# WILPINJONG COAL PROJECT

## APPENDIX K

## Road Transport Assessment


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# WILPINJONG COAL PROJECT
# ROAD TRANSPORT ASSESSMENT

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# TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES



## LIST OF ATTACHMENTS

# K1 INTRODUCTION

The Wilpinjong Coal Project (the Project) is located approximately 40 kilometres (km) north-east of Mudgee in New South Wales (NSW) (Figures K-1 and K-2). The Wilpinjong coal resource is located in the Ulan-Bylong area in the northern sector of the Western Coalfield. The Project is located in the Mid-Western Regional local government area (Figure K-3). The Mid-Western Regional local government area was proclaimed by the NSW government in May 2004 and comprises the whole of the former Mudgee Shire, as well as part of the former Rylstone and Merriwa Shires.

Construction activities would be undertaken during Year 1 of the Project. The majority of construction activities would be completed in the first 6 months of Year 1. An on-site temporary construction camp would accommodate up to 100 people during the construction phase. The mining operation would involve the extraction of coal using open cut mining methods over the 21 year life of the Project with an annual production of up to 13 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal. The Project would operate 24 hours per day, 7 days per week.

Product coal would be conveyed to a train load-out bin above the Project rail loop located within the Mining Lease Application (MLA 1) area for loading on to trains and transporting by rail to either the Bayswater/Liddell rail unloader or the Port of Newcastle. This would involve an average of four 8,500 tonne train movements per day.

The potential road transport impacts associated with the Project therefore relate principally to the movement of employees and consumables/deliveries during the operational life of the mine, together with the movement of construction workers and building supplies during the construction phase.

TRAFFIX has been commissioned by Wilpinjong Coal Pty Limited (WCPL) to undertake a road transport assessment of the Project. This report presents an assessment of road transport related issues for the Project in accordance with the general requirements of the NSW Roads and Traffic Authority (RTA) *Guide to Traffic Generating Developments* (RTA, 2002).

The report is structured as follows:

Section K1: Introduction

Section K2: Existing Traffic Conditions

Section K3: Description of the Development

Section K4: Traffic Generation During Mine Construction

Section K5: Traffic Generation During Mine Operations

Section K6: Other Traffic Implications of the Project

Section K7: Recommended Traffic Management Measures

Section K8: Conclusions

## K1.1 REGIONAL LOCATION AND PROJECT SITE

The Project is located in the Ulan-Bylong area approximately 40 km to the north-east of the township of Mudgee, approximately 20 km to the east of the township of Ulan, and is to the west of the township of Wollar in the Hunter Region of New South Wales. The township of Bylong lies about 15 km to the east of the Project site.

A regional location and Project site plan are provided on Figures K-1 and K-2 respectively.


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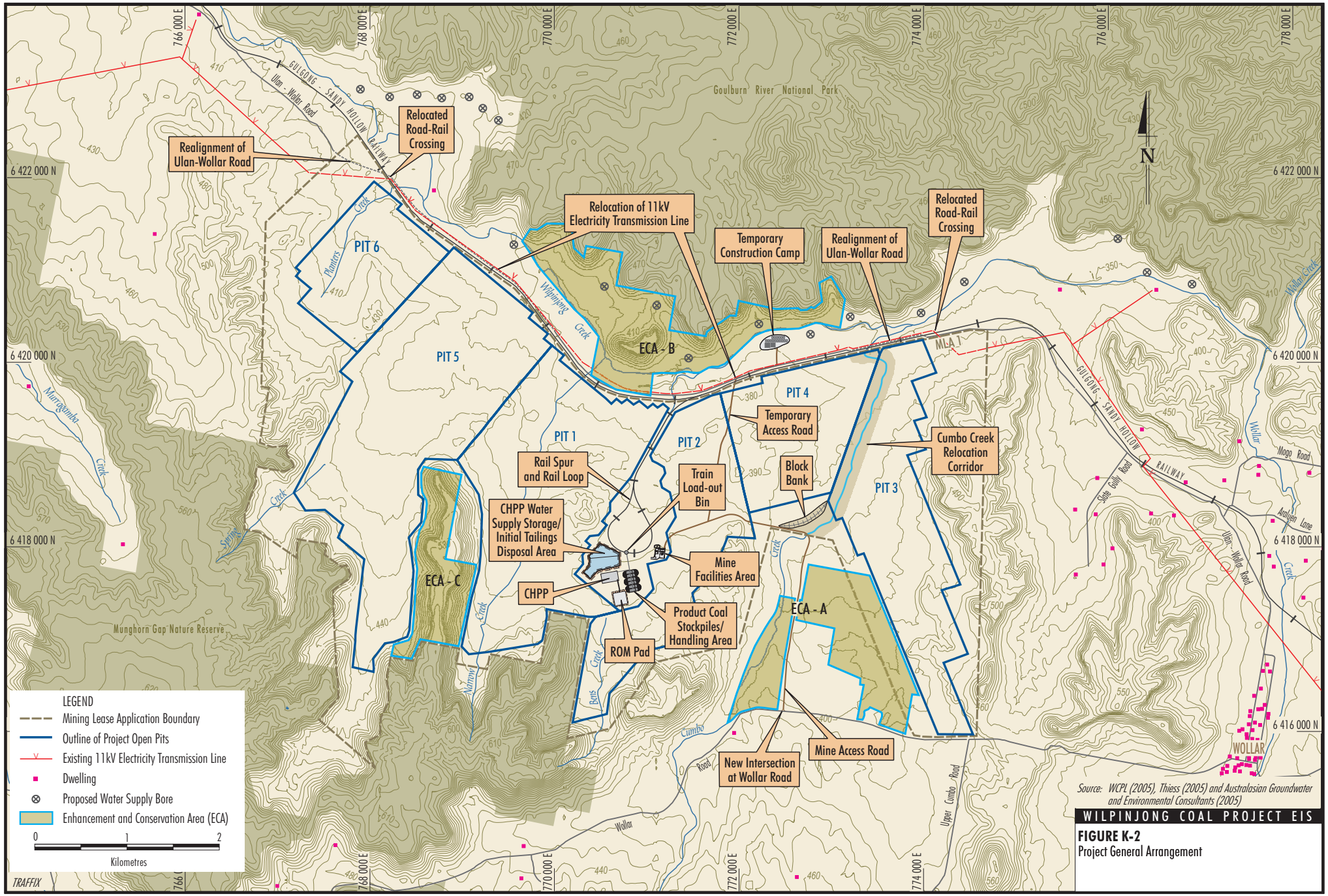


*Source: WCPL (2005), Thiess (2005) and Australasian Groundwater and Environmental Consultants (2005)*

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**FIGURE K-2**
Project General Arrangement

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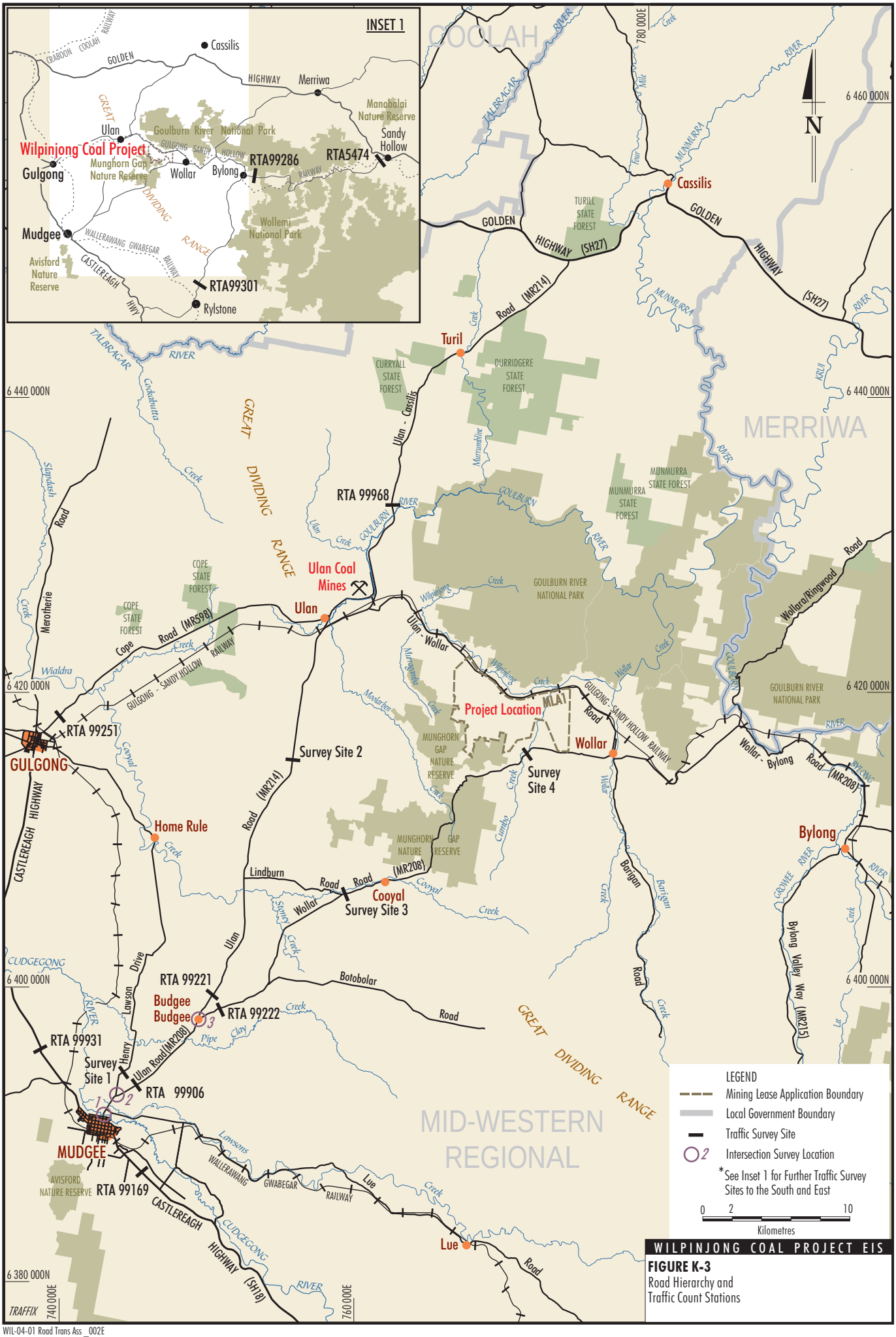


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# K2 EXISTING TRAFFIC CONDITIONS

## K2.1 ROAD HIERARCHY

The region is serviced principally by the Castlereagh Highway (State Highway No. 18) which traverses generally on a north-south alignment and extends from Lithgow in the south to the Golden Highway (State Highway No. 27) to the north (Figure K-1). The Castlereagh Highway passes through Mudgee to the south-west and through the township of Gulgong to the west of the Project site (Figures K-1 and K-3).

The Golden Highway (State Highway No. 27) is located to the north of the Goulburn River National Park and traverses generally on an east-west alignment and extends west from Singleton through Denman, Sandy Hollow and Merriwa (Figures K-1 and K-3).

The State Highways are under the management and control of the NSW RTA.

The Project site is also serviced by Main Road 208 which extends from the Castlereagh Highway at Mudgee to the Golden Highway at Sandy Hollow and forms the south-eastern boundary of the Project (Figures K-1 and K-2). Main Road 208 is titled Henry Lawson Drive, Ulan Road, Wollar Road and Wollar-Bylong Road respectively when travelling from Mudgee to Bylong (Figure K-3).

To the east of the Project site at Bylong, Main Road 208 is intersected by Main Road 215 (Bylong Valley Way/Bylong Road) which extends to the south, connecting to the Castlereagh Highway south of Rylstone (Figure K-1).

In addition, Main Road 214 (Ulan Road/Ulan-Cassilis Road) traverses generally on a north-south alignment and extends between Main Road 208 (Wollar Road) at Budgee Budgee and the Golden Highway to the west of the township of Cassilis (Figures K-1 and K-3). This route passes through the township of Ulan to the west of the Project site.

