BOWDENS
SILVER

Part 11
Traffic and Transport Assessment

State Significant Development No. 5765

Prepared by:

The Transport Planning Partnership Pty Ltd

May 2020

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BOWDENS SILVER

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Traffic and Transport Assessment

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COMMONLY USED ACRONYMS AND UNITS

AADT	Annual Average Daily Traffic
ASD	Approach Sight Distance
ATS	Average Travel Speed
AUL	Auxiliary Left-turn
AUR	Auxiliary Right-turn
BAL	Basic Auxiliary Left
BAR	Basic Auxiliary Right
CHL	Channelised left turn
CHR	Channelised right turn
DA	Development Application
EA	Environmental Assessment
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
GML	General Mass Limit
HCM	Highway Capacity Manual
km	kilometres
km/h	kilometres per hour
LGA	Local Government Area
LOS	Level of Service
MGSD	Minimum Gap Sight Distance
mi/h	miles per hour
Mt	million tonnes
MWRC	Mid-Western Regional Council
NAF	non-acid forming
PCU	Passenger Car Unit
PFFS	Percent of Free Flow Speed
PTSF	Percent-Time-Spent-Following
RMS	NSW Roads and Maritime Services
SEARs	Secretary’s Environmental Assessment Requirements
SISD	Safe Intersection Sight Distance
t	tonnes
TSF	Tailings Storage Facility
TTPP	The Transport Planning Partnership
WAF	Workers Accommodation Facility
WRE	waste rock emplacement

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EXECUTIVE SUMMARY

The Transport Planning Partnership (TTPP) was commissioned by R.W. Corkery & Co on behalf of Bowdens Silver Pty Limited (Bowdens Silver) to prepare a traffic and transport assessment for the Bowdens Silver Project (the Project). This assessment is a part of the Environmental Impact Assessment to support an application for the development of a silver mine near Lue, New South Wales (NSW).

The Project

The Project comprises development of an open cut silver mine, with a processing plant, waste rock emplacement (WRE), ore stockpile, oxide ore stockpile, tailings storage facility (TSF) and a visual and acoustic barrier. These principal components would be supported by a range of on-site and off-site infrastructure. The on-site infrastructure comprises haul roads, water management structures, power/water reticulation, workshops, stores, compounds and offices/amenities. The off-site infrastructure comprises a relocated section of Maloneys Road, including a new railway bridge crossing and new crossing of Lawsons Creek, a 132 kV power line (which is the subject of a separate application) and a water supply pipeline.

The Project would require a site establishment and construction period of approximately 18 months, and once operational, Bowdens Silver anticipates the mine would operate for approximately 15 years.

Mine Site Access

The primary vehicular access to the Mine Site would be via the mine access road, which would extend from the relocated Maloneys Road and follow the general alignment of the existing Maloneys Road within the Mine Site. During construction of the TSF embankment, vehicular access to the TSF construction area would be via a haul road which would intersect with the relocated Maloneys Road south-west of the mine access road. Following commissioning of the relocated Maloneys Road at the end of Month 6 of the site establishment and construction stage, the existing access from Maloneys Road would be closed to the public, and used by a small number of Project exploration personnel only.

Project Workforce

During the 18-month site establishment and construction stage, the Project would employ an average of approximately 150 people based at the Mine Site, with a peak of 248 workers on site during Month 13 of the construction stage. Prior to commissioning of the relocated Maloneys Road, a peak of 124 workers would be present at the Mine Site.

Once operational, the Project would employ approximately 190 to 228 personnel throughout the Project life.

Mineral Concentrate Transport

B-doubles and semi-trailers would be used to transport silver/lead and zinc concentrates in sealed containers from the Mine Site. Silver/lead concentrate would be transported by road to either Parkes or Kelso, from where it would be transferred by rail to Port Pirie. Zinc concentrate would be transported from the Mine Site to either Port Botany or the Port of Newcastle.

Road Transport Assessment Scenarios

This road transport assessment has adopted the following scenarios to assess the potential traffic and transport impacts of the Project:

- Site establishment and construction stage in 2021 – including peak construction activity at the Mine Site both before and after commissioning of the relocated Maloneys Road; and
- Operational stage in 2031– including operational activity combined with peak haulage of material to the TSF embankment.

Together with the Project-generated traffic, the assessments consider the implications of background growth and other major developments in the region.

Existing Road Network

The roads which provide vehicular access to and from the Mine Site include Ulan Road, Lue Road, Pyangle Road and Maloneys Road. The Project would involve the closure of a section of Maloneys Road to the public, with the primary Mine Site vehicular access to be provided via a new intersection on Lue Road west of Lue, and the relocated Maloneys Road.

Subject to some travel restrictions, B-double access is permitted on Ulan Road and Lue Road, and on the designated route through Mudgee (Short Street, Duoro Street, Horatio Street and Sydney Road). School bus services are provided along Lue Road.

A program of traffic surveys undertaken in the region in 2017 found that on an average weekday, the roads in the region carry in the order of:

- fewer than 100 vehicles per day on the local unsealed roads;
- 840 vehicles per day and 75 vehicles per hour on Lue Road through Lue;
- 8 400 vehicles per day and 720 vehicles per hour on Ulan Road near Lue Road; and
- 2 000 vehicles per day and 160 vehicles per hour on Ulan Road north of Ulan.

Surveys of intersections in Mudgee indicate that the total evening peak hour volumes through the intersections are higher than the morning peak hour volumes. The total number of heavy vehicles through the intersections is however higher during the morning peak hour than the evening peak hour. Analysis of the operating conditions using SIDRA INTERSECTION 8 indicates that the intersections currently operate satisfactorily, with short delays to drivers and spare capacity.

A review of the road crash history of routes to be used by Project-related traffic found no specific location with a notably poor crash history that may suggest an inherent concern with the road geometry or controls that may be exacerbated by increased use of the road system resulting from the Project. A road safety audit on Lue Road identified deficiencies and assigned risk ratings to those deficiencies.

Baseline Future Traffic

Changes to traffic conditions on the local and regional road network which are unrelated to the Project may be expected to occur. Such changes may result from other major developments in the region and as a result of general non-specific growth in background traffic. Forecasts of the cumulative impacts of background non-specific traffic growth, and expected changes at major developments in the region (Bylong Coal Project, Wilpinjong Coal Mine, Moolarben Coal Mine, and Ulan Coal Mine Complex) have been developed.

Project Traffic – Site Establishment and Construction Stage

During the site establishment and construction stage, the Project would generate traffic as a result of the workforce travelling to and from the Mine Site each day, deliveries and visitors, and construction of the Stage 1 TSF embankment.

In order to mitigate potential traffic impacts, Bowdens Silver would provide a bus service for the workforce during the site establishment and construction stage. On a busy weekday during the peak initial phase of the site establishment and construction stage in Month 6 (prior to commissioning of the relocated Maloneys Road), the Project is anticipated to generate:

- 120 light vehicle trips per day;
- 8 bus trips per day; and
- 50 heavy vehicle trips per day.

On a busy weekday during the peak site establishment and construction stage in Month 13 (following commissioning of the relocated Maloneys Road), the Project is anticipated to generate:

- 200 light vehicle trips per day;
- 12 bus trips per day;
- 50 heavy vehicle trips per day; and
- 256 heavy vehicle trips per day for TSF construction, restricted to that part of relocated Maloneys Road between the mine access road and the entrance to the TSF construction area.

On a busy day during the busiest month prior to commissioning of the relocated Maloneys Road, the Project would generate up to 78 light vehicle, eight bus and 36 heavy vehicle movements though Lue on a weekday. On a busy day during the busiest month following construction of the relocated Maloneys Road, the Project would generate up to 82 light vehicle, four bus and 14 heavy vehicle movements per day through Lue.

Project Traffic – Operational Stage

Once operational, the Project would generate traffic as a result of the workforce travelling to and from the Mine Site each day, deliveries and visitors, construction of the Stage 2 and 3 TSF embankment during Years 1 to 8, and transportation of mineral concentrates.

In order to mitigate potential traffic impacts, Bowdens Silver would provide a bus service for the workforce during the operational stage. Once operational, on a busy weekday, the Project is anticipated to generate:

- 156 light vehicle trips per day;
- 28 bus trips per day;
- 16 heavy vehicle trips per day; and
- up to 102 heavy vehicle trips per day for the Stage 2 TSF construction, restricted to that part of relocated Maloneys Road between the mine access road and the entrance to the TSF embankment area.

On a busy day once the Project is operational, the Project would generate up to 70 light vehicle, 12 bus and two heavy vehicle movements through Lue on a weekday. Buses travelling through Lue to and from the east would typically be smaller capacity “Coaster” style buses rather than full size coaches.

Future Road Transport Environment

With the combined effects of changes to major developments in the region, background traffic growth to 2021 and the Project-related traffic, on a busy weekday during the busiest month of the site establishment and construction stage following construction of the relocated Maloneys Road, the roads in the region are forecast to carry in the order of:

- 250 vehicles per day and 90 vehicles per hour on the relocated Maloneys Road;
- 160 vehicles per day and 35 vehicles per hour on Pyangle Road;
- 1 000 vehicles per day and 75 vehicles per hour on Lue Road through Lue;
- 8 500 vehicles per day and 730 vehicles per hour on Ulan Road near Lue Road; and
- 900 vehicles per day and 80 vehicles per hour on Ulan Road north of Ulan.

During the peak site establishment and construction stage, the Levels of Service on Lue Road, Ulan Road and Castlereagh Highway would remain acceptable.

With the combined effects of changes to major developments in the region, background traffic growth to 2031 and the Project-related traffic, on a busy weekday during the ongoing operational stage of the Project, the roads in the region are forecast to carry in the order of:

- 190 vehicles per day and 30 vehicles per hour on the relocated Maloneys Road;
- 180 vehicles per day and 40 vehicles per hour on Pyangle Road;
- 1 200 vehicles per day and 120 vehicles per hour on Lue Road through Lue;
- 10 500 vehicles per day and 900 vehicles per hour on Ulan Road near Lue Road; and
- 1 400 vehicles per day and 110 vehicles per hour on Ulan Road north of Ulan.

During the operational stage peak hours for Project-related traffic generation, acceptable Levels of Service are anticipated on Lue Road, Ulan Road and Castlereagh Highway. No additional midblock road capacity is required as a result of the Project-generated traffic.

Road Design

The relocated Maloneys Road and mine access road would be constructed to a general carriageway width of 11.0 m, consistent with Austroads requirements for rural roads carrying more than 15 per cent heavy vehicles, and would be designed to meet the Austroads sight distance requirements for both cars and trucks.

To accommodate the short-term use of Pyangle Road and Maloneys Road for site access during the initial six months of the site establishment and construction stage, localised widening of the carriageway would be undertaken to provide suitable passing opportunities for heavy vehicles.

Intersection Treatments

The conceptual design of the new intersection of Lue Road and the relocated Maloneys Road includes channelised left and right turn lanes in Lue Road, which exceeds the minimum requirements for the intersection based on forecast traffic volumes. The detailed design would be developed in accordance with Austroads design requirements, taking into consideration the swept paths of B-doubles turning in and out of Lue Road and the sight distance requirements based on the design speeds on the approach roads.

The conceptual design of the new intersection of the relocated Maloneys Road and the mine access road is consistent with Austroads' basic rural road intersection treatments based on the forecast traffic volumes at the intersection. The detailed design would be developed in accordance with Austroads design requirements, taking into consideration the swept paths of B-doubles turning in and out of the mine access road and the sight distance requirements based on the design speeds on the approach roads.

The new intersection of the relocated Maloneys Road and the TSF embankment access road would include Austroads' basic rural road intersection treatments based on the forecast traffic volumes at the intersection. The detailed design would be developed in accordance with Austroads design requirements, taking into consideration the swept paths of B-doubles turning in and out of the TSF embankment access road and the sight distance requirements based on the design speeds on the approach roads.

The existing intersection of Lue Road with Pyangle Road warrants a BAL and BAR treatment in Lue Road. It has a widened unsealed shoulder for left turns into Pyangle Road but would require widening of the shoulder on the southern side of Lue Road to achieve a BAR treatment. This is the minimum preferred treatment which is warranted without the Project-generated traffic.

Car Parking

Car parking would be provided on the Mine Site to meet the anticipated peak demands. Temporary car parking facilities would be provided within the Mine Site during the site establishment and construction stage. During the operational stage, car parking for employees and visitors, and set down and pick up facilities for the buses would be located within the administration area.

Oversize Vehicles

The proposed movement for any oversize vehicles would be negotiated with RMS and MWRC on a case-by-case basis, and would be undertaken in accordance with the relevant requirements of the regulatory authorities.

Dangerous Goods

Dangerous goods required for the Project would be transported in accordance with the *Australian Code for the Transport of Dangerous Goods by Road and Rail* and the current State legislation, including the *Dangerous Goods (Road and Rail Transport) Act 2008* and the *Dangerous Goods (Road and Rail Transport) Regulation 2014.*

Local Impacts of Mineral Concentrate Transport

All vehicles involved in mineral concentrate transport would travel from the Mine Site to Lue Road without passing through Lue.

The roads through Mudgee which would be used for the transport of mineral concentrates are part of the RMS approved B-double route, and the small number of additional B-double movements generated by the Project would have negligible impact on the operation of the amenity of local residents or the operation of key intersections.

Product despatch to Newcastle would use semi-trailers which would travel via Ulan Road north of Lue Road to access Golden Highway and New England Highway.

Traffic Management Plan

Bowdens Silver would develop and implement a Project Traffic Management Plan which would apply to all light and heavy vehicles operated on the public road network by employees or contractors engaged by Bowdens Silver for transport tasks associated with the Project.

1. INTRODUCTION

Bowdens Silver Pty Ltd (Bowdens Silver), proposes to develop and operate an open cut silver mine and associated infrastructure, in an area approximately 2 km northeast of Lue and 26 km east of Mudgee within the Mid-Western Regional Local Government Area (LGA) of New South Wales (see **Figure 1**). The proposed mine and its associated infrastructure (the "Project") are located on Bowdens Silver-owned land, land under option to purchase, or land the subject of agreements with Bowdens Silver.

The Project is a State Significant Development pursuant to the *State Environmental Planning Policy (State and Regional Development) 2011* by virtue of the Project having a capital investment value greater than $30 million. The Project Development Application (DA) will therefore require assessment under Division 4.7 of Part 4 of the EP&A Act. The consent authority for the Project will be the Minister for Planning and Environment or the Independent Planning Commission acting under delegation from the Minister.

This report has been prepared on behalf of Bowdens Silver to present the results of an assessment of the road transport implications of the Project. This report accompanies an Environmental Impact Statement (EIS) prepared in accordance with the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), with reference to the road transport components of the Secretary's Environmental Assessment Requirements (SEARs) issued for the Project by the Department of Planning and Environment as well as issues identified by the Roads and Maritime Services (RMS), the former Department of Education and Communities and Mid-Western Regional Council (MWRC) with respect to traffic and transport-related matters identified by the Lue and district community.

Coverage of the road transport components of the Government Agency requirements within this report is outlined in **Table 1** whilst **Table 2** presents coverage relating to those matters identified by the Lue and district community.

The remainder of this report is set out as follows.

- Section 2 presents an overview of the Project, to provide the context of its possible impacts on the road transport environment.
- Section 3 describes the existing road environment conditions in the vicinity of the Mine Site, including the road network, traffic volumes and composition, historical growth in traffic, road safety history, and the capacity of the road network.
- Section 4 assesses the traffic generation of the Project during its construction and operational stages, and the distribution of that traffic on the road network.
- Section 5 presents forecasts of future changes to the road environment which are unrelated to the Project but are planned or expected to occur.
- Section 6 assesses the Project's impacts upon the future road transport environment and identifies the mitigation measures required to minimise adverse transport-related impacts of the Project.
- Section 7 presents the conclusions to the study.

Figure 1 Locality Plan

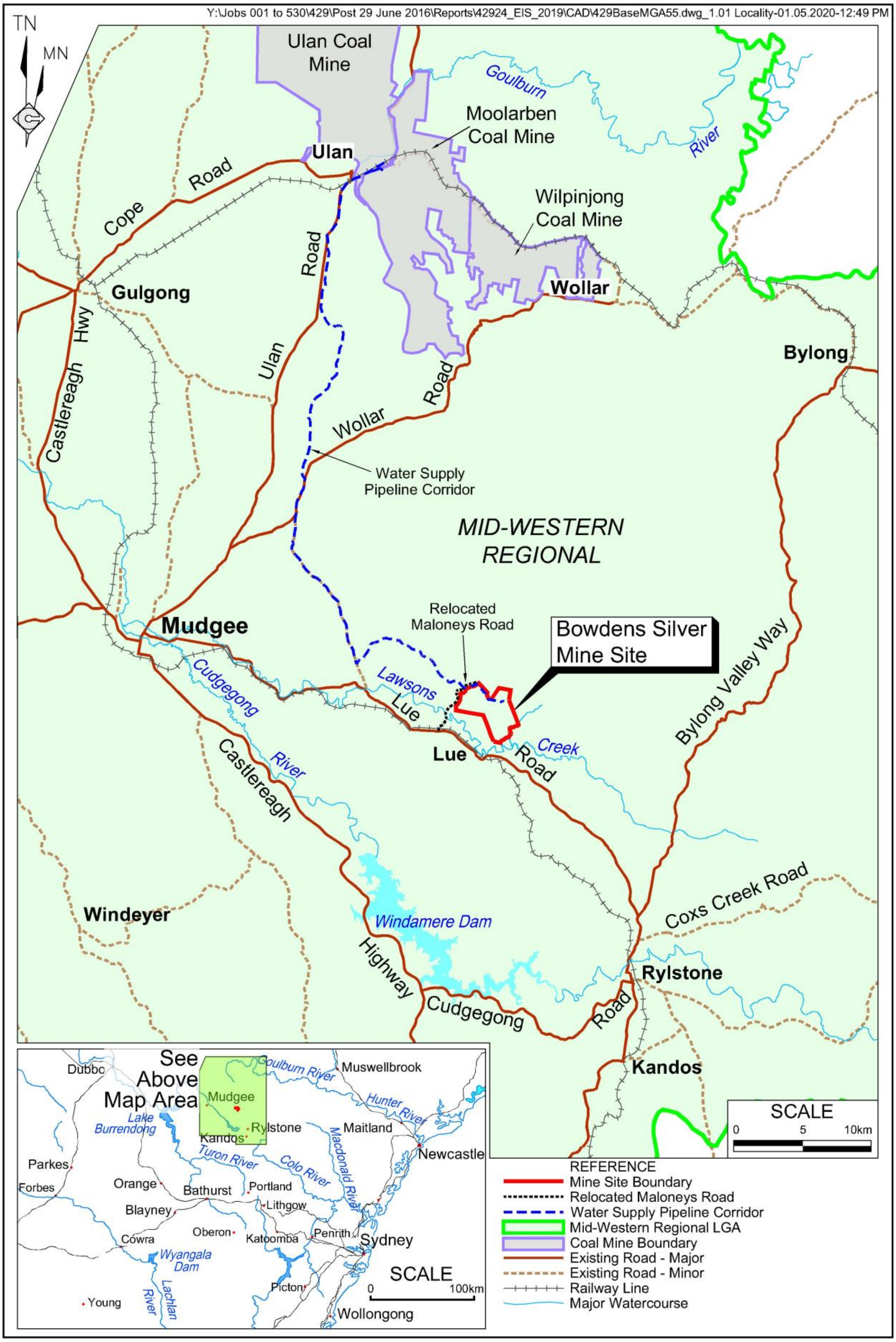

Table 1
Coverage of SEARs and Other Government Agency Requirements

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<table>
<tr><th colspan="2">Relevant Requirement(s)</th><th>Coverage in Report</th></tr>
<tr><td colspan="3">Secretary’s Environmental Assessment Requirements</td></tr>
<tr><td colspan="2">The EIS must include an assessment of the likely transport impacts of the development on the capacity, condition, safety and efficiency of the local and State road network, having regard to Mid-Western Regional Council’s and RMS’s requirements.
The SEARs refer to the following list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the environmental assessment of this development:
• Guide to Traffic Generating Developments 2002 (RTA)
• Austroads Guide to Road Design and RMS supplements to road design
• Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development.</td><td>This report has been prepared with consideration to these and other relevant guidelines described in Section 8</td></tr>
<tr><td colspan="3">Relevant Requirements Nominated by Other Government Agencies</td></tr>
<tr><td rowspan="9">Roads & Maritime Services 29/01/13</td><td>Prepare a traffic impact study in accordance with the methodology set out in Section 2 of the RTA's Guide to Traffic Generating Developments and including:</td><td></td></tr>
<tr><td>• hours and days of construction and operation for each stage of the project and how proposed operations will interact with other road users;</td><td>Sections 4 and 6</td></tr>
<tr><td>• road transport volumes and types broken down into origin and destination, travel routes, peak hours for the construction, operation and decommissioning of the project. The study should provide details of projected transport operations including volumes of traffic and tonnage to be transported. Volumes should also include mine input related traffic generation (e.g. fuel deliveries, potable water deliveries, maintenance, services) and impacts of mine related traffic generation on public roads. The traffic study should address internal traffic movements and parking facilities;</td><td>Sections 4 and 6.12</td></tr>
<tr><td>• any oversize and over-mass vehicles and loads expected for the construction, operation or decommissioning of the project;</td><td>Sections 4.1.3, 4.1.5 and 4.2.6</td></tr>
<tr><td>• the shortest and least trafficked route having been given priority for the movement of construction materials and machinery to minimise the risk and impact to other motorists so far as is reasonably practicable;</td><td>Sections 2.2, 2.4, 4.1.1 and 4.2.1</td></tr>
<tr><td>• temporary and permanent staff numbers (including employees and contractors) and staff parking arrangements during construction, operation and decommissioning of the project. Modes and volumes of transportation of mining staff to and from the site, details of measures proposed to minimise staff commuter traffic on the local and classified road network and measures to improve commuter safety should also be included;</td><td>Sections 2.3, 4.1.2, 4.2.2 and 6.12</td></tr>
<tr><td>• the impact of generated traffic and measures employed to ensure efficiency and safety on the public road network during construction, operation and decommissioning of the project;</td><td>Sections 6.1 to 6.8</td></tr>
<tr><td>• any mitigating measures required to address expected traffic generation;</td><td>Sections 6.9 to 6.16</td></tr>
<tr><td>• local climate conditions that may affect road safety for vehicles used during construction and operation of the project (e.g. dust, fog, wet weather, etc.).</td><td>Section 3.12</td></tr>
</table>

Table 1 (Cont'd)
Coverage of SEARs and Other Government Agency Requirements

Page 2 of 2

Relevant Requirement(s)		**Coverage in Report**
Relevant Requirements Nominated by Other Government Agencies (Cont'd)		
Roads & Maritime Services 29/01/13 (Cont'd)	• Proposed access treatments should be identified and be in accordance with Austroads Guide to Road Design 2010 and RMS Supplements including safe intersection sight distance;	Sections 6.10.3 and 6.10.4
	• Details of any required infrastructure works to support any increased demand on the road network as a result of this project. Alternative transport modes such as rail should also be explored.	Sections 6.9 to 6.16
Roads and Maritime Services 15/02/13	Prepare a Safety Audit of roads between the proposed mine site and Mudgee.	Annexure 4
Roads and Maritime Services 07/05/19	• Details of pipeline crossings and encroachments of/within classified roads. Details are to include locations, depths and minimum clearances.	See EIS Section 2.10.3
	• Prior to the installation of pipe within classified road reserves, pursuant to section 138 of the Roads Act 1993, the prior consent of Mid-Western Regional Council with Roads and Maritime concurrence, is required.	See EIS Section 2.10.3
Department of Education and Communities 13/02/13	Assess potential impacts from the number and timing of private traffic trips per annum from mine staff passing the school site during operation and construction periods.	Section 6.7
	Describe the route, number, timing and type of heavy vehicle trips per annum to transport mine materials that passes the school site during construction and operation periods.	Section 4.2.5
Mid-Western Regional Council 14/03/13	Assess the potential impact of traffic movements (type and frequency) that are anticipated for the whole of the period of the construction and operation of the project including commuter traffic, transport of equipment and the transport of concentrates.	Sections 4 and 6
	Assess the potential impact to roads from changes to traffic including in this assessment all roads, intersections, culverts* and bridges*.	Section 6
	Assess the potential impact to traffic flow through those towns and villages.	Section 6.1, 0
	Ensure roads comply with Austroads standards in terms of traffic volumes including consideration of heavy haulage.	Sections 6.9 and 6.10
	Assess the potential impact and identify any required mitigation procedures for the transportation of hazardous materials along the proposed haulage routes.	Section 6.14
	Ensure applicable criteria are met for road dilapidation upgrades, maintenance and the re-alignment of any roads including Maloneys Road	See EIS Section 2.9
* Beyond the scope of the Traffic Assessment		

Table 2
Issues Raised by Lue and District Community

Issue(s)	Coverage in Report
Traffic impact to existing roads in the mine vicinity and potential mitigation options, e.g. road sealing.	Section 6
Hazardous material, e.g. cyanide transportation in accordance with applicable codes.	Section 6.14
The effect of the mine on traffic levels.	Section 6
How would the concentrate be transported from the Mine Site?	Sections 2.4 and 4.2.5
What contingencies would be implemented to ensure the concentrate doesn't escape in the event of a vehicular accident? Would the concentrate be sealed?	Sections 2.4, 4.2.5 and 6.14
Would the transport of cyanide to the site and its handling be covered by the International Cyanide Management Code?	See SCSC* Part 4
We are concerned about the increased traffic during construction and operational phases. How much extra traffic would there actually be?	Sections 4 and 6.1
Do the local roads have the capacity to cope with the extra traffic?	Sections 6.4 and 6.5
Would transport hours be restricted?	Section 4
What is the proposed transport route?	Sections 2.4, 4.1.1 and 4.2.1
Where would the new access road be located?	Figure 2
We are concerned about the preferred location of the intersection of Lue Road and the new access road. Can this be moved further west for safety reasons and to reduce noise?	Figure 2
There are frequent fogs at the proposed location of the intersection – would this be considered in the design?	Section 3.12
We are concerned that the new access road would be located near the waste facility which wouldn't be safe – what options are Bowdens Silver considering?	Figure 2
Would the new access road be sealed?	Section 6.9
What road improvements would be carried out?	Sections 6.9, 6.10 and 6.11
Who would maintain the roads used by trucks?	See EIS Section 4.12.4.2
Would adequate signage be provided to ensure safety for other drivers and pedestrians?	Section 6.16
How would driver speed and behaviour be managed?	Section 6.15
Would truck drivers obey the road rules? We don't think they would.	Section 6.15
Would a detailed Hazard Assessment be included in the EIS?	See EIS Section 4.16
How many trucks would there be down Lue Road per day?	Section 4.1.5 and 4.2.6
B-doubles are not permissible on Lue Road, would you be doing road works?	Section 3.1
What roads would they be using to go through Mudgee?	Section 2.4
Where would be the transfer point between trucks and rail?	Section 2.4
To get to Parkes, would you go through Dubbo? Would you improve those roads?	Section 2.4
*SCSC = Specialist Consultant Studies Compendium	

2. THE PROJECT

2.1 OVERVIEW OF THE PROJECT

The seven principal components within the Mine Site are:

i) a main open cut pit and two satellite open cut pits, collectively covering approximately 52 ha;

ii) a processing plant and related infrastructure covering approximately 22 ha;

iii) a waste rock emplacement (WRE) covering approximately 77 ha;

iv) a low grade ore stockpile covering approximately 14 ha (9 ha above WRE)[1];

v) an oxide ore stockpile covering approximately 8 ha;

vi) a tailings storage facility (TSF) covering approximately 117 ha; and

vii) the southern barrier to provide visual and acoustic protection to properties south of the Mine Site covering approximately 32 ha.

The above components would be supported by a range of on-site and off-site infrastructure. The on-site infrastructure comprises haul roads, water management structures, power/water reticulation, workshops, stores, compounds and offices/amenities. The off-site infrastructure comprises a relocated section of Maloneys Road (including a new railway bridge crossing and new crossing of Lawsons Creek, see Section 2.2), a 132 kV power line and a water supply pipeline for the delivery of water from the Ulan Coal Mine and/or Moolarben Coal Mine to the Mine Site. **Figure 2** displays the indicative locations of the principal mine components. It is noted that the 132kV power line required for the mine power supply would be the subject of a Part 5 application submitted under the *Environmental Planning and Assessment Act 1979* (EP&A Act) to the relevant energy provider.

The Project would incorporate conventional open cut pits (one main and two smaller, satellite pits), from which overburden/waste rock is removed from above and around the silver-zinc-lead ore and either used for on-site construction activities or placed in the out-of-pit WRE or the southern barrier. The mined ore would be transported by haul trucks to the on-site processing plant where it would be crushed, milled and processed to liberate the silver, zinc and lead minerals. These minerals would be collected by conventional froth flotation to produce two concentrates that would be dewatered and transported off site by truck. The residual materials from processing (tailings) would be pumped in the form of a slurry to a TSF located to the west of the main open cut pit.

The Project would require a site establishment and construction period of approximately 18 months during which the processing plant and all related infrastructure and the initial embankment of the TSF would be constructed. Once operational, Bowdens Silver anticipates the mine would produce concentrates for approximately 15 years. In total, it is proposed the mine life would be approximately 16.5 years, i.e. from the commencement of the site establishment and construction stage to the completion of concentrate production. It is envisaged rehabilitation activities would be completed over a period of approximately seven years, i.e. from Year 16 to Year 23. **Figure 3** displays the duration of each of the main components throughout the mine life and Project life.

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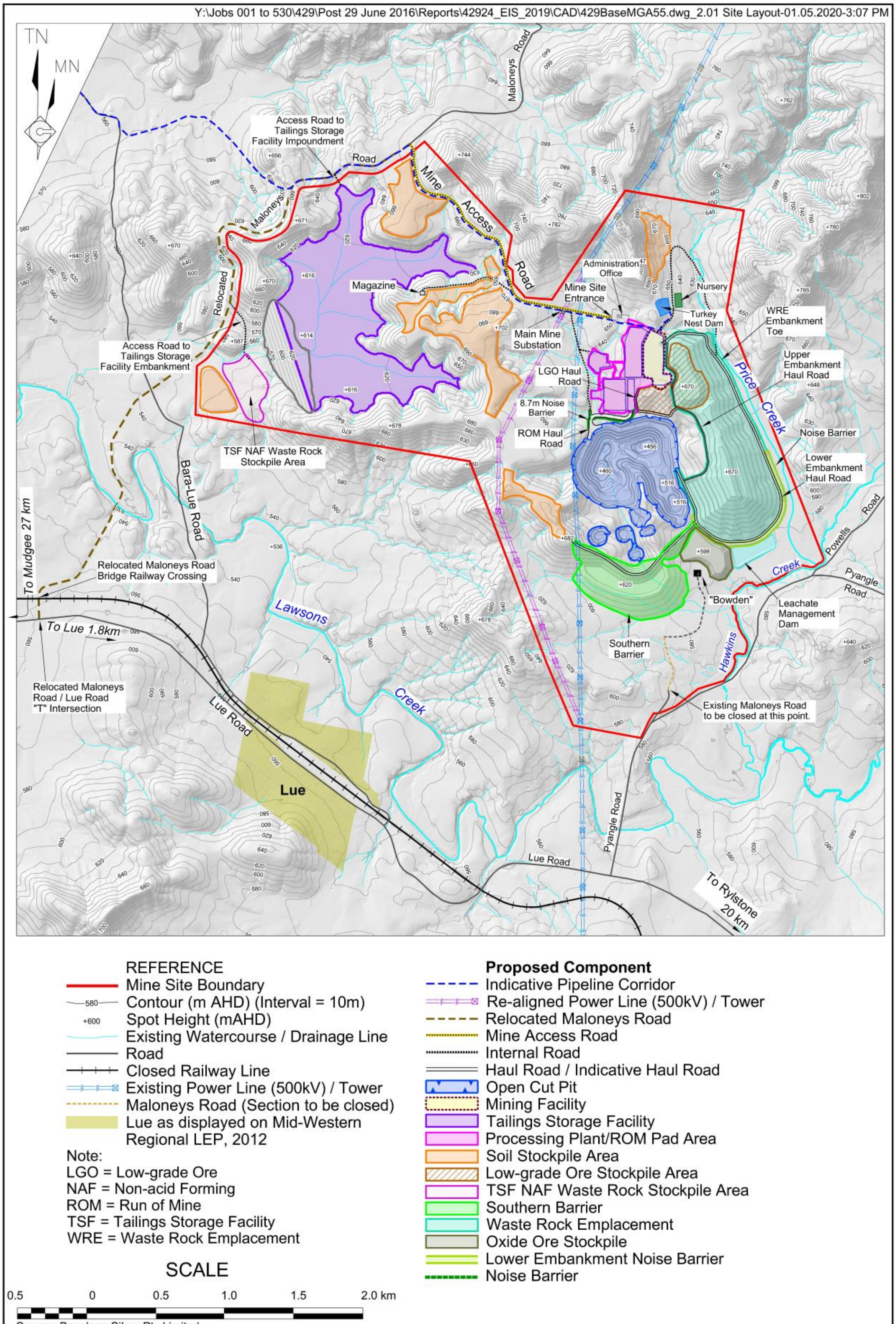
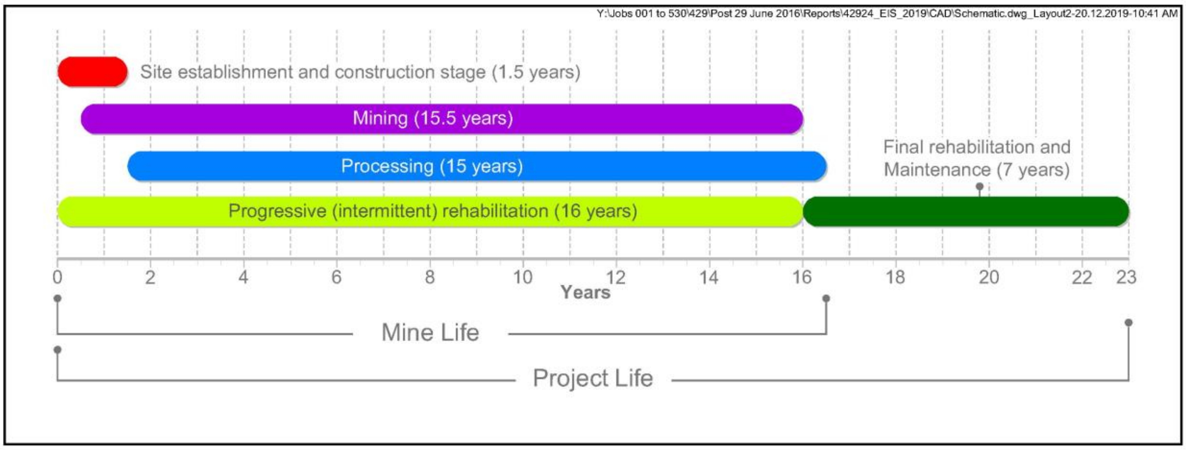
[1] The low grade ore stockpile would be constructed adjacent to but largely upon the northern sections of the WRE.

Figure 2 Mine Site Layout



Source: Bowdens Silver Pty Limited

Figure 3 Mine Life and Project Life



2.2 MINE SITE ACCESS

Access to the Mine Site would be via a relocated section of Maloneys Road and the mine access road.

The 5.2 km section of relocated Maloneys Road would provide a vehicular connection between the existing Maloneys Road at the mine access road, approximately 5 km north of its intersection with Pyangle Road to a new intersection with Lue Road, approximately 1.8 km west of Lue.

The mine access road would provide the primary vehicular access to the Mine Site, extending from the existing Maloneys Road at Blackmans Gully at the north-eastern boundary of the Mine Site to the entrance of the Mine Site. The mine access road would follow the existing general alignment of the northern section of Maloneys Road within the Mine Site, which would be closed to the public. Whilst the southern 1.2 km length of the existing section of Maloneys Road immediately north of Pyangle Road would be closed to the public, it would be retained as a secondary access to the Mine Site and the offices of Bowdens Silver's exploration team.

During the early stages of the site establishment and construction stage (i.e. Month 1 to Month 6), the existing road network would provide access to the Mine Site. This access would be via Lue Road, Pyangle Road and Maloneys Road. During the latter stages of the site establishment and construction stage (i.e. from Month 7), and throughout the Project life, primary vehicular access would be via Lue Road, relocated Maloneys Road and the mine access road.

