

APPENDIX 13

Traffic Assessment



**TRAFFIC & TRANSPORT IMPACT
ASSESSMENT**

FOR

**THE ULAN COAL
CONTINUED OPERATIONS PROJECT**

AT

ULAN

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Prepared By

TRANSPORT & URBAN PLANNING
Traffic Engineering, Transport Planning
Road Safety & Project Management Consultants
5/90 Toronto Parade
P.O. Box 533
SUTHERLAND NSW 2232
Tel: (02) 9545-1411
Fax: (02) 9545-1556
Email: tupa@tpg.com.au

EXECUTIVE SUMMARY

This report documents the traffic and transport impacts of the Ulan Coal - Continued Operations Project (referred to here after as 'the Project').

The Project seeks approval for continued open cut and underground mining operations for a further 21 years.

The assessment of the existing road and intersections that provide access to Ulan Coal Mine indicate that traffic conditions on the road network and at the intersections are generally good.

Recent road safety audits on the road network have identified the need to improve the delineation and road edge formation and shoulder provision including the maintenance of shoulders on Ulan Road between Mudgee and Ulan and Cope Road between Gulgong and Ulan. There is also a need for consideration of auxiliary lanes for turning traffic in at Ulan Road at the Ulan Road / Wollar Road intersection.

Ulan Coal Mine currently generates 952 two way vehicle trips on a weekday (5 day average) and 760 two way vehicle trips per day (7 day average).

Heavy vehicles comprise 7.6% (5 day average)-8.2% (7 day average) of total traffic generated by Ulan Coal Mine. The existing hours of operation are for 24 hours, 7 days per week. Historically coal produced by Ulan Mine was transported by rail to Port Waratah and the Eraring Power Station , with an average of 4 trains loaded per day and an approved limit of 28 train loads per week.

The project will increase the peak production rate to 20mtpa, while the hours of operation would remain unchanged at 24 hours, 7 days.

The peak workforce and traffic generation of the mine will occur in Year 4 (2013 based on current planning) when up to 1084 employees/contractors are estimated to be employed by the mine. This will be an increase of 554 employee/contractors over the existing workforce and will include an estimated 270 construction workers.

After Year 4 the workforce and traffic generation will decline incrementally to current (2009) levels in Year 13. From Year 14 to Year 21 the workforce and traffic generation will be approximately 30% lower than 2009 levels.

In Year 4 the maximum traffic generation of the mine will increase by:

- An additional 782 two way trips to and from the mine on an average day (ie. AADT);*
- An additional 984 two way trips to and from the mine on a weekday (ie. 5 day average);*
- and*

- *An additional 440 vehicle trips during the 6.00am – 7.00am period on a Friday, which will be the peak hour (and day) for the mine.*

Heavy vehicles generated by the mine in Year 4 are expected to be 4.7% - 5.0% of total vehicles.

Deliveries to the mine will increase from:

- *16 vehicle trips (8 in/8 out) to 24 vehicle trips (12 in/12 out) per day (7 day average)*
- *22 vehicle trips (11 in/11 out) to 34 vehicle trips (17 in / 17 out) on a weekday.*

The remainder of the heavy vehicles in Year 4 will be made up of heavy vehicles used by contractors. Total heavy vehicles in Year 4 are expected to be:

- *72 vehicle trips (36 in / 36 out) per day (7 day average); and*
- *96 vehicle trips (48 in / 48 out) on a weekday.*

The assessment of cumulative impacts has been undertaken for Friday 6.00am – 7.00am peak hour in Year 2013 and includes the existing traffic levels with UMCL's current operation, Wilpinjong Coal mine, as well as future background traffic growth, the additional traffic from the Project and the approved Moolarben Stage 1 mine, and the Moolarben Stage 2 proposal.

The assessment of the cumulative impacts has found that while there is a substantial increase in traffic volumes using the road network due to the mines, traffic conditions on the road network and at the principal intersections are expected to remain satisfactory with a satisfactory to good level of service and low vehicle delays.

Transport and Urban Planning recommends that the existing 'AUR' right turn treatment at the Ulan Road/Cope Road intersection be upgraded to 'CHR' treatment (ie. right turn bay) to reduce potential conflicts between southbound through traffic in Ulan Road and right turn traffic from Ulan Road into Cope Road. Transport and Urban Planning also supports the recommendations of the previous road safety audit for Ulan Road and Cope Road on the need to improve delineation and road edge formation and shoulder provision and maintenance along sections of these routes, as well as the other measures identified in the audit.

Other potential road safety issues such as information about driver fatigue could be included in future training strategies adopted by Ulan Coal Mines Limited.

The additional traffic associated with the Project is not expected to have any negative impacts on school bus routes. While there will be some increase in vehicles using the road network at school bus times due to the Project, the total volumes of traffic using the road networks will be relatively small in real terms.

The increase in the number of trains operating between Ulan Coal Mine and Port Waratah will have relatively minor impacts on the 18 rail level crossings between Ulan Coal Mine and

Muswellbrook. Each train movement requires the road at the level crossing to be closed to traffic for some 121 seconds (2 minutes).

The additional train movements will be spread throughout the day and will result in an additional 12-24 minutes per day when the roads at each level crossing would be closed to allow the trains to proceed through the level crossing.

A separate Construction Traffic Management Plan will be prepared by Ulan Coal to address all the road and traffic issues associated with the construction of the mine.

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1.0 INTRODUCTION

1.1 Background

Ulan Coal Mines Limited (UCML) is located approximately 1.5 km from the village of Ulan, within the Mid Western Regional Council Local Government Area (LGA). The site is located approximately 38 km north-east of Mudgee, 19 km north-east of Gulgong and 65 and 60 km north north-west of the townships of Kandos and Rylstone in New South Wales (**Figure 1**).

UCML is a joint venture between Xstrata Coal Australia Pty Ltd (90%) and Mitsubishi Development (10%). Coal deposits were first worked at Ulan in the early 1920s and continued sporadically until the mining operations were expanded to include the open cut mine in 1982 and an underground longwall mine commencing in 1986. Since the introduction of long wall mining, over 28 long wall panels have been successfully completed.

UCML currently operates under four major Development Consents and 34 planning approvals for various mining related activities across the complex. UCML is seeking one consolidated Major Project Approval to cover current and proposed operations for the next 21 years.

The existing mining operations at UCML consist of Ulan No. 3 Underground and associated surface operations. Open cut mining ceased in mid 2008 as the approved resource had been exhausted. UCML is one of numerous mining assets managed by Xstrata Coal NSW. To assist in maintaining coal production across the group, UCML is proposing an extension of the current open cut operations, as well as concurrently mining the approved Ulan No. 3 Underground and an approved area now referred to as Ulan West under a modified mine plan. The 21 year conceptual mine plan involves open cut and long wall mining in the Ulan Seam. A combined production rate of up to 20 million tonnes per annum (Mtpa) product coal is proposed, compared with the current approval for 10mtpa.

Following approval, employment will increase at the mine up to year 4 when it will peak at 1084 employees and contractors (an increase in the operational workforce of 401 positions on current levels). After year 4 employment will decline steadily and reach current levels in year 13 with further reductions after this.

Other operational or approved mining projects in the vicinity of UCML (**Figure 1**) include:

- Moolarben Coal Project which is located near Ulan and has its vehicle access from Ulan Road in Stage 1; and
- Wilpinjong Coal Project which is located west of Wollar and has its vehicle access from Ulan - Wollar Road.

It is noted that the Moolarben Coal Project have recently had a major project application on public exhibition for Stage 2 of the mine which has a proposed vehicle access from Ulan-Wollar Road.

1.2 Authority Requirements

This report examines the traffic and transport issues associated with the Ulan Coal - Continued Operations project (herein referred to as 'the Project'). The Project has been classified as a 'Major Project' as defined by the State Environment Planning Policy (SEPP) (Major Projects) 2005, and therefore requires approval from the NSW Minister for Planning under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Transport and Urban Planning has been engaged to assess and evaluate the potential traffic and transport impacts associated with the Project. As such this assessment accompanies a broader Environmental Assessment of the Project being prepared by Umwelt (Australia) Pty Ltd (Umwelt).

As part of the preparation of the Traffic and Transport Impact Assessment for the Project, consideration was given to the requirements of the Director General (of the Department of Planning), Roads and Traffic Authority and Mid Western Regional Council, as well as any key issues identified by these authorities, being:

- a description of the existing environment;
- an assessment of the potential impacts of all stages of the Project, including any cumulative impacts associated with the concurrent operation of the Project with any other existing or approved mining operation in the region, taking into consideration any relevant policies, guidelines, plans and statutory provisions;
- a description of the measures that would be implemented to avoid, minimise, mitigate and/or offset the potential impacts of the Project, including detailed contingency plans for managing any significant risks to the environment.

The assessment has been undertaken in accordance with the requirements of the Roads and Traffic Authority's Guide to Traffic Generating Developments (October 2002).

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).

Director General Requirements

The Director General, in a letter dated 22 October 2008 nominated the following issues for transport including:

- accurate predictions of the road and rail traffic of the project;
- a detail assessment of the potential impacts of this traffic on the safety and efficiency of the road and rail networks, paying particular attention to the railway crossings that would be affected by the project; and
- a detailed description of the measures that would be implemented to upgrade and/or maintain these networks over the life of the project.

1.3 Structure of this Report

This report has been prepared to assess the traffic and transport impacts associated with the Project during the construction and operational phases of the mine.

The remaining sections of this report address the following:

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

2.0 EXISTING MINE OPERATIONS AT ULAN COAL

2.1 Existing Mining Operations

Mining at UCML has been undertaken since the early 1920's, with the open cut and underground mining operations as we know them today commencing in 1982 and 1986 respectively. Since the commencement of mining, UCML have both modified their existing approvals and received approval for new mining operations and associated infrastructure. As such, UCML currently operates under 34 Project Approvals. To ensure the longevity of the mine UCML is seeking one consolidated Major Project Approval to cover current and proposed operations for the next 21 years.

The existing mining operations at UCML consist of Ulan No.3 Underground and associated surface operations. Open cut mining ceased in mid 2008 as the approved resource had been exhausted

The Open Cut and Ulan No.3 Underground operations are supported by separate administration, store, workshop and staff facilities.

Vehicle access to the open cut and underground mines is via separate access roads located off Ulan Road. The entrance to the Open Cut Mine is located approximately 0.88 kilometres north of the Cope Road intersection. The entrance to the Underground Mine is located approximately 6.6km north of the Cope Road intersection.

Coal is currently transported off site by train via the Gulgong-Sandy Hollow rail line to the east to either Port Waratah at Newcastle for coal export or to local Power Stations within the Hunter region for domestic use.

The rail loop for the loading of the trains is located to the northeast of the Open Cut Mine Access Road.

2.2 Hours of Operation

The existing mine at Ulan Coal operates 24 hours a day, 7 days a week.

2.3 Workforce

During the operation of the open cut and underground mines the typical workforce (employee and contractors) was approximately 530 personnel. This figure includes administration staff.

The Ulan No.3 Underground Mine operates the following shifts:

Weekdays

- day shift (7am – 3.30pm, Monday - Friday);
- day shift (7.00am – 5.00pm, Monday – Friday);
- afternoon shift (2pm – 12am, Monday – Thursday); and
- night shift (10.30pm to 8.30am, Monday - Friday).

Weekends

- day shift (7.00am – 7.00pm, Friday – Sunday); and
- night shift (7.00pm – 7.00am, Friday – Sunday).

The underground workers are supported by administrative and management personnel who work a 5 day week day shift (7am – 5pm).

When operating, Open Cut Mine personnel work 7 days a week in the following shifts:

- day shift 6am – 6pm;
- day shift 7am – 7pm;
- night shift 6pm – 6am; and
- night shift 7pm – 7am.

The open cut staff work 5 days per week day shift as follows:

- 6.30 am – 6.30pm, Monday – Friday (32 personnel); and
- 7am – 5pm, Monday – Friday (80 personnel)

2.4 Rail Operations

Coal produced by UCML is transported by rail to Port Waratah for export and to local Power Stations in the Hunter region for domestic use. All coal trains used by UCML arrive and depart from/to the east. The UCML loop rail line is located north east of the Open Cut Mine Access Road. There are no UCML rail movements to the west of the UCML rail loop.

UCML currently loads an average of four trains per day with an approved limited average of 28 rail movements per week.

2.5 Traffic Generation

Traffic generated by UCML consists of employee, contractor, visitor and supply delivery traffic.

Table 2.1 shows the traffic generation of the mine as recorded in traffic counts undertaken for the week between 10-16 December 2008.

TABLE 2.1

EXISTING TRAFFIC GENERATION OF UCML¹

Location	Traffic volumes (two way trips)	
	Average weekday (5 day average)	Daily (7 day average)
Underground Mine Access Road	777	623
Open Cut Mine Access Road ²	175	137
Total	952	760

Note: 1. Based on workforce of 530 personnel

2. Traffic associated with only the Surface Operations as open cut mining operations had ceased,

Reference to Table 2.1 shows that the traffic generation of the Mine on a weekday is 952 vehicles (two way trips) which includes 64 heavy vehicles (Austroads Classes 3-12) i.e. 32 in/32 out trips.

When averaged over the 7 days (AADT) the traffic generation per day is 760 vehicles (two way trips), including 48 heavy vehicles (Austroads Classes 3-12) i.e. 24 in/24 out.

Heavy Vehicle Trips

Heavy vehicle trips consist of deliveries to UCML, as well as heavy vehicles used by some contractors. The latter vehicles are typically small rigid trucks. Heavy vehicles represent 8.2% and 7.6% of the total traffic generation of UCML respectively on a weekday and per 7 day average (AADT).

For the week 10-16 December 2008 deliveries to the mine averaged 11 per day (22 vehicle trips) on weekdays and 8 per day (16 vehicle trips) over 7 days (7 day average – AADT). It is noted that the traffic counts were undertaken in a period which coincided with the construction of the Moolarben Coal Mine access road. The additional vehicle movement associated with this activity are expected to be within the natural variation associated with the traffic use on this road network and are therefore not considered significant.

Truck movements to the mine are associated with deliveries of fuels, spare parts for mining equipment and general supplies. Fuel is delivered by a B double truck from Sydney. Historically explosives have been delivered via Merriwa and the Ulan Orica plant, typically once a week. One transport company typically makes deliveries three days per week for general supplies. Additional deliveries are made as required.

Surveys undertaken by Christopher Hallam & Associates in June 2004 on truck trips to and from the mine confirmed the following usage of the roads adjacent to the mine;

- To and from the north along Ulan Road (MR214) - 17%
- To and from the south along Ulan Road (MR214) - 38%
- To and from the west along Cope Road (MR598) - 37%
- To and from Ulan Village - 8%

Employee / Contractor trips

Based on employee data provided by UCML the proportion of employees using the road network between the mine and their place of residence is calculated to be:

- Area generally north of the mine using Ulan Road towards Cassilis (MR214) to/from the north. - 3%
- Mudgee township and area generally south of the mine using Ulan Road (MR214) towards Mudgee . - 69%
- Gulgong township and area west of the mine using Cope Road (MR598). - 26%
- Ulan Village. - 2%

3.0 PROJECT DESCRIPTION

3.1 Mining Operations

The Project is for continued open cut and underground mining operations at Ulan Coal Mine for a further 21 years. This includes:

- An extension to the Open Cut Operations; and
- Concurrent mining the approved Ulan No. 3 Underground and approved Ulan West areas under a modified mine plan.

The Project area is shown in **Figure 3**.

Up to 20 million tonnes per annum of product coal is proposed to be produced from the combined mining operations .

As part of the continued operations of the mine, existing infrastructure will continue to be utilised where possible. However some modification to the existing infrastructure as well as new infrastructure are required to support the future mining operations. Surface facilities such as, ventilation and dewatering infrastructure, service boreholes and associated power and access infrastructure for the modified Ulan West, Ulan No. 3 underground mines and the open cut extension will continue to be constructed to support mining operations as they develop.

3.2 Hours of Operation

The hours of operation will continue to be 24 hours, 7 days a week.

3.3 Workforce

Based on current operations the workforce at UCML is expected to increase by 554 employees and contractors by year 4, with a total workforce of 1084 employees and contractors including 270 on site construction personnel.

In year 5 it is expected that the workforce will reduce to 931 personnel and decline to 758 persons by year 10 with a further reduction to 375 persons in year 14 until year 21 when the workforce will reduce to 255 persons.

Table 3.1 shows the estimated total workforce of the mine at various intervals over the 21 year mine life.

TABLE 3.1**ESTIMATED TOTAL WORKFORCE OVER LIFE OF THE PROJECT**

Year	1	2	4	5	6	10	13	14	15	20	21
Ulan West	225	283	520*	375	375	375	375	375	375	375	255
Ulan No.3	438	434	434	426	383	383	191				
Open Cut	130	130	130	130	130						
Total	793	847	1084	931	888	758	566	375	375	375	255

* Assumes 270 construction personnel on site. In year 4 the workforce will ramp up for 3 months and then phase to an operational mine.