The main roads described above are regional roads, which are under the care and control of the various local councils (e.g. Mid-Western Regional Council), with funding assistance provided by the RTA.

In a more local context, the Project site is also serviced by local routes which provide alternative access to communities in the locality. In particular, the Ulan-Wollar Road traverses the southern side of Wilpinjong Creek and extends from Wollar via the Project site to Ulan (Figure K-3). This route becomes Main Road 598 (Cope Road) to the west of Ulan, which extends to the township of Gulgong and traverses the northern side of the Gulgong-Sandy Hollow Railway Line. The Ulan-Wollar Road intersects the Wollar Road (Main Road 208) in the township of Wollar to the east of the Project.

East of Wollar, access to Rylstone is available via Main Road 215. A local (unsealed) route is also available between Wollar Road (Main Road 208) and the township of Merriwa and the Golden Highway to the north-east of the Project site (Figure K-3).

The road system in the vicinity of the Project site is shown on Figures K-1 and K-3. It is proposed that access to the Project site during operations would be via a new Mine Access Road from Wollar Road (Main Road 208) (Figure K-2). The majority of traffic movements during operation of the Project would occur between the Project site and Mudgee via Wollar Road (Main Road 208) which would provide a sealed road access route via the classified main road system as outlined above. A photographic record is presented in Attachment K-A which details this route, extending between Wilpinjong Road (at chainage 0.0 km) immediately to the south of the Project and Short Street at Mudgee (at chainage 43.5 km).

## K2.2 ROAD CONDITIONS

The existing conditions of roads of relevance to the Project are summarised below.

***Main Road 208 (Wollar Road) - Budgee Budgee to Wollar***

Wollar Road (Main Road 208) between Budgee Budgee and Wollar (Figure K-3) is a two lane rural road which has a bitumen seal of variable width ranging from 6.0 metres (m) to 7.5 m, with unsealed road shoulders of average width about 2.0 m. There are two sections (totalling approximately 2.3 km) which are less than 6.0 m in width. Wollar Road is constructed on a generally level grade with some sections in rolling terrain and with extensive overtaking opportunities.

***Main Road 208 (Wollar to Sandy Hollow)***

Main Road 208 between Wollar and Sandy Hollow (Figure K-1) is a two lane rural road which has a bitumen seal of variable width ranging from 6.0 to 7.5 m, with unsealed road shoulders of average width about 2.0 m. This route is constructed on rolling terrain with sections of winding road alignment east of Bylong. Some short sections of this road are also unsealed in the vicinity of Bylong and these are progressively being sealed by Council.

***Main Road 208/Main Road 214 (Henry Lawson Drive, Ulan Road, Ulan-Cassilis Road)***

Henry Lawson Drive (south of MR 208 at Budgee Budgee), Ulan Road and Ulan-Cassilis Road (Main Road 208/214) north of Mudgee (Figure K-3) are constructed as two lane rural roads which have a bitumen seal of variable width ranging from 7.0 m to 7.5 m, with unsealed road shoulders of width ranging from 2.0 m to 3.0 m. They are constructed on a generally level grade with extensive overtaking opportunities.

***Main Road 598 (Cope Road) - East of Gulgong***

Cope Road east of Gulgong (Main Road 598) (Figure K-3) is a two lane rural road which has a bitumen seal of variable width ranging from 6.0 m to 7.5 m, with unsealed road shoulders of average width 2.0 m. It is constructed on a generally level grade with some sections within rolling terrain and with extensive overtaking opportunities.

***Main Road 215 (Bylong Valley Way/Bylong Road) – South of Bylong***

Bylong Valley Way/Bylong Road (Main Road 215) links Bylong and Rylstone (Figures K-1 and K-3) and is a two lane rural road which has a bitumen seal of variable width ranging from 6.0 m to 7.5 m over the majority of its length, with unsealed road shoulders of average width 2.0 m. It is constructed on a generally level grade with some sections within rolling terrain and with extensive overtaking opportunities. Some short sections of this road are unsealed in the vicinity of Bylong and these are progressively being sealed by Council.

***Wollara/Ringwood Road***

Wollara/Ringwood Road is an unsealed local rural road which provides access between Wollar Road and the Golden Highway near Merriwa (Figures K-1 and K-3). It is constructed with a carriageway width that varies between 5.0 m and 6.0 m and is in satisfactory condition, with a generally level grade.

### *Ulan-Wollar Road*

The Ulan-Wollar Road is a local rural road which is unsealed for the majority of its length and provides direct access between Ulan and Wollar, via the northern part of the Project site. The road is sealed on the approaches to Ulan and Wollar and it is constructed with a carriageway width that is generally 6.0 m wide with additional shoulders and is in good condition, within generally gently rolling terrain.

## K2.3 REVIEW OF TRAFFIC VOLUMES

A review of available traffic flow data on the various access routes has been undertaken to establish a base case against which the potential traffic impacts associated with the Project may be assessed. Automatic classification counts were undertaken at four survey sites to provide a more detailed understanding of conditions on key roads of interest. These were undertaken over a one week period between Friday 6 August and Thursday 12 August 2004 and included volumes and vehicle classifications (vehicle type) by direction over this period, at each location (Attachment K-B). The available traffic counts from the Project surveys and RTA data are summarised in Table K-1, and relevant survey locations are shown on Figure K-3.

**Table K-1**
**Annual Average Daily Traffic Flows[1]**

| Road | Station Number | Road Name/Location | Year | | | |
|---|---|---|---|---|---|---|
| | | | Other | 2001 | 2002 | 2004 |
| Main Road 208 | RTA 05474 | West of Golden Highway | 290 (1992) | - | - | - |
| | RTA 99286 | East of Bylong | 141 (1999) | - | - | - |
| | Survey Site 4 | Wollar Road – West of Wollar (near Wilpinjong Road) | - | - | - | 166 |
| | Survey Site 3 | Wollar Road - West of Cooyal | - | - | - | 352 |
| | RTA 99222 | Wollar Road - East of Ulan Road | - | 743 | 613 | - |
| | RTA 99906 | Ulan Road - North of Mudgee | 2,969 (1999) | - | 3,482 | - |
| Main Road 214 | RTA 92268 | Ulan-Cassilis Road - North of Ulan | - | 597 | - | - |
| | Survey Site 2 | Ulan Road - South of Ulan | - | - | - | 790 |
| | RTA 99221 | Ulan Road - North of Wollar Road/Budgee Budgee | 1,490 (1999) | - | 1,321 | - |
| Main Road 598 | RTA 99510 | Cope Road - East of Gulgong Centre | 1,119 (1999) | - | - | - |
| Henry Lawson Drive | Survey Site 1 | North of Main Road 208 | - | - | - | 953 |
| Main Road 215 | RTA 99301 | Bylong Road - North of Rylstone | 359 (1999) | - | - | - |

Source: Traffic Volumes & Supplementary Data, RTA and Project Traffic Counts 2004
Note 1: Average Annual Daily Traffic (AADT) is two way traffic (flow in both directions) - 7 day count

***Existing Levels of Service***

Based on the publication entitled *Guide to Traffic Engineering Practice: Roadway Capacity* (Austroads, 1988), the existing traffic flows shown in Table K-1 relate to Level Of Service (LOS) A for the majority of roads in the vicinity of the Project. This is a condition of free flow in which drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired travel speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent. The only exception is Ulan Road (Main Road 208/214) north of Mudgee which provides a LOS B which is in the zone of stable flow and drivers still have reasonable freedom to select their desired travel speed and to manoeuvre within the traffic stream, although the general level of comfort and convenience is a little less than with LOS A.

## K2.4 PEAK PERIOD INTERSECTION OPERATION

In addition to potential route impacts, the need for traffic improvements at intersections needs to be assessed. To determine baseline conditions, turning movement counts were undertaken during the morning and afternoon peak periods at key intersections along the main access route (Main Road 208) connecting to Mudgee at the following locations:

- the intersection of Short Street with Henry Lawson Drive (Main Road 208) at Mudgee;
- the intersection of Henry Lawson Drive with Ulan Road (Main Road 208) north of Mudgee; and
- the intersection of Wollar Road (Main Road 208) with Ulan Road (Main Road 208/214).

The existing intersection volumes are shown in Figure K-4 for the periods of 6.00 am-7.00 am and 6.00 pm-7.00 pm which would relate to the timeframe where most worker arrivals and departures would occur and are discussed further below. The results of these surveys were analysed using the INTANAL computer program to determine intersection performance characteristics under these existing traffic conditions. The INTANAL model produces a range of outputs, the most useful of which are the Degree of Saturation (DOS) and Average Vehicle Delay (AVD). The AVD is in turn related to LOS criteria. These performance measures can be interpreted using the following explanations:

- **DOS** - the DOS is a measure of the operational performance of individual intersections. As both queue length and delay increase rapidly as DOS approaches 1, it is usual to attempt to keep DOS to less than 0.9. When DOS exceeds 0.9 residual queues can be anticipated, as occurs at many major intersections throughout metropolitan areas during peak periods. For intersections controlled by roundabout or give way/stop control, satisfactory intersection operation is generally indicated by a DOS of 0.8 or less.
- **AVD** - the AVD for individual intersections provides a measure of the operational performance of an intersection. In general, levels of acceptability of AVD for individual intersections depend on the time of day (motorists generally accept higher delays during peak commuter periods) and the road system being modelled (motorists are more likely to accept longer delays on side streets than on the main road system).
- **LOS** - this is a comparative measure which provides an indication of the operating performance of an intersection as shown in Table K-2.

**Table K-2**
**Level of Service Criteria**

| Level of Service | Average Vehicle Delay (secs/veh) | Traffic Signals, Roundabout | Give Way and Stop Signs |
|---|---|---|---|
| A | less than 14 | Good operation. | Good operation. |
| B | 15 to 28 | Good with acceptable delays and spare capacity. | Acceptable delays and spare capacity. |
| C | 29 to 42 | Satisfactory. | Satisfactory but accident study required. |
| D | 43 to 56 | Operating near capacity. | Near capacity and accident study required. |
| E | 57 to 70 | At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode. | At capacity and requires other control mode. |
| F | More than 70 | Unsatisfactory and requires additional capacity. | Unsatisfactory and requires other control mode or major treatment. |

The results of the modelling, based on existing flows and intersection geometries, are shown in Table K-3.

**Table K-3**
**Existing Intersection Performances - Peak Hours**

| Intersection | | Control | Peak Period | Degree of Saturation | Average Vehicle Delay | Level of Service |
|---|---|---|---|---|---|---|
| No | Description | | | | | |
| 1 | Short Street/Henry Lawson Street | Roundabout | AM | 0.11 | 6.3 | A |
| | | | PM | 0.09 | 6.3 | A |
| 2 | Henry Lawson/Ulan Road | Seagull[1] | AM | 0.03 | 6.5 | A |
| | | | PM | 0.03 | 6.5 | A |
| 3 | Ulan Road/Wollar Road | Priority[2] | AM | 0.03 | 5.6 | A |
| | | | PM | 0.02 | 5.3 | A |

Note 1: This incorporates a median storage lane in Ulan Road to allow right turns from Henry Lawson Drive to take place in two separate 'stages'.

Note 2: Priority control refers to an intersection under 'stop' or 'give way' control or is otherwise uncontrolled with a 'T' junction rule applying.

It can be seen from Table K-3 that these intersections all operate satisfactorily, with LOS A and with minimal delays.

In accordance with the *Road Design Guide* (RTA, 1996), with the current peak hour traffic flows, the intersection of Wollar Road (Main Road 208) with Ulan Road (Main Road 208/214) presently requires a Basic (Type BAR) right turn from Ulan Road into Wollar Road as defined in the Guide, with an unsealed passing lane (Attachment K-C). This is not provided with the current intersection geometry.

## K2.5 TRAFFIC SAFETY

A review of accident data has been undertaken for roads of interest within the former Mudgee Shire Council LGA for the period 1998 to 2003 inclusive. This review has focussed on the roads that would carry the majority of Project traffic flows and the results are provided in Table K-4 below.