Vehicular and personnel access to the operational areas of the Mine Site would be controlled by a security gate system at the entrance of the Mine Site, approximately 2.2 km from the intersection of the mine access road and relocated Maloneys Road. A locked gate and grid would be located north of Pyangle Road on the secondary access road to the Mine Site.

During construction of the initial TSF embankment, as well as the second and third raises of the TSF embankment, vehicular access to the TSF embankment is proposed via a haul road which intersects the relocated Maloneys Road approximately 1.4 km south-west of the mine access road.

2.3 PROJECT WORKFORCE

During the 18-month site establishment and construction stage, the Project would employ an average of 150 people based at the Mine Site for site establishment and construction activities. The number of workers on site would vary throughout this stage, with a peak of approximately 248 workers on site during Month 13 of the construction stage. The site establishment and construction workforce would consist of:

- employees of the contractor appointed to manage the engineering, procurement and construction activities, (likely to be based either in Sydney, Newcastle, Wollongong or interstate);
- employees of local contractors and service providers (either employed directly or sub-contracted) to undertake specific tasks, such as site earthworks, crushing and screening of construction materials, TSF construction and processing plant installation; and
- employees of Bowdens Silver, drawn from local towns, villages and surrounds.

Once operational, the Project is expected to employ approximately 190 to 228 personnel throughout the Project life. These personnel would be employed directly by Bowdens Silver or through the mining contractor or other contractors employed on site.

Mudgee is the largest centre in the local area from which the workforce is likely to be drawn and/or live, however a component of experienced mining and other personnel are anticipated to be drawn from the east in the Rylstone and Kandos area. Bowdens Silver has advised that it expects that approximately 65 percent of the workforce would reside to the west of Lue, and 35 percent to the east.

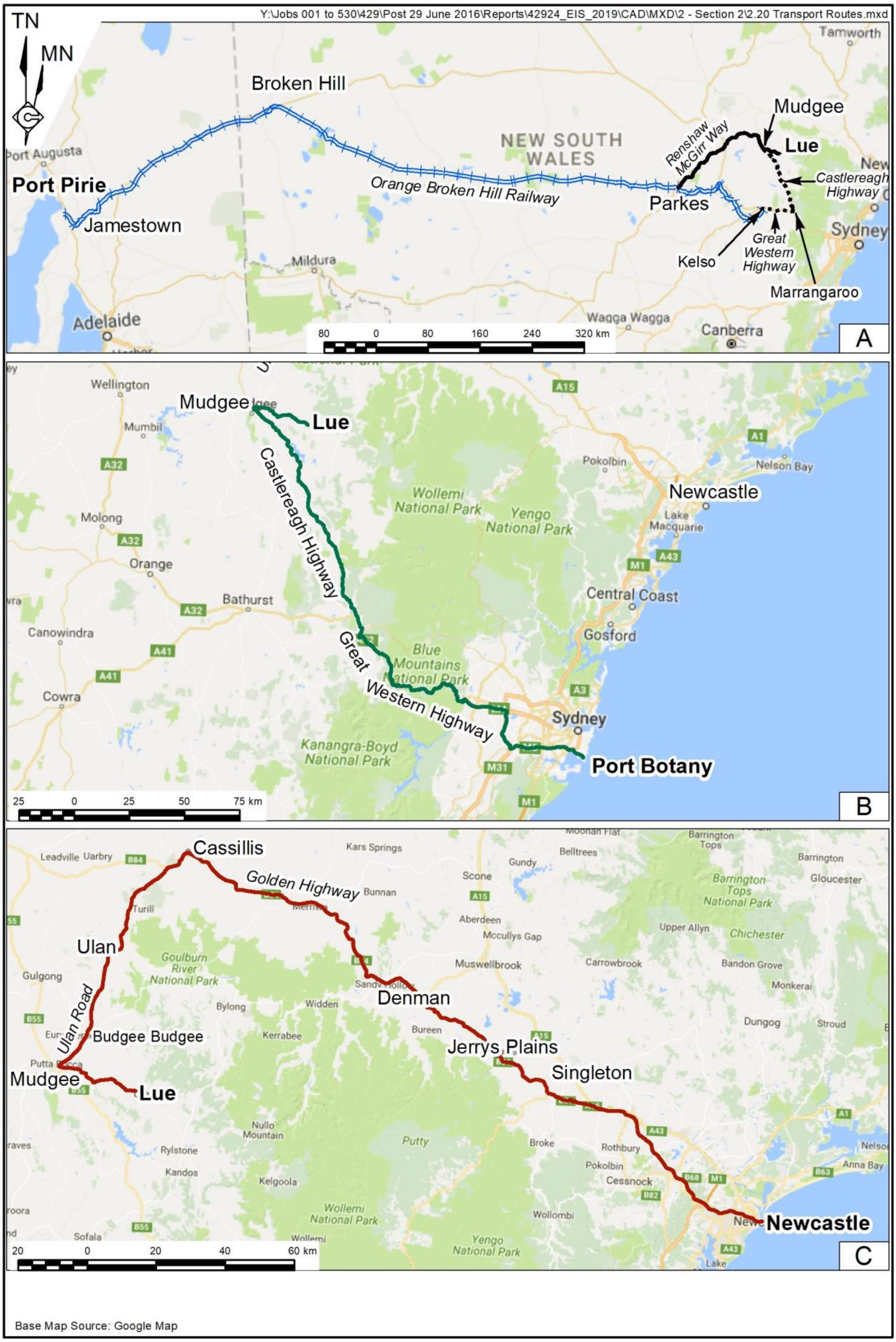
2.4 CONCENTRATE DESPATCH AND TRANSPORT ROUTES

Based on the annual production of between 20,000 tonnes (t) and 30,000 t of mineral concentrates, average daily product despatches would be approximately one to three truckloads generating two to six heavy vehicle movements Monday to Saturday, public holidays excluded. B-double trucks and semi-trailers would be used to transport the concentrate containers in order to maximise the load carried and minimise the number of truck movements.

The silver/lead concentrate would be transported in 2 t capacity sealed bulk bags that would be loaded by forklift into 6.1 m shipping containers for despatch to the lead smelter in Port Pirie in South Australia, approximately 1,350 km from the Mine Site. Each shipping container destined for Port Pirie would be loaded with approximately 22 t of concentrate and each truck carrying silver/lead concentrate would carry two shipping containers, i.e. approximately 44 t of concentrate per load. Shipping containers bound for Port Pirie would be transported by road from the Mine Site to either Parkes or Kelso (near Bathurst, see **Figure 4**, inset A) and from either Parkes or Kelso by rail to Port Pirie. In total, between approximately 200 and 290 loads of silver/lead concentrate would be despatched annually or one or two loads per day.

The zinc concentrate would be transported by road in sealed containers to either Port Botany (see **Figure 4**, inset B) or the Port of Newcastle (see **Figure 4**, inset C) for shipment to an overseas zinc refinery. The number of loads of zinc concentrate despatched would be between approximately 280 and 410 per year or one or two loads per day.

Figure 4 Concentrate Transport Routes



Base Map Source: Google Map

The proposed haulage route to Parkes would be via:

- mine access road;
- relocated Maloneys Road;
- Lue Road;
- Ulan Road;
- Short Street;
- Duoro Street;
- Market Street – Castlereagh Highway;
- Goolma Road;
- Mitchell Highway (A32); and
- Renshaw McGirr Way.

The proposed haulage route to Kelso would be via:

- mine access road;
- relocated Maloneys Road;
- Lue Road;
- Ulan Road;
- Short Street;
- Duoro Street;
- Market Street – Castlereagh Highway;
- Castlereagh Highway; and
- Great Western Highway.

The proposed haulage route to Port Botany would be:

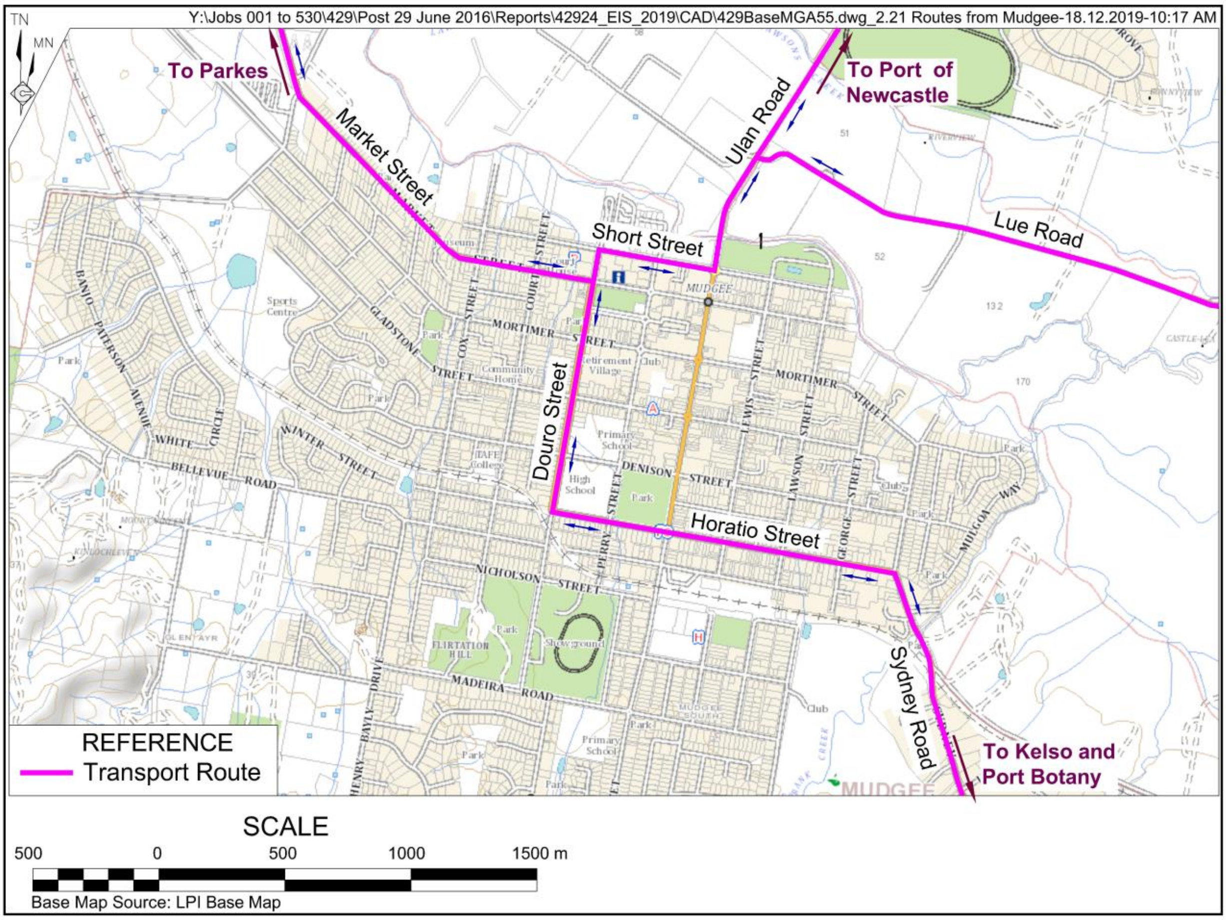
- mine access road;
- relocated Maloneys Road,
- Lue Road;
- Ulan Road;
- Short Street – Douro Street – Horatio Street – Sydney Road – Castlereagh Highway (B55);
- Great Western Highway (A32);
- M4 Western Motorway;
- Westlink M7;
- M5 Motorway;
- General Holmes Drive;
- Foreshore Road; and
- Botany Road.

The proposed haulage route to the Port of Newcastle would be:

- mine access road;
- relocated Maloneys Road;
- Lue Road;
- Ulan Road;
- Golden Highway (B84) – Jerrys Plains Road – Putty Road – Mitchell Line of Road;
- New England Highway (A15);
- M15 Hunter Expressway;
- John Renshaw Drive (B68-A1);
- New England Highway;
- Maitland Road; and
- Industrial Drive.

Heavy vehicle transport routes through Mudgee are shown on **Figure 5**.

Figure 5 Heavy Vehicle Transport Routes Through Mudgee



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2.5 ROAD TRANSPORT ASSESSMENT SCENARIOS

This road transport assessment has adopted the following scenarios to assess the potential traffic and transport impacts of the Project:

- Site establishment and construction stage – including peak construction activity at the Mine Site; and
- Operational stage – including operational activity combined with peak haulage of material to the TSF embankment.

The assessment considers the implications of other expected changes to the road transport environment as a result of other developments in the region and background growth in traffic between existing conditions and the assessment years above. These aspects are discussed in Section 5 of this report. This study assumes that the peak construction activity during the site establishment and construction stage would occur in 2021. The operational stage assessment is assumed to occur ten years after commencement of operations, i.e. in 2031.

3. EXISTING ROAD TRANSPORT ENVIRONMENT

This section describes the existing road network conditions in the vicinity of the Mine Site, including the road network, traffic volumes and composition, historical growth in traffic, road safety history, and the capacity of the road network.

3.1 ROAD NETWORK

The roads which provide access to and from the Mine Site are described below.

Lue Road provides a link between Ulan Road (MR208) near Mudgee in the west and Bylong Valley Way (MR215) near Rylstone in the east (refer to **Figure 1**). Lue Road provides the primary access to Lue, which lies approximately midway along Lue Road (refer to **Figure 2**). Through Lue, Lue Road is known as Swanston Street. Lue Road typically has a single travel lane in each direction, with a sealed road surface. In the vicinity of Lue, Lue Road has centreline marking, which varies between single dashed lines, single barrier/single dashed lines and double barrier lines at different locations.

Lue Road has a general posted speed limit of 100 kilometres per hour (km/h), reducing to 80 km/h on the approaches to Lue, and 60 km/h within Lue. A 40 km/h school speed zone operates on Lue Road during the morning and afternoon school periods (i.e. 8:00 am to 9:30 am and 2:30 pm to 4:00 pm) in the vicinity of the Lue Public School. A widened sealed shoulder area is provided adjacent to the school, which allows for parking off the main carriageway.

Lue Road is an approved B-double route for general mass limit (GML) B-double vehicles up to 25 m long between Ulan Road (MR208) and Bylong Valley Way (MR215). Use of Lue Road by such vehicles is subject to a speed limit of 80 km/h and only permitted outside of school bus operation times. The intersection of Ulan Road and Lue Road is controlled with a single lane roundabout which has been designed not to permit B-doubles to turn left from Ulan Road to Lue Road, i.e., B-double access to and from Ulan Road is restricted to right in, left out and right out movements only.

Pyangle Road extends northwards from Lue Road at a T-intersection about 1 km east of where Lue Road crosses under the railway trestle bridge near Half Acre Creek (refer to **Figure 2**). This road has an unsealed surface, with the exception of the short distance at its approaches to Lue Road and Maloneys Road. The road is signposted as being subject to flooding where it crosses Lawsons Creek, about 300 m from Lue Road. Pyangle Road has a posted speed limit of 100 km/h.

Maloneys Road currently provides light vehicle access to the Mine Site, and extends generally northwards from Pyangle Road and through the Mine Site to Bara Road near Bald Hill. Maloneys Road is an unsealed road, with no sign posted speed limit. As an unsealed road, the speed would typically be limited to 80 km/h. The intersection of Maloneys Road and Pyangle Road is a T-intersection, noting that Maloneys Road is aligned at an acute angle to Pyangle Road.

Bara-Lue Road is an unsealed road located west of Lue that intersects with Cox Street to the south and extends to Bara Road to the north-west. Approximately 1.6 km from Cox Street, Bara-Lue Road intersects with a private road at a T-intersection, at which Bara-Lue Road from the western and southern approaches, and the private road forms the northern approach. Currently there is a gated access at the private road north of Bara-Lue Road.

Ulan Road (MR208 and MR214) is a Regional road connecting Mudgee to the south and the Golden Highway at Cassilis to the north via Budgee Budgee and Ulan (refer to **Figure 4 - inset C**). North of Ulan, it is also known as Ulan-Cassilis Road. Ulan Road is a two-lane two-way undivided rural road, with bitumen seal and unsealed shoulders. Ulan Road is an approved B-double route for GML 25 m B-doubles between Mudgee and Golden Highway (HW27) at Cassillis, with no specific restrictions along that route. Golden Highway is also an approved route for GML 25 m B-doubles, with no specific travel restrictions.

Ulan Road typically has a posted speed limit of 100 km/h and reduces to 80 km/h and further to 50 km/h towards the town of Mudgee. Between Mudgee and the entrance to the Ulan Mine Complex underground and surface facilities, Ulan Road has been the subject of the *Ulan Road Strategy* (ARRB, 2011). Since that study was undertaken, some upgrading of Ulan Road has occurred, and Mid-Western Regional Council has plans to progressively upgrade that section of Ulan Road to address road delineation and pavement conditions and improve the safety of this road for all road users

Short Street, Douro Street, Horatio Street and Sydney Road (refer to **Figure 5**) are located within the town of Mudgee. These roads form part of the GML 25 m B-double route between the southern end of Ulan Road and Castlereagh Highway (HW18) southeast of Mudgee, with no specific travel restrictions. The general speed limit along these roads is 50 km/h, with a 40 km/h school speed zone (8.00 am to 9.30 am and 2.30 pm to 4.00 pm) on Douro Street adjacent to Mudgee Public School and Mudgee High School. Castlereagh Highway southeast and northwest of Mudgee is also an approved route for GML 25 m B-doubles, with no specific travel restrictions.

3.2 PEDESTRIAN FACILITIES

There are no formal pedestrian footpaths on either side of the roads in the vicinity of the Mine Site, nor in or around Lue. Pedestrian activity along Maloneys Road and Pyangle Road is negligible and formal facilities are not warranted along these unsealed roads.

3.3 PUBLIC TRANSPORT SERVICES

Ogden’s Coaches provides bus routes 560, 561, 562 and 563 around Mudgee, as shown in **Figure 6**. Services are infrequent with one or two services in the morning, and two or three services in the afternoon. Route 563 traverses the approved B-double route along Ulan Road, with a bus stop located south of Henry Lawson Drive.

Ogden’s Coaches also provides school bus services along Ulan Road and Lue Road, servicing various schools, and operating Monday to Friday only:

- MA2/MP2 Wollar–Mudgee schools via Ulan Road. The morning bus departs Wollar at 7:30 am and arrives at its first stop within Mudgee at 8:17 am. In the afternoon, it departs Mudgee at 3:39 pm and arrives at Wollar at 4:45 pm.
- MA5/MP5 Frog Rock–Mudgee schools via Ulan Road. The morning bus departs Frog Rock at 7:40 am and arrives at its first stop within Mudgee at 8:35 am. In the afternoon, it departs its last stop in Mudgee at 3:50 am and arrives at Frog Rock at 4:35 pm.

Figure 6 Bus Routes

Source: www.ogdenscoaches.com.au (last visited in August 2019)

- MA8/MP8 Totnes/Putta Bucca–Mudgee via Ulan Road. The morning bus departs Totnes at 7:43 am, and arrives at its first stop within Mudgee at 8:32 am (travelling via Putta Bucca and avoiding Ulan Road south of Henry Lawson Drive). The afternoon bus departs its last stop within Mudgee at 3:40 pm, and arrives at Totnes at 4:30 pm.
- MA12/MP12 Lue – Mudgee schools via Lue Road. The morning bus departs the corner of Lue Road and Pyangle Road at 7:50 am and arrives at its first stop within Mudgee at 8:33 am. The afternoon bus departs its last stop in Mudgee at 3:40 pm and arrives at the corner of Lue Road and Pyangle Road at 4:23 pm.

Lithgow Buslines provides a school bus service between Kandos and Rylstone to and from Lue Public School. The morning and afternoon bus routes operate along Lue Road, with side routes on Pyangle Road, and on Cox Street/Garner Street to pick up or set down students. The published timetables (www.buslinesgroup.com.au, viewed November 2019), indicate that the morning bus departs Rylstone at approximately 8:15 am and arrives at Lue Public School at 8:48 am. The afternoon bus departs Lue Public School at 3:03 pm, and arrives at Rylstone at approximately 3:35 pm.

Based on the above, it is expected that a school bus may be present on Lue Road to the west of Lue between approximately 7:50 am and 8:30 am, and between 3:40 pm and 4:30 pm, and a school bus may be present on Lue Road to the east of Lue between approximately 8:15 am and 8:50 am, and between approximately 3:00 pm and 3:35 pm. It is noted that restrictions apply for B-double vehicles on Lue Road during school bus operation times.

3.4 HISTORIC TRAFFIC VOLUMES

NSW Roads and Maritime Services (RMS) publishes traffic volume data at selected locations on its roads. Available data on roads in the vicinity of the Mine Site were collated for the period from 2002 to 2013. **Table 3** presents historic Annual Average Daily Traffic (AADT) data for the surveyed locations in the local area and shows how changes in daily traffic volumes have occurred on these roads over that period. It should be noted that the AADT represents the average number of axle pairs (rather than vehicles) passing in both directions during a 24 hour period, estimated over a period of one year.

The count stations generally exhibit an upward trend in traffic volumes between 2002 and 2013. The average annual linear growth rate over all the survey stations was 1.8 per cent per annum during this 11-year period, however this varied from route to route.

3.5 TRAFFIC SURVEY PROGRAM

To quantify current traffic conditions on the local roads in the vicinity of the Mine Site and within Mudgee as a baseline against which future conditions can be assessed, a program of traffic surveys was commissioned by TTPP. Automatic tube count surveys were completed over seven days between 15 February and 21 February 2017 (Sites 1 to 10), and between 4 May and 10 May 2017 (Site 11).

Table 3
Regional Historic Average Annual Daily Traffic Data (2002 to 2013)

RMS Count Station	Location	2002	2005	2008	RMS Estimated 2013	Linear Growth per annum
MR214 Cassilis Road						
99.221	Budgee Budgee – North of MR208 Mudgee Road	1 321	1 231	1 627	1 791	3.2%
99.511	Ulan – South of MR598 Gulgong Road	1 418	1 555	1 692	1 921	3.2%
99.509	Ulan – North of MR598 Gulgong Road	1 370	1 490	1 610	1 809	2.9%
MR208 Ulan Road						
99.286	East of MR215, Rylstone Road	151	115	126	120	-1.8%
99.287	North of MR 215, Rylstone Road	83	94	95	96	1.4%
99.289	24km north of MR214, Cassilis Road	238	249	261	280	1.6%
99.222	Budgee Budgee – 2.5km east of MR214	613	591	729	793	2.7%
99.290	Budgee Budgee – west of MR214, Cassilis Road	2 722	2 962	3 201	3 601	2.9%
99.906	Mudgee – north of Henry Lawson Drive	3 482	3 627	3 865	4 285	2.1%
99.168	Mudgee – north of Cudgegong River bridge	5 605	5 963	6 321	6 919	2.1%
99.291	Mudgee – north of Short Street	4 541	4 717	4 893	5 186	1.3%
Mudgee Road						
99.467	0.7km north of MR215 Rylstone Road	-	-	590	520	-2.4%
SH18 Castlereagh Highway						
99.922	1.2km South of Burrundulla Road	2 342	2 371	2 600	2 800	1.8%
Source: RMS						

The tube count surveys collected vehicle volume, classification and speed data at hourly intervals over the seven-day survey period at the following locations as shown in **Figure 8**.

1. Bara-Lue Road northwest of Lue;
2. Lue Road west of Lue;
3. Lue Road (Swanston Street) in Lue;
4. Cox Street in Lue;
5. Lue Road east of Lue;
6. Lue Road east of Pyangle Road;
7. Pyangle Road north of Lue Road;
8. Maloneys Road north of Pyangle Road;
9. Ulan Road 6 km north of Ulan;
10. Ulan Road 600 m north of Lue Road; and
11. Castlereagh Highway west of Hill End Road.

Vehicle turning movement surveys were also undertaken in Mudgee during the morning and afternoon periods on Thursday 4 May 2017 (Sites A to C), Wednesday 15 February 2017 (Site D) and Tuesday 3 July 2017 and Wednesday 4 July 2018 (Site E):

A. Church Street and Short Street;

B. Short Street and Douro Street;

C. Douro Street and Market Street;

D. Lue Road and Ulan Road; and

E. Douro Street and Castlereagh Highway.

The survey locations are presented in **Figure 7**, **Figure 8** and **Figure 9** and results are presented in Annexure 2.

3.6 DAILY TRAFFIC VOLUMES

Table 4 presents a summary of the daily traffic volumes collected during the traffic survey program using automatic tube counters in 2017. The data indicate that weekday volumes are distinctly different from weekend volumes, with weekend volumes being noticeably lower than weekday volumes. The surveys indicate that on weekdays:

- Lue Road carries in the order of 700 to 900 vehicles per day, with an average of 840 vehicles per day in Lue on weekdays;
- Ulan Road carries in the order of 8,000 to 8,800 vehicles per day north of Lue Road and 1,800 to 2,100 vehicles per day north of Ulan;
- the unsealed roads that connect with Lue Road carry an average of fewer than 110 vehicles per weekday, and

Castlereagh Highway west of Mudgee carries in the order of 4,350 vehicles per weekday.

Figure 7 Traffic Survey Locations

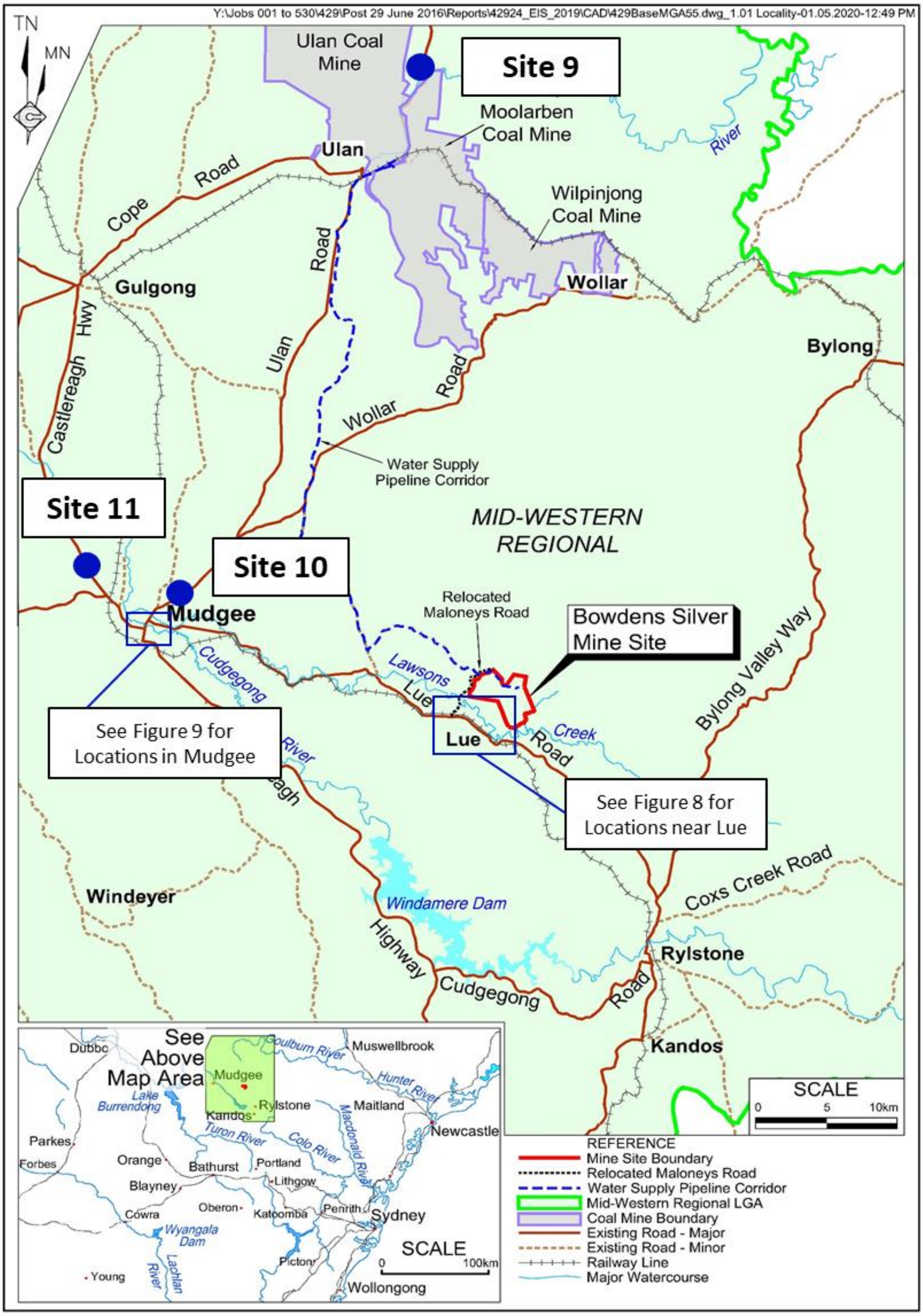

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Figure 8 Traffic Survey Locations near Lue

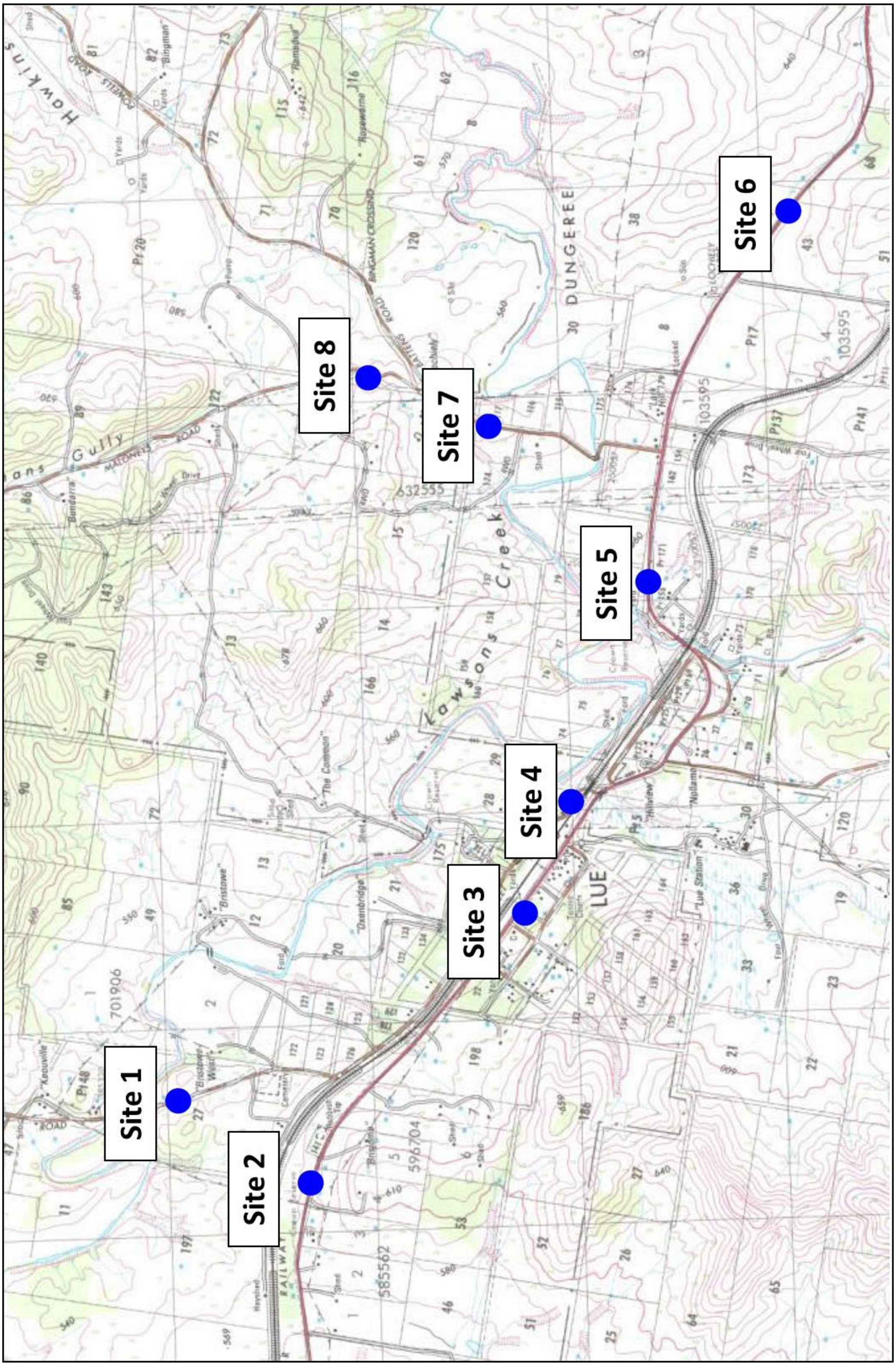

Figure 9 Traffic Survey Locations in Mudgee

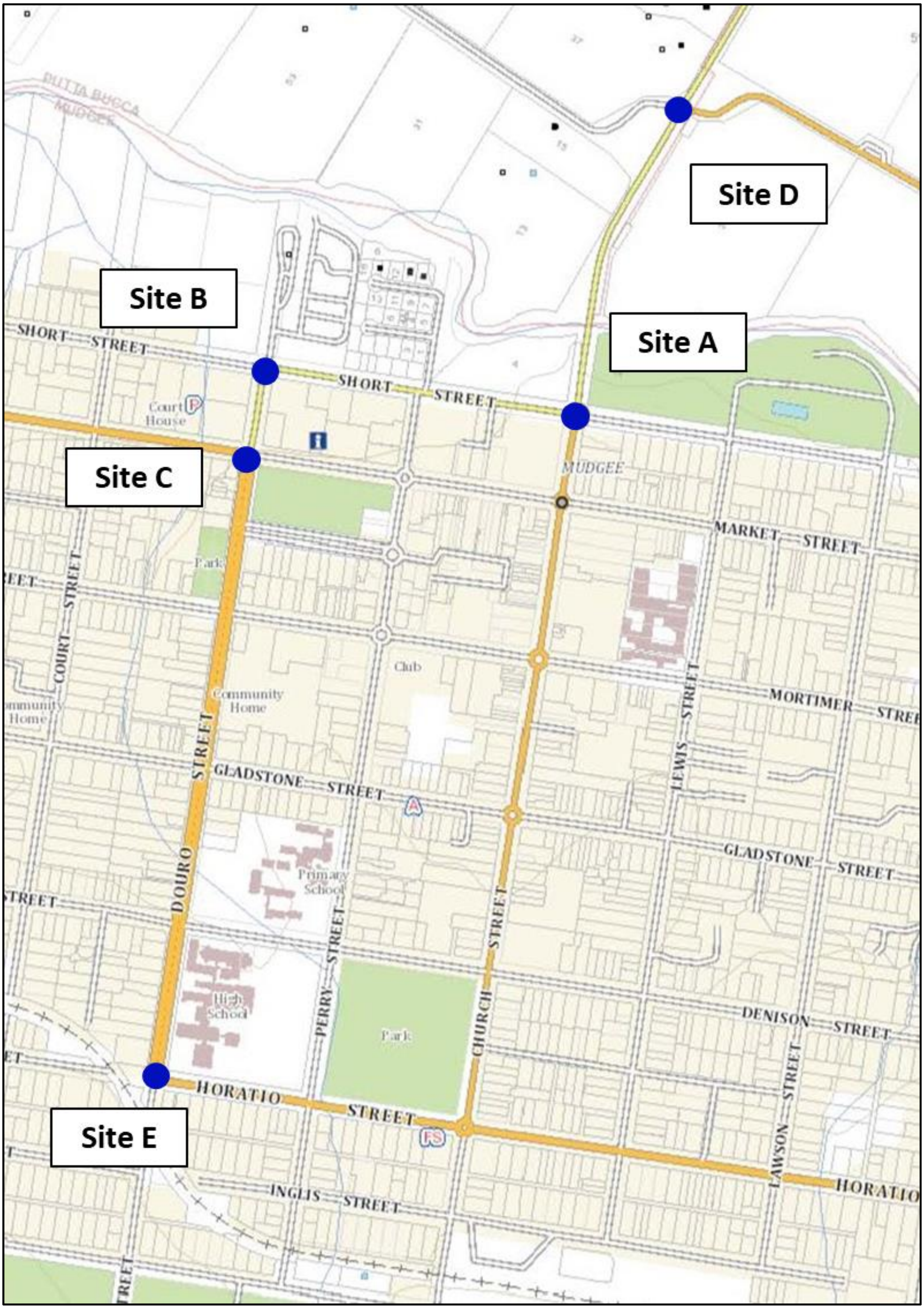

Table 4
Surveyed 2017 Daily Two Way Traffic Volumes (vehicles per day)

Location*		Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Average Weekday	Average Weekend	Average Day
1	Bara-Lue Road northwest of Lue	19	15	26	14	24	13	15	20	14	18
2	Lue Road west of Lue	803	894	915	889	884	709	554	877	632	717
3	Lue Road (Swanston Street) in Lue	766	869	855	859	852	691	543	840	617	776
4	Cox Street in Lue	30	35	61	24	49	43	35	40	39	40
5	Lue Road east of Lue	726	845	840	823	841	636	519	815	578	747
6	Lue Road east of Pyangle Road	687	797	774	769	785	596	493	762	545	700
7	Pyangle Road north of Lue Road	100	107	139	111	86	43	53	109	48	91
8	Maloneys Road north of Pyangle Road	71	86	97	109	85	31	31	90	31	73
9	Ulan Road north of Ulan	1 976	1 948	1 806	2 024	2 069	1 096	1 440	1 965	1 268	1 766
10	Ulan Road north of Lue Road	8 030	8 116	8 437	8 451	8 784	6 545	5 248	8 364	5 897	7 659
11	Castlereagh Highway west of Hill End Road	3 985	4 075	4 303	4 547	4 839	3 708	3 924	4 350	3 816	4 197

* See **Figure 7** and **Figure 8** for locations

3.7 TRAFFIC COMPOSITION

The surveys described in Section 3.5 also provide data on the composition of traffic on the roads, using the Austroads Vehicle Classification System. Light vehicles include motorcycles, cars, vans, 4WDs, and utilities (including those towing a trailer or caravan). Heavy vehicles include single unit trucks and buses with two to four axles and articulated vehicles such as semi-trailers, rigid trucks with trailers, B-doubles and road trains. **Table 5** summarises the composition of the traffic on the average weekday and Saturday over the survey period.

