APPENDIX 8

Traffic Study

CLIENTS | PEOPLE | PERFORMANCE

Austar Coal Mine Pty Ltd

Report for Austar Coal Mine

Traffic Study

July 2008

Revision 0

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 Purpose of Report

This traffic study report has been prepared by GHD Pty Ltd to address the overall traffic impact from the proposed development of the Austar Coal Mine Stage 3 Surface Infrastructure Site at Quorrobolong Road.

1.2 Background

A Traffic Impact Assessment is required as part of the Environmental Assessment for the Part 3A Application to assess the traffic impacts of the proposed Surface Infrastructure Site accessed from Quorrobolong Road. It is understood that the site of the proposed Surface Infrastructure Site is located approximately 10 kilometres south of Cessnock. The proposed Surface Infrastructure Site will be the access point to the mine for the majority of employees. The existing access point is off Middle Road. No coal will be transported from the new site on Quorrobolong Road. Heavy Vehicles will access the site during construction and for deliveries of minor employee related stores and equipment. The existing pit top facility on Middle Road will be maintained as the main access point for mining equipment and mine maintenance.

Of the employees currently working at the existing mining operation, approximately 50% live in the Cessnock Local Government Area, 20% are from Lake Macquarie LGA and 15 % are from Newcastle. Employees from Cessnock are expected to travel to the site via Vincent Street and Quorrobolong Road. Employees from Newcastle would be expected to arrive at the site via Cessnock or Sandy Creek Road (via Lake Road). Employees from Lake Macquarie would be expected to arrive at the site via Lake Road and Sandy Creek Road.

The mine operates 24 hours a day, seven days a week in designated shifts.

1.3 Scope of Investigations

A Traffic Impact Assessment (TIA) was undertaken for inclusion in the Austar Coal Mine Project – Stage 3 Part 3A environmental assessment. The TIA was developed in accordance with the requirements of Cessnock City Council and the RTA *Guide to Traffic Generating Developments* (October 2002). The study included the following:

- Impact of additional traffic on the capacity of the local road network during the construction and operational stages of the proposed development;
- Assessment of the intersection performance of the following:
  - Wollombi Road / West Avenue Intersection;
  - Aberdare Road / Vincent Street Intersection; and
  - Quorrobolong Road / Sandy Creek Road Intersection.
- Review of access arrangements in terms of road safety and recommend an intersection treatment to the facility;
- Assessment of the potential demand for parking and the proposed car parking arrangements;

- A check that the site access caters for all vehicles expected to access the site and that all movements to/from Quorrobolong Road are in a forward direction;
- A review of existing regulatory signage and line marking in the vicinity of the site and identification of any need for modification as a result of the development;
- Visual assessment of the pavement condition and road geometry on Quorrobolong Road;
- Comment on the potential road safety mitigation measures in the event of subsidence on Sandy Creek Road and Quorrobolong Road;
- Comment on the impact to public transport (especially school bus services including bus stops), cyclists and pedestrians (if any); and
- Recommendation of upgrade works and/or strategies to improve road safety at the site.

1.4 Consultation with government bodies

Roads and Traffic Authority (Hunter Region)

GHD met with representatives of the RTA on 7 September 2007 to discuss traffic impacts potentially caused by the proposed mine development. The RTA had no objections to the development and foresaw minimal traffic impacts that may be caused by the proposed traffic volumes along the assumed routes. The RTA expressed road safety at the proposed access on Quorrobolong Road in light of the 24 hour shift work as an issue to be addressed. GHD and the RTA concurred that a Type B or type AUR intersection arrangement would be the relevant safety control at the proposed access location.

Cessnock City Council

GHD held discussions with a representative of Cessnock City Council (CCC) on 21 August 2007 to discuss traffic impacts potentially caused by the proposed development. GHD discussed potential key routes that would be used by workers accessing the site and the impacts to key intersections along the route. CCC's representative generally agreed on the key routes of interest through Cessnock, and suggested that the key intersections requiring assessment were the intersection of Wollombi Road and West Avenue and the intersection of Aberdare Road and Vincent Street.

