to be 6.00am-7.00am and 6.00pm-7.00pm which will coincide with the majority (67%) of the employee / contractor trips into (AM) and out of the mine (PM). Some 268 vehicle trips are expected during these hours.

An assessment of the traffic impacts associated with the construction traffic indicates that traffic conditions at the principal intersections will continue to be satisfactory during the AM and PM peak periods associated with construction.

Edderton Road

The proposal incorporates longwall mining under a section of Edderton Road between Quarry Creek and just west of Edderton Homestead, which will result in subsidence of sections of the road and subsequent road and pavement damage. To manage this process and to mitigate any adverse impacts, Mt Arthur Coal will prepare a traffic management and road maintenance plan / strategy for Edderton Road, which will address planning, notification, monitoring and repair works, including any temporary road diversions. The plan / strategy will be prepared in consultation with Muswellbrook Shire Council.

Antiene Railway Station Road

The Underground Project will increase the number of coal trains from Mt Arthur Coal using the Antiene rail spur line from the currently approved maximum of 18 movements per day (i.e. 9 trains) to a maximum of 24 movements per day. There is an existing issue where the trains on the Antiene rail spur line occasionally block vehicle access to a number of properties off Antiene Railway Station Road due to the location

of the rail signal on the spur line. Mt Arthur Coal is committed to working with the other relevant industry and government stakeholders (including Anglo Coal, Macquarie Generation, Muswellbrook Shire Council and the Australian Rail Track Corporation) to address this issue. Mt Arthur Coal has commenced discussions with Muswellbrook Shire Council regarding the establishment of a working group to consider possible solutions.

1.0 INTRODUCTION

1.1 Background

Mt Arthur Coal Pty Ltd (Mt Arthur Coal) operates the Mt Arthur Coal open cut coal mine south of Muswellbrook in the upper Hunter Valley of NSW. The company supplies thermal coal for both export and domestic markets and is a wholly owned subsidiary of BHP Billiton Hunter Valley Energy Coal. The Mt Arthur Coal operation includes the areas formerly known as Mount Arthur North (MAN) mine and Bayswater Colliery. Mining has occurred at the Mt Arthur Coal site in the former Bayswater Colliery area since the 1960s, whilst mining in the MAN area started in 2002.

The existing Mt Arthur Coal operations consist of three open cut mining areas, the Bayswater No. 2 mining area (extraction complete), the Bayswater No. 3 mining area and the MAN mining area. To meet increased export demand for coal, Mt Arthur Coal is currently investigating the potential for underground mining in the Bayswater No. 3 mining area. The Mt Arthur Underground Project will access the coal reserve through existing open cut pits and will build on Mt Arthur Coal's existing infrastructure, including the coal handling and preparation plant (CHPP) and rail loading facility.

The 21 year concept mine plan involves longwall mining in five seams, with an estimated total marketable reserve of approximately 160 Mt. The approximate underground mining area is shown on **Figure 1**. A production rate of approximately 8 million tonnes per annum (Mtpa) is predicted for the 21 year mine plan.

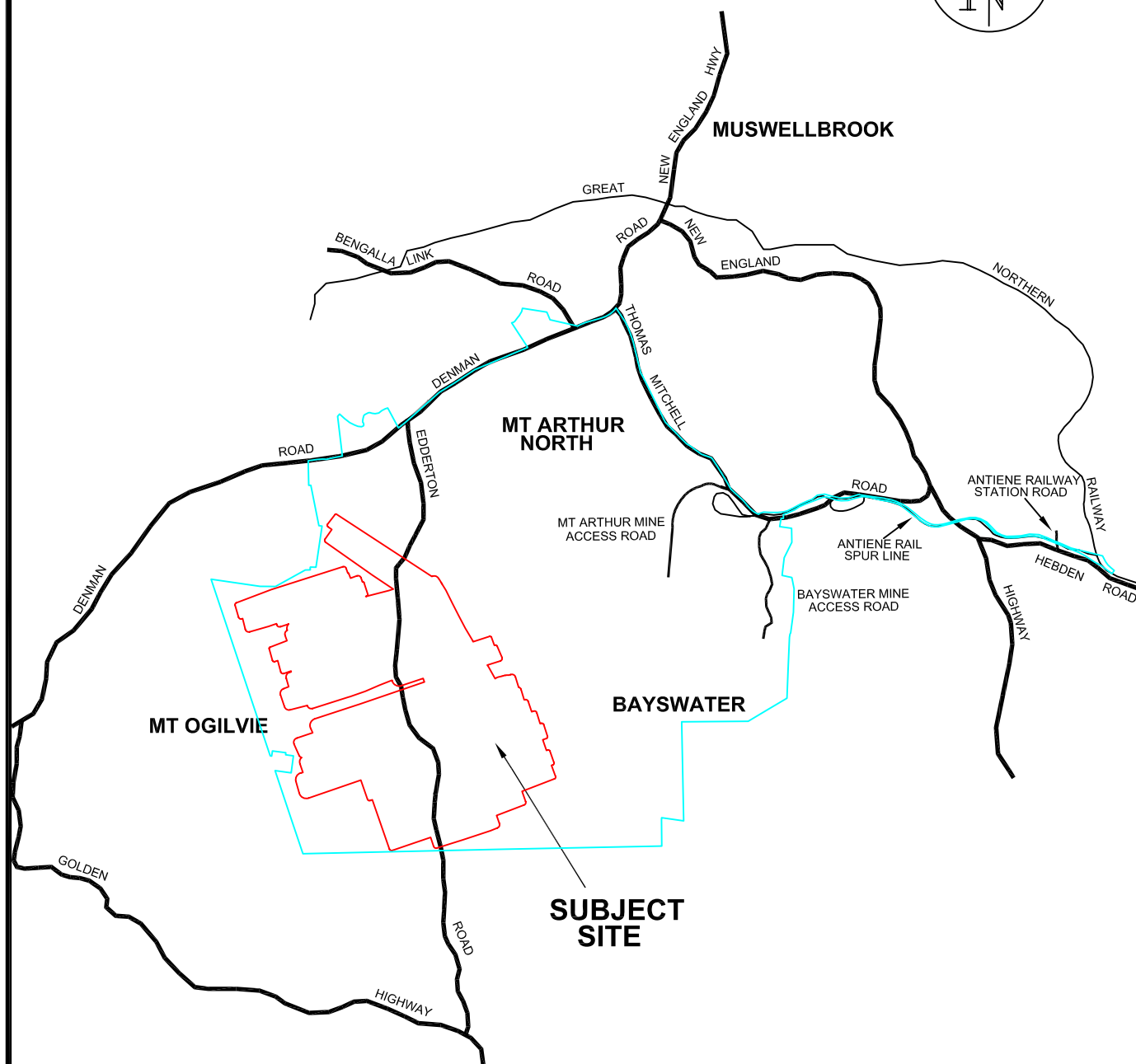
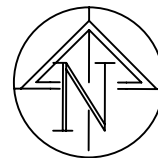
1.2 Authority Requirements

As part of the preparation of the Traffic and Transport Impact Assessment for the proposal, consideration was given to the requirements of the Director General (of the Department of Planning), Roads and Traffic Authority and Muswellbrook Shire Council, as well as any key issues identified by these authorities.

No specific key traffic / transport issues were nominated by the Director General of Planning (in letter dated 26 April 2006) other than the assessment should take into account appropriate State Government Technical and Policy Guidelines.

The Roads and Traffic Authority, in a letter dated 9 March 2006, indicated that the Roads and Traffic Authority's primary interests in the road network are to:

- Maintain an efficient and safe road system (includes SEPP 11 considerations).
- Facilitate the integration of land and transport (includes draft SEPP 66 considerations).
- Maintain the integrity and security of the road network, property and assets.



LEGEND

- MINING AFFECTATION BOUNDARY
- PROJECT APPLICATION BOUNDARY

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FIGURE 1

MT ARTHUR COAL UNDERGROUND PROJECT,
MUSWELLBROOK
SITE LOCATION

JOB NO.26072

The Roads and Traffic Authority stated that the traffic study should consider the traffic generation of the proposal, road capacity, intersection delays and road safety and indicated that traffic modelling of key intersections may also be required.

Muswellbrook Shire Council, in a letter dated 16 March 2006, raised the following issues:

1. Edderton Road, and in particular, the proposed mining underneath the road and any subsidence and ongoing road maintenance associated with this; and
2. Potential safety for residents who are required to cross the existing rail spur line used by Mt Arthur Coal (between Mt Arthur Coal and Main Northern Line) at public roads and associated rights of way.

1.3 Structure of this Report

This report has been prepared as part of the Environmental Assessment to assess the traffic impacts associated with the underground mine during the operational phase of the mine and during the construction period.

The assessment has been undertaken in accordance with the requirements of the Roads and Traffic Authority's Guide to Traffic Generating Developments (October 2002) and Planning NSW EIS Guidelines – Road and Related Facilities (September 1996).

Other technical standards / publications referenced in this assessment include:

- Roads and Traffic Authority's Road Design Guide.
- Austroads Guide to Traffic Engineering Parts 1-15 (as appropriate).

The remaining sections of this report address the following:

- Section 2 provides an overview of the existing mine operations at Mt Arthur Coal.
- Section 3 describes the proposal.
- Section 4 examines the existing traffic conditions on the road network.
- Section 5 evaluates the traffic impacts of the proposed underground mine in the operational phase, as well as during the construction period.
- Section 6 provides conclusions.

2.0 EXISTING MINE OPERATIONS AT MT ARTHUR COAL

2.1 Existing Mine Operations

The existing Mt Arthur coal operations consist of three (3) open cut mining areas, the Bayswater No. 2 mining area (extraction complete), the Bayswater 3 mining area and the Mt Arthur North mine. The current operation extracts and processes the coal and transports the coal via the mine's existing rail facility.

Vehicle access to Mt Arthur Coal mine is from an existing access road which forms a T junction intersection with Thomas Mitchell Drive.

The Bayswater Access Road provides a secondary and minor vehicle access point to Mt Arthur Coal site from Thomas Mitchell Drive, some 500 metres south of the existing mine access road.

2.2 Hours of Operation

The existing mine at Mt Arthur Coal operates 24 hours 7 days a week.

2.3 Workforce

The total workforce of the mine on any weekday is approximately 456 persons. Other than management and administration staff who make up approximately 110 persons and work during the day, the remainder of the workforce are shift workers.

On weekdays the day shift which starts at 6.30am, has approximately 194 persons. Forty (40) of these finish at 2.30pm with the remainder (154 persons) finishing between 6.30pm and 7.10pm.

The night shift, which has approximately 152 persons starts at 6.30pm and finishes between 6.30am and 7.10am.

The management and administration staff typically start between 6.30am and 8am and finish between 3.30pm and 6pm.

2.4 Traffic Generation of the Existing Mine Operations

All the coal produced by Mt Arthur Coal mine is transported by rail or by overland conveyor to Bayswater Power Station.

The traffic generation of the existing mine consists of employee and visitor trips as well as maintenance trips / deliveries to the mine.

Based on information supplied by Mt Arthur Coal, on any weekday the total daily traffic generation of the mine is estimated to be:

- 388 employee / contractor trips¹ using light vehicles into and out of the mine, (based on 85% driver ratio per 100 employees);

¹ Note: some contractors use small trucks, i.e. small rigid trucks)

- 18 visitor trips into and of the mine using light vehicles;
- 60 delivery / maintenance vehicles of which 30 are estimated to be light vehicles and 30 heavy vehicles (Austroad Class 3 and above);
- 20-30 miscellaneous trips into / out of the mine consisting of contractors and / or management staff leaving the mine for short periods during the day.

It should be noted that Orica have a depot at Mt Arthur Coal which services a number of mines in the area and this generates additional light and heavy vehicle trips into and out of Mt Arthur Coal on weekdays.

3.0 PROPOSAL

3.1 Operational Phase

3.1.1 Description of Proposal

The proposal is to access coal reserves in the existing mining area and the adjacent exploration area to the west using underground mining techniques. The coal reserves will be accessed through existing open cut pits and Mt Arthur Coal's existing infrastructure will be used to process the coal. All the coal will be transported via the existing rail facility at Mt Arthur Coal.

The concept mine plan predicts a production rate of approximately 8 million tonnes per annum (Mtpa) for 21 years.

The proposal is to use the existing road accesses to Mt Arthur Coal Mine from Thomas Mitchell Drive.

As the proposal will involve longwall mining under Edderton Road and mine subsidence, there will be a need to undertake remediation works on the road during the life of the mine, which may include temporary road diversions.

3.1.2 Hours of Operation

The proposed hours of operation are 24 hours, seven (7) days per week.

3.1.3 Workforce

The workforce is expected to vary depending on the level of activity as follows:

- Miners and or contractors – 96 to 177 persons evenly split over 3 shifts per day;
- Run of Mine (ROM) Facility Operators 6-8 persons split over 2 shifts per day;
- Management and administration staff – 67 to 102 persons.

Work times are likely to be:

- Miners – 3 shifts from 12 midnight to 8am, 8am to 4pm and 4pm to 12 midnight;
- ROM Facility Workers – 2 shifts from 6.30am to 6.50pm and 6.30pm to 6.50am;
- Management and Administration Staff – who will typically start between 6.30am and 8.00am and finish between 3.30pm and 6pm.

While Mt Arthur Coal does not currently expect that shift times for the Underground Project will overlap with the shift times for the existing open cut mine operations, an alternative scenario with overlapping shift times has been considered in the traffic assessment to assess the potential worst case traffic impact.

3.1.4 Traffic Generation of Proposal

As noted above, all the coal produced by the Underground Project will be transported by rail.

The traffic generation of the proposal will consist of employee and visitor trips, as well as deliveries and maintenance vehicle trips.

Based on the information provided by Mt Arthur Coal, additional daily vehicle trips associated with the proposal are estimated to be:

- Between 144 to 244 employee trips into and out of the mine on a weekday. These would be light vehicles (based on a 85% driver ratio per 100 employees);
- 18 visitor trips into and out of the mine per day which would also be light vehicles;
- 60 delivery / maintenance trips into and out of the mine per day, of which 30 are estimated to be heavy vehicles (Austroad Class 3 and above) with the remainder (30 vehicles) light vehicles.

3.2 Construction Phase

3.2.1 Timing and Hours of Operation

The construction period for the underground mine is expected to be 2 years. Construction hours will be typically 7am-6pm, Monday to Friday, plus limited activity 8am to 1pm Saturday.

3.2.2 Workforce

The construction workforce is expected to peak in the second year of construction at approximately 300 workers. The Mt Arthur Underground Project workforce is expected to be approximately 170 persons at this time, providing a total workforce of 470 persons at this time.

3.2.3 Construction Routes

Vehicle (road) access to the mine during the construction period will be primarily via the existing mine access road that intersects with Thomas Mitchell Drive. Construction routes will be Thomas Mitchell Drive, New England Highway and Denman Road.

Some construction vehicles may also use the Bayswater Access Road to access the project site.

3.2.4 Construction Traffic

Construction traffic will consist of:

- Construction worker trips and project employee trips, estimated to be a maximum of 400 vehicle trips per day into and out of the mine (based on 85% driver rate) which will be predominantly light vehicles; and
- Up to 20 deliveries per day into and out of the mine (Austroads Class 3 and above) which will be heavy vehicles. Most of these (85%) are expected to use New England Highway and Thomas Mitchell Drive with 15% using Denman Road and Thomas Mitchell Drive.

4.0 EXISTING TRAFFIC CONDITIONS

4.1 Principal Road Network

The principal road network that is adjacent to and or provides access to the Mt Arthur Coal Mine includes:

- New England Highway;
- Denman Road;
- Thomas Mitchell Drive;
- Edderton Road;
- Mt Arthur Coal Access Road; and
- Bayswater Access Road.

Figure 2 shows the principal road network for the proposal.