Table 5
Surveyed 2017 Average Weekday Daily Traffic Composition

Location*		Vehicles per Day			Percent of Total	
		Light	Heavy	Total	Light	Heavy
1	Bara-Lue Road northwest of Lue	15	5	20	75	25
2	Lue Road west of Lue	752	125	877	86	14
3	Lue Road (Swanston Street) in Lue	778	62	840	93	7
4	Cox Street in Lue	34	6	40	85	15
5	Lue Road east of Lue	735	80	815	90	10
6	Lue Road east of Pyangle Road	699	63	762	92	9
7	Pyangle Road north of Lue Road	88	21	109	81	19
8	Maloneys Road north of Pyangle Road	72	18	90	80	20
9	Ulan Road north of Ulan	1 375	588	1 965	70	30
10	Ulan Road north of Lue Road	7 362	997	8 364	88	12
11	Castlereagh Highway west of Hill End Road	3 769	580	4 350	87	13

Difference between the total vehicles and the sum of light and heavy vehicles is due to small numbers of unclassified vehicles.
* See **Figure 7** and **Figure 8** for locations

Table 5 demonstrates at on the average weekday, approximately 7 to 14 percent of vehicles on Lue Road are heavy vehicles, 11 to 30 percent of vehicles on Ulan Road are heavy vehicles, while heavy vehicles make up between 15 and 25 percent of vehicles on the side roads, noting that where small total volumes occur, the percentage contribution of heavy vehicles can be highly variable. Heavy vehicles made up about 13 percent of total traffic on the Castlereagh Highway west of Mudgee on average weekdays.

Table 6 demonstrates the difference between the types of vehicles at the survey locations on the surveyed Saturday.

Table 6
Surveyed 2017 Saturday Daily Traffic Composition

Location*		Vehicles per Day			Percent of Total	
		Light	Heavy	Total	Light	Heavy
1	Bara-Lue Road northwest of Lue	13	0	13	100	0
2	Lue Road west of Lue	626	83	709	88	12
3	Lue Road (Swanston Street) in Lue	658	33	691	95	5
4	Cox Street in Lue	36	7	43	84	16
5	Lue Road east of Lue	604	32	636	95	5
6	Lue Road east of Pyangle Road	565	31	596	95	5
7	Pyangle Road north of Lue Road	33	10	43	77	23
8	Maloneys Road north of Pyangle Road	25	6	31	81	19
9	Ulan Road north of Ulan	856	238	1 096	78	22
10	Ulan Road north of Lue Road	5 900	639	6 539	90	10
11	Castlereagh Highway west of Hill End Road	3 381	327	3 708	91	9

Difference between the total vehicles and the sum of light and heavy vehicles is due to small numbers of unclassified vehicles.
* See **Figure 7** and **Figure 8** for locations

On the surveyed Saturday, heavy vehicles accounted for between 5 and 12 percent of total traffic on Lue Road, between 10 and 23 percent of total traffic on Ulan Road, and between 0 and 25 percent of vehicles on the side roads. Heavy vehicles made up about 9 percent of total traffic on Castlereagh Highway on Saturdays.

Comparing the light and heavy traffic volumes in **Table 5** and **Table 6**, it is evident that the number of heavy vehicles on Saturday is lower than on the average weekday.

3.8 PEAK HOUR TRAFFIC VOLUMES

Table 7 presents the average weekday morning peak (AM Peak) and evening peak (PM Peak) hourly volumes measured at each of the survey locations. These are the highest total volume recorded in any one hour before midday and after midday over the average weekday. The results in **Table 7** demonstrate that on the average weekday, the traffic in Lue Road peaks generally between 8.00 am and 9.00 am and between 5.00 pm and 6.00 pm. The highest hourly traffic volume recorded on Lue Road was 78 vehicles per hour, which occurred west of Lue during the PM peak hour.

Table 7
Average Weekday Peak Hourly Two Way Traffic (vehicles per hour)

Location*		AM Peak Hour				PM Peak Hour			
		Hour Start	Light	Heavy	Total	Hour Start	Light	Heavy	Total
1	Bara-Lue Road northwest of Lue [A]	8:00	1	1	2	17:00	1	0	1
2	Lue Road west of Lue	8:00	63	13	76	17:00	67	11	78
3	Lue Road (Swanston Street) in Lue	8:00	71	4	75	17:00	69	6	75
4	Cox Street in Lue [A]	8:00	2	1	3	17:00	3	0	3
5	Lue Road east of Lue	8:00	62	7	69	17:00	66	5	71
6	Lue Road east of Pyangle Road	7:00	61	6	67	16:00	63	4	67
7	Pyangle Road north of Lue Road	7:00	11	2	13	16:00	10	1	11
8	Maloneys Road north of Pyangle Road	7:00	10	1	11	16:00	10	0	10
9	Ulan Road north of Ulan	6:00	116	44	160	15:00	121	40	161
10	Ulan Road north of Lue Road	8:00	575	66	641	17:00	653	67	720
11	Castlereagh Highway west of Hill End Road	8:00	328	45	373	16:00	339	42	381

[A] No distinct peak hour occurred due to very low volumes, recorded volumes are those for the same hours as the peak hours on Lue Road.

* See **Figure 7** and **Figure 8** for locations

The variation in hourly traffic on the minor roads is quite low throughout the average weekday, ranging between 0 and 11 vehicles per hour during these AM and PM peak hours.

Table 8 presents the Saturday peak hourly volumes measured at each of the survey locations.

The results demonstrate that on Lue Road on Saturdays, the typical morning peak hour occurs between 8.00 am and 9.00 am and the afternoon peak hour occurs between 1.00 pm and 2.00 pm. The peak hours for Ulan Road and Castlereagh Highway were more concentrated around the middle of the day. Peak hourly traffic volumes on Saturday were generally less than those recorded during the weekdays.

The distribution of traffic throughout the day was also notably different on Saturdays than on weekdays. The weekday traffic tends to display distinct morning and evening peaks, with a decline in traffic volumes through the middle of the day. On Saturday, there tends to be one distinct peak during the day, with that peak occurring between the times of the morning and evening weekday peaks.

Table 8
Saturday Peak Hourly Two Way Traffic (vehicles per hour)

Location*		AM Peak Hour				PM Peak Hour			
		Hour Start	Light	Heavy	Total	Hour Start	Light	Heavy	Total
1	Bara-Lue Road northwest of Lue [A]	8:00	1	0	1	13:00	0	0	0
2	Lue Road west of Lue	8:00	55	10	65	13:00	62	8	70
3	Lue Road (Swanston Street) in Lue	8:00 9:00	58 57	1 2	59 59	13:00	66	2	68
4	Cox Street in Lue [A]	7:00	4	0	4	13:00	4	0	4
5	Lue Road east of Lue	8:00	57	2	59	13:00	62	3	65
6	Lue Road east of Pyangle Road	8:00	53	2	55	13:00	58	3	61
7	Pyangle Road north of Lue Road	9:00	2	1	3	14:00	6	1	7
8	Maloneys Road north of Pyangle Road	7:00	4	1	5	12:00	4	0	4
9	Ulan Road north of Ulan	10:00	77	15	92	13:00	73	16	89
10	Ulan Road north of Lue Road	11:00	538	52	590	12:00	511	54	565
11	Castlereagh Highway west of Hill End Road	11:00	334	31	365	12:00	320	38	358

[A] No distinct peak hour occurred due to very low volumes, recorded volumes are those for the same hours as the peak hours on Lue Road.

* See **Figure 7** and **Figure 8** for locations

3.9 ROADWAY CAPACITY AND EFFICIENCY

Austroads (2017c) provides guidelines for the capacity and performance of two lane, two-way rural roads, and refers in turn to the Highway Capacity Manual (HCM) (Transportation Research Board, 2016), which is considered the primary reference document on this topic.

The capacity of a road is defined as the maximum hourly rate at which vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under the prevailing roadway, traffic and control conditions. The capacity of a single traffic lane is affected by factors such as the pavement width and restricted lateral clearances, the presence of heavy vehicles and grades.

Level of Service (LOS) is defined as a qualitative measure describing the operational conditions within a traffic stream as perceived by drivers and/or passengers. A LOS definition generally describes these conditions in terms of factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort, convenience and safety. LOS A provides the best traffic conditions, with no restriction on desired travel speed or overtaking. LOS B to D describes progressively worse traffic conditions. LOS E occurs when traffic conditions are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre in the traffic stream. The service flow rate for LOS E is taken as the capacity of a lane or roadway. In rural situations, LOS C is generally considered to be acceptable. At LOS C, most vehicles are travelling in platoons (i.e., in relatively close proximity to each other such that following vehicles travel at the speed of the lead vehicle) and travel speeds are curtailed. At LOS D, platooning increases significantly, and the demand for passing is high, but the capacity to do so is low.

The LOS experienced by drivers on two-way rural roads is dependent on the drivers' expectations regarding the road, and three classes of road are defined in the HCM. Class I roads are those on which motorists expect to travel at relatively high speeds. They most often serve long-distance trips or provide connecting links between facilities that serve long-distance trips. Class II roads are those on which motorists do not necessarily expect to travel at high speeds, and may function as access routes to Class I facilities, serve as scenic or recreational routes or pass through rugged terrain. Class III roads serve moderately developed areas, and may be portions of a Class I or Class II highway that pass through small towns or developed recreational areas, where local traffic mixes with through traffic, and the density of unsignalised roadside access points increases.

The primary determinant of a road's classification for operational analysis is the drivers' expectations, which may not necessarily agree with the functional classification. The surveyed roads serving the Project would typically be considered as Class II roads under the HCM descriptions, as drivers would expect some level of restriction to their freedom of movement along the routes as a result of characteristics of the route such as limits on the opportunities for overtaking (e.g. centre linemarking, sight distances, lack of overtaking lanes). Although Lue Road would generally be considered a Class II road, the surveyed location on Lue Road within Lue may be considered as a Class III road as it is located within Lue. It is noted however that the HCM method only applies to roads with speed limits of 45 mi/h (approximately 72 km/h) and above, while the speed limit in Lue is 60 km/h (and 40 km/h during the school speed zone periods). The assessment which follows assumes a posted speed limit of 70 km/h at this location, and therefore should be considered only a general guide to the LOS experienced.

On Class II roads, LOS is defined only in terms of Percent-Time-Spent-Following (PTSF). PTSF is a measure of the level of opportunities to overtake, and is estimated from the demand traffic volumes, the directional distribution of that traffic, and the percentage of no-passing zones. The LOS criteria for Class II and Class III two lane roads are as shown in **Table 9**.

Table 9
Level of Service Criteria for Two Lane Roads

Level of Service	Class II Roads Percent-Time-Spent-Following (PTSF)	Class III Roads Percent of Free Flow Speed (PFFS)
A	≤ 40	> 91.7
B	> 40 – 55	> 83.3 – 91.7
C	> 55 – 70	> 75.0 – 83.3
D	> 70 – 85	> 66.7 – 75.0
E	≥ 85	≤ 66.7

Table 10 presents the results of the assessment of average weekday midblock conditions for travel in each direction on the road network during the surveyed busiest hours using the HCM method. The results should be considered as being representative of the length of road indicated by the survey location rather than the specific surveyed location.

Table 10
Average Weekday Peak Hour Levels of Service on Lue Road and Ulan Road (2017)

Road and Location*		Class	Hour Start	Northbound or Eastbound		Southbound or Westbound	
				Criteria	LOS	Criteria	LOS
Weekday AM Peak Hour							
2	Lue Road west of Lue	II	8:00	19	A	37	A
3	Lue Road (Swanston Street) in Lue	III	8:00	93	A	93	A
5	Lue Road east of Lue	II	8:00	24	A	39	A
6	Lue Road east of Pyangle Road	II	7:00	36	A	27	A
9	Ulan Road north of Ulan	II	6:00	26	A	25	A
10	Ulan Road north of Lue Road	II	8:00	42	B	65	C
11	Castlereagh Highway west of Hill End Road	II	8:00	36	A	47	B
Weekday PM Peak Hour							
2	Lue Road west of Lue	II	17:00	37	A	17	A
3	Lue Road (Swanston Street) in Lue	III	17:00	93	A	93	A
5	Lue Road east of Lue	II	17:00	38	A	23	A
6	Lue Road east of Pyangle Road	II	16:00	27	A	35	A
9	Ulan Road north of Ulan	II	15:00	14	A	35	A
10	Ulan Road north of Lue Road	II	17:00	61	C	60	C
11	Castlereagh Highway west of Hill End Road	II	16:00	45	B	41	B

Refer to **Table 9** for criteria basis of each road Class
* See **Figure 7** and **Figure 8** for locations

Table 11 presents the results of the assessment of Saturday mid-block conditions at the surveyed locations on the road network during the surveyed busiest hours at each location.

Table 11
Saturday Peak Hour Levels of Service on Lue Road and Ulan Road (2017)

Road and Location		Class	Hour Start	Northbound or Eastbound		Southbound or Westbound	
				Criteria	LOS	Criteria	LOS
Saturday AM Peak Hour							
2	Lue Road west of Lue	II	8:00	17.7	A	36	A
3	Lue Road (Swanston Street) in Lue	III	11:00	93.6	A	93.6	A
5	Lue Road east of Lue	II	8:00	15.5	A	41.3	B
6	Lue Road east of Pyangle Road	II	8:00	40.8	B	15.5	A
9	Ulan Road north of Ulan	II	10:00	26.0	A	17.5	A
10	Ulan Road north of Lue Road	II	11:00	57.7	C	51.0	B
11	Castlereagh Highway west of Hill End Road	II	11:00	34.6	A	47.4	B
Saturday PM Peak Hour							
2	Lue Road west of Lue	II	13:00	34.4	A	21.7	A
3	Lue Road (Swanston Street) in Lue	III	13:00	27.2	A	35.2	A
5	Lue Road east of Lue	II	13:00	13.5	A	35.3	A
6	Lue Road east of Pyangle Road	II	13:00	27.3	A	34.4	A
9	Ulan Road north of Ulan	II	13:00	22.9	A	19.5	A
10	Ulan Road north of Lue Road	II	12:00	58.2	C	48.3	B
11	Castlereagh Highway west of Hill End Road	II	12:00	41.3	B	44.0	B

Refer to **Table 9** for criteria basis of each road Class
* See **Figure 7** and **Figure 8** for locations

The results in **Table 10** and **Table 11** indicate that drivers would generally experience satisfactory levels of service with regard to roadway efficiency and delays during the busiest hours. The level of service C on Ulan Road north of Lue Road assumes that section of road is considered a Class II road, while many drivers would perceive it as a Class III road due to its proximity to Mudgee. As a Class III road, the level of service at this location would be B.

It should be noted that this LOS is a general measure of the vehicle operating conditions on the roads with regard to the number of vehicles and their potential for interaction with each other. It does not reflect the existing road pavement conditions.

3.10 INTERSECTION TURNING MOVEMENTS

The results of the intersection turning movement surveys indicate that the hour during which the peak number of vehicle movements occurs at each intersection does not necessarily coincide across all the surveyed intersections. The results of the surveys are presented in **Annexure 2**, and key results are summarised in **Table 12**.

Table 12
Total Peak Hourly Vehicle Movements at Intersections (vehicles per hour)

Intersection		AM Peak Hour				PM Peak Hour			
		Hour Start	Light	Heavy	Total	Hour Start	Light	Heavy	Total
A	Church Street and Short Street	8:00	898	50	948	16:30	1 211	34	1 245
B	Short Street and Douro Street	8:00	294	19	313	16:30	370	14	384
C	Douro Street and Market Street	8:00	960	55	1 015	15:30	1 124	42	1 166
D	Lue Road and Ulan Road	8:00	751	48	799	16:30	921	39	960
E	Douro Street and Horatio Street	8:00	783	28	811	16:30	1 009	21	1 030
Refer to **Figure 9** for locations									

The intersection survey results indicate that the total evening peak hour volumes through the intersections are higher than the morning peak hour volumes. The total number of heavy vehicles through the intersections is however higher during the morning peak hour than the evening peak hour.

3.11 OPERATION OF INTERSECTIONS

The peak period surveys of vehicle turning movements at key intersections (refer to Section 3.5) have been assessed to determine the peak hour at each intersection.

The operating performance of the Lue Road/ Ulan Road intersection has been assessed using SIDRA INTERSECTION Version 8 (SIDRA), a computer-based modelling package which calculates intersection performance characteristics, including the degree of saturation, average delays, and LOS. The degree of saturation is the ratio of the arrival rate of vehicles to the capacity. The operating characteristics can be compared with the performance criteria set out in **Table 13**. It is noted that average delay per vehicle is expressed in seconds per vehicle and is measured for the movement with the highest average delay per vehicle at priority and roundabout intersections.

Table 13
Level of Service Criteria for Intersections

Level of Service	Average Delay (sec/vehicle)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity At signals, incidents cause excessive delays, roundabouts require other control mode.	At capacity, requires other control mode
F	> 70	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; requires other control mode
Source: RMS Guide to Traffic Generating Developments, 2002			

Table 14 presents a summary of the existing peak hour operating conditions of the surveyed intersections, with full results presented in **Annexure 3** of this report.

Table 14
Existing Condition Intersection Modelling Results

Intersection		Control	AM Peak		PM Peak	
			Delay (sec/veh)	Level of Service	Delay (sec/veh)	Level of Service
A	Church Street and Short Street	Roundabout	11.3	A	11.8	A
B	Short Street and Douro Street	Give Way Priority	5.6	A	6.0	A
C	Douro Street and Market Street	Roundabout	11.4	A	11.2	A
D	Lue Road and Ulan Road	Roundabout	9.8	A	9.6	A
E	Douro Street and Horatio Street	Give Way Priority	10.4	A	12.1	A
Refer to **Figure 9** for locations						

The analysis results indicate that the intersections currently operate satisfactorily, with short delays and spare capacity. The highest average delays reported in **Table 14** at the intersection of Lue Road with Ulan Road are experienced by the drivers of vehicles turning right out of Lue Road during the morning peak hour (eight vehicles per hour) as well as the afternoon peak hour (nine vehicles per hour).

The intersections located along the B-double route within Mudgee currently operate satisfactorily with short delays and spare capacity. The highest delays being experienced by road users occur in the southbound right turn movement from Douro Street into Castlereagh Highway in both the morning and afternoon peak hours (in the order of 30-40 vehicles per hour).

3.12 ROAD SAFETY REVIEW

Validated crash data were obtained from RMS for the most recent five-year period available, being from 1 October 2013 to 30 September 2018, and also including provisional data for the period to August 2019. The data include those crashes which conform with the national guidelines for reporting and classifying road vehicle crashes based on the following criteria:

- The crash was reported to the police.
- The crash occurred on a road open to the public.
- The crash involved at least one moving vehicle.
- The crash involved at least one person being killed or injured or at least one motor vehicle being towed away.

The total data included 89 crashes over the period investigated, and the reported characteristics of the crashes along each key route relevant to the Project are tabulated in **Annexure 3** and discussed below.

Roads around Lue

The roads in and around Lue were investigated, including:

- Lue Road (Swanston Street) between the 100 km/h speed limit zones; and
- Local roads including Pyangle Road, Bara Lue Road and Maloneys Road.

Over the period investigated, two crashes were reported on these roads. Both were single vehicle crashes, occurred in fine weather and daylight on a dry road surface, and involved a light vehicle. In one crash, the driver was distracted by something outside of the vehicle, and the other the driver suffered a sudden illness. One crash occurred on Swanston Street and the other on Lue Road near Walkers Lane east of Lue.

The data do not reveal any location with a notable cluster of crashes which might suggest an inherent issue with the road geometry or control in Lue.

Route to the East of Lue

The route from Lue to the east was investigated, including:

- Lue Road from the outskirts of Lue (start of 100 km/h speed limit zone) to Bylong Valley Way (approximately 18 km).

This route would be used by Project-generated traffic travelling to and from the east. Over the period investigated, ten crashes were reported on this route. All ten crashes were single vehicle crashes, and eight of them occurred on a dry road surface. One crash involved a motorcycle, and the rest involved light vehicles. Two of the crashes involved a driver swerving to avoid an animal.

The data do not indicate any location with a notable cluster of crashes which might suggest an inherent issue with the road geometry or traffic controls at that location. Speeding on bends along the route contributed to more than half of the crashes along the route.

Route to the West of Lue to Mudgee Outskirts

The route from Lue to the west towards Mudgee was investigated, including:

- Lue Road from the outskirts of Lue (start of 100 km/h speed limit zone) to the intersection with Ulan Road (approximately 26 km).

This route would be used by Project-generated traffic travelling to and from the west and southeast via Mudgee, and also to and from the north via Golden Highway. Over the period investigated, 21 crashes were reported on this route. With one exception involving overtaking vehicles, these were single vehicle crashes involving loss of control of the vehicle.

Nine of the crashes occurred on a wet road surface, including one on ice or snow. Speed was nominated as a contributing factor in nine of the crashes, and fatigue was nominated as a contributing factor in five of the crashes. One crash involved a motorcycle, and the rest involved light vehicles.

The review of the history of crashes indicates that although there is no specific location (such as a specific intersection or bend in the road) with a particularly poor record, the speed of vehicles on bends in Lue Road west of Lue contributed to drivers losing control of their vehicle in nearly half of the crashes recorded.

Route to the North of Mudgee

The route from the outskirts of Mudgee towards the north was investigated, including:

- Ulan Road from the intersection with Lue Road to the intersection with Wollar Road at Budgee Budgee (approximately 9 km).

This route would be used by Project-generated traffic travelling to and from Golden Highway. Over the period investigated, 15 crashes were reported on this route. Five of these were single vehicle crashes, and ten crashes occurred on a dry road surface. Two crashes involved a motorcycle, two involved a pedal cycle, one involved a large rigid truck, and all other vehicles involved in the crashes were light vehicles.

Two fatal crashes occurred on this route, both of which involved a pedal cyclist in 2014. Speeding and fatigue were nominated as contributing factors in one of those crashes, in which a southbound utility struck a southbound cyclist in the 50 km/h zone north of Lue Road. The other fatal crash occurred in the 80 km/h speed limit zone south of Henry Lawson Drive and involved loss of control of a southbound cycle and “equipment failure/fault”.

The data do not indicate any location with a notable cluster of crashes which might suggest an inherent issue with the road geometry or traffic controls.

Route Through Mudgee towards the West

The route from the outskirts of Mudgee and through Mudgee towards the west was investigated, including:

- Ulan Road from the intersection with Lue Road to Short Street;
- Short Street from Ulan Road to Duoro Street;
- Duoro Street from Short Street to Market Street (Castlereagh Highway); and
- Castlereagh Highway from Duoro Street to Hill End Road at Caerleon.

This route would be used by Project-generated traffic travelling to and from the west through Mudgee, and the Ulan Road – Short Street – Duoro Street portion would be used by Project-generated traffic travelling to and from the southeast through Mudgee. Over the period investigated, 16 crashes were reported on this route. Two of these occurred in the 80 km/h speed limit zone west of Mudgee, and the remainder occurred in the 50 km/h urban area.

The crashes involved one motorcycle, one pedal cycle, one large rigid truck and two articulated heavy vehicles.

The data do not indicate any location with a notable cluster of crashes which might suggest an inherent issue with the road geometry or traffic controls.

Route Through Mudgee towards the South East

The route through Mudgee towards the southeast was investigated, including:

- Duoro Street (Castlereagh Highway) from Market Street to Horatio Street (Castlereagh Highway); and
- Horatio Street (Castlereagh Highway) from Duoro Street (Castlereagh Highway) to Queens Pinch Road at Burrundulla (total routes approximately 8 km).

This route would be used by Project-generated traffic travelling to and from the southeast through Mudgee, which would also use the Ulan Road – Short Street – Duoro Street portion of the route to the west described above. Over the period investigated, 25 crashes were reported on this route. Four of these occurred in the 100 km/h speed limit zone east of Mudgee, and the remainder occurred in the 50 km/h urban area.

The crashes involved one motorcycle, two pedal cycles, one large rigid truck and three articulated heavy vehicles.

The data do not indicate any location with a notable cluster of crashes which might suggest an inherent issue with the road geometry or traffic controls.

Road Crash History of All Routes

The review of the crash history of routes expected to be used by Project-generated traffic did not identify any causation factors related to the geometry or controls at specific location on the routes.

Fog or mist were present at the time of two of the reported crashes, one of which occurred in darkness on a bend in Lue Road west of Havilah, when loose gravel and snow or ice were also present on the road. The other occurred at dawn on Castlereagh Highway in the urban area of Mudgee. Foggy conditions are therefore not considered to represent a particular road safety hazard in the region.

Inappropriate driver speed was identified as a contributing factor in nearly one quarter of the 89 crashes reported, and fatigue was identified as a contributing factor in 11 crashes. A combination of speed and fatigue was nominated as a contributing factor in four of these crashes.

Single vehicle crashes typically resulted in a vehicle striking an object such as an animal, tree, fence, culvert or utility pole. The data do not indicate whether the fixed roadside objects were located within the zone on each side of the road that should be kept free from features which would be potentially hazardous to errant vehicles, and this was reviewed as part of a road safety audit of Lue Road (Section 3.13).

3.13 ROAD SAFETY AUDIT

An independent road safety audit on the existing road conditions on Lue Road between Mudgee and Lue was conducted prior to the preparation of this traffic and transport assessment. This road safety audit report is included at **Annexure 4**. The road safety deficiencies documented in **Annexure 4** mainly involve:

- insufficient centre line and edge line delineation particularly at night time;
- inconsistent treatments for guiding drivers through curves;
- unprotected roadside hazards within the clear zone, including substantive trees and slopes that are not traversable;
- pavement damage; and
- fretted seal edge.

Road safety for all users would be improved if these safety deficiencies were to be addressed. It is understood that since the road safety audit was completed, some upgrades to Lue Road have been completed.

4. PROJECT TRAFFIC

With regard to the road transport implications of the Project, it is expected that each stage would include the transport of the workforce to and from the Mine Site at the start and end of each shift, deliveries and visitors to the Mine Site, and once operational, the transport of mineral concentrate from the Mine Site. Each of these aspects is considered in this section. For clarity, a vehicle trip is a one way movement, so a vehicle which arrives at the Mine Site then departs the Mine Site generates two vehicle trips.

4.1 SITE ESTABLISHMENT AND CONSTRUCTION STAGE

4.1.1 Vehicular Access Routes

Prior to the construction of the relocated Maloneys Road and the mine access road during the initial phase or six months of the site establishment and construction stage, all vehicular access to the Mine Site would be via the existing road network:

- to/from west via Lue Road (west, through Lue) – Pyangle Road – Maloneys Road; and
- to/from east via Lue Road (east, avoiding Lue) – Pyangle Road – Maloneys Road.

Once construction of the relocated Maloneys Road and the mine access road is complete, vehicular access to the Mine Site would be via the newly constructed road network[2]:

- to/from west via Lue Road (west, avoiding Lue) – relocated Maloneys Road – mine access road; and
- to/from east via Lue Road (east, through Lue) – relocated Maloneys Road – mine access road.

With the exception of those vehicles hauling excess excavated material from the installation of the water supply pipeline for stockpiling and use within the Mine Site, all vehicles associated with the water supply pipeline and 132 kV transmission line installation would not typically be based at the Mine Site, except when such work occurs at or close to the Mine Site. Similarly, the workforce involved in the construction of the relocated Maloneys Road and the mine access road would not typically travel directly to and from the Mine Site each day.

However, in order to ensure a robust assessment of the potential impacts of the Project on the road transport environment is undertaken, it has been assumed that all of the site establishment and construction workforce, visitor and delivery vehicles would travel to and from the Mine Site each day.

4.1.2 Workforce Traffic

The on-site workforce would vary over the 18-month site establishment and construction stage, with an average, including exploration personnel, of approximately 151 people. Construction hours would vary depending on the activity being undertaken, as presented in **Table 15**, noting

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[2] Exploration personnel would continue to travel to the Bowdens Office and core library via the closed section of Maloneys Road.

that the construction hours would be subject to meeting noise criteria, especially after 6:00 pm. The peak of the site establishment and construction stage is expected to occur during Month 13, by which time relocated Maloneys Road would be constructed. Prior to the construction of relocated Maloneys Road in Month 6, the peak workforce would be 134 people on site. **Table 15** presents the peak workforce expected for each key activity both before and after construction of relocated Maloneys Road.

Table 15
Peak Site Establishment and Construction Stage Workforce and Hours

Activity	Monday to Friday		Saturday	
	Hours	**Peak Workforce**	**Hours**	**Peak Workforce**
Prior to Construction of Relocated Maloneys Road (Month 6)				
Site Earthworks and Infrastructure	7:00 am to 6:00 pm	59	7:00 am to 6:00 pm	59
Processing Plant	7:00 am to 6:00 pm	30	7:00 am to 6:00 pm	30
Tailings Storage Facility	7:00 am to 6:00 pm	25	7:00 am to 6:00 pm	25
Water Pipeline (off-site)	7:00 am to 6:00 pm	10	7:00 am to 6:00 pm	10
Exploration	8:00 am to 4:00 pm	20	8:00 am to 4:00 pm	20
After Construction of Relocated Maloneys Road (Month 13)				
Site Earthworks and Infrastructure	7:00 am to 6:00 pm	20	7:00 am to 6:00 pm	20
Processing Plant	7:00 am to 6:00 pm	183	7:00 am to 6:00 pm	183
Tailings Storage Facility	7:00 am to 6:00 pm	25	7:00 am to 6:00 pm	25
Water Pipeline (off-site)	7:00 am to 6:00 pm	10	7:00 am to 6:00 pm	10
Exploration	8:00 am to 4:00 pm	20	8:00 am to 4:00 pm	20

The busiest hours of the day for the movement of the workforce to and from the Mine Site during the peak activity prior to construction of relocated Maloneys Road would be:

- 6:00 am to 7:00 am, with the arrival of 114 workers for the 7:00 am shift start;
- 6:00 pm to 7:00 pm with the departure of 114 workers after the 6:00 pm shift end; and
- 7:00 am to 8:00 am and 4:00 pm to 5:00 pm, with the arrival and departure of the 20 exploration personnel.

The busiest hours of the day for the movement of the workforce to and from the Mine Site during the peak of the site establishment and construction stage of the Project after construction of relocated Maloneys Road would be:

- 6:00 am to 7:00 am, with the arrival of 228 workers for the 7:00 am shift start;
- 6:00 pm to 7:00 pm with the departure of 228 workers after the 6:00 pm shift end; and
- 7:00 am to 8:00 am and 4:00 pm to 5:00 pm, with the arrival and departure of the 20 exploration personnel.

Based on Bowdens Silver's experience with its current workforce and expressions of interest from potential employees, it is anticipated that the likely residential locations of the on-site construction workforce would be such that 65 per cent of the workforce would travel to and from the west and 35 per cent would travel to and from the east. On this basis, at the time of peak activity during Month 6, approximately 81 workers would travel to and from the west and 43 workers would travel to and from the east. At the time of peak activity during Month 13, approximately 161 workers would travel to and from the west, and 87 workers would travel to and from the east.

In order to mitigate potential traffic impacts, Bowdens Silver would provide a bus service for the workforce during the site establishment and construction stage and anticipates that this service would be utilised by approximately 65 per cent of the workforce, excluding the exploration workers who would travel by private vehicle. The remaining workforce would typically travel to and from the Mine Site by private vehicle.

Based on our experience with similar projects in regional locations, it is anticipated that unless private vehicle access is managed, the adoption of car-pooling within the construction workforce is limited. Subsequently, to ensure a robust assessment of the potential impacts of the Project on the road environment, it has been assumed that construction workers travelling by private vehicle would travel with an occupancy of one person per vehicle.

The number of vehicle trips generated by the construction workforce travelling to and from the Mine Site at the time of peak activity during the site establishment and construction stage of the Project is presented in **Table 16**. This assumes that buses do not layover at the Mine Site when not in use, rather empty buses would depart the Mine Site immediately after dropping passengers. Similarly, empty buses would arrive on site during the hour prior to picking up passengers.

Table 16
Peak Site Establishment and Construction Workforce Vehicle Trip Generation

		To and From West	To and From East	Total
Workers Present per Day	Month 6 Month 13	87 161	47 87	**134** **248**
Bus Travel				
Workers by Bus	Month 6 Month 13	48 96	26 52	**74** **148**
Bus Trips per Day (two way)	Month 6 Month 13	4 8	4 4	**8** **12**
AM Peak Hour Bus Trips	Month 6 Month 13	2 4	2 2	**4** **6**
PM Peak Hour Bus Trips	Month 6 Month 13	1 2	1 1	**2** **3**
Car Travel				
Workers by Car	Month 6 Month 13	39 65	21 35	**60** **100**
Car Trips per Day (two way)	Month 6 Month 13	78 130	42 70	**120** **200**
AM Peak Hour Car Trips	Month 6 Month 13	26 52	14 28	**40** **80**
PM Peak Hour Car Trips	Month 6 Month 13	26 52	14 28	**40** **80**
Assumes buses do not layover at the Mine Site, and all workers arrive or depart in one hour before or after their shift. AM Peak hour 6:00 am to 7:00 am, PM peak hour 6:00 pm to 7:00 pm.				

4.1.3 Delivery and Visitor Traffic

During the site establishment and construction stage of the Project, heavy vehicles would deliver construction equipment and processing plant components, construction materials, fuel and other supplies to the Mine Site. Heavy vehicles would include rigid trucks, semi-trailers, tankers, B-doubles and some oversize or overmass vehicles. It is anticipated that initially, the bulk of the heavy vehicle traffic would be related to the transportation of heavy machinery to the Mine Site for initial construction activities including the construction of the relocated Maloneys Road. In order to limit heavy vehicle traffic movements through Lue, Bowdens Silver would program the delivery of the bulk of the mobile equipment to be used in the open cut development and the delivery of processing plant components to occur after the relocated Maloneys Road and mine access road are constructed.

Subsequently, it is anticipated that the number of heavy vehicle trips would vary throughout the site establishment and construction stage of the Project, with higher levels of heavy vehicle activity expected during:

- the initial six month period with the transport of heavy machinery to the Mine Site for construction activities, notably for construction of the relocated Maloneys Road and mine access road;
- construction/installation of the processing plant in Months 8 to 17; and
- construction/installation of the water supply pipeline (commencing approximately Month 8), with transport of excess excavated material from trenching for stockpiling within the Mine Site.

The activities associated with the site establishment and construction stage are expected to require an average of five heavy vehicles per day, and up to 21 heavy vehicles per day. Deliveries would typically occur between 8:00 am and 5:00 pm although it is noted that Bowdens Silver would make every effort to avoid peak traffic periods as well as ensuring that any route restrictions relating to travel times on Lue Road are observed. The majority of heavy vehicle trips are expected to approach and depart to and from the west of Lue.