Cessnock City Council provided existing traffic count information for the surrounding road network.

2. Existing Conditions

2.1 Site Description and Surrounding Land Uses

The proposed Surface Infrastructure Site is located approximately 10 kilometres south of Cessnock and will be the access point to the mine for the majority of employees. Access to the site will be via Quorrobolong Road. The location of the site is shown in Figure 1.

The area directly surrounding the site is within the Werakata State Conservation Area. North of the site along Quorrobolong Road is the small residential suburb of Kitchener. Land to the north of Kitchener is currently in the process of being rezoned for residential development with potential for 1000 new lots. Due to the current stage of the rezoning process, the traffic generated from this development is not being considered in this assessment.

The existing coal mine pit top facility is located west of the proposed site at Paxton and is accessed via Middle Road. The current operation operates 24 hours a day, seven days a week in designated shifts.

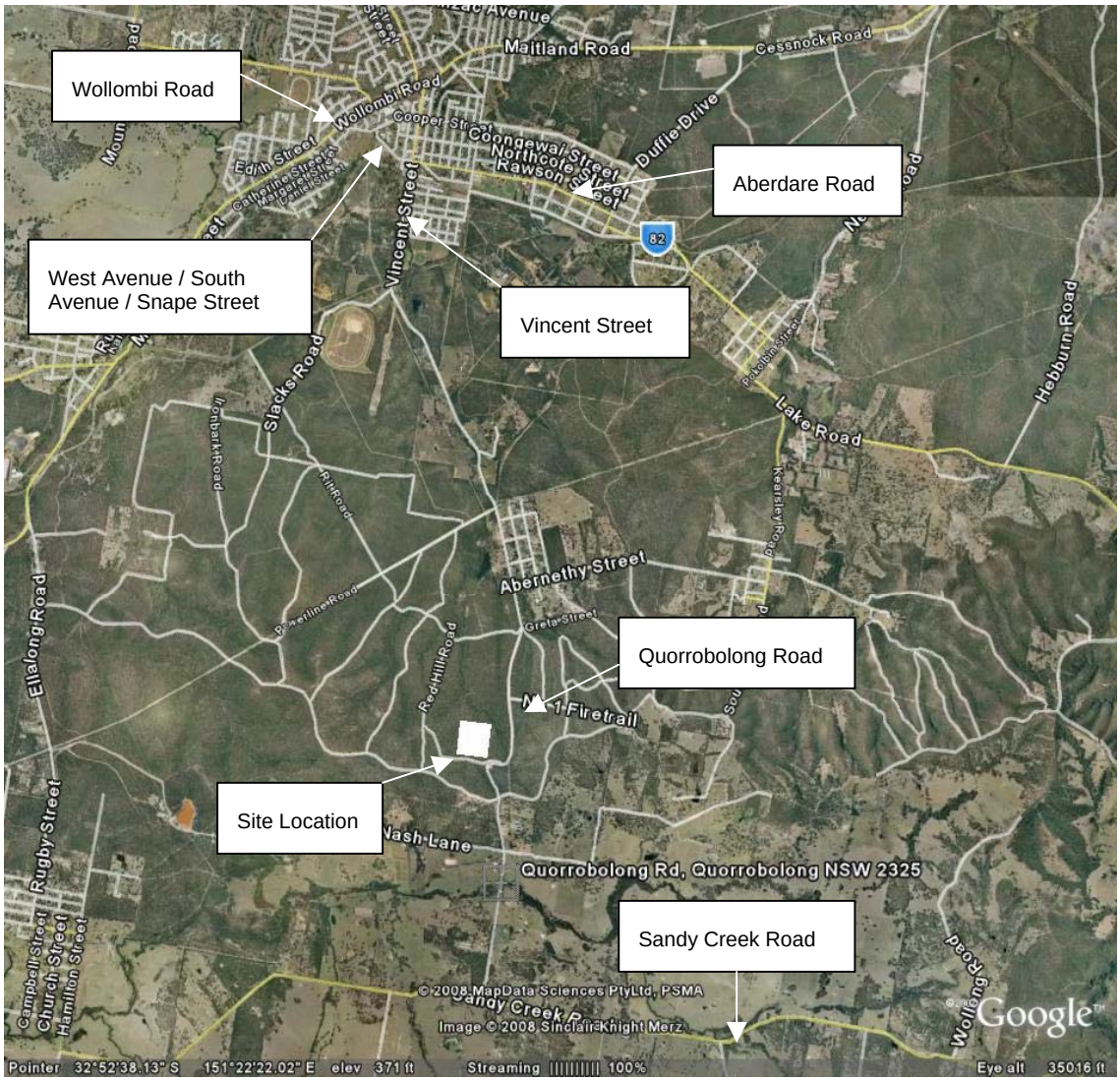
Figure 1 Proposed Surface Infrastructure Site location