4.2 Description of Existing Roads

4.2.1 New England Highway

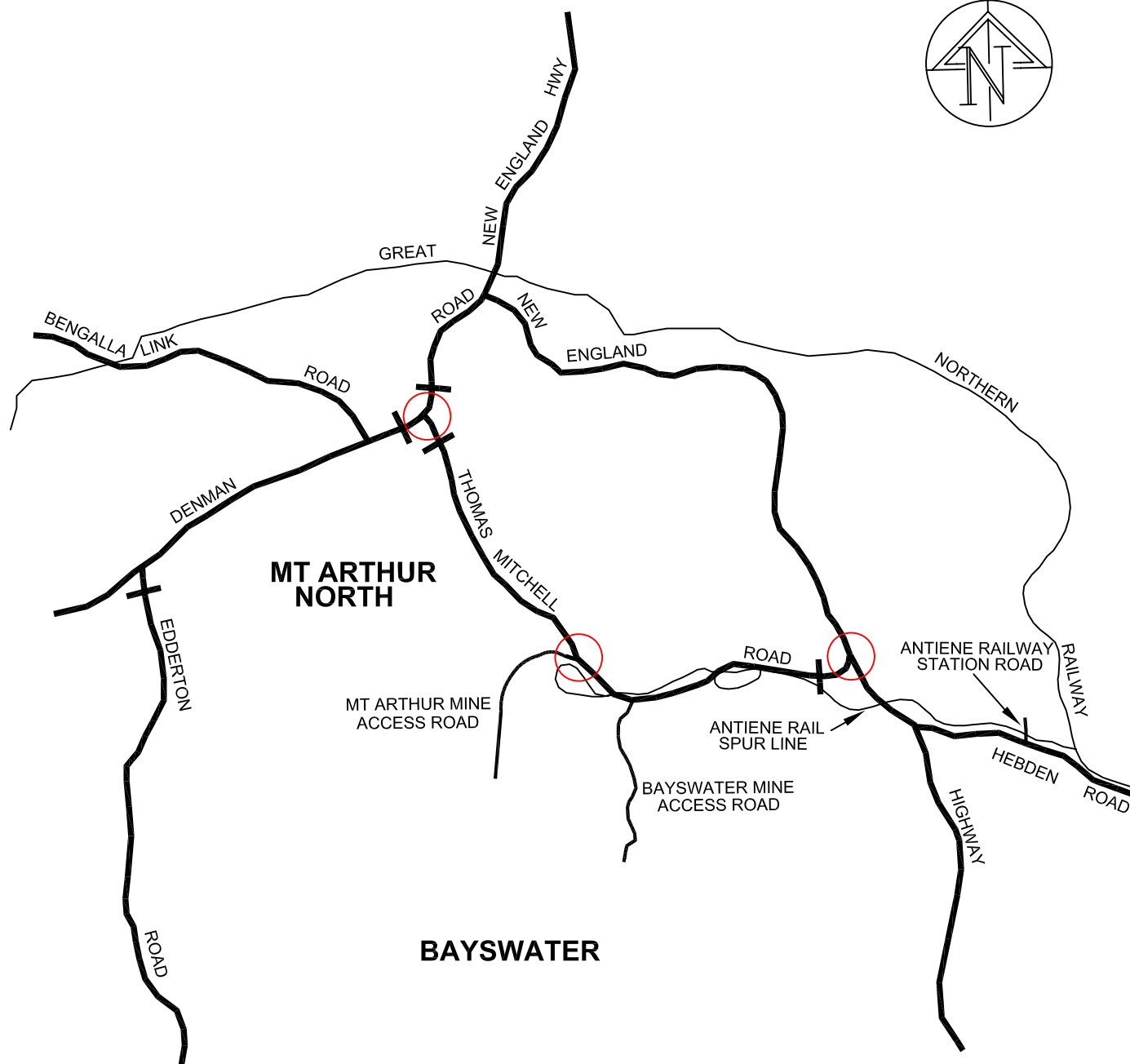
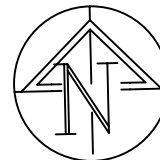
New England Highway is a major State Highway under the control of the RTA. The Highway is a main north / south link that passes through Muswellbrook and carries local, regional and interstate traffic.

Within Muswellbrook urban area, the New England Highway has a high level of traffic management with traffic signals and roundabout control at principal intersections and priority control on minor intersections. In this section, it is generally 4 lanes wide (2 lanes in each direction) plus room for parking. Outside the urban area, the road is a high standard rural highway with appropriate high standard of traffic management and a posted speed limit of 100km/h. The traffic management includes regular passing lanes for overtaking, wide sealed shoulders, turning lanes at principal intersections, warning signs, centre line and edge line marking including RPM's, and guideposts and reflectors.

4.2.2 Denman Road

Denman Road (MR 209) is a State road funded by the RTA but maintained by Muswellbrook Shire Council. Denman Road connects the town of Denman to the New England Highway at Muswellbrook. Within the Muswellbrook urban area, Denman Road, although wider, is line marked to carry 2 lanes of traffic (one lane in each direction).

Outside the urban area, Denman Road is a 2 lane rural road with a 7 metre road pavement and 1-2 metre shoulders. Traffic management includes centre line and edge line marking, guideposts and reflectors, and warning signs. Intersections along Denman Road are under priority / sign control.



LEGEND

— VOLUME AND CLASSIFICATION COUNT

○ INTERSECTION COUNT

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FIGURE 2

MT ARTHUR COAL UNDERGROUND PROJECT,
MUSWELLBROOK

PRINCIPAL ROAD NETWORK AND TRAFFIC COUNT LOCATIONS

JOB NO.26072

4.2.3 Thomas Mitchell Drive

Thomas Mitchell Drive is a local road under the control of Muswellbrook Shire Council. The road links between New England Highway, approximately 10 km (south of Muswellbrook) and Denman Road, approximately 4 km (west of Muswellbrook).

Thomas Mitchell Drive provides access to Mt Arthur Coal and Drayton Coal mines, as well as the Muswellbrook Industrial Estate.

The road also provides a bypass to the Muswellbrook Township for vehicles, including heavy vehicles, travelling between Denman Road and the New England Highway, south of Muswellbrook and provides heavy vehicle access to the Bengalla Mine and the future Mt Pleasant Mine.

Thomas Mitchell Drive is generally a 2 lane road with a 7.0 metre wide road pavement and 1-2 metre shoulders. Traffic management on the road includes centre line and edge line road marking, warning signs, guideposts and reflectors. The section of road through the industrial area has a wider sealed pavement.

All intersections along Thomas Mitchell Drive are under priority / sign control. Speed limit along Thomas Mitchell Drive is 100 km/h in the rural sections and 80 km/h past the industrial area.

4.2.4 Edderton Road

Edderton Road is a local road under the control of Muswellbrook Shire Council. Edderton Road has a 14 tonne load limit and connects between Denman Road (west of Thomas Mitchell Drive) and the Golden Highway near Jerry's Plains and generally provides access to adjoining rural properties.

Adjacent to the boundary of Mt Arthur Coal mine, Edderton Road has a 6.0 metre wide sealed road pavement and minimal traffic management consistent with its current use. Speed limit along Edderton Road is 100km/h.

4.2.5 Mt Arthur Coal Access Road

Mt Arthur Coal Mine Access Road is a road that provides access to Mt Arthur Coal Mine from Thomas Mitchell Drive.

The road is generally 2 lanes wide and constructed to a high standard. Traffic management includes centre line and edge line road marking, warning signs and channelisation at principal intersections.

The speed limit is predominantly 70km/h, reducing to 20km/h adjacent the main parking area.

4.2.6 Bayswater Access Road

The current Bayswater Access Road was constructed in recent years as part of the construction of Mt Arthur Coal's Rail Facility, replacing the previous access point to Bayswater Mine (now part of Mt Arthur Coal). The road is a private road that provides access to facilities located near the Rail Loading Facility and to the occasional heavy vehicle accessing the Mt Arthur Coal mine site.

The road is generally 2 lanes wide and constructed to a good standard with satisfactory traffic management and a 40km/h speed limit.

4.2.7 Principal Intersections

The principal intersections that provide access to Mt Arthur Coal mine include:

- New England Highway / Thomas Mitchell Drive;
- Denman Road / Thomas Mitchell Drive; and
- Thomas Mitchell Drive / Mt Arthur Coal Mine Access Road.

A description of these intersections is provided below in accordance with the Roads and Traffic Authority's Road Design Guide – Intersections at Grade Treatments for Rural Intersections.

New England Highway / Thomas Mitchell Drive

Thomas Mitchell Drive forms a T junction with New England Highway approximately 10 kilometres south of Muswellbrook township. The intersection's geometry includes:

- 2 lanes northbound on New England Highway plus a left turn deceleration lane (165 metres long including taper) for the left turn to Thomas Mitchell Drive;
- 1 lane southbound on the New England Highway plus a right turn bay for the right turn into Thomas Mitchell Drive (170 metres long including taper);
- A 2 lane approach in Thomas Mitchell Drive.

The intersection has been upgraded to its current configuration by the RTA (funded by developer [Mt Arthur Coal] contributions) in the last 6 years. The intersection layout as described in the RTA's Rural Design Guide includes:

- CHR right turn treatment in New England Highway;
- AUL left turn treatments in Thomas Mitchell Drive and New England Highway as well as a left turn auxiliary lane in New England Highway.

Thomas Mitchell Drive is subject to Give Way (priority control). Other traffic management in the intersection includes intersection warning sign, intersection lighting, pavement markings including RPMs.

The speed limit is 100km/h. Sight distance at the intersection is good in all approaches and meets RTA and Austroad requirements for the estimated vehicle operating speeds at the intersection.

Denman Road / Thomas Mitchell Drive

Thomas Mitchell Drive forms a T junction with Denman Road approximately 4 kilometres west of the New England Highway's junction with Denman Road. The intersection has recently been upgraded by Muswellbrook Council with funds from Council, the RTA and from developers (Mt Arthur Coal) contributions.

The intersection's geometry includes:

- 1 through lane eastbound in Denman Road plus an auxiliary lane (AUR treatment) for right turn into Thomas Mitchell Drive;
- 1 through lane westbound plus a left turn deceleration lane (auxiliary lane 160 metres long including taper) with an AUL treatment for the left turn into Thomas Mitchell Drive;
- 2 approach lanes in Thomas Mitchell Drive including an AUL left turn treatment for the left turn into Denman Road.

Thomas Mitchell Drive is subject to priority (Give Way) control. Other traffic management at the intersection includes intersection lighting, intersection warning signs and pavement marking including RPMs.

The speed limit at the intersection is 80km/h. Sight distance at the intersection is good in all approaches and meets RTA and Austroad requirements for the estimated vehicle operating speeds.

Thomas Mitchell Drive / Mt Arthur Coal Mine Access Road

Mt Arthur Coal Mine Access Road forms a T junction with Thomas Mitchell Drive approximately 4.5 kilometres south of Denman Road.

The intersection's geometry includes:

- 1 through lane southbound in Thomas Mitchell Drive together with a right turn lane (CHR treatment, 160 metres long including taper) for the right turn into the Mine Access Road;
- 1 through lane northbound plus a deceleration lane (auxiliary lane 80 metres long including taper) with an AUL treatment for the left turn into the Mine Access Road.
- A short section of wider pavement providing for 2 vehicles at the intersection, in the approach of Mt Arthur Coal Mine Access Road tapering to 1 lane. An AUL treatment is provided for the left turn out of the Mine Access Road.

Intersection warning signs and pavement marking are also provided at the intersection.

The speed limit in Thomas Mitchell Drive at the intersection is 100km/h. The sight distance at the intersection is generally good and is considered to meet the RTA and Austroad requirements for the estimated vehicle operating speeds at the intersection.

4.2.8 Other Intersections

Thomas Mitchell Drive / Bayswater Access Road

This intersection provides secondary access to the Mt Arthur Coal site and is used by a small number of delivery vehicles to Mt Arthur Coal mine. Bayswater Access Road forms a T junction with Thomas Mitchell Drive, south of the Mt Arthur Coal Mine Access Road.

The intersection's geometry includes seagull channelisation with:

- 1 through lane southbound in Thomas Mitchell Drive together with a right turn lane (CHR treatment, 105 metres long including taper) for the right turn into Bayswater Access Road.
- A right turn acceleration lane in Thomas Mitchell Drive (250 metres long including taper) to accommodate the right turn out of Bayswater Access Road to travel south.
- 1 through lane northbound plus a deceleration lane (auxiliary lane 165 metres long including taper) with an AUL treatment for the left turn into Bayswater Access Road.
- A short section of wider pavement providing for 2 vehicles at the intersection, in the approach of Bayswater Access Road tapering to 1 lane. An AUL treatment is provided for the left turn out of the Bayswater Access Road together with a left turn acceleration lane 105 metres long including taper in Thomas Mitchell Drive.

Bayswater Access Road is subject to Stop sign control. At the time of the inspection, the existing pavement markings at the intersection were worn and require maintenance (i.e. remarking)

The speed limit in Thomas Mitchell Drive at the intersection is 100km/h with a 40km/h speed limit in Bayswater Access Road. The sight distance at the intersection is good and considered to meet the RTA and Austroad requirements for the estimated vehicle operating speeds at the intersection.

4.3 Existing Traffic Conditions on the Road Network

4.3.1 Traffic Volumes on Road Network

Traffic volumes using the principal road network in and around the Mt Arthur Coal mine were collected as part of this assessment. This included published RTA traffic volumes on the New England Highway, as well as daily volumes and vehicle classification counts on Thomas Mitchell Drive, Denman Road and Edderton Road. Peak hour traffic volumes were also collected at the principal intersections on the road network that adjoins Mt Arthur Coal. **Figure 2** shows the traffic count locations.

The traffic volume and classification counts for Thomas Mitchell Drive, Denman Road and Edderton Road were undertaken between 15-22 September 2006. The intersection counts were undertaken during the same period, as well as on 7 February 2007.

4.3.2 New England Highway

Table 4.1 shows the daily (AADT) traffic volumes using the New England Highway south of Denman Road as recorded by the RTA in 2004.

Reference to Table 4.1 shows that the Daily Traffic Volumes (AADT) using the New England Highway were 10,259 vehicles (car equivalents) at the southern end of Muswellbrook township increasing to 16,253 car equivalents within the township just south of Denman Road.

TABLE 4.1

AVERAGE 7 DAY (AADT) TRAFFIC VOLUMES NEW ENGLAND HIGHWAY

Location	2004 AADT Volume
At Southern boundary of town	10,269
South of Denman Road	16,253

4.3.3 Thomas Mitchell Drive

Tables 4.2 and 4.3 show the traffic volumes using Thomas Mitchell Drive south of Denman Road and also west of New England Highway. Reference to these tables shows that on a typical weekday (5 day average) Thomas Mitchell Drive carries two way traffic volumes of 4,414 vehicles (vpd) south of Denman Road and 2,430 vehicles (vpd) west of New England Highway. Heavy vehicles (Austroads Classes 3-12) total 606 vehicles (vpd) and comprise some 13.7% of the total weekday volumes south of Denman Road and total 489 vehicles (vpd) to comprise 20.1% (of total weekday volumes) west of New England Highway. Typical 7 day average (AADT) two way traffic volumes are 3,495 vehicles (vpd) south of Denman Road and 1,947 vehicles (vpd) west of New England Highway.

TABLE 4.2

**THOMAS MITCHELL DRIVE, SOUTH OF DENMAN ROAD
5 DAY AVERAGE & 7 DAY AVERAGE
TRAFFIC VOLUMES & VEHICLE CLASSIFICATION**

Direction of Travel	Weekday					
	5 Day Average			7 Day Average (AADT)		
	Light ¹	Heavy ²	Total	Light ¹	Heavy ²	Total
North	1900	308	2208	1513	238	1751
South	1908	298	2206	1514	230	1744
Total	3808	606	4414	3027	468	3495
Proportion of Total	86.3%	13.7%	100%	86.6%	13.4%	100%

Source – Traffic Counts 15-22 September 2006

¹ Light vehicles - Austroads 1 & 2 vehicle classifications & Motorbikes

² Heavy vehicles - Austroads 3-12 vehicle classifications

TABLE 4.3

**THOMAS MITCHELL DRIVE, WEST OF NEW ENGLAND HIGHWAY
5 DAY AVERAGE & 7 DAY AVERAGE
TRAFFIC VOLUMES & VEHICLE CLASSIFICATION**

Direction of Travel	Weekday					
	5 Day Average			7 Day Average (AADT)		
	Light ¹	Heavy ²	Total	Light ¹	Heavy ²	Total
East	967	232	1199	777	179	956
West	974	257	1231	793	198	991
Total	1941	489	2430	1570	377	1947
Proportion of Total	79.9%	20.1%	100%	80.6%	19.4%	100%

Source – Traffic Counts 15-22 September 2006

¹ Light vehicles - Austroads 1 & 2 vehicle classifications & Motorbikes

² Heavy vehicles - Austroads 3-12 vehicle classifications

Tables 4.4 and 4.5 show the hourly traffic volumes on a typical weekday (5 day average) and per day (7 day average) in Thomas Mitchell Drive.

Reference to Table 4.4 shows that the AM and PM peak hours on average weekdays generally occurs between 6am-7am (AM peak hour) and 3pm-4pm (PM peak hour). At these times, Thomas Mitchell Drive, south of Denman Road carries:

- two way traffic volumes of 655 vehicles per hour (vph) with 135 vph northbound and 520 vph southbound in the 6am-7am hour; and
- two way traffic volumes of 468 vehicles per hour (vph) with 334 vph northbound and 134 vph southbound in the 3pm-4pm hour.

Reference to Table 4.5 shows that the peak hour traffic volumes on weekdays using Thomas Mitchell Drive, west of New England Highway are in the order of:

- two way volumes of 388 vph, with 81 vph eastbound and 307 vph westbound in the 6am-7am hour; and
- two way traffic volumes 226 vph, with 163 vph eastbound and 63 vph westbound in the 3pm-4pm hour.

TABLE 4.4

**THOMAS MITCHELL DRIVE, SOUTH OF DENMAN ROAD
HOURLY TRAFFIC VOLUMES**

Time	5 Day Average (Weekday)			7 Day Average (AADT)		
	North	South	Total	North	South	Total
Midnight – 1am	8	2	10	7	2	9
1am – 2am	8	2	10	6	2	8
2am – 3am	4	2	6	3	2	5
3am – 4am	7	3	10	6	3	9
4am – 5am	7	19	26	6	16	22
5am – 6am	22	192	214	18	153	171
6am – 7am	135	520	655	119	398	517
7am – 8am	157	196	353	122	149	271
8am – 9am	100	123	223	80	97	177
9am – 10am	108	105	213	90	86	176
10am -11am	114	105	219	94	86	180
11am – Midday	117	117	234	97	93	190
Midday – 1pm	121	121	242	99	93	192
1pm – 2pm	117	122	239	92	93	185
2pm – 3pm	160	136	296	125	104	229
3pm – 4pm	334	134	468	248	102	350
4pm – 5pm	269	109	378	202	86	288
5pm – 6pm	186	72	258	140	63	203
6pm – 7pm	112	67	179	96	62	158
7pm – 8pm	58	24	82	49	23	72
8pm – 9pm	20	14	34	16	12	28
9pm -10pm	13	8	21	10	7	17
10pm – 11pm	14	9	23	13	8	21
11pm – Midnight	18	4	22	13	4	17
Total	2208	2206	4414	1751	1744	3495

Source: Traffic Counts 15-22 September 2006

NB: Differences in totals are due to rounding when calculating hourly averages.