During the construction phase the operating hours are expected to be 7.00am – 7.00pm Monday to Sunday. Works that are not audible at any nearby sensitive noise receiver may be undertaken outside these hours.

During the operational phase, shift times (and the total mining workforce in Year 5 – Year 5 is the first full year in which only mining operations will be undertaken) for the Ulan No.3 and Ulan West Underground mines is likely to be similar to the following:

- 7.00am – 3.30pm, Monday – Friday (88 and 91 personnel);
- 7.00am – 5.00pm, Monday – Friday (39 and 32 personnel);
- 2.00pm – 12.00am, Monday - Thursday - (88 and 71 personnel);
- 10.30pm – 8.30am, Monday – Friday – (84 and 71 personnel);
- 7.00am – 7.00pm, Friday – Sunday – (71 and 55 personnel);
- 7.00pm – 7.00am, Friday – Sunday – (61 and 50 personnel).

The Open Cut Mine contract personnel work 7 days a week as per the following shifts:

- 6am – 6pm (10 personnel);
- 7am – 7pm (21 personnel);
- 6pm – 6am (10 personnel); and
- 7pm – 7am (14 personnel).

The UCML open cut staff work 5 days per week day shift as follows:

- 6.30 am – 6.30pm, Monday – Friday (20 personnel);
- 7am – 5pm, Monday – Friday (55 personnel)

In Year 4 which will be the peak year for employment, operational staff and shift personnel will represent 116% of the Year 5 workforce.

3.4 Rail Operations

All coal produced by the mine will be transported by rail to Port Waratah for export or to other domestic users. All trains will arrive and depart the mine from/to the east.

As part of the Project the coal loading facilities on the rail loop will be upgraded.

To transport the annual production of up to 20 million tonnes, it is proposed to load an average of 7 trains per day with a peak of 10 trains per day.

3.5 Traffic Generation

The traffic generation of the mine will be at its maximum in year 4 and will gradually reduce to less than the current traffic generation of the existing mine by year 14.

Table 3.2 sets out the traffic generation over the life of the mine on a weekday and 7 day average based on:

- The current vehicle trip rates for the workforce and visitors. Visitor trip movements have been increased/decreased in proportion to the increase/decrease in the workforce for each respective year; and
- A 50% increase in the number of delivery vehicles commencing in year 1, with delivery vehicle numbers reducing after year 7 in proportion with the total workforce. The increase in delivery vehicles from year 1 also includes deliveries associated with construction activities at the mine.

TABLE 3.2

ESTIMATED TWO WAY TRAFFIC VOLUMES GENERATED OVER THE LIFE OF THE PROJECT

	Daily Trips (7 day average)							
	2009 (existing)	Year 2	Year 4	Year 6	Year 10	Year 13	Year 14	Year 21
Workforce/visitors	744	1186	1518	1244	1062	792	526	358
Deliveries	16	24	24	24	22	18	14	10
Total	760	1210	1542	1268	1084	810	540	368
Increase/decrease from 2009	-	+450	+782	+508	+324	+50	- 220	- 372

	Weekday Trips (5 day average)							
	2009 (existing)	Year 2	Year 4	Year 6	Year 10	Year 13	Year 14	Year 21
Workforce/visitors	930	1486	1902	1558	1330	994	658	448
Deliveries	22	34	34	34	32	24	16	12
Total	952	1520	1936	1592	1362	1018	674	460
Increase/decrease from 2009	-	+568	+984	+640	+410	+66	-278	-492

Table 3.3 shows the expected origin and destination of the workforce (employee / contractor) and visitor trips based on employee survey data, as well as the heavy vehicle trips over the life of the mine, which is based on the surveys of heavy vehicles undertaken by Christopher Hallam & Associates in June 2004.

TABLE 3.3**EXPECTED ORIGIN AND DESTINATIONS OF VEHICLE TRIPS
TO AND FROM UCML**

Location/Road	Proportion of Trips	
	Workforce / Visitor	Heavy Vehicles
North (Ulan Road)	3%	17%
South (Ulan Road)	69%	38%
West (Cope Road)	26%	37%
Ulan Village	2%	8%

4.0 EXISTING TRAFFIC CONDITIONS**4.1 Principal Road Network****4.1.1 Principal Road Network**

The road network generally used by vehicles accessing UCML includes:

- Ulan Road (MR 214 and part MR 208);
- Cope Road (MR 598);
- Ulan – Wollar Road;
- Ulan Coal Open Cut Access Road;
- Ulan Coal Underground and Administration Access Road; and
- Bobadeen Road;
- Ulan Village Access via Main Street; and
- Clifffdale Road and Blue Springs Road which provide access to Wonga Roo Road.

Figure 2 shows the principal road network surrounding the Project.

4.1.2 Standards for Rural Roads

The major roads that provide access to UCML are typically 2 lane roads.

The RTA's Road Design Guide provides guidance on required lane and shoulder widths for 2 lane roads based on AADT volumes. These standards relate to RTA type roads, which have a highway or arterial type function.

The minimum lane widths are as follows:

- AADT 150 - 500 vpd - 3.0 metre lane width (ie 6.0 metre road width for 2 lanes)
- AADT 500 – 2000 vpd - 3.0 – 3.5 metre lane width (ie 6.0 – 7.0 metre road width for 2 lanes)
- AADT > 2000 vpd - 3.5 metre lane width (ie 7.0 metre road width for 2 lanes)

Recommended shoulder widths where there is no provision for cyclist are as follows:

- AADT < 500 vpd - 1.0 – 1.5 metres
- AADT – 500 – 1000 vpd - 1.0 – 2.0 metres
- AADT > 1000 vpd - 2.0 – 3.0 metres

Shoulder sealing of 0.5 metres from the edge of the travel lane is recommended when the AADT is less than 2000 vpd and 1.0 metres when the AADT is greater than 2000 vpd

4.1.3 Level of Service

Level of Service is used as a performance standard for roads (and intersections). Level of Service is a qualitative assessment of the quantitative effect of factors such as speed, volume of traffic, geometric features, traffic interruptions, delays and freedom to manoeuvre. There are six Levels of Service for roads. The following descriptions are for roads with interrupted traffic streams, such as rural roads.

- Level of Service A – this, the top level is a condition of free flow.
- Level of Service B – this level is in the zone of stable flow and drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream.
- Level of Service C – this service level is also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre in the traffic stream.
- Level of Service D – this level is close to the limit of stable flow but is approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream.
- Level of Service E – This occurs when traffic volumes are at or close to capacity and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream.
- Level of Service F - this service level is in the zone of forced flow. With it the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs and queuing and delays result. In short the traffic demand exceeds the capacity of the road or lane.

The desirable Level of Service for rural roads is Level of Service C or above (ie. A, B or C).

4.2 Description of Existing Roads

4.2.1 Ulan Road (MR 214 and Part MR 208)

Ulan Road (MR 214) is the main road between Mudgee and Cassilis. It is generally a two lane rural road with a sealed pavement width between 6.6 metres to 7.5 metres with variable shoulder widths.

The section of the road between Mudgee and UCML has a relatively flat and straight road alignment with overtaking opportunities along parts of the road. Sections of the road at Frog Rock and Cooks Gap areas have larger grades with a slightly narrower road pavement. Traffic management includes centre line marking, guide posts / reflectors, edge lines in sections and warning signs. The pavement condition is generally satisfactory.

Ulan Road, north of the UCML (i.e. towards Casillis), has similar road alignment and traffic management.

Approximately 9.6 kilometres north of Mudgee, Ulan Road (MR 214) meets Wollar Road (MR 208). From this intersection MR 208 becomes the main road to Mudgee.

Ulan Road (MR 208) enters the Mudgee township from the north where it crosses the Cudgegong River before intersecting with Short Street and Church Street. This intersection has a roundabout treatment.

Outside of the township of Mudgee the speed limit along this route is 100kph except for a short section of 80kph on the edge of Mudgee.

The major roads intersecting the Ulan Road (MR 214 and Part MR 208) are:

- Henry Lawson Drive approximately 1.8 kilometres north of Mudgee. This road provides access to vineyards and rural properties in the area and is the alternative route to Gulgong. This intersection is constructed with ‘CHR’ and ‘AUL’ treatments for the right turn and left turn movements in the main road (ie. right turn bay and left turn bay/deceleration lane).
- Wollar Road (MR 208) approximately 9.6 kilometres north of Mudgee. Ulan Road is constructed as the main road with the eastern arm of Wollar Road intersecting as T junction. There is no widening for Wollar Road at the intersection and a basic ‘BAR’ and ‘BAL’ intersection treatment is provided at this junction. The safety of this intersection has been raised during consultation undertaken for the Project. As Wollar Road is a principal route in the region, the road authorities should give consideration to upgrading the intersection to include a suitable treatment for turning traffic in Ulan Road at the intersection .
- Cope Road (MR598) approximately 40 km north of Mudgee. See **section 4.2.2**

Ulan Road (MR 214 and part MR 208) is a school bus route.

4.2.2 Cope Road (MR 598)

Cope Road (MR 598) connects Ulan Village with Gulgong. Cope Road intersects with Ulan Road to the south of UCML. Cope Road outside Ulan Village to Gulgong is signposted with a 100km/h speed limit.

Cope Road has a relatively straight and flat road alignment with a pavement width between 6.2 metres to 7.5 metres. The road has plenty of overtaking opportunities. Those sections that have been upgraded have sealed shoulders and the remainder of the road has unsealed shoulders. Traffic management includes centre line marking, guide

posts / reflectors and edge lines where the pavement is 7.0 metres wide. Cope Road is a school bus route.

Within Ulan Village, which has a speed limit of 50km/h, Ulan School fronts Cope Road and a school zone is provided adjacent the school's frontage.

The rail line that serves UCML (Gulgong – Sandy Hollow Railway) runs parallel to Ulan Road near the intersection. A level crossing is provided in Cope Road some 40 metres from Ulan Road. The level crossing is signposted and has flashing lights and appropriate road marking.

4.2.3 Ulan-Wollar Road

Ulan-Wollar Road is a minor rural road which connects Ulan with Wollar and is sealed from Ulan Road to the vehicle entrance of Wilpinjong mine. Modifications to this road are proposed as part of the Moolarben Coal Project. Ulan-Wollar Road intersects Ulan Road approximately 2.95km north of Cope Road.

4.2.4 Ulan Coal Mine - Open Cut Access Road

Ulan Open Cut Mine Access Road intersects Ulan Road 0.88km north of Cope Road and provides access to the Open Cut Mine. The Access Road has a sealed road pavement 7.0 metres wide with shoulders and centre line markings.

A level crossing (with the Gulgong – Sandy Hollow Railway) is provided in the Access Road some 30 metres from Ulan Road. Flashing lights, signposting and line marking is provided at the level crossing.

4.2.5 Ulan Coal Mine - Underground & Administration Access Road

The UCML Underground and Administration Access Road intersect Ulan Road approximately 6.6km north of Cope Road.

The Underground Mine Access Road has a 7.0 metre wide pavement with shoulders. In addition the access road has centre and edge line marking, guide posts / reflectors. The speed limit on the Underground Mine Access Road is 80km/h.

4.2.6 Bobadeen Road

Bobadeen Road is a minor local road that provides access to the surface facilities associated with the existing UCML Underground operations and one resident. Bobadeen Road intersects Ulan Road approximately 11.4km north of Cope Road. Bobadeen Road is mostly unsealed, with a road carriageway 6.0 metres wide plus shoulders.

UCML currently has an application in with NSW Dept of Lands to close the western section of Bobadeen road and acquire it from the MWRC to control public access into UCML Mining Lease areas for safety purposes in relation to subsidence.

4.2.7 Ulan Village Mine Access

The Ulan Village access via Main Street to UCML was historically used as access to the original underground operation and more recently has been used by construction contractors. The Access Road is located off Cope Road in Ulan Village via Main Street.

4.2.8 Wongaroo Road Access

Wongaroo Road provides access to the western extent of the project area. Typically access into this area is associated with exploration activities and light vehicle access for security and land management activities. Access to the mine via Wongaroo Road is expected to be infrequent and when in use will typically involve less than ten vehicles per day.

4.2.9 Principal Intersections

The principal intersections associated with the Project include:

- Ulan Road / Cope Road;
- Ulan Road / UCML Open Cut Access Road; and
- Ulan Road / UCML Underground and Administration Access Road.

A description of these intersections is provided below in accordance with the Roads and Traffic Authorities Road Design Guide – Intersections at Grade – Treatments for Rural Intersections. **Appendix 1** provides details of these treatments.

Ulan Road / Cope Road

Cope Road forms a T junction intersection with Ulan Road near Ulan Village. The intersection's layout includes:

- an 'AUR' auxiliary lane in Ulan Road for the right turn into Cope Road.
- an 'AUL' auxiliary lane in Ulan Road (deceleration lane) for the left turn into Cope Road and a short acceleration lane in Ulan Road for the left turn out of Cope Road.
- single lane approach in Cope Road with suitable radii for the left turns into and out of Cope Road; and
- directional signposting at the intersection.

Cope Road is subject to Give Way Control at the intersection.

A rail level crossing is located in Cope Road some 40 metres from Ulan Road. Flashing lights, signposting (including advance warning signs) and road marking is provided on both approaches to the level crossing. Sight distance at the intersection is good and exceeds 250 metres to/from the south and 300 metres to/from the north.

Ulan Road / UCML Open Cut Access Road

UCML Open Cut Access Road forms a T junction with Ulan Road some 0.88km north of Cope Road.

The intersection layout includes:

- an 'AUR' auxiliary lane in Ulan Road for the right turn into the Open Cut Access Road;
- an 'AUL' auxiliary lane in Ulan Road (deceleration lane) for the left turn into the Open Cut Access Road and a short acceleration lane for the left turn out of the Open Cut Access Road;
- a wide single lane approach in the Open Cut Access Road with suitable radii for the left turns into and out of the Open Cut Access Road; and directional signposting at the intersection.

The Open Cut Access Road is subject to Give Way Control and street lighting is provided at the intersection.

The Open Cut Access Road includes a rail level crossing located some 30 metres from its intersection with Ulan Road. Traffic management provided at the level crossing includes flashing lights, signposting and road marking as well as advance signs in Ulan Road and in the Open Cut Access Road.

Sight distance at the intersection is good and exceeds 250 metres to and from the north and 300 metres to and from the south in Ulan Road.

Ulan Road / UCML Underground and Administrative Access Road

UCML Underground and Administrative Access Road (Underground Access Road) forms a T junction with Ulan Road some 6.6km north of Cope Road.

The intersection layout includes:

- an 'AUR' auxiliary lane in Ulan Road for the right turn into the Underground Access Road;
- an 'AUL' auxiliary lane (deceleration lane) in Ulan Road for the left turn into the Underground Access Road;
- wide single lane approach in the Underground Access Road with suitable radii for the left turn into and out of the Access Road; and
- directional signage at the intersection.

The Underground Access Road is subject to Give Way control and street lighting is provided at the intersection.

Sight distance at the intersection is good and exceeds 250 metres to the north and 400 metres to the south.

4.2.10 Other Intersections

Other intersections include:

- Ulan Road / Ulan – Wollar Road;
- Ulan Road/Moolarben Mine Access Road

- Ulan Road / Bobadeen Road; and
- Cope Road/ Main Street / McKay Street (Ulan Village)

A description of these intersections is outlined below.

Ulan Road / Ulan – Wollar Road

Ulan-Wollar Road forms a T junction with Ulan Road some 2.95km north of Cope Road.

The intersection's layout includes:

- a 'CHR' right turn lane treatment in Ulan Road for the right turn into Ulan-Wollar Road;
- an 'AUL' auxiliary lane (deceleration lane) in Ulan Road for the left turn into Ulan-Wollar Road;
- A short lane storage area in Ulan Road for the right turn out of Ulan-Wollar Road;
- Single lane approach in Ulan-Wollar Road with suitable left turn kerb radii for the left turns into / out of Ulan-Wollar Road.

Ulan-Wollar Road is subject to Give Way control at the intersection.

Sight distance at the intersection is good and exceeds 250 metres to and from the north and south in Ulan Road

Ulan Road/Moolarben Mine Access Road

This intersection was constructed recently as part of the Stage 1 Moolarben Coal Project approval. A description of the intersection is contained in Section 5.2.5 of this report.

Ulan Road / Bobadeen Road

Bobadeen Road forms a T junction intersection with Ulan Road approximately 11.4km north of Cope Road.

The intersection layout include:

- 'BAR' and 'BAL' basic intersection layout for the right and left turn movements from Ulan Road.
- single lane approach (unsealed) in Bobadeen Road; and
- priority (Give Way) control on Bobadeen Road at Ulan Road.