2.2 Local Road Network

The key roads surrounding the Quorrobolong Site are highlighted in **Figure 2**. These include:

- Quorrobolong Road;
- Sandy Creek Road;
- Wollombi Road;
- West Avenue / South Avenue / Snape Street;
- Aberdare Road;
- Duffy Drive;
- Maitland Drive; and
- Vincent Street.

Figure 2 Key roads and intersections surrounding the Quorrobolong Site



2.2.1 Quorrobolong Road

Access to the proposed mine will be via Quorrobolong Road. Quorrobolong Road is a well graded and sealed two-lane two-way rural road with approximately a 6m road seal width at the proposed access point to the Surface Infrastructure Site. The pavement is currently in good condition with generally 1.2m shoulders over culverts. Quorrobolong Road is a detour route for heavy vehicles travelling from Ellalong to Newcastle or Maitland due to a 20 tonne weight restriction for Sandy Creek Road between Quorrobolong Road and Lake Road. It has a speed limit of 100km/h.

A winding section of Quorrobolong Road approximately 250m south of the of the proposed access contains speed advisory signs ranging from 45km/h to 75km/h. Line marking is present on this section of road (approximately 1km in length) and safety barriers are provided where necessary. The pavement condition on this section of road is good. Photo 1 shows the horizontal alignment south of the proposed access.

Photo 1 Quorrobolong Road south of the proposed access

2.2.2 Sandy Creek Road

Sandy Creek Road is a two-lane two-way rural road that extends between Hamilton Street in the west and Lake Road in the east. The road consists of tight bends with speed advisory signs ranging from 35km/h to 75km/h for approximately 3km. For the remainder of the length of Sandy Creek Road the horizontal and vertical geometry of the road appears satisfactory for the 100km/h sign posted speed. The pavement is currently in good condition and has centre and edge line marking. A load limit of 20 tonnes applies to the one lane wooden Wallis Creek Fosters Bridge situated approximately 8km east of the intersection of Sandy Creek Road and Quorrobolong Road (shown in Photo 2).

It is noted that the majority of light vehicle traffic travelling from the south east (Lake Macquarie, Central Coast) would currently access the existing mine site at Paxton via Sandy Creek Road. Sandy Creek Road will remain the preferred route for the proposed development for vehicles travelling from the southeast.

Photo 2 Wallis Creek Fosters Bridge – Sandy Creek Road

2.2.3 Wollombi Road (MR181A)

Wollombi Road is a two-lane two-way road connecting the town of Wollombi approximately 25km south west of Cessnock to Cessnock City centre. Wollombi Road becomes Maitland Road where the two roads intersect with Vincent Street in the Cessnock City centre. Wollombi Road performs the role of a two (2) lane urban road with on street parking, bicycle lane facilities and a speed limit of 60 km/h at the intersection with West Avenue.