TABLE 4.5

**THOMAS MITCHELL DRIVE, WEST OF NEW ENGLAND HIGHWAY
HOURLY TRAFFIC VOLUMES**

Time	5 Day Average (Weekday)			7 Day Average (AADT)		
	East	West	Total	East	West	Total
Midnight – 1am	2	4	6	2	4	6
1am – 2am	6	4	10	5	4	9
2am – 3am	3	5	8	3	4	7
3am – 4am	6	5	11	5	5	10
4am – 5am	5	12	17	4	10	14
5am – 6am	16	66	82	14	54	68
6am – 7am	81	307	388	69	245	314
7am – 8am	107	130	237	85	98	183
8am – 9am	48	74	122	36	57	91
9am – 10am	54	57	111	43	50	93
10am – 11am	47	61	108	38	48	86
11am – Midday	57	52	109	44	41	85
Midday – 1pm	62	50	112	49	39	88
1pm – 2pm	59	55	114	46	43	89
2pm – 3pm	90	72	162	70	56	126
3pm – 4pm	163	63	226	120	49	169
4pm – 5pm	139	51	190	107	40	147
5pm – 6pm	94	43	137	73	35	108
6pm – 7pm	61	61	122	55	58	113
7pm – 8pm	48	15	63	45	13	58
8pm – 9pm	12	6	18	10	5	15
9pm – 10pm	7	8	15	7	7	14
10pm – 11pm	9	26	35	8	23	31
11pm – Midnight	25	5	30	19	4	23
Total	1199	1231	2430	956	991	1947

Source: Traffic Counts 15-22 September 2006

NB: Differences in totals are due to rounding when calculating hourly averages.

4.3.4 Denman Road

Tables 4.6 and 4.7 show traffic volumes using Denman Road, east and west of Thomas Mitchell Drive. Reference to Table 4.6 shows that on a typical weekday (5 day average) Denman Road, east of Thomas Mitchell Drive carries two way traffic volumes of 6,254 vehicles (vpd). Heavy vehicles (Austroad Class 3-12) total 634 vehicles (vpd) and comprise some 10.1% of the total weekday volumes. Typical 7 day average (AADT) two way volumes are 5,321 vehicles (vpd).

Traffic volumes using Denman Road west of Thomas Mitchell Drive are lower. Reference to Table 4.7 shows that on a typical weekday (5 day average) this section of Denman Road carries two way traffic volumes of 3,838 vehicles (vpd). Heavy vehicles (Austroad Class 3-12) total 524 vehicles (vpd) and comprise some 13.7% of the total weekday volumes. Typical 7 day average (AADT) two way volumes are 3,398 vehicles (vpd).

TABLE 4.6

**DENMAN ROAD, EAST OF THOMAS MITCHELL DRIVE
5 DAY AVERAGE & 7 DAY AVERAGE
TRAFFIC VOLUMES & VEHICLE CLASSIFICATION**

Direction of Travel	Weekday					
	5 Day Average			7 Day Average (AADT)		
	Light ¹	Heavy ²	Total	Light ¹	Heavy ²	Total
East	2802	333	3135	2394	278	2672
West	2818	301	3119	2417	232	2649
Total	5620	634	6254	4811	510	5321
Proportion of Total	89.9%	10.1%	100%	90.4%	9.6%	100%

Source – Traffic Counts 15-22 September 2006

¹ Light vehicles - Austroads 1 & 2 vehicle classifications & Motorbikes

² Heavy vehicles - Austroads 3-12 vehicle classifications

TABLE 4.7

**DENMAN ROAD, WEST OF THOMAS MITCHELL DRIVE
5 DAY AVERAGE & 7 DAY AVERAGE
TRAFFIC VOLUMES & VEHICLE CLASSIFICATION**

Direction of Travel	Weekday					
	5 Day Average			7 Day Average (AADT)		
	Light ¹	Heavy ²	Total	Light ¹	Heavy ²	Total
East	1677	242	1919	1503	197	1700
West	1637	282	1919	1469	229	1698
Total	3314	524	3838	2972	426	3398
Proportion of Total	86.3%	13.7%	100%	87.5%	12.5%	100%

Source – Traffic Counts 15-22 September 2006

¹ Light vehicles - Austroads 1 & 2 vehicle classifications & Motorbikes

² Heavy vehicles - Austroads 3-12 vehicle classifications

Hourly traffic volumes using Denman Road on a typical weekday (5 day average) and per day (7 day average) are shown in Tables 4.8 and 4.9.

Table 4.8 shows the hourly traffic volumes in Denman Road east of Thomas Mitchell Drive. Reference to Table 4.8 shows that on a typical weekday, this section of Denman Road carries:

- two way traffic volumes of 714 vph with 118 vph eastbound and 596 vph westbound in the 6am-7am hour; and

- two way traffic volumes of 624 vph with 421 vph eastbound and 203 vph westbound in the 3pm-4pm hour.

Table 4.9 shows the hourly traffic volumes in Denman Road, west of Thomas Mitchell Drive. Reference to Table 4.9 shows that on a typical weekday, this section of Denman Road carries:

- two way traffic volumes of 353 vph with 132 vph eastbound and 221 vph westbound in the 6am-7am hour; and
- two way traffic volumes of 332 vph with 172 vph eastbound and 160 vph westbound in the 4pm-5pm hour.

TABLE 4.8

**DENMAN ROAD, EAST OF THOMAS MITCHELL DRIVE
HOURLY TRAFFIC VOLUMES**

Time	5 Day Average (Weekday)			7 Day Average (AADT)		
	East	West	Total	East	West	Total
Midnight – 1am	8	7	16	10	8	18
1am – 2am	11	3	14	9	3	12
2am – 3am	4	5	9	4	4	8
3am – 4am	8	6	14	8	5	13
4am – 5am	9	26	35	8	23	31
5am – 6am	34	211	245	29	169	198
6am – 7am	118	596	714	108	462	570
7am – 8am	191	236	427	160	183	343
8am – 9am	210	177	387	173	148	321
9am – 10am	180	149	329	165	134	299
10am -11am	180	147	327	167	134	301
11am – Midday	181	164	345	164	151	315
Midday – 1pm	180	175	355	160	156	316
1pm – 2pm	166	182	348	147	163	310
2pm – 3pm	215	187	402	183	163	346
3pm – 4pm	421	203	624	326	173	499
4pm – 5pm	367	188	555	294	158	452
5pm – 6pm	267	165	432	217	146	363
6pm – 7pm	166	142	308	149	129	277
7pm – 8pm	122	56	178	107	50	157
8pm – 9pm	32	41	73	31	37	68
9pm -10pm	26	26	52	22	23	45
10pm – 11pm	18	18	36	16	17	33
11pm – Midnight	20	9	29	16	9	25
Total	3135	3119	6254	2672	2649	5321

Source: Traffic Counts 15-22 September 2006

NB: Differences in totals are due to rounding when calculating hourly averages.

TABLE 4.9

**DENMAN ROAD, WEST OF THOMAS MITCHELL DRIVE
HOURLY TRAFFIC VOLUMES**

Time	5 Day Average (Weekday)			7 Day Average (AADT)		
	East	West	Total	East	West	Total
Midnight – 1am	3	7	10	5	8	13
1am – 2am	3	3	6	4	3	7
2am – 3am	2	4	6	2	4	6
3am – 4am	4	6	10	3	5	8
4am – 5am	10	15	25	8	13	21
5am – 6am	64	63	127	54	51	105
6am – 7am	132	221	353	106	179	285
7am – 8am	129	140	269	112	111	223
8am – 9am	157	104	261	128	89	217
9am – 10am	127	99	226	117	91	208
10am – 11am	124	102	226	116	94	210
11am – Midday	115	102	217	106	97	203
Midday – 1pm	111	107	218	100	104	204
1pm – 2pm	108	118	226	99	115	214
2pm – 3pm	121	117	238	109	112	221
3pm – 4pm	165	154	319	138	134	272
4pm – 5pm	172	160	332	150	135	285
5pm – 6pm	134	148	282	119	125	244
6pm – 7pm	97	117	214	91	104	195
7pm – 8pm	82	50	132	96	46	122
8pm – 9pm	22	36	58	22	33	55
9pm – 10pm	17	22	39	16	21	37
10pm – 11pm	12	16	28	12	16	28
11pm – Midnight	8	10	18	8	9	17
Total	1919	1919	3838	1700	1698	3399

Source: Traffic Counts 15-22 September 2006

NB: Differences in totals are due to rounding when calculating hourly averages.

4.3.5 Edderton Road

Traffic volumes using Edderton Road are relatively low, when compared to the volumes using the adjacent roads. Table 4.10 shows daily traffic volumes and vehicle classifications. Reference to Table 4.10 shows that on a typical weekday (5 day average) Edderton Road, south of Denman Road carries two way weekday traffic volumes of 632 vehicles (vpd). Heavy vehicles (Austroads Class 3-12) total 84 vehicles (vpd) and comprise 13.3% of the total volume. Typical 7 day average (AADT) two way volumes using Edderton Road are 565 vehicles (vpd).

TABLE 4.10

**EDDERTON ROAD, SOUTH OF DENMAN ROAD
5 DAY AVERAGE & 7 DAY AVERAGE
TRAFFIC VOLUMES & VEHICLE CLASSIFICATION**

Direction of Travel	Weekday					
	5 Day Average			7 Day Average (AADT)		
	Light¹	Heavy²	Total	Light¹	Heavy²	Total
North	278	46	324	249	38	287
South	270	38	308	245	33	278
Total	548	84	632	494	71	565
Proportion of Total	86.7%	13.3%	100%	87.4%	12.6%	100%

Source – Traffic Counts 15-22 September 2006

¹ Light vehicles - Austroads 1 & 2 vehicle classifications & Motorbikes

² Heavy vehicles - Austroads 3-12 vehicle classifications

Table 4.11 shows hourly traffic volumes using Edderton Road, south of Denman Road on a typical weekday (5 day average) and per day (7 day average).

Reference to Table 4.11 shows that peak hour traffic volumes (on a typical weekday) are in the order of:

- 59 vph (two way) with 20 vph northbound and 39 vph southbound during the 6am-7am hour; and
- 62 vph (two way) with 42 vph northbound and 20 vph southbound during the 4pm-5pm hour.

TABLE 4.11

**EDDERTON ROAD, SOUTH OF DENMAN ROAD
HOURLY TRAFFIC VOLUMES**

Time	5 Day Average (Weekday)			7 Day Average (AADT)		
	North	South	Total	North	South	Total
Midnight – 1am	1	0	1	1	0	1
1am – 2am	1	1	2	1	1	2
2am – 3am	0	1	1	0	0	0
3am – 4am	0	1	1	0	1	1
4am – 5am	1	4	5	1	4	5
5am – 6am	8	18	26	7	14	21
6am – 7am	20	39	59	17	31	48
7am – 8am	17	22	39	15	18	33
8am – 9am	21	14	35	18	13	31
9am – 10am	14	17	31	12	15	27
10am – 11am	21	17	38	20	17	37
11am – Midday	17	18	35	18	18	36
Midday – 1pm	23	20	43	20	19	39
1pm – 2pm	19	18	37	18	18	36
2pm – 3pm	22	19	41	20	19	39
3pm – 4pm	34	21	55	28	19	47
4pm – 5pm	42	20	62	34	19	53
5pm – 6pm	30	23	53	26	21	47
6pm – 7pm	17	15	32	16	14	30
7pm – 8pm	8	7	15	7	7	14
8pm – 9pm	3	5	8	3	5	8
9pm – 10pm	3	4	7	3	4	7
10pm – 11pm	2	2	4	2	2	4
11pm – Midnight	1	1	2	1	1	2
Total	324	308	632	287	278	565

Source: Traffic Counts 15-22 September 2006

NB: Differences in totals are due to rounding when calculating hourly averages.

4.3.6 Intersection Traffic Volumes and Operating Conditions

Intersection traffic counts were undertaken at the intersections of Thomas Mitchell Drive / Mt Arthur Coal Mine Access Road, Thomas Mitchell Drive / Denman Road and Thomas Mitchell Drive / New England Highway on 19 and 20 September 2006 and 7 February 2007.

Figures 3 and 4 shows the traffic volumes using these intersections during the AM peak hour (6.00am-7.00am) and the PM peak hour (3.15pm-4.15pm). The peak hour represents the one hour when the maximum number of vehicles used the intersections.

The 6.00am-7.00am peak hour also coincides with the highest AM traffic generation of Mt Arthur Coal mine. During the PM period, the highest traffic generation for Mt Arthur Coal occurs between 6.00pm-7.00pm which coincides with the major shift time changes.

Reference to **Figures 3 and 4** shows the predominant turning movements at the principal intersections.

At Mt Arthur Mine Access Road intersection the major turning movements are right turn into Mt Arthur Mine Access Road from Thomas Mitchell Drive and the corresponding left turn out of the Access Road to travel north in Thomas Mitchell Drive.

The major turning movements at Denman Road / Thomas Mitchell Drive are the left turn from Denman Road into Mitchell Road to travel towards Mt Arthur mine and the corresponding right turn from Thomas Mitchell Drive into Denman Road to travel towards Muswellbrook township.

The major turning movements at Thomas Mitchell Drive / New England Highway are the left turn from New England Highway into Thomas Mitchell Drive and the corresponding right turn out of Thomas Mitchell Drive into New England Highway to travel towards Singleton.

Figures 5 and 6 show the intersection volumes for 7.15am-8.15am hour period (**Figure 5**) and 6.00pm-7.00pm hour period (**Figure 6**). During these periods, the major traffic movements are similar to the peak hours, however the traffic volumes are lower.

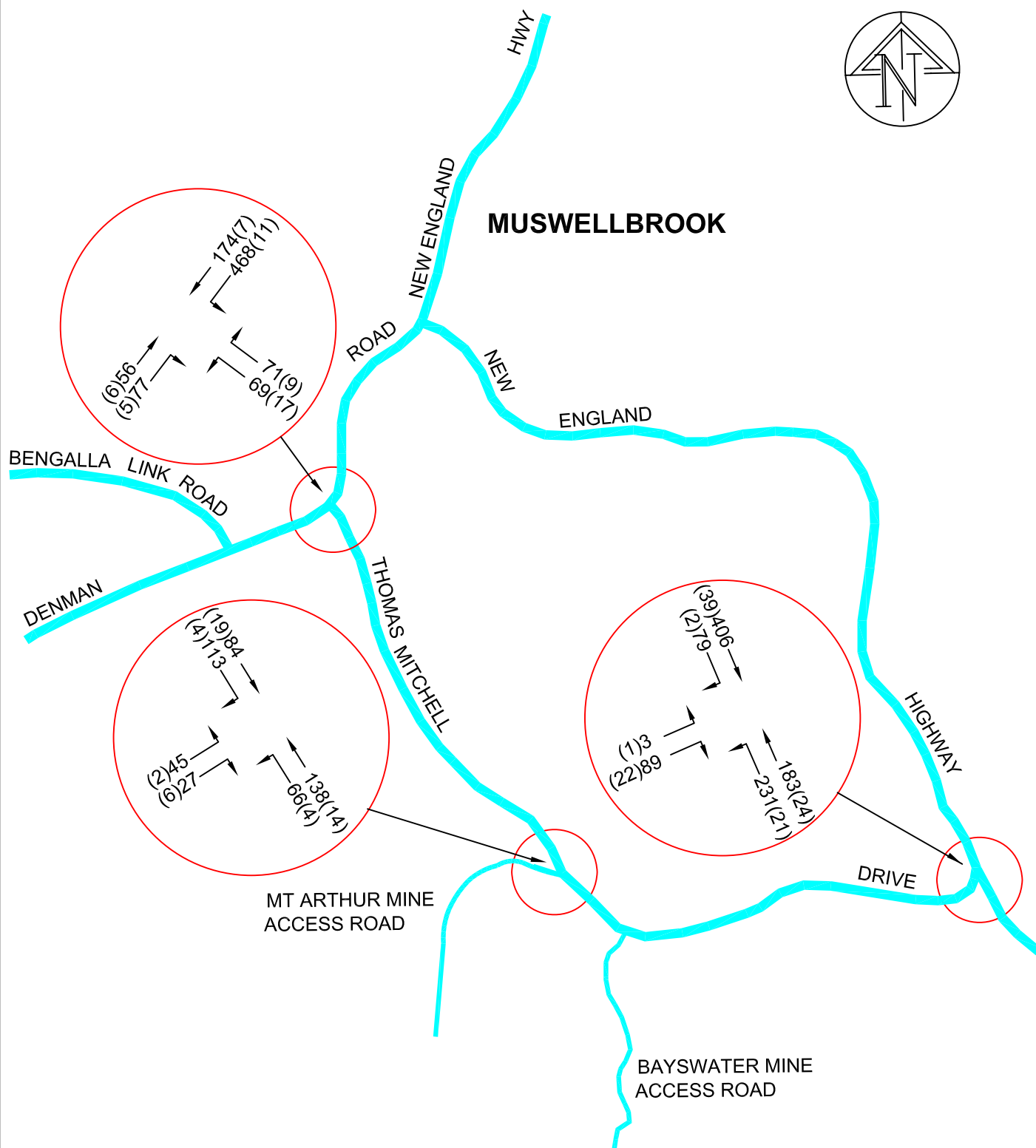
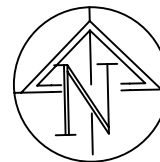
Traffic Modelling

To assess the traffic conditions and operational performance of these intersections during the peak hour periods, traffic modelling has been undertaken using the software package INTANAL. The RTA's Guide to Traffic Generating Developments, October 2002 nominates INTANAL as an appropriate traffic model that can be used with all forms of intersection control.