With regard to oversize and overmass vehicles, over the site establishment and construction stage, the Project is expected to require approximately:

- 95 oversize or overmass loads, principally low loaders to deliver processing plant components and mobile equipment;
- 45 oversize loads to the Mine Site predominantly for transportable buildings, mainly from Month 13 of the site establishment and construction stage.

On any one day, it is anticipated that up to four oversize or overmass vehicles may travel to or from the Mine Site, and while the majority are expected to travel to and from the west, occasional oversize or overmass vehicles may approach or depart to the east. The management of oversize and overmass vehicles is discussed in Section 6.13.

The number of heavy and oversize or overmass vehicle trips generated on a busy day during the site establishment and construction stage of the Project is presented in **Table 17**.

Table 17
Peak Day Site Establishment and Construction Visitor and Delivery Vehicle Trip Generation

	To and From West	To and From East	Total
Heavy Vehicles			
Vehicles per Day	16	5	21
Trips per Day	32	10	42
Peak Trips per Hour	4	1	5
Oversize/Overmass Vehicles			
Vehicles per Day	2	2	4
Trips per Day	4	4	8
Peak Trips per Hour	1	1	2

4.1.4 TSF Embankment Construction Haulage Traffic

Construction of the initial (Stage 1) TSF embankment would occur during the site establishment and construction stage. A fleet of six B-doubles would transport approximately 2.0 million tonnes (Mt) of waste rock from the main open cut pit to the area adjacent to the TSF embankment, using a 1.4 km section of the relocated Maloneys Road between its intersection with the mine access road and the access road to the TSF embankment area. This activity would occur Monday to Saturday, excluding public holidays, during daylight hours only, taken to be 11 hours per day between 7:00 am and 6:00 pm.

Assuming a capacity of 50 tonnes (t) per truck, this would require approximately 40,000 truckloads to construct the initial (Stage 1) TSF embankment. Over the one year construction period, this would result in an average of 133 truckloads per day or approximately 12 loads per hour. With the return of the empty truck from the TSF embankment to the Mine Site, this would generate 24 truck trips per hour on the relocated Maloneys Road between the mine access road and the access road to the TSF embankment area.

4.1.5 Total Project Traffic – Site Establishment and Construction Stage

Table 18 summarises the total traffic forecast to be generated during the peak activity periods of the site establishment and construction stage both before and after construction of the relocated Maloneys Road. **Table 18** demonstrates that on a busy weekday during the peak initial phase of the site establishment and construction stage in Month 6 (prior to commissioning of the relocated Maloneys Road), the Project is anticipated to generate:

- 120 light vehicle trips per day; and
- 58 heavy vehicle trips per day.

On a busy weekday during the peak site establishment and construction stage in Month 13 (following commissioning of the relocated Maloneys Road), the Project is anticipated to generate:

- 200 light vehicle trips per day;
- 62 heavy vehicle trips per day; and
- 266 heavy vehicle trips per day for TSF construction, restricted to that part of relocated Maloneys Road between the mine access road and the entrance to the TSF construction area.

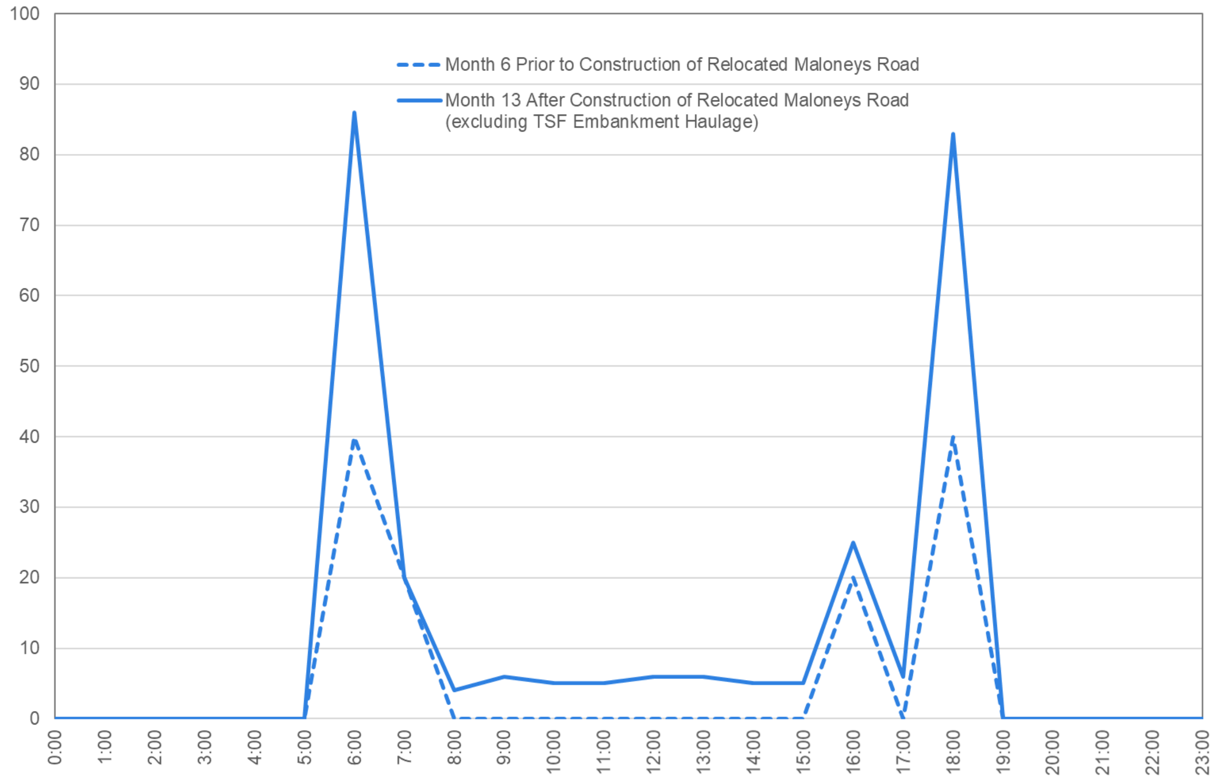
Table 18
Peak Day Site Establishment and Construction Daily Traffic (vehicle trips per day)

	Light Vehicles	Buses	Heavy Vehicles	Oversize Vehicles	TSF Haulage	Total
Month 6 with Existing Road Network						
Lue Road east of Pyangle Road	42	4	10	4	0	**60**
Lue Road through Lue	78	4	32	4	0	**118**
Pyangle Road Lue Road to Maloneys Road	120	8	42	8	0	**178**
Maloneys Road Pyangle Road to Secondary mine access road	120	8	42	8	0	**178**
Month 13 With Relocated Maloneys Road						
Lue Road east of Pyangle Road	70	4	10	4	0	**88**
Pyangle Road Lue Road to Maloneys Road	40	0	0	0	0	**40**
Maloneys Road Pyangle Road to Secondary mine access road	40	0	0	0	0	**40**
Secondary mine access road	40	0	0	0	0	**40**
Lue Road through Lue	82	4	10	4	0	**100**
Lue Road west of Relocated Maloneys Road	130	4	32	4	0	**118**
Relocated Maloneys Road Lue Road to TSF Embankment	160	8	42	8	0	**218**
Relocated Maloneys Road Lue Road to TSF Embankment	160	8	42	8	266	**484**
New mine access road	160	8	42	8	266	**484**
* Includes 40 light vehicle trips for exploration personnel travelling to and from the Bowdens office and core library						

Table 18 indicates that on a busy day during the busiest month prior to construction of the relocated Maloneys Road, the Project would generate up to 118 vehicle movements through Lue on a weekday. On a busy day during the busiest month following construction of the relocated Maloneys Road, the Project would generate up to 100 vehicle movements per day through Lue.

Figure 10 presents the distribution of Project-related traffic throughout the weekdays, during the busiest days at peak site establishment and construction activity both before and after construction of relocated Maloneys Road. This excludes the trips generated by the TSF construction haulage trucks, which would be limited to the relocated Maloneys Road.

Figure 10 Project-Related Peak Construction Stage Weekday Traffic



Prior to construction of the relocated Maloneys Road, the total vehicle trips generated by the Project during the peak site establishment and construction stage would peak in the hours:

- between 6:00 am and 7:00 am, with 40 light vehicle and 4 bus trips; and
- between 6:00 pm and 7:00 pm, with 40 light and 2 bus trips.

Following construction of the relocated Maloneys Road, the total vehicle trips generated by the Project during the peak site establishment and construction stage would peak in the hours:

- between 6:00 am and 7:00 am, with 80 light vehicle and 6 bus trips; and
- between 6:00 pm and 7:00 pm, with 80 light and 3 bus trips.

Considering the pattern of background traffic on Saturday (Section 3.8), the Project-related traffic would not contribute to existing peak hourly traffic on the road network. The weekdays would remain the more critical period with regard to potential impacts on the operation of the road network during the site establishment and construction stage.

Table 19 summarises the traffic forecast to be generated during the peak hours at the time of peak activity during the site establishment and construction stage of the Project prior to commissioning of the relocated Maloneys Road.

Table 19
Month 6 Peak Day Site Establishment and Construction Peak Hour Traffic
(vehicle trips per hour)

	Light Vehicles	Buses	Heavy Vehicles	Oversize Vehicles	TSF Haulage	Total
AM Project Traffic Peak Hour 6:00 am to 7:00 am						
Lue Road east of Pyangle Road	14	2	0	0	0	**16**
Lue Road through Lue	26	2	0	0	0	**28**
Pyangle Road Lue Road to Maloneys Road	40	4	0	0	0	**44**
Maloneys Road Pyangle Road to Secondary mine access road	40	4	0	0	0	**44**
PM Project Traffic Peak Hour 6:00 pm to 7:00 pm						
Lue Road east of Pyangle Road	14	1	0	0	0	**15**
Lue Road through Lue	26	1	0	0	0	**27**
Pyangle Road Lue Road to Maloneys Road	40	2	0	0	0	**42**
Maloneys Road Pyangle Road to Secondary mine access road	40	2	0	0	0	**42**

Table 20 summarises the traffic forecast to be generated during the peak hours at the time of peak activity during the site establishment and construction stage of the Project following construction of the relocated Maloneys Road.

Table 19 and **Table 20** indicate that on a busy weekday, the Project would generate up to 28 vehicle movements per hour through Lue prior to commissioning of the relocated Maloneys Road and up to 30 vehicle movements per hour through Lue following commissioning of the relocated Maloneys Road. The period following commissioning of the relocated Maloneys Road would therefore be the more critical with regard to both the wider road network capacity and operations, and to the impacts on local conditions within Lue. The assessment which follows in Section 6 therefore focusses on the project-related traffic generation during Month 13 of the site establishment and construction stage.

Table 20
Month 13 Peak Day Site Establishment and Construction Peak Hour Traffic
(vehicle trips per hour)

	Light Vehicles	Buses	Heavy Vehicles	Oversize Vehicles	TSF Haulage	Total
AM Project Traffic Peak Hour 6:00 am to 7:00 am						
Lue Road east of Pyangle Road	28	2	0	0	0	**30**
Pyangle Road Lue Road to Maloneys Road	0	0	0	0	0	**0**
Maloneys Road Pyangle Road to Secondary mine access road	0	0	0	0	0	**0**
Secondary mine access road	0	0	0	0	0	**0**
Lue Road through Lue	28	2	0	0	0	**30**
Lue Road west of Relocated Maloneys Road	52	4	0	0	0	**56**
Relocated Maloneys Road Lue Road to TSF Embankment	80	6	0	0	0	**86**
Relocated Maloneys Road TSF Embankment to mine access road	80	6	0	0	0	**86**
Mine access road	80	6	0	0	0	**86**
PM Project Traffic Peak Hour 6:00 pm to 7:00 pm						
Lue Road east of Pyangle Road	28	1	0	0	0	**29**
Pyangle Road Lue Road to Maloneys Road	0	0	0	0	0	**0**
Maloneys Road Pyangle Road to Secondary mine access road	0	0	0	0	0	**0**
Secondary mine access road	0	0	0	0	0	**0**
Lue Road through Lue	28	1	0	0	0	**29**
Lue Road west of Relocated Maloneys Road	52	2	0	0	0	**54**
Relocated Maloneys Road Lue Road to TSF Embankment	52	2	0	0	0	**54**
Relocated Maloneys Road TSF Embankment to mine access road	52	2	0	0	0	**54**
Mine access road	52	2	0	0	0	**54**

4.2 OPERATIONAL STAGE

4.2.1 Vehicular Access Routes

When operational, Project-related traffic, with the exception of exploration workers, would access the Mine Site via the relocated Maloneys Road:

- to/from west via Lue Road (avoiding Lue) – relocated Maloneys Road – mine access road; and
- to/from east via Lue Road (through Lue) – relocated Maloneys Road – mine access road.

The exploration workers would continue to access the Mine Site via the secondary mine access road via Pyangle Road and the retained southern section of Maloneys Road. The despatch of mineral concentrates would use the routes described in Section 2.4, and the trucks hauling NAF waste rock from the main open cut pit to the TSF NAF waste rock stockpile area would use that part of the relocated Maloneys Road between the mine access road and the entrance to the TSF NAF waste rock stockpile area adjacent to the TSF embankment.

4.2.2 Workforce Traffic

Once operational, the Project would employ between approximately 190 to 228 personnel on site. The operational workforce would travel to and from the Mine Site at the start and end of their shift. The anticipated number of workers per shift and the shift hours for the peak operational workforce are summarised in **Table 21**.

Table 21
Operational Workforce and Shift Hours

Personnel	Days	Shift Arrangements	Workforce Present per Shift
Administration, Technical and Professional	Monday to Friday	8:00 am to 4:00 pm	42
Exploration	Monday to Friday	8:00 am to 4:00 pm	20
Mining	7 days	7:00 am to 7:00 pm 2:00 pm to 10:00 pm 7:00 pm to 7:00 am	23 3 9
Processing Plant, Maintenance and Technical	7 days	6:00 am to 6:00 pm 2:00 pm to 10:00 pm 6:00 pm to 6:00 am	37 1 10

Table 21 demonstrates that on a typical weekday, 145 workers would travel to and from the Mine Site. Based on Bowdens Silver's experience with its current workforce and expressions of interest from potential employees, it is anticipated that the likely residential locations of the on-site construction workforce would be such that 65 per cent of the workforce would travel to and from the west and 35 per cent would travel to and from the east.

Similar to the site establishment and construction stage, in order to mitigate potential traffic impacts, Bowdens Silver would provide a bus service for the workforce during the operational stage and anticipates that this service would be utilised by the majority of the workforce, with the exception of the exploration workers. Bus services would coincide with the planned shift start and end times. Those workers not travelling by bus would typically drive to and from the Mine Site by car. It is likely that some car-pooling for those workers travelling by car would occur. Experience with similar projects suggests that each car would carry an average of 1.1 people per car.

The size of buses used to transport the workforce would be selected to suit the anticipated number of people to be transported, so may vary from a smaller "Coaster" type minibus to a large coach, if required. A bus service would not be provided where only very low numbers of workers would be moving to or from the Mine Site during a shift changeover. Where possible, it would be expected that buses would not travel empty, rather a single bus would be used to transport workers both to and from the Mine Site, such that (for example) a bus bringing workers to the mining day shift would then transport workers departing from the previous night shift. Nevertheless, the assessment which follows assumes that all buses depart the Mine Site immediately after dropping off passengers, and return to the Mine Site in the hour prior to picking up passengers.

Table 22 summarises the expected travel characteristics of the operational workforce on weekdays.

Table 22
Operational Workforce Weekday Travel Characteristics

	To and From West	**To and From East**	**Total**
Workers Present per Day	94	51	**145**
Bus Travel			
Workers by Bus	49	23	**72**
Bus Trips per Day (two way)	16	12	**28**
Car Travel			
Workers by Car	45	28	**73**
Car Trips per Day (two way)	90	56	**146**

On weekend days, it is assumed that the Administration and Professional employees would not work at the Mine Site, however, it is likely that some professional employees may work on weekend days. In any event, the number of vehicle trips would be below that of weekdays.

As demonstrated in **Table 21**, the operational workforce shift times would be spread such that workers for different activities would start and end work at different times through the day in order to limit traffic impacts to local road users. Assuming that all travel occurs within the hour immediately prior to the start of a shift and the hour immediately following the end of a shift, the distribution of vehicle trips throughout the weekdays is presented in **Table 23**.

Table 23
Operational Workforce Weekday Hourly Vehicle Trips (vehicle trips per hour)

Hour Starting	Car Trips per Hour		Bus Trips per Hour		Total Vehicle Trips per Hour		
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound	Two Way
Morning							
5:00 am*	13	0	3	2	16	2	18
6:00 am	8	6	2	3	10	9	19
7:00 am	34	9	2	2	36	11	47
Afternoon							
1:00 pm	3	0	0	0	3	0	3
2:00 pm	0	0	0	0	0	0	0
3:00 pm	0	0	2	0	2	0	2
4:00 pm	0	34	0	2	0	36	36
5:00 pm	6	0	3	1	9	1	10
6:00 pm	9	13	2	2	11	15	26
7:00 pm	0	8	0	2	0	10	10
8:00 pm	0	0	0	0	0	0	0
9:00 pm	0	0	0	0	0	0	0
10:00 pm	0	3	0	0	0	3	3
Daily	73	73	14	14	87	87	174
* Workforce travelling to the Mine Site for a 6:00 am start							

On weekend days, the Administration and most Professional employees would not work at the Mine Site, so the daily total trips would be lower on weekends than on weekdays. These workers do not contribute to the peak hourly trip generation as shown in **Table 23**, so the peak hourly number of trips generated by the operational workforce would be the same on weekend days as on weekdays.

4.2.3 Delivery and Visitor Traffic

During the operational stage of the Project, heavy vehicles including rigid trucks, semi-trailers, tankers and B-doubles would deliver processing plant reagents, fuel, explosives and other consumables. This is expected to generate up to 30 deliveries per week, or five heavy vehicle deliveries on any one day. Additional light vehicles may be expected to travel to and from the Mine Site, due to contractors and other visitors attending the Mine Site. On average, it is anticipated that five such visits may occur per day on a weekday. Deliveries and visitor trips would typically occur between 8:00 am and 5:00 pm.

Table 24 summarises the forecast vehicle trips generated by visitors and deliveries during the operational stage of the Project.

Table 24
Operational Visitor and Delivery Vehicle Trip Generation

	To and From West	To and From East	Total
Light Vehicles			
Present per Day	4	1	5
Trips per Day	8	2	10
Peak Trips per Hour	1	1	2
Heavy Vehicles			
Present per Day	4	1	5
Trips per Day	8	2	10
Peak Trips per Hour	2	0	2

4.2.4 TSF Embankment Construction Haulage Traffic

Between Years 1 and 8 of the Operational (processing) stage of the Project, the transfer of the NAF waste rock to the TSF NAF waste rock stockpile area for the second and third raises of the TSF embankment would occur. A fleet of three B-doubles would transport NAF waste rock from the open cut pit to the TSF NAF waste rock stockpile area, using that part of the relocated Maloneys Road between the mine access road and the entrance to the TSF embankment area. This activity would occur Monday to Saturday excluding public holidays, during daylight hours only, taken to be 11 hours per day between 7:00 am and 6:00 pm.

The TSF embankment raises would occur as follows.

- Stage 2 – approximately 2.3 Mt of NAF waste rock would be transported for construction of the Stage 2 embankment raise over a period of approximately three years. Assuming a capacity of 50 t per truck, this would require approximately 46,000 truckloads to complete the Stage 2 TSF embankment raise. Over three years, this would result in an average of 51 truckloads per day, and approximately four to five loads per hour. With the return of the empty truck from the NAF waste rock stockpile area adjacent to the TSF embankment to the Mine Site, this would generate an average of up to 10 truck trips per hour on the relocated Maloneys Road and mine access road.
- Stage 3 – Approximately 3.2 Mt of NAF waste rock would be transported for construction of the third raise over a period of approximately five years. Assuming a capacity of 50 t per truck, this would require approximately 64,000 truckloads to complete the Stage 3 TSF embankment raise. Over five years, this would result in an average of 43 truck loads per day, and approximately four loads per hour. With the return of the empty truck from the TSF embankment to the Mine Site, this would generate an average of eight truck trips per hour on the relocated Maloneys Road and mine access road.

The average hourly trip generation of the TSF construction activity would therefore be approximately ten truck trips per hour during Stage 2 (Years 1 to 3) and eight truck trips per hour during Stage 3 (Years 4 to 8) on the relocated Maloneys Road and mine access road.

4.2.5 Mineral Concentrate Transport

Once the Project is operational, mineral concentrates would be produced which would be despatched between 7:00 am and 6:00 pm Monday to Saturday, 52 weeks per year, excluding public holidays. Mineral concentrate transport would occur outside of the heavy vehicle restriction periods during school bus operation times on Lue Road. It is expected that a school bus may be present on Lue Road between approximately 7:50 am and 8:30 am, and between 3:40 pm and 4:30 pm (Section 3.3). On this basis, transport of mineral concentrate would not occur between 7:30 am and 8:30 am, nor between 3:30 pm and 4:30 pm on weekdays.

Mineral concentrate despatch would use B-doubles and semi-trailers, with concentrates transported in sealed containers. Each truck would carry two sealed containers each with 22 t of silver/lead concentrate or zinc concentrate.

Based on the annual production of between 20,000 t and 30,000 t of mineral concentrates, the Project would generate between 455 and 682 loads of concentrates per year, or between one and three loads per day. With the return of empty trucks, total mineral concentrate despatch would generate between two and six trips per day on the road network. Those trips would be spread between the proposed haulage routes described in Section 2.4.

4.2.6 Total Project Traffic – Operational Stage

Table 25 summarises the weekday daily trip generation of the Project during peak operational activity, noting that one vehicle arriving and departing generates two vehicle trips.

Table 25
Peak Weekday Project Operational Daily Traffic (vehicle trips per day)

	Light Vehicles	Buses	Heavy Vehicles	TSF Haulage[A]	Mineral Concentrate	Total
Lue Road east of Pyangle Road	58	12	0	0	0	**70**
Pyangle Road Lue Road to Maloneys Road	40	0	0	0	0	**40**
Maloneys Road Pyangle Road to Secondary mine access	40	0	0	0	0	**40**
Secondary mine access road	40	0	0	0	0	**40**
Lue Road Pyangle Road to Relocated Maloneys Road	70	12	0	0	0	**82**
Lue Road west of Relocated Maloneys Road	98	16	10	0	6	**130**
Relocated Maloneys Road Lue Road to TSF Embankment	116	28	10	0	6	**160**
Relocated Maloneys Road TSF Embankment to mine access road	116	28	10	102[B]	6	**262**
Mine access road	116	28	10	102[B]	6	**262**

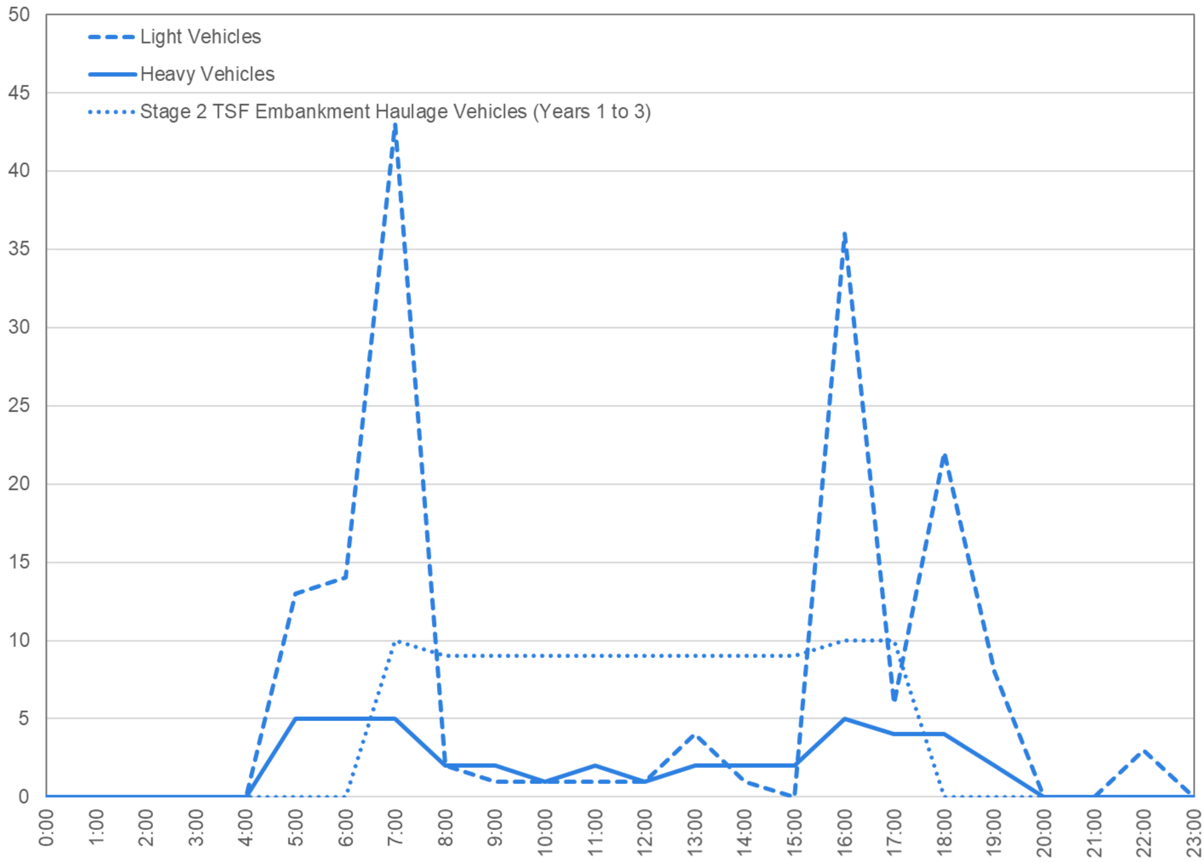
[A] Occurs during Years 1 to 8 of operations only
[B] Years 1 to 3 (Stage 2) reducing to 86 trips per day in Years 4 to 8 (Stage 3)

Table 25 demonstrates that on a busy weekday during the Stage 2 TSF embankment construction activity, the Project is anticipated to generate:

- 156 light vehicle trips per day; and
- 146 heavy vehicle trips per day, of which 102 trips per day are restricted to that part of relocated Maloneys Road between the mine access road and the entrance to the TSF embankment area.

Figure 11 presents the distribution of Project-generated traffic throughout a weekday, during the transport and stockpiling of NAF waste rock for the TSF embankment raises between Years 1 and 8.

Figure 11 Project Weekday Operational Traffic



Considering the pattern of background traffic on a Saturday (Section 3.8) the Project-related traffic would not contribute to existing peak hourly traffic on the road network. The weekdays would remain the more critical period with regard to potential impacts on the operation of the road network during the operational stage.

Table 26 summarises the weekday peak hourly trip generation of the Project during peak operational activity. The overall busiest hours with the combined effects of the workforce and other vehicle trips would occur between 7:00 am and 8:00 am, and between 4:00 pm and 5:00 pm. Trips generated by visitors and deliveries (including oversize or overmass vehicles) would not commence until 8:00 am, and so would not contribute to the morning peak hour activity.

Table 26 demonstrates that the Project would generate peaks of:

- 43 light vehicle trips and 15 heavy vehicle trips during the weekday morning; and
- 36 light vehicle trips and 15 heavy vehicle trips during the weekday afternoon.

Ten of the 15 heavy vehicle trips generated during the peak hours would be haulage trucks for the TSF construction, and so would be limited to that part of the relocated Maloneys Road between the mine access road and the entrance to the TSF embankment area.

Table 26
Weekday Project Operational Peak Hour Traffic (vehicle trips per hour)

	Light Vehicles[A]	Buses	Heavy Vehicles[B]	TSF Haulage[C]	Mineral Concentrate	Total
AM Project Traffic Peak 7:00 am to 8:00 am						
Lue Road east of Pyangle Road	15	2	0	0	0	**17**
Pyangle Road Lue Road to Maloneys Road	20	0	0	0	0	**20**
Maloneys Road Pyangle Road to Mine Site	20	0	0	0	0	**20**
Existing mine access road	20	0	0	0	0	**20**
Lue Road through Lue	21	2	0	0	0	**23**
Lue Road west of Relocated Maloneys Road	28	2	0	0	0	**31**
Relocated Maloneys Road Lue Road to TSF Embankment	23	4	0	0	1	**28**
Relocated Maloneys Road TSF Embankment to mine access road	23	4	0	10	1	**38**
Mine access road	23	4	0	10	1	**38**
PM Project Traffic Peak 4:00 pm to 5:00 pm						
Lue Road east of Pyangle Road	13	1	0	0	0	**14**
Pyangle Road Lue Road to Maloneys Road	20	0	0	0	0	**20**
Maloneys Road Pyangle Road to Mine Site	20	0	0	0	0	**20**
Existing mine access road	20	0	0	0	0	**20**
Lue Road through Lue	19	1	0	0	0	**20**
Lue Road west of Relocated Maloneys Road	23	1	2	0	1	**27**
Relocated Maloneys Road Lue Road to TSF Embankment	16	2	2	0	1	**21**
Relocated Maloneys Road TSF Embankment to mine access road	16	2	2	10	1	**31**
Mine access road	16	2	2	10	1	**31**

[A] Includes employees and visitors, visitors would not travel during the AM peak hour
[B] Includes heavy vehicle deliveries and occasional oversize or overmass vehicles
[C] During Stage 2 TSF embankment development in Years 1 to 3

5. BASELINE FUTURE TRAFFIC CONDITIONS

Changes to traffic and local and regional road network conditions may be expected to occur which are unrelated to the Project. Such changes may result from other major developments in the region and as a result of general non-specific growth in background traffic. These are discussed in this section, to establish baseline future traffic volumes that can be expected without the Project.

5.1 BACKGROUND TRAFFIC GROWTH

Growth in background traffic in the region (i.e. traffic unrelated to the Project or other specific major developments) has been estimated to occur at a rate of approximately 2.0 per cent per annum over the next ten years. This is consistent with the rate adopted in Parsons Brinckerhoff (2016) for roads in the Bylong Valley and similar to the linear growth rate in AADT observed over the period from 2002 to 2013 on roads in the region (refer to **Table 3**).

This assessment assumes that the peak site establishment and construction stage of the Project would occur in 2021, so the baseline conditions for that scenario include four years of growth above the surveyed volumes in 2017.

The operational stage traffic generation (excluding haulage trips associated with the TSF embankment haulage which would vary over time as described in Section 4) would continue throughout the Project life. The baseline conditions for this scenario assume ten years of background growth above the surveyed volumes in 2017, i.e. represents approximately 2027.

The background growth assumed in this assessment has been applied to the traffic volumes surveyed in 2017 in their entirety, and so allow for growth of traffic generated by the other mining developments in the region. Changes to that traffic generation have also been separately considered in Section 5.2, thus the growth assumptions applied herein are considered conservatively high.

5.2 DEVELOPMENTS IN THE REGION

Changes to the traffic conditions can be expected in the region as a result of changes to existing major developments in the region, which are unrelated to the Project. The potential changes to traffic conditions due to approved or proposed developments are discussed in this section. The locations of the major development are presented in **Figure 1**.

5.2.1 Wilpinjong Coal Mine

The Wilpinjong Coal Mine is an open cut coal mining operation located approximately 40 km north-east of Mudgee (**Figure 1**), with vehicular access via Ulan-Wollar Road. The Wilpinjong Extension Project was approved in April 2017, and permits mining operations to continue on that site until 2033. GTA Consultants (2015a) assessed the road transport implications of the Wilpinjong Extension Project, including the impacts of an increase in the operational workforce from 476 people in 2015 to a peak of 625 people in 2024; and construction activity employing 100 people in 2017, 40 people in 2018, and 40 people in 2024. **Table 27** summarises the traffic generation forecasts of the Wilpinjong Coal Mine and Wilpinjong Extension Project on that part of Ulan Road which may also carry Project-related traffic.

Table 27
Wilpinjong Extension Project Traffic on Ulan Road

Location on Ulan Road	Daily Traffic (vehicles per day)	
	2017	**2024**
North of Hollyoak Bridge	594	542
South of Wollar Road	594	542
South of Cope Road	701	645
South of Ulan-Wollar Road	889	827

The forecasts indicate that the Wilpinjong Extension Project can be expected to result in a minor decrease in traffic on Ulan Road after 2017, of around 50 vehicles per day at the southern part of Ulan Road near Mudgee, and around 60 vehicles per day near Ulan-Wollar Road.

5.2.2 Moolarben Coal Mine

The Moolarben Coal Complex (**Figure 1**) is approved to operate until 31 December 2038, and mining operations are permitted to occur 24 hours per day, seven days per week. Vehicular access to the Moolarben Coal Complex is provided off Ulan Road north of its intersection with Ulan-Wollar Road, and off Ulan-Wollar Road. The approvals for the Moolarben Coal Complex include four open cut areas (OC1 to OC4), three underground mining areas (UG1, UG2 and UG4) and other mining and transport related infrastructure and facilities. GTA Consultants (2015b) assessed the road transport implications of the Moolarben UG1 Optimisation Modification, which included the impacts of an increase in the operational workforce to 740 people with an average workforce of approximately 670 people; and construction activity during 2016 and 2017, employing an average of 120 people and a peak of 250 people.

GTA Consultants (2015b) identified the main routes which would be used by traffic travelling to and from the Moolarben Coal Complex, which includes Ulan Road, which may also be used by Project-related traffic. **Table 28** summarises the traffic generation forecasts of the Moolarben Coal Complex on Ulan Road for 2017 during peak construction activity and for 2027 during peak operational workforce with the UG1 Optimisation Modification.

Table 28
Moolarben Coal Complex Traffic on Ulan Road

Location on Ulan Road	Daily (vehicles per day)	
	2017	**2027**
North of Hollyoak Bridge	1 053	806
South of Wollar Road	1 053	806
South of Cope Road	1 331	1 022
South of Ulan-Wollar Road	1 565	1 218
Source: GTA Consultants, 2015b		

The forecasts indicate that the traffic generated by the Moolarben Coal Complex can be expected to result in decreases in traffic on Ulan Road after 2017, of around 250 vehicles per day at the southern part of Ulan Road near Mudgee, and around 350 vehicles per day near Ulan-Wollar Road.

5.2.3 Ulan Coal Mine Complex

The Ulan Coal Mine Complex is located approximately 38 km north-east of Mudgee (**Figure 1**), and has vehicular accesses off Ulan Road north of Cope Road, south of Ulan-Wollar Road, and north of Ulan-Wollar Road.

The approved Ulan Coal Continued Operations Project (Continued Operations Project) permits mining operation on the site until 2033. A traffic and transport impact assessment was undertaken by Transport and Urban Planning (2009), which found that the peak workforce and traffic generation of the mine would occur in Year 4, with the operational phase of the Continued Operations Project commencing in Year 5. It is assumed that Year 4 occurred in 2014, based on commencement of the Continued Operations Project in 2011, and reported workforce numbers during 2015. Modifications to the Continued Operations Project have since been approved, however have not involved changes to the number of employees, so no further traffic assessments have been undertaken.

Forecasts of traffic generated by the Continued Operations Project have been developed, based on the assessment and traffic distribution presented by Transport and Urban Planning (2009), modified to reflect the result of an Origin-Destination survey conducted in 2012 at the Wilpinjong Coal Mine (GTA Consultants, 2013), and adjusted for average weekday conditions and shift times. **Table 29** summarises the estimated hourly and daily traffic generation of the Ulan Coal Complex in 2017 and 2027.

Table 29
Ulan Coal Mine Complex Traffic on Ulan Road

	Weekday (vehicles per day)	
Location	**2017**	**2027**
North of Hollyoak Bridge	747	304
South of Wollar Road	747	304
South of Cope Road	927	379
South of Ulan-Wollar Road	1 429	578

The forecasts indicate that the traffic generated by the Ulan Coal Complex can be expected to result in significant decreases in traffic on Ulan Road after 2017, of around 440 vehicles per day at the southern part of Ulan Road near Mudgee, and around 850 vehicles per day near Ulan-Wollar Road.

A further Modification (Modification 4) was approved in July 2019. With regard to traffic, the Environmental Assessment (EA) (Eco Logical, 2017) prepared in support of that modification states that,

> *"Workforce numbers, operating hours, product volumes and transport routes will not change. Traffic impacts associated with the proposed modification are expected to be consistent with the existing approved development."*

If approved, Modification 4 is therefore not expected to impact future traffic conditions.