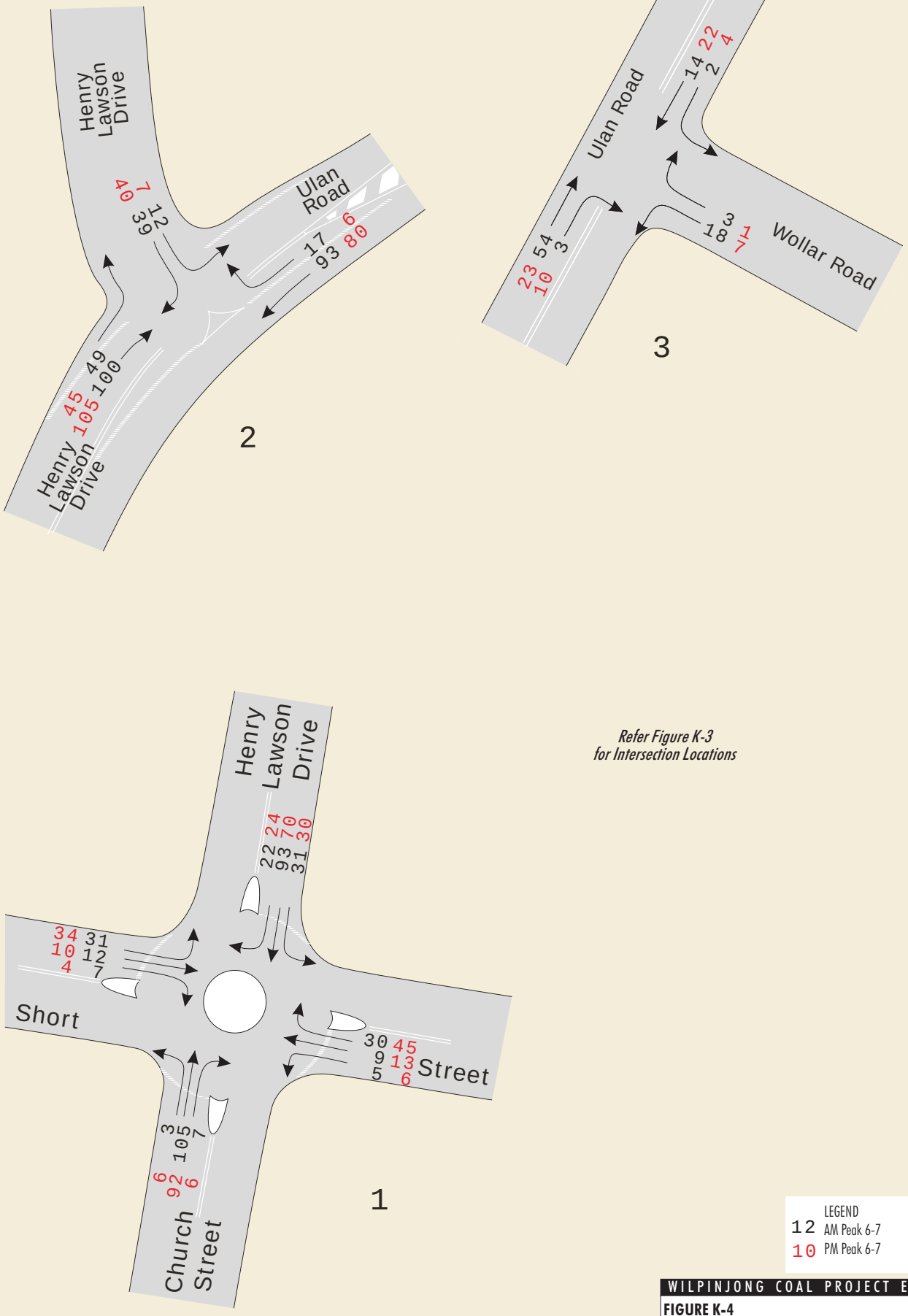


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**FIGURE K-4**
Existing Peak Period Intersection Volumes

TRAFFIX

**Table K-4**
**Summary of RTA Accident Data**

| Road | Year Recorded | | | | | | | | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1998 | | | 1999 | | | 2000 | | | 2001 | | | 2002 | | | 2003 | | | |
| | I | T | F | I | T | F | I | T | F | I | T | F | I | T | F | I | T | F | |
| MR 208 Ulan Road (Mudgee to Budgee Budgee) | 2 | 5 | - | 1 | 2 | - | 2 | 2 | - | 5 | 1 | - | 4 | 3 | - | - | 2 | - | 29 |
| MR 214 Ulan Road (Budgee Budgee to Ulan) | 3 | 4 | - | 1 | 1 | - | 2 | 3 | - | 1 | 4 | 1 | 3 | - | 1 | 1 | 4 | 1 | 30 |
| MR 214 Ulan - Cassilis Road (North of Ulan) | 1 | - | - | 1 | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - | 4 |
| MR 208 Wollar Road (Budgee Budgee to Wollar) | - | 1 | - | 2 | - | 1 | 1 | 4 | - | 1 | - | - | - | 3 | 1 | 1 | - | - | 15 |
| Ulan-Wollar Road | - | - | - | 1 | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| MR 598 Cope Road (east of Gulgong) | - | 1 | - | - | - | - | 1 | 1 | - | - | 1 | - | 4 | - | - | 2 | - | - | 10 |

I = Injury, T = Tow Away, F = Fatality
Source: RTA, 2004

The accident data in Table K-4 does not indicate any safety issues associated with the local road network that are of particular relevance to the Project. As would be expected, crash rates are higher for Ulan Road (MR 208/214) which carries higher traffic volumes (Table K-1).

## K2.6 CUMULATIVE TRAFFIC POTENTIAL

As shown on Figure K-1, the Ulan Coal Mines are located approximately 11 km to the north-west of the Project, near the village of Ulan. The Ulan Coal Mines form part of the existing traffic baseline for the Project, as the traffic counts undertaken for the Project and RTA traffic counts (Section K2.3) include traffic movements associated with this existing development.

However, the Ulan Coal Mines operate under a number of consents. A 2 Mtpa underground mining operation comprising Underground Mine No. 4, a new Coal Handling and Preparation Plant (CHPP), rail loop and train loading facility was approved in October 1985 as part of Stage 2 of the Ulan Coal Mines. The Underground Mine No. 4 and associated surface facilities that comprised part of Ulan Stage 2 were not developed at that time.

The peak construction workforce associated with Ulan Stage 2 was predicted to be up to 100 people (Kinhill Stearns, 1983). The peak operational workforce associated with the undeveloped component of Ulan Stage 2 was not separately stated in the Ulan Stage 2 EIS (Kinhill Stearns, 1983), however, from the information that is provided, it is estimated that the peak operational workforce of the undeveloped component would be approximately 250 people. Consequently, on the basis of the traffic generation assumptions provided in the Ulan Stage 2 EIS, if the undeveloped components of Ulan Stage 2 were to be developed, additional mine related traffic (approximately 150 movements at peak operations) would be generated on the local road network, with approximately 100 of these movements occurring between Ulan and Mudgee.

In addition, while the Ulan Coal Mines is currently operating with a workforce of approximately 300 people (Martin and Associates, 2005), the *Mining Lease Application No. 80 Development Application and Environmental Impact Statement* (Kinhill, 1998) indicates that employment at the Ulan Coal Mines could be up to 410 people in the period 2008 to 2014. Consequently, on the basis of the traffic generation assumptions provided in Kinhill (1998), if the Ulan Coal Mines were to increase the mine workforce up to this level, then related traffic flows would also increase by up to 150 vehicle movements (with approximately 100 of these occurring between Ulan and Mudgee).

While there is uncertainty associated with future traffic flows associated with the approved and undeveloped components of the Ulan Coal Mines, some traffic flow increases could occur during the life of the Project. In order to accommodate this possibility in the assessment, potential cumulative impacts are considered in Section K6.7.

## K3 DESCRIPTION OF THE DEVELOPMENT

The proposed development involves the construction and operation of the Project to accommodate the extraction of up to 13 Mtpa of ROM coal over a 21 year Project life. The main activities associated with development of the Project would include:

- development and operation of an open cut mine within the MLA 1 area to produce coal for domestic electricity generation and export markets;
- selective highwall mining of the Ulan Seam within the MLA 1 area;
- a Coal Handling and Preparation Plant (CHPP) and mine facilities area;
- water management infrastructure including the relocation of Cumbo Creek;
- water supply bores and associated pump and pipeline system;
- placement of mine waste rock (i.e. overburden, interburden/partings and coarse rejects) predominantly within mined-out voids;
- placement of tailings within a combination of out-of-pit and in-pit tailings storages;
- development and rehabilitation of final mine landforms and establishment of woodland vegetation in areas adjacent to the Project;
- a mine access road, temporary construction camp access road, internal access roads and haul roads;
- closure of Wilpinjong Road and Bungulla Road;
- realignment of two sections of Ulan-Wollar Road (including the relocation of two road-rail crossings);
- relocation of the existing 11 kilovolt electricity transmission line;
- an on-site temporary construction camp to accommodate up to 100 people during the construction phase;
- a rail spur and rail loop;
- coal handling and train loading infrastructure;
- transportation of product coal to market via train; and
- Enhancement and Conservation Areas.

Construction would be undertaken during Year 1 of the Project. The majority of construction activities would be completed in the first 6 months of Year 1. An on-site temporary construction camp would accommodate up to 100 people during the construction phase.

The mining operation would involve the extraction of coal using open cut mining methods. Haul trucks would be used to transport ROM coal to the ROM pad and dump hopper located adjacent to the CHPP for washing and loading onto trains. These haul truck movements are 'internalised' and would not result in any traffic impacts external to the Project site.

The potential road transport impacts associated with the proposed development therefore relate to the construction phase (associated with the movement of workers, equipment and supplies/deliveries) and the operations phase (associated with the movement of staff and visitors, deliveries and consumables).

The potential road transport impacts arising from the development have therefore been assessed separately for the construction and operational phases in the following sections.

# K4 TRAFFIC GENERATION DURING MINE CONSTRUCTION

## K4.1 OVERVIEW

The construction phase of the mine would involve an average construction workforce of 200 people, however, short term peaks in construction may require up to 250 people. The following assesses the potential traffic impacts of the maximum workforce of 250, in order to be conservative.

Ninety percent of the construction workforce (i.e. maximum of 225) would be expected to be present on-site on any given day, taking into account staff absentee rates associated with sick leave, rostered leave and off-site activities.

A temporary construction camp at the site would accommodate up to 100 workers, the majority of whom would be present for extended periods and would not commute to the Project site on a daily basis. It is expected that approximately 70% of these workers on average would arrive on a Monday morning and depart on a Friday afternoon. Accordingly, the highest overall traffic flows would be expected on Mondays and Fridays. These construction workers would access the camp at a temporary site access that would be located near the construction camp on Ulan-Wollar Road. This access would therefore need to accommodate the predicted 70 arrivals prior to 7am on a Monday and 70 departures after 6.00 pm on a Friday and would also be used for general daily worker traffic to and from the camp (expected to be lower due to significant car pooling and/or use of shuttle buses to and from the camp).

A maximum of 125 other workers would commute from the local towns and rural areas and these workers would commute on a daily basis. It is expected that many of the contractors would make separate arrangements to pool vehicles or shuttle workers each day in vans or mini-buses. Accordingly, it has been assumed that an average vehicle occupancy of 1.4 workers per vehicle would be attained. This reduction has not been applied to the workers who reside at the temporary construction camp and are expected to primarily commute to the camp on a Monday morning and depart on a Friday afternoon independently of other workers, with less opportunity for car-pooling.

Accordingly, it is expected that the profile of daily worker traffic generation during peak construction activities would be as follows:

*Monday*

- 70 camp worker arrivals in 70 cars prior to 7.00 am;
- 125 other worker arrivals in 89 cars prior to 7.00 am; and
- 125 other worker departures in 89 cars after 6.00 pm.