INTANAL assesses the operational performance of intersections under traffic signal, roundabout or sign control. Criteria for interpreting INTANAL modelling results are reproduced in **Appendix 1**. The best criteria for assessing intersections controlled by priority or sign control are Level of Service (LS), Degree of Saturation (DS), Average Vehicle Delay (AVD) and Highest Movement Delay (HMD). The Highest Movement Delay determines the Level of Service for priority or sign controlled intersections. The desirable design criteria for intersections is a Level of Service D or better. See **Appendix 1** for Criteria for Interpreting Results of Intanal Analysis.

The modelling has been undertaken using the existing geometry and traffic controls at the intersections together with the peak hour traffic volumes shown in **Figures 3 and 4**. Allowance has been made for the number of heavy vehicles at the intersections.

The results of the traffic modelling are shown in Tables 4.12, 4.13 and 4.14. Reference to Table 4.12 shows that the Thomas Mitchell Drive / Mt Arthur Coal Mine Access Road intersection operates at a satisfactory level of service in the peak hours with a Level of Service B operation and average vehicle delays of 13-14 seconds for the minor movements. The highest movement delay is for the right turn out of Mt Arthur Coal mine access road, which is in the order of 14-16 seconds.



LEGEND

406 - TOTAL VEHICLES

(39) - HEAVY VEHICLES

TRANSPORT AND URBAN PLANNING

TRAFFIC, TRANSPORT & PROJECT
MANAGEMENT CONSULTANTS

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Phone 02 9545 1411 Fax 02 9545 1556

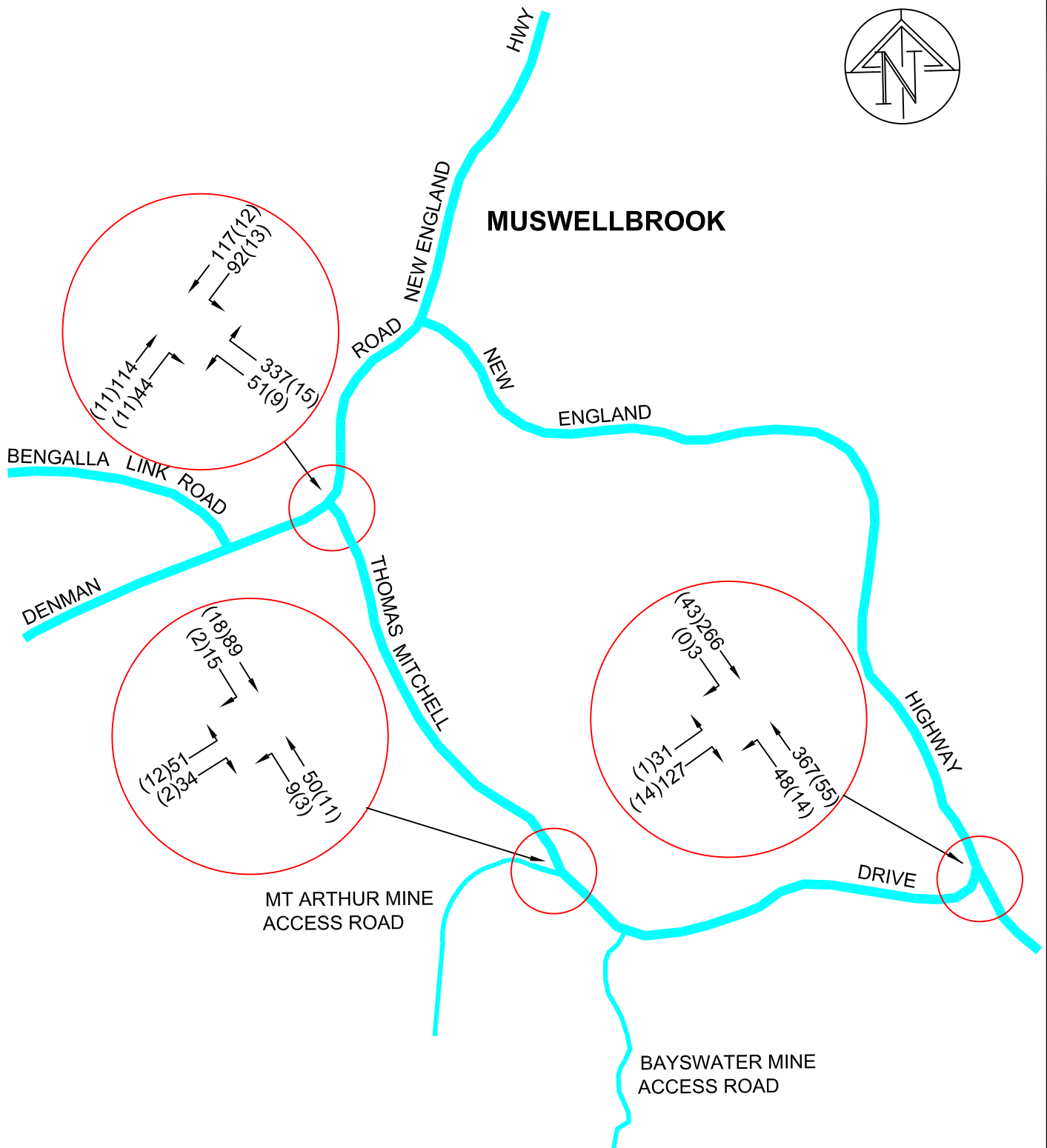
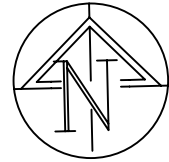
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FIGURE 3

MT ARTHUR COAL UNDERGROUND PROJECT,
MUSWELLBROOK
EXISTING INTERSECTION VOLUMES
AM PEAK HOUR 6 AM - 7 AM

JOB NO.26072



LEGEND

266 - TOTAL VEHICLES
(43) - HEAVY VEHICLES

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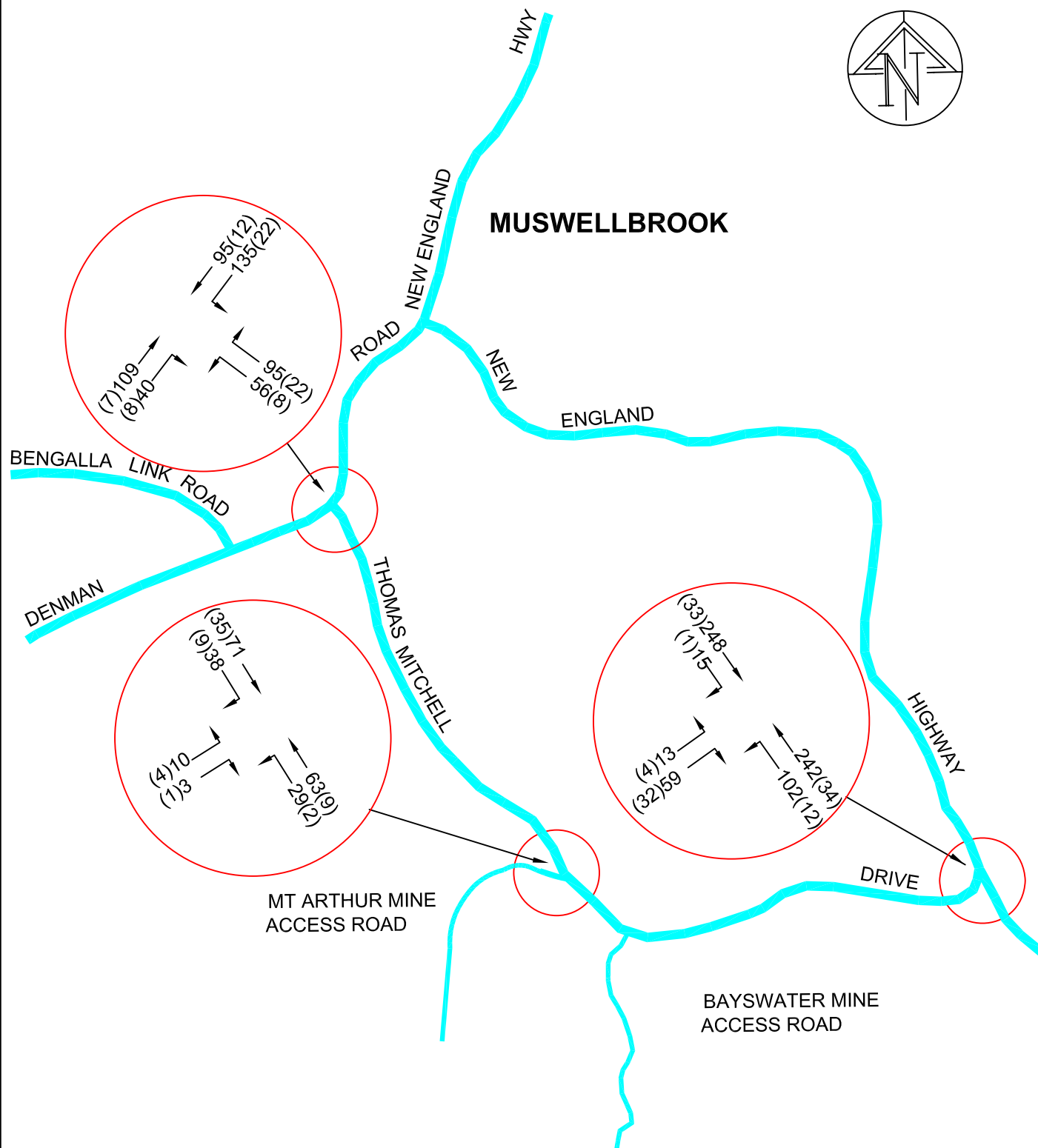
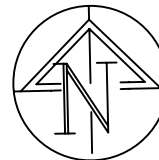
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FIGURE 4

MT ARTHUR COAL UNDERGROUND PROJECT,
MUSWELLBROOK
EXISTING INTERSECTION VOLUMES
PM PEAK HOUR 3.15 PM - 4.15 PM

JOB NO.26072



LEGEND

242 - TOTAL VEHICLES
(34) - HEAVY VEHICLES

TRANSPORT AND URBAN PLANNING

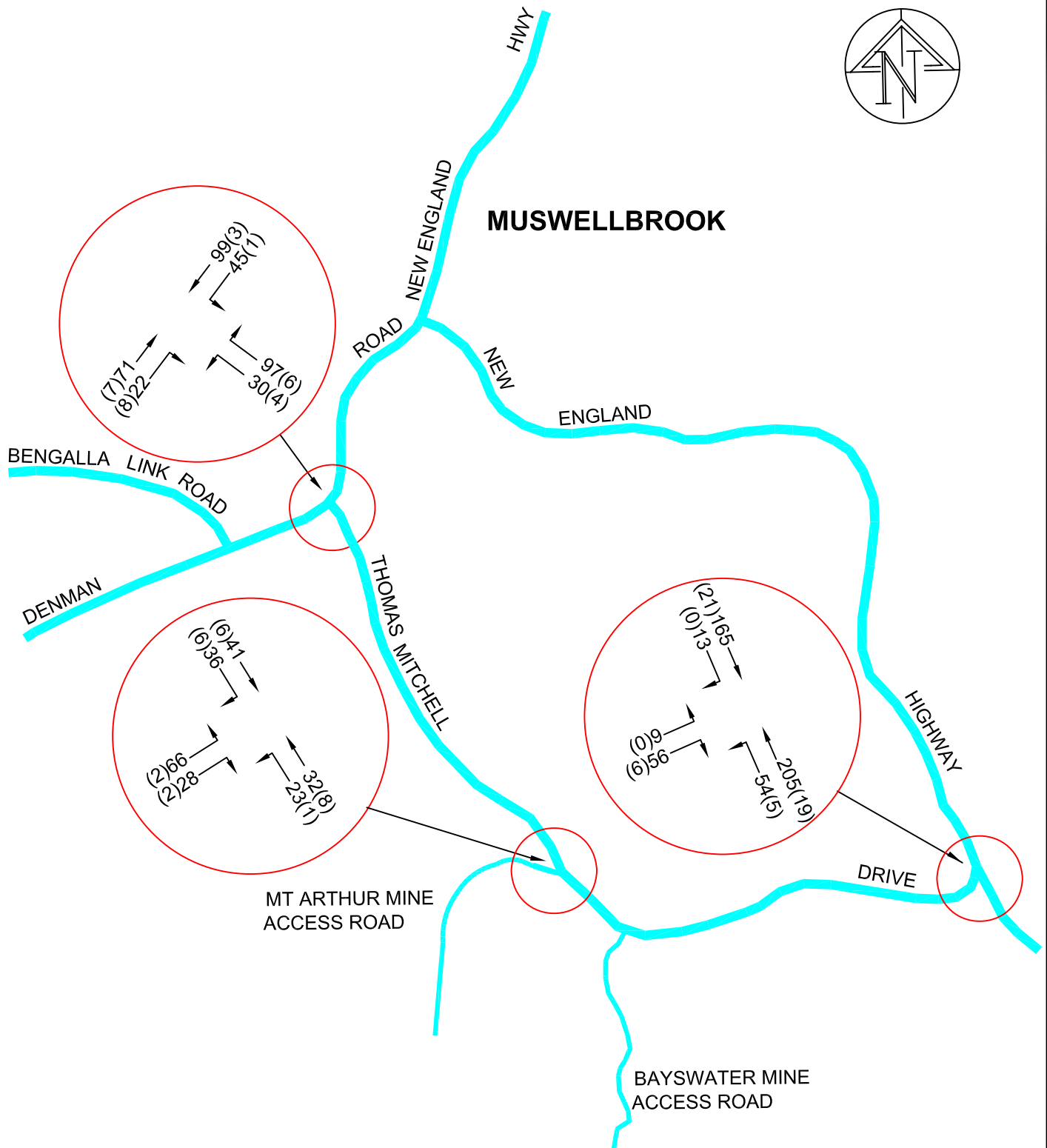
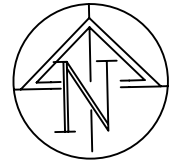
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FIGURE 5
MT ARTHUR COAL UNDERGROUND PROJECT,
MUSWELLBROOK
EXISTING INTERSECTION VOLUMES
7.15 AM - 8.15 AM
JOB NO.26072



LEGEND

165 - TOTAL VEHICLES
(21) - HEAVY VEHICLES

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FIGURE 6 MT ARTHUR COAL UNDERGROUND PROJECT, MUSWELLBROOK EXISTING INTERSECTION VOLUMES 6 PM - 7 PM

JOB NO.26072

TABLE 4.12

**INTANAL ANALYSIS FOR THOMAS MITCHELL DRIVE / MT ARTHUR
COAL ACCESS ROAD**

Criteria	AM Peak (6.00am-7.00am)	PM Peak (3.15pm-4.15pm)
LS	B	B
DS	0.10	0.09
AVD	13.4	13.0
HMD	16.0	14.7

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

Reference to Table 4.13 shows that the Denman Road / Thomas Mitchell Drive intersection has a satisfactory level of service during the peak hours with a Level of Service A/B operation and average vehicle delays for the minor movements of 9-11 seconds. The highest delays are for the right turn out of Thomas Mitchell Drive and these average 13-15 seconds per vehicle, during these periods. Delays for some individual vehicles turning right out of Thomas Mitchell Drive may be higher, particularly during the PM peak hour, due to the high arrival rates that occur in parts of the peak hour.

TABLE 4.13

**INTANAL ANALYSIS FOR DENMAN ROAD /
THOMAS MITCHELL DRIVE**

Criteria	AM Peak (6.00am-7.00am)	PM Peak (3.15pm-4.15pm)
LS	A	B
DS	0.17	0.66
AVD	9.2	10.2
HMD	13.3	14.7

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

Reference to Table 4.14 shows that the New England Highway / Thomas Mitchell Drive intersection has a satisfactory operation with a Level of Service B operation and average vehicle delays for the minor movements between 15-20 seconds. The highest delay is for the right turn out of Thomas Mitchell Drive which averages between 21-25 seconds per vehicle in the peak hours. Individual delays for fully laden heavy vehicles turning right out of Thomas Mitchell Drive may be higher during the peak hours due to the larger gaps required for these vehicles to enter the traffic stream.

TABLE 4.14

**INTANAL ANALYSIS FOR NEW ENGLAND HIGHWAY /
THOMAS MITCHELL DRIVE**

Criteria	AM Peak (6.00am-7.00am)	PM Peak (3.15pm-4.15pm)
LS	B	B
DS	0.37	0.49
AVD	14.9	19.9
HMD	21.0	24.7

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

4.4 Road Safety

The RTA road crash statistics were provided by the RTA for those sections of the road network adjacent Mt Arthur Coal Mine for the 5 year period from 1 January 2000 to 31 December 2004.

The sections of the road network included:

- New England Highway between Denman Road and Ravensworth (approximately 28 kilometres);
- Denman Road between Golden Highway at Denman and New England Highway at Muswellbrook (approximately 21 kilometres);
- Thomas Mitchell Drive (approximately 11 kilometres); and
- Edderton Road (approximately 15 kilometres).

Table 4.15 provides a summary of the total number of accidents (midblock and at intersections) that occurred on these roads by severity and year. New England Highway and Denman Road have the highest number of accidents. This would be expected as both these are longer lengths of road and carry higher traffic volumes than the local roads. Accident levels on Thomas Mitchell Drive (8 accidents in 5 years including 6 injury accidents) and Edderton Road (7 accidents in 5 years including 4 injury accidents) are lower. Five (5) of the accidents in Thomas Mitchell Drive were single vehicle run off the road accidents, which suggests excessive vehicle speed and or other factors such as fatigue. As these accidents occurred along the length of the road, there is no treatable pattern.