2.2.4 West Avenue, South Avenue and Snape Street

West Avenue, South Avenue and Snape Street are local roads that connect Wollombi Road to Vincent Street at the intersections of West Avenue (priority) and Snape Street (signalised) respectively. They are typically two (2) lane urban roads with a 50 km/h speed limit.

2.2.5 Aberdare Road (MR220)

Aberdare Road performs the role of a sub-arterial that extends between Vincent Street in the west and Caledonia Street in the east. It is typically a two (2) lane urban road with a speed limit of 60 km/h.

2.2.6 Duffie Drive

Duffie Drive is a two-lane two-way road with a 25 tonne load limit. The road pavement is line marked and in good condition with a speed limit of 100km/h. Duffie Drive provides an alternate route bypassing Cessnock city centre for vehicles travelling to the north east.

2.2.7 Maitland Road (MR588)

Maitland Road is a two-way two-lane arterial road collecting through traffic from Wollombi Road and Cessnock Road. Maitland Road provides the main arterial link between Cessnock City centre and Kurri Kurri. Maitland Road has a signposted speed limit of 60km/h in the vicinity of Vincent Street. The pavement has line marking and is in good condition.

2.2.8 Vincent Street (MR220)

Vincent Street is an urban road that extends between Wollombi Road in the north and Quorrobolong Road in the south. It is typically a two (2) lane urban road with turn bays located at the intersection approaches to accommodate right / left turn movements, on-street parking north of Aberdare Road and a speed limit of 60 km/h.

2.3 Existing Network Performance

The existing road network performance has been measured based on Australian Traffic Survey (ATS) classified turning movement surveys that were undertaken on 6 September 2007 at the three (3) key intersections within the study area as listed below (and highlighted in Figure 2).

- Wollombi Road / West Avenue (priority intersection);
- Aberdare Road / Vincent Street (signalised intersection); and
- Quorrobolong Road / Sandy Creek Road (priority intersection).

The counts were carried out between 7.00 - 9.00 AM in the morning and between 3.00 – 6.00 PM in the evening peak. The traffic survey indicates that the morning (8.00– 9.00 AM) and evening (4.00 – 5.00 PM) peak hour operations represents the period(s) that the existing road network is the most congested.

2.3.1 Road Network

The performance of the existing road network surrounding the development site has been measured in terms of Level of Service (LOS). The LOS criteria has been based on peak hour flows per direction for urban roads and peak hour flows on two (2) lane two way roads (with design speed of 100 km/h) for rural roads as defined in RTA's Guide to Traffic Generating Developments and detailed in Table 1 and Table 2 respectively.

Table 1 Urban road peak hour flows per direction

Level of Service	One Lane (veh/hr)
A	200
B	380
C	600
D	900
E	1400

Source: RTA Guide to Traffic Generating Developments, October 2002, Version 2.2

Table 2 Peak hour flow on two (2) lane rural road (veh/hr)

Level of Service	Veh/hr
B	530
C	870
D	1410
E	2290

Source: RTA Guide to Traffic Generating Developments, October 2002, Version 2.2

The LOS criteria in Table 2 is based on the following assumptions:

- Design speed of 100 kph;
- Terrain level with 20% no overtaking;
- An average of 15% heavy vehicles;
- 3.7 metre traffic lane widths; and
- 60/40 directional split of traffic.

The current level of service for the key roads surrounding the Quorrobolong Site (as listed in Section 2.2) during the surveyed morning (8.00 – 9.00 AM) and evening (4.00 – 5.00 PM) peak hour(s) is highlighted in Table 3.

The analysis indicates that Wollombi Road east of West Avenue, West Avenue/South Avenue/Snape Street, Vincent Street and Aberdare Road operates satisfactorily during the morning and evening peak periods, with the highest level of service experienced shown to be LOS C and spare capacity to accommodate increased traffic growth.