Sight distance at the intersection is satisfactory.

Cope Road/Main Street / McKay Street (Ulan Village)

This intersection is located in Ulan Village where the speed limit is 50km/hr.

Main Street is the continuation of Cope Road from Ulan Road. McKay Street forms a T junction with Main Street 0.7kms west of Ulan Road. The route (i.e. MR598) follows McKay Street and Robinson Street where it becomes Cope Road west of Ulan Village.

The intersection layout is a basic 'BAR' and 'BAL' layout with directional signposting and road marking provided at the intersection. Sight distance at the intersection is good and exceeds 120 metres.

4.3 Existing Conditions on the Road Network

4.3.1 Daily Traffic Volumes on the Road Network

Traffic volumes using the principal road network in and around UCML were collected as part of this assessment. This included traffic volumes from published reports from other proposals in the area, as well as traffic volumes collected on the road network, as part of this assessment.

Traffic volume and classification counts were undertaken between 10-16 December 2008. **Figure 4** shows the count locations as well as daily traffic volumes broken down into weekday volumes (5 day average) and 7 day average (AADT) traffic volumes. It should be noted that construction activities associated with Moolarben Coal Project Stage 1 were being undertaken during the traffic count period and the traffic counts would reflect light and heavy vehicles associated with the Stage 1 construction.

4.3.2 Ulan Road (MR 214)

Table 4.1 shows the traffic volumes using Ulan Road, south of Cope Road at Ulan. Reference to Table 4.1 shows that on a typical weekday (5 day average) Ulan Road carries two way traffic volumes of 1271 vehicles per day (vpd). Heavy vehicles (Austroad classes 3-12) total 171 vpd and comprise some 13.5% of the total weekday volumes.

Typical 7 day average (AADT) two way traffic volumes in this section of Ulan Road are 1090 vpd.

TABLE 4.1

ULAN ROAD, SOUTH OF COPE ROAD

Direction of Travel	Traffic Volumes					
	5 Day Average			7 Day Average (AADT)		
	Light ¹	Heavy ²	Total	Light ¹	Heavy ²	Total
North	526	83	609	458	65	523
South	574	88	662	499	68	567
Total	1100	171	1271	957	133	1090
Proportion of Total	86.5%	13.5%	100%	87.8%	12.2%	100%

Source – Traffic Counts 10-16 December 2008

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

² Heavy vehicles - Austroads 3-12 vehicle classifications

Traffic volumes in the section of Ulan Road between Cope Road and south of Ulan-Wollar Road are shown in Tables 4.2 and 4.3.

Traffic volumes in this section of Ulan Road are slightly higher and reflect the traffic volumes associated with UCML and Ulan-Wollar Road.

Reference to Tables 4.2 and 4.3 shows that typical two way weekday traffic volumes (5 day average) range between 1719-1777 vpd. Heavy vehicles (Austroad class 3-12) total 241-245 vpd and represent 13.6% -14.3% of the total weekday volumes. Typical 7 day average (AADT) two way traffic volumes in this section of Ulan Road are 1488-1518 vpd.

TABLE 4.2

**ULAN ROAD, NORTH OF COPE ROAD AND SOUTH OF
ULAN COAL MINE OPEN CUT ACCESS ROAD**

Direction of Travel	Traffic Volumes					
	5 Day Average			7 Day Average (AADT)		
	Light ¹	Heavy ²	Total	Light ¹	Heavy ²	Total
North	747	117	864	642	93	735
South	789	124	913	686	97	783
Total	1536	241	1777	1328	190	1518
Proportion of Total	86.4%	13.6%	100%	87.5%	12.5%	100%

Source – Traffic Counts 10-16 December 2008

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

² Heavy vehicles - Austroads 3-12 vehicle classifications

TABLE 4.3

**ULAN ROAD, NORTH OF ULAN COAL MINE OPEN CUT ACCESS ROAD
AND SOUTH OF ULAN-WOLLAR ROAD**

Direction of Travel	Traffic Volumes					
	5 Day Average			7 Day Average (AADT)		
	Light ¹	Heavy ²	Total	Light ¹	Heavy ²	Total
North	743	116	859	652	93	745
South	731	129	860	642	101	743
Total	1474	245	1719	1294	194	1488
Proportion of Total	85.7%	14.3%	100%	87.0%	13.0%	100%

Source – Traffic Counts 10-16 December 2008

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

² Heavy vehicles - Austroads 3-12 vehicle classifications

Table 4.4 and 4.5 shows the traffic volumes using Ulan Road south and north of the UCML Underground Access Road, respectively.

Reference to Table 4.4 shows that the typical weekday (5 day average) two way traffic volume in Ulan Road, south of the Underground Mine Access Road is 1477 vpd. Heavy vehicles (Austroad Class 3-12) total 251 vehicles (vpd) and represent 17.0% of the total vehicles. Typical 7 day average (AADT) two way traffic volumes in this section are 1283 vpd.

Weekday (5 day average) two way traffic volumes in Ulan Road north of the Underground Mine Access Road (Table 4.5) are lower and in the order of 743 vpd. Heavy vehicles (Austroad Class 3-12) total 149 vpd and comprise some 20% of the total vehicles. Typical 7 day average (AADT) two way traffic volumes in this section are 691 vpd.

TABLE 4.4

ULAN ROAD, NORTH OF ULAN-WOLLAR ROAD AND SOUTH OF ULAN COAL MINE UNDERGROUND ACCESS ROAD

Direction of Travel	Traffic Volumes					
	5 Day Average			7 Day Average (AADT)		
	Light ¹	Heavy ²	Total	Light ¹	Heavy ²	Total
North	614	123	737	545	96	641
South	612	128	740	544	98	642
Total	1226	251	1477	1089	194	1283
Proportion of Total	83.0%	17.0%	100%	84.9%	15.1%	100%

Source – Traffic Counts 10-16 December 2008

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

² Heavy vehicles - Austroads 3-12 vehicle classifications

TABLE 4.5

ULAN ROAD, NORTH OF UNDERGROUND COAL MINE ACCESS ROAD

Direction of Travel	Traffic Volumes					
	5 Day Average			7 Day Average (AADT)		
	Light ¹	Heavy ²	Total	Light ¹	Heavy ²	Total
North	303	71	374	292	56	348
South	291	78	369	181	62	343
Total	594	149	743	473	118	691
Proportion of Total	80.0%	20.0%	100%	82.9%	17.1%	100%

Source – Traffic Counts 10-16 December 2008

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

² Heavy vehicles - Austroads 3-12 vehicle classifications

4.3.3 Cope Road (MR 598)

Table 4.6 shows the traffic volumes using Cope Road west of Ulan Village. Reference to Table 4.6 shows that on a typical weekday (5 day average) Cope Road carries two way traffic volumes of 611 vpd. Heavy vehicles total 98 vehicles (vpd) and comprise some 16.0% of the total vehicles. Typical 7 day average (AADT) two way volumes in Cope Road are 547 vpd.

TABLE 4.6

COPE ROAD WEST OF ULAN VILLAGE

Direction of Travel	Traffic Volumes					
	5 Day Average			7 Day Average (AADT)		
	Light ¹	Heavy ²	Total	Light ¹	Heavy ²	Total
East	247	50	297	227	40	267
West	266	48	314	241	39	280
Total	513	98	611	468	79	547
Proportion of Total	84.0%	16.0%	100%	85.5%	14.5%	100%

Source – Traffic Counts 10-16 December 2008

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

² Heavy vehicles - Austroads 3-12 vehicle classifications

4.3.4 Ulan-Wollar Road

Christopher Hallan and Associates undertook traffic counts in Ulan-Wollar Road, east of Ulan Road in June 2004.

At that time two way weekday (5 day average) traffic volumes using Ulan-Wollar Road were found to be 99 vpd. Typical 7 day average (AADT) traffic volumes were 98 vpd.

Traffic volumes using Ulan-Wollar Road during December 2008 are likely to be higher than this figure as construction work was in progress on the Moolarben Coal Mine project during this period and the Wilpinjong Coal Mine is now operating and use the Ulan – Wollar road as the main means of access.

4.3.5 Ulan Coal Mine Access Roads

Tables 4.7 and 4.8 show the traffic volumes using the access road to UCML Open Cut and to the Underground Mine and Administration area respectively.

Reference to Table 4.7 shows that weekday (5 day average) two way traffic volumes using the Open Cut Mine Access Road are 175 vpd. Heavy vehicles (Austroad Classes 3-12) total 12 vehicles (vpd) and represent 6.8% of the total vehicles. Typical 7 day average (AADT) two way traffic volumes using the Open Cut Mine Access Road are 137 vpd.

TABLE 4.7

**ULAN COAL MINE OPEN CUT ACCESS ROAD,
NORTH OF ULAN ROAD**

Direction of Travel	Traffic Volumes					
	5 Day Average			7 Day Average (AADT)		
	Light ¹	Heavy ²	Total	Light ¹	Heavy ²	Total
To mine	84	6	90	65	5	70
From mine	79	6	85	62	5	67
Total	163	12	175	127	10	137
Proportion of Total	93.2%	6.8%	100%	92.7%	7.3%	100%

Source – Traffic Counts 10-16 December 2008

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

² Heavy vehicles - Austroads 3-12 vehicle classifications

Reference to Table 4.8 shows that weekday (5 day average) two way traffic volumes using the Underground Mine and Administrative Access Road are 777 vpd. Heavy vehicles (Austroad Clauses 3-12) total 64 vehicles (vpd) and comprise 8.2% of the total vehicles using the Access Road. Typical 7 day average (AADT) two way traffic volumes using the Underground Mine Access Road are 623 vpd.

TABLE 4.8

**ULAN COAL MINE UNDERGROUND ACCESS ROAD,
WEST OF ULAN ROAD**

Direction of Travel	Traffic Volumes					
	5 Day Average			7 Day Average (AADT)		
	Light ¹	Heavy ²	Total	Light ¹	Heavy ²	Total
To mine	351	32	383	284	24	308
From mine	362	32	394	293	24	315
Total	713	64	777	577	48	623
Proportion of Total	91.8%	8.2%	100%	92.3%	7.7%	100%

Source – Traffic Counts 10-16 December 2008

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

² Heavy vehicles - Austroads 3-12 vehicle classifications

4.3.6 Peak Hour Traffic Volumes and Intersection Conditions

Table 4.9 shows the weekday peak hour traffic volumes on the road network adjacent UCML, as recorded in the traffic counts undertaken during 10-16 December 2008 period.

The AM peak hour which occurs between 6am – 7am has the highest traffic volumes, with the section of Ulan Road south of Cope Road carrying two way traffic volumes in the order of 137 vehicles per hour (vph) and south of UCML's Underground Mine Access Road carrying two way traffic volumes in the order of 210 vehicles per hour (vph).

North of the Underground Mine Access Road, traffic volumes using the Ulan Road are 21 vph.

Cope Road carries two way traffic volumes of 66 vph during the AM peak hour.

Traffic volumes using the Open Cut Mine Access and Underground Mine Access Roads are 39 vph and 134 vph respectively.

The traffic volumes in the AM peak hour are tidal with the majority of traffic travelling towards Ulan from Mudgee and Gulgong. **Figure 5** which shows the direction of travel during the AM and PM peak hours, demonstrates this.

Traffic volumes using the road network during the PM peak hour (3pm – 4pm) are lower than the AM peak hour with two way traffic volumes in Ulan Road between south of Cope Road and south of the Underground Mine Access Road in the order of 98-128 vph. North of the Underground Mine Access Road two way traffic volumes in Ulan Road are 63 vph.

Cope Road carries two way traffic volumes of 40 vph in the PM peak hour. Two way traffic volumes using Ulan Coal's Open Cut Mine Access Road and Underground Mine Access Road during the PM peak hour are 6 vph and 65 vph respectively.

The peak hour traffic volumes are relatively small in real terms and the capacity of the road network and the intersections on the road network would easily accommodate this level of traffic.

TABLE 4.9

**WEEKDAY PEAK HOUR TRAFFIC VOLUMES
USING ROAD NETWORK**

Location	Two Way Traffic Volumes	
	AM peak hour 6am – 7am	PM peak hour 3pm – 4pm
Ulan Road south of Cope Road	137	98
Ulan Road north of Cope Road	210	128
Ulan Road south of Ulan-Wollar Road	181	126
Ulan Road north of Ulan-Wollar Road	143	124
Ulan Road north of UCML Underground Mine Access Road	21	63
Cope Road west of Ulan Village	66	40
UCML Open Cut Mine Access Road	39	6
UCML Underground Mine Access Road	134	65

Source – Traffic Counts 10-16 December 2008

Table 4.10 shows peak hour Levels of Service Volume Thresholds for 2 lane rural roads as shown in the RTA’s Guide to Traffic Generating Developments. Reference to Table 4.10 shows that for roads with 10-15% of heavy vehicles;

- Level of Service A occurs when two way peak hour volumes are less than 530-560 vph; and
- Level of Service B occurs when two way volumes are greater than 530-560, and vph less than 870-920 vph; and
- Level of Service C occurs when two way volumes are greater than 870-920 vph but less than 1410-1480 vph.

The maximum peak hour two way traffic volumes using Ulan Road north and south of Cope Road at 137-210 vph, and also using Cope Road at 66 vph are considerably lower than 530-560 vph volume threshold indicating that both these roads currently operate at a Level of Service A operation. Similarly the mine access roads also operate at a Level of Service A operation.

TABLE 4.10

**PEAK HOUR FLOW ON TWO-LANE RURAL ROADS
(VEHICLES PER HOUR)
(DESIGN SPEED OF 100KM/HR)**

Terrain	Level of Service	Proportion of Heavy Vehicles			
		0%	5%	10%	15%
Level	A	<630	<590	<560	<530
	B	630	590	560	530
	C	1030	970	920	870
	D	1630	1550	1480	1410
	E	2630	2500	2390	2290

Source Table 4.5 RTA Guide to Traffic Generating Developments October 2002

All of the intersections as noted in **Section 4.1.1** currently operate at a good level of service (consistent with a level of Service A operation) during the AM and PM peak hours. Traffic conditions at the intersections are characterised by low vehicle delays to those movements subject to priority control and frequent gaps in the traffic flow along the major roads, which allows vehicles to turn off or onto the major roads with minimal delay.

4.3.7 Traffic Growth on Road Network

The Roads and Traffic Authority’s AADT traffic count data has been used to measure traffic growth on the road network between 1992 and 2005. (NB. The traffic counts undertaken as part of this assessment have measured the traffic increases in Ulan Road and Cope Road due to UCML and Wilpinjong since 2005).

During this 13 year period traffic growth on the road network has been mixed with increases on some roads and reductions on other roads as follows:

- Ulan Road (MR 214), north of UCML – average of 0.67% increase per year.

- Ulan Road (MR 214), north of Budgee Budgee (approximately mid way between Ulan and Mudgee) – No traffic growth with a reduction of traffic volume between 1992 – 2005
- Ulan Road (MR 208), north of Mudgee township – average of 2.7% increase per year
- Cope Road (MR 598), at railway bridge in Gulgong – average of 2.4% increase per year.

The traffic growth assumptions have been used to increase the measured base 2008 traffic volumes (which includes the Wilpinjong Coal Mine traffic) to 2013 for the assessment of cumulative impacts. The Moolarben Coal Mine traffic movements are in addition to the base 2008 traffic volumes and have been included in the cumulative impact assessment.

4.4 Road Safety

4.4.1 Accidents

The RTA road crash statistics were provided by the RTA for those sections of the road network adjacent UCML for the 3 year period from 1 January 2005 to 31 December 2007.

The sections of the road network included:

- Ulan Road (MR 214 and part MR 208) from Mudgee to Turill (approximately 65km); and
- Cope Road (MR 598) from Gulgong to Ulan (approximately 24km).

Table 4.11 provides a summary of the total number of accidents (mid block and at intersections on these roads by severity and year.

Cope Road (MR 598) experienced 1-3 accidents per year during this period, all of which were single vehicle accidents. Of the total number of 7 accidents that occurred over the 3 year period, 4 (57%) of those were injury accidents.

Ulan Road (MR 214 and part MR 208) experienced increasing numbers of accidents between 2005 and 2007, with a total of 20 accidents over the 3 year period, 12 (48%) of which were injury accidents. Thirteen (13) of the accidents were single vehicle accidents.

The majority of the accidents occurred between south of Ulan and Eurunderee, which is approximately 10km north of Mudgee township.

There was one (1) accident at the Ulan Road / Cope Road intersection over the 3 year period, which was a non-injury (tow away) accident.

There were no reported accidents at the intersections in Ulan Road that provide access to UCML (i.e. Open Cut Access Road and Underground Mine Access Road) during this period.