5.2.4 Cumulative Development Traffic Changes

Table 30 summarises the forecast cumulative impacts of the developments on daily traffic volumes on Ulan Road, expressed as changes from the 2017 conditions. This generally assumes:

- the surveys during 2017 included the traffic forecast to be generated by the Wilpinjong Extension Project, Moolarben Coal Complex and Ulan Coal Complex for 2017;
- during the site establishment and construction stage of the Project, the Wilpinjong Extension Project would be operational generating the average of the 2017 and 2024 forecasts, the Moolarben Coal Complex and Ulan Coal Complex would be generating traffic consistent with the 2027 forecasts (being reflective of ongoing conditions expected at each of those mines); and
- during the operational stage of the Project, the Wilpinjong Extension Project would be generating traffic consistent with the 2024 forecasts, the Moolarben Coal Complex and Ulan Coal Complex would be generating traffic consistent with the 2027 forecasts (being reflective of the ongoing conditions expected at each of those mines).

Table 30
Weekday Cumulative Development Traffic Changes from 2017 (vehicles per day)

	Project Site Establishment and Construction Stage	Project Operational Stage
Ulan Road South of Ulan-Wollar Road		
Wilpinjong Coal Project	-31	-62
Moolarben Coal Project	-348	-348
Ulan Coal Complex	-851	-851
Total Development Changes	-1 230	-1 261
Ulan Road South of Wollar Road		
Wilpinjong Coal Project	-26	-52
Moolarben Coal Project	-247	-247
Ulan Coal Complex	-444	-444
Total Development Changes	-717	-743

Table 30 indicates that the cumulative impact of the other mining developments in the region are expected to result in decreases in the total traffic associated with those developments after 2017. It is acknowledged that as the aforementioned assessments tend to overestimate traffic generation forecasts in order to robustly assess possible impacts of each development, hence the reductions in daily traffic presented in **Table 30** may tend to be overstated.

5.3 BASELINE TRAFFIC VOLUMES

Table 31 presents the forecasts of baseline daily traffic volumes for the years during which the Project site establishment and construction stage and Project operational stage assessments are considered. These represent the forecast weekday daily traffic volumes in those years assuming that the Project does not proceed.

Table 31
Baseline and Predicted Average Weekday Daily Traffic (vehicles per day)

Location		Surveyed 2017	Site Establishment and Construction Stage 2021			Operational Stage 2031		
			Growth	Mines[A]	Total	Growth	Mines[A]	Total
1	Bara-Lue Road northwest of Lue	20	1	0	21	5	0	25
2	Lue Road west of Lue	878	71	0	949	279	0	1,157
3	Lue Road in Lue	841	69	0	910	267	0	1,108
4	Cox Street near railway bridge	40	3	0	43	13	0	53
5	Lue Road east of railway bridge	815	68	0	883	260	0	1,075
6	Lue Road east of Lue	763	62	0	825	243	0	1,006
7	Pyangle Road north of Lue Road	109	9	0	118	34	0	143
8	Maloneys Road north of Pyangle Road	90	7	0	97	28	0	118
9	Ulan Road north of Ulan	1,965	160	-1,230	895	625	-1,261	1,329
10	Ulan Road north of Lue Road	8,362	685	-717	8,330	2,666	-743	10,285
11	Castlereagh Highway west of Hill End Road	4,350	358	0	4,708	1,389	0	5,739

[A] Cumulative impacts of changes at other mining developments (Section 5.2)

During the site establishment and construction stage, the peak hours for Project-related traffic generation are expected to occur between 6:00 am and 7:00 am, and between 6:00 pm and 7:00 pm (Section 4.1.5). The baseline traffic volumes during those peak hours are summarised in **Table 32**. This assumes that the changes in traffic generated by other mining developments in the region during the Project-related peak hours would be proportional to the daily forecast change.

During the operational stage, the peak hours for Project-related traffic generation are expected to occur between 7:00 am and 8:00 am, and between 4:00 pm and 5:00 pm (Section 4.1.5). The baseline traffic volumes during those peak hours for the operational stage of the Project assessment are summarised in **Table 33**. This table assumes that the changes in traffic generated by other mining developments in the region during the Project-related peak hours would be proportional to the daily forecast change.

Table 32
Project Site Establishment and Construction Stage
Baseline and Predicted Average Weekday Peak Hour Traffic (vehicles per day)

Location		Surveyed 2017		Background Growth to 2021		Cumulative Developments		Total	
		AM	PM	AM	PM	AM	PM	AM	PM
1	Bara-Lue Road northwest of Lue	0	1	0	0	0	0	**0**	**1**
2	Lue Road west of Lue	42	42	3	4	0	0	**45**	**46**
3	Lue Road (Swanston Street) in Lue	38	40	4	4	0	0	**42**	**44**
4	Cox Street in Lue	0	3	0	0	0	0	**0**	**3**
5	Lue Road east of Lue	36	38	3	3	0	0	**39**	**41**
6	Lue Road east of Pyangle Road	35	33	3	2	0	0	**38**	**35**
7	Pyangle Road north of Lue Road	8	4	1	0	0	0	**9**	**4**
8	Maloneys Road north of Pyangle Road	8	2	0	1	0	0	**8**	**3**
9	Ulan Road north of Ulan	160	89	13	7	-100	-56	**73**	**40**
10	Ulan Road north of Lue Road	414	485	34	40	-35	-42	**413**	**483**
11	Castlereagh Highway west of Hill End Road	166	194	14	0	0	0	**180**	**210**
During Project peak hours AM peak hour 6:00 am to 7:00 am, PM peak hour 6:00 pm to 7:00 pm									

Table 33
Project Operational Stage
Baseline and Predicted Average Weekday Peak Hour Traffic (vehicles per day)

Location		Surveyed 2017		Background Growth to 2031		Cumulative Developments		Total	
		AM	PM	AM	PM	AM	PM	AM	PM
1	Bara-Lue Road northwest of Lue	1	0	1	1	0	0	**2**	**1**
2	Lue Road west of Lue	69	72	23	23	0	0	**92**	**95**
3	Lue Road (Swanston Street) in Lue	62	70	20	23	0	0	**82**	**93**
4	Cox Street in Lue	1	3	1	1	0	0	**2**	**4**
5	Lue Road east of Lue	68	67	22	21	0	0	**90**	**88**
6	Lue Road east of Pyangle Road	67	67	21	21	0	0	**88**	**88**
7	Pyangle Road north of Lue Road	13	11	4	3	0	0	**17**	**14**
8	Maloneys Road north of Pyangle Road	11	10	4	3	0	0	**15**	**13**
9	Ulan Road north of Ulan	105	136	34	43	-67	-87	**72**	**92**
10	Ulan Road north of Lue Road	451	687	144	220	-40	-61	**555**	**846**
11	Castlereagh Highway west of Hill End Road	248	381	79	122	0	0	**327**	**503**
During Project peak hours AM peak hour 7:00 am to 8:00 am, PM peak hour 4:00 pm to 5:00 pm									

6. PROJECT IMPACTS AND MITIGATION MEASURES

6.1 FUTURE DAILY TRAFFIC VOLUMES

Table 34 presents the forecast weekday daily traffic volumes at the surveyed locations in the vicinity of the Mine Site during both the peak site establishment and construction stage (Month 13) and the operational stage. It is noted that these forecasts also take into account the diversions of existing traffic which may occur with the construction of the relocated Maloneys Road. The likely impacts of such diversions are described below.

- The existing vehicles on Bara-Lue Road north of Lue are assumed to divert to the relocated Maloneys Road once constructed (in reality some vehicles would be expected to continue to use Bara-Lue Road, however this assumption ensures a robust assessment of conditions on the relocated Maloneys Road and its intersections).
- The section of Maloneys Road north of Pyangle Road would be closed to the public once the relocated Maloneys Road is constructed[3], resulting in diversion of all surveyed traffic from that road, which also uses Pyangle Road north of Lue Road (Location 7). For the purpose of this assessment, it has been assumed that the existing background traffic volumes on Maloneys Road would be removed from that road but those on Pyangle Road would be retained, which is considered to overestimate the likely future background traffic volumes on Pyangle Road.

The forecasts also assume that of the Project-related traffic travelling to and from the west, approximately five per cent would travel via Ulan Road north of Lue Road, and five per cent would continue west through Mudgee to Castlereagh Highway.

Table 34
Future Average Weekday Daily Traffic with the Project (vehicles per day)

Page 1 of 2

Location		Site Establishment and Construction Stage 2021			Operational Stage 2031		
		Baseline	Project	Total	Baseline	Project	Total
1	Bara-Lue Road / Relocated Maloneys Road northwest of Lue	22	222	244	25	160	185
2	Lue Road west of Lue	949	174	1 123	1 157	130	1 287
3	Lue Road (Swanston Street) in Lue	909	100	1 009	1 108	82	1 190
4	Cox Street in Lue	43	0	43	53	0	53
5	Lue Road east of Lue	882	100	982	1 075	82	1 157

[3] A 550 m section of the existing Maloneys Road would remain open to the public to provide access for two landowners adjacent to Maloneys Road (see **Figure 2**).

Table 34 (Cont'd)
Future Average Weekday Daily Traffic with the Project (vehicles per day)

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Location		Site Establishment and Construction Stage 2021			Operational Stage 2031		
		Baseline	Project	Total	Baseline	Project	Total
6	Lue Road east of Pyangle Road	825	88	913	1 006	70	1 076
7	Pyangle Road north of Lue Road	118	40	158	143	40	183
8	Maloneys Road north of Pyangle Road	0	40	40	0	40	40
9	Ulan Road north of Ulan	897	8	905	1 329	4	1 333
10	Ulan Road north of Lue Road	8 336	8	8 344	10 285	4	10 289
11	Castlereagh Highway west of Hill End Road	4 708	8	4 716	5 739	4	5 743

Table 34 indicates that during the peak of the site establishment and construction stage, the Project-related traffic can be expected to contribute approximately ten percent of the daily traffic on Lue Road in Lue. Once operational, Project-related traffic would represent approximately seven percent of the daily traffic on Lue Road in Lue.

6.2 FUTURE TRAFFIC COMPOSITION

The composition of the forecast average weekday traffic on the local roads near the Mine Site during the site establishment and construction stage prior to the re-alignment of Maloneys Road (Month 6) is summarised in **Table 35**.

Table 35 demonstrates that prior to the re-alignment of Maloneys Road, Lue Road would carry 87 to 175 heavy vehicles per day, representing approximately 11 percent of total vehicles on Lue Road in Lue, and 10 to 16 percent of total vehicles outside of Lue. The Project would contribute 40 of the forecast 108 heavy vehicles per day on Lue Road through Lue, of which four heavy vehicles per day would be buses transporting the workforce to and from the east.

The composition of the forecast average weekday traffic on the local roads near the Mine Site during the peak site establishment and construction stage (Month 13) is presented in

Table 36.

Table 36 demonstrates that during the peak of the Site Establishment and Construction Stage of the Project, Lue Road would carry 86 to 179 heavy vehicles per day, representing approximately 8 percent of total vehicles on Lue Road in Lue, and 10 to 16 percent of total traffic outside of Lue. The Project would contribute 18 of the forecast 105 heavy vehicles per day on Lue Road through Lue, of which four heavy vehicles per day would be buses transporting the workforce to and from the west.

Table 35
Project Site Establishment and Construction Stage Month 6
Average Weekday Total Daily Traffic Composition and Project Contribution

Location			Vehicles per Day			Percent of Total	
			Light	Heavy	Total	Light	Heavy
1	Bara-Lue Road northwest of Lue	Total (Project)	16 (0)	5 (0)	21 (0)	76	24
2	Lue Road west of Lue	Total (Project)	892 (78)	175 (40)	1,067 (118)	84	16
3	Lue Road in Lue	Total (Project)	920 (78)	108 (40)	1,028 (118)	89	11
4	Cox Street in Lue	Total (Project)	37 (0)	6 (0)	43 (0)	86	14
5	Lue Road east of Lue	Total (Project)	838 (42)	105 (18)	943 (60)	89	11
6	Lue Road east of Pyangle Road	Total (Project)	798 (42)	87 (18)	885 (60)	90	10
7	Pyangle Road north of Lue Road	Total (Project)	215 (120)	81 (58)	296 (178)	73	27
8	Maloneys Road north of Pyangle Road	Total (Project)	198 (120)	77 (58)	275 (178)	72	28
Project traffic contribution is included in Total traffic							

Table 36
Project Site Establishment and Construction Stage Month 13
Average Weekday Total Daily Traffic Composition and Project Contribution

Location			Vehicles per Day			Percent of Total	
			Light	Heavy	Total	Light	Heavy
1	Relocated Maloneys Road northwest of Lue	Total (Project)	176 (160)	67 (62)	243 (222)	72	28
2	Lue Road west of Lue	Total (Project)	944 (130)	179 (44)	1 123 (174)	84	16
3	Lue Road (Swanston Street) in Lue	Total (Project)	924 (82)	86 (18)	1 009 (100)	92	8
4	Cox Street in Lue	Total (Project)	37 (0)	6 (0)	43 (0)	86	14
5	Lue Road east of Lue	Total (Project)	878 (82)	105 (18)	982 (100)	89	11
6	Lue Road east of Pyangle Road	Total (Project)	827 (70)	87 (18)	913 (88)	91	10
7	Pyangle Road north of Lue Road	Total (Project)	135 (40)	23 (0)	158 (40)	85	15
8	Maloneys Road north of Pyangle Road	Total (Project)	40 (40)	0 (0)	40 (40)	100	0
Project traffic contribution is included in Total traffic							

The composition of the forecast average weekday traffic on the local roads near the Mine Site during the peak operational stage in 2031 is summarised in **Table 37**.

Table 37
Project Operational Stage 2031
Average Weekday Total Daily Traffic Composition and Project Contribution

Location			Vehicles per Day			Percent of Total	
			Light	Heavy	Total	Light	Heavy
1	Relocated Maloneys Road northwest of Lue	Total (Project)	135 (116)	50 (44)	185 (160)	73	27
2	Lue Road west of Lue	Total (Project)	1 090 (98)	197 (32)	1 287 (130)	85	15
3	Lue Road (Swanston Street) in Lue	Total (Project)	1 096 (70)	94 (12)	1 190 (82)	92	8
4	Cox Street in Lue	Total (Project)	45 (0)	8 (0)	53 (0)	85	15
5	Lue Road east of Lue	Total (Project)	1 040 (70)	117 (12)	1 157 (82)	90	10
6	Lue Road east of Pyangle Road	Total (Project)	980 (58)	96 (12)	1 076 (70)	91	9
7	Pyangle Road north of Lue Road	Total (Project)	156 (40)	27 (0)	183 (40)	85	15
8	Maloneys Road north of Pyangle Road	Total (Project)	40 (40)	0 (0)	40 (40)	100	0
Project traffic contribution is included in Total traffic							

Table 37 demonstrates that during the operational stage of the Project, Lue Road would carry 94 to 197 heavy vehicles per day, representing approximately 8 percent of total vehicles on Lue Road in Lue, and 9 to 15 percent of total traffic outside of Lue. The Project would contribute 12 of the forecast 94 heavy vehicles per day on Lue Road through Lue, all of which would be buses transporting the workforce to and from the west.

6.3 FUTURE PEAK HOUR TRAFFIC VOLUMES

Table 38 presents the forecast weekday peak hourly traffic volumes at the surveyed locations in the vicinity of the Mine Site during the peak site establishment and construction stage. It is noted that the time at which the peak hours occur would change with the Project-related traffic, as it would occur earlier than the existing peak hours around Lue. As above, these forecasts also take into account the diversions of existing traffic which may occur with the construction of the relocated Maloneys Road.

Table 38
Project Site Establishment and Construction Stage Month 13
Future Average Weekday Peak Hour Traffic with the Project (vehicles per day)

Location		Baseline		Project Traffic		Total	
		AM	PM	AM	PM	AM	PM
1	Bara-Lue Road/relocated Maloneys Road northwest of Lue	0	1	86	83	86	84
2	Lue Road west of Lue	45	46	56	54	101	100
3	Lue Road (Swanston Street) in Lue	42	44	30	29	72	73
4	Cox Street in Lue	0	3	0	0	0	3
5	Lue Road east of Lue	39	41	30	29	69	70
6	Lue Road east of Pyangle Road	38	35	30	29	68	64
7	Pyangle Road north of Lue Road	9	4	0	0	9	4
8	Maloneys Road north of Pyangle Road	0	0	0	0	0	0
9	Ulan Road north of Ulan	73	40	3	3	76	43
10	Ulan Road north of Lue Road	413	483	3	3	416	486
11	Castlereagh Highway west of Hill End Road	180	210	3	3	183	213
During Project peak hours AM peak hour 6:00 am to 7:00 am, PM peak hour 6:00 pm to 7:00 pm							

During the peak of the site establishment and construction stage of the Project, the future peak hourly traffic volumes on the local roads in the vicinity would all remain at or below 100 vehicles per day. Lue Road in Lue would carry up to 73 vehicles per hour during the evening peak hour following commissioning of the relocated Maloneys Road, with Project-related traffic making up approximately 40 per cent of that peak hour traffic.

Table 39 presents the forecast weekday peak hourly traffic volumes at the surveyed locations in the vicinity of the Mine Site during the operational stage. As above, the baseline forecasts also take into account the diversions of existing traffic which would occur with the construction of the relocated Maloneys Road.

Table 39
Project Operational Stage 2031
Future Average Weekday Peak Hour Traffic with the Project (vehicles per day)

Location		Baseline		Project Traffic		Total	
		AM	**PM**	**AM**	**PM**	**AM**	**PM**
1	Bara-Lue Road/relocated Maloneys Road northwest of Lue	2	1	28	21	30	22
2	Lue Road west of Lue	92	95	31	27	123	122
3	Lue Road (Swanston Street) in Lue	82	93	23	20	105	113
4	Cox Street in Lue	2	4	0	0	2	4
5	Lue Road east of Lue	90	88	23	20	113	108
6	Lue Road east of Pyangle Road	88	88	17	14	105	102
7	Pyangle Road north of Lue Road	17	14	20	20	37	34
8	Maloneys Road north of Pyangle Road	0	0	20	20	20	33
9	Ulan Road north of Ulan	72	92	1	1	73	93
10	Ulan Road north of Lue Road	555	846	1	1	556	847
11	Castlereagh Highway west of Hill End Road	327	503	1	1	328	504
During Project peak hours AM peak hour 7:00 am to 8:00 am, PM peak hour 4:00 pm to 5:00 pm							

Table 39 indicates that in the longer term with the Project-generated traffic and background growth in traffic unrelated to the Project, the peak hourly volumes on Lue Road in Lue would peak at 113 vehicles per hour. The Project-related traffic would make up approximately 18 to 22 per cent of the peak hourly traffic through Lue.

6.4 FUTURE ROADWAY CAPACITY AND EFFICIENCY

The future traffic conditions with the Project-related traffic and background changes in traffic have been assessed using the HCM method described in Section 3.9 to assess the future Levels of Service expected to be experienced by drivers. **Table 40** presents the results of the assessment of average weekday midblock conditions on the road network during the Project peak hours during the site establishment and construction stage of the Project. The results should be considered as being representative of the length of road indicated by the survey location rather than the specific surveyed location.

Table 40
Site Establishment and Construction Stage Assessment 2021
Future Average Weekday Peak Hour Levels of Service

Road and Location		Class	Northbound or Eastbound		Southbound or Westbound	
			Criteria	LOS	Criteria	LOS
Weekday AM Peak Hour 6:00 am to 7:00 am						
2	Lue Road west of Lue	II	41	B	16	A
3	Lue Road (Swanston Street) in Lue	III	93	A	93	A
5	Lue Road east of Lue	II	19	A	40	A
6	Lue Road east of Pyangle Road	II	17	A	42	B
9	Ulan Road north of Ulan	II	20	A	21	A
10	Ulan Road north of Lue Road	II	53	B	29	A
11	Castlereagh Highway west of Hill End Road	II	26	A	28	A
Weekday PM Peak Hour 6:00 pm to 7:00 pm						
2	Lue Road west of Lue	II	19	A	39	A
3	Lue Road (Swanston Street) in Lue	III	93	A	93	A
5	Lue Road east of Lue	II	47	B	9	A
6	Lue Road east of Pyangle Road	II	46	B	9	A
9	Ulan Road north of Ulan	II	12	A	24	A
10	Ulan Road north of Lue Road	II	48	B	52	B
11	Castlereagh Highway west of Hill End Road	II	31	A	30	A
Refer to **Table 9** for criteria basis of each road Class						

The results in **Table 40** indicate that during the peak site establishment and construction stage, the Levels of Service on Lue Road, Ulan Road and Castlereagh Highway would remain acceptable.

Table 41 presents the results of the assessment of future average weekday midblock conditions on the road network during the Project peak hours during the operational stage of the Project, including the cumulative effects of background growth over ten years beyond the surveyed conditions and changes to major developments in the region. As for **Table 40,** the results should be considered as being representative of the length of road indicated by the survey location rather than the specific surveyed location.

Table 41
Project Operational Stage Assessment 2031
Future Average Weekday Peak Hour Levels of Service

Road and Location		Class	Northbound or Eastbound		Southbound or Westbound	
			Criteria	LOS	Criteria	LOS
Weekday AM Peak Hour 7:00 am to 8:00 am						
2	Lue Road west of Lue	II	32	A	31	A
3	Lue Road (Swanston Street) in Lue	III	93	A	93	A
5	Lue Road east of Lue	II	33	A	35	A
6	Lue Road east of Pyangle Road	II	27	A	41	B
9	Ulan Road north of Ulan	II	27	A	13	A
10	Ulan Road north of Lue Road	II	48	B	58	C
11	Castlereagh Highway west of Hill End Road	II	41	B	40	A
Weekday PM Peak Hour 4:00 pm to 5:00 pm						
2	Lue Road west of Lue	II	30	A	34	A
3	Lue Road (Swanston Street) in Lue	III	93	A	93	A
5	Lue Road east of Lue	II	35	A	33	A
6	Lue Road east of Pyangle Road	II	41	B	24	A
9	Ulan Road north of Ulan	II	12	A	29	A
10	Ulan Road north of Lue Road	II	63	C	67	C
11	Castlereagh Highway west of Hill End Road	II	53	B	49	B
Refer to **Table 9** for criteria basis of each road Class						

The results in **Table 41** indicate that during the operational stage peak hours for Project-related traffic generation, acceptable Levels of Service are anticipated on Lue Road and Ulan Road.

Comparing these results with the Levels of Service resulting from the surveyed peak hour conditions (**Table 10**), the Levels of Service during the Project peak hours with the combined effects of background growth to 2031, other developments in the region and the operational stage of Project would remain unchanged from those of the surveyed peak hours in 2017, with the exception of Castlereagh Highway west of Mudgee, at which good Levels of Service are expected. No additional midblock road capacity is therefore required as a result of the Project-generated traffic.

6.5 OPERATION OF INTERSECTIONS

At unsignalised intersections with minor roads, where there are relatively low volumes of through and turning vehicles, capacity considerations are usually not significant. As a guide, at volumes below the following combinations of maximum design hour volumes at a cross intersection with a two lane two-way road, capacity analysis is not warranted:

- major road 400 vehicles per hour, minor road 250 vehicles per hour;
- major road 500 vehicles per hour, minor road 200 vehicles per hour; and
- major road 650 vehicles per hour, minor road 100 vehicles per hour.

The key intersections serving the Project are T-intersections and so have fewer potentially conflicting movements than a cross intersection.

Comparing the forecast peak hourly traffic volumes on the roads in the local area during the peak site establishment and construction stage (**Table 38**) and the operational stage of the Project (**Table 39**) it is evident that the peak hourly volumes at the local intersections would remain well below the threshold levels at which capacity analysis would be warranted.

The majority of Project-generated traffic in Mudgee would be related to the movement of the workforce between the workers' places of residence and the Mine Site. It would therefore be expected that those trips would disperse throughout Mudgee. Considering the forecast number of trips and the demonstrated spare capacity at the key intersections (Section 3.11), the impact on any one intersection in Mudgee would be imperceptible to most drivers.

6.6 LOCAL IMPACTS OF MINERAL CONCENTRATE TRANSPORT ROUTES

Daily despatch of mineral concentrates is expected to generate between two and six trips per day on the local road network, spread between the proposed transport routes described in Section 2.4. These include use of roads through Mudgee, including:

- Short Street, Duoro Street and Market Street to Castlereagh Highway west of Mudgee for trips to and from Parkes (see **Figure 5**); and
- Short Street, Duoro Street, Horatio Street and Sydney Road to Castlereagh Highway east of Mudgee for trips to and from Port Botany or Kelso (see **Figure 5**).

These roads are all part of the RMS approved B-Double routes through Mudgee and so do not raise any new issues with regard to heavy vehicle access. Considering the availability of spare capacity at the key intersections (Section 3.11), the number of trips on any one day on each of these routes would be sufficiently low that they would have negligible impact on the amenity of local residents or the operation of key intersections and roads.

Product despatch to the Port of Newcastle is proposed to use Ulan Road north of Lue Road to access the Golden Highway and the New England Highway. B-double access is permitted for the outbound trips from the Mine Site to the Port of Newcastle, however B-doubles are not permitted to turn left from Ulan Road to Lue Road, thus the proposed vehicle configuration for the transport of mineral concentrate to the Port of Newcastle would be a semi-trailer and not a B-Double. The small number of trips on any one day would have a negligible impact on the performance of those roads.

All vehicles involved in mineral concentrate transport would travel from the mine access road to Lue Road without travelling through Lue, and therefore, mineral concentrate despatch would not have any direct impact on Lue.

6.7 INTERACTION WITH SCHOOL TRAFFIC

The proposed timing of shifts during both the construction and operational stages of the Project is such that the number of trips generated by the workforce travelling to and from the Mine Site during the before and after school zone periods (8.00 am to 9.30 am and 2.30 pm to 4.00 pm) would be very low. Considering that the access arrangements minimise the number vehicles travelling through Lue, the impact on traffic volumes near Lue Public School during the before and after school periods would be negligible. B-doubles generated by the Project would be restricted from using Lue Road during the before and after school periods (Section 3.3).

The Project-generated traffic would therefore be expected to have very limited opportunity to interact with the school-generated traffic around Lue Public School. Employees or contractors engaged by Bowdens Silver for transport tasks associated with the Project would be required to comply with the Project Traffic Management Plan (TMP) described in Section 6.15.

6.8 ROAD SAFETY

The review of road crash data in the area (Section 3.12) found that with the exception of some sections of Lue Road east of Mudgee, there are no locations which appear to demonstrate an inherent safety issue. Based on this review, it is considered that the roads in the local area have no particular accident pattern or causation factors which may be exacerbated by increased use of the road system resulting from the Project.

6.9 ROAD DESIGN

The relocated Maloneys Road and the mine access road (see **Figure 12**) would be constructed to a general carriageway width of 11.0 m, consisting of:

- two 3.5 m wide travel lanes;
- two 1.0 m wide sealed shoulders; and
- two 1.0 m unsealed shoulder/V drains.

The posted speed limit on the relocated Maloneys Road is proposed to be not more than 100 km/h. A reduced speed limit may be appropriately imposed between the mine access road and the access to the TSF embankment area, due to the presence of the slower-moving haulage trucks in the hillier terrain. The appropriate speed limit would be determined as part of the detailed road design process.

The mine access road would not be open to the public, and hence its posted speed limit would be determined by operational and safety considerations within the site. TTPP's experience at mine sites is that the speed limit on the internal access road is typically in the order of 60 km/h.

Whilst the proposed road design standard is consistent with Austroads (2016) requirements for rural road widths for a road carrying a design AADT of between 1,000 and 3,000 vehicles per day and thus greater than the anticipated traffic, Austroads does recommend a minimum seal width of 7.0 m on designated heavy vehicle routes or where the AADT contains more than 15 percent heavy vehicles, as is the case for the proposed road. Subsequently, this standard is considered to be appropriate for the relocated Maloneys Road, which would carry Project-related traffic including the trucks hauling material for the TSF embankment development.

The relocated Maloneys Road and mine access road would be designed to meet the Stopping Sight Distance requirements of Austroads (2016) for both cars and trucks, to ensure a normally alert driver, travelling at the design speed (posted speed limit) on a wet pavement has sufficient time to perceive, react and brake to a stop before reaching a hazard on the road ahead.

During the initial six months of the site establishment and construction stage of the Project, Maloneys Road and Pyangle Road would be used as the access for the Mine Site, carrying up to 120 light and 58 heavy vehicles per day (**Table 18**) and up to 40 light and four heavy vehicles per peak hour (**Table 19**) during Month 6. Once the relocated Maloneys Road is commissioned, the Project would generate 40 light vehicle trips per day on those roads.

Maloneys Road and Pyangle Road are both unsealed roads carrying in the order of 90 to 110 vehicles per day on an average weekday, which includes light vehicles currently accessing the Mine Site. Based on the ARRB unsealed roads classification system (ARRB, 2009), Pyangle Road and Maloneys Road would be considered as Class 4A roads, being minor roads used for connection between local centres of population (in this case, the Mine Site) and the primary road network, carrying between 50 and 150 vehicles per day. These roads may or may not be sealed depending on their importance and function, and would typically have a minimum carriageway width of 5.5 m and operating speed standard of up to 70 km/h depending on terrain.

During the peak of the initial site establishment and construction stage of the Project, the volumes on those roads would exceed those generally expected on a Class 4B unsealed road, and they would operate in a manner similar to a Class 4A unsealed road. These are used for major movements between population centres and connections to adjacent areas, and can carry large vehicles. These roads may or may not be sealed, and would typically have a minimum carriageway width of 7 m and operating speed standard of up to 80 km/h depending on terrain. Sealing of a Class 4A unsealed road may be considered if it is economically justified.

As the roads would operate with higher volumes for a limited period of time, neither upgrading of the roads to meet all the geometric design standards of Class 4A roads, nor sealing of the roads is considered to be warranted. Localised widening of the carriageway to 7 m (including shoulders) along Maloneys Road and Pyangle Road would be undertaken to provide passing opportunities for heavy vehicles with suitable sight distances for heavy vehicle drivers travelling in opposing directions to observe each other.

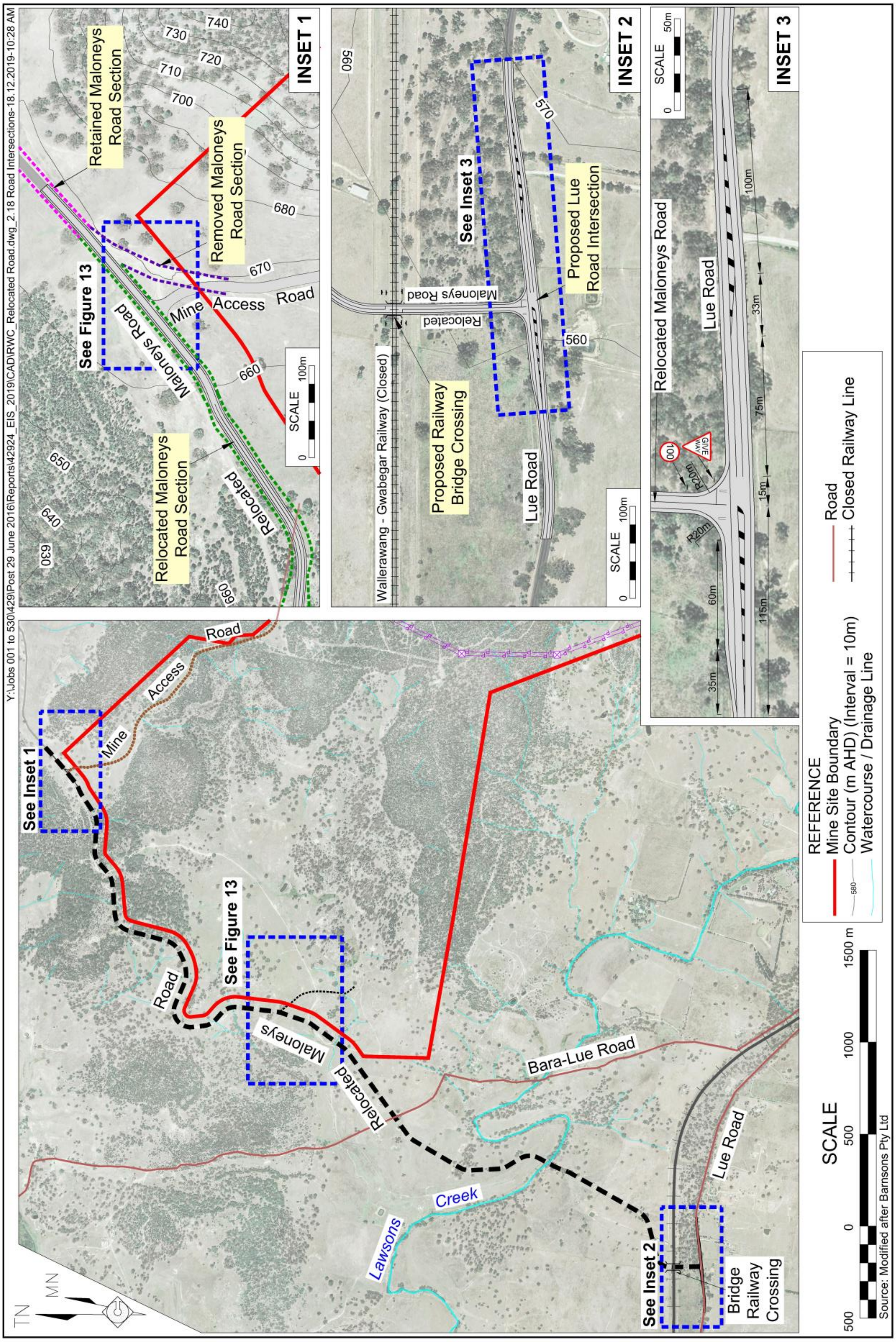
6.10 INTERSECTION TREATMENTS

6.10.1 Introduction

The Project would require new intersections to be constructed at (see **Figure 12**):

- Lue Road and relocated Maloneys Road;
- mine access road and relocated Maloneys Road; and
- relocated Maloneys Road and the access road to the TSF embankment area (for use during the delivery of NAF waste rock to the TSF NAF waste rock stockpile area).

Figure 12 Road Intersections and Railway Crossing



The new intersections would be designed and constructed in accordance with Austroads and relevant Council requirements, taking into consideration the ongoing use by B-doubles and semi-trailers for transport of mineral concentrates and occasional access by oversize or overmass vehicles.

Austroads (2017d) sets out warrants based on peak hour turning and through traffic volumes for major road turn treatments for basic, auxiliary lane and channelised treatments at rural intersections. The warrants focus on the safety performance of the intersection, while operational performance may require a higher level treatment, however as discussed in Section 6.5, the forecast volumes at the new intersections would be sufficiently low that there would be no concerns regarding capacity and delays to vehicles.

The general minimum preferred treatments at rural road intersections are Basic Auxiliary Left (BAL) and Basic Auxiliary Right (BAR) treatments. The rural BAL treatment on the major road has a widened shoulder, which assists turning vehicles to move further off the through carriageway, making it easier for through vehicles to pass a vehicle turning left into the minor road. The rural BAR treatment features a widened shoulder on the major road that allows through vehicles, having slowed, to pass to the left of vehicles turning right into the minor road. The BAL treatment on the minor road allows turning movements to occur from a single lane, with a shoulder that is too narrow to be used by left-turning vehicles, so as to prevent vehicles from standing two abreast at the holding line. These design features are preferred to safely manage the movement of vehicles in the high speed rural environment.

Auxiliary lane turn treatments have short lengths of auxiliary lane provided to improve safety, especially on high speed roads. The Auxiliary Right-turn treatment (AUR) on the major road is created by the use of a short lane with standard painted stripes, where the median lane is shared between through and right turning vehicles, and the auxiliary kerbside lane allows through vehicles to pass a vehicle which has slowed to turn right. AUR treatments are not used in NSW, rather a channelised right turn (CHR) treatment with a short turn bay known as a CHR(S) treatment is preferred. This is a modification of the channelised treatment described below.

Auxiliary Left-turn (AUL) treatments on the major and minor road are normal indented turn lanes, used only by vehicles turning left. The auxiliary lane treatment on the major road is safer than a basic treatment, however the channelised treatment described below is preferred where practicable, as the risk of collisions is lower. Consequently, Austroads (2017d) indicates that a channelised left turn (CHL) treatment should be used wherever practicable. The AUL treatment on the minor road is less safe than a basic or channelised treatment, and therefore while it is included in the warrants, it is not recommended, and Austroads (2017d) indicates that a BAL or CHL treatment should be used wherever practicable.