*Friday*

- 125 other worker arrivals in 89 cars prior to 7.00 am;
- 125 other worker departures in 89 cars after 6.00 pm; and
- 70 camp worker departures in 70 cars after 6.00 pm.

The construction workers would be drawn from within the local area and the wider region. They would use all available routes and the following distributions are considered appropriate for assessment purposes:

- 40% to/from the north via the Ulan-Wollar Road (Main Road 214) to access the Golden Highway (State Highway No. 27), where this traffic would be split into traffic travelling east to Merriwa, Muswellbrook and Singleton and traffic travelling west to Dunedoo and Dubbo;

- 20% to/from the east via Wollar Road (Main Road 208) with half of these (10%) travelling via Sandy Hollow, one quarter (5%) travelling north to Merriwa and one quarter (5%) travelling south to Rylstone;
- 30% to/from Mudgee via Main Road 208 (Wollar Road); and
- 10% to/from the west via the Ulan-Wollar Road and Main Road 598 to Gulgong.

In addition to these movements, some 40 vehicle movements per day have been assumed to be generated by visitors (20 in, 20 out) and these are expected to be predominantly to/from Mudgee.

Finally, it is estimated that a total of 24 heavy vehicle and small truck movements per day would be generated during the construction phase (12 in, 12 out). These relate to the following components:

- B Double Fuel deliveries 2 movements per week.
- Machine parts deliveries 50 movements per week.
- Explosives deliveries 2 movements per week.
- Small trucks visitors/sales 6 movements per day.
- Other small truck deliveries 10 movements per day.

It is expected that 60% of all consumables/deliveries would be from Mudgee, 10% from Gulgong and 30% from Bylong or further east.

The above traffic would potentially affect route capacities (based on daily traffic volumes) as well as intersection performances (based on peak period conditions). These are assessed separately below.

## K4.2 POTENTIAL IMPACTS ON DAILY TRAFFIC VOLUMES

The peak daily traffic volumes that would be generated by the construction operations may be summarised as follows:

*Mondays and Fridays*

- 248 light vehicle (worker) movements;
- 40 light vehicle (visitor) movements; and
- 24 heavy vehicle/small truck movements (representing approximately 8.0% of the total volume).

*312 Total Movements*

These traffic movements have been distributed on to the road network on the basis of the distributions discussed above. On the basis that Mondays and Fridays together represent traffic conditions that would prevail almost 30% of the time, the higher volume increase associated with 312 daily movements has been adopted for assessment. The potential impact of this traffic on existing routes is discussed below and shown in Tables K-5 and K-6. Table K-6 provides a summary of the traffic generation on routes to the east and west of the Project during construction.

**Table K-5**
**Project Traffic Distribution – Construction Phase**

| Type Traffic | MR 208 (Wollar Road) to West of Site (to Mudgee) | MR 208 to East of Site | | | Ulan-Wollar Road to West of Site | |
|---|---|---|---|---|---|---|
| | | To Golden Highway (E) | To Wollara/ Ringwood Road (N) | To Rylstone (S) | To Gulgong (W) | To Ulan Cassilis Road (N/E) |
| Construction Light Vehicles (workers and visitors) | **115** | **49** | | | **124** | |
| | | 25 | 12 | 12 | 25 | 99 |
| Construction Small Truck/Heavy Vehicle | **14** | **8** | | | **2** | |
| | | 8 | - | - | 2 | - |

Based upon these distributions, Table K-6 illustrates how the traffic generation associated with construction would affect existing traffic volumes.

**Table K-6**
**Potential Impact of Project Construction Phase on Existing Traffic Flows**

| Road | Station Number | Road Name Location | Current Traffic Volume | Project Workforce/ Visitors | Project Deliveries/ Trucks | Project Total Increase | New Traffic Volume with Project | % Change |
|---|---|---|---|---|---|---|---|---|
| Main Road 208 | 5474 | West of Golden Highway | 300 | 25 | 8 | 33 | **333** | 11.0 |
| | 99286 | East of Bylong | 141 | 25 | 8 | 33 | **174** | 23.4 |
| | Survey Site 4 | Wollar Road – West of Wollar (near Wilpinjong Road) | 166 | 115 | 14 | 129 | **295** | 77.7 |
| | Survey Site 3 | Wollar Road - West of Cooyal | 352 | 115 | 14 | 129 | **481** | 36.6 |
| | 99222 | Wollar Road - East of Ulan Road | 613 | 115 | 14 | 129 | **742** | 21.0 |
| | 99906 | Ulan Road - North of Mudgee | 3,482 | 115 | 14 | 129 | **3,611** | 3.7 |
| Main Road 214 | 92268 | Ulan-Cassilis Road - North of Ulan | 597 | 99 | - | 99 | **696** | 16.6 |
| | Survey Site 2 | Ulan Road South of Ulan | 790 | - | - | - | **790** | 0.0 |
| | 99221 | Ulan Road - North of Wollar Road/ Budgee Budgee | 1,321 | - | - | - | **1,321** | 0.0 |
| Main Road 598 | 99510 | Cope Road - East of Gulgong Centre | 1,119 | 25 | 2 | 27 | **1,146** | 2.4 |
| Henry Lawson Drive | Survey Site 1 | North of Main Road 208 | 953 | - | - | - | **953** | 0.0 |
| Main Road 215 | 99301 | Bylong Road - North of Rylstone | 359 | 12 | - | 12 | **371** | 3.3 |
| Wollara/ Ringwood Road | - | North of Wollar Road | 100 | 12 | - | 12 | **112** | 12.0 |
| Ulan-Wollar Road | - | East of Main Road 214 | 175 | 124 | 2 | 126 | **301** | 72.0 |

* Based on most recent traffic counts and estimates (Section K2).

***Main Road 208 (Wollar Road/Wollar-Bylong Road)***

*East of Bylong/West of the Golden Highway*

Table K-6 indicates that Main Road 208 to the east of the proposed Project site access carries moderate volumes of 141 vehicles movements per day (vpd) to the east of Bylong. This increases at its eastern end (west of the Golden Highway – RTA Station 05474) which carried an average annual daily traffic (AADT) of 290 vpd in 1992 (Table K-1). Since that time, traffic conditions are not expected to have altered significantly and for assessment purposes, it has been assumed that about 300 vpd would be appropriate for adoption as the current volume at this station for assessment purposes (Table K-6).

In this regard, the construction activity would generate a maximum additional 33 vpd along Wollar Road east of Bylong on Mondays and Fridays with 8 small truck/heavy vehicle movements expected. This would result in a daily flow of 174 vpd east of Bylong and 333 vpd west of the Golden Highway (Table K-6). These increases are low and would have no material impact on traffic conditions along this route. Hence, no upgrading of Main Road 208 would be required to the east of the proposed Project site access during the construction phase.

*West of Wollar/West of Cooyal*

Wollar Road to the west of the Project site access carried a daily flow of 352 vpd at Cooyal and 166 vpd near the mine access road (Survey Sites 3 and 4 – 2004 – Figure K-3). The construction activity would result in a maximum additional 129 vpd, including 14 small truck/heavy vehicle movements. Hence, traffic volumes would increase to 481 vpd (or 37%) west of Cooyal and to 295 (or 78%) at the mine access road west of Wollar (Table K-6). The resultant volumes relate to LOS A based on the *Guide to Traffic Engineering Practice Part 2: Roadway Capacity* (Austroads, 1988a) and this is therefore satisfactory.

As stated in Section K2.2, Wollar Road has a seal of variable width ranging from 6.0 m to 7.5 m, with unsealed road shoulders of average width 2.0 m. Accordingly, Wollar Road is capable of accommodating the additional construction traffic without any significant improvements, subject to a more detailed road conditions audit to identify the need for any localised works. For example, it is noted that there is a total length of approximately 2.3 km between the proposed site access and Ulan Road that has a carriageway width of between 5.5 and 6.0 metres and improvement of these sections is recommended.

*East of Ulan Road*

This section of Wollar Road carries more traffic (613 vehicles in 2002 – Table K1), due to traffic inputs from Botobolar Road (including traffic to and from local wineries). The construction activity would result in a maximum additional 129 vpd on this section, including 14 small truck/heavy vehicle movements. Hence, traffic volumes would increase from 613 vpd to 742 vpd or 21% (Table K-6). These flows relate to a LOS A based on Austroads (as referenced above). This section of road is in good condition with edge line marking and a minimum pavement width of 6.5 m and would therefore not require any significant upgrading in support of the Project construction traffic movements.

***Main Road 208 (Ulan Road South of Main Road 214)***

This road presently carries a daily traffic volume of about 3,482 vpd on the outskirts of Mudgee (at RTA Station 99906 – 2002 data). The construction activity would result in a maximum additional 129 vehicle movements per day, including 14 small truck/heavy vehicle movements. Hence, traffic volumes would increase from 3,482 vpd to 3,611 vpd or 4% (Table K-6).

In this regard, Ulan Road is constructed as a two lane sealed rural road south of Main Road 214, with generally 3.5 to 3.75 m wide lanes and 2.0 to 3.0 m wide unsealed shoulders. The *Rural Road Design – Guide to Geometric Design of Rural Roads* (Austroads, 1993) requires 3.5 m wide lanes and 2.5 to 3.0 m unsealed shoulders for volumes over 1,000 vpd and the existing road is therefore adequate for the increased traffic, subject to a more detailed road conditions audit to identify the need for any localised improvements. In addition, the existing LOS B currently achieved for this route based on *Guide to Traffic Engineering Practice Part 2: Roadway Capacity* (Austroads, 1988a) would also remain unchanged.

***Main Road 214 (Ulan Road North of Main Road 208)***

This section of Ulan Road presently carries a daily traffic volume of 1,321 vpd north of Main Road 208 at Budgee Budgee (2002 data), reducing to 790 vpd south of Ulan (Survey Site 2 - 2004 data). This section of Ulan Road is not expected to attract any additional Project traffic and existing conditions are not expected to change, with light vehicles relying on the alternate shorter route to Gulgong etc. via the Ulan-Wollar road discussed below.

***Main Road 215 (Bylong Valley Way/Bylong Road)***

This road presently carries a daily traffic volume of about 359 vpd north of Rylstone (1999 data) and this is expected to be the favoured route for travel to/from Rylstone. In this regard, the construction activity would generate an additional 12 vpd along this route, south of Bylong. This would result in a daily flow of 371 vpd which is low (approximately 3% increase) and would have no material impact on traffic conditions along this route. Hence, no upgrading of Main Road 215 would be required during the construction phase.

***Wollara/Ringwood Road***

This road is unsealed and presently carries negligible traffic volumes estimated at less than 100 vpd north of Wollar Road. In this regard, the construction activity would generate an additional 12 vpd along this route, resulting in a daily flow that would remain below the 150 vpd threshold where a one-lane unsealed roadway is satisfactory, based on *Rural Road Design – Guide to Geometric Design of Rural Roads* (Austroads, 1993). The additional volume is moderate (12% increase) and would have no material impact on traffic conditions along this route. Hence, no upgrading of this road would be required during the construction phase. It is also noted that an alternate all-weather route is available to Merriwa via Main Road 208 to Sandy Hollow and the Golden Highway (State Highway No. 27).

***Ulan-Wollar Road***

No traffic count data is available for this road, although Mudgee Shire Council's *2004 Road Network Strategic Plan* identifies that it has a volume ranking of 6 which indicates volumes of between 100 and 250 vpd. For assessment purposes, it is considered appropriate to adopt an average of 175 vpd. The construction activity is estimated to generate a maximum additional 126 vpd on this route (to the west), including a maximum of 2 small truck/heavy vehicle movements. This includes light traffic travelling via Main Road 214 to link with the Golden Highway (State Highway No. 27) to access Singleton, Muswellbrook and Dubbo, as well as traffic continuing to the west at Ulan to travel to Gulgong via Cope Road. Accordingly, traffic volumes on this route would increase from 175 vpd to 301 vpd which is a 72% increase.