Accident statistics for the principal intersections that provide access to Mt Arthur Coal Mine during the 5 year period were as follows:

- New England Highway / Thomas Mitchell Drive – one (1) accident, which was an injury accident and occurred in 2004;
- Denman Road / Thomas Mitchell Drive – total of two (2) accidents which occurred in 2003, one (1) of which was an injury accident.

While there is no identifiable pattern to the accidents at the above intersections, it is noted that Denman Road / Thomas Mitchell Drive intersection has been recently upgraded to provide turning lanes in Denman Road.

There were no reported accidents at the intersection of Thomas Mitchell Drive and Mt Arthur Coal Mine access road during this period.

TABLE 4.15

**ROAD CRASH STATISTICS FOR SURROUNDING ROADS
BETWEEN 2000 AND 2004**

New England Highway (Ravensworth to Muswellbrook) – 28 kilometres

Year	Total Accidents	Tow Away Accidents	Injury Accidents	Fatal Accidents
2000	12	5	4	3
2001	20	10	10	-
2002	20	9	11	-
2003	20	10	10	-
2004	26	19	7	-
Total	98	53	42	3

Denman Road ¹ (Golden Highway to New England Highway) – 21 kilometres

Year	Total Accidents	Tow Away Accidents	Injury Accidents	Fatal Accidents
2000	6	2	4	-
2001	9	4	5	-
2002	12	8	3	1
2003	7	4	2	1
2004	12	7	5	-
Total	46	25	19	2

¹ Includes intersection accidents at New England Highway and Golden Highway.

Thomas Mitchell Drive – 11 kilometres

Year	Total Accidents	Tow Away Accidents	Injury Accidents	Fatal Accidents
2000	-	-	-	-
2001	2	-	2	-
2002	1	1	-	-
2003	-	-	-	-
2004	5	1	4	-
Total	8	2	6	0

TABLE 4.15 (Con't)**Edderton Road – 15 kilometres**

Year	Total Accidents	Tow Away Accidents	Injury Accidents	Fatal Accidents
2000	2	-	2	-
2001	2	1	1	-
2002	2	1	1	-
2003	1	1	-	-
2004	-	-	-	-
Total	7	3	4	0

4.5 Summary of Existing Traffic Conditions

The assessment of the existing road network including the intersections indicates that traffic conditions are satisfactory to good with adequate road and intersection capacity.

The level of the traffic volumes using New England Highway, Thomas Mitchell Drive and Denman Road reflect the role that these roads play in the overall road hierarchy for the area.

The principal intersections on the public road network have been upgraded by the road authorities in recent years. The intersection of Thomas Mitchell Drive and Mt Arthur Coal Mine Access Road provides suitable channelisation to cater for the turning movements into and out of the mine in a safe manner.

A review of the accident data on the road network indicates that road safety levels at the 3 principal intersections and on the wider road network are satisfactory.

5.0 ASSESSMENT OF TRAFFIC IMPACTS

5.1 Peak Traffic Generation of Existing Mine at Mt Arthur Coal

The peak traffic generation of the existing mine operations at Mt Arthur Coal was established from traffic counts undertaken on 19 and 20 September 2006 and 7 February 2007.

Table 5.1 shows traffic movements into and out of Mt Arthur Coal via the access road at Thomas Mitchell Drive, during the AM period (5.30am-9.30am) and the PM period (2.30pm-8.00pm).

The AM and PM peak hours coincide with the shift time changes for the miners and process workers at Mt Arthur Coal, with the AM peak occurring between 6.00am-7.00am and PM occurring between 6.00pm-7.00pm.

During the AM peak hour (6.00am-7.00am) the mine generated a total of 251 vehicle movements with 179 vehicles entering and 72 vehicles exiting the mine.

During the PM peak hour (6.00pm-7.00pm) the mine generated a total of 153 vehicle movements with 59 vehicles entering and 94 vehicles exiting the mine.

TABLE 5.1

TRAFFIC GENERATION ¹ OF EXISTING MT ARTHUR COAL MINE DURING WEEKDAY AM AND PM PERIODS

Time	In			Out			Total		
	Light Veh	Heavy Veh ²	Combined	Light Veh	Heavy Veh ²	Combined	Light Veh	Heavy Veh ²	Combined
AM Period									
5.30-5.45am	21	0	21	0	4	4	21	4	25
5.45-6.00am	34	4	38	0	0	0	34	4	38
6.00-6.15am	75	1	76	3	3	6	78	4	82
6.15-6.30am	57	3	60	7	0	7	64	3	67
6.30-6.45am	25	1	26	27	5	32	52	6	58
6.45-7.00am	14	3	17	27	0	27	41	3	44
7.00-7.15am	16	4	20	21	5	26	37	9	46
7.15-7.30am	12	4	16	2	1	3	14	5	19
7.30-7.45am	13	3	16	2	0	2	15	3	18
7.45-8.00am	19	3	22	3	2	5	22	5	27
8.00-8.15am	12	1	13	1	2	3	13	3	16
8.15-8.30am	4	0	4	0	1	1	4	1	5
8.30-8.45am	0	1	1	4	1	5	4	2	6
8.45-9.00am	7	2	9	0	2	2	7	4	11
9.00-9.15am	2	2	4	1	2	3	3	4	7
9.15-9.30am	1	4	5	1	1	2	2	5	7

TABLE 5.1 (Cont)

Time	In			Out			Total		
	Light Veh	Heavy Veh ²	Combined	Light Veh	Heavy Veh ²	Combined	Light Veh	Heavy Veh ²	Combined
PM Period									
2.30-2.45pm	4	0	4	25	2	27	29	2	31
2.45-3.00pm	7	1	8	16	0	16	23	1	24
3.00-3.15pm	5	2	7	20	2	22	25	4	29
3.15-3.30pm	3	3	6	15	1	16	18	4	22
3.30-3.45pm	4	0	4	19	4	23	23	4	27
3.45-4.00pm	6	1	7	21	7	28	27	8	35
4.00-4.15pm	6	1	7	16	2	18	22	3	25
4.15-4.30pm	0	1	1	23	3	26	23	4	27
4.30-4.45pm	1	1	2	19	1	20	20	2	22
4.45-5.00pm	3	0	3	12	1	13	15	1	16
5.00-5.15pm	3	0	3	10	2	12	13	2	15
5.15-5.30pm	0	0	0	9	0	9	9	0	9
5.30-5.45pm	6	2	8	12	1	13	18	3	21
5.46-6.00pm	15	2	17	8	0	8	23	2	25
6.00-6.15pm	28	1	29	6	1	7	34	2	36
6.15-6.30pm	24	0	24	12	1	13	36	1	37
6.30-6.45pm	3	0	3	33	2	35	36	2	38
6.45-7.00pm	0	3	3	39	0	39	39	3	42
7.00-7.15pm	1	0	1	16	1	17	17	1	18
7.15-7.30pm	1	0	1	3	0	3	4	0	4
7.30-7.45pm	1	0	1	4	1	5	5	1	6
7.45-8.00pm	1	0	1	5	2	7	6	2	8

¹ Traffic generation includes all trips into and out of the mine on the days of the surveys, including Orica personnel.

² Heavy vehicles include small trucks (small rigid trucks), used by some contractors and Orica truck movement into and out of the mine.

5.2 Traffic Impacts of Proposal in Operational Phase

5.2.1 Traffic Generation

The Mt Arthur Underground Project is expected to have a 21 year life with the maximum activity levels occurring towards the end of the mine plan.

The traffic generation of the proposed underground mine based on the maximum activity levels is estimated to be:

- 244 employee trips into and out of the mine on a weekday based on 85% driver ratio. These would be light vehicles.
- 18 visitor trips into and out of the mine per day, which would also be light vehicles; and

- Up to 60 delivery / maintenance trips into and out of the mine per day. Thirty (30) of these are estimated to be heavy vehicles with thirty (30) light vehicles.

The maximum traffic generation will occur at shift time changes associated with underground miners and other workers.

In the AM and PM periods, the shift times occur at 8am and 4pm.

Information provided by Mt Arthur Coal indicates that the shift workers arrive some 15-45 minutes before the shift starts, the majority leaving the mine within 30 minutes of the shift ending. To adopt a worst case for the assessment, it has been assumed that all the shift workers will arrive and depart within the one hour that represents 45 minutes before the shift change times and 15 minutes after.

Based on a maximum of 59 miners / contractors per shift and a 85% driver rate, the traffic generation would be 50 vehicles arriving and departing the mine within this one hour.

The maximum number of vehicle trips by management and administration staff is estimated to be 87 vehicle trips (based on 85% driver rate) into and out of the mine per day with arrivals occurring between 6.30am and 8.00am and departures between 3.30pm and 6pm.

It has been assumed that 67% of these staff, which is 58 vehicles, will arrive in this hour in the morning and will depart in this hour after the day shift finishes.

Visitor and delivery / maintenance vehicle trips are estimated to be:

- 3 visitor arrivals and departure trips in the AM and PM; and
- 10 delivery / maintenance arrival and departures trips in the AM and PM hour.

Based on the above, the maximum traffic generation of the proposed Underground Project in the operational phase will be as follows:

- 7.15am-8.15am – 121 vehicles entering the mine and 63 vehicles exiting the mine; and
- 3.15pm-4.15pm – 63 vehicles entering the mine and 121 vehicles exiting the mine.

An alternative scenario where the shift times of the Underground Project overlap with the shift times of the existing mine operation has also been examined. Details of this are set out in Section 5.2.6.

5.2.2 Traffic Assignment of Road Network

The home locations of the future employees are expected to be similar to the existing Mt Arthur Coal workers. Table 5.2 shows the home locations of the existing employees at Mt Arthur Coal, which has been adopted as the basis for determining trip assignments to and from Mt Arthur Coal for the project employees.

TABLE 5.2

**EXPECTED HOME LOCATIONS OF PROJECT EMPLOYEES /
CONTRACTORS**

Town	Residential Distribution
Muswellbrook	37%
Denman	6%
Scone	13%
Aberdeen	7%
Singleton	26%
Cessnock	2%
Other – Lower Hunter	7%
Other – Upper Hunter	2%

Based on Table 5.2, it would be expected that the trip assignment to and from Mt Arthur Coal for employees / contractors associated with the project would be:

- 63% to and from the north along Thomas Mitchell Drive with 57% using Denman Road east of Thomas Mitchell Drive and 6% using Denman Road west of Thomas Mitchell Drive;
- 37% to and from the south along Thomas Mitchell Drive with 35% using New England Highway south of Thomas Mitchell Drive and 2% using New England Highway north of Thomas Mitchell Drive.

This assignment is consistent with the traffic counts undertaken at Mt Arthur Coal Mine Access Road / Thomas Mitchell Drive intersection and at the adjacent intersections.

Approximately 85% of the visitor and delivery / maintenance vehicles are expected to arrive / depart from / to the south along Thomas Mitchell Drive via the New England Highway with the remaining 15% arriving and departing to / from the north along Thomas Mitchell Drive via Denman Road.

5.2.3 Cumulative Traffic Increases due to Future Developments

An examination of RTA AADT traffic volumes for Denman Road and the New England Highway indicates that traffic volumes using these roads have been relatively static for a number of years.

AADT volumes on Denman Road, west of the New England Highway, increased by 7.3% between 1992 and 2004 which represents an average increase of 0.6% per year.

AADT volumes on the New England Highway at the southern end of Muswellbrook township increased by 1.5% between 1998 and 2004, which represents an average increase of 0.3% per year.

Therefore, future growth in background traffic is expected to be limited to specific developments in the area. Two other mine projects, namely Mt Pleasant Mine and the Anvil Hill Mine are approved, but yet to commence in the Muswellbrook area.

Both of the mines (if constructed) will increase traffic volumes using the road network in Muswellbrook and in particular at the Denman Road / Thomas Mitchell Drive intersection.

Traffic estimates contained in the Mt Pleasant Mine EIS (ERM Mitchell McCotter 1997) indicated that the peak hour volume increases at Denman Road / Thomas Mitchell Drive intersection would be 204 vehicles per hour and 95 vehicles per hour at the New England Highway / Thomas Mitchell Drive intersection. The EIS stated that this increase would typically occur between 6.00am-8.00am in the morning and 6.00pm-8.00pm in the evenings based on the shift time changes adopted for the Mt Pleasant Mine.

The Traffic Assessment Report for Anvil Hill Coal Mine (TPK & Associates Pty Ltd, May-July 2006) estimated peak hour increases of 113 vph in the AM peak hour and 98 vph in the PM peak hour at the intersection of Denman Road / Thomas Mitchell Drive. The estimated increases in Thomas Mitchell Drive and hence at the intersection of New England Highway / Thomas Mitchell Drive are 25 vph and 22 vph in the AM and PM peak hours respectively.

The peak hours for Anvil Hill Mine are nominated as 6.30am-7.30am (AM peak) and 6.30pm-7.30pm (PM peak) in the Traffic Assessment Report.

5.2.4 Traffic Impacts of Mt Arthur Underground Project in Operational Phase

Road Network

The proposed Mt Arthur Underground Project at maximum employment levels will increase daily traffic volumes on the road network as follows:

- Denman Road, west of Thomas Mitchell Drive – 32 vpd, which represents an increase of 0.8% on the weekday average traffic volume of 3,828 vpd.
- Denman Road, east of Thomas Mitchell Drive – 300 vpd, which represents an increase of 4.8% on the weekday average traffic volume of 6,254 vpd.
- Thomas Mitchell Drive, south of Denman Road – 332 vpd, which represents an increase of 7.5% on the weekday average traffic volume of 4,414 vpd.
- Thomas Mitchell Drive, west of New England Highway – 312 vpd, which represents an increase of 12.8% on the weekday average traffic volume of 2,430 vpd.
- New England Highway at Thomas Mitchell Drive – 312 vpd, which represents an increase of approximately 3.0% on the daily (AADT) traffic volume of 10,269 vpd. (**NB.** AADT measured at southern end of Muswellbrook town.)

The impact of this additional traffic on these roads is assessed as satisfactory. The increase will not substantially change the existing level of service on these roads in terms of delay and or reduced road capacity. All of these roads are major roads in the Muswellbrook area with a functional role to carry state and regional traffic in terms of the areas road hierarchy.

Impact on Intersections

The maximum employment and other activity levels for Mt Arthur Underground Project are not expected to occur until the latter part of the 21 year mine plan. However, to assess a worst case scenario for the purpose of this assessment, it has been assumed that the maximum activity levels will be reached soon after commissioning of the mine.

As noted previously, the peak hours for the operational phase of the mine will be 7.15am-8.15am and 3.15pm- 4.15pm and associated with the shift time changes. While the PM period (3.15pm-4.15pm) will coincide with the PM peak period on the adjacent road network, the AM period (7.15am-8.15am) will not.

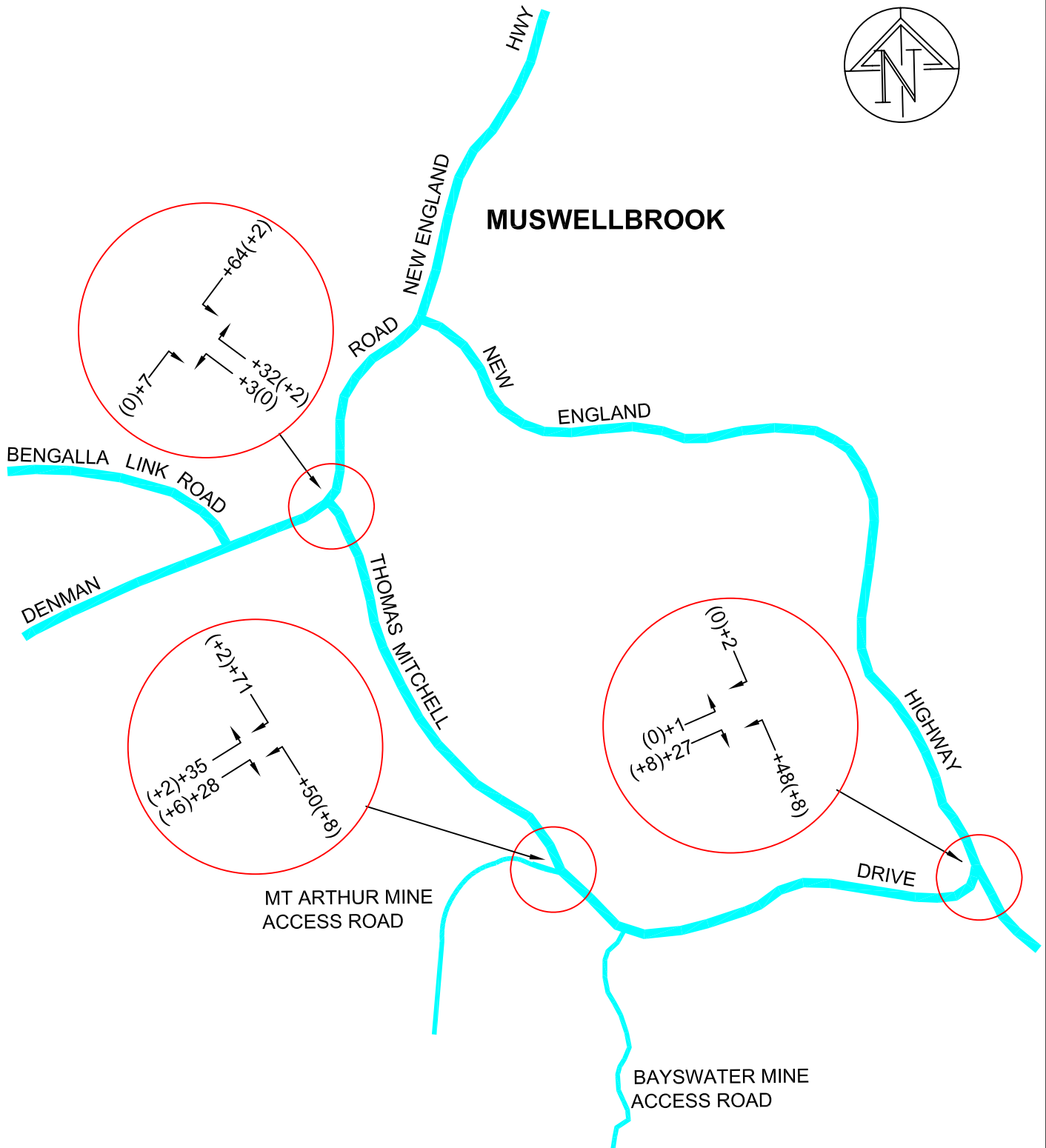
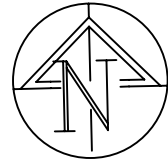
Figures 7A and 7B shows the additional traffic associated with the operational phase of the Mt Arthur Underground Project assigned to the road network in accordance with the traffic assignment outlined in Section 5.2.2 for the 7.15am-8.15am and 3.15pm-5.15pm periods.