Wollombi Road west of West Avenue however is shown to be approaching capacity (LOS D) and is likely to experience unstable traffic flow conditions during the peak hour operations. Vehicles are observed to diverge at Wollombi Road / West Avenue intersection alleviating the traffic impacts on Wollombi Road east of West Avenue.

Table 3 Peak hour level of service on the surrounding road network during the morning and evening peak periods

Road / Street	Type	Number of Lanes	AADT	%HV	AM Peak (8-9AM)							PM Peak (4-5PM)						
					North/ Eastbound	LOS	West/ Southbound	LOS	Combined	LOS	HV%	North/ Eastbound	LOS	West/ Southbound	LOS	Combined	LOS	HV%
Wollombi Road West of West Avenue	Urban	1	11803	4%	782	D	480	C	1262		7%	647	C/D	872	D	1519		3%
Wollombi Road East of West Avenue	Urban	1	18201	5%	457	C	262	B	719		9%	347	B	464	C	811		4%
South Avenue	Urban	1	4165	4%	290	B	326	B	616		8%	407	B/C	364	B	771		5%
Vincent Street North	Urban	1	8116	9%	274	B	161	A	435		16%	317	B	427	C	744		6%
Aberdare Street	Urban	1	10372	6%	298	B	384	B	682		10%	492	C	413	C	905		6%
Qurrobolong Road	Rural	1	664	6%	45		11		56	A	9%	30		19		49	A	6%
Sandy Creek Road East of Qurrobolong Road	Rural	1	1238	6%	39		46		85	A	9%	35		65		100	A	8%

2.3.2 Intersection Performance

The three (3) key intersections surrounding the Quorrobolong Site (and as highlighted in Figure 2) were modelled with the aid of Sidra Intersection 3.1 (SIDRA) traffic modelling software, based on the volumes from the surveyed turning movement counts. The main performance indicators from SIDRA include:

- Degree of saturation – a measure of the ratio between traffic volumes and the capacity of the intersection;
- Average delay – how long in seconds the average vehicle waits at the intersection;
- Level of service – a measure of the overall performance of the intersection (as defined in Table 4); and
- 95% back of queue – the queue length in which five (5) per cent of all observed queues (per cycle) on the specified approach are observed to exceed.

Table 4 Performance Criteria for Intersections

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

Source: RTA Guide to Traffic Generating Developments, October 2002, Version 2.2

Table 5 and Table 6 highlight the results of the intersection analysis by showing the current level of service for the morning and evening peak hours respectively.

Table 5 Existing intersection performance, morning peak hour (8.00 – 9.00 AM)

Location	Degree of Saturation	Average Delay (sec/veh)	Level of Service (LOS)	95% Back of Queue (m)
Wollombi Road / West Avenue				
West Avenue	0.284	8.7	A	11
Wollombi Road NE	0.168	0.3	A	0
Wollombi Road SW	0.849	20.1	B	134
All Vehicles	**0.849**	**14.0**	**NA**	**134**
Aberdare Road / Vincent Street				
Vincent Street N	0.286	26.6	B	30
Aberdare Road E	0.537	34.7	C	83
Vincent Street S	0.286	26.6	B	30
Snape Street W	0.537	31.8	C	86
All Vehicles	**0.538**	**31.4**	**C**	**86**
Quorrobolong Road / Sandy Creek Road				
Quorrobolong Road N	0.011	15.4	B	0
Sandy Creek Road E	0.032	7.5	A	1
Sandy Creek Road W	0.030	4.8	A	0
All Vehicles	**0.032**	**7.0**	**NA**	**1**

Source: GHD - SIDRA analysis

Table 6 Existing intersection performance, evening peak hour (4.00 – 5.00 PM)

Location	Degree of Saturation	Average Delay (sec/veh)	Level of Service (LOS)	95% Back of Queue (m)
Wollombi Road / West Avenue				
West Avenue	0.655	14.6	B	46
Wollombi Road NE	0.279	0.1	A	0
Wollombi Road SW	1.218	116	F	349
All Vehicles	**1.216**	**53.1**	**NA**	**349**