This flow is above the 150 vpd threshold where a single lane unsealed carriageway would be satisfactory (assuming open terrain) based on the *Rural Road Design – Guide to Geometric Design of Rural Roads* (Austroads, 1993). In view of the expected volume increase, it would require an unsealed 8.0 m wide road carriageway comprising two lanes each 3.0 m wide with 1 m wide shoulders. This is presently provided and the existing road is therefore adequate for the increased traffic (subject to a more detailed road conditions audit to identify the need for any minor localised improvements). Sealing of the road is not warranted for the short-term nature of the construction phase. Traffic flows on this road during the operational phase would be significantly lower (Section K5).

***Main Road 214 (Ulan-Cassilis Road North of Ulan)***

This road presently carries a daily traffic volume of about 597 vpd (2001 data). Construction activity is estimated to generate an additional 99 vpd on this route. This would include Project traffic travelling via Main Road 214 to link with the Golden Highway (State Highway No. 27) to access Singleton, Muswellbrook and Dubbo. Accordingly, traffic volumes on this route would increase from 597 vpd to 696 vpd or 17%. This is moderate and this increase would have no material impact on traffic conditions along this route. In particular, it is noted that the resultant volumes relate to LOS A based on *Guide to Traffic Engineering Practice Part 2: Roadway Capacity* (Austroads, 1988a) and this is satisfactory. Hence, no upgrading of Main Road 214 north of Ulan would be required during the construction phase.

***Main Road 598 (Cope Road East of Gulgong)***

This road presently carries a daily traffic volume of about 1,119 vpd (1999 data) east of Gulgong. Construction activity is estimated to generate an additional 27 vehicle movements on this route, including 2 heavy vehicle/small truck movements associated with movements to/from Gulgong. Accordingly, traffic volumes on this route would increase from about 1,119 vpd to 1,146 vpd or approximately 2%. This minor increase would have no material impact on traffic conditions along this route. In particular, it is noted that the resultant volumes relate to LOS A based on *Guide to Traffic Engineering Practice Part 2: Roadway Capacity* (Austroads 1988a) and this is satisfactory. Hence, no upgrading of Main Road 598 would be required during the construction phase.

## K4.3 OVERSIZE TRAFFIC

A number of overwidth, overheight or overweight heavy loads could be generated during the construction phase. However the number of these oversize loads would be small. All such loads would be transported with the relevant permits, licences and escorts, as required by the relevant regulatory authorities. The proposed route for these oversize loads would be selected in consultation with the relevant local councils. However, it is expected that they would travel only along State Highways and Main Roads to the Project site.

## K4.4 PEAK PERIOD INTERSECTION OPERATION

The additional traffic impacts associated with the mine construction would potentially increase delays at intersections and these impacts are different depending upon the day of the week, with higher volumes on Monday mornings and on Friday afternoons, associated with the extra movements to and from the temporary construction camp. In this regard, the following scenarios have been tested for peak times of mining activity:

- Monday AM peak period; and
- Friday PM peak period.

Conservatively, the construction traffic generated during each of these periods would include the following:

- half of the daily construction workforce traffic (124 movements each peak); and
- one eighth of the daily small truck/heavy vehicle and visitor movements (3 and 5 movements respectively each peak).

Hence the peak hour traffic generated by the construction phase would be approximately 132 movements, distributed as follows:

*Monday AM Peak (6.00 am-7.00 am)*

- 128 vehicle movements in; and
- 4 vehicle movements out.

*Friday PM Peak (6.00 pm-7.00 pm)*

- 4 vehicle movements in; and
- 128 vehicle movements out.

These movements would be spread onto the road network in the same proportions as the daily traffic and would therefore include (approximately):

- 48 vehicles turning in/out of the main site access - travelling from/to the west on Main Road 208;
- 22 vehicles turning in/out of the main site access - travelling from/to the east on Main Road 208; and
- 62 vehicles accessing the site via the construction camp temporary access from Ulan-Wollar Road and travelling to/from the west.

The intersections previously assessed were therefore reanalysed based upon the expected volumes described above and the results are shown in Table K-7. In addition, the proposed Mine Access Road onto Wollar Road has also been assessed, based upon an assumption of a Type B intersection treatment as discussed further below. Finally, the temporary construction camp access on Ulan-Wollar Road and Project access from this road has been assessed. In this regard, the peak volumes of 70 vehicles per hour at these accesses are moderate and occur at a time when through traffic volumes on Ulan-Wollar Road are negligible.

**Table K-7**
**Future Intersection Performances during Construction - Peak Hours**

| Intersection | | Control | Peak Period | Degree of Saturation | Average Vehicle Delay | Level of Service |
|---|---|---|---|---|---|---|
| No | Description | | | | | |
| 1 | Short St/ Henry Lawson Street | Roundabout | am | 0.12 | 6.9 | A |
| | | | pm | 0.12 | 6.4 | A |
| 2 | Henry Lawson/ Ulan Road | Seagull | am | 0.03 | 6.9 | A |
| | | | pm | 0.03 | 6.5 | A |
| 3 | Ulan Road/ Wollar Road | Priority | am | 0.07 | 5.7 | A |
| | | | pm | 0.02 | 5.6 | A |
| - | Mine Access | Priority | am | 0.07 | 5.9 | A |
| | | | pm | 0.12 | 5.9 | A |
| - | Temporary Construction Camp Access/Project Access | Priority | am | 0.02 | 1.2 | A |
| | | | pm | 0.02 | 1.2 | A |

It can be seen that all existing intersections would continue to operate satisfactorily with no change in LOS and with minimal delays. Hence, no improvements are required to existing intersections on capacity grounds. Further, the proposed access roadways also operate satisfactorily. It is evident that the intersection of the Mine Access Road with Wollar Road, the *Road Design Guide Section 4: Intersections at Grade (*RTA, 1996) requires a minimum right turn treatment (Type BAR). This incorporates a passing lane for westbound through traffic of length approximately 100 m, subject to detailed design. This widening is generally unsealed for a Type BAR treatment. Notwithstanding, a Type AUR (Auxiliary Lane Right Turn) treatment would provide a higher level of amenity and safety, particularly in view of the use of this intersection by a proportion of small trucks and heavy vehicles. This treatment is based on the *Road Design Guide* (RTA, 1996). This would require the widening to be sealed and extended over a distance of about 190 m, subject to detailed design (Attachment K-C).

In addition to the above, the *Road Design Guide* (RTA, 1996) requires the left turn treatment from Wollar Road into the Mine Access Road to be separately considered. In this regard, a minimum treatment (Type BAL) would be required. An auxiliary lane is not required for this type, with a single radius return provided. This design is based on the *Road Design Guide* (RTA, 1996) (Attachment K-C). It should be noted that turn radii would need to be designed to accommodate heavy vehicles (including B Doubles) without the need to cross the road centrelines. Finally, the Mine Access Road is to be sealed for a distance of 100 m on approach to its intersection with Wollar Road. This should be undertaken early during the construction phase.

The temporary construction camp access from Ulan-Wollar Road and the access to the Project site would require suitable splays (turnouts) to accommodate safe turns. No sealing of these accesses would be required.

The intersection of Wollar Road (Main Road 208) with Ulan Road (Main Road 214) presently requires a Type BAR right turn from Ulan Road into the Wollar Road, with an unsealed passing lane. This is not provided for current volumes and the additional construction traffic would increase the need for this to be provided.

## K5 TRAFFIC GENERATION DURING MINE OPERATIONS

### K5.1 OVERVIEW

The mine operations phase would follow the construction phase discussed in Section K4. At peak production, the mine would be operated by up to 162 staff as shown in Table K-8.

**Table K-8**
**Project Operation Workforce**

| Category | Shift Time | Number |
|---|---|---|
| Administration Staff | 7.00 am to 5.00 pm | 20 |
| Day Shift | 6.30 am to 7.00 pm | 71 |
| Night Shift | 6.30 pm to 7.00 am | 71 |

It is expected that about 30% of these staff would participate in car-pooling and accordingly, this equates to an average car occupancy of 1.43 people per car. In addition, a 10% reduction has been assumed to take account of staff absentee rates associated with sick leave, rostered leave and off-site activities. On this basis, 200 vehicle movements per day are expected to be generated by mine employees (100 in, 100 out). A further 20 movements per day are expected to be generated by visitors (10 in, 10 out) between Mudgee and the site, resulting in a total of 220 movements per day in light vehicles.

It is expected that 80% of this permanent workforce would come from Mudgee, 10% from Gulgong and 10% from other areas.

Finally, it is estimated that a total of 16 small truck/heavy vehicle movements per day would be generated during the operational phase (8 in, 8 out). These relate to the following components:

- B Double Fuel deliveries 4 movements per week.
- Machine parts deliveries 4 movements per week.
- Explosives deliveries 4 movements per week.
- Small trucks visitors/sales 6 movements per day.
- Other small truck deliveries 8 movements per day.

It is expected that 75% of all consumables/deliveries would access the site from Mudgee, 10% from Gulgong and 15% from Bylong.

The above traffic would potentially affect route capacities (based on daily traffic volumes) as well as intersection performances (based on peak period conditions). These are assessed separately below.

## K5.2 POTENTIAL IMPACTS ON DAILY TRAFFIC VOLUMES

The daily traffic volumes that would be generated by the above operations may be summarised as follows and these movements would occur on all days of the week:

- 200 light vehicle (worker) movements;
- 20 light vehicle (visitor) movements; and
- 16 small truck/heavy vehicle movements (representing 6.8% of the total volume).
  *236 Total Movements (118 in, 118 out)*

These movements have been distributed onto the road network on the basis of the distributions discussed above. The potential impact of this traffic on existing routes is discussed below and shown in Tables K-9 and K-10.

**Table K9**
**Project Traffic Distribution – Operational Phase**

| **Type Traffic** | **Wollar Road West of Site (to Mudgee)** | **Wollar Road East of Site** | | | **Ulan-Wollar Road West of Site** | |
|---|---|---|---|---|---|---|
| | | To Golden Highway (E) | To Wollara/ Ringwood Road (N) | To Rylstone (S) | To Gulgong (W) | To Ulan Cassilis Road (N/E)t |
| Operation Light (workers and visitors) | **180** | **16** | | | **24** | |
| | | 6 | 6 | 4 | 20 | 4 |
| Operation Small truck /Heavy Vehicle | **12** | **2** | | | **2** | |
| | | 2 | - | | 2 | - |

Based upon these distributions, Table K-10 illustrates how the traffic generation associated with the operational phase would affect existing traffic volumes.

**Table K-10**
**Potential Impact of Project Operational Phase on Existing Traffic Flows**

| Road | Station Number | Location | Current Traffic Volume * | Project Workforce/ Visitors | Project Deliveries/ Trucks | Project Total Increase | New Traffic Volume with Project | % Change |
|---|---|---|---|---|---|---|---|---|
| Main Road 208 | 5474 | West of Golden Highway | 300 | 6 | 2 | 8 | **308** | 2.7% |
| | 99286 | East of Bylong | 141 | 6 | 2 | 8 | **149** | 5.7% |
| | Survey Site 4 | Wollar Road - West of Wollar (near Wilpinjong Road) | 166 | 180 | 12 | 192 | **358** | 115.7% |
| | Survey Site 3 | Wollar Road - West of Cooyal | 352 | 180 | 12 | 192 | **544** | 54.5% |
| | 99222 | Wollar Road - East of Ulan Road | 613 | 180 | 12 | 192 | **805** | 31.3% |
| | 99906 | Ulan Road - North of Mudgee | 3,482 | 180 | 12 | 192 | **3,674** | 5.5% |
| Main Road 214 | 92268 | Ulan-Cassilis Road - North of Ulan | 597 | 4 | - | 4 | **601** | 0.7% |
| | Survey Site 2 | Ulan Road - South of Ulan | 790 | - | - | - | **790** | 0.0% |
| | 99221 | Ulan Road - North of Wollar Road/Budgee Budgee | 1,321 | - | - | - | **1,321** | 0.0% |
| Main Road 598 | 99510 | Cope Road - East of Gulgong | 1,119 | 20 | 2 | 22 | **1,141** | 2.0% |
| Henry Lawson Drive | Survey Site 1 | North of Main Road 208 | 953 | - | - | - | **953** | 0.0% |
| Main Road 215 | 99301 | Bylong Road - North of Rylstone | 359 | 4 | - | 4 | **363** | 1.1% |
| Wollara/ Ringwood Road | - | North of Wollar Road | 100 | 6 | - | 6 | **106** | 6.0% |
| Ulan-Wollar Road | - | East of Main Road 214 | 175 | 24 | 2 | 26 | **201** | 14.9% |

* Based on most recent traffic counts and estimates (Section K2).