To assess the impact of the operational traffic on the principle intersections, the software package INTANAL has been used.

The traffic modelling has been undertaken with the additional traffic volumes as shown on **Figures 7A and 7B** overlaid onto existing traffic volumes on the road network during the 7.15am-8.15am and 3.15pm-4.15pm periods. Allowance has been made for heavy vehicles.

Tables 5.3, 5.4 and 5.5 show the traffic modelling results for 3 principal intersections.

Reference to Table 5.3 which shows the modelling results for the intersection of Thomas Mitchell Drive / Mt Arthur Coal Access Road indicates that the intersection will continue to operate at a satisfactory level with a Level of Service B operation and acceptable delays for the minor traffic movements. The overall increase in delays to the minor movements due to the operational traffic is 1-2 seconds per vehicle.



LEGEND

27 - TOTAL VEHICLES
(8) - HEAVY VEHICLES

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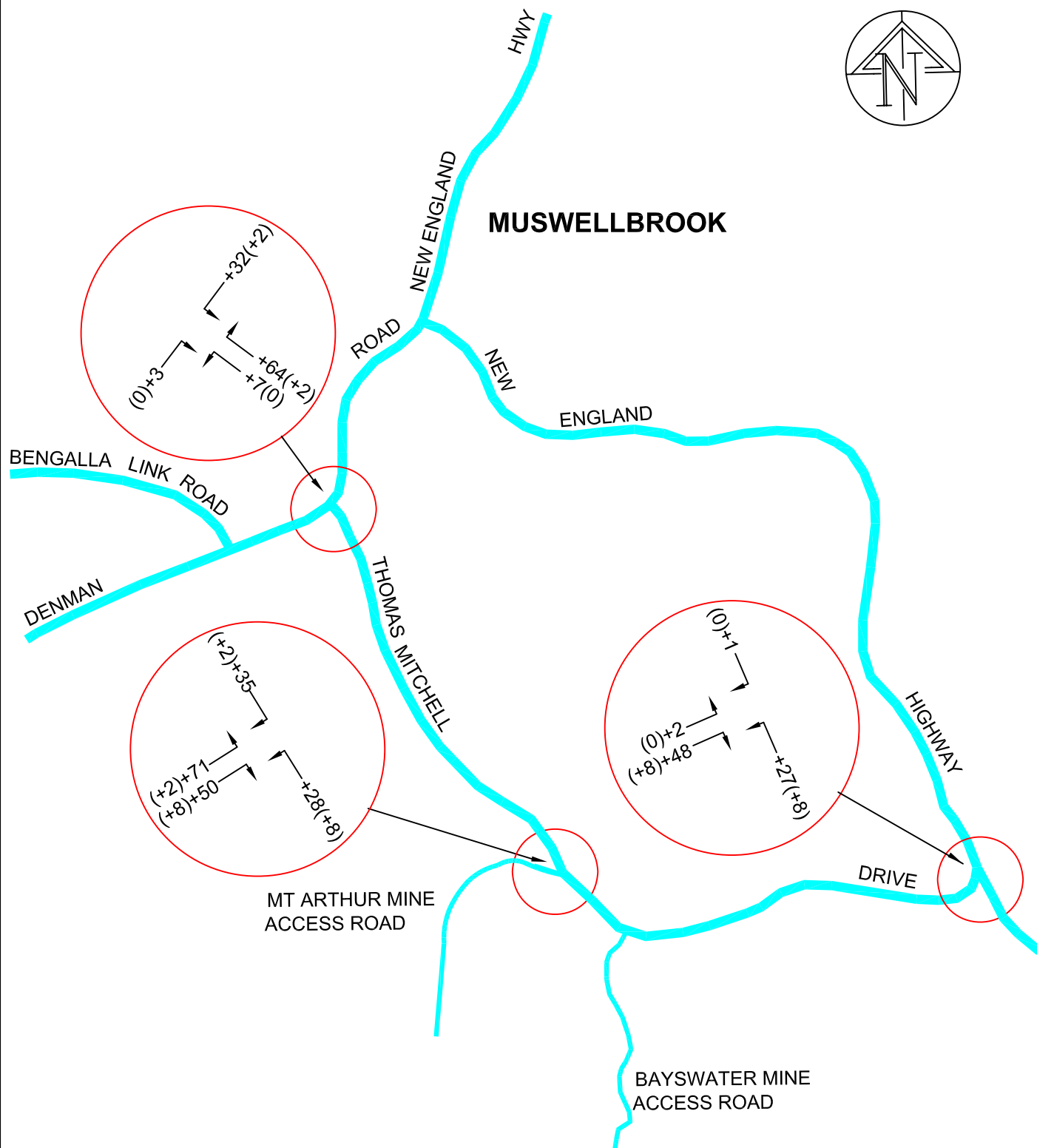
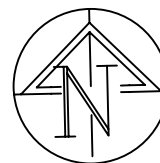
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FIGURE 7A

MT ARTHUR COAL UNDERGROUND PROJECT,
MUSWELLBROOK

**PROPOSAL'S OPERATIONAL TRAFFIC
IN 7.15 AM - 8.15 AM PERIOD**

JOB NO.26072



LEGEND

27 - TOTAL VEHICLES

(8) - HEAVY VEHICLES

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FIGURE 7B

MT ARTHUR COAL UNDERGROUND PROJECT,
MUSWELLBROOK

**PROPOSAL'S OPERATIONAL TRAFFIC
IN 3.15 PM - 4.15 PM PERIOD**

JOB NO.26072

TABLE 5.3

**INTANAL ANALYSIS FOR THOMAS MITCHELL DRIVE / MT ARTHUR
COAL ACCESS ROAD WITH OPERATIONAL TRAFFIC**

Criteria	AM Peak (7.15am-8.15am)		PM Peak (3.15pm-4.15pm)	
	Existing	Operational Traffic	Existing	Operational Traffic
LS	B	B	B	B
DS	0.04	0.10	0.09	0.19
AVD	12.7	13.1	13.0	13.4
HMD	14.6	15.2	14.7	15.3

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

Table 5.4 shows the traffic modelling results for the intersection of Thomas Mitchell Drive / Denman Road. Reference to this table shows that the intersection will operate at satisfactory level with a Level of Service B operation and acceptable average vehicle delays for the minor movements. The increase in delays to the minor movements at the intersection due to the operational traffic is 1-2 seconds per vehicle.

TABLE 5.4

**INTANAL ANALYSIS FOR DENMAN ROAD/ THOMAS MITCHELL DRIVE
WITH OPERATIONAL TRAFFIC**

Criteria	AM Peak (7.15am-8.15am)		PM Peak (3.15pm-4.15pm)	
	Existing	Operational Traffic	Existing	Operational Traffic
LS	A	B	B	B
DS	0.27	0.34	0.66	0.79
AVD	8.3	10.5	10.2	12.8
HMD	13.9	14.3	14.7	15.5

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

Table 5.5 shows the traffic modelling results for the intersection of New England Highway / Thomas Mitchell Drive. Reference to this table shows that this intersection would continue to operate at a Level of Service B operation which is satisfactory. The increase in delays to the minor movements due to the operational traffic is 1-3 seconds per vehicle.

TABLE 5.5

**INTANAL ANALYSIS FOR NEW ENGLAND HIGHWAY / THOMAS
MITCHELL DRIVE WITH OPERATIONAL TRAFFIC**

Criteria	AM Peak (7.15am-8.15am)		PM Peak (3.15pm-4.15pm)	
	Existing	Operational Traffic	Existing	Operational Traffic
LS	B	B	B	B
DS	0.35	0.48	0.49	0.80
AVD	15.5	15.7	19.9	21.2
HMD	20.1	21.0	24.7	27.2

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

In concluding, the traffic modelling confirms that the additional traffic associated with the operational phase will not have significant impacts on the three (3) principal intersections and conditions at these intersections are expected to remain satisfactory.

5.2.5 Cumulative Impacts

The cumulative traffic volume increases associated with the Underground Project as well as the Mt Pleasant project and Anvil Hill project will have the most significant impacts at those times that coincide with the shift time changes.

Table 5.6 shows a comparison of the expected AM and PM peak hours for each of the above mine proposals. While the Underground Project may have some degree of overlap with Mt Pleasant and Anvil Hill, if constructed, in the AM period between 7.15am and 8.15am, there is no overlap in the PM peak hour for the Underground Project, which is 3.15pm-4.15pm.

TABLE 5.6

**COMPARISON OF AM AND PM PEAK HOURS FOR APPROVED /
PROPOSED MINES**

Mt Arthur Underground Project (Proposed)	Mt Pleasant Mine (Approved)	Anvil Hill Mine (Approved)	Comments
AM peak hour 7.15am-8.15am	AM Peak Hour between 6.00am-8.00am	AM Peak Hour 6.30am-7.30am	The Underground Project may overlap with Mt Pleasant Mine and has a 15 minute period where it overlaps with Anvil Hill Mine
PM peak hour 3.15pm-4.15pm	PM Peak Hour between 6.00pm-8.00pm	PM Peak Hour 6.30pm-7.30pm	The Underground Project does not overlap with other mine proposals

To examine the cumulative impacts of the Underground Project with the other mines on the principal intersections, additional traffic modelling has been undertaken using the software package INTANAL.

The modelling has been undertaken for 7.15am-8.15am period using the additional estimated maximum volumes for the Underground Project in its operational phase, plus the estimated additional volumes associated with Mt Pleasant and Anvil Hill mines. Section 5.2.3 details estimates for Mt Pleasant and Anvil Hill. In this regard, the full volume estimates have been adopted for Mt Pleasant and 25% (i.e. equivalent of 15 minutes) of the Anvil Hill volume estimates for the AM peak hour. The volumes have been assigned to the road network based on the information contained in Section 5.2.3.

Tables 5.7, 5.8 and 5.9 show the traffic modelling results for 3 principal intersections.

Reference to Table 5.7 which shows the modelling results for the intersection of Thomas Mitchell Drive / Mt Arthur Coal Access Road indicates that the intersection will continue to operate at a satisfactory level with a Level of Service B operation in the AM peak hour. The overall increase in delays to the minor movements due to the cumulative traffic of all proposals is 1-2 seconds per vehicle.

TABLE 5.7

INTANAL ANALYSIS FOR THOMAS MITCHELL DRIVE / MT ARTHUR COAL ACCESS ROAD WITH OPERATIONAL AND CUMULATIVE TRAFFIC

Criteria	AM Peak (7.15am-8.15am)		
	Existing	Operational Traffic	Cumulative Traffic
LS	B	B	B
DS	0.04	0.10	0.10
AVD	12.7	13.1	13.3
HMD	14.6	15.2	15.9

Where:

- LS Level of Service
- DS Degree of Saturation
- AVD Average Vehicle Delay in Seconds
- HMD Highest Movement Delay in Seconds

Table 5.8 shows the traffic modelling results for the intersection of Thomas Mitchell Drive / Denman Road. Reference to this table shows that the intersection will operate at satisfactory level with a Level of Service B operation in the AM peak hour. The increase in delays to the minor movements at the intersection due to the cumulative traffic of all proposals is 3-5 seconds per vehicle.

TABLE 5.8

**INTANAL ANALYSIS FOR DENMAN ROAD/ THOMAS MITCHELL DRIVE
WITH OPERATIONAL AND CUMULATIVE TRAFFIC**

Criteria	AM Peak (7.15am-8.15am)		
	Existing	Operational Traffic	Cumulative Traffic
LS	A	B	B
DS	0.27	0.34	0.42
AVD	8.3	10.5	11.8
HMD	13.9	14.3	17.5

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

Table 5.9 shows the traffic modelling results for the intersection of New England Highway / Thomas Mitchell Drive. Reference to this table shows that this intersection would continue to operate at a Level of Service B operation in the AM peak hour. The increase in delays to the minor movements due to the cumulative traffic of all proposals is 1-2 seconds per vehicle.

TABLE 5.9

**INTANAL ANALYSIS FOR NEW ENGLAND HIGHWAY / THOMAS
MITCHELL DRIVE WITH OPERATIONAL AND CUMULATIVE TRAFFIC**

Criteria	AM Peak (7.15am-8.15am)		
	Existing	Operational Traffic	Cumulative Traffic
LS	B	B	B
DS	0.35	0.48	0.58
AVD	15.5	15.7	16.0
HMD	20.1	21.0	21.8

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

In concluding, the traffic modelling confirms that the cumulative traffic associated with all proposals will not have significant impacts on the three (3) principal intersections in the AM peak hour and conditions at these intersections are expected to remain satisfactory.

5.2.6 Cumulative Impacts of Alternative Scenario where Shift Times Overlap

An alternative scenario has also been examined for the operational phase to ensure a worst case is considered. In this alternative scenario, the Underground Project shift times overlap with the existing mine operation's shift times. For this scenario, the traffic generation for the Underground Project would be:

- 6.00-7.00am - 121 vehicles entering the mine and 63 vehicles exiting the mine; and
- 6.00-7.00pm - 63 vehicles entering the mine and 121 vehicles exiting the mine.

These times for the Mt Arthur Underground Project would also coincide with the shift times for the future Mt Pleasant and Anvill Hill mines. For the purpose of this assessment, the full traffic generation of these future mines at the shift changeover times as detailed in Section 5.2.3 has been considered to be using the road network during the 6.00am – 7.00am and 6.00pm – 7.00pm periods as follows:

- Denman Road / Thomas Mitchell Drive intersection – 204 vph in both periods from Mt Pleasant and 113 vph and 98 vph in the AM and PM peak hours respectively from Anvil Hill; and
- New England Highway / Thomas Mitchell Drive intersection – 95 vph in both periods from Mt Pleasant and 25 vph and 22 vph in the AM and PM peak hours respectively from Anvil Hill.

To examine the impacts on the principal intersections of the Mt Arthur Underground Project's traffic and the future traffic of the Mt Pleasant and Anvil Hill Mines during these periods, the software package INTANAL has been used.

The traffic modelling has been undertaken with the additional traffic from the Mt Arthur Underground Project as well as for the future mines overlaid on the existing traffic volumes during the 6.00am – 7.00am and 6.00pm – 7.00pm periods, with allowance for heavy vehicles. The traffic has been assigned to the road network in accordance with the traffic assignment outlined in Section 5.2.2.

The results of the modelling are set out in Tables 5.10, 5.11 and 5.12.

Reference to Table 5.10 which shows the modelling results for the intersection of Thomas Mitchell Drive / Mt Arthur Coal Access Road indicates that the intersection will continue to operate at a satisfactory level with a Level of Service B operation and acceptable delays for the minor traffic movements. The overall increase in delays to the minor movements due to the operational and cumulative traffic is 1-2 seconds per vehicle.

TABLE 5.10

**INTANAL ANALYSIS FOR THOMAS MITCHELL DRIVE / MT ARTHUR
COAL ACCESS ROAD WITH OPERATIONAL & CUMULATIVE TRAFFIC
FOR ALTERNATIVE SHIFT TIMES**

Criteria	AM Peak (6.00am-7.00am)			PM Peak (6.00pm-7.00pm)		
	Existing	Operational Traffic	Cumulative Traffic	Existing	Operational Traffic	Cumulative Traffic
LS	B	B	B	B	B	B
DS	0.10	0.16	0.17	0.08	0.17	0.18
AVD	13.4	13.7	14.0	12.8	13.2	13.5
HMD	16.0	16.8	17.6	14.3	15.0	15.5

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

Table 5.11 shows the traffic modelling results for the intersection of Thomas Mitchell Drive / Denman Road. Reference to this table shows that the intersection will operate at satisfactory level with a Level of Service A/B operation and acceptable average vehicle delays for the minor movements. The increase in delays to the minor movements at the intersection, due to the operational and cumulative traffic is 3-4 seconds per vehicle.

TABLE 5.11

**INTANAL ANALYSIS FOR DENMAN ROAD/ THOMAS MITCHELL DRIVE
WITH OPERATIONAL & CUMULATIVE TRAFFIC
FOR ALTERNATIVE SHIFT TIMES**

Criteria	AM Peak (6.00am-7.00am)			PM Peak (6.00pm-7.00pm)		
	Existing	Operational Traffic	Cumulative Traffic	Existing	Operational Traffic	Cumulative Traffic
LS	A	A	B	A	A	B
DS	0.17	0.24	0.34	0.18	0.29	0.37
AVD	9.2	9.4	10.8	7.4	8.3	8.2
HMD	13.3	13.6	17.8	11.5	12.0	14.6

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

Table 5.12 shows the traffic modelling results for the intersection of New England Highway / Thomas Mitchell Drive. Reference to this table shows that this intersection would continue to operate at a Level of Service B operation which is a satisfactory operation. The increase in delays to the minor movements due to the operational and cumulative traffic is 1-2 seconds per vehicle.