Location	Degree of Saturation	Average Delay (sec/veh)	Level of Service (LOS)	95% Back of Queue (m)
Aberdare Road / Vincent Street				
Vincent Street N	0.611	28.8	C	84
Aberdare Road E	0.713	41.4	C	94
Vincent Street S	0.716	30.0	C	74
Snape Street W	0.741	34.5	C	127
All Vehicles	**0.741**	**33.8**	**C**	**127**
Quorrobolong Road / Sandy Creek Road				
Quorrobolong Road N	0.034	4.8	A	1
Sandy Creek Road E	0.018	13.2	A	0
Sandy Creek Road W	0.016	3.3	A	0
All Vehicles	**0.034**	**5.9**	**NA**	**1**

Source: GHD - SIDRA analysis

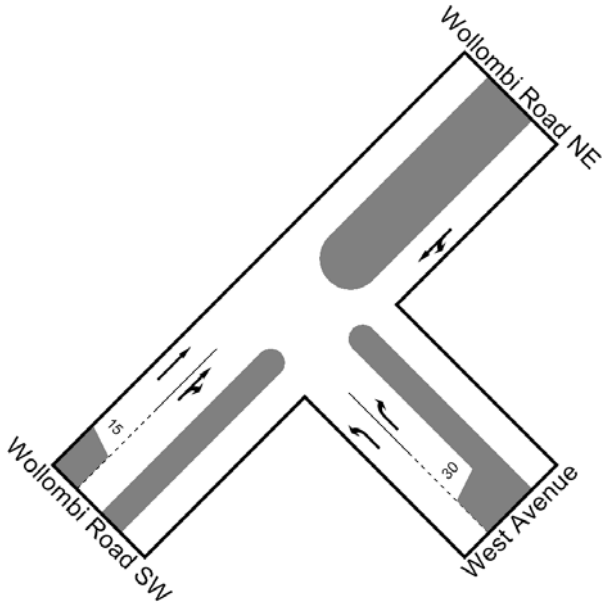
Wollombi Road / West Avenue Intersection

Modelling Assumptions

The principal assumptions employed in modelling this priority intersection include:

- The intersection layout has been based from on-site observations and measurements for lane widths, turn bay lengths etc. It was observed on-site that through traffic is currently bypassing queued right turn traffic travelling from Wollombi Road onto West Avenue by using the adjacent bike lane / parking lane when not occupied. To account for this movement a short through lane of 15 metres has been included in the modelling as shown in Figure 3. This movement is not encouraged from a safety perspective and would not be able to be undertaken if vehicles are parked or cyclist are using the bike lane. Without including this short through lane however, the 95% back of queue on Wollombi Road southwest approach is calculated (in SIDRA) to be approximately 400 metres in the morning peak and one (1) kilometre in the evening peak which is not considered to be a good measure of existing conditions from on-site observations.

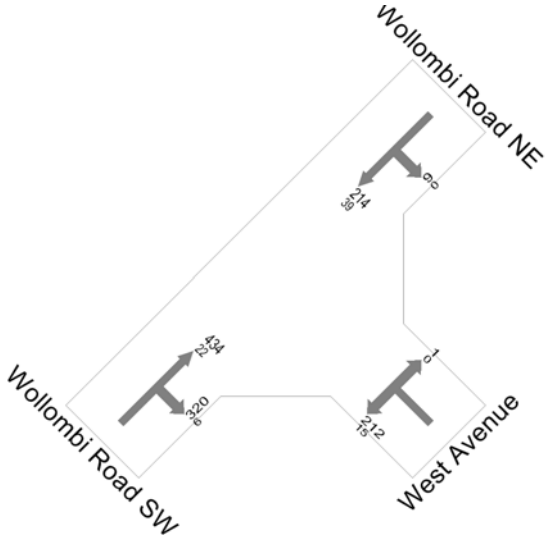
Figure 3 Wollombi Road / West Avenue intersection modelling layout