***Main Road 208 (Wollar Road/Wollar-Bylong Road))***

*East of Bylong/West of the Golden Highway*

The mine operation activity would generate an additional 8 vpd (including 2 truck movements) along Wollar Road east of Bylong. This would result in a daily flow of 149 vpd east of Bylong and 308 vpd west of the Golden Highway. These increases are low (approximately 6% and 3% respectively) and would have no material impact on traffic conditions along this route. Hence, no upgrading of Main Road 208 would be required to the east of the proposed site access during the mine operational phase.

*West of Wollar/West of Cooyal*

The mine operation activity would result in an additional 192 vpd, including 12 small truck/heavy vehicle movements (Table K-10). Hence, traffic volumes would increase from 352 vpd to 544 vpd on the central section and from 166 to 358 vpd on the eastern section near the mine access.

This section of Wollar Road has a seal of variable width generally ranging from 6.0 m to 7.5 m, with unsealed road shoulders of average width 2.0 m. In this regard, *Rural Road Design – Guide to Geometric Design of Rural Roads* (Austroads, 1993) requires lane widths of between 3.0 m and 3.5 m for AADT's of between 500 vpd and 1,000 vpd. The latter width is 'desirable,' particularly where speeds are over 100km/h in undulating country or where the proportion of heavy vehicles is high. In this regard, the signposted speed does not exceed 100km/h and in addition, the proportion of heavy vehicles would not be high. During the operational phase, the volume on the western part of this section would increase to a maximum of 544 vpd and the proportion of small truck/heavy vehicles would be approximately 9%, which is low. Traffic improvements to support the Project would therefore be limited to those described for the construction phase (Section K4.2).

*East of Ulan Road*

Traffic volumes would increase from 613 vpd to 805 vpd or 31% (Table K-10) during the operational phase. This section of road is in good condition with line marking and a minimum pavement width of 6.5 m and would therefore not require any significant upgrading in support of the Project operational phase traffic movements.

***Main Road 208 (Ulan Road south of Main Road 214)***

The mine operation activity would result in an additional 192 vehicle movements per day, including 12 small truck/heavy vehicle movements (Table K-10). Hence, traffic volumes would increase from 3,482 vpd to 3,674 vpd or 6%. Ulan Road is constructed as a two lane sealed rural road south of Main Road 208, with generally 3.5 to 3.75 m wide lanes and 2.0 to 3.0 m wide unsealed shoulders. *Rural Road Design – Guide to Geometric Design of Rural Roads* (Austroads, 1993) requires 3.5 m wide lanes and 2.5 to 3.0 m unsealed shoulders for volumes over 1,000 vpd and the existing road is therefore considered adequate for the minor increase in traffic associated with the Project. In addition, the existing LOS "B" currently achieved for this route based on the Austroads guidelines would also remain unchanged.

***Main Road 214 (Ulan Road north of Main Road 208)***

This section of Ulan Road is not expected to gain any additional traffic as a consequence of the mine operations, with reliance made on the alternate shorter route via the Ulan-Wollar road discussed below.

***Main Road 215 (Bylong Valley Way/Bylong Road)***

This road presently is expected to be the favoured route for travel to/from Rylstone. In this regard, the mine operation activity would generate an additional 4 vpd along this route, south of Bylong. This would result in a daily flow of 363 vpd (Table K-10) which is low (1%) and this increase would have no material impact on traffic conditions along this route. Hence, no upgrading of Main Road 215 would be required during the mine operational phase.

***Wollara/Ringwood Road***

This road presently carries negligible traffic volumes estimated at less than 100 vpd north of Wollar Road and extends between Wollar Road and the Golden Highway as a local access route to Merriwa. This route is unsealed. In this regard, the mine operation activity would generate a maximum additional 6 vpd along this route, resulting in a daily flow that would remain below the 150 vpd threshold where a one-lane unsealed roadway is satisfactory, based on *Guide to Traffic Engineering Practice Part 2: Roadway Capacity* (Austroads, 1988a). The additional volume is minimal and this increase would have no material impact on traffic conditions along this route. Hence, no upgrading of this road would be required during the mine operational phase. It is also noted that an alternate all-weather route is available to Merriwa via Main Road 208 to Sandy Hollow and the Golden Highway (State Highway No. 27).

***Ulan-Wollar Road***

The mine operation activity is estimated to generate an additional 26 vpd on this route, including 24 light vehicles and 2 small truck/heavy vehicles. This includes traffic travelling via Main Road 214 to link with the Golden Highway (State Highway No. 27) to access Singleton, Muswellbrook and Dubbo, as well as traffic continuing to the west at Ulan to travel to Gulgong. Accordingly, traffic volumes on this route would increase from 175 vpd to 201 vpd or 15%.

This flow is above the 150 vpd threshold where a single lane unsealed carriageway would be satisfactory (assuming open terrain), based on the *Rural Road Design – Guide to Geometric Design of Rural Roads* (Austroads, 1993). In view of the expected volume and the use of this road by some heavy vehicles, the existing unsealed 8.0 m wide formed carriageway comprising two lanes each 3.0 m wide with 1 m wide shoulders is suitable. This road would need to be appropriately maintained, however sealing of the road is not warranted for the mine operational phase given the minor traffic increases involved.

***Main Road 214 (Ulan-Cassilis Road North of Ulan)***

Mine operation activity is estimated to generate an additional 4 vpd on this route (Table K-10). Accordingly, traffic volumes on this route would increase from 597 vpd to 601 vpd (1%). This is very minor and this increase would have no material impact on traffic conditions along this route.

In particular, it is noted that the resultant volumes relate to LOS ‘A’ based on *Guide to Traffic Engineering Practice Part 2: Roadway Capacity* (Austroads, 1988a) and this is satisfactory. Hence, no upgrading of Main Road 214 would be required during the mine operational phase.

***Main Road 598 (Cope Road East of Gulgong)***

Mine operation activity is estimated to generate an additional 22 vpd on this route, including 20 light vehicles and 2 small truck/heavy vehicles and this is associated with movements to/from Gulgong. Accordingly, traffic volumes on this route would increase from about 1,119 vpd to 1,141 vpd (2%) (Table K-10). This is minor and this increase would have no material impact on traffic conditions along this route. In particular, it is noted that the resultant volumes relate to LOS ‘A’ based on *Guide to Traffic Engineering Practice Part 2: Roadway Capacity* (Austroads, 1988a) and this is satisfactory. Hence, no upgrading of Main Road 598 would be required during the mine operational phase.

## K5.3 PEAK PERIOD TRAFFIC DURING MINE OPERATION

In addition to the assessment of potential route impacts, the need for traffic improvements at intersections needs to be assessed during the operational phase. In this regard, the results of the modelling based on existing flows and intersection geometries, are shown in Table K-3. The additional traffic impacts associated with the mine operation would increase delays at these intersections.

Applying the same logic to the calculation of peak hour traffic flows as for the construction phase (Section K4.4) the peak hour flows would be somewhat spread in the morning due to the differing start and finish times associated with the different workforce shifts (Table K-8):

*Weekday AM Peak (6.00 am-7.00 am)*

- 60 administrative/day shift staff vehicle movements in;
- 3 visitor movements in;
- 1 small truck/heavy vehicle movement in; and
- 1 small truck/heavy vehicle movement out.

  *65 Total Movements (64 in, 1 out)*

*Weekday AM Peak (7.00 am-8.00 am)*

- 45 night shift vehicle movements out;
- 3 visitor movements out;
- 2 small truck/heavy vehicle movements in; and
- 1 small truck/heavy vehicle movement out.

  *51 Total Movements (48 out, 4 in)*

The AM peak (6.00 am-7.00 am) is the higher morning peak, and is therefore assessed further below. These AM peak movements would be spread on the road network in the same proportions as the daily traffic and would therefore include approximately:

- 52 vehicles turning in/out of the main site access - travelling from/to the west; and
- 13 vehicles turning in/out of the main site access - travelling from/to the east.

Administrative staff would generally leave at 5.00 pm and would not be included in the afternoon peak. In practice the afternoon peak hour would run over approximately 1.25 to 1.5 hours as the night shift staff would arrive before 6.30 pm and day shift staff would leave after 7.00 pm. However, in order to be conservative, this traffic was combined into one hour for assessment purposes, as follows:

*Weekday PM Peak (6.00 pm-7.00 pm)*

- 50 day shift/administration vehicle movements out;
- 46 night shift vehicle movements in;
- 3 visitor movements out:
- 2 truck movements in; and
- 1 truck movement out.

  *102 Total Movements (46 in, 54 out)*

These PM peak movements would be spread on the road network in the same proportions as the daily traffic and would therefore include approximately:

- 82 vehicles turning in/out of the main site access - travelling from/to the west; and
- 20 vehicles turning in/out of the main site access - travelling from/to the east.

The intersections previously assessed (Section K2.4) were therefore reanalysed based upon the expected volumes and the results are shown in Table K-11. The proposed Mine Access Road onto Wollar Road has also been assessed, based upon an assumption of a Type B intersection treatment.

All intersections would continue to operate satisfactorily with no change in LOS and with minimal delays. Hence, no improvements are required to existing intersections on capacity grounds.

**Table K-11**
**Future Intersection Performances During Operation - Peak Hours**

| Intersection | | Control | Peak Period | DOS | AVD | LOS |
|---|---|---|---|---|---|---|
| No | Description | | | | | |
| 1 | Short St/ Henry Lawson Street | Roundabout | AM | 0.12 | 6.9 | A |
| | | | PM | 0.12 | 6.4 | A |
| 2 | Henry Lawson/ Ulan Road | Seagull | AM | 0.03 | 6.8 | A |
| | | | PM | 0.03 | 6.5 | A |
| 3 | Ulan Road/ Wollar Road | Priority | AM | 0.07 | 5.6 | A |
| | | | PM | 0.02 | 5.6 | A |
| - | Mine Access | Priority | AM | 0.03 | 6.4 | A |
| | | | PM | 0.08 | 6.4 | A |

Intersection upgrade requirements during the operational phase are the same as for construction (Section K4.4).

## K6 OTHER TRAFFIC IMPLICATIONS OF THE PROJECT

### K6.1 MINE ACCESS ROAD

The primary access to the Project would be provided via construction of an unsealed two-lane Mine Access Road connecting the mine facilities area to Wollar Road. Warning and restricted access signs would be posted at intervals along the Mine Access Road. Separate parking areas for heavy and light vehicles would be provided adjacent to the mine facilities area.

Road shoulders and guardrails would be installed where required in accordance with Section 6 of the *Road Design Guide* (RTA, 1996). A low level floodway crossing would also be installed for the Mine Access Road across Cumbo Creek and one of its tributaries.

The Mine Access Road geometry would be designed to comply with the *Rural Road Design – Guide to Geometric Design of Rural Roads* (Austroads, 1993). The Mine Access Road would be constructed partially along the alignment of the existing Wilpinjong Road, however realignment of the southern section of the road and intersection of Wilpinjong Road with Wollar Road would be required to improve visibility.

The intersection would be designed as a "Type B' intersection in accordance with the *Guide to Traffic Engineering Practice Part 5: Intersections at Grade* (Austroads, 1988b). This would incorporate a Type AUR right turn (with an auxiliary right turn lane) and a Type BAL (basic left turn treatment) as discussed above. Intersection pavement design would be prepared in accordance with *A Guide to the Structural Design of Road Pavements* (Austroads, 1992). Approximately 100 m of the Mine Access Road would be sealed on the approach to the intersection with Wollar Road to minimise transport of gravels onto the Wollar Road pavement.