TABLE 4.11**ACCIDENT STATISTICS FOR ULAN ROAD AND
COPE ROAD BETWEEN 2005 AND 2007****Ulan Road – MR 214 and part MR 208 (Mudgee to Turill) – 64km**

Year	Total Accidents	Tow Away Accidents	Injury Accidents	Fatal Accidents	Intersection Accidents	Non-Intersection Accidents	Single Vehicle Accidents
2005	3	1	2	-	1	2	2 (all cars)
2006	6	1	5	-	1	5	3 (2 cars, 1 motorcycle)
2007	11	6	5	-	0	11	8 (7 cars, 1 light truck)

Cope Road (MR 598) (Gulgong to Ulan) – 24km

Year	Total Accidents	Tow Away Accidents	Injury Accidents	Fatal Accidents	Intersection Accidents	Non-Intersection Accidents	Single Vehicle Accidents
2005	1	-	1	-	-	1	1 (motorcycle)
2006	3	1	2	-	-	3	3 (all cars)
2007	3	2	1	-	2*	1	3 (2 cars, 1 light truck)

* Single vehicle accident

4.4.2 Road Safety Audits

Sinclair Knight Merz (SKM) conducted road safety audits of Ulan Road (MR 214 and MR 208) and Cope Road in August 2006, as part of the assessment for Stage 1 of the Moolarben Coal Project. This included audits of:

- Ulan Road between Mudgee (corner Church Street and Short Street) and Ulan (MR214 bridge over railway line, which was the most readily identifiable landmark in the vicinity of the proposed site access point 4)
- Cope Road (MR 598) between Gulgong (corner Station Street and Nandoura Street) and its intersection with Ulan Road (MR 214) at Ulan

The key findings of the SKM audit on both routes was the need to improve:

- Delineation; and
- Road edge formation and shoulder provision.

Delineation is predominantly a night time issue and SKM found that the provision of guide posts was sporadic along both routes.

SKM recommended that the delineation be upgraded along both routes and in particular the provision of guidepost with reflectors at standard spacing along the full length of both

routes, together with regular maintenance to replace damaged posts and control vegetation.

SKM also recommended that road pavement edges should also be checked regularly and repaired as necessary to maintain a sufficiently wide road pavement (at least 6 metres to provide safe clearance from oncoming traffic) and to provide a smooth transition between the road pavement and gravel shoulder area.

The SKM road safety audit also identified the need to provide improved delineation of the bend in Ulan Road at the intersection of Mud Hut Creek Road by way of a chevron marker sign and to replace missing guideposts at or near the intersection. Conditions at this intersection were raised during community consultation for this project and it is considered that the SKM's recommendation for this intersection should be considered for implementation.

4.5 Bus Routes

School bus services operate along several of the roads adjacent to Ulan Mine including Ulan Road (MR 214 and part MR 208) and Cope Road (MR 598). These include services between:

- Cooks Gap – Mudgee;
- Ulan – Mudgee;
- Ulan – Wollar;
- Turil – Gulgong;
- Yarrawonga – Gulgong; and
- Winchester Cr and Ridge Road – Ulan.

School bus services typically operate on the roads generally between 7.30am and 9.00am and 3.30pm to 5.00pm on school days.

Country Link also operates a limited bus service in the Gulgong / Mudgee area to connect to Cityrail services at Lithgow which use a section of Cope Road.

4.6 Gulgong to Sandy Hollow Rail Line

This rail line is a freight rail line that connects to the Main Northern Railway Line. The Gulgong to Sandy Hollow rail line is used by UCML and other coal mines to transport coal to Port Waratah at Newcastle and other domestic customers within the Hunter Region. It is understood that it is also used for other general freight.

SKM examined train operations on this line as part of their assessment of Moolarben Coal Mine Project Stages 1 and 2 and information concerning the railway operation has been drawn from the SKM reports for Stages 1 and 2.

The Muswellbrook to Ulan section was opened in about 1982 and the Ulan to Gulgong section was completed in the late 1980's. This section of the track has no constraints in regard to locomotives and rolling stock configurations with 1.6 km long coal trains at 30 tonne axle loads.

Currently UCML load an average of 4 coal trains per day and has an approved average limit of 28 rail movements per week. All of their trains operate between the mine (northeast of the Open Cut Access Road) at Ulan and Port Waratah via Muswellbrook including delivery to domestic power generation customers.

Other coal mines that are approved to use this line to transport coal to Port Waratah via Muswellbrook are:

- Moolarben (Stage 1) – average 4 trains per day (8 train movements)
- Wilpinjong – average 6 trains per day (12 train movements)
- Mangoola (formerly Anvill Hill near Muswellbrook) – average 4 trains per day (8 train movements)
- Bengalla (near Muswellbrook) – average 3 trains per day (6 train movements)
- Mt Pleasant (near Muswellbrook) – average 3 trains per day (6 train movements)

Moolarben Stage 2 if approved would increase the number of loaded trains from Moolarben by an average of 1 train per day (2 train movements)

SKM undertook an assessment of the level crossings between Ulan and Muswellbrook, in February 2006 and again in May 2008. There are 18 level crossings between UCML and Muswellbrook all of which were classified as public roads.

SKM found that the majority of the public road level crossings surfaced with bitumen were fitted with automatic warning lights and bells.

Those crossings that had unsealed approach roads had various forms of protection from give way signs with no advanced warning signs up to stop signs with advanced warning signs, as well as sites with automatic warning lights and bells.

SKM reported that the crossings were generally in fair condition, although some minor maintenance/repairs to the traffic facilities and approach roads were required.

SKM noted in its Moolarben Stage 2 (February 2009) report, that the work required to address the deficiencies noted in the Conditions report for the level crossings is the responsibility for the relevant local government authority and the Australian Rail Track Corporation (ARTC).

Based on train lengths of 1276 metres SKM calculated that the average delay at level crossings for the slowest loaded coal train line would be approximately 121 seconds (2 minutes). Delay for empty trains would be lower than this as there are no speed restrictions on empty trains.

5.0 ASSESSMENT OF TRAFFIC IMPACTS

5.1 Traffic Impacts of the Project

5.1.1 Traffic Generation in Operational and Construction Phase

The maximum traffic generation of the Project will occur in year 4 of operations and has been adopted to determine and assess the worst case traffic impacts of the Project. At this time there will be a total of 1084 personnel (employees and contractors) working at the mine including 270 contractors associated with construction activities. This will be an increase of 554 personnel from the existing mine's workforce.

The additional mining workforce for Ulan West Underground Mine will generally work 3 shifts per day on weekdays and 2 shifts per day on the weekends.

Friday morning shift start time of 7.00am will have the highest number of the mining workforce commencing at this time.

The finish times of the various shifts on weekdays do not coincide with the start times of the next shift, so there is very little overlap of times for arrivals and departures at the mine for these shifts.

The construction hours are expected to be 7.00am – 7.00pm Monday to Sunday. The construction workforce start time of 7.00am on weekdays will coincide with the start time of mining workforce and the 1 hour period between 6.00am – 7.00am will be the busiest hour in terms of traffic generation.

Based on the information presented in Section 3.3 and adopting the current vehicle trip rates of the existing workforce and visitors, the Project is expected to generate a maximum of:

- an additional 782 two way trips to and from the mine on an average day (i.e. AADT);
- an additional 984 two way trips to and from the mine on a weekday (i.e. 5 day average); and
- an additional 440 vehicle trips during the 6.00am – 7.00am period on a Friday, which will be the peak hour for the mine. The peak hour assumes that 100% of the construction workforce will arrive in the 6.00am – 7.00am period, which will coincide with the travel period for the operational mining staff. This is a worst case scenario, which has been adopted for this assessment. In reality it is likely that up to 67% of the construction workforce would travel in the peak hour between 6.00am – 7.00am, with remaining 33% of construction contractors arriving and departing over several hours between 7.00am and 6.00pm.

The above traffic volumes include deliveries and visitor trips to the mine. The number of trips by delivery vehicles will increase by:

- 8 trips (4 in/4 out) on an average day (7 day average); and
- 12 trips (6 in/6 out) on a weekday.

Heavy vehicles which will include delivery vehicles and some contractor vehicle trips as well as construction vehicles in year 1 to 4 are expected to be in the order of 4.7% - 5.0% of total daily weekday traffic.

In year 4 the total number of heavy vehicle trips generated by the mine is expected to be:

- 72 trips (36 in/36 out) per day (7 day average) which is an increase of 24 vehicle trips (12 in /12 out); and
- 96 trips (48 in/48 out) per weekday, which is an increase of 32 vehicle trips (16 in/16 out).

Based on the origins and destinations shown in Table 3.3 the additional heavy vehicles would use the following roads:

- Ulan Road south (to and from Mudgee) – 10-12 heavy vehicle trips per day/weekday
- Cope Road – 10-12 heavy vehicle trips per day/weekday
- Ulan Road north (to and from Cassillis) – 4-6 heavy vehicle trips per day/weekday; and
- Ulan Village – 0-2 heavy vehicle trips per day/weekday.

5.1.2 Traffic Assignment on Road Network

Table 3.3 shows the expected origins and destinations of vehicle trips to and from the mine and this has been used to assign the predicted increase/decrease of traffic on the road network.

The construction workforce will be split between the Construction Access Road which is accessed from Ulan Village via Main Street, and the Open Cut and Underground Access Roads located off Ulan Road. The Underground workforce will use the Underground Access Road. Mining contractors who have office facilities near the Construction Access Road will continue to use this entrance. For the assessment, the proportion of construction traffic using the various access points is as follows:

- Construction Access Road – 20% of the construction workforce plus all construction deliveries as well as existing vehicle trips;
- Open Cut Access Road – 60% of the construction workforce as well as the existing vehicle trips using this road; and
- Underground Access Road – 20% of the construction workforce, plus all (100%) of the underground workforce, as well as the existing vehicles trips using this road.

Additional weekday and Friday peak hour traffic volumes using the road network due to the Project peak in 2013 (year 4) and are estimated as:

- An additional 680 vehicle trips on a weekday on Ulan Road between Mudgee and Ulan with an additional 299 vehicles northbound and 6 vehicles southbound in the 6.00am – 7.00am Friday peak hour.

- An additional 256 vehicle trips on a weekday on Cope Road with an additional 113 vehicles east bound and 2 vehicles westbound in the 6.00am – 7.00am Friday peak hour.
- An additional 30 vehicle trips on a weekday on Ulan Road north of UCML (towards Cassilis) with an additional 13 vehicles south bound in the 6.00am – 7.00am Friday peak hour

Table 5.1 shows the additional two way weekday and AM peak hour traffic using the road network near Ulan due to the Project in 2013 (year 4).

Figure 6 shows the additional traffic volumes on the road network near Ulan generated by the Project in the 6.00am – 7.00am Friday peak hour.

TABLE 5.1

**ADDITIONAL TWO WAY TRAFFIC VOLUMES
USING ROAD NETWORK IN THE AM PEAK HOUR AND ON WEEKDAYS
WITH PROJECT IN YEAR 4 (2013)**

Location	Two Way Traffic Volumes	
	AM Friday Peak Hour 6.00am – 7.00am	Weekday
Ulan Road south of Cope Road	+305	+680
Ulan Road north of Cope Road	+382	+862
Ulan Road south of Ulan-Wollar Road	+248	+586
Ulan Road north of Ulan-Wollar Road	+248	+586
Ulan Road north of UCML Underground Access Road	+13	+30
Cope Road west of Ulan Village	+115	+256
UCML Open Cut Access Road	+142	+284
UCML Underground Access	+251	+592
Ulan Coal Construction Access Road	+47	+108
Cope Road (Main Street) west of Ulan Road	+143	+320

5.1.3 Future Base Traffic Growth

Depending on timing of Project Approval, Year 4 of the Mine Plan is estimated to occur in 2013.

Traffic growth on the road network has been mixed with little or no growth on sections of Ulan Road between Ulan and Budgee Budgee and 2.4% growth on Cope Road in Gulgong. For the purpose of this assessment, 1.0% growth per annum has been adopted for Ulan Road and 2.4% growth per annum adopted for Cope Road, to derive 2013 traffic volumes. This traffic growth assumptions have been used to increase the December 2008 measured base traffic volumes in the assessment of cumulative impacts.

5.2 Cumulative Traffic Impact in 2013

5.2.1 Other Approved and Proposed Projects

The Moolarben Coal Project (Stage 1) and the Wilpinjong Coal Project are approved Coal Projects that will be operating in 2013. The Wilpinjong Coal Project was operational when the traffic count data was collected in December 2008, and as such there will be no cumulative impact as the traffic for the Wilpinjong Coal Project are included in the existing (base) traffic volumes.

The proposed Moolarben Coal Project (Stage 2) has not been approved but has been considered for the purpose of assessing the cumulative traffic impact of the Project. It is assumed that both Moolarben Stage 1 and 2 will be commissioned and fully operational (ie. operational phase) in 2013. However, the impacts for Stages 1 and 2 have been assessed separately, as Stage 2 is not yet approved.

5.2.2 Moolarben Coal Project – Stage 1

The assessment report prepared by SKM for Moolarben Coal Project – Stage 1 estimated that the operational phase would generate:

- 436 two way vehicle trips on a weekday (i.e.218 trips in/218 trips out);
- 188 two way vehicle trips on weekends (i.e. 94 trips in/94 trips out; and
- 125 inbound trips to the mine in the peak hour which would occur in the 6.00am – 7.00am period. A further 64 vehicles would leave the mine in the 7.00am – 8.00am period.

Moolarben Coal Mine is located adjacent to UCML and traffic associated with Moolarben Mine would use Ulan Road and Cope Road. Access to the mine in Stage 1 would be from Ulan Road approximately 400 metres north of the existing rail bridge at Ulan. This is approximately 3.9 kilometres north of Cope Road.

SKM stated that the majority of the operational staff would reside in Mudgee or Gulgong but do not provide any traffic assignment in the Stage 1 report. The Stage 2 SKM report assumes 80% of the workforce will reside in Mudgee and 20% in Gulgong and that the number of employee vehicles using Ulan Road and Cope Road for both stages would be split into these proportions.

Based on this, the Moolarben Coal Mine (Stage 1) would result in:

- An additional 348 vehicles on a weekday would use Ulan Road between Mudgee and the Mine site with an additional 100 vehicles northbound in the 6.00am to 7.00am weekday peak hour; and
- An additional 88 vehicles would use Cope Road with an additional 25 vehicles eastbound in the 6.00am to 7.00am weekday peak hour;

5.2.3 Moolarben Coal Project - Stage 2

At peak production Moolarben Coal Project Stage 2 would require an additional 122 workers to that required for Stage 1 and that the total operational workforce for Moolarben at this time would be 439 people.

SKM estimates that the additional traffic generation for Stage 2 would be:

- 244 two way vehicle trips on a weekday (ie. 122 trips in / 122 trips out);
- No additional trips on weekends as Stage 2 will not have any weekend shifts; and
- 82 inbound trips to the mine in the 6.00am – 7.00am peak hour period. A further 40 vehicles would leave in the 7.00am – 8.00am period.

Vehicle access for Stage 2 employees would be from the Ulan-Wollar Road east of Ulan Road.

Adopting the traffic arrangement with 80% of employee vehicles using Ulan Road and 20% of employee vehicles using Cope Road Stage 2 of Moolarben Coal Project would result in:

- An additional 196 vehicles on a weekday would use Ulan Road between Mudgee and Ulan with an additional 66 vehicles northbound in the 6.00am – 7.00am weekday peak hour;
- An additional 48 vehicles on a weekday would use Cope Road with an additional 16 vehicles eastbound in the 6.00am to 7.00am weekday peak hour; and
- An additional 244 vehicles on a weekday would use Ulan- Wollar Road between the Stage 2 access point and Ulan Road with an additional 82 vehicles eastbound in the 6.00am to 7.00am weekday peak hour.

5.2.4 Cumulative Traffic Impacts on Road Network

Weekday Volumes

Table 5.2 shows the weekday (5 day average) volumes on the road network near Ulan with the Ulan Project and Stage 1 of Moolarben as well as the project with Stages 1 and 2 of Moolarben in 2013. The existing 2009 weekday volumes are also shown. It is noted that the traffic volumes associated with the Wilpinjong Coal Project are included in the existing i.e. base traffic numbers and are therefore considered in the cumulative impact assessment.

While there is a significant increase in the traffic volumes using the road network due to the Ulan Project and Stages 1 and 2 of Moolarben, the total daily traffic volumes are well within the capacity of the roads.

This is demonstrated in the assessment of the peak hour traffic flows on the road network which is undertaken below.