TABLE 5.12

**INTANAL ANALYSIS FOR NEW ENGLAND HIGHWAY / THOMAS
MITCHELL DRIVE WITH OPERATIONAL & CUMULATIVE TRAFFIC
FOR ALTERNATIVE SHIFT TIMES**

Criteria	AM Peak (6.00am-7.00am)			PM Peak (6.00pm-7.00pm)		
	Existing	Operational Traffic	Cumulative Traffic	Existing	Operational Traffic	Cumulative Traffic
LS	B	B	B	B	B	B
DS	0.42	0.56	0.69	0.16	0.32	0.45
AVD	14.9	15.4	15.9	14.5	15.1	15.7
HMD	21.0	22.1	23.3	17.5	18.4	19.2

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

In concluding, the traffic modelling confirms that the additional traffic associated with the different shift times in the operational phase, as well as the other cumulative traffic from the future Mt Pleasant and Anvil Hill mines will not have significant impacts on the 3 principal intersections during the 6.00am – 7.00am and 6.00pm – 7.00pm periods and conditions at these intersections are expected to remain satisfactory.

5.3 Traffic Impacts in Construction Phase

5.3.1 Traffic Generation

The construction phase is expected to take 2 years with the construction workforce peaking in the second year.

Based on the information provided in Section 3.2 of this report, the maximum daily traffic generation during the construction phase is estimated to be up to 420 vehicle trips into and out of Mt Arthur Coal consisting of:

- 400 construction worker and project employee trips into and out of the mine, which will be mostly light vehicles; and
- Up to 20 deliveries per day into and out of the mine (Austroads Class 3 and above) which will be heavy vehicles. Most of these (85%) are expected to use

New England Highway and Thomas Mitchell Drive with 15% using Denman Road and Thomas Mitchell Drive.

Construction workers are expected to come from or stay in accommodation in and around Muswellbrook Local Government area and other adjacent areas. For the purpose of this assessment, the traffic assignment adopted for the employee trips in the operational phase has been adopted for the construction phase with:

- 63% of contractor / employee trips to arrive and depart from / to the north in Thomas Mitchell Drive; and
- 37% of contractor / employee trips to arrive and depart from / to the south in Thomas Mitchell Drive.

5.3.2 Traffic Impacts

Access to the project site for the construction workforce and the delivery vehicles will be via Mt Arthur Coal Access Road and or via Bayswater Access Road.

For the purpose of the assessment of the traffic impacts in the construction phase, 2 worst case scenarios have been examined as follows:

- Scenario 1 assumes all access will be via Mt Arthur Coal Access Road; and
- Scenario 2 assumes a proportion of the workforce and deliveries will be via Bayswater Access Road.

Away from these two (2) intersections with Thomas Mitchell Drive, the traffic impacts on the wider road network will be the same, regardless of which access road is used.

Impacts for Access via Mt Arthur Coal Access Road and for the Wider Road Network

The largest impact associated with the additional vehicle trips associated with construction will occur during the weekday AM and PM peak hours at the 3 principal intersections on the adjacent road network, namely:

- Thomas Mitchell Drive / Mt Arthur Coal Access Road;
- Thomas Mitchell Drive / Denman Road; and
- Thomas Mitchell Drive / New England Highway.

Construction hours are 7.00am to 6.00pm Monday to Friday and 8am to 1pm Saturday (limited activity on Saturday). The majority (67%) of construction workers / project employees are expected to arrive and depart Mt Arthur Coal in the one hour period before and after the construction hours. The remainder, approximately 33%, will arrive and depart outside these times depending on work levels. Deliveries are expected to occur between 7.00am-6.00pm on weekdays.

Based on this, the peak hour traffic generation for the construction phase is estimated to be:

- Up to 268 vehicles will arrive at Mt Arthur Coal between 6.00am-7.00am; and
- Up to 268 vehicles will depart Mt Arthur Coal between 6.00pm and 7.00pm.

The 6.00am-7.00am arrival period for the construction traffic will overlap with AM peak hour on the road network. During the 6.00pm-7.00pm construction traffic departure period, traffic volumes on the road network are lower.

Figures 8A and 8B shows the additional construction traffic distributed over the road network in accordance with the traffic assignment outlined above in Section 5.3.1 for the 6.00am-7.00am and 6.00pm-7.00pm periods.

To assess the impact of the construction traffic on the principle intersections, the software package INTANAL has been used.

The traffic modelling has been undertaken with the additional traffic volumes as shown on **Figures 8A and 8B** overlaid onto existing traffic volumes on the road network during the 6.00am-7.00am and 6.00pm-7.00pm periods.

Tables 5.13, 5.14 and 5.15 show the traffic modelling results for 3 principal intersections.

Reference to Table 5.13 which shows the modelling results for the intersection of Thomas Mitchell Drive / Mt Arthur Coal Access Road indicates that the intersection will continue to operate at a satisfactory level with a Level of Service B operation and acceptable delays for the minor traffic movements. The overall increase in delays to the minor movements due to the construction traffic is 1-2 seconds per vehicle.

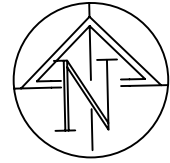
TABLE 5.13

INTANAL ANALYSIS FOR THOMAS MITCHELL DRIVE / MT ARTHUR COAL ACCESS ROAD WITH CONSTRUCTION TRAFFIC

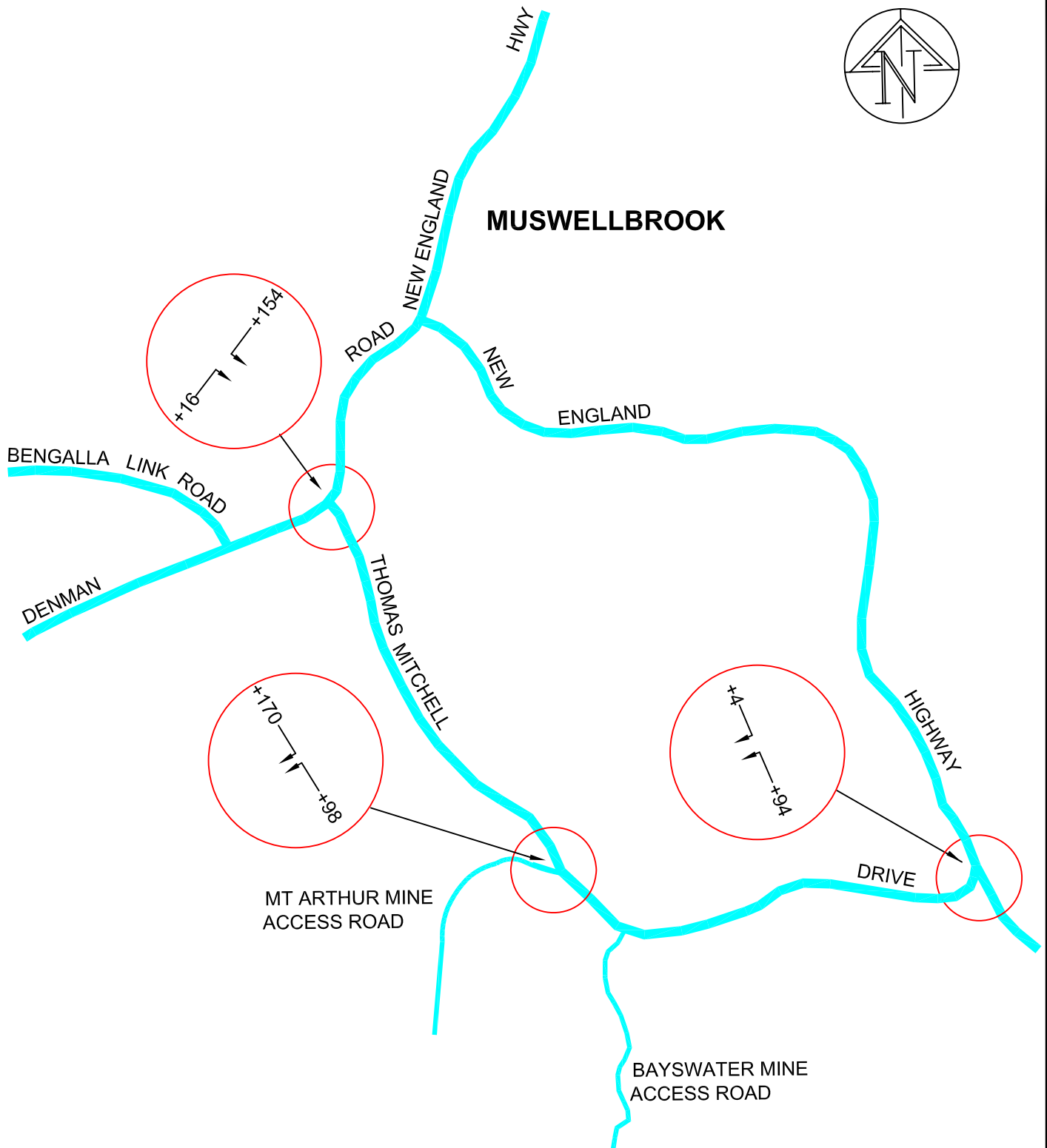
Criteria	AM Peak (6.00am-7.00am)		PM Peak (6.00pm-7.00pm)	
	Existing	Construction Traffic	Existing	Construction Traffic
LS	B	B	B	B
DS	0.10	0.31	0.08	0.36
AVD	13.4	14.0	12.8	14.2
HMD	16.0	17.1	14.3	15.6

Where:

- LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds



MUSWELLBROOK



LEGEND

127 - TOTAL VEHICLES

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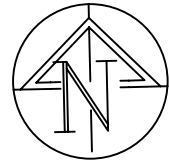
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FIGURE 8A

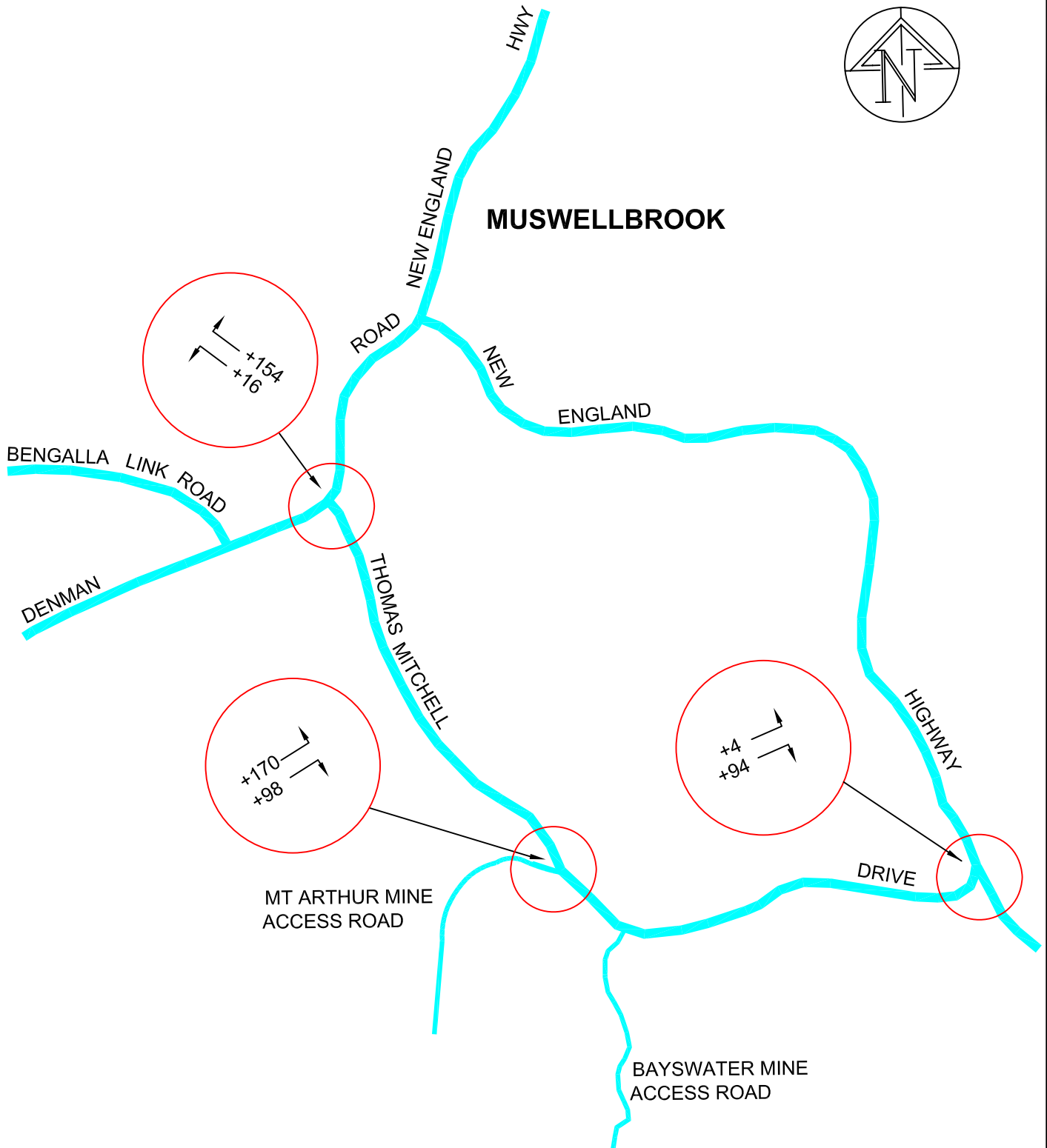
MT ARTHUR COAL UNDERGROUND PROJECT,
MUSWELLBROOK

**PROPOSAL'S CONSTRUCTION TRAFFIC
IN 6.00 AM - 7.00 AM PERIOD**

JOB NO.26072



MUSWELLBROOK



LEGEND

127 - TOTAL VEHICLES

TRANSPORT AND URBAN PLANNING

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FIGURE 8B

MT ARTHUR COAL UNDERGROUND PROJECT,
MUSWELLBROOK

**PROPOSAL'S CONSTRUCTION TRAFFIC
IN 6.00 PM - 7.00 PM PERIOD**

JOB NO.26072

Table 5.14 shows the traffic modelling results for the intersection of Thomas Mitchell Drive / Denman Road. Reference to this table shows that the intersection will operate at satisfactory level with a Level of Service A/B operation and acceptable average vehicle delays for the minor movements. The increase in delays to the minor movements at the intersection, due to the construction traffic is 1-2 seconds per vehicle.

TABLE 5.14

**INTANAL ANALYSIS FOR DENMAN ROAD/ THOMAS MITCHELL DRIVE
WITH CONSTRUCTION TRAFFIC**

Criteria	AM Peak (6.00am-7.00am)		PM Peak (6.00pm-7.00pm)	
	Existing	Construction Traffic	Existing	Construction Traffic
LS	A	B	A	A
DS	0.17	0.68	0.18	0.51
AVD	9.2	9.2	7.4	9.9
HMD	13.3	14.1	11.5	13.0

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

Table 5.15 shows the traffic modelling results for the intersection of New England Highway / Thomas Mitchell Drive. Reference to this table shows that this intersection would continue to operate at a Level of Service B operation which is a satisfactory operation. The increase in delays to the minor movements due to the construction traffic is 1-2 seconds per vehicle.

TABLE 5.15

**INTANAL ANALYSIS FOR NEW ENGLAND HIGHWAY / THOMAS
MITCHELL DRIVE WITH CONSTRUCTION TRAFFIC**

Criteria	AM Peak (6.00am-7.00am)		PM Peak (6.00pm-7.00pm)	
	Existing	Construction Traffic	Existing	Construction Traffic
LS	B	B	B	B
DS	0.42	0.42	0.16	0.47
AVD	14.9	14.9	14.5	17.0
HMD	21.0	21.2	17.5	19.3

Where:

LS Level of Service
DS Degree of Saturation
AVD Average Vehicle Delay in Seconds
HMD Highest Movement Delay in Seconds

In concluding, the traffic modelling confirms that the impacts of the additional traffic associated with the construction phase will not have significant impacts on the 3 principal intersections and conditions at these intersections are expected to remain satisfactory.

Impacts for Access via Bayswater Access Road

Under this scenario, up to a maximum of 135 construction workers and or 115 light vehicles (based on 85% driver ratio per 100 employees) and 10 delivery vehicles per day would access the project site from Thomas Mitchell Drive via Bayswater Access Road during the construction phase.

Using the same assumptions as above, 67% of the construction workers vehicles would arrive and depart Mt Arthur Coal in the one hour period before and after the construction hours. Based on this, the peak use of Bayswater Access Road is estimated to be:

- Up to 77 vph will arrive between 6.00-7.00am and with 52 vph from the north and 25 vph from the south;
- Up to 77 vph will depart between 6.00pm-7.00pm with 52 vph departing to the north and 25 vph departing to the south.

To examine the impact of the construction traffic on Thomas Mitchell Drive / Bayswater Access Road intersection, INTANAL modelling has been undertaken with the construction traffic volumes above overlaid onto the estimated existing volumes at the intersection.

The results of the modelling are shown in Table 5.16 and indicate that the intersection will retain a satisfactory to good operation with a Level of Service A operation and low vehicle delays for the minor movements. The increase in delay for the minor movements at the intersection due to the construction traffic are less than 1 second per vehicle.