A minor realignment of the Mine Access Road would be temporarily required prior to Year 7 of the Project as mining progresses within the site. A portion of the Mine Access Road would be moved to the south to accommodate mining in Pit 2 before being relocated back to its original alignment across the re-profiled mine waste rock emplacement.

### K6.2 CONSTRUCTION PHASE - TEMPORARY CONSTRUCTION CAMP AND PROJECT ACCESS ON ULAN-WOLLAR ROAD

The temporary construction camp access on Ulan-Wollar Road and the access from Ulan Road to the Project have been assessed. In this regard, the peak volumes of up to 70 vehicles per hour at these accesses would be moderate and would occur at a time when through traffic volumes on Ulan-Wollar Road are negligible.

These two accesses from Ulan-Wollar Road would require suitable splays to accommodate safe turns and no sealing would be required. A Traffic Management Plan would be prepared in consultation with the RTA and Mid-Western Regional Council prior to any works on the public road network.

### K6.3 CLOSURE OF WILPINJONG ROAD AND BUNGULLA ROAD

Existing public roads including Wilpinjong Road and Bungulla Road would be closed in accordance with the requirements of the Mid-Western Regional Council and would be used for internal access purposes where practicable.

### K6.4 DIVERSION OF ULAN-WOLLAR ROAD

It is proposed to undertake local diversions of the Ulan-Wollar Road to facilitate open cut operations in the north of the MLA area. There are two diversions, including a 2.5 km diversion in the north-western part of the site (in Project Year 13) and an 800 m diversion in the north-east of the site (in Project Year 8). Railway crossings associated with the road relocations would be constructed to suitable standards in consultation with relevant rail authorities. A Traffic Management Plan would be prepared in consultation with the RTA and Mid-Western Regional Council prior to any works on the public road network.

The road diversions would involve the construction of an unsealed two-lane road and as these diversions would occur during the operational phase, the road requires an unsealed 8 0 m wide formed carriageway comprising two lanes each 3.0 m wide with 1 m wide shoulders, as discussed in Section K5.2.

### K6.5 BLASTING

During the open cut operations there would be occasions when blasting would be required within 500 m of Wollar Road (Main Road 208) and Ulan-Wollar Road.

Approvals would be sought from the RTA and Mid-Western Regional Council to close the roads for periods of less than 15 minutes to allow blasting to occur.

A Traffic Management Plan would be developed in consultation with the RTA and Mid-Western Regional Council and in accordance with the RTA *Traffic Control at Worksites Manual* (RTA, 2003). Issues to be covered by the Traffic Management Plan include:

- method of road closure;
- signage providing advance warning and at the road closure;
- review of traffic volumes;
- lengths of closures and expected queue lengths;
- access for emergency services;
- notification process; and
- monitoring and reporting requirements.

## K6.6 ROAD SAFETY

Impacts of Project-related traffic on State Highways would be minimal and no change in road safety conditions is expected. The current accident rates on local roads (Table K-4) are typical for rural areas and the Project is not likely to significantly alter the existing local road safety environment. The proposed road audit discussed in Section K8 would however provide a possible opportunity for minor improvements in road safety.

## K6.7 POTENTIAL CUMULATIVE IMPACTS

As described in Section K2.6, there is some possibility that additional approved development at the Ulan Coal Mines could increase traffic flows and result in additional cumulative traffic impacts with Project traffic flows.

If the two scenarios outlined in Section K2.6 were to coincide with the Project construction or operational phase peak traffic generation periods, then cumulative impacts could occur. However the traffic flows estimated in Section K2.6 would be concentrated on Ulan Road (MR214/208) between Ulan and Mudgee (Figure K-3).

Potential cumulative impacts of this additional traffic would be largely limited to the section of Ulan Road between Mudgee and Budgee Budgee (MR208) (Figure K-3), as all Project traffic coming north from Mudgee would turn off at Budgee Budgee onto Wollar Road to access the Project site. Lesser potential for cumulative impacts would occur on MR598 (Cope Road) east of Gulgong and MR214 (Ulan-Cassilis Road) north of Ulan, as the Project would contribute less traffic to these routes (Tables K-6 and K-10) and existing traffic flows on these roads are also significantly lower (Table K-1).

The addition of up to 200 vehicle movements per day on the section of Ulan Road (MR 208) between Mudgee and Budgee Budgee arising from approved development at the Ulan Coal Mines would result in minor increases in delays at relevant intersections at peak times but with no change in the LOS of these intersections, either during the construction or operation stage of the Project. The additional traffic would also not lead to any capacity issues along this route. However, given the uncertainty of the timing or nature of any such traffic increases in the local area, it is recommended that WCPL consult with the Mid-Western Regional Council, RTA and other mine operators during the life of the Project to manage any cumulative traffic issues, should they arise.

## K7 RECOMMENDED TRAFFIC MANAGEMENT MEASURES

The following traffic management measures are recommended for the Project.

***Development of the Mine Access Road and Intersection with Wollar Road***

- The Mine Access Road intersection with Wollar Road would afford excellent sight distances in both directions of over 200 m.

- The intersection would need to be a Type B intersection incorporating a Type AUR right turn treatment from Wollar Road (with an auxiliary turn lane) and a Type BAL left turn treatment from Wollar Road (a basic left turn treatment), in accordance with the *Road Design Guide* (RTA, 1996) (Attachment K-C). The detailed design should accommodate turning manoeuvres of B Doubles as defined by the *Guide to Traffic Engineering Practice Part 5: Intersections at Grade* (Austroads, 1988b) with these vehicles turning without crossing the centrelines of the intersection approaches in Wollar Road. This would require the widening to be sealed and extended over a distance of about 190 m, subject to detailed design.

- The Mine Access Road should be sealed for a distance of approximately 100 m on approach to its intersection with Wollar Road and it is recommended that this be undertaken early during the construction phase to minimise the potential for gravels to be transported onto Wollar Road.

***Ulan-Wollar Road***

- During the construction phase, the Ulan-Wollar Road between Ulan and the Project site would require an unsealed 8.0 m wide formed carriageway comprising two lanes each 3.0 m wide with 1 m wide shoulders. This configuration is presently available (subject to a detailed road conditions audit) and accordingly this road would need to be maintained to current standards. Sealing of the unsealed sections of the road is not warranted for the short term nature of the construction phase. Less Project-related traffic would use Ulan-Wollar Road during the operational phase when compared to the construction phase traffic volumes so the road would be satisfactory for the life of the Project.

***Construction Phase – Temporary Access to Ulan-Wollar Road***

- During the construction phase, the Project would require temporary access to Ulan-Wollar Road at the Project and at the construction camp and this would require suitable intersections to be constructed with Ulan-Wollar Road. The traffic would travel for a short distance on Ulan-Wollar Road to avoid the need for an additional road crossing of the Gulgong-Sandy Hollow rail line. No sealing of these intersections would be required due to the low traffic volumes and short term nature of their use.

***Improvements to Wollar Road***

- The Western section of Wollar Road currently carries traffic volumes in excess of 500 vpd (Table K-1). This section of road is in good condition with edge line marking and a minimum pavement width of 6.5 m and would therefore not require any significant upgrading in support of the construction or operational phase of the Project.

- During the construction phase, Wollar Road (west of the Mine Access Road) (Table K-6) would carry total volumes of approximately 290 vpd at Site 4 and approximately 480 vpd West of Cooyal (Site 3). During the operational phase, this section would carry volumes of 358 vpd at Site 4 (Figure K-3) and 544 vpd at Site 3 (Figure K-3). These traffic volumes would require minimum lane widths of 3.0 m, with road shoulders of minimum width 1.0 m and this is generally provided on the route. However, there is a total length of approximately 2.3km that requires widening to provide 3.0 m lanes. No other significant improvements are required. This should be confirmed as part of a road conditions audit prior to Project construction.

***Improvement to the Wollar Road and Ulan Road Intersection***

- The existing traffic flows at the intersection of Wollar Road (Main Road 208) with Ulan Road (Main Road 208/214) presently requires a Type BAR right turn from Ulan Road into the Wollar Road, with an unsealed passing lane (Section K2.4). This is not currently provided and the additional construction and operational phase Project traffic would increase the need for this improvement.

***Road Audit and Consultation Programme***

- It is recommended that prior to and following road improvements, a road safety audit be undertaken to check compliance with relevant standards.

- It is recommended that regular consultation be undertaken with the RTA and Mid-Western Regional Council as appropriate during the Project construction and operational phases.

## K8 CONCLUSIONS

In summary, the local road network is capable of accommodating the additional mine construction and operational phase traffic. A preliminary review of road conditions along Wollar Road over the 44 km length between the proposed mine access and Mudgee indicates that a short section of approximately 2.3 km length would require widening, plus some repair of substandard surfacing. This should be confirmed by a road conditions audit prior to construction.

In view of the above assessment, it is concluded that the potential road traffic impacts arising from the Project can be accommodated on the existing road network, subject to the implementation of the management measures described in Section K7. On this basis, traffic generated by the Project can be managed in a manner that conforms to RTA safety and design requirements.

## K9 REFERENCES

Austroads (1988a) *Guide to Traffic Engineering Practice Part 2: Roadway Capacity*.

Austroads (1988b) *Guide to Traffic Engineering Practice Part 5: Intersections at Grade*.

Austroads (1992) *A Guide to the Structural Design of Road Pavements*.

Austroads (1993) *Rural Road Design: Guide to Geometric Design of Rural Roads*.

Kinhill Pty Ltd (1998) *Mining Lease Application No. 80 – Development Application and Environmental Impact Statement*. Report prepared for Ulan Coal Mines Limited.

Kinhill Stearns Engineers (1983) *Ulan Coal Mines Stage 2 – Colliery Development and Expansion Environmental Impact Statement*. Report prepared for Ulan Coal Mines Limited.

Martin and Associates (2005) *Wilpinjong Coal Project – Community Infrastructure Assessment*. Report prepared for Wilpinjong Coal Pty Limited.

Mudgee Shire Council (2004) *Road Network Strategic Plan*.

NSW Roads and Traffic Authority (RTA) (1996) *Road Design Guide*.

RTA (2002) *Guide to Traffic Generating Developments.*

RTA (2003) *Traffic Control at Worksites Manual.*

# ATTACHMENT K-A

# PHOTOGRAPHIC RECORD OF THE MAIN ACCESS ROUTE VIA WOLLAR ROAD

**Chainage 0.00 km.**
Willpinjong Road T-junction.

**Chainage 0.00 km.**
Wilpinjong Road T-junction. View east.

**Chainage 0.00 km.**
Wilpinjong Road T-junction. View west.

**Chainage 0.2 km.**
Sight distance to north.

**Chainage 0.2 km.**
Sight distance to south.


**Chainage 1.0 km.**
View south at Cumbo Creek causeway.

**Chainage 4.3 km.**
6.5 metre carriageway.

**Chainage 5.1 km.**
Change of road surface at Munghorn.

**Chainage 6.9 km.**
Munghorn.

**Chainage 11.2 km.**
Munghorn.

**Chainage 13.5 km.**
Cooyal border. Change of surface.

**Chainage 14.8 km.**
Rough road surface. 6 metre carriageway.

**Chainage 15.5 km.**
Causeway and change of surface.

**Chainage 15.5 km.**
Kains Flat Road intersection. Road widens to 6.5 metres.

**Chainage 18.1 km.**
7 metre carriageway.

**Chainage 19.5 km.**
Linburn Lane cross intersection. 6.5 metre carriageway.

**Chainage 21.0 km.**
Mahons Road. 5.5 metre carriageway.

**Chainage 21.8 km.**
Causeway.

**Chainage 22.9 km.**
Kurtz Lane T-junction.

**Chainage 24.5 km.**
Causeway. Road changes surface.


**Chainage 25.5 km.**
Causeway at Abbotts Creek. Edgelines begin at causeway.

**Chainage 25.8 km.**
6.5 metre carriageway.


**Chainage 28.2 km.**
Botobolar Road T junction. Edgelines begin. 7 metre carriageway.

**Chainage 32.2 km.**
Causeway.

**Chainage 33.7 km.**
Ulan Road T- junction. No auxiliary lanes.

**Chainage 33.7 km.**
View south along Ulan Road.


**Chainage 33.7 km.**
No edgelines on carriageway on Ulan Road.

**Chainage 34.6 km.**
Crowleys Lane.

**Chainage 37.9 km.**
Blacksprings Road and Buckaroo Road.


**Chainage 39.2 km.**
Temporary 60 km/h speed limit.

**Chainage 40.8 km.**
View south.

**Chainage 41.5 km.**
Mogs Lane intersection.

**Chainage 41.7 km.**
Henry Lawson Drive.

**Chainage 41.9 km.**
60 km/h zone at Country Comfort Resort.


**Chainage 43.1 km.**
40 km/h zone at Pitts Lane.


**Chainage 43.5 km.**
Short Street roundabout. Route 86 to Bathurst, Gulgong and Wellington.

ATTACHMENT K-B

SURVEYED TRAFFIC COUNT DATA

Not included in this copy
Available on request from Wilpinjong Coal Pty Limited.