Channelised treatments at the intersections are CHR and CHL treatments for right and left turns respectively. The channelised "CH" treatments separate conflicting vehicle paths by raised or painted medians and/or islands, and often use auxiliary lanes in conjunction with channelisation. The CHR treatment on the major road provides a continuous lane for through vehicles only, and an auxiliary turn lane for right turning vehicles only. CHL treatments on the major or minor road provide a separate left turn "slip" lane, separated from the adjacent lane by a painted or raised island. Channelised treatments are preferred over auxiliary lane treatments where practicable, as the risk of collisions is lower.

The forecast traffic volumes at the proposed new intersections have been compared with the Austroads (2017d) warrants, discussed below.

6.10.2 Lue Road and Relocated Maloneys Road

During the peak site establishment and construction stage, the Project would generate the following turning movements on the major road at the intersection of Lue Road with the relocated Maloneys Road:

- 54 vehicles per hour turning left from Lue Road to the relocated Maloneys Road; and
- 29 vehicles per hour turning right from Lue Road to the relocated Maloneys Road.

Once operational, the Project would generate up to:

- 11 vehicles per hour turning left from Lue Road to the relocated Maloneys Road; and
- 6 vehicles per hour turning right from Lue Road to the relocated Maloneys Road.

Considering the total peak hourly volumes forecast on Lue Road (**Table 38** and **Table 39**), comparison with the Austroads (2017d) warrants indicates that the future traffic volumes would require BAL and BAR treatments in Lue Road at its intersection with the relocated Maloneys Road. A conceptual layout of the intersection is provided in **Figure 12**, which includes channelised left and right turn lanes in Lue Road. The conceptual CHL/CHR treatment therefore exceeds the minimum treatment required by the Austroads warrants, separating through and turning vehicles into separate lanes.

The detailed intersection design would also be developed to meet the various minimum sight distance requirements set out in Austroads (2017b), including Approach Sight Distance (ASD) to ensure all drivers are aware of the presence of the intersection; Safe Intersection Sight Distance (SISD) to allow drivers on Lue Road to decelerate to a stop if required before reaching the potential collision point with a vehicle exiting the relocated Maloneys Road; and minimum gap sight distance (MGSD), related to the critical gap between opposing vehicles that drivers will accept when undertaking a crossing or turning manoeuvre at the intersection.

The detailed intersection design would also take into consideration the swept paths of the B-doubles turning into and out of Lue Road at the intersection, to ensure that sufficient space is available for these vehicles to turn without crossing the centreline of the roads into opposing traffic lanes.

The survey on Lue Road west of Lue (Location 2) found that the 85th percentile speed of eastbound vehicles was 104.1 km/h and of westbound vehicles was 99.8 km/h. The required SISD based on a 100 km/h approach design speed on a level road is 248 m, and based on a 104 km/h design speed, is 263 m. The available sight distance from the east along Lue Road towards the proposed intersection is below the required SISD due to a horizontal bend on Lue Road. To achieve inter-visibility between an approaching driver along Lue Road and a driver exiting Lue Road, it is recommended that the line of trees along the southern side of Lue Road be trimmed and the verge lowered. The available sight distance from the west along Lue Road to the proposed intersection location exceeds the required SISD and is satisfactory.

6.10.3 Mine Access Road and Relocated Maloneys Road

During the site establishment and construction stage, the Project would generate up to 83 vehicles per hour turning right from the relocated Maloneys Road into the mine access road. Once operational, the Project would generate up to 42 vehicles per hour turning right from the relocated Maloneys Road into the mine access road.

Considering the peak hourly volumes forecast on the relocated Maloneys Road, comparison with the Austroads (2017d) warrants indicate that the future traffic volumes warrant a BAR treatment in relocated Maloneys Road at its intersection with the mine access road. The conceptual intersection layout presented in **Figure 13** (Part A) includes this treatment. It is noted that the major traffic demands would be between the mine access road and the relocated Maloneys Road south, rather than the through movements along the relocated Maloneys Road as would be expected at a standard T-intersection. It is however, considered inappropriate to re-orient the priority at the intersection to favour these movements.

The detailed intersection design would also be developed to meet the various Austroads (2017b) sight distance requirements, with due consideration of the movement of heavy vehicles at the intersection. This would include the need for B-doubles using the mine access road to be able to turn into and out of the mine access road without crossing the centrelines into opposing traffic lanes.

6.10.4 TSF Embankment Access and Relocated Maloneys Road

During the site establishment and construction stage, the Project would generate 13 vehicles per hour turning left from relocated Maloneys Road into the access road to the TSF embankment area. Once operational, the Project would generate up to five vehicles per hour turning left from relocated Maloneys Road into the access road to the TSF embankment area.

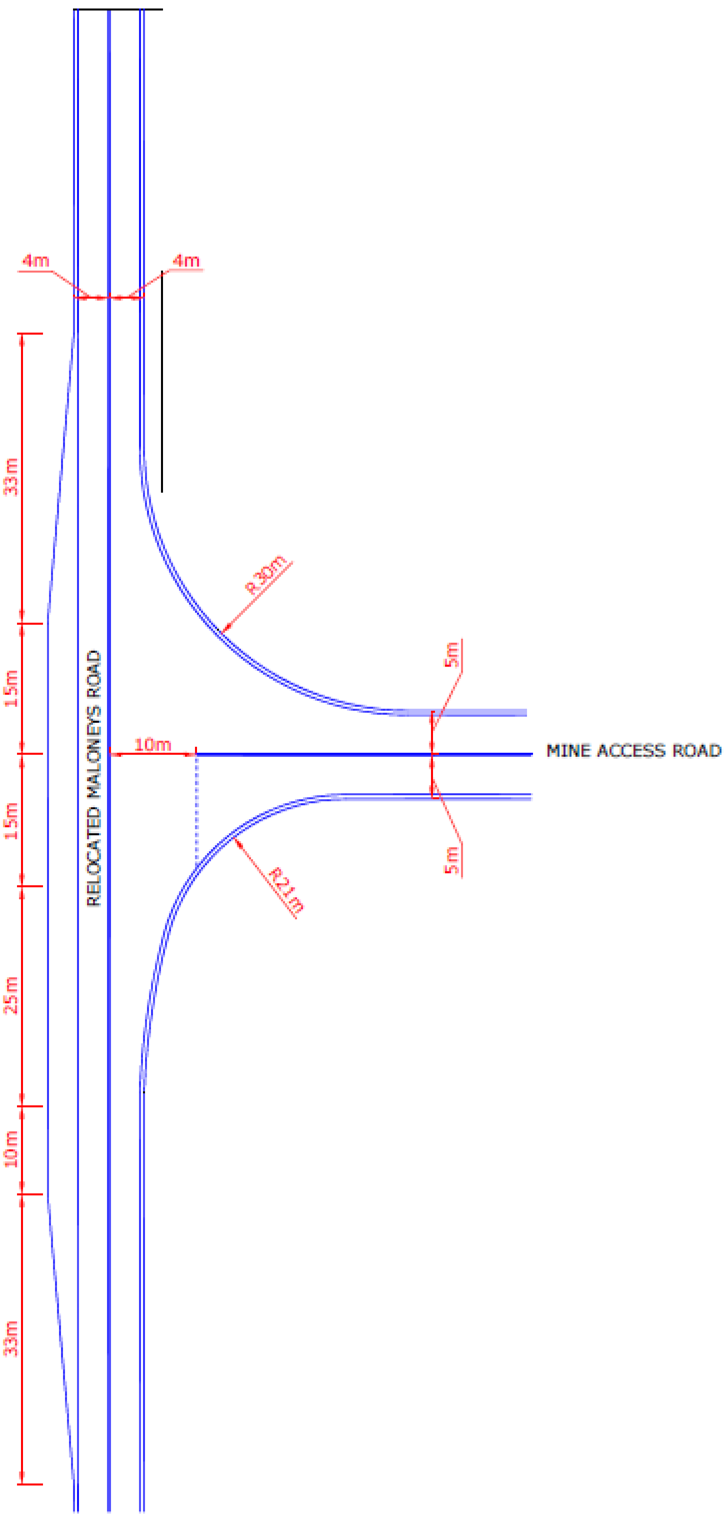
Considering the forecast traffic volumes on the relocated Maloneys Road, comparison with the Austroads (2017d) warrants indicates that the future traffic volumes warrant a BAL treatment in relocated Maloneys Road at its intersection with the TSF embankment access road.

The detailed intersection design would be developed to meet the various Austroads (2017b) minimum sight distance requirements, including Approach Sight Distance (ASD) to ensure all drivers are aware of the presence of the intersection; Safe Intersection Sight Distance (SISD) to allow drivers on the relocated Maloneys Road to decelerate to a stop if required before reaching the potential collision point with a vehicle exiting the TSF construction road; and minimum gap sight distance (MGSD), related to the critical gap between opposing vehicles that drivers will accept when undertaking a crossing or turning manoeuvre at the intersection.

A conceptual layout of the T-intersection design is displayed in **Figure 13** (Part B). The detailed intersection design would also have due consideration of the movement of heavy vehicles at the intersection. This would include the need for the B-doubles accessing the TSF construction area to be able to turn into and out of the relocated Maloneys Road without crossing the centrelines into opposing traffic lanes.

Figure 13 New Intersections – Conceptual Designs

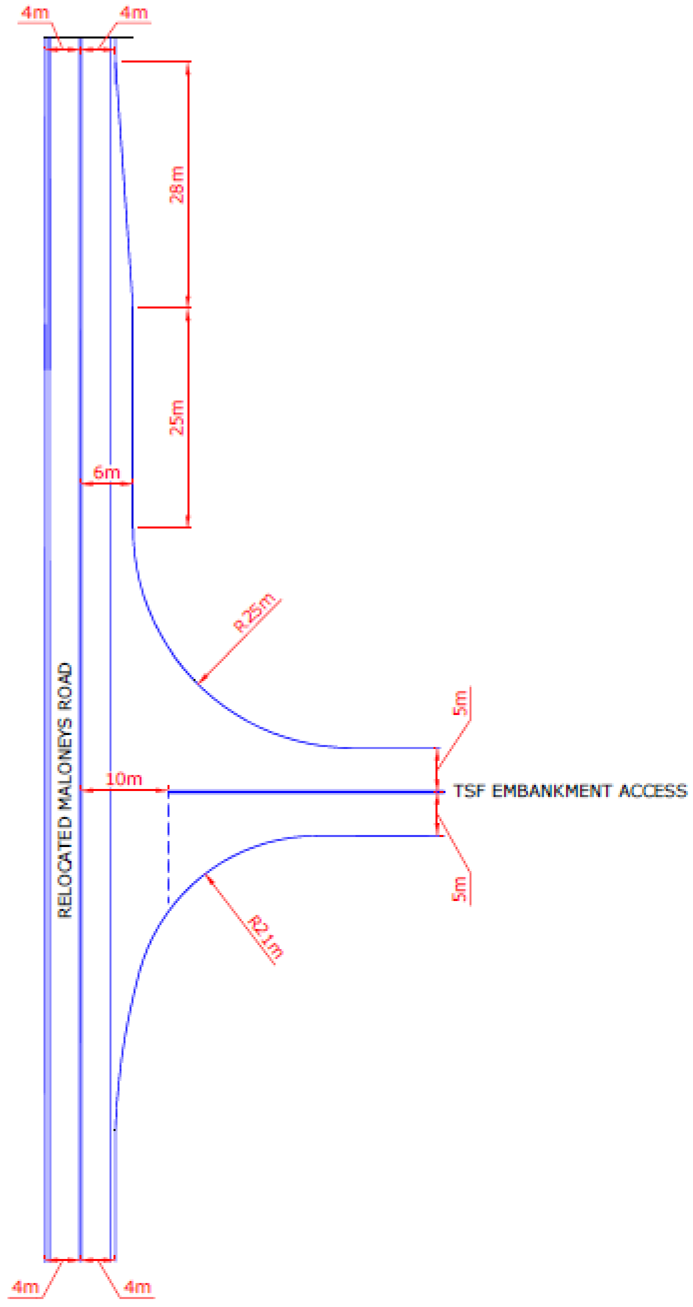
A: Mine Access Road and Relocated Maloneys Road



Note: concept plan dimensions are based on design speed 100 km/h on Relocated Maloneys Road, required geometry may be reduced for lower design speed.

Figure 13 New Intersections – Conceptual Designs

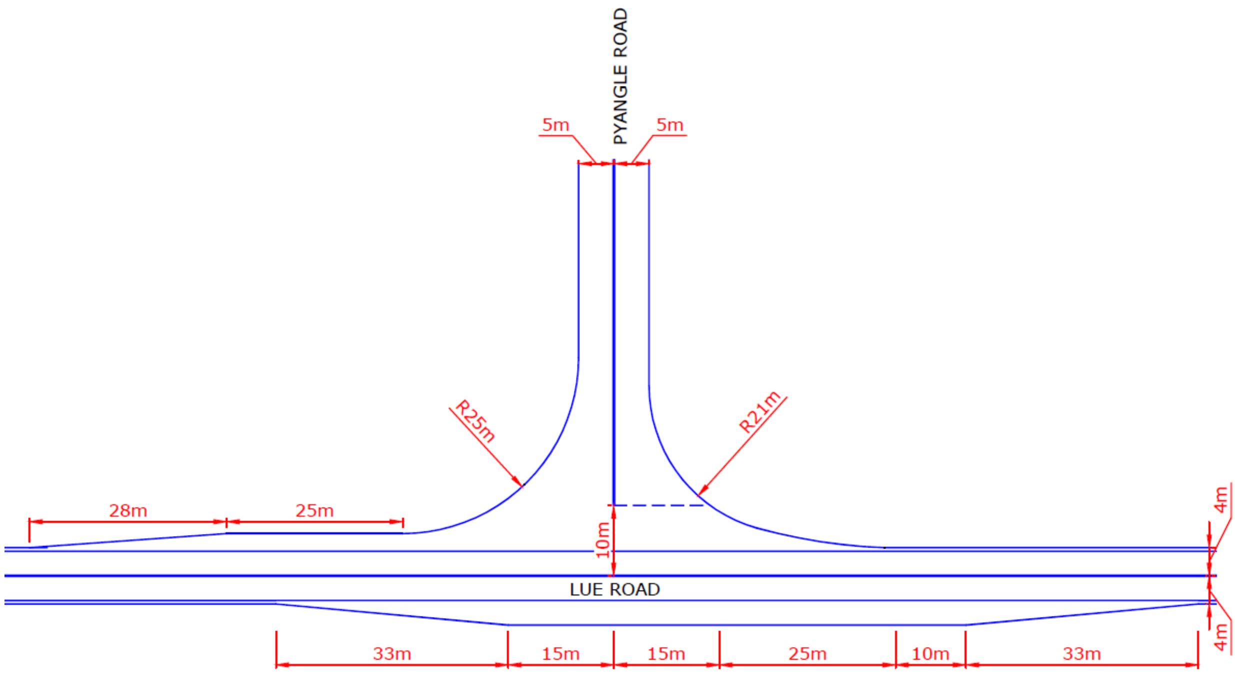
B: TSF Embankment Access and Relocated Maloneys Road



Note: concept plan dimensions are based on design speed 100 km/h on Relocated Maloneys Road, required geometry may be reduced for lower design speed.

Figure 13 New Intersections – Conceptual Designs

C: Lue Road and Pyangle Road



6.10.5 Lue Road and Pyangle Road

Although not a new intersection, the Project would also introduce ongoing vehicle turning movements at the intersections of Lue Road with Pyangle Road, and of Pyangle Road with Maloneys Road.

During the peak of the initial six month site establishment and construction stage, the Project would generate the following peak turning movements on the major road at the intersection of Lue Road with Maloneys Road:

- 27 vehicles per hour turning left from Lue Road to Pyangle Road and
- 15 vehicles per hour turning right from Lue Road to Pyangle Road.

During the peak site establishment and construction stage following commissioning of the relocated Maloneys Road, and during the operational stage, the Project would generate some additional through trips along Lue Road past Pyangle Road, and the following peak turning movements on the major road at the intersection of Lue Road with Maloneys Road:

- 13 vehicles per hour turning left from Lue Road to Pyangle Road and
- 7 vehicles per hour turning right from Lue Road to Pyangle Road.

Considering the forecast traffic volumes, comparison with the Austroads (2017d) warrants indicates that the traffic volumes warrant a BAL and BAR treatment in Lue Road at its intersection with Pyangle Road. The existing intersection has widened unsealed shoulder for left turns to Pyangle Road. To achieve a BAR treatment, the shoulder on the southern side of Lue Road would be widened in accordance with Austroads requirements, noting that this preferred minimum treatment is warranted without the Project-related traffic.

A conceptual design of the intersection is displayed in **Figure 13** (Part C).

6.11 RAILWAY BRIDGE CROSSING

A new railway bridge crossing would be constructed west of Lue on the relocated Maloneys Road, noting that this part of the Wallerawang-Gwabegar branch line is currently closed.

6.12 CAR PARKING

During the site establishment and construction stage, temporary car parking facilities for the workforce would be located within the Mine Site, generally in proximity to the respective area of construction (e.g. TSF or processing plant).

Car parking for employees and visitors during the operational stage would be located within the administration area, together with parking, set-down and pick-up facilities for the buses. Car parking would be provided to meet the anticipated peak demand of approximately 60 light vehicles. The car parking and bus facilities would be separated from the movement of heavy vehicles within the Mine Site to the extent possible.

6.13 OVERSIZE VEHICLES

The proposed movement for any oversize vehicles would be negotiated with RMS and MWRC on a case-by-case basis. All oversize loads would be transported with the relevant permits obtained in accordance with *Additional Access Conditions for oversize and overmass heavy vehicles and loads* (RMS, 2017), and any other licences and escorts as required by the regulatory authorities.

6.14 DANGEROUS GOODS

The transportation, handling and storage of any dangerous goods at the Project would be conducted in accordance with the requirements of the *Storage and Handling of Dangerous Goods – Code of Practice 2005* (WorkCover, 2005).

Dangerous goods required for the Project would be transported in accordance with the *Australian Code for the Transport of Dangerous Goods by Road and Rail* and the current State legislation, including the *Dangerous Goods (Road and Rail Transport) Act 2008* and the *Dangerous Goods (Road and Rail Transport) Regulation 2014.*

6.15 PROJECT TRAFFIC MANAGEMENT PLAN

Bowdens Silver would develop and implement a Project TMP which would apply to all light and heavy vehicles operated on the public road network by employees or contractors engaged by Bowdens Silver for transport tasks associated with the Project. The TMP would form part of the employee contract or transport contractual arrangements and would address such matters as:

- compliance with access routes;
- road rules, laws and regulations, including the use of mobile phones;
- driver licensing requirements for the relevant vehicle;
- respecting the rights of other road users and displaying courtesy to other motorists;
- maintaining safe following distances between vehicles, and increasing separation in poor weather;
- vehicle condition and maintenance;
- medical fitness of the driver;
- securing and overhang of loads;
- heavy vehicle convoy travel;
- reporting of any unsafe driving practices or incidents;
- passenger behaviour;
- appropriate use of headlights, cruise control, etc.;
- driver behaviour expectations at any specific locations or situations on the public road network including near schools;

- appropriate parking of vehicles;
- adherence to preferred access routes; and
- use of private vehicles to perform work activities for Bowdens Silver.

6.16 WAYFINDING

The defined routes to the Mine Site would be appropriately signposted to the satisfaction of MWRC to give drivers who are unfamiliar with the route reassurance information and sufficient advance warning of the need to turn into the relocated Maloneys Road from Lue Road to access the Mine Site.

7. CONCLUSIONS

This study has found that the traffic generated by the Bowdens Silver Project would be accommodated on the surrounding road network with acceptable impacts on the capacity, efficiency and safety of the road network, subject to:

- design of new roads to meet Austroads design standards;
- design of new intersections to meet Austroads design standards;
- provision of passing opportunities for heavy vehicles on Maloneys Road and Pyangle Road for the initial site establishment and construction stage;
- transport of all oversize or overmass vehicles and dangerous goods to be in accordance with relevant authority requirements; and
- development and implementation of a Project Traffic Management Plan

8. REFERENCES

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Annexures

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Annexure 1

Traffic Survey Results

(Total No. of pages including blank pages = 18)

Note: This Annexure is only available on the digital version of this document

Job No	N2978
Client	TTPP
Site	Bara Lue Rd just south of Lawson Creek
Location	Lue
Site No	2
Start Date	15-Feb-17
Description	Volume Summary
Direction	Combined

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	20-Feb	21-Feb	15-Feb	16-Feb	17-Feb	18-Feb	19-Feb		
AM Peak	3	1	6	3	5	2	3		
PM Peak	3	5	5	2	3	3	2	20	18
0:00	0	0	1	0	0	1	1	0	0
1:00	0	0	0	0	0	0	0	0	0
2:00	0	0	0	0	0	0	0	0	0
3:00	0	0	0	0	0	0	0	0	0
4:00	0	0	0	0	0	0	0	0	0
5:00	0	0	0	0	0	0	0	0	0
6:00	1	0	0	0	0	0	1	0	0
7:00	1	1	1	1	3	0	2	1	1
8:00	1	1	2	2	5	1	0	2	2
9:00	2	0	2	2	1	2	1	1	1
10:00	3	1	3	3	0	2	0	2	2
11:00	1	1	6	0	3	1	3	2	2
12:00	1	1	5	0	3	0	2	2	2
13:00	2	3	2	1	3	0	0	2	2
14:00	1	0	1	2	1	0	1	1	1
15:00	2	1	1	0	0	3	2	1	1
16:00	1	0	0	0	1	0	1	0	0
17:00	0	5	1	0	0	0	0	1	1
18:00	0	0	1	1	3	1	1	1	1
19:00	3	0	0	0	1	1	0	1	1
20:00	0	1	0	0	0	1	0	0	0
21:00	0	0	0	2	0	0	0	0	0
22:00	0	0	0	0	0	0	0	0	0
23:00	0	0	0	0	0	0	0	0	0
Total	19	15	26	14	24	13	15	20	18

7-19	15	14	25	12	23	10	13	18	16
6-22	19	15	25	14	24	12	14	19	18
6-24	19	15	25	14	24	12	14	19	18
0-24	19	15	26	14	24	13	15	20	18

Job No	N2978
Client	TTPP
Site	Lue Rd
Location	Lue
Site No	3
Start Date	15-Feb-17
Description	Volume Summary
Direction	Combined

MATRIX Traffic and Transport Data

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon 20-Feb	Tue 21-Feb	Wed 15-Feb	Thu 16-Feb	Fri 17-Feb	Sat 18-Feb	Sun 19-Feb		
AM Peak	68	75	83	76	84	65	56	877	807
PM Peak	73	99	86	84	74	70	54		
0:00	0	1	2	2	0	4	2	1	2
1:00	0	0	1	0	1	2	2	0	1
2:00	1	0	2	0	1	2	0	1	1
3:00	1	6	1	0	1	1	0	2	1
4:00	7	12	12	9	12	5	4	10	9
5:00	20	22	26	22	15	8	9	21	17
6:00	34	45	39	52	39	24	9	42	35
7:00	64	75	78	66	64	20	17	69	55
8:00	68	67	83	76	84	65	28	76	67
9:00	55	55	67	70	69	57	56	63	61
10:00	62	50	49	58	55	56	46	55	54
11:00	53	54	50	36	51	62	38	49	49
12:00	44	49	65	55	50	54	54	53	53
13:00	43	64	44	53	66	70	43	54	55
14:00	53	54	59	54	74	45	53	59	56
15:00	57	48	86	67	71	53	48	66	61
16:00	73	84	73	77	54	45	42	72	64
17:00	73	99	79	84	52	38	35	77	66
18:00	38	49	41	35	48	22	21	42	36
19:00	20	29	25	28	30	23	11	26	24
20:00	13	13	14	17	19	16	15	15	15
21:00	17	13	9	15	12	23	11	13	14
22:00	6	2	8	8	14	7	8	8	8
23:00	1	3	2	5	2	7	2	3	3
Total	803	894	915	889	884	709	554	877	807

7-19	683	748	774	731	738	587	481	735	677
6-22	767	848	861	843	838	673	527	831	765
6-24	774	853	871	856	854	687	537	842	776
0-24	803	894	915	889	884	709	554	877	807

Job No	N2978
Client	TTPP
Site	Swanston St 100m east of Hapur St
Location	Lue
Site No	4
Start Date	15-Feb-17
Description	Volume Summary
Direction	Combined

MATRIX Traffic and Transport Data

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	20-Feb	21-Feb	15-Feb	16-Feb	17-Feb	18-Feb	19-Feb		
AM Peak	73	68	80	76	80	61	58		
PM Peak	74	97	72	87	76	68	53	840	776
0:00	0	1	2	2	0	3	3	1	2
1:00	0	0	1	0	1	4	2	0	1
2:00	1	0	1	0	1	2	0	1	1
3:00	1	6	1	2	1	1	0	2	2
4:00	7	12	11	7	12	4	4	10	8
5:00	19	21	23	19	14	8	8	19	16
6:00	30	39	36	49	38	20	7	38	31
7:00	56	68	72	58	56	20	17	62	50
8:00	73	63	80	76	80	59	25	74	65
9:00	46	54	60	64	66	59	58	58	58
10:00	57	49	45	56	56	49	47	53	51
11:00	56	51	49	32	46	61	39	47	48
12:00	43	54	61	48	47	57	53	51	52
13:00	35	60	43	55	60	68	43	51	52
14:00	54	55	70	45	76	46	52	60	57
15:00	58	50	72	78	73	47	46	66	61
16:00	74	83	67	75	53	46	45	70	63
17:00	69	97	70	87	50	35	30	75	63
18:00	36	50	37	34	44	23	22	40	35
19:00	21	26	18	29	27	21	14	24	22
20:00	10	14	20	17	17	21	15	16	16
21:00	15	12	8	15	17	22	8	13	14
22:00	4	2	6	6	13	10	4	6	6
23:00	1	2	2	5	4	5	1	3	3
Total	766	869	855	859	852	691	543	840	776

7-19	657	734	726	708	707	570	477	706	654
6-22	733	825	808	818	806	654	521	798	738
6-24	738	829	816	829	823	669	526	807	747
0-24	766	869	855	859	852	691	543	840	776

Job No	N2978
Client	TTPP
Site	Cox St east of Peel St
Location	Lue
Site No	5
Start Date	15-Feb-17
Description	Volume Summary
Direction	Combined

MATRIX Traffic and Transport Data

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	20-Feb	21-Feb	15-Feb	16-Feb	17-Feb	18-Feb	19-Feb		
AM Peak	5	5	9	3	4	5	3		
PM Peak	3	4	6	4	10	6	4	40	40
0:00	0	0	1	0	0	5	0	0	1
1:00	0	0	0	0	0	0	0	0	0
2:00	0	0	0	0	0	0	0	0	0
3:00	0	0	0	0	0	0	0	0	0
4:00	0	0	0	0	0	0	0	0	0
5:00	0	0	0	2	1	0	0	1	0
6:00	0	0	0	1	0	1	0	0	0
7:00	0	3	3	0	1	4	3	1	2
8:00	2	5	1	2	4	2	2	3	3
9:00	4	2	9	0	0	2	3	3	3
10:00	4	1	3	3	1	1	1	2	2
11:00	5	3	6	1	1	1	1	3	3
12:00	3	2	3	2	1	2	4	2	2
13:00	3	1	4	1	3	4	3	2	3
14:00	1	1	0	1	3	2	3	1	2
15:00	3	4	6	4	1	6	3	4	4
16:00	0	3	5	2	6	1	3	3	3
17:00	1	4	5	1	4	3	3	3	3
18:00	2	3	4	3	3	3	3	3	3
19:00	1	1	5	1	10	4	1	4	3
20:00	1	1	4	0	7	1	0	3	2
21:00	0	0	0	0	1	0	2	0	0
22:00	0	0	0	0	0	0	0	0	0
23:00	0	1	2	0	2	1	0	1	1
Total	30	35	61	24	49	43	35	40	40

7-19	28	32	49	20	28	31	32	31	31
6-22	30	34	58	22	46	37	35	38	37
6-24	30	35	60	22	48	38	35	39	38
0-24	30	35	61	24	49	43	35	40	40

Job No	N2978
Client	TTPP
Site	Lue Rd west of Pyangle Rd
Location	Lue
Site No	6
Start Date	15-Feb-17
Description	Volume Summary
Direction	Combined

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	20-Feb	21-Feb	15-Feb	16-Feb	17-Feb	18-Feb	19-Feb		
AM Peak	74	71	78	65	71	59	47		
PM Peak	80	92	73	77	76	65	64	815	747
0:00	0	2	0	2	0	5	3	1	2
1:00	0	0	1	0	1	5	1	0	1
2:00	1	0	1	0	1	2	0	1	1
3:00	1	6	1	2	1	1	0	2	2
4:00	6	12	11	6	11	3	4	9	8
5:00	18	22	21	17	13	8	7	18	15
6:00	30	35	32	46	36	18	8	36	29
7:00	60	71	78	64	69	23	17	68	55
8:00	74	58	78	65	71	59	28	69	62
9:00	44	53	52	63	64	42	45	55	52
10:00	54	54	47	60	55	45	47	54	52
11:00	51	55	43	34	49	56	28	46	45
12:00	39	49	65	43	53	46	64	50	51
13:00	37	56	40	55	61	65	42	50	51
14:00	45	55	71	44	76	47	48	58	55
15:00	50	49	72	77	60	37	40	62	55
16:00	80	72	63	75	45	52	43	67	61
17:00	64	92	73	76	49	33	36	71	60
18:00	28	48	36	35	42	26	22	38	34
19:00	17	24	24	24	27	23	11	23	21
20:00	11	15	14	21	23	16	15	17	16
21:00	12	12	8	8	20	13	5	12	11
22:00	4	2	6	3	10	5	4	5	5
23:00	0	3	3	3	4	6	1	3	3
Total	726	845	840	823	841	636	519	815	747

7-19	626	712	718	691	694	531	460	688	633
6-22	696	798	796	790	800	601	499	776	711
6-24	700	803	805	796	814	612	504	784	719
0-24	726	845	840	823	841	636	519	815	747

Job No	N2978
Client	TTPP
Site	Lue Rd between Pyangle and Tongbong Rd
Location	Lue
Site No	7
Start Date	15-Feb-17
Description	Volume Summary
Direction	Combined

MATRIX Traffic and Transport Data

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	20-Feb	21-Feb	15-Feb	16-Feb	17-Feb	18-Feb	19-Feb		
AM Peak	70	67	79	65	67	55	45		
PM Peak	75	87	72	74	66	61	60	762	700
0:00	0	2	1	1	0	5	3	1	2
1:00	0	0	1	0	1	4	1	0	1
2:00	1	0	1	0	0	2	0	0	1
3:00	1	6	1	1	1	1	0	2	2
4:00	6	11	10	5	11	3	4	9	7
5:00	17	20	18	17	13	8	7	17	14
6:00	29	33	29	43	40	17	8	35	28
7:00	57	67	79	65	67	21	16	67	53
8:00	70	54	67	58	64	55	27	63	56
9:00	41	50	52	60	62	39	43	53	50
10:00	51	51	41	51	50	42	45	49	47
11:00	48	52	41	34	45	52	26	44	43
12:00	37	46	54	44	51	43	60	46	48
13:00	35	53	37	56	57	61	39	48	48
14:00	43	52	67	39	66	44	45	53	51
15:00	47	46	72	70	59	35	38	59	52
16:00	75	68	65	72	53	49	41	67	60
17:00	61	87	62	74	47	31	34	66	57
18:00	26	45	28	26	38	24	21	33	30
19:00	16	23	19	20	17	21	11	19	18
20:00	10	14	13	19	16	15	14	14	14
21:00	12	12	7	7	15	13	5	11	10
22:00	4	2	7	4	10	5	4	5	5
23:00	0	3	2	3	2	6	1	2	2
Total	687	797	774	769	785	596	493	762	700

7-19	591	671	665	649	659	496	435	647	595
6-22	658	753	733	738	747	562	473	726	666
6-24	662	758	742	745	759	573	478	733	674
0-24	687	797	774	769	785	596	493	762	700

Job No	N2978
Client	TTPP
Site	Pyangle Rd
Location	Lue
Site No	8
Start Date	15-Feb-17
Description	Volume Summary
Direction	Combined

MATRIX Traffic and Transport Data

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	20-Feb	21-Feb	15-Feb	16-Feb	17-Feb	18-Feb	19-Feb		
AM Peak	15	17	17	14	12	3	8		
PM Peak	13	13	14	15	12	13	5	109	91
0:00	0	0	0	1	0	0	2	0	0
1:00	0	0	0	0	0	0	1	0	0
2:00	0	0	0	0	0	0	0	0	0
3:00	0	0	0	0	0	0	0	0	0
4:00	0	0	1	0	0	0	0	0	0
5:00	2	0	2	0	0	0	0	1	1
6:00	5	5	9	11	11	0	1	8	6
7:00	11	17	11	14	12	0	2	13	10
8:00	15	7	17	6	10	0	0	11	8
9:00	6	8	3	10	6	3	8	7	6
10:00	9	7	11	9	6	2	5	8	7
11:00	6	11	7	3	7	0	3	7	5
12:00	8	4	11	5	2	0	5	6	5
13:00	4	9	5	3	12	1	2	7	5
14:00	5	3	4	6	12	7	5	6	6
15:00	3	9	14	8	6	13	5	8	8
16:00	13	13	12	15	0	1	3	11	8
17:00	4	6	14	8	1	1	3	7	5
18:00	5	4	5	4	0	2	3	4	3
19:00	0	1	7	5	1	1	3	3	3
20:00	1	3	0	1	0	2	1	1	1
21:00	3	0	1	1	0	5	1	1	2
22:00	0	0	4	1	0	4	0	1	1
23:00	0	0	1	0	0	1	0	0	0
Total	100	107	139	111	86	43	53	109	91

7-19	89	98	114	91	74	30	44	93	77
6-22	98	107	131	109	86	38	50	106	88
6-24	98	107	136	110	86	43	50	107	90
0-24	100	107	139	111	86	43	53	109	91

Job No	N2978
Client	TTPP
Site	Maloney Rd
Location	Lue
Site No	9
Start Date	15-Feb-17
Description	Volume Summary
Direction	Combined

MATRIX Traffic and Transport Data

Hour Starting	Mon 20-Feb	Tue 21-Feb	Wed 15-Feb	Thu 16-Feb	Fri 17-Feb	Sat 18-Feb	Sun 19-Feb	W'Day Ave	7 Day Ave
AM Peak	11	13	10	17	11	5	2		
PM Peak	9	12	15	17	12	4	5	90	73
0:00	0	0	0	0	0	1	0	0	0
1:00	0	0	0	0	0	0	0	0	0
2:00	0	0	0	0	0	0	0	0	0
3:00	0	0	0	0	0	0	0	0	0
4:00	0	0	0	0	0	0	0	0	0
5:00	1	0	2	0	0	0	0	1	0
6:00	4	5	9	10	11	2	1	8	6
7:00	8	13	9	17	8	5	2	11	9
8:00	11	6	10	7	9	3	0	9	7
9:00	3	8	2	8	4	3	1	5	4
10:00	4	4	8	6	5	1	1	5	4
11:00	1	8	2	8	2	2	2	4	4
12:00	7	4	7	7	1	4	3	5	5
13:00	3	7	5	4	12	3	5	6	6
14:00	7	2	3	6	3	1	2	4	3
15:00	4	8	15	8	12	2	1	9	7
16:00	9	12	8	17	5	0	3	10	8
17:00	3	6	11	6	2	0	4	6	5
18:00	4	1	2	2	3	2	4	2	3
19:00	0	1	1	2	2	1	1	1	1
20:00	0	1	0	1	5	0	1	1	1
21:00	2	0	0	0	1	1	0	1	1
22:00	0	0	3	0	0	0	0	1	0
23:00	0	0	0	0	0	0	0	0	0
Total	71	86	97	109	85	31	31	90	73

7-19	64	79	82	96	66	26	28	77	63
6-22	70	86	92	109	85	30	31	88	72
6-24	70	86	95	109	85	30	31	89	72
0-24	71	86	97	109	85	31	31	90	73

Job No	N2978
Client	TTPP
Site	Ulan Rd 200m south of Ulan Coal Mines Turn Off
Location	Lue
Site No	10
Start Date	15-Feb-17
Description	Volume Summary
Direction	Combined