TABLE 5.16

INTANAL ANALYSIS FOR THOMAS MITCHELL DRIVE / BAYSWATER ACCESS ROAD WITH CONSTRUCTION TRAFFIC

Criteria	AM Peak (6.00am-7.00am)		PM Peak (6.00pm-7.00pm)	
	Existing	Construction Traffic	Existing	Construction Traffic
LS	A	A	A	A
DS	0.03	0.08	0.02	0.08
AVD	10.0	10.2	9.2	10.0
HMD	13.2	13.7	11.6	12.0

Where:

LS Level of Service

DS Degree of Saturation

AVD Average Vehicle Delay in Seconds

HMD Highest Movement Delay in Seconds

5.4 Other Impacts

5.4.1 Edderton Road

The proposal will involve longwall mining under a section of Edderton Road from Quarry Creek (i.e. where it crosses Edderton Road) to just west of Edderton Homestead, which is a distance of approximately 6.5km.

Based on information provided in the EA, subsidence of the road of up to approximately 2.1 metres may occur, in some sections due to a single subsidence event.

To manage this process and mitigate any adverse impacts, Mt Arthur Coal will prepare a traffic management and road maintenance plan / strategy for Edderton Road, in consultation with Muswellbrook Shire Council. An approval under Section 138 of the *Roads Act* 1993 will be required to undertake the required works.

The plan / strategy will include (but not limited to):

- notification procedures for local residents and others affected by works;
- monitoring of road conditions during longwall mining operations under Edderton Road;
- preparation of traffic management plans of changes / diversions and or for repairs as required);
- undertake and or fund road repairs as required including temporary road diversions on the road; and
- remediation works of Edderton Road after the longwall mining is completed, consistent with its current condition.

It would be expected that in the event of any temporary road closures of sections of Edderton Road for repairs, access to local properties will be maintained via temporary diversions onto unsealed roads.

If necessary, other through traffic using Edderton Road could be diverted via the Golden Highway and Denman Road, which provides an alternative route.

Currently Edderton Road carries a total of 632 vehicles per day (two way) and between 15-62 vehicles per hour (two way). The temporary diversion of this level of traffic to the Golden Highway and Denman Road is not expected to have any adverse impacts on these roads.

As part of the Development Consent for the Bayswater 3 mining area, a future grade separated intersection of an internal haul road and Edderton Road will be constructed. The final design of this intersection will be discussed with Muswellbrook Shire Council prior to construction.

5.4.2 Antiene Railway Station Road

The Antiene Rail Spur Line used by Mt Arthur Coal and the adjacent coal mines to haul coal runs parallel to a section of Hebden Road.

There are several residential properties located to the north of the spur line near where the spur line joins the main northern line that are accessed via a level crossing on Antiene Railway Station Road. It is understood that Council has recently approved a small subdivision in the area, which may increase the number of residential properties in the area.

The current signalling system on the spur line results in coal trains waiting for a signal to proceed, blocking the level crossing road access on Antiene Railway Station Road, where these properties access Hebden Road.

The main issue for these properties apart from the inconvenience when the trains delay vehicle access to properties, is one of vehicle access in times of an emergency. The Underground Project will increase the number of trains used by Mt Arthur Coal from the currently approved daily maximum of 18 train movements per day to a maximum of 24 movements per day.

Mt Arthur Coal has recognised that the increase in train movements associated with the Underground Project has the potential to increase the frequency of trains blocking the crossing. There are a number of organisations that are relevant to this issue including Anglo Coal (the lessees of the Antiene Rail Spur), Muswellbrook Shire Council (roads authority for Antiene Railway Station Road), Macquarie Generation (operators of an adjacent rail unloading facility which is currently under construction), the Australian Rail Track Corporation and Mt Arthur Coal as a user of the Antiene spur. Mt Arthur Coal is committed to working with the other relevant industry and government stakeholders to address the current access situation for the residences in the east Antiene area and has commenced discussions with Muswellbrook Shire Council regarding the establishment of a working group to consider possible solutions.

5.4.3 Night Time Road Safety at Intersections

The Roads & Traffic Authority, in the recent consideration of the South Pit Extension Project at Mt Arthur Coal, identified driver fatigue of shift workers as a potential contributing factor to night time road safety at intersections on the classified road network. To address this matter, the Roads & Traffic Authority has recommended that a night time road safety audit be undertaken for the intersections of New England Highway / Thomas Mitchell Drive and Denman Road / Thomas Mitchell Drive.

The night road safety audit should identify any deficiencies at these intersections with regard to the readability of the geometry and the signposting and delineation which might contribute to reduced road safety levels at night.

The findings of the night time audit would assist in addressing any road elements associated with driver fatigue that might contribute to reduced road safety. The other element associated with driver fatigue is human behaviour which could be addressed

through education and training strategies undertaken by Mt Arthur Coal with its project workforce.

6.0 CONCLUSIONS

This report documents the assessment of the traffic and transport impacts of the proposed Mt Arthur Underground Project.

The proposal is for Mt Arthur Coal to access coal reserves in the existing mine and the adjacent exploration area to the west using underground mining. The concept mine plan predicts a production rate of approximately 8 million tonnes per annum for 21 years. Mt Arthur Coal's existing infrastructure will be used to process the coal and the coal will be transported by the existing rail facility at Mt Arthur Coal. Vehicle access to the mine will be via the existing road access to Mt Arthur Coal from Thomas Mitchell Drive. The proposal will increase the workforce at Mt Arthur Coal with additional operational staff working 3 shifts per day and management and administration staff working on weekdays, with start and finish times occurring between 6.30am and 6pm.

An assessment of the existing roads and intersections that provide the principal access to / from Mt Arthur Coal indicate that traffic conditions on the road network and at the intersections are satisfactory. The three (3) principal intersections which are Thomas Mitchell Drive / Mt Arthur Mine Coal Access Road, Thomas Mitchell Drive / Denman Road and Thomas Mitchell Drive / New England Highway have all been upgraded in the last 6 years.

Once operational, the Mt Arthur Underground Project will generate some 322 vehicle trips into and out of Mt Arthur Coal (i.e. 322 in / 322 out) per day at maximum activity levels. Some 30 of these trips into and out of the mine will be heavy vehicles (i.e. 30 in / 30 out).

The peak times for traffic impacts during the operational phase will be 7.15am to 8.15am and 3.15pm to 4.15pm on weekdays, which coincide with the likely shift time changes at 8am and 4pm. During these periods a total of 184 vehicles are estimated to enter and or exit the Mt Arthur Coal site. These times do not overlap with existing peak traffic generation times for Mt Arthur Coal, which are 6.00am-7.00am and 6.00pm-7.00pm.

An assessment of the impacts of this additional traffic on the principal intersection indicates that the impacts will be satisfactory and the road network including the intersections will continue to operate at a satisfactory level of service.

In terms of cumulative impacts, the peak hours for the Underground Project may in part overlap with the shift time changes for the future mines at Mt Pleasant and Anvil Hill, during the 7.15am-8.15am period. The cumulative impacts will be the most significant at the principal intersections on the road network. An assessment of the cumulative impacts of all three mines during this period indicates that traffic conditions will remain satisfactory at the principal intersections and all intersections will continue to operate at a satisfactory level of service.

Although Mt Arthur Coal does not currently expect that shift times for the Underground Project will overlap with the existing mine operations, an alternative scenario has been examined where shift times for the Underground Project overlap

with the existing operations during the 6.00am – 7.00am and 6.00pm – 7.00pm periods to assess the potential worst case impact. This assessment has also included the full traffic generation and the cumulative impacts of the future mines at Mt Pleasant and Anvil Hill. The assessment of this scenario has found that the traffic impacts will be satisfactory and traffic conditions on the road network, including at the three (3) principal intersections, will continue to be satisfactory with the additional traffic from Mt Arthur Underground Project and the future mines using the road network during the 6.00am – 7.00am and the 6.00pm – 7.00pm periods.

Construction of the Mt Arthur Underground Project is expected to take 2 years. During the construction phase of the Project, employment levels will peak in the second year. At this time it is expected that up to 420 vehicle trips will be made into and out of the mine on a weekday (i.e. 420 in / 420 out) including 20 heavy vehicles (i.e. 20 in / 20 out).

Peak hours during construction are expected to be 6.00am-7.00am and 6.00pm-7.00pm which will coincide with the majority (67%) of the employee / contractor trips into (AM) and out of the mine (PM). Some 268 vehicle trips associated with construction phase traffic are expected during these hours.

An assessment of the traffic impacts associated with the construction traffic indicates that traffic conditions at the principal intersections will continue to be satisfactory during the AM and PM peak periods associated with construction.

The project incorporates longwall mining under a section of Edderton Road between Quarry Creek and just west of Edderton Homestead, which may result in subsidence of sections of the road and subsequent road and pavement damage. To manage this process and to mitigate any adverse impacts, Mt Arthur Coal will prepare a traffic management and road maintenance plan / strategy for Edderton Road, which will address planning, notification, monitoring and repair works, including any temporary road diversions. The plan / strategy will be prepared in consultation with Muswellbrook Shire Council.

The Mt Arthur Underground Project will increase the number of coal trains using the Antiene rail spur line from the currently approved maximum of 18 train movements per day to a maximum of 24 movements per day. There is an existing issue where these trains due to the location of the rail signal on the spur line, may block vehicle access to a number of properties off Antiene Railway Station Road.

Mt Arthur Coal has recognised that an increase in train movements associated with the Underground Project has the potential to increase the frequency of trains blocking the crossing and is committed to working with the other relevant industry and government stakeholders (including Anglo Coal, Macquarie Generation, Muswellbrook Shire Council and the Australian Rail Track Corporation) to resolve this issue. Mt Arthur Coal has commenced discussions with Muswellbrook Shire Council regarding the establishment of a working group to consider possible solutions.

APPENDIX 1

CRITERIA FOR INTERPRETING RESULTS OF INTANAL ANALYSIS

I. Level of Service (LS)

LS	Traffic Signals and Roundabouts	Average Vehicle Delay in Seconds
A	Good	0-14
B	Good with minimal delays and spare capacity	15-28
C	Satisfactory with spare capacity	29-42
D	Satisfactory but operating near capacity	43-56
E	At capacity and incidents will cause excessive delays	57-60
F	Unsatisfactory and requires additional capacity	>70
LS	Give Way and Stop Signs	Highest Movement Delay (in Seconds)
A	Good	0-14
B	Acceptable delays and spare capacity	15-28
C	Satisfactory	29-42
D	Near capacity and accident study required	43-56
E	At capacity and requires other Control Delays Mode	57-60
F	Unsatisfactory and requires other Control Mode	>70

2. Average Vehicle Delay (AVD)

The AVD provides a measure of the operational performance of an intersection. For intersections controlled by traffic signals or a roundabout, satisfactory intersection performance is achieved where:

- the TOTAL average delay of the intersection is less than 70 secs; and
- no individual movement through the intersection experiences a delay greater than 120 secs.

For intersections controlled by GIVE WAY or STOP signs, satisfactory intersection performance is achieved where no individual movement (Highest Movement Delay) through the intersection experiences a delay greater than 40 secs.

3. Highest Movement Delay (HMD)

Highest Movement Delay is the Highest average delay for any movement at an intersection. It is useful for determining the delay for minor movements at intersections controlled by Stop/Give Way signs or roundabouts.

4. Total Delay

Total Delay is the intersections total delay expressed in vehicle hours per hour, ie. the sum of all delay which occurs at an intersection, during the modelled period, which in most cases is a one-hour of the modelled peak.

Some caution is required in interpreting Total Delay as Total Delay will always increase with the traffic volumes.

Also, for intersections controlled by STOP or GIVE WAY control, only the minor movements such as the turning movements from the major road and the movements out of the minor road face delays. For this reason total delay for intersections controlled by STOP or GIVE WAY signs tend to be lower than for intersections controlled by traffic signals. In this situation Level of Service and Degree of Saturation are better performance measures, particularly when assessing if another form of control is required.

Total Delay should be used to assist in comparing the likely improvements to be gained in terms of overall delay for geometric improvements, control and operation for roundabouts and traffic signals.

Therefore its main use should be for comparing different/competing design improvements for the same intersection which is controlled by either roundabouts or traffic signals.

5. Degree of Saturation (DS)

The DS is another measure of the operational performance of individual intersections. DS is calculated for all movements at the intersection. The DS displayed is usually the highest DS for any single movement at the intersection during the period modelled.

For intersections controlled by traffic signals² both queue length and delay increase rapidly as DS approaches 1, and it is usual to attempt to keep DS to less than 0.9. Values of DS in the order of 0.7 generally represent satisfactory intersection operation. When DS exceeds 0.9 queues can be anticipated.

At lower cycle lengths a DS around 0.9 can be acceptable as are small increases in DS between different designs.

For intersections controlled by a roundabout or GIVE WAY or STOP signs, satisfactory intersection operation is indicated by a DS of 0.8 or less.

6. Average Vehicle Cost or Total \$ Cost per Vehicle (AVC)

This is calculated as Total Cost / Total Vehicles using the intersection and represents the Average Vehicle Cost. It is useful in comparing different design scenarios which may have increased traffic volumes for some scenarios, as it calculates the average cost per vehicle.

It should be used for examining the operation of traffic signal and roundabouts.

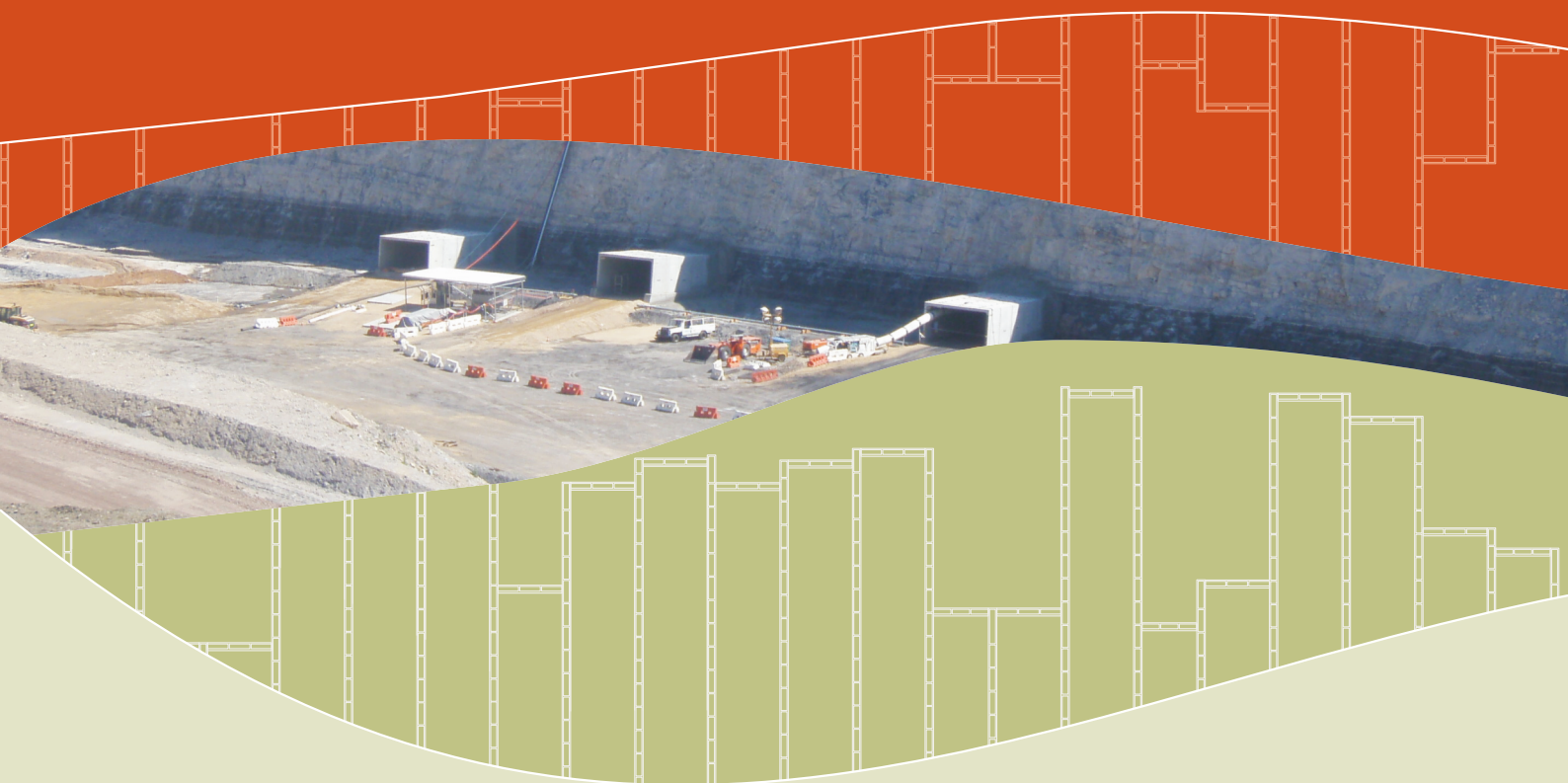
There is no threshold for determining what is an acceptable average cost, however this cost increases significantly as an intersection becomes over saturated. i.e. level of service E & F.

² The values of DS for intersections under traffic signal control are only valid for cycle length of 120 seconds

APPENDIX 2

REFERENCES

- Roads and Traffic Authority – Road Design Guide (1989 and subsequent updates).
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- Austroads – Guide to Traffic Engineering Practice – Parts 1-15 (as relevant) (various dates from 1988).
- Department of Urban Affairs and Planning – Roads and Related Facilities – EIS Guideline September 1996.
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