TABLE 5.2

FUTURE (2013) WEEKDAY (5 DAY AVERAGE) TWO WAY TRAFFIC VOLUMES USING ROAD NETWORK WITH ALL MINES IN OPERATION

Location	Two Way Weekday Traffic Volumes		
	2009 Existing (Wilpinjong and existing Ulan))	2013 With Moolarben Stage 1 & additional Ulan Project	2013 With Moolarben Stages 1 & 2 & additional Ulan Project
Ulan Road south of Cope Road	1271	2394	2590
Ulan Road north of Cope Road	1777	3164	3408
Ulan Road south of Ulan-Wollar Road	1719	2827	3071
Ulan Road north of Ulan-Wollar Road*	1477	2573	2573
Ulan Road north of UCML Underground Access Road	743	810	810
Cope Road west of Ulan Village	611	1028	1076
UCML Open Cut Access Road	175	459	459
UCML Underground Access Road	777	1369	1369
Ulan Coal Construction Access Road	-	108	108
Cope Road (Main Street), west of Ulan Road	611	1092	1140

* South of Access Road to Moolarben Coal Mine

Peak Hour Volumes

Table 5.3 shows the two way Friday AM peak hour (6.00am – 7.00am) volumes using the road network adjacent Ulan in 2013 with the Project, Wilpinjong and Stage 1 of Moolarben as well as for the Project with Stages 1 and 2 of Moolarben. For comparison purpose the 2009 existing traffic volumes are also shown in the table.

With the Project, Wilpinjong and Stage 1 of Moolarben in operation there will be a significant increase as compared to the existing 2009 traffic volumes, although traffic conditions are expected to remain satisfactory to good as detailed below. The additional traffic associated with Stage 2 of Moolarben will increase peak hour volumes in Cope Road and Ulan Road south of Ulan-Wollar Road.

TABLE 5.3

**EXISTING AND FUTURE (2013) 6AM – 7AM PEAK HOUR TRAFFIC
VOLUMES USING ROAD NETWORK WITH ALL
MINES IN OPERATION**

Location	Two Way Friday Traffic Volumes AM Peak Hour – 6am-7am		
	2009 Existing (Wilpinjong and existing Ulan)	2013 With Moolarben Stage 1 & additional Ulan Project	2013 With Moolarben Stages 1 & 2 & additional Ulan Project
Ulan Road south of Cope Road	137	549	615
Ulan Road north of Cope Road	210	728	810
Ulan Road south of Ulan-Wollar Road	181	563	645
Ulan Road north of Ulan-Wollar Road*	143	524	524
Ulan Road north of UCML Underground Access Road	21	36	36
Cope Road west of Ulan Village	66	214	230
UCML Open Cut Access Road	39	181	181
UCML Underground Access Road	134	385	385
Ulan Coal Construction Access Road	-	47	47
Cope Road (Main Street), west of Ulan Road	66	246	262

*South of Access Road to Moolarben Coal Mine

Table 5.4 shows peak hour Levels of Service Volume Thresholds for 2 lane rural roads as shown in the RTA's Guide to Traffic Generating Developments. Reference to Table 5.4 shows that for roads with 10-15% of heavy vehicles.

- Level of Service A occurs when two way peak hour volumes are less than 530-560 vph; and
- Level of Service B occurs when two way volumes are greater than 530-560, and vph less than 870-920 vph.
- Level of Service C occurs when two way volumes are greater than 870-920 vph but less than 1410-1480 vph.

Level of Service C or better (ie. A, B or C) is the desirable design criteria.

For Scenario 1 with the Ulan Project and Stage 1 of Moolarben;

- Ulan Road south of Cope Road will carry an estimated 549 vph which indicates a Level of Service A bordering on Level of Service B operation.
- Ulan Road between Cope Road and Ulan – Wollar Road will carry an estimated 563 – 728 vph which indicates a Level of Service B operation.
- Ulan Road north of Moolarben Coal Access Road will carry an estimated 389 vph and north of UMCL Underground Access Road an estimated 36 vph, which indicates a Level of Service A operation.

For Scenario 2 with the Ulan Project and Stages 1 and 2 of Moolarben;

- Ulan Road south of Cope Road will carry an estimated 615 vph which indicates a Level of Service B operation.
- Ulan Road between Cope Road and Ulan – Wollar Road will carry an estimated 645 – 810 vph which indicates a Level of Service B operation.
- Ulan Road north of Moolarben Coal Access Road will carry an estimated 389 vph and north of UMCL Underground Access Road an estimated 36 vph, which indicates a Level of Service A operation
- Cope Road is estimated to carry between 214 – 230 vph in both scenarios which indicates a Level of Service A operation.

Main Street west of Ulan Road is estimated to carry between 246 – 262 vph in both scenarios which indicates a Level of Service A operation in the peak hour (even allowing for its lower speed limit).

Similarly the three access roads to UCML are estimated to carry traffic volumes between 47 – 385 vph in both scenarios which indicates a Level of Service A operation on these roads.

TABLE 5.4

**PEAK HOUR FLOW ON TWO-LANE RURAL ROADS
(VEHICLES PER HOUR)
(DESIGN SPEED OF 100KM/HR)**

Terrain	Level of Service	Proportion of Heavy Vehicles			
		0%	5%	10%	15%
Level	A	<630	<590	<560	<530
	B	630	590	560	530
	C	1030	970	920	870
	D	1630	1550	1480	1410
	E	2630	2500	2390	2290

Source Table 4.5 RTA Guide to Traffic Generating Developments October 2002

5.2.5 Cumulative Traffic Impact on Intersections due to the Project

The additional traffic generated by the Project will have minor impacts on a number of intersections on the road network at or near Ulan. The impacts are assessed below.

The intersection assessment is based on AUSTROAD’s Graphs for Average Delay to Minor Stream Vehicles at Unsignalised Intersections as published in Guide to Traffic Engineering Practice – Part 5; Intersections at Grade. These graphs provide estimates of vehicle delay for minor movements (ie. subject to priority control). Minor movements are

those traffic movements that must give way to one or more major movements (which have priority) at intersections.

Figures 7 & 8 shows the projected 2013 cumulative traffic volumes on the road network near Ulan in the 6.00am – 7.00am Friday peak hour for the Project with Stage 1 of Moolarben – scenario 1 (**Figure 7**) and the Project, and with Stages 1 and 2 of Moolarben – scenario 2 (**Figure 8**). For the intersection assessments at Ulan the combined major movement traffic volumes in the 6.00am-7.00am peak hour in 2013 range between 400-730 vph, for scenario 1 (**Figure 7**) and 400-810 vph for scenario 2 (**Figure 8**). These traffic volumes are tidal and are travelling towards the three mines at/near Ulan from Mudgee and Gulgong. Opposing through volumes will be 17-30 vph. Minor movements at all the intersections which are subject to priority control will range between 3-200 vph for scenario 1 and 3-216 vph for scenario 2. The highest vehicle delay will be experienced by the left turn from Cope Road (Main Street) into Ulan Road. The left turn will be 200-216 vph and will be opposed by the northbound through movement in Ulan Road which will be in the order of 532-578 vph.

Minor movements at the intersection will typically accept gaps of between 4-6 seconds with follow up headways of between 2-4 seconds.

Table 5.4 shows average vehicle delay for gap acceptance and follow up headways of 4 seconds / 2 seconds, 5 seconds / 3 seconds and 6 seconds / 4 seconds respectively and where the minor traffic stream ranges between 50-300 vph and the major traffic stream between 500-900 vph, based on the Austroad graphs.

Reference to Table 5.4 shows that the average vehicle delays for the mine movements range between 1.5 seconds per vehicle up to 17.0 seconds per vehicle. These delays are satisfactory and are consistent with a Level of Service A operation if 14 seconds or less and Level of Service B operation if greater than 15 seconds.

TABLE 5.4

AVERAGE VEHICLE DELAY FOR MINOR TRAFFIC STREAMS AT INTERSECTIONS UNDER GIVE WAY / STOP OR PRIORITY CONTROL

Minor Traffic Stream (vph)	Major Traffic Stream (vph)	Average Vehicle Delay in Seconds (secs)		
		4 Sec Gap 2 sec Follow up Headway	5 sec Gap 3 sec Follow up Headway	6 sec Gap 4 sec Follow up Headway
50	500	1.5	2.4	4.0
50	900	3.0	5.5	9.5
100	600	1.9	3.5	5.8
200	600	2.5	4.5	9.0
300	700	3.2	6.0	17.0

Source: *Austrroads Guide to Traffic Engineering Practice – Part 5.*

Based on this, it is concluded that the intersections will continue to operate at a satisfactory level with low vehicle delays to the minor traffic movements that are subject to priority control.

Additional information concerning the cumulative impacts at each intersection with the Project, and Stages 1 and 2 of Moolarben is outlined below.

Ulan Road / Ulan Underground Access Road

The traffic volumes using this intersection will be the same with Stage 1 and 2 of Moolarben.

During the 6.00am – 7.00am peak hour, this intersection will accommodate the following additional traffic associated with the project:

- 235 vph turning left from the southern approach of Ulan Road into the Underground Access Road;
- 13 vph using the northern approach in Ulan Road including 8 vph turning right into the Access Road with 5 vph travelling south; and
- 8 vehicles exiting the site.

The intersection's channelisation includes auxiliary turning lanes in Ulan Road and no further improvements are required. Due to the relatively low traffic volumes using the intersection, the intersection will continue to operate at a good Level of Service (Level of Service A operation) with low vehicle delays.

Ulan Road / Moolarben Coal Mine Access Road

This intersection is located on Ulan Road approximately 1 kilometre north of Ulan-Wollar Road. The traffic volumes using this intersection will be the same with Stage 1 and 2 of the Moolarben.

During the 6.00am – 7.00 peak hour the intersection will accommodate 125 vehicles turning right into Moolarben Access Road from Ulan Road.

An additional 204 vph in the 6.00am – 7.00am peak hour will use this intersection including 235 vph north bound and 13 vph south bound, due to the Project.

This intersection's channelisation includes auxiliary lanes in Ulan Road (right and left turn bays) for turning traffic including a 'CHR' right turn bay treatment. No further improvements are considered required.

The cumulative impacts on this intersection for the additional traffic will be minor and the intersection will continue to operate at a good level of service with low vehicle delays for the minor movements which are subject to priority control.

Ulan Road / Ulan – Wollar Road

During the 6.00am – 7.00am peak hour this intersection will accommodate the following additional traffic;

- 125 north bound vehicles in Ulan Road generated by Stage 1 of Moolarben Mine;
- The turning traffic to Ulan – Wollar Road associated with Stage 2 of Moolarben which is estimated at 82 right turn vehicles; and
- The additional traffic from the Project which is 235 vph north bound in Ulan Road and 13 vph south bound.

This intersection's channelisation includes auxiliary lanes in Ulan Road (right and left turn bays) for turning traffic including a 'CHR' right turn bay treatment. No further improvements are considered required.

Due to the relatively low traffic volumes that will use this intersection, the intersection will continue to operate at a good level of service with low delays to the minor movements subject to priority control and the cumulative traffic impacts on the intersection will be minor.

Ulan Road / UCML Open Cut Access Road

During the 6.00am – 7.00am peak hour this intersection will accommodate;

- 125 and 82 (total of 207) north bound vehicles in Ulan Road associated with Stages 1 and 2 of Moolarben respectively; and
 - The additional traffic for the Project estimated as: 235 vph northbound in Ulan Road together with 138 vph turning left from Ulan Road into the Open Cut Access Road; and
 - 4 vph turning right into the Open Cut Access Road from Ulan Road and 9 vph southbound.

The intersections channelization includes auxiliary lanes in Ulan Road to cater for left and right turn vehicles into the Open Cut Access Road.

The additional traffic associated with the mines can be accommodated at the intersection, and traffic conditions will remain good with low vehicle delays for the minor movements subject to priority control. No further improvements are considered required at the intersection.

Ulan Road / Cope Road

This intersection will be used by the majority of traffic travelling from Mudgee and Gulgong to and from Ulan, Wilpinjong and Moolarben mines.

There will be an increase in turning traffic at the intersection during the day at shift start and finish times of the mines. This will include the right turn from Ulan Road into Cope Road and the corresponding left turn movement from Cope Road into Ulan Road to travel north.

During the 6.00am – 7.00am peak hour this intersection will accommodate the following additional traffic;

- 125 and 82 (total of 207) vehicles associated with Stages 1 and 2 of Moolarben respectively arriving from Gulgong via Cope Road and from Mudgee; and

- The additional traffic for the Project estimated as:
 - 266 vph northbound in Ulan Road together with 33 vph turning left into Cope Road (Main Street)
 - 3 vph turning right into Cope Road from Ulan Road and 6 vph southbound; and
 - 107 vph turning left from Cope Road into Ulan Road to travel north.

The intersections channelisation includes auxiliary lanes in Ulan Road for the right and left turn left movements into Cope Road.

Due to the increase in the number of right turn movements into Cope Road from Ulan Road associated with the mines, it is recommended that the existing 'AUR' auxiliary lane for the right turn be upgraded to a 'CHR' right turn bay treatment (see **Appendix 1**, for details of 'CHR' treatment). This will require line marking changes and possibly some pavement widening at the intersection. The proposed 'CHR' right turn bay treatment would reduce the potential for rear end accidents to occur at the intersection involving south bound through vehicles and right turn vehicles into Cope Road.

With or without the proposed improvement, delays for minor movements at the intersection subject to priority control will continue to be relatively low and the intersection will operate at a good Level of Service.

Cope Road / Main Street / McKay Street (Ulan Village)

This intersection will accommodate a proportion of the traffic associated with the Project, as well as traffic from the other mines that travels to and from Gulgong and the surrounding areas via Cope Road.

During the 6.00am – 7.00am peak hour this intersection will accommodate the following additional vehicles;

- 25 and 16 (total of 51) vehicles turning right at McKay Street into Main Street to travel towards Ulan Road associated with Stages 1 and 2 of Moolarben respectively;
- The additional traffic associated with the Project estimated as;
 - 101 vph turning right out of McKay Street to travel towards Ulan Road together with 12 vph turning left into Main Street to travel towards the UCML Construction Access Road
 - 34 vph from Ulan Road travelling towards UCML Construction Access Road as well as the 2 vph turning left into Cope Road; and
 - The small number of vehicles from Ulan Village travelling to the Project site via this intersection.

The intersection has a basic 'BAR' and 'BAL' layout with sign/priority control on McKay Street.

While there will be a noticeable increase in traffic at the intersection due to the mining projects, the traffic conditions at the intersection will remain satisfactory with low

vehicle delays for those movements subject to priority control. No further improvements are considered required at the intersection.

Intersections on the Wider Road Network

The Project will generate an additional 305 vph travelling between Mudgee and Ulan in the Friday 6.00am – 7.00am peak hour in 2013.

While these vehicle numbers will be noticeable, it is considered that the impacts of these additional vehicles on the existing intersections closer to Mudgee will be minor in terms of capacity.

The Traffic Impact Assessments for the Wilpinjong and Moolarben (Stages 1 and 2) Coal Mines examined the 3 intersections of;

- Ulan Road/ Short Street/Church Street which has Roundabout Channelisation
- Ulan Road/ Henry Lawson Drive which has 'CHR' and 'AUL' Channelisation in Ulan Road
- Ulan Road/Wollar Road which has 'BAR' and 'BAL' Basic Intersection Treatment.

The above assessments found that the traffic volumes along these intersections in the 6.00am – 7.00am period were relatively low and all the intersections would continue to operate at a Level of Service A operation, with low vehicle delays for the minor movements and spare capacity at the intersections with the Wilpinjong and Moolarben Coal Mines operating.

The additional traffic associated with the Project will not increase delays at these intersections to the extent that it would result in a substantial change to level of service at the intersections, which would result in an unsatisfactory operation in terms of capacity or delay to the minor vehicle movements.

Notwithstanding this, the additional traffic from Wilpinjong mine and Moolarben (Stages 1 and 2) and the Project is likely to reinforce the existing need to provide auxiliary lanes (at least for the right turn movement) in Ulan Road at the Wollar Road intersection, to ensure that road safety is not compromised at the intersection. The road authorities should consider upgrading this intersection in a future program.

In concluding it is considered that the additional traffic associated with the Project will not substantially change the Level of Service at the above intersections, or at any other intersections in Ulan Road between Mudgee and Ulan.

5.3 Road Safety

The SKM road safety audit recommended improvements to delineation and road edge formation and shoulder provision particularly the maintenance of pavement edges on roads such as Ulan Road and Cope Road to improve potential road safety along these routes. Transport and Urban Planning agrees that these measures should be implemented to improve potential road safety along the routes, as well as the other measures identified in the audit that are endorsed by the road authority. Transport and Urban Planning also recommends that Ulan Road/Cope Road intersection be upgraded to provide a 'CHR' treatment for the right turn from Ulan Road into Cope Road.

Speed and fatigue are common factors leading to road crashes in NSW. Campaigns and other measures to educate and change behaviour of drivers in relation to speed and fatigue may also be effective in improving potential road safety particularly on rural roads.