MATRIX Traffic and Transport Data

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	20-Feb	21-Feb	15-Feb	16-Feb	17-Feb	18-Feb	19-Feb		
AM Peak	166	180	146	159	147	92	109		
PM Peak	169	154	139	158	186	89	141	1965	1766
0:00	1	12	5	11	7	5	5	7	7
1:00	3	8	6	7	7	3	4	6	5
2:00	1	3	2	1	5	3	0	2	2
3:00	4	2	4	1	8	3	5	4	4
4:00	33	37	31	44	36	15	4	36	29
5:00	154	167	139	138	134	37	33	146	115
6:00	166	180	146	159	147	72	55	160	132
7:00	104	97	113	103	108	65	37	105	90
8:00	93	75	56	95	88	67	50	81	75
9:00	90	99	79	92	102	63	63	92	84
10:00	84	100	78	123	112	92	85	99	96
11:00	103	78	108	87	110	75	109	97	96
12:00	112	121	111	145	134	65	90	125	111
13:00	142	120	125	150	159	89	134	139	131
14:00	127	126	109	135	184	70	139	136	127
15:00	169	154	139	158	186	77	141	161	146
16:00	155	141	123	142	119	59	118	136	122
17:00	117	113	108	105	111	70	93	111	102
18:00	89	100	81	75	100	70	85	89	86
19:00	50	53	38	55	95	61	77	58	61
20:00	53	40	63	57	38	19	45	50	45
21:00	51	46	54	59	21	10	48	46	41
22:00	57	52	70	61	40	3	14	56	42
23:00	18	24	18	21	18	3	6	20	15
Total	1976	1948	1806	2024	2069	1096	1440	1965	1766

7-19	1385	1324	1230	1410	1513	862	1144	1372	1267
6-22	1705	1643	1531	1740	1814	1024	1369	1687	1547
6-24	1780	1719	1619	1822	1872	1030	1389	1762	1604
0-24	1976	1948	1806	2024	2069	1096	1440	1965	1766

Job No	N2978
Client	TTPP
Site	Ulan Rd north of Lue Rd
Location	Lue
Site No	11
Start Date	15-Feb-17
Description	Volume Summary
Direction	Combined

MATRIX Traffic and Transport Data

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	20-Feb	21-Feb	15-Feb	16-Feb	17-Feb	18-Feb	19-Feb		
AM Peak	697	619	687	665	601	590	465		
PM Peak	752	800	749	715	724	566	473	**8364**	**7659**
0:00	7	18	23	12	24	44	44	17	25
1:00	7	16	17	18	16	29	18	15	17
2:00	5	7	8	8	13	15	19	8	11
3:00	17	14	15	20	21	11	17	17	16
4:00	107	134	134	137	119	43	43	126	102
5:00	321	355	348	362	321	146	131	341	283
6:00	377	423	437	438	393	164	111	414	335
7:00	400	456	441	471	486	302	156	451	387
8:00	697	619	687	665	540	381	273	642	552
9:00	542	488	498	506	601	543	354	527	505
10:00	457	400	460	478	542	516	421	467	468
11:00	444	471	443	433	483	590	465	455	476
12:00	511	522	531	503	625	566	473	538	533
13:00	462	448	476	467	664	442	402	503	480
14:00	468	456	464	495	528	392	403	482	458
15:00	626	586	643	614	724	394	389	639	568
16:00	719	684	711	715	607	405	355	687	599
17:00	752	800	749	687	617	402	377	721	626
18:00	440	488	485	534	476	396	291	485	444
19:00	337	344	378	353	358	316	230	354	331
20:00	157	208	239	243	254	181	137	220	203
21:00	82	83	114	137	198	111	93	123	117
22:00	44	45	59	82	82	99	27	62	63
23:00	51	51	77	73	92	57	19	69	60
Total	8030	8116	8437	8451	8784	6545	5248	8364	7659

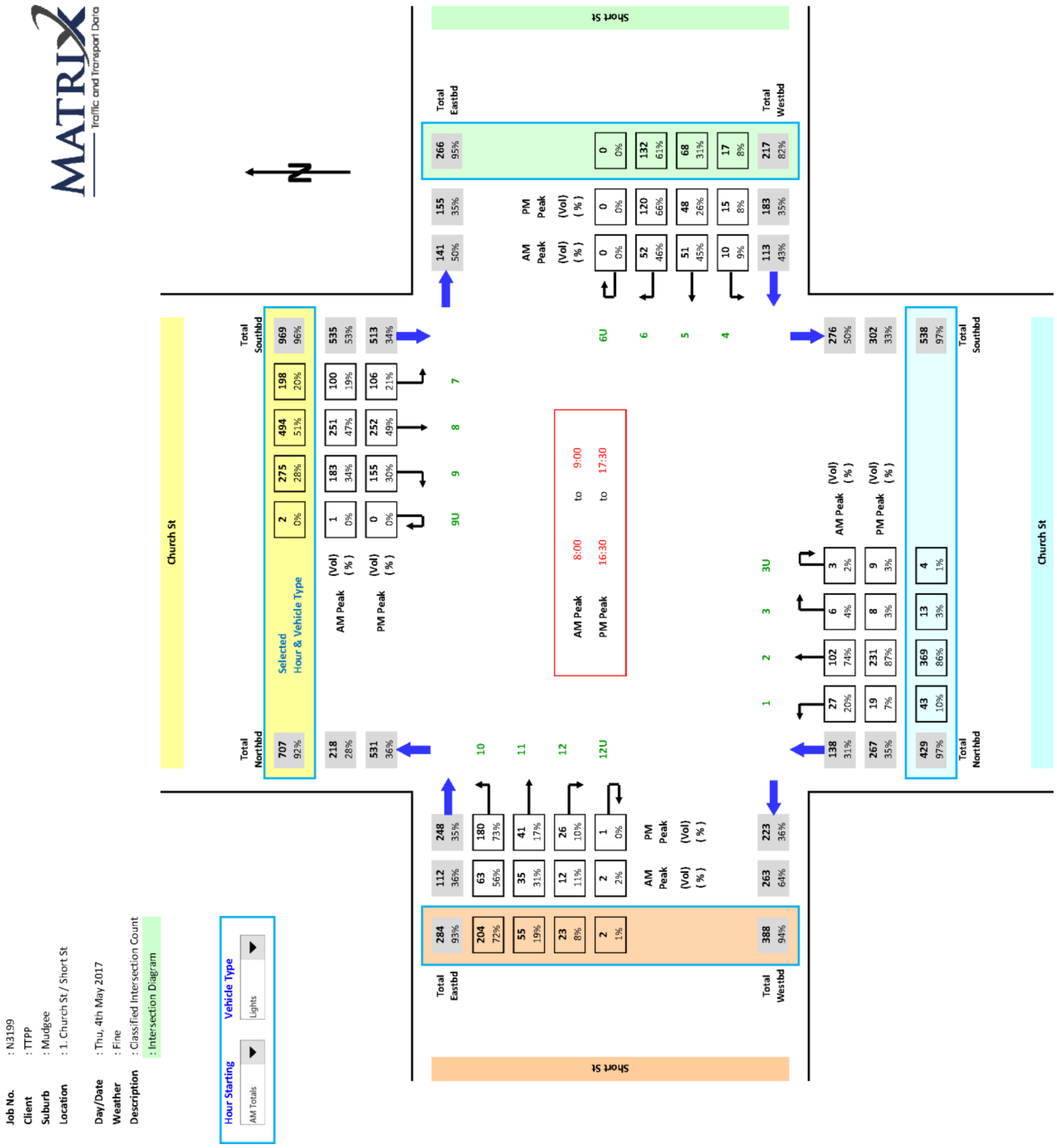
7-19	6518	6418	6588	6568	6893	5329	4359	6597	6096
6-22	7471	7476	7756	7739	8096	6101	4930	7708	7081
6-24	7566	7572	7892	7894	8270	6257	4976	7839	7204
0-24	8030	8116	8437	8451	8784	6545	5248	8364	7659

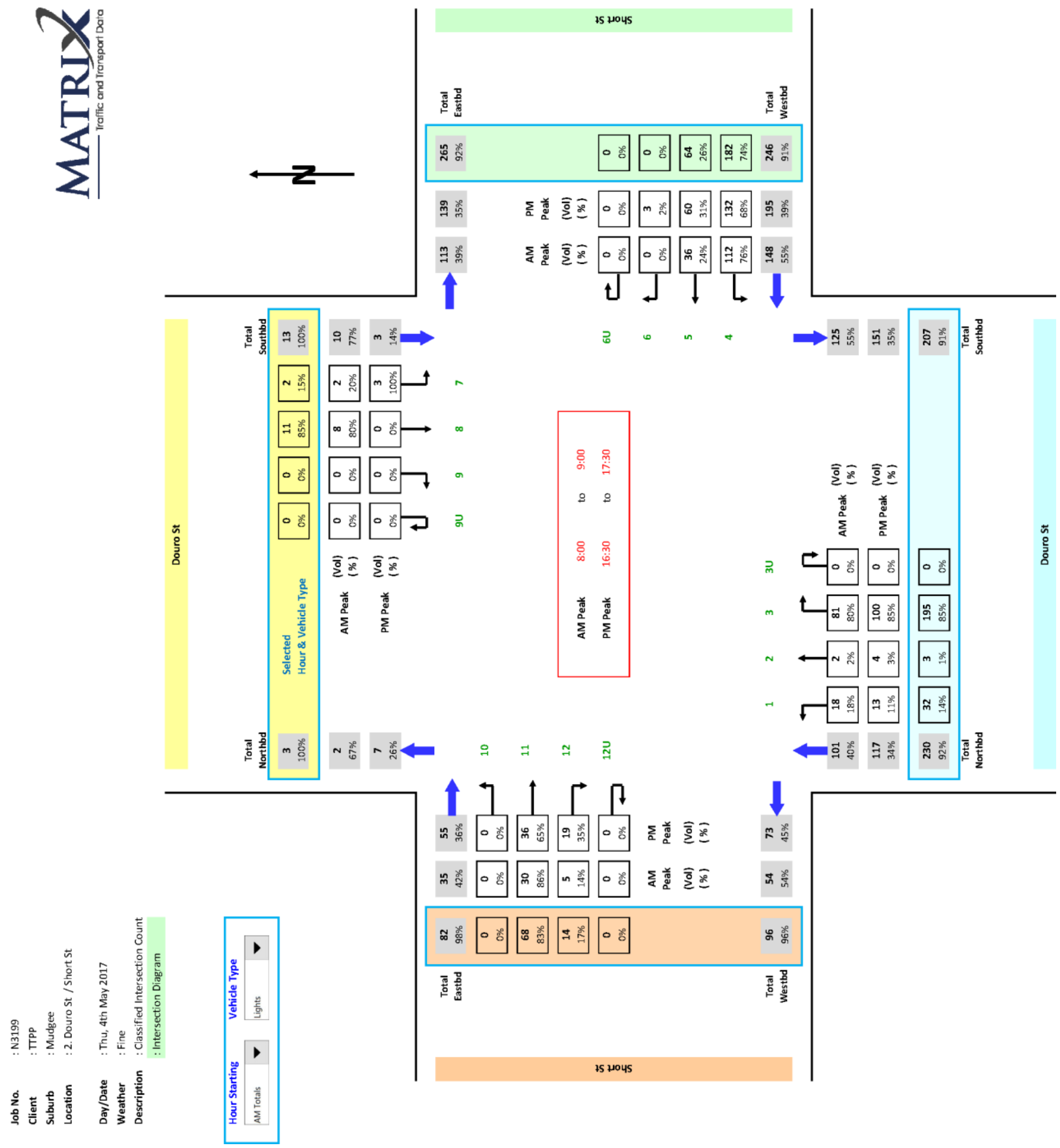
Job No	N3199 - Mudgee
Client	TTPP
Site	Castlereagh Rd
Location	Mudgee
Site No	1
Start Date	4-May-17
Description	Volume Summary
Direction	Combined

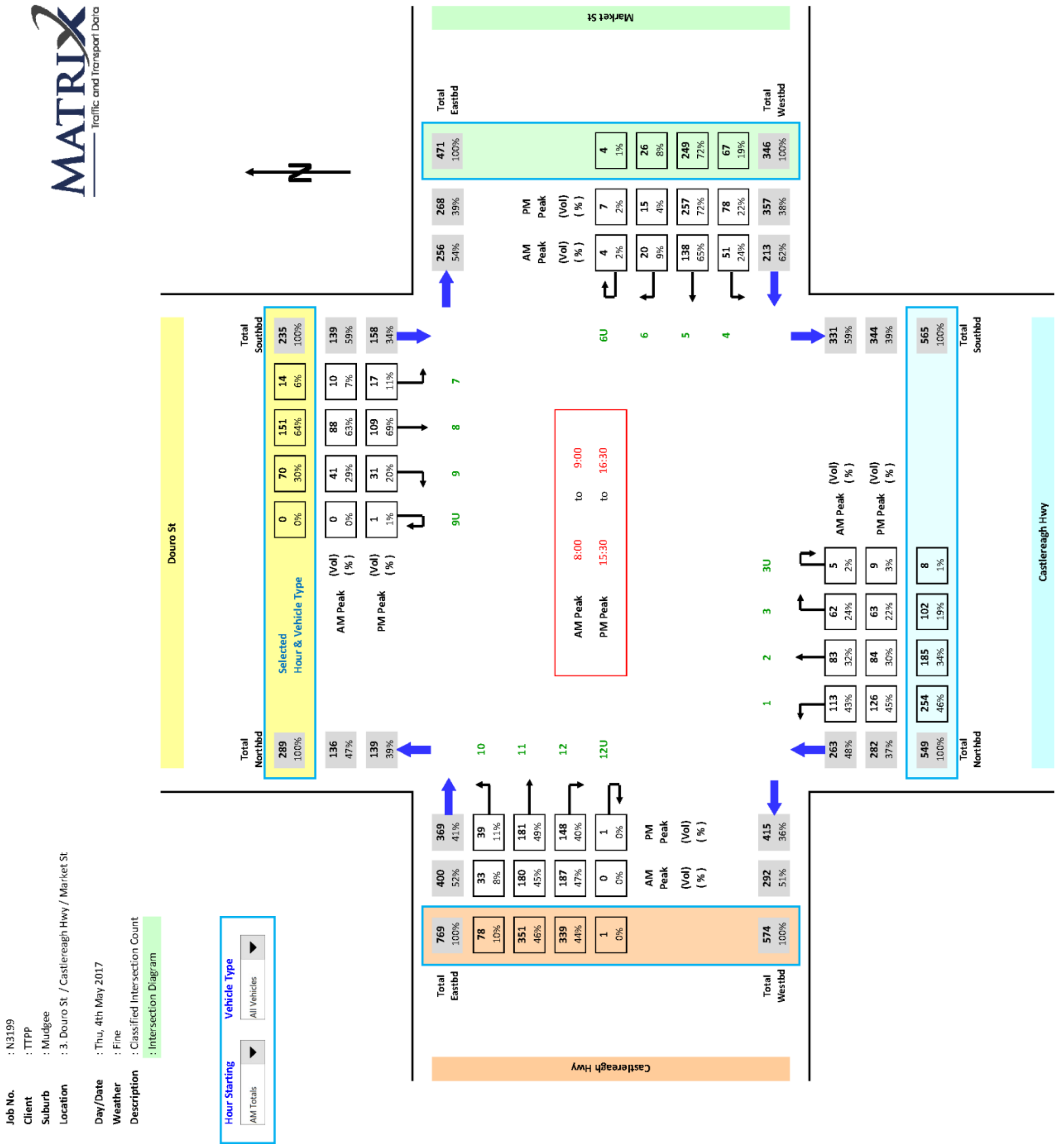
MATRIX Traffic and Transport Data

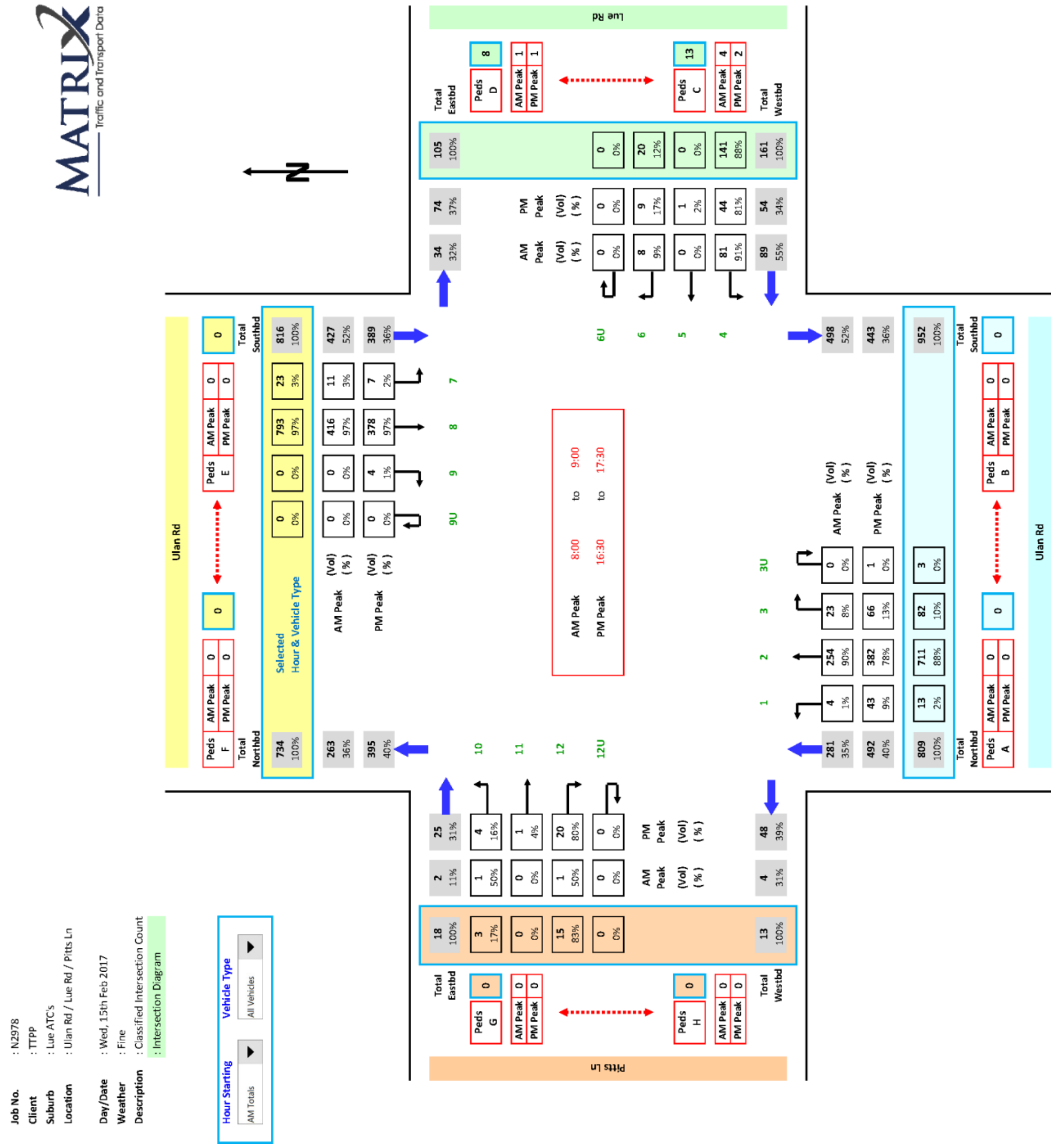
Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	8-May	9-May	10-May	4-May	5-May	6-May	7-May		
AM Peak	369	343	400	402	370	365	367		
PM Peak	347	394	392	404	423	358	408	**4350**	**4197**
0:00	7	8	13	3	8	14	21	8	11
1:00	5	6	5	9	9	13	12	7	8
2:00	8	6	11	8	11	11	10	9	9
3:00	7	10	10	15	11	10	5	11	10
4:00	26	20	18	19	25	10	6	22	18
5:00	60	59	82	56	68	38	28	65	56
6:00	168	169	166	177	150	85	47	166	137
7:00	234	260	263	265	217	158	86	248	212
8:00	369	343	400	402	353	234	148	373	321
9:00	284	312	357	367	336	328	236	331	317
10:00	330	287	321	296	370	340	303	321	321
11:00	298	241	287	309	329	365	367	293	314
12:00	268	295	262	323	325	358	384	295	316
13:00	255	280	307	318	345	289	408	301	315
14:00	311	314	272	347	395	268	382	328	327
15:00	347	394	351	373	391	257	328	371	349
16:00	347	340	392	404	423	275	247	381	347
17:00	306	351	353	344	413	257	206	353	319
18:00	168	167	186	193	257	134	353	194	208
19:00	80	85	86	127	135	87	190	103	113
20:00	36	50	69	91	93	45	84	68	67
21:00	36	45	45	54	100	59	36	56	54
22:00	22	21	35	31	54	44	30	33	34
23:00	13	12	12	16	21	29	7	15	16
Total	3985	4075	4303	4547	4839	3708	3924	4350	4197

7-19	3517	3584	3751	3941	4154	3263	3448	3789	3665
6-22	3837	3933	4117	4390	4632	3539	3805	4182	4036
6-24	3872	3966	4164	4437	4707	3612	3842	4229	4086
0-24	3985	4075	4303	4547	4839	3708	3924	4350	4197


MATRIX
Traffic and Transport Data
Job No. : N3199
Client : TTPP
Suburb : Mudgee
Location : 1. Church St / Short St
Day/Date : Thu, 4th May 2017
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram
Hour Starting
AM Totals
Vehicle Type
Lights
Church St
Short St
Selected Hour & Vehicle Type
AM Peak 8:00 to 9:00
PM Peak 16:30 to 17:30
Total Southbd
Total Northbd
Total Eastbd
Total Westbd


Job No. : N3199
Client : TTPP
Suburb : Mudgee
Location : 2. Douro St / Short St
Day/Date : Thu, 4th May 2017
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram
Hour Starting
AM Totals
Vehicle Type
Lights
Douro St
Short St
AM Peak 8:00 to 9:00
PM Peak 16:30 to 17:30


MATRIX Traffic and Transport Data
Job No. : N3199
Client : TTPP
Suburb : Mudgee
Location : 3. Douro St / Castlereagh Hwy / Market St
Day/Date : Thu, 4th May 2017
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram
Hour Starting AM Totals
Vehicle Type All Vehicles
Market St
Douro St
Castlereagh Hwy
Castlereagh Hwy
Selected Hour & Vehicle Type
AM Peak 8:00 to 9:00
PM Peak 15:30 to 16:30
N

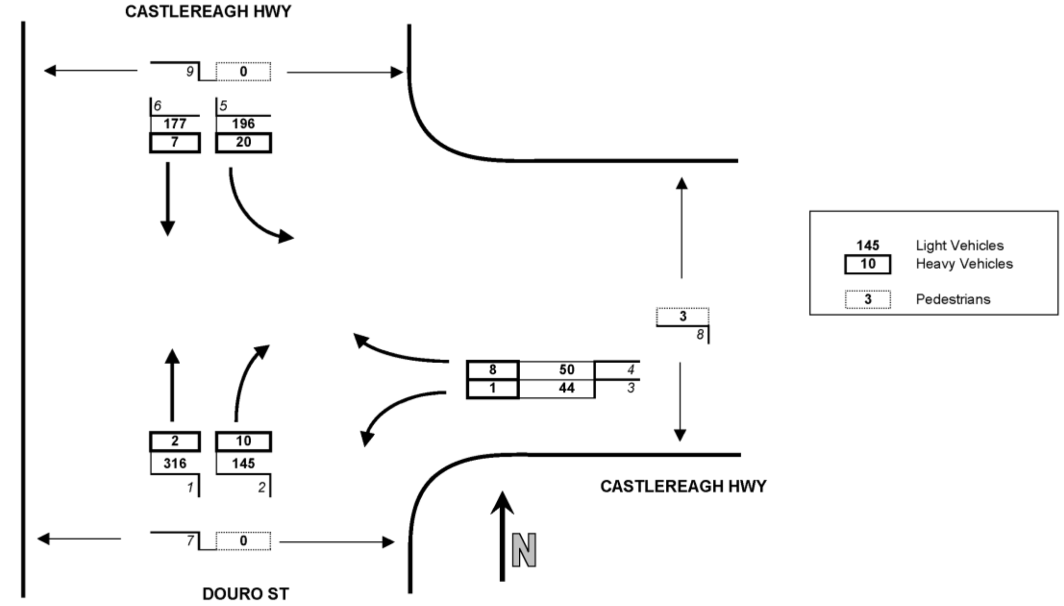

MATRIX
Traffic and Transport Data
Job No. : N2978
Client : TTPP
Suburb : Lue ATC's
Location : Ulan Rd / Lue Rd / Pitts Ln
Day/Date : Wed, 15th Feb 2017
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram
Hour Starting
AM Totals
Vehicle Type
All Vehicles
Ulan Rd
Lue Rd
Pitts Ln
Selected Hour & Vehicle Type
AM Peak 8:00 to 9:00
PM Peak 16:30 to 17:30

4/7/2018 - CASTLEREAGH HWY / DOURO ST, MUDGEE

9:00 <<< HOUR ENDING **Wednesday**

Summary:	
CASTLEREAGH HWY / DOURO ST	
928	Total Light Vehicles
48	Total Heavy Vehicles
3	Total Pedestrians

Quality Surveys
182845



4/7/2018 - CASTLEREAGH HWY / DOURO ST, MUDGEE

Light Vehicles / **Pedestrians**

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR	Pedestrians 7	8	9
06:15	25	10	2	4	9	1	51		0	0	0
06:30	32	12	1	9	26	8	88		0	0	0
06:45	24	14	1	9	22	9	79		0	1	0
07:00	21	28	11	6	32	20	118	336	0	1	0
07:15	27	12	7	14	18	14	92	377	0	1	0
07:30	31	20	6	6	38	19	120	409	0	1 <	0
07:45	23	13	6	15	27	21	105	435	0	0	0
08:00	40	19	7	13	42	11	132	449	0	0	1 <
08:15	50	18	6	14	35	24	147	504	0	0	0 <
08:30	60	38	10	18 <	41	26	193	577	0	2	0 <
08:45	83	51	10	8	47	61	260	732	0	1	0 <
09:00	123 <	38 <	18 <	10	73 <	66 <	328	928 <	0	0	0

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
06:15	0	0	1	2	3	0	6	
06:30	0	2	0	1	0	2	5	
06:45	0	0	0	4	2	0	6	
07:00	2	0	0	3	0	0	5	22
07:15	0	0	1	11	1	0	13	29
07:30	2 <	0	1	4	2	1	10	34
07:45	0 <	1	2 <	7	2	0	12	40
08:00	2 <	0	0 <	5 <	3	3	13	48 <
08:15	0 <	0	1 <	2	4	0	7	42
08:30	0	0	0	3	0	0	3	35
08:45	2 <	5	0	2	7	2	18	41
09:00	0	5 <	0	1	9 <	5 <	20	48 <

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
06:15	25	10	3	6	12	1	57	
06:30	32	14	1	10	26	10	93	
06:45	24	14	1	13	24	9	85	
07:00	23	28	11	9	32	20	123	358
07:15	27	12	8	25	19	14	105	406
07:30	33	20	7	10	40	20	130	443
07:45	23	14	8	22	29	21	117	475
08:00	42	19	7	18	45	14	145	497
08:15	50	18	7	16	39	24	154	546
08:30	60	38	10	21 <	41	26	196	612
08:45	85	56	10	10	54	63	278	773
09:00	123 <	43 <	18 <	11	82 <	71 <	348	976 <

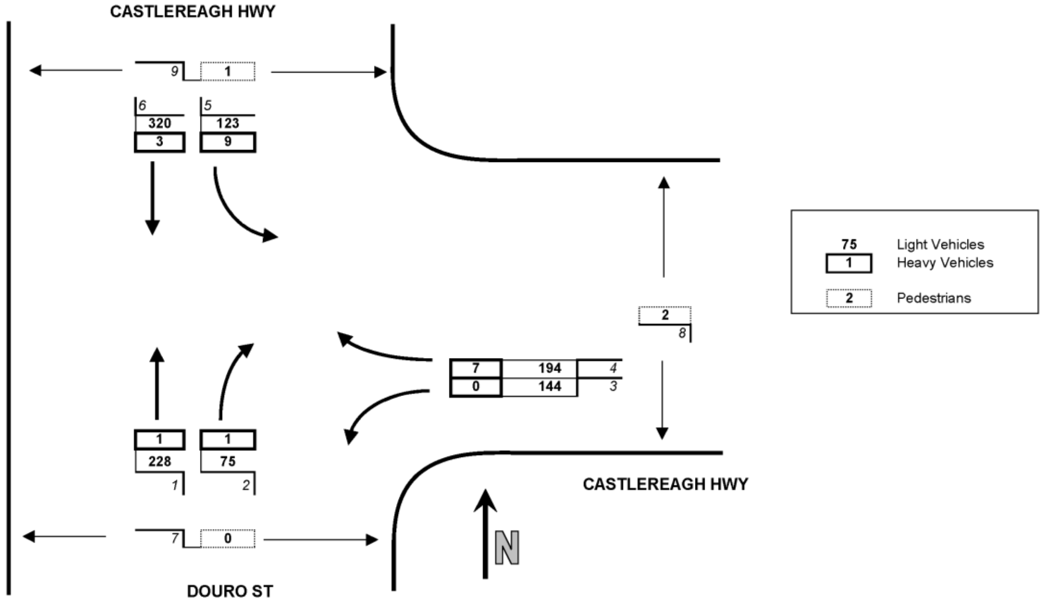
Note : Arrows "<" indicate the end time for the peak hour for each turning movement.

3/7/2018 - CASTLEREAGH HWY / DOURO ST, MUDGEE

17:30 <<< HOUR ENDING **Tuesday**

Summary:	CASTLEREAGH HWY / DOURO ST
1084	Total Light Vehicles
21	Total Heavy Vehicles
3	Total Pedestrians

Quality Surveys
182845



3/7/2018 - CASTLEREAGH HWY / DOURO ST, MUDGEE

Light Vehicles / **Pedestrians**

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR	Pedestrians 7	8	9
15:15	41	23	21	23	32	66	206		0	0	0
15:30	56	26	18	33	30	71	234		0	1	0
15:45	42	10	43	35	43	80	253		0	0	0
16:00	48	21	21	38	40 <	62	230	923	1 <	2 <	0
16:15	50	21	37	34	29	70	241	958	0 <	0 <	0
16:30	44	23	33	33	32	70	235	959	0 <	0	0
16:45	59	14	35	52	33	80	273	979	0 <	0	1 <
17:00	56	24	33	56	26	68	263	1012	0	1	0 <
17:15	61	23 <	47 <	48	37	91	307	1078	0	1	0 <
17:30	52 <	14	29	38 <	27	81 <	241	1084 <	0	0	0 <
17:45	58	16	37	40	17	56	224	1035	0	0	1 <
18:00	56	26	31	28	19	56	216	988	0	0	0 <

Heavy Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
15:15	0	0	0	4	10	1	15	
15:30	1	7	0	2	4	2	16	
15:45	1	9	0	7	9	2	28	
16:00	2	0	1 <	2 <	8 <	1 <	14	73 <
16:15	5 <	1 <	0 <	3	2	1 <	12	70
16:30	0	0	0 <	0	1	0	1	55
16:45	0	0	0 <	3	2	1	6	33
17:00	0	0	0	2	3	2	7	26
17:15	1	1	0	0	0	0	2	16
17:30	0	0	0	2	4	0	6	21
17:45	0	0	1 <	1	4	0	6	21
18:00	2	0	0 <	0	0	1	3	17

All Vehicles

	1	2	3	4	5	6	Total Vehicles 15 MIN	HOUR
15:15	41	23	21	27	42	67	221	
15:30	57	33	18	35	34	73	250	
15:45	43	19	43	42	52	82	281	
16:00	50	21 <	22	40	48 <	63	244	996
16:15	55	22	37	37	31	71	253	1028
16:30	44	23	33	33	33	70	236	1014
16:45	59	14	35	55	35	81	279	1012
17:00	56	24	33	58	29	70	270	1038
17:15	62	24	47 <	48	37	91	309	1094
17:30	52	14	29	40 <	31	81 <	247	1105 <
17:45	58	16	38	41	21	56	230	1056
18:00	58 <	26	31	28	19	57	219	1005

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

Annexure 2

Intersection Modelling Results

(Total No. of pages including blank pages = 12)

Note: This Annexure is only available on the digital version of this document

MOVEMENT SUMMARY

Site: 101 [1- Church St/Short St_AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Church St- S												
1	L2	28	0.0	0.162	5.9	LOS A	1.0	7.1	0.59	0.61	0.59	45.5
2	T1	109	1.9	0.162	6.1	LOS A	1.0	7.1	0.59	0.61	0.59	46.3
3	R2	6	0.0	0.162	9.6	LOS A	1.0	7.1	0.59	0.61	0.59	46.2
3u	U	3	0.0	0.162	11.3	LOS A	1.0	7.1	0.59	0.61	0.59	46.8
Approach		147	1.4	0.162	6.3	LOS A	1.0	7.1	0.59	0.61	0.59	46.2
East: Short St-E												
4	L2	11	0.0	0.167	5.6	LOS A	0.8	6.3	0.52	0.69	0.52	44.9
5	T1	61	12.1	0.167	5.8	LOS A	0.8	6.3	0.52	0.69	0.52	45.7
6	R2	71	22.4	0.167	9.8	LOS A	0.8	6.3	0.52	0.69	0.52	45.3
6u	U	1	0.0	0.167	10.7	LOS A	0.8	6.3	0.52	0.69	0.52	46.2
Approach		143	16.2	0.167	7.8	LOS A	0.8	6.3	0.52	0.69	0.52	45.4
North: Church St- N												
7	L2	112	5.7	0.416	3.9	LOS A	2.5	17.8	0.23	0.50	0.23	45.9
8	T1	271	2.3	0.416	3.8	LOS A	2.5	17.8	0.23	0.50	0.23	46.9
9	R2	199	3.2	0.416	7.3	LOS A	2.5	17.8	0.23	0.50	0.23	46.7
9u	U	1	0.0	0.416	8.9	LOS A	2.5	17.8	0.23	0.50	0.23	47.4
Approach		582	3.3	0.416	5.0	LOS A	2.5	17.8	0.23	0.50	0.23	46.6
West: Short St-W												
10	L2	71	6.0	0.114	4.3	LOS A	0.5	3.7	0.32	0.52	0.32	46.1
11	T1	41	10.3	0.114	4.3	LOS A	0.5	3.7	0.32	0.52	0.32	47.0
12	R2	13	0.0	0.114	7.7	LOS A	0.5	3.7	0.32	0.52	0.32	47.0
12u	U	2	0.0	0.114	9.3	LOS A	0.5	3.7	0.32	0.52	0.32	47.6
Approach		126	6.7	0.114	4.8	LOS A	0.5	3.7	0.32	0.52	0.32	46.5
All Vehicles		999	5.3	0.416	5.6	LOS A	2.5	17.8	0.34	0.54	0.34	46.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [1- Church St/Short St_PM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Church St- S												
1	L2	20	0.0	0.321	6.4	LOS A	2.2	15.9	0.67	0.67	0.67	45.2
2	T1	246	1.3	0.321	6.7	LOS A	2.2	15.9	0.67	0.67	0.67	46.0
3	R2	8	0.0	0.321	10.2	LOS A	2.2	15.9	0.67	0.67	0.67	45.9
3u	U	9	0.0	0.321	11.8	LOS A	2.2	15.9	0.67	0.67	0.67	46.5
Approach		284	1.1	0.321	6.9	LOS A	2.2	15.9	0.67	0.67	0.67	46.0
East: Short St-E												
4	L2	16	0.0	0.212	5.6	LOS A	1.0	7.6	0.53	0.71	0.53	44.7
5	T1	52	2.0	0.212	5.6	LOS A	1.0	7.6	0.53	0.71	0.53	45.5
6	R2	132	4.0	0.212	9.2	LOS A	1.0	7.6	0.53	0.71	0.53	45.4
6u	U	1	0.0	0.212	10.7	LOS A	1.0	7.6	0.53	0.71	0.53	46.0
Approach		200	3.2	0.212	8.0	LOS A	1.0	7.6	0.53	0.71	0.53	45.4
North: Church St- N												
7	L2	125	10.9	0.422	4.1	LOS A	2.6	19.1	0.29	0.51	0.29	45.7
8	T1	265	0.0	0.422	3.9	LOS A	2.6	19.1	0.29	0.51	0.29	46.8
9	R2	169	3.7	0.422	7.5	LOS A	2.6	19.1	0.29	0.51	0.29	46.6
9u	U	1	0.0	0.422	9.0	LOS A	2.6	19.1	0.29	0.51	0.29	47.3
Approach		561	3.6	0.422	5.1	LOS A	2.6	19.1	0.29	0.51	0.29	46.5
West: Short St-W												
10	L2	195	2.7	0.275	5.4	LOS A	1.4	10.6	0.53	0.66	0.53	45.8
11	T1	43	0.0	0.275	5.3	LOS A	1.4	10.6	0.53	0.66	0.53	46.7
12	R2	28	3.7	0.275	9.0	LOS A	1.4	10.6	0.53	0.66	0.53	46.5
12u	U	1	0.0	0.275	10.4	LOS A	1.4	10.6	0.53	0.66	0.53	47.2
Approach		267	2.4	0.275	5.8	LOS A	1.4	10.6	0.53	0.66	0.53	46.0
All Vehicles		1313	2.7	0.422	6.1	LOS A	2.6	19.1	0.46	0.60	0.46	46.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: TTPP - THE TRANSPORT PLANNING PARTNERSHIP | Processed: Tuesday, 16 July 2019 11:57:40 AM
Project: C:\Users\penny.dalton\Documents\TTPP Projects Local Copy\16329 Bowdens Silver Mine\16329_Bowdens_190716.sip8