# ATTACHMENT K-C

# GUIDELINE EXTRACTS RELEVANT TO INTERSECTION DESIGN

### 4.8.5.2 *Type "AUR" (AUxiliary lane Right turn)- pavement widening with an unprotected turn.*

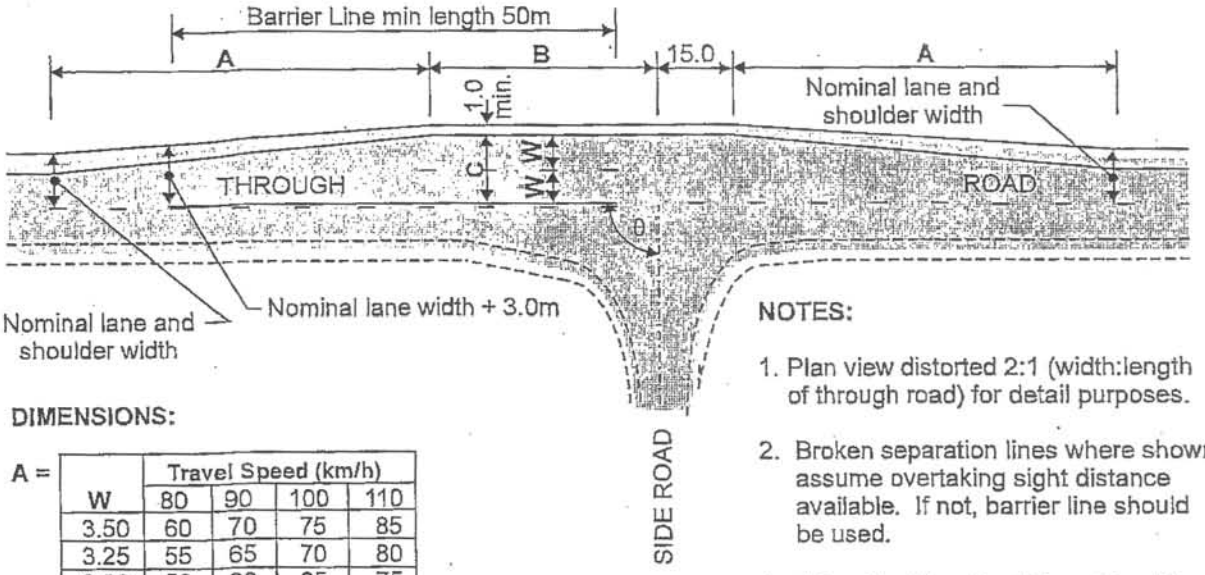
This treatment provides a widened section of sealed pavement equivalent in width to the adjacent through lane. The adjoining shoulder should be a minimum of 1.0m wide. Details are provided in **Figure 4.8.24**. The sealed area is sufficient for a heavy vehicle (19.0m long) to deviate from its through path and pass on the left of a single unit heavy vehicle.

***The storage length should not be increased.*** If additional storage is required then Type "CHR" treatment should be used.

A particular advantage of Type "AUR" treatment is that it does not restrict overtaking for opposing through vehicles (where overtaking sight distance is available).

Linemarking should be as shown in **Figure 4.8.24.**

Signposting should be in accordance with **"Signs and Markings" Manual.**




**DIMENSIONS:**

A =

| W | Travel Speed (km/h) 80 | 90 | 100 | 110 |
|---|---|---|---|---|
| 3.50 | 60 | 70 | 75 | 85 |
| 3.25 | 55 | 65 | 70 | 80 |
| 3.00 | 50 | 60 | 65 | 75 |

Dimension **A** based on formula:

$$\frac{0.8 \times \text{travel speed(km/h)} \times \text{Lane Width(W)}}{3.6}$$

B =

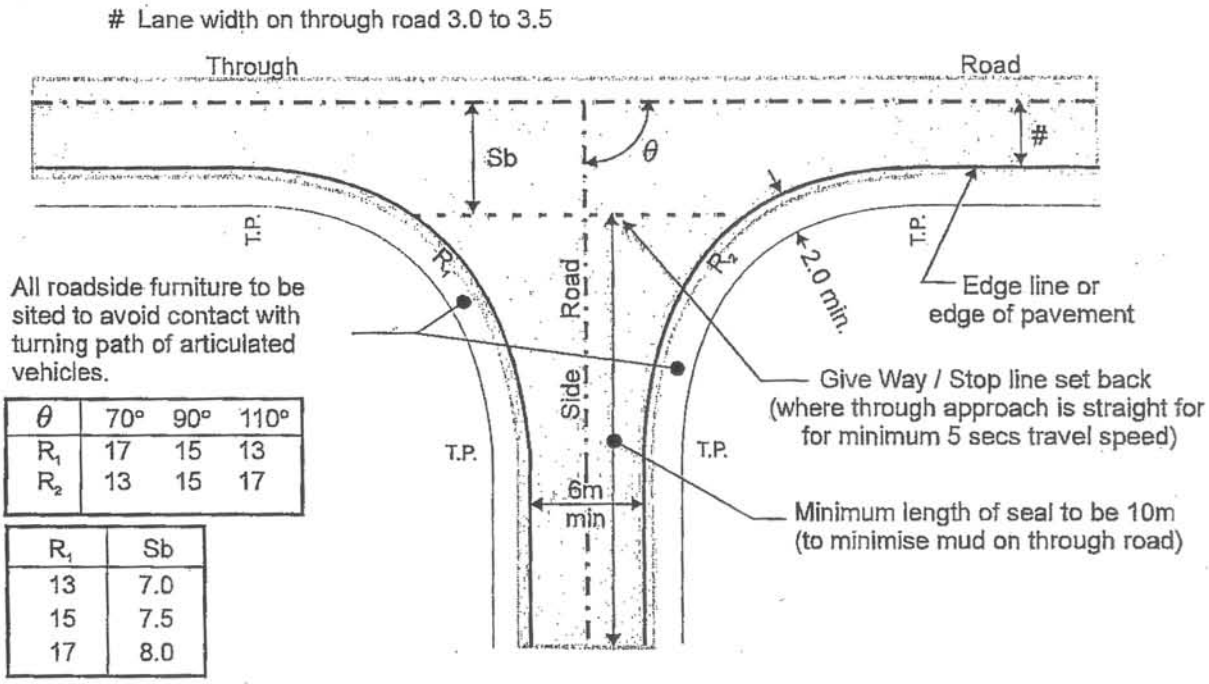
| θ | 70° | 90° | 110° |
|---|---|---|---|
| Length(m) | 40 | 35 | 30 |

C = on straight - 2 x **W** (nominal lane width).
on curve - 2 x **W** (nominal lane width) + corresponding widening for curve radius; refer Section 2 - **Table 2.2.2**
*(See additional notes on Figure 4.5.3)*

**NOTES:**

1. Plan view distorted 2:1 (width:length of through road) for detail purposes.
2. Broken separation lines where shown assume overtaking sight distance available. If not, barrier line should be used.
3. 1.0m shoulder should be widened adjacent to safety barrier or when catering for bicycles
4. Layout to be linemarked as shown. **Do not use continuity lines**

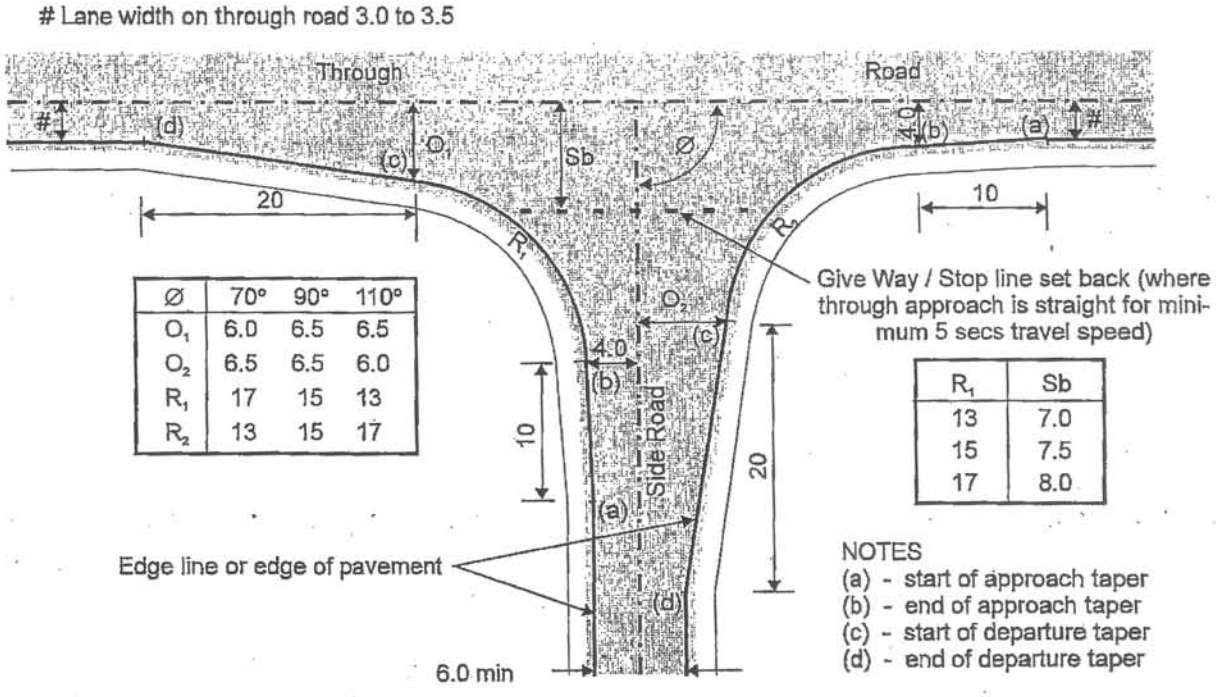
*Figure 4.8.24 - Type "AUR" Right Turn Treatment*




| θ | 70° | 90° | 110° |
|---|---|---|---|
| $R_1$ | 17 | 15 | 13 |
| $R_2$ | 13 | 15 | 17 |

| $R_1$ | Sb |
|---|---|
| 13 | 7.0 |
| 15 | 7.5 |
| 17 | 8.0 |

*Figure 4.8.34 - Details of Type "BAL" Layout for Rural Sites where Side Road AADT < 50.*




| Ø | 70° | 90° | 110° |
|---|---|---|---|
| $O_1$ | 6.0 | 6.5 | 6.5 |
| $O_2$ | 6.5 | 6.5 | 6.0 |
| $R_1$ | 17 | 15 | 13 |
| $R_2$ | 13 | 15 | 17 |

| $R_1$ | Sb |
|---|---|
| 13 | 7.0 |
| 15 | 7.5 |
| 17 | 8.0 |

*Figure 4.8.35 - Details of Type "BAL" Layout for Rural Sites. where Side Road AADT ≥ 50 and / or specifically for articulated vehicles.*