The safety of mine workers is a critical workplace issue for mine operators and their safety when travelling to and from their workplace would also be a concern for the mine operators. Information about fatigue including driver fatigue is an issue that could be addressed through educational and training strategies undertaken by UCML with its workforce, in association with other measures to manage fatigue at the workplace such as shift rostering and rest breaks during shifts etc.

Measures to address speeding is best undertaken on a community wide basis through educational programs conducted by the RTA (and local councils as applicable) and regular enforcement campaigns undertaken by the NSW Police.

5.4 Potential Interaction with and Impacts on School Bus Routes

The school bus routes generally operate on the road network between 7.30am – 9.00am and between 3.30pm and 5.00pm. The travel hours for the additional shifts for the Project for the most part will not substantially overlap with travel hours for the school buses.

There are 2 shifts one with 104 workers (91 vehicles) that will finish at 3.30pm Monday to Thursday with a corresponding travel time of 3.30pm to 4.30pm on the road network and one which finishes at 7.00am on Monday morning with 55 workers (48 vehicles) and corresponding travel time of 7.00am – 8.00am on the road network.

The impacts associated with these vehicles are assessed as relatively minor given the low volumes of traffic that use the road network in the area between 7.00am – 8.00am and 3.30pm and 4.30pm on school days. School buses are highly visible when using the road network and the UCML workforce would be familiar with the school bus routes and the hours the buses operate.

Alternative transport options such as the use of public transport for the workers at UCML are not available to the workforce, as a potential means to reduce car travel. It is anticipated that some car pooling currently occurs and this is expected to continue on an informal basis. Implementing a shuttle bus service is not considered to be practicable given:

- the range of shift hours; and
- some personnel work overtime.

5.5 Impact on Railway Level Crossings

UCML currently loads an average of 4 trains per day with approved limit of an average of 28 trains per week.

As part of the Project approval is being sought to load an average of 7 trains per day with a peak of up to 10 trains per day.

None of the existing or future UCML trains impact on the existing rail level crossings in Ulan at Cope Road or at the Open Cut Access Road.

The additional number of trains will impact on the 18 level crossings between UCML and Muswellbrook. Most of these level crossings are located at lightly trafficked rural roads, although some are used more than others.

The additional number of trains associated with the Project will be between 3 loaded trains (6 train movements) and 6 loaded trains (12 train movements) per day.

Adopting an average delay of 121 seconds (2 minutes) per train at the level crossings the proposed increase in trains would increase the delay at each of the 18 level crossings by;

- 12 minutes per day for 3 loaded trains (ie. 6 train movements)
- 24 minutes per day for 6 loaded trains (ie. 12 train movements)

The trains arrivals and departures would be spread over the day and the increase in delay in any given hour at the rail level crossings, which is around 2 minutes per train would be relatively small. While there is no standard for the maximum delay to traffic at a level crossing, delays of up to 180 seconds (3 minutes) are generally considered to be acceptable.

5.6 Construction Traffic Management Plan

Following approval UCML will prepare a Construction Traffic Management Plan to minimise potential impacts during the construction phase.

Construction access to the mine for heavy vehicles will be primarily from the existing Construction Access Road via Main Street in Ulan Village. Some heavy vehicles associated with construction may also utilise the other access roads.

The construction workforce is expected to use the following vehicle access roads to the mine:

- Construction Access Road – 20% of the workforce
- Open Cut Access Road – 60% of the workforce
- Underground Access Road – 20% of the workforce.

The principles of the Construction Traffic Management Plan would include

- The scheduling of heavy vehicle movements particularly any oversized loads, so as to minimise any disruption to local traffic and where possible, avoid school arrival and departure times.
- Separate traffic management plans for the movement of any over size vehicles with approvals as required; and
- Regular liaison with the local traffic authorities and the police during the construction phase.

6.0 RECOMMENDED CONTROL MEASURES

The recommended control measures for the Project are summarised below:

No further improvements are required at the following intersections:

- Ulan Road / Ulan Underground Mine and Administrative Access Road;
- Ulan Road / Moolarben Coal Mine Access Road;
- Ulan Road / Ulan – Wollar Road;
- Ulan Road / UCML Open Cut Access Road; and
- Cope Road / Main Street / McKay Street (Ulan Village)

Ulan Road / Cope Road

- The intersections channelisation includes auxiliary lanes in Ulan Road for the right and left turn left movements into Cope Road. Due to the increase in the number of right turn movements into Cope Road from Ulan Road associated with the three mines, it is recommended that the existing ‘AUR’ auxiliary lane for the right turn be upgraded to a ‘CHR’ right turn bay treatment.

Ulan and Cope Roads

Improve delineation and road edge formation and shoulder provision including shoulder maintenance as per the SKM road safety audit for the Moolarben Coal Project, as well as the other recommendations of the audit that are endorsed by the road authority. In addition the road authorities should consider the future upgrading of the Ulan / Wollar Road intersection to provide auxiliary lanes for turning vehicles (particularly the right turn) in Ulan Road.

7.0 CONCLUSIONS AND RECOMMENDATIONS

This report documents the assessment of the traffic and transport impacts of the proposed continued operations at UCML.

The assessment has examined the cumulative traffic impacts of the Project together with the approved Stage 1 and the proposed Stage 2 of Moolarben mine for the year 2013.

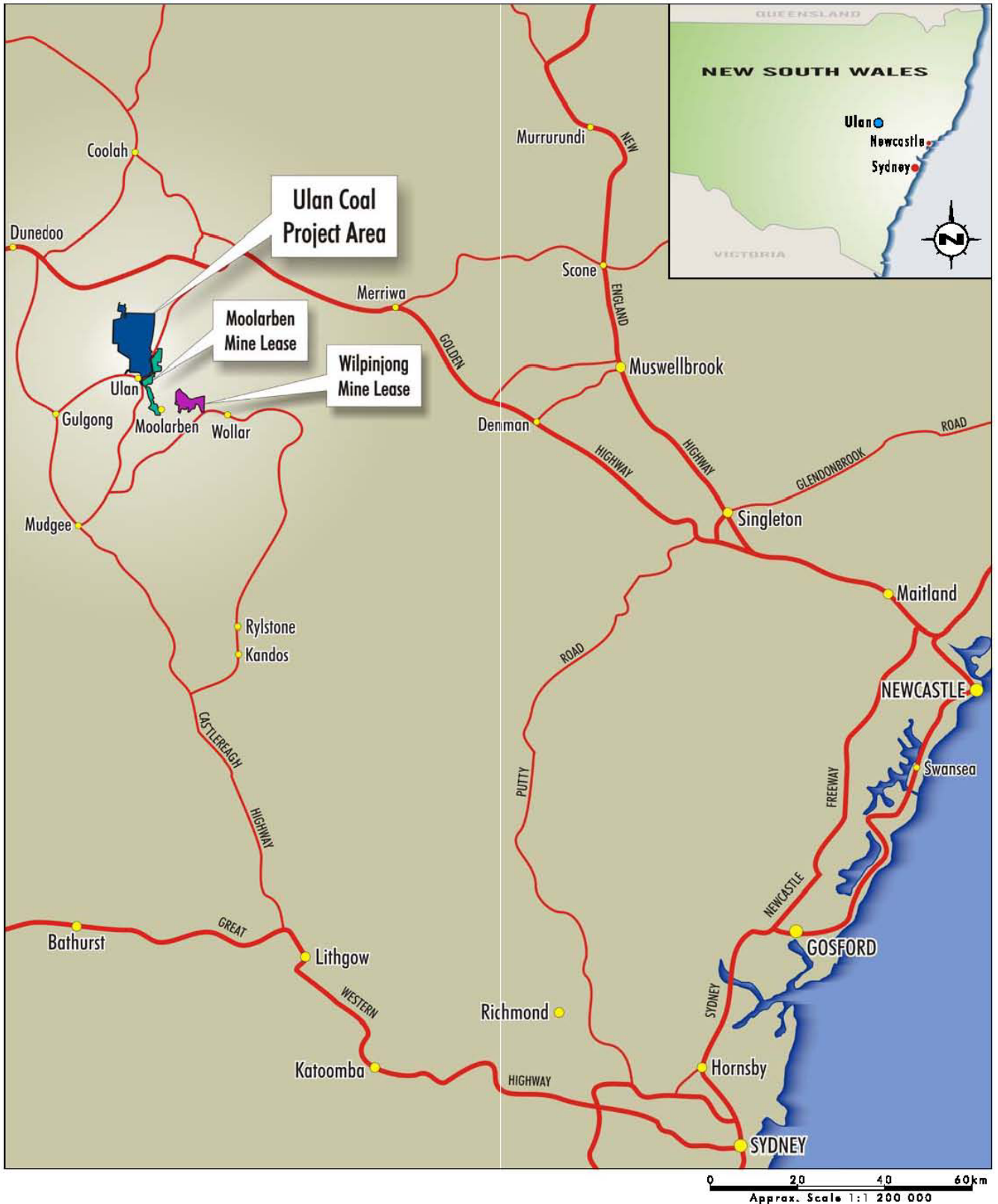
The assessment has found that while there will be a substantial increase in traffic volumes due to the Project and Moolarben Stage 1, as compared to the existing 2009 traffic volumes, traffic conditions are expected to remain satisfactory with relatively good conditions being maintained on the road network and at the principal intersections.

Transport and Urban Planning recommends that the existing 'AUR' right turn treatment at the Ulan Road/Cope Road intersection be upgraded to a 'CHR' treatment (ie. right turn bay) to reduce potential conflicts between southbound through traffic in Ulan Road and right turn traffic from Ulan Road into Cope Road. Transport and Urban Planning also supports the recommendations of the previous Moolarben Coal Project road safety audit for Ulan Road and Cope Road on the need to improve delineation and road edge formation and shoulder provision including shoulder maintenance along sections of these routes as well as the other measures identified in the audit. Consideration of improvements at the Ulan Road / Wollar Road intersection should also be considered in a future program.

A separate Construction Traffic Management Plan should be prepared by UCML following approval to minimise road and traffic impacts during construction.

REFERENCES

- AUSTRROADS (1987) - “Guide to Traffic Engineering Practice – Parts 1-15” (as appropriate)
- AUSTRROADS (2003) - “Rural Road Design Guide”
- Christopher Hallam & Associates Pty Ltd (April 2005) - “Review of Road Transport Implications of Current and Proposed Operation of Ulan Coal Mines”.
- J Wyndham Prince Pty Ltd (April 2007) - “Traffic Impact Assessment – Wilpinjong Coal Project – Operational Phase Access Route Modification”.
- Roads and Traffic Authority (1999) - “Road Design Guide”
- Roads and Traffic Authority (2002) - “Guide to Traffic Generating Developments Version 2.2 October 2002”.
- Sinclair Knight Merz (SKM) (2006) - “Traffic Impact, Road Safety and Railway Level Crossing Assessment”. Appendix 15 of the Moolarben Coal Project – Stage 1 Environmental Assessment Report.
- Sinclair Knight Merz (SKM) (Nov 2008) – Traffic Impact Assessment and Rail Traffic Impact Assessment (February 2009). Appendix 12 and 13 of the Moolarben Coal Project – Stage 2.
- Traffix (2005) - “Appendix K Wilpinjong Coal Project Road Transport Assessment”. Appendix K of Wilpinjong Coal Project Environmental Impact Statement.



TRANSPORT AND URBAN PLANNING
TRAFFIC, TRANSPORT & PROJECT
MANAGEMENT CONSULTANTS
 5/90 Toronto Parade, Sutherland NSW 2232
 Phone 02 9545 1411 Fax 02 9545 1556
tupa@tpgi.com.au www.transurbanplan.com.au

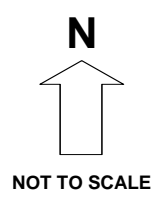
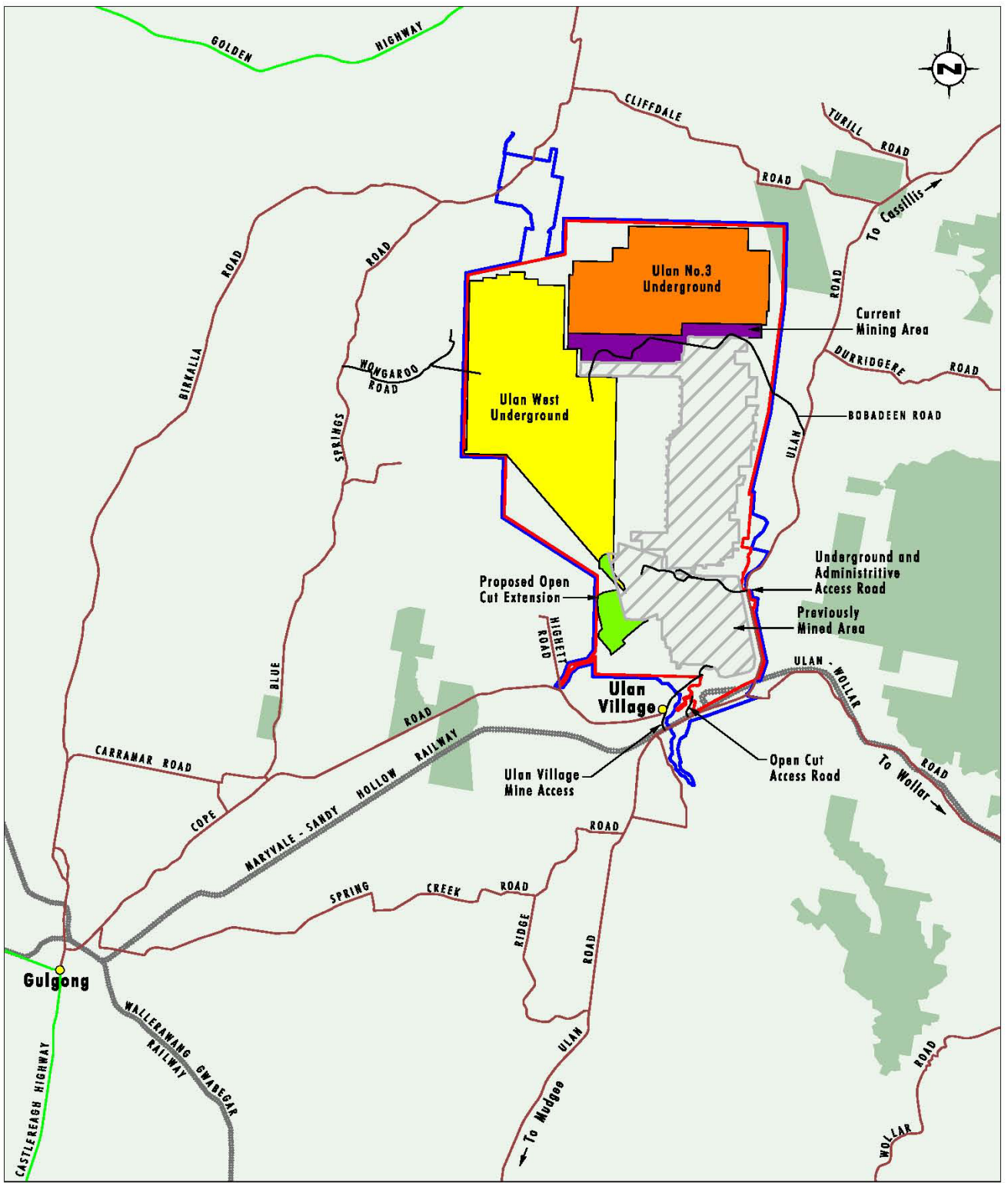


FIGURE 1
ULAN COAL - CONTINUED OPERATIONS
ULAN ROAD, ULAN
SITE LOCATION
 JOB NO. 28081



Source: Ulan Coal, Department of Lands (2006)