MOVEMENT SUMMARY

Site: 101 [2-Short St/Duoro St_AM]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Duoro St- S												
1	L2	19	0.0	0.058	4.6	LOS A	0.0	0.0	0.00	0.48	0.00	46.7
2	T1	2	0.0	0.058	0.0	LOS A	0.0	0.0	0.00	0.48	0.00	47.2
3	R2	92	6.9	0.058	4.5	LOS A	0.0	0.0	0.00	0.48	0.00	47.3
Approach		113	5.6	0.058	4.5	NA	0.0	0.0	0.00	0.48	0.00	47.2
East: Short St-E												
4	L2	127	7.4	0.115	4.7	LOS A	0.5	3.7	0.03	0.50	0.03	46.5
5	T1	41	7.7	0.115	4.3	LOS A	0.5	3.7	0.03	0.50	0.03	47.0
6	R2	1	0.0	0.115	5.1	LOS A	0.5	3.7	0.03	0.50	0.03	46.9
Approach		169	7.5	0.115	4.6	LOS A	0.5	3.7	0.03	0.50	0.03	46.6
North: Private Road_N												
7	L2	2	0.0	0.009	4.9	LOS A	0.0	0.2	0.20	0.45	0.20	46.4
8	T1	8	0.0	0.009	4.2	LOS A	0.0	0.2	0.20	0.45	0.20	46.9
9	R2	1	0.0	0.009	4.9	LOS A	0.0	0.2	0.20	0.45	0.20	46.6
Approach		12	0.0	0.009	4.4	LOS A	0.0	0.2	0.20	0.45	0.20	46.8
West: Short St-W												
10	L2	1	0.0	0.030	4.6	LOS A	0.1	0.8	0.08	0.45	0.08	46.8
11	T1	33	3.2	0.030	4.2	LOS A	0.1	0.8	0.08	0.45	0.08	47.2
12	R2	5	0.0	0.030	5.6	LOS A	0.1	0.8	0.08	0.45	0.08	47.4
Approach		39	2.7	0.030	4.4	LOS A	0.1	0.8	0.08	0.45	0.08	47.2
All Vehicles		333	6.0	0.115	4.5	NA	0.5	3.7	0.03	0.49	0.03	46.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 101 [2-Short St/Duoro St_PM]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Duoro St- S												
1	L2	15	7.1	0.068	4.6	LOS A	0.0	0.0	0.00	0.48	0.00	46.6
2	T1	4	0.0	0.068	0.0	LOS A	0.0	0.0	0.00	0.48	0.00	47.2
3	R2	111	4.8	0.068	4.5	LOS A	0.0	0.0	0.00	0.48	0.00	47.4
Approach		129	4.9	0.068	4.4	NA	0.0	0.0	0.00	0.48	0.00	47.3
East: Short St-E												
4	L2	146	5.0	0.146	4.6	LOS A	0.6	4.7	0.00	0.50	0.00	46.6
5	T1	63	0.0	0.146	4.3	LOS A	0.6	4.7	0.00	0.50	0.00	47.1
6	R2	3	0.0	0.146	5.3	LOS A	0.6	4.7	0.00	0.50	0.00	46.9
Approach		213	3.5	0.146	4.5	LOS A	0.6	4.7	0.00	0.50	0.00	46.7
North: Private Road_N												
7	L2	3	0.0	0.004	5.0	LOS A	0.0	0.1	0.23	0.48	0.23	46.1
8	T1	1	0.0	0.004	4.3	LOS A	0.0	0.1	0.23	0.48	0.23	46.6
9	R2	1	0.0	0.004	5.0	LOS A	0.0	0.1	0.23	0.48	0.23	46.4
Approach		5	0.0	0.004	4.9	LOS A	0.0	0.1	0.23	0.48	0.23	46.3
West: Short St-W												
10	L2	1	0.0	0.053	4.6	LOS A	0.2	1.3	0.15	0.47	0.15	46.5
11	T1	39	2.7	0.053	4.3	LOS A	0.2	1.3	0.15	0.47	0.15	46.9
12	R2	20	0.0	0.053	6.0	LOS A	0.2	1.3	0.15	0.47	0.15	47.1
Approach		60	1.8	0.053	4.9	LOS A	0.2	1.3	0.15	0.47	0.15	47.0
All Vehicles		407	3.6	0.146	4.5	NA	0.6	4.7	0.03	0.49	0.03	46.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [3-Castlereagh Hwy/Market St/Duoro St_AM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Duoro St- S												
1	L2	119	7.1	0.264	5.0	LOS A	1.6	11.9	0.47	0.58	0.47	45.6
2	T1	87	2.4	0.264	4.8	LOS A	1.6	11.9	0.47	0.58	0.47	46.5
3	R2	65	0.0	0.264	8.3	LOS A	1.6	11.9	0.47	0.58	0.47	46.4
3u	U	5	0.0	0.264	9.9	LOS A	1.6	11.9	0.47	0.58	0.47	47.0
Approach		277	3.8	0.264	5.8	LOS A	1.6	11.9	0.47	0.58	0.47	46.1
East: Market Street- E												
4	L2	54	11.8	0.241	5.9	LOS A	1.4	10.1	0.56	0.63	0.56	45.3
5	T1	145	2.2	0.241	5.7	LOS A	1.4	10.1	0.56	0.63	0.56	46.3
6	R2	21	5.0	0.241	9.3	LOS A	1.4	10.1	0.56	0.63	0.56	46.1
6u	U	4	0.0	0.241	10.8	LOS A	1.4	10.1	0.56	0.63	0.56	46.8
Approach		224	4.7	0.241	6.2	LOS A	1.4	10.1	0.56	0.63	0.56	46.1
North: Duoro St- N												
7	L2	11	0.0	0.179	6.2	LOS A	1.0	7.8	0.62	0.69	0.62	44.9
8	T1	93	8.0	0.179	6.5	LOS A	1.0	7.8	0.62	0.69	0.62	45.6
9	R2	43	4.9	0.179	10.0	LOS A	1.0	7.8	0.62	0.69	0.62	45.5
9u	U	1	0.0	0.179	11.4	LOS A	1.0	7.8	0.62	0.69	0.62	46.2
Approach		147	6.4	0.179	7.6	LOS A	1.0	7.8	0.62	0.69	0.62	45.6
West: Castlereagh Hwy-W												
10	L2	35	9.1	0.394	5.0	LOS A	2.9	22.0	0.53	0.60	0.53	45.0
11	T1	189	1.1	0.394	4.9	LOS A	2.9	22.0	0.53	0.60	0.53	46.0
12	R2	197	11.2	0.394	8.8	LOS A	2.9	22.0	0.53	0.60	0.53	45.7
12u	U	1	0.0	0.394	10.1	LOS A	2.9	22.0	0.53	0.60	0.53	46.5
Approach		422	6.5	0.394	6.8	LOS A	2.9	22.0	0.53	0.60	0.53	45.8
All Vehicles		1071	5.4	0.394	6.5	LOS A	2.9	22.0	0.53	0.62	0.53	45.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 101 [3-Castlereagh Hwy/Market St/Duoro St_PM]

New Site
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Duoro St- S												
1	L2	133	0.8	0.304	5.5	LOS A	1.9	13.7	0.59	0.66	0.59	45.4
2	T1	88	2.4	0.304	5.6	LOS A	1.9	13.7	0.59	0.66	0.59	46.2
3	R2	66	0.0	0.304	9.1	LOS A	1.9	13.7	0.59	0.66	0.59	46.1
3u	U	9	0.0	0.304	10.7	LOS A	1.9	13.7	0.59	0.66	0.59	46.7
Approach		297	1.1	0.304	6.5	LOS A	1.9	13.7	0.59	0.66	0.59	45.8
East: Market Street- E												
4	L2	82	0.0	0.389	5.8	LOS A	2.5	18.0	0.60	0.65	0.60	45.4
5	T1	271	2.7	0.389	5.9	LOS A	2.5	18.0	0.60	0.65	0.60	46.3
6	R2	16	0.0	0.389	9.4	LOS A	2.5	18.0	0.60	0.65	0.60	46.2
6u	U	7	0.0	0.389	11.0	LOS A	2.5	18.0	0.60	0.65	0.60	46.8
Approach		376	2.0	0.389	6.1	LOS A	2.5	18.0	0.60	0.65	0.60	46.1
North: Duoro St- N												
7	L2	18	0.0	0.190	6.0	LOS A	1.1	7.9	0.61	0.67	0.61	45.2
8	T1	115	2.8	0.190	6.2	LOS A	1.1	7.9	0.61	0.67	0.61	46.0
9	R2	33	0.0	0.190	9.6	LOS A	1.1	7.9	0.61	0.67	0.61	45.9
9u	U	1	0.0	0.190	11.2	LOS A	1.1	7.9	0.61	0.67	0.61	46.5
Approach		166	1.9	0.190	6.9	LOS A	1.1	7.9	0.61	0.67	0.61	45.9
West: Castlereagh Hwy-W												
10	L2	41	12.8	0.375	5.1	LOS A	2.8	21.4	0.54	0.60	0.54	45.1
11	T1	191	1.7	0.375	4.9	LOS A	2.8	21.4	0.54	0.60	0.54	46.1
12	R2	156	14.2	0.375	9.0	LOS A	2.8	21.4	0.54	0.60	0.54	45.7
12u	U	1	0.0	0.375	10.1	LOS A	2.8	21.4	0.54	0.60	0.54	46.6
Approach		388	7.9	0.375	6.6	LOS A	2.8	21.4	0.54	0.60	0.54	45.8
All Vehicles		1227	3.6	0.389	6.5	LOS A	2.8	21.4	0.58	0.64	0.58	45.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 101 [Lue-Ulan EX AM]

Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Ulan Road (S)												
1	L2	4	0.0	0.191	3.1	LOS A	1.2	8.9	0.08	0.37	0.08	47.3
2	T1	267	9.1	0.191	3.2	LOS A	1.2	8.9	0.08	0.37	0.08	48.3
3	R2	24	0.0	0.191	7.2	LOS A	1.2	8.9	0.08	0.37	0.08	48.4
Approach		296	8.2	0.191	3.5	LOS A	1.2	8.9	0.08	0.37	0.08	48.3
East: Lue Road (E)												
4	L2	85	6.2	0.103	5.6	LOS A	0.5	3.9	0.54	0.61	0.54	46.0
5	T1	1	0.0	0.103	5.4	LOS A	0.5	3.9	0.54	0.61	0.54	47.1
6	R2	8	12.5	0.103	9.8	LOS A	0.5	3.9	0.54	0.61	0.54	46.9
Approach		95	6.7	0.103	5.9	LOS A	0.5	3.9	0.54	0.61	0.54	46.1
North: Ulan Road (N)												
7	L2	12	27.3	0.296	3.4	LOS A	1.8	13.0	0.13	0.35	0.13	47.1
8	T1	438	3.8	0.296	3.3	LOS A	1.8	13.0	0.13	0.35	0.13	48.3
9	R2	1	0.0	0.296	7.3	LOS A	1.8	13.0	0.13	0.35	0.13	48.4
Approach		451	4.4	0.296	3.3	LOS A	1.8	13.0	0.13	0.35	0.13	48.3
West: Pitts Lane (W)												
10	L2	1	0.0	0.003	4.4	LOS A	0.0	0.1	0.42	0.48	0.42	45.9
11	T1	1	0.0	0.003	4.4	LOS A	0.0	0.1	0.42	0.48	0.42	46.9
12	R2	1	0.0	0.003	8.5	LOS A	0.0	0.1	0.42	0.48	0.42	46.9
Approach		3	0.0	0.003	5.8	LOS A	0.0	0.1	0.42	0.48	0.42	46.6
All Vehicles		844	6.0	0.296	3.7	LOS A	1.8	13.0	0.16	0.39	0.16	48.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 101 [Lue-Ulan EX PM]

Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Ulan Road (S)												
1	L2	45	0.0	0.324	3.2	LOS A	2.3	16.3	0.11	0.39	0.11	47.1
2	T1	402	2.4	0.324	3.2	LOS A	2.3	16.3	0.11	0.39	0.11	48.1
3	R2	69	6.1	0.324	7.3	LOS A	2.3	16.3	0.11	0.39	0.11	48.1
Approach		517	2.6	0.324	3.7	LOS A	2.3	16.3	0.11	0.39	0.11	48.0
East: Lue Road (E)												
4	L2	46	4.5	0.062	5.3	LOS A	0.3	2.4	0.53	0.59	0.53	46.0
5	T1	1	0.0	0.062	5.2	LOS A	0.3	2.4	0.53	0.59	0.53	47.0
6	R2	9	11.1	0.062	9.6	LOS A	0.3	2.4	0.53	0.59	0.53	46.9
Approach		57	5.6	0.062	6.0	LOS A	0.3	2.4	0.53	0.59	0.53	46.2
North: Ulan Road (N)												
7	L2	7	14.3	0.311	3.8	LOS A	1.9	14.1	0.29	0.40	0.29	46.7
8	T1	398	5.8	0.311	3.7	LOS A	1.9	14.1	0.29	0.40	0.29	47.7
9	R2	4	0.0	0.311	7.7	LOS A	1.9	14.1	0.29	0.40	0.29	47.8
Approach		409	5.9	0.311	3.7	LOS A	1.9	14.1	0.29	0.40	0.29	47.7
West: PItts Lane (W)												
10	L2	4	0.0	0.028	5.4	LOS A	0.1	1.0	0.53	0.63	0.53	44.6
11	T1	1	0.0	0.028	5.5	LOS A	0.1	1.0	0.53	0.63	0.53	45.5
12	R2	21	0.0	0.028	9.5	LOS A	0.1	1.0	0.53	0.63	0.53	45.5
Approach		26	0.0	0.028	8.7	LOS A	0.1	1.0	0.53	0.63	0.53	45.4
All Vehicles		1009	4.1	0.324	4.0	LOS A	2.3	16.3	0.22	0.41	0.22	47.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

▽ Site: 101 [Douro-Horatio Ex AM]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Douro St S												
2	T1	335	0.6	0.173	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
3	R2	163	6.5	0.185	8.0	LOS A	0.8	5.7	0.50	0.72	0.50	51.3
Approach		498	2.5	0.185	2.6	NA	0.8	5.7	0.16	0.24	0.16	56.8
East: Horatio St												
4	L2	47	2.2	0.043	6.4	LOS A	0.2	1.1	0.29	0.57	0.29	52.6
6	R2	61	13.8	0.116	10.4	LOS A	0.4	3.4	0.55	0.77	0.55	49.4
Approach		108	8.7	0.116	8.6	LOS A	0.4	3.4	0.44	0.69	0.44	50.8
North: Douro St N												
7	L2	227	9.3	0.131	5.7	LOS A	0.0	0.0	0.00	0.57	0.00	53.2
8	T1	194	3.8	0.102	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		421	6.8	0.131	3.1	NA	0.0	0.0	0.00	0.31	0.00	56.1
All Vehicles		1027	4.9	0.185	3.4	NA	0.8	5.7	0.13	0.31	0.13	55.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 101 [Douro-Horatio Ex PM]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Douro St S												
2	T1	241	0.4	0.125	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
3	R2	80	1.3	0.093	8.0	LOS A	0.4	2.6	0.50	0.71	0.50	51.5
Approach		321	0.7	0.125	2.0	NA	0.4	2.6	0.12	0.18	0.12	57.6
East: Horatio St												
4	L2	152	0.0	0.161	7.2	LOS A	0.6	4.2	0.42	0.67	0.42	52.3
6	R2	212	3.5	0.385	12.1	LOS A	2.0	14.7	0.64	0.91	0.83	48.6
Approach		363	2.0	0.385	10.1	LOS A	2.0	14.7	0.55	0.81	0.66	50.1
North: Douro St N												
7	L2	139	6.8	0.078	5.6	LOS A	0.0	0.0	0.00	0.57	0.00	53.3
8	T1	340	0.9	0.175	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		479	2.6	0.175	1.6	NA	0.0	0.0	0.00	0.17	0.00	57.9
All Vehicles		1163	1.9	0.385	4.4	NA	2.0	14.7	0.20	0.37	0.24	55.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Annexure 3

Road Crash History Summary

(Total No. of pages including blank pages = 8)

Note: This Annexure is only available on the digital version of this document

Table A3.1
Reported Crashes on Roads Around Lue

	Pedestrian	Adjacent Approaches	Opposing Directions	Same Direction	U-Turn / Parking	Overtaking	On Path	Off Path, On Straight	Off Path, on Curve
Total Crashes							1	1	
Location Type									
Undivided road							1	1	
Divided Road									
Intersection									
Road Surface									
Dry Road							1	1	
Wet Road									
Snow or Ice									
Natural Lighting									
Dawn									
Daylight							1	1	
Darkness									
Weather									
Fine							1	1	
Fog or mist									
Overcast									
Raining									
Other									
Vehicles Involved									
Pedal Cycle									
Motorcycle									
Car, 4WD, Utility							1	1	
Rigid Truck									
Articulated Vehicle									
Severity of Crash									
Fatal									
Injury							1		
Non-injury								1	
Factors*									
Speed								1	
Fatigue									
Speed Limit									
50 km/h									
60 km/h							1		
80 km/h								1	
100 km/h									

* More than one factor can be nominated for a single crash

Table A3.2
Reported Crashes along the Route to the East of Lue

	Pedestrian	Adjacent Approaches	Opposing Directions	Same Direction	U-Turn / Parking	Overtaking	On Path	Off Path, On Straight	Off Path, on Curve
Total Crashes							1	1	8
Location Type									
Undivided road							1	1	8
Divided Road									
Intersection									
Road Surface Condition									
Dry Road							1		7
Wet Road								1	1
Snow or Ice									
Natural Lighting									
Dawn									
Daylight							1	1	7
Darkness									1
Weather									
Fine							1		6
Fog or mist									
Overcast								1	2
Raining									
Other									
Vehicles Involved									
Pedal Cycle									
Motorcycle									1
Car, 4WD, Utility							1	1	7
Rigid Truck									
Articulated Vehicle									
Severity of Crash									
Fatal									
Injury								1	6
Non-injury							1		2
Factors*									
Speed									6
Fatigue									2
Speed Limit									
50 km/h									
60 km/h									
80 km/h									
100 km/h							1	1	8

* More than one factor can be nominated for a single crash

Table A3.3
Reported Crashes along the Route to the West of Lue to Mudgee Outskirts

	Pedestrian	Adjacent Approaches	Opposing Directions	Same Direction	U-Turn / Parking	Overtaking	On Path	Off Path, On Straight	Off Path, on Curve
Total Crashes						1	2	7	11
Location Type									
Undivided road						1	2	7	11
Divided Road									
Intersection									
Road Surface Condition									
Dry Road							2	4	6
Wet Road						1		3	4
Snow or Ice									1
Natural Lighting									
Dawn or dusk								2	1
Daylight						1		3	7
Darkness							2	2	3
Weather									
Fine							1	5	6
Fog or mist									1
Overcast							1	1	
Raining						1		1	3
Other									1
Vehicles Involved									
Pedal Cycle									
Motorcycle								1	
Car, 4WD, Utility						1	2	6	11
Rigid Truck									
Articulated Vehicle									
Severity of Crash									
Fatal									
Injury						1		5	10
Non-injury							2	2	1
Factors*									
Speed								1	8
Fatigue								3	2
Speed Limit									
50 km/h									
60 km/h									
80 km/h								1	
100 km/h						1	2	6	11

* More than one factor can be nominated for a single crash

Table A3.4
Reported Crashes along the Route to the North of Mudgee

	Pedestrian	Adjacent Approaches	Opposing Directions	Same Direction	U-Turn / Parking	Overtaking	On Path	Off Path, On Straight	Off Path, on Curve
Total Crashes		1	2	4	1	2	2	1	2
Location Type									
Undivided road			1	2	1	2	2	1	2
Divided Road									
Intersection		1	1	2					
Road Surface Condition									
Dry Road		1	1	2	1	2	2	1	
Wet Road			1	2					2
Snow or Ice									
Natural Lighting									
Dawn or dusk		1	1				1		1
Daylight				4		2		1	1
Darkness			1		1		1		
Weather									
Fine		1	1	2	1	1	2	1	
Fog or mist									
Overcast				1		1			
Raining			1	1					2
Other									
Vehicles Involved									
Pedal Cycle								1	
Motorcycle						1			
Car, 4WD, Utility		2	3	7	1	2	2		
Rigid Truck			1						
Articulated Vehicle									
Severity of Crash									
Fatal				1				1	
Injury		1	1	1	1	1			1
Non-injury			1	2		1	2		1
Factors*									
Speed				1					1
Fatigue				1					
Speed Limit									
50 km/h				1					
60 km/h									
80 km/h		1	1		1			1	1
100 km/h			1	3		2	2		1

* More than one factor can be nominated for a single crash

Table A3.5
Reported Crashes along the Route Through Mudgee to the West

	Pedestrian	Adjacent Approaches	Opposing Directions	Same Direction	U-Turn / Parking	Overtaking	On Path	Off Path, On Straight	Off Path, on Curve	Other
Total Crashes		4	2	2	2			4	1	1
Location Type										
Undivided road			1	1	1			3		1
Divided Road										
Intersection		4	1	1	1			1	1	
Road Surface Condition										
Dry Road		4	2	2	2			1	1	1
Wet Road								3		
Snow or Ice										
Natural Lighting										
Dawn or dusk		2								
Daylight		2	2	2	2			3	1	
Darkness								1		1
Weather										
Fine		4	2	2	1			1	1	1
Fog or mist										
Overcast					1			2		
Raining								1		
Other										
Vehicles Involved										
Pedal Cycle				1						
Motorcycle		1								
Car, 4WD, Utility		7	3	2	4			6		1
Rigid Truck									1	
Articulated Vehicle										
Severity of Crash										
Fatal										
Injury		2		2	1			2		1
Non-injury		2	2		1			1		
Factors*										
Speed									1	
Fatigue								1		
Speed Limit										
50 km/h		4	1	1	2			4	1	1
60 km/h										
80 km/h			1	1						
100 km/h										

* More than one factor can be nominated for a single crash

Table A3.6
Reported Crashes along the Route Through Mudgee to the South East

	Pedestrian	Adjacent Approaches	Opposing Directions	Same Direction	U-Turn / Parking	Overtaking	On Path	Off Path, On Straight	Off Path, on Curve	Other
Total Crashes		8	1	6	4		1	3	2	
Location Type										
Undivided road				2	4		1	3		
Divided Road									1	
Intersection		8	1	4					1	
Road Surface Condition										
Dry Road		8	1	5	4		1	2	1	
Wet Road				1				1	1	
Snow or Ice										
Natural Lighting										
Dawn or dusk					1				1	
Daylight		6	1	6	3		1	1		
Darkness		2						2	1	
Weather										
Fine		8	1	5	4		1	2		
Fog or mist									1	
Overcast				1					1	
Raining								1		
Other										
Vehicles Involved										
Pedal Cycle		1		1						
Motorcycle		1								
Car, 4WD, Utility		14	2	9	8		1	2	2	
Rigid Truck										
Articulated Vehicle				1				1		
Severity of Crash										
Fatal										
Injury		5	1	4	3			2	1	
Non-injury		3		2	1		1	1	1	
Factors*										
Speed					1				2	
Fatigue								2		
Speed Limit										
50 km/h		8	1	5	4		1		2	
60 km/h										
80 km/h										
100 km/h				1				3		

* More than one factor can be nominated for a single crash

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Annexure 4

Existing Conditions Road Safety Audit

(Total No. of pages including blank pages = 20)

Note: This Annexure is only available on the digital version of this document

Bowdens Silver Mine Project

Lue Road between Mudgee and Lue
Stage 5 – Existing Conditions Road Safety Audit

Prepared for:

RW Corkery

13/03/2017

The Transport Planning Partnership
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ttpp
transport planning

The Transport
Planning Partnership

Bowdens Silver Mine Project

Lue Road between Mudgee and Lue
Stage 5 – Existing Conditions Road Safety Audit

Client: RW Corkery

Version: Final

Date: 13/03/2017

TTPP Reference: 16036

Quality Record

Version	Date	Prepared by	Reviewed by	Approved by	Signature
Final	7/03/2017	Ken Hollyoak	Doris Lee	Ken Hollyoak	

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APPENDICES

1 ROAD SAFETY AUDIT SUMMARY

Audited project:	Lue Road – Mudgee to Lue
Developer:	Bowdens Silver Mine
Audit Team:	Ken Hollyoak (lead level 3 road safety auditor) Doris Lee (level 3 road safety auditor)
Audit type:	Existing Conditions Stage 5
Commencement meeting:	N/A
Audit date:	10 February 2017
Completion meeting:	N/A
Previous audit:	None

The objective of this road safety audit is to examine and identify road safety concerns along Lue Road between Mudgee and Lue.

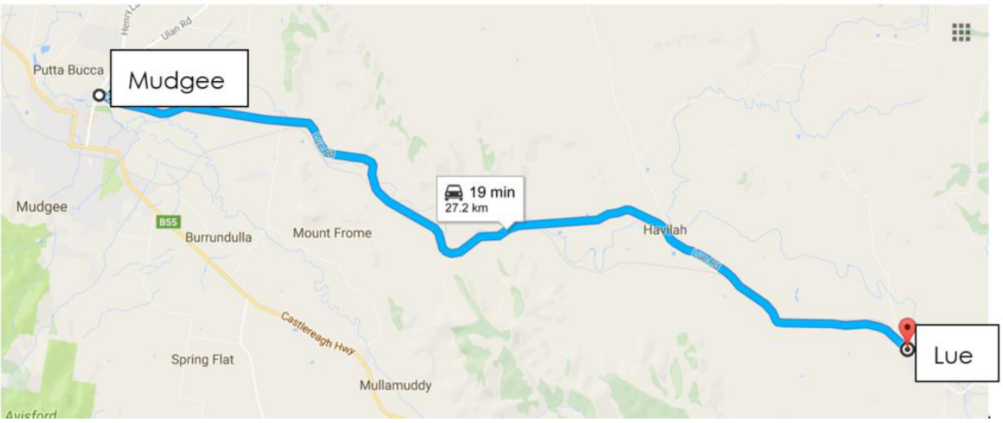
The findings of the road safety audit have been detailed in Section 4.3 of this report.

2 INTRODUCTION

2.1 Background

This report has been prepared on behalf of Bowdens Silver Mine to present the road safety issues identified in a road safety audit on Lue Road between Mudgee and Lue. Figure 2.1 shows the extent of the audit.

Figure 2.1: Length of Site Audit



2.2 Audit Objective

The objective of this Audit was to identify issues which might constitute a road safety risk.

2.3 Procedures and Reference Material

The procedures used are these described in the Roads and Maritime Services' 2011 Guidelines for Road Safety Audit Practices. The Austroads Guide to Road Safety: Part 6 Roads Safety Audit checklist was used by the audit team as a reference in this existing conditions road safety audit. Key elements examined included:

- Road alignment and cross-section
- Auxiliary lanes
- Intersections
- Signs and lighting
- Markings and delineation

- Crash barriers and clear zones
- Bridges and culverts
- Pavement
- Floodways and causeways
- Miscellaneous – other safety issues.

2.4 Audit Team

The RSA was carried out by the following team:

- Ken Hollyoak (RSA-02-0249) – level 3 road safety auditor (lead auditor).
- Doris Lee (RSA-02-0128) - level 3 road safety auditor (team member).

3 ROAD SAFETY AUDIT PROGRAM

3.1 Commencement Meeting

No commencement meeting was held

3.2 Site and Field Audit

A daylight site inspection was carried out on Thursday 9th February 2017 in fine conditions and the night time inspection was also undertaken on Thursday 9th October 2016 when there were fine conditions. Photographs and videos were taken during both visits.

It is acknowledged that Lue Road was being partially reconstructed at the time of the audit so there were some sections of construction/gravel road at the time of the audit. As these sections were temporarily in this condition, they were not included in the audit.

3.3 Completion Meeting

No completion meeting was undertaken.

4 ROAD SAFETY AUDIT FINDINGS

4.1 Introduction

The road safety audit findings have been documented in Table 4.2.

Table 4.1 provides specific details of the audit findings and a risk rating as high, medium or low. The risk ratings have been based on the risk matrix presented in Table 4.1, which has been adopted from the standard Austroads Risk Matrix.

Table 4.1: Risk Matrix

Likelihood / Severity	Highly probable	Occasional	Improbable
Major	High	High	Medium
Moderate	High	Medium	Low
Minor	Medium	Low	Low

The terms in Table 4.1 are described below.

Likelihood:

- Highly probable: It is likely that more than one crash of this type could occur within a five-year period.
- Occasional: It is likely that less than one crash of this type could occur within a five-year period.
- Improbable: Less than one crash of this type could occur within a 10-year period.

Severity:

- Major: The crash is likely to result in a fatality or serious injuries

  For example, high/medium speed vehicle collision, high/medium speed collision with a fixed object, pedestrian struck at high speed, and cyclist hit by car.

- Moderate: The crash is likely to result in minor injuries or large scale of property damage

  For example, some slow speed vehicle collisions, cyclist falls, and rear end crashes.

- Minor: The crash is likely to result in minor property damage or many near miss crash events

  For example, some slow speed collisions, pedestrian walks into object (no head injury), and car reverses into post.

Priority:

- High: Very important, and needs to be addressed urgently.
- Medium: Important, and needs to be addressed as soon as possible.
- Low: Needs to be considered as part of regular maintenance/planning program.

4.2 Responding to the Audit Report

As set out in the road safety audit guidelines, the responsibility for the rests with the project manager, not with the auditor. The project manager is under no obligation to accept the audit findings. Neither is it the role of the auditor to agree to, or approve the project manager's responses to the audit.

The audit provides the opportunity to highlight potential road safety problems and have them formally considered by the project manager in conjunction with all other project considerations.

4.3 Road Safety Audit Findings

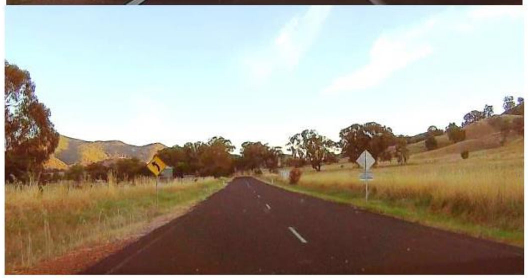
The audit findings are documented in Table 4.2 which provides:

- specific details of the road safety issues identified during the audit
- a risk level rating for each of the road safety audit findings.

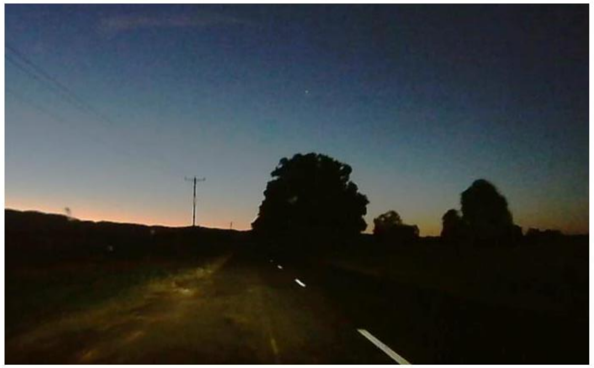
It should be acknowledged that positive attributes of the audited road section have not been discussed. Deficiencies that do not cause a safety problem are also not listed.

In-line with RMS best practice recommendations have not been included in the road safety audit findings.

Table 4.2: Road Safety Audit Findings

Item No.	Descriptions of Findings	Photograph	Likelihood	Severity	Risk Rating
1	There appeared to be an inconsistency in the provision of curve warning signs, advisory speed limit signs, chevron alignment markers (CAM) etc. Some seemingly similar bends have different or no treatment. It is not known whether an assessment of the bends has been undertaken using a ball bank indicator and a calibrated speedometer. Other concerns were • size of CAMS • Position of advance warning and speed advisory signs (some seemed very close to and some seemed far away from the bend)	  	Occasional	Major	High

Item No.	Descriptions of Findings	Photograph	Likelihood	Severity	Risk Rating
2.	Whilst the delineation along Lue Road is generally sufficient during the day-time, the road delineation is poor at night due to the low retro-reflectivity of the centreline and edgeline markings and the lack of raised reflective pavement markers (RRPMs) along significant sections of the road. This may cause motorists to position their vehicle incorrectly within the traffic lane during darkness and adverse weather conditions, increasing the potential for head-on and run-off-road collisions.	  	Occasional	Major	High

Item No.	Descriptions of Findings	Photograph	Likelihood	Severity	Risk Rating
3.	There was insufficient delineation along significant lengths of the road due to lack of guideposts to mark the edge of the roadway.		Occasional	Major	High
4.	There were a number of potential hazards (i.e. trees) within or very close to the clear zone. The presence of these roadside hazards does not provide a safe recovery zone for an errant vehicle.		Improbable	Major	Medium

Item No.	Descriptions of Findings	Photograph	Likelihood	Severity	Risk Rating
5.	The culvert crossing is unprotected, not traversable, and poses a significant risk for an errant vehicle as it could cross the concrete blocks and enter the watercourse.		Improbable	Major	Medium
6.	There was also a noticeable volume of debris/tree litter on the shoulders which when combined with a gravel shoulder could result in errant vehicles losing traction if they move to the edge of the shoulder and over-compensating which may lead to crashes.		Improbable	Moderate	Low

Item No.	Descriptions of Findings	Photograph	Likelihood	Severity	Risk Rating
7.	The wearing course of the road surface has worn away in places. Errant vehicles, particularly in wet conditions may lose control on such patches.		Improbable	Moderate	Low
8.	There were some areas of loose gravel on side roads which extended into the main road carriageway. Loose material on the road surface would adversely affect the controllability of a vehicle and could increase the chance of driver's error and the likelihood of a crash.		Improbable	Moderate	Low

Item No.	Descriptions of Findings	Photograph	Likelihood	Severity	Risk Rating
9.	There were a number of steep embankments beyond the shoulder within the clear zone. Errant vehicles would not be able to recover on these slopes.	 	Improbable	Moderate	Low

Item No.	Descriptions of Findings	Photograph	Likelihood	Severity	Risk Rating
10.	The drop in the pavement edge would make it difficult for 2 wheeled vehicles to drive back onto the road if a vehicle leaves the carriageway. Also, if a motorcyclist/cyclist was travelling along/close to this interface, the change in surface could unseat the rider.	 	Improbable	Moderate	Low

Item No.	Descriptions of Findings	Photograph	Likelihood	Severity	Risk Rating
11.	There were some signs that had become loose such that the sign was giving incorrect information.		Improbable	Minor	Low
12.	The railway crossing sign was superfluous as the rail line is disused and has been covered in road seal.		-	-	Note only

5 CONCLUDING STATEMENT

The findings and opinions in the report are based on the examination of the specific road and environs at the time of the audit.

The auditors have endeavoured to identify features of the road environment that could be modified to improve safety, although it must be recognised that safety cannot be guaranteed since no road can be regarded as absolutely safe.

While every effort has been made to ensure the accuracy of this report, it is made available strictly on the basis that anyone relying on it does so at their own risk without any liability to the Auditors.

KJ Hollyoak

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