0 2.0 4.0 8 km
1:175 000

Legend

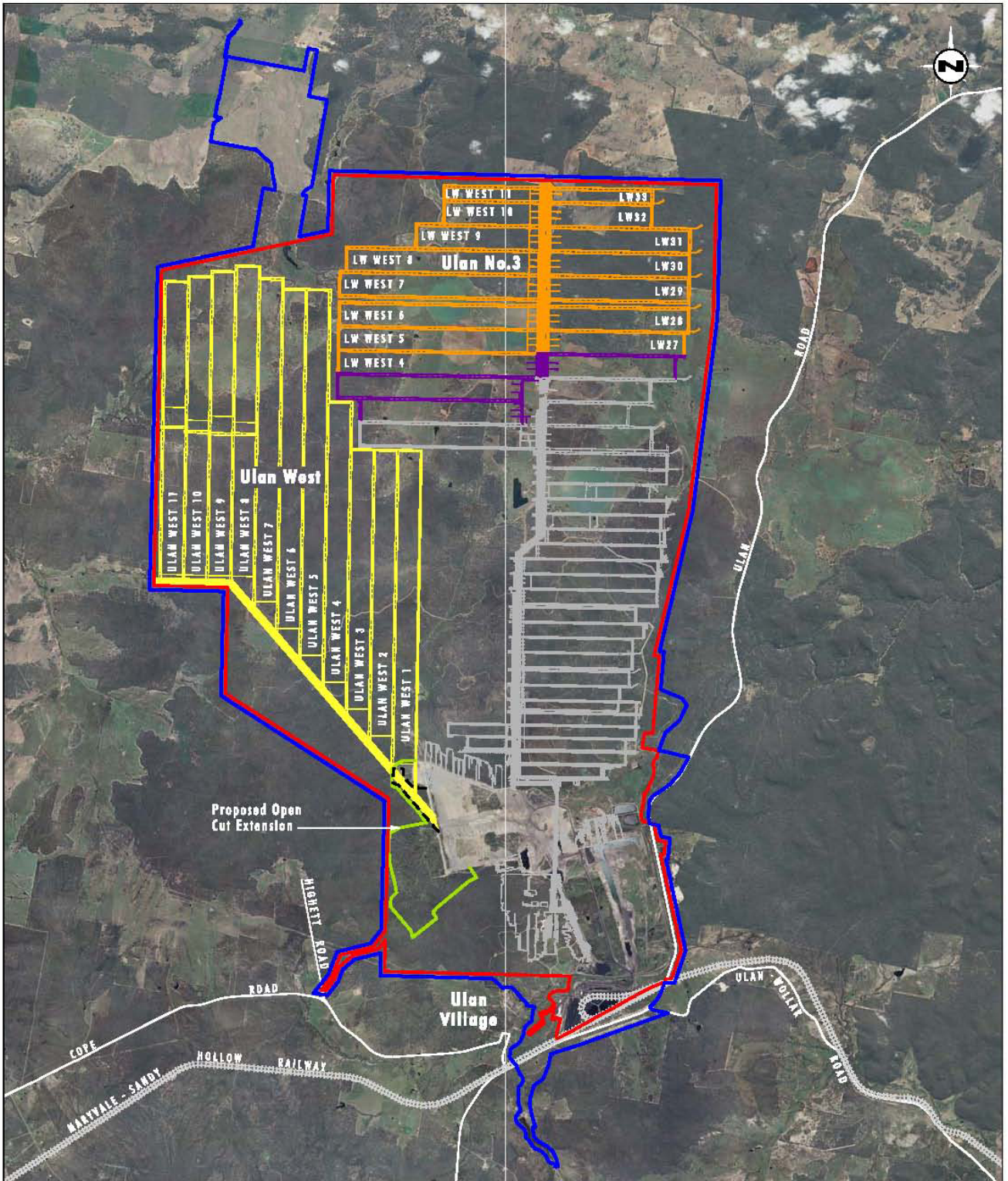
- | | |
|--------------------------------------|--------------------------------------|
| Colliery Holding Boundary | National Park and Conservation Areas |
| Project Boundary | Major Road |
| Proposed Open Cut Extension | Secondary Road |
| Proposed Ulan West Mine Plan | Site Access Road |
| Current Mining and SMP Approved Area | Railway Line |
| Previous Mine Operations | |
| Ulan No.3 Underground Mine Plan | |

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MANAGEMENT CONSULTANTS
 5/90 Toronto Parade, Sutherland NSW 2232
 Phone 02 9545 1411 Fax 02 9545 1556
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N

 NOT TO SCALE

FIGURE 2
ULAN COAL - CONTINUED OPERATIONS
ULAN ROAD, ULAN
EXISTING AND PROPOSED
MINING AREAS
 JOB NO. 28081



Source: Ulan Coal, Aerial Photo December 2007

0 1.0 2.5 5.0km
1:100 000

Legend

- Colliery Holding Boundary
- Project Boundary
- Proposed Open Cut Extension
- - - Proposed Ulan West Mine Plan
- - - Ulan No.3 Underground Mine Plan
- Previous Mining Operations
- Current Mining and SMP Approved Area
- - - Box Cut Option

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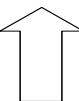
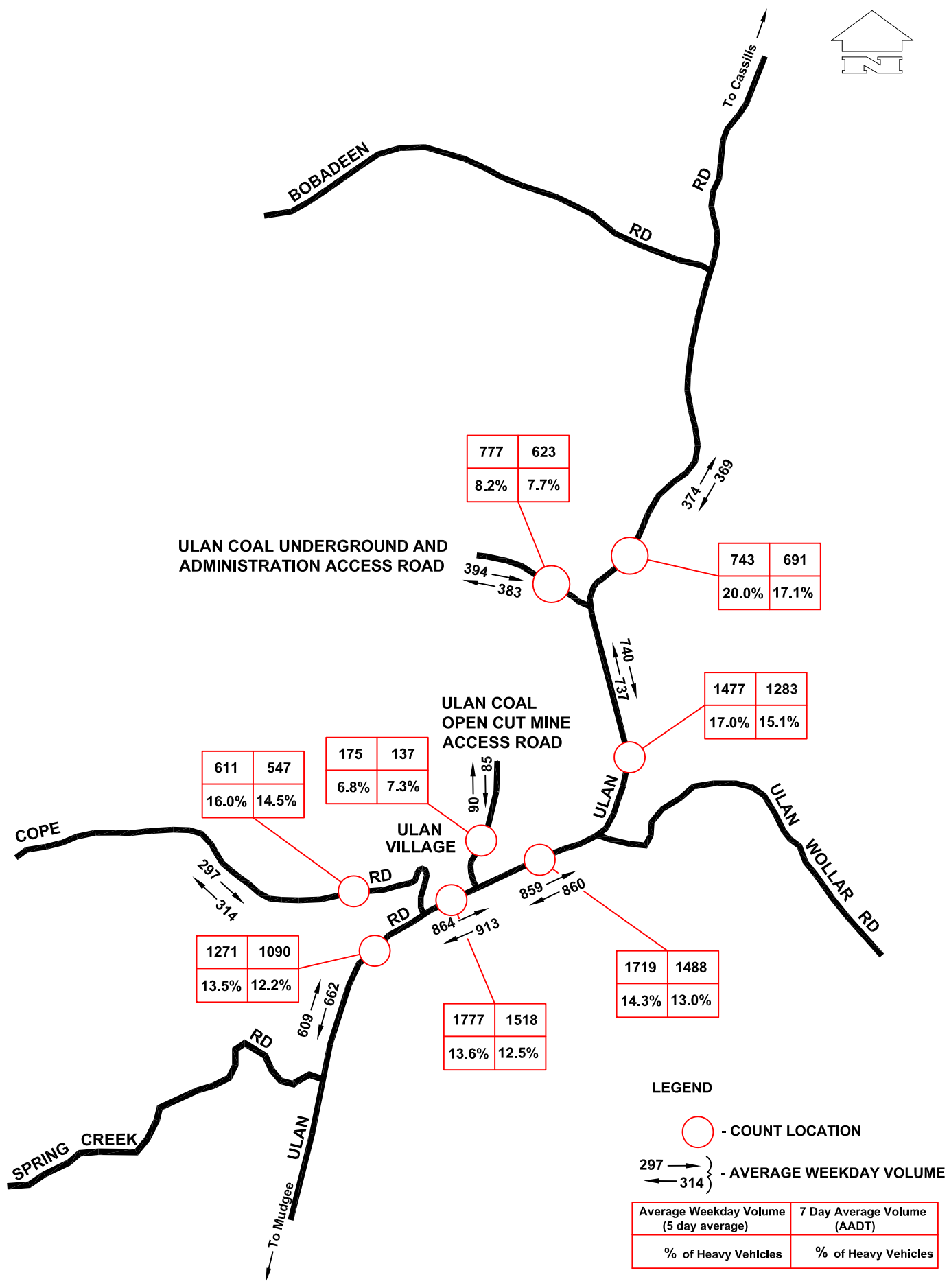
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FIGURE 3
ULAN COAL - CONTINUED OPERATIONS
ULAN ROAD, ULAN
MINE SITE LAYOUT
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FIGURE 4
 ULAN COAL - CONTINUED OPERATIONS
 ULAN ROAD, ULAN
AVERAGE DAILY TRAFFIC VOLUMES
 JOB NO.28081



ULAN COAL UNDERGROUND AND ADMINISTRATION ACCESS ROAD

+8
← +243

RD

+13
← +5
← +8

+235

ULAN COAL

MOOLARBEN COAL ACCESS ROAD

ULAN COAL OPEN CUT MINE ACCESS ROAD

CONSTRUCTION ACCESS ROAD

+1
← +6

MAIN ST

+142

ULAN

ULAN - WOLLAR RD

COPE RD

+113
← +2

+12
← +101

+47
← +2
← +34

+33
← +266

+107
← +3
← +6

+138
← +235

+4
← +9

+235
← +13

RD

ULAN
← +299
← +6

LEGEND

+7 - AM PEAK HOUR ADDITIONAL TRAFFIC VOLUME

+1
← +6 - AM PEAK HOUR ADDITIONAL TRAFFIC VOLUME FROM VILLAGE

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FIGURE 6
ULAN COAL - CONTINUED OPERATIONS
ULAN ROAD, ULAN
2013 AM PEAK HOUR 6.00AM - 7.00AM
ADDITIONAL TRAFFIC VOLUMES FOR
ULAN COAL PROJECT
JOB NO.28081



ULAN COAL UNDERGROUND AND
ADMINISTRATION ACCESS ROAD

19 →
← 366

RD
11 →
← 25

ULAN
COAL

MOOLARBEN COAL
ACCESS ROAD

125 →
← 0

369 →
← 30

ULAN COAL
OPEN CUT MINE
ACCESS ROAD

CONSTRUCTION
ACCESS ROAD

ULAN
494 →
← 30

COPE 204 →
RD
← 10

47 →
← 200
MAIN ST
46 →
← 702

178 →
← 3

536 →
RD
← 27

ULAN - WOLLAR RD
46 →
← 1

532 →
ULAN
← 17

LEGEND

532 - 2013 AM PEAK HOUR
TRAFFIC VOLUME

NOTE

AM PEAK HOUR 2013 CUMULATIVE TRAFFIC
VOLUMES INCLUDES BACKGROUND GROWTH
STAGE 1 MOOLARBEN PLUS ULAN COAL -
CONTINUED OPERATIONS

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5/90 Toronto Parade, Sutherland NSW 2232
Phone 02 9545 1411 Fax 02 9545 1556

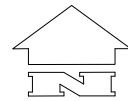
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FIGURE 7

ULAN COAL - CONTINUED OPERATIONS
ULAN ROAD, ULAN

2013 AM PEAK HOUR 6.00AM - 7.00AM
CUMULATIVE TRAFFIC VOLUMES FOR
ULAN PROJECT WITH STAGE 1 MOOLARBEN
JOB NO.28081



ULAN COAL UNDERGROUND AND ADMINISTRATION ACCESS ROAD

19 →
← 366

RD
11 →
← 25

ULAN COAL

MOOLARBEN COAL ACCESS ROAD

125 →
← 0

ULAN COAL OPEN CUT MINE ACCESS ROAD

CONSTRUCTION ACCESS ROAD

ULAN
494 →
← 30

COPE RD
220 →
← 10

MAIN ST
47 →
← 216

178 →
← 3

RD
618 →
← 27

ULAN - WOLLAR RD
128 →
← 1

ULAN
598 →
← 17

LEGEND

598 - 2013 AM PEAK HOUR TRAFFIC VOLUMES

NOTE

AM PEAK HOUR 2013 CUMULATIVE TRAFFIC VOLUMES INCLUDES BACKGROUND GROWTH STAGES 1 & 2 MOOLARBEN PLUS ULAN COAL - CONTINUED OPERATIONS

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 5/90 Toronto Parade, Sutherland NSW 2232
 Phone 02 9545 1411 Fax 02 9545 1556
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FIGURE 8
 ULAN COAL - CONTINUED OPERATIONS
 ULAN ROAD, ULAN
 2013 AM PEAK HOUR 6.00AM - 7.00AM
 CUMULATIVE TRAFFIC VOLUMES FOR ULAN PROJECT WITH STAGES 1 & 2 MOOLARBEN
 JOB NO.28081

APPENDIX 1

ROADS AND TRAFFIC AUTHORITY RURAL INTERSECTION TYPES AND WARRANT FOR RURAL TURN LANES

4.5.4 Output

The output of this process of considering the layout options for the site will be a number of intersection layouts, and forms of control, that are clearly *inappropriate*. The remaining options and forms of control are then carried forward into the evaluation process. This process is detailed in **Section 4.6**.

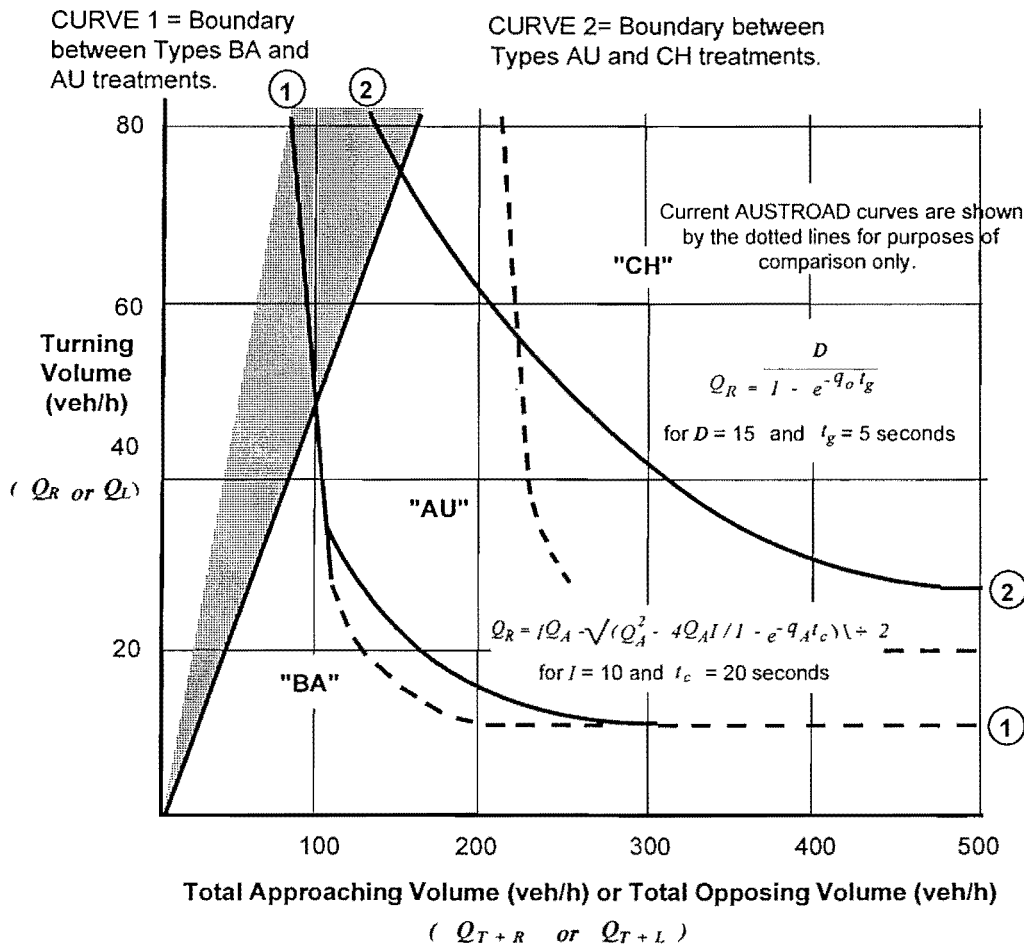
In the absence of any other information, **Table 4.5.3** can assist in identifying layout options, and forms of control, which are not suited to a site.

At RURAL sites McKerral, Leong & Dominis (ref 11) considered the probability of interference to a through vehicle by a turning vehicle slowing down, or stopping in front. This is shown in **Figure 4.5.12** below.

Curve 1 shows the relationship where 10 vehicles are required to slow each hour ($I=10$) and the conflict time (t_c) is 20 seconds. In the formula, Q_A is the total approach volume (veh/hr), Q_R (or Q_L) the turning volume (ie. Q_A) (veh/hr), and q_A the total approach volume given as veh/sec.

Curve 2 shows where 15 veh/h must stand waiting for a gap (t_g) of 5 secs. Here q_0 is the volume of opposing traffic in veh/sec., and t_g is the gap necessary to turn (assumed as 5 secs).

It must be stressed that **Figure 4.5.12** is only a guide and the final choice should take into account strategic aspects such as planning for more consistency in driver expectations along key routes.

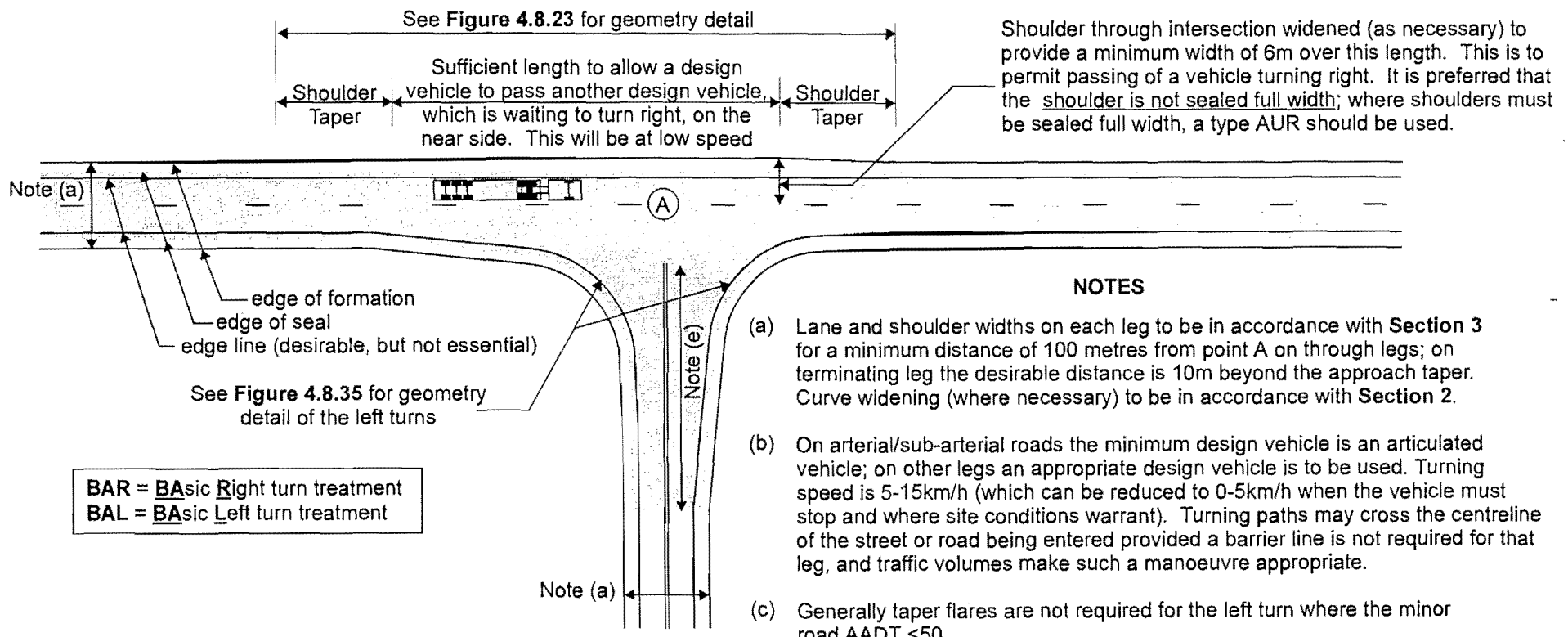


NOTES:

1. Where peak hour volumes are not available, assume the design peak hour volume equals 15% of the AADT. for 500 hours each year; use 5% of AADT for the rest of the year. See Section 1.4. for further details.
 2. Use graph "AU" to select need for an auxiliary lane. Use "CH" to determine if a sheltered right turn is required. On high speed roads with substantial volumes of heavy vehicles, the use of Type "AU" and "CH" is preferred for safety reasons.
 3. Use of Types "AU" and "CH" is preferred on high speed and/or heavy vehicle routes to enhance safety.
- In this region more than 50% of the approaching traffic turns. Hence consideration needs to be given to possible realignment of the intersection to suit the major traffic movement.

Figure 4.5.12 - Warrants for Rural Turn Lanes

This layout does not rely on pavement markings and can be used on an unsealed wearing surface.
 This layout suits sites where the amount of turning traffic is small.



NOTES

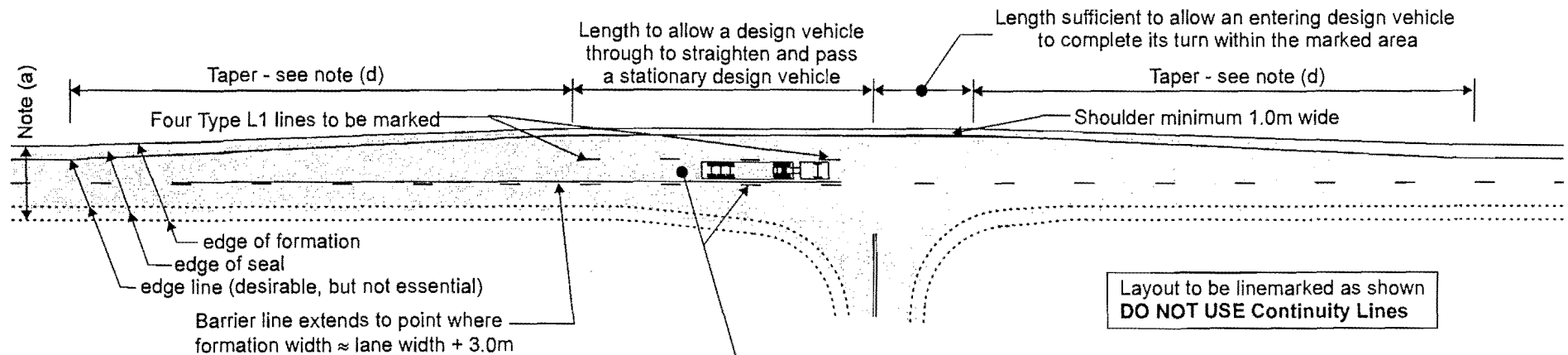
- (a) Lane and shoulder widths on each leg to be in accordance with Section 3 for a minimum distance of 100 metres from point A on through legs; on terminating leg the desirable distance is 10m beyond the approach taper. Curve widening (where necessary) to be in accordance with Section 2.
- (b) On arterial/sub-arterial roads the minimum design vehicle is an articulated vehicle; on other legs an appropriate design vehicle is to be used. Turning speed is 5-15km/h (which can be reduced to 0-5km/h when the vehicle must stop and where site conditions warrant). Turning paths may cross the centreline of the street or road being entered provided a barrier line is not required for that leg, and traffic volumes make such a manoeuvre appropriate.
- (c) Generally taper flares are not required for the left turn where the minor road AADT <50.
- (d) Sight distance to be appropriate for the 85th percentile free speed of each approach movement. Furniture (especially signs) and planting are not to interfere with sight distance requirements.
- (e) Where through road is sealed and side road is not, the side road is to be sealed to the end of the turn as a minimum and, preferably, to the start of the tapers.
- (f) All non-frangible furniture to be located outside clear zone or be protected. Locate drainage headwalls and raised letter box type grates outside the clear zone of the through road.

BAR = Basic Right turn treatment
BAL = Basic Left turn treatment

Section 4.8 provides details of geometry whilst "Signs and Markings" gives the location of signs and details of pavement marking.

Figure 4.5.2 - Type BAR and BAL Layout Combined to show a Basic Rural Intersection Treatment on both a Through and a Terminating Leg

This layout is particularly suited to rural areas where high speed, low volume traffic occurs, yet the volume of turning traffic is sufficient to make a conflict likely.



Turn arrows are only necessary if site specific problems are anticipated; barrier lines are required for opposing direction if arrows are used

AUR = AUxiliary lane **R**ight turn treatment
AUL = AUxiliary lane **L**eft turn treatment

This layout is designed to store one design vehicle and allow another design vehicle to pass. Where longer storage is necessary a channelised layout is preferred. Where an auxiliary right turn lane is required on the terminating leg, the "AUL" layout can be used.

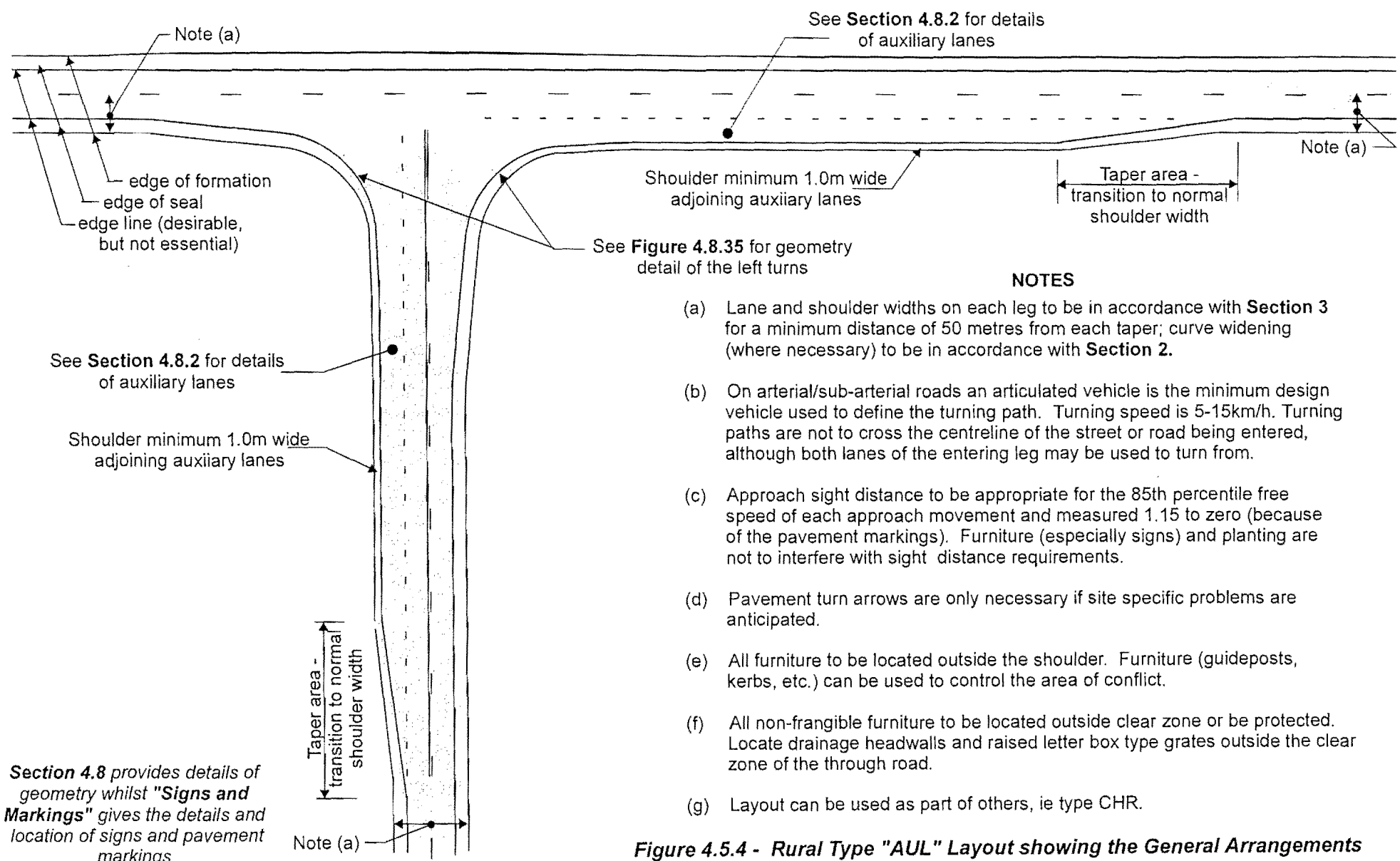
Section 4.8 provides details of geometry whilst **"Signs and Markings"** gives the details and location of signs and pavement marking. Advanced warning signs, alerting drivers to the presence of the intersection, may be required.

Layout to be linemarked as shown
DO NOT USE Continuity Lines

NOTES

- (a) Lane and shoulder widths on each leg to be in accordance with **Section 3** for a minimum distance of 50 metres from each taper; curve widening (where necessary) to be in accordance with **Section 2**.
- (b) On arterial/sub-arterial roads an articulated vehicle is the minimum design vehicle used to define the turning path. Turning speed is 5-15km/h. Turning paths may cross the centreline of the street or road being entered provided a barrier line is not required for that leg, and traffic volumes make such a manoeuvre appropriate.
- (c) Approach sight distance to be appropriate for the 85th percentile free speed of each approach movement and measured 1.15 to zero (because of the pavement markings). Furniture (especially signs) and planting are not to interfere with sight distance requirements.
- (d) Taper length determined on basis that some reduction in speed occurs.
- (e) All furniture to be located outside the shoulder. Furniture (guideposts, kerbs, etc. can be used to control the area of conflict.
- (f) All non-frangible furniture to be located outside clear zone or be protected. Locate drainage headwalls and raised letter box type grates outside the clear zone of the through road

Figure 4.5.3 - Rural Type "AUR" Layout



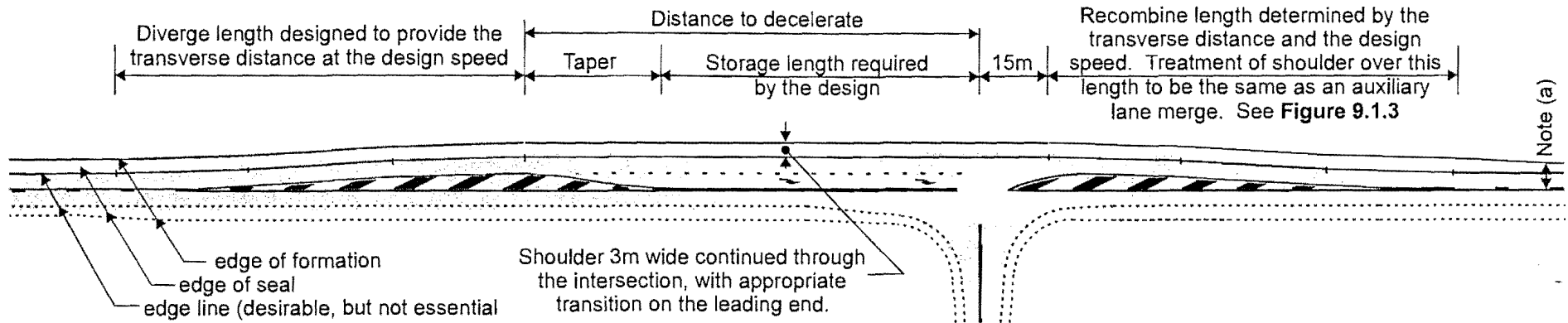
NOTES

- (a) Lane and shoulder widths on each leg to be in accordance with **Section 3** for a minimum distance of 50 metres from each taper; curve widening (where necessary) to be in accordance with **Section 2**.
- (b) On arterial/sub-arterial roads an articulated vehicle is the minimum design vehicle used to define the turning path. Turning speed is 5-15km/h. Turning paths are not to cross the centreline of the street or road being entered, although both lanes of the entering leg may be used to turn from.
- (c) Approach sight distance to be appropriate for the 85th percentile free speed of each approach movement and measured 1.15 to zero (because of the pavement markings). Furniture (especially signs) and planting are not to interfere with sight distance requirements.
- (d) Pavement turn arrows are only necessary if site specific problems are anticipated.
- (e) All furniture to be located outside the shoulder. Furniture (guideposts, kerbs, etc.) can be used to control the area of conflict.
- (f) All non-frangible furniture to be located outside clear zone or be protected. Locate drainage headwalls and raised letter box type grates outside the clear zone of the through road.
- (g) Layout can be used as part of others, ie type CHR.

Figure 4.5.4 - Rural Type "AUL" Layout showing the General Arrangements for both a Through and a Terminating Leg.

Section 4.8 provides details of geometry whilst "Signs and Markings" gives the details and location of signs and pavement markings

This form of layout has particular application at complex sites with heavy, turning movements, and accident black spots which could be assisted by separation of movements.



NOTES

- Lane and shoulder widths on each leg to be in accordance with **Section 3** for a minimum distance of 100 metres from the start of each median; curve widening (where necessary) to be in accordance with **Section 2**.
- The longest expected vehicle to be used to define the turning path. Turning speed is 5-15km/h (which can be reduced to 0-5km/h where site conditions warrant). Turning paths are NOT to cross the centreline of the street or road being entered.
- Approach sight distance to be appropriate for the 85th percentile free speed of each approach movement and measured 1.15m to zero (because of the pavement markings). Furniture (especially signs) and planting are not to interfere with sight distance requirements.
- On a curved alignment the diverge and recombine lengths are still to have geometry appropriate to the design speed. A system of offsets (as shown in **Figure 4.8.25**) may be used to determine initial geometry.
- All non-frangible furniture to be located outside the clear zone or protected. Locate drainage headwalls and raised letter box type grates outside the clear zone of the through road.

Section 4.8 provides details of geometry whilst "**Signs and Markings**" gives the details and location of signs and pavement marking. Advanced warning signs, alerting drivers to the presence of the intersection, may be required.

Figure 4.5.6 - Type "CHR" Rural T Intersection Layout General Details