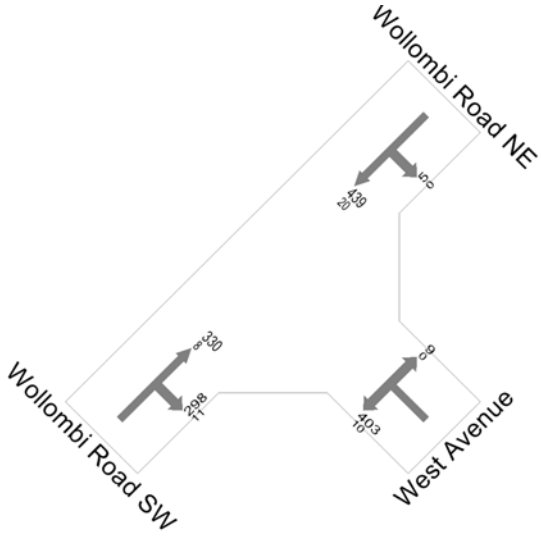
- The speed limit along Wollombi Road and West Avenue has been modelled to be 60 km/h and 50 km/h respectively; and
- The classified turn counts during the morning and evening peak periods are as shown in Figure 4.

Figure 4 Wollombi Road / West Avenue AM and PM peak classified turn counts

AM Peak



PM Peak



Analysis Results

The results in Table 5 indicate that currently during the morning peak the intersection operates with a good level of service (LOS B), minor vehicle delays and spare capacity. The through traffic flow on Wollombi Road southwest approach is however, shown to be impacted / inhibited by the queued right turn movements (approximately 130m 95% back of queue).

The results in Table 6 indicate that currently during the evening peak the intersection operates with an unsatisfactory level of service (LOS F), considerable vehicle delays (in particular on the Wollombi southwest approach) and is approaching capacity. The through traffic flow on Wollombi Road southwest approach is shown to be considerably impacted / inhibited (LOS F) by the queued right turn movements (approximately 350m 95% back of queue).

The intersection performance analysis highlights that under existing conditions mitigation measures should be considered at this intersection by the inclusion of a short right turn bay or a through overtaking lane on the Wollombi Road southwest approach. This would significantly improve the eastbound through traffic flow, as well as improve the operation of the intersection in terms of safety.

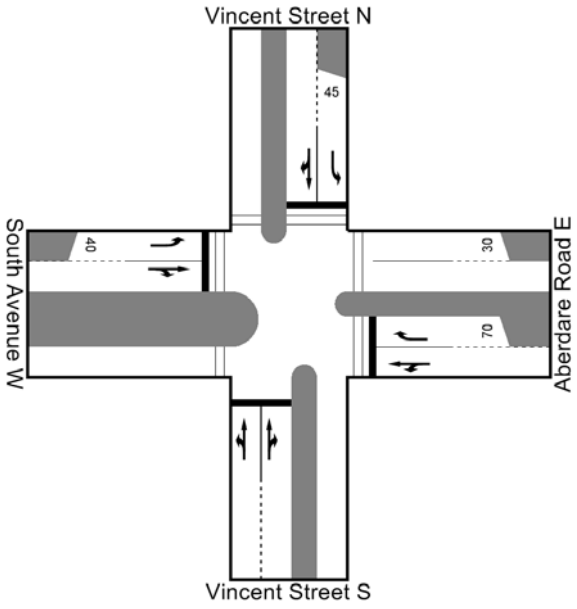
Aberdare Road / Vincent Street Intersection

Modelling Assumptions

The principal assumptions employed in modelling this signalised intersection include:

- The intersection layout has been based from on-site observations and measurements for lane widths, turn bay lengths etc and is as shown in Figure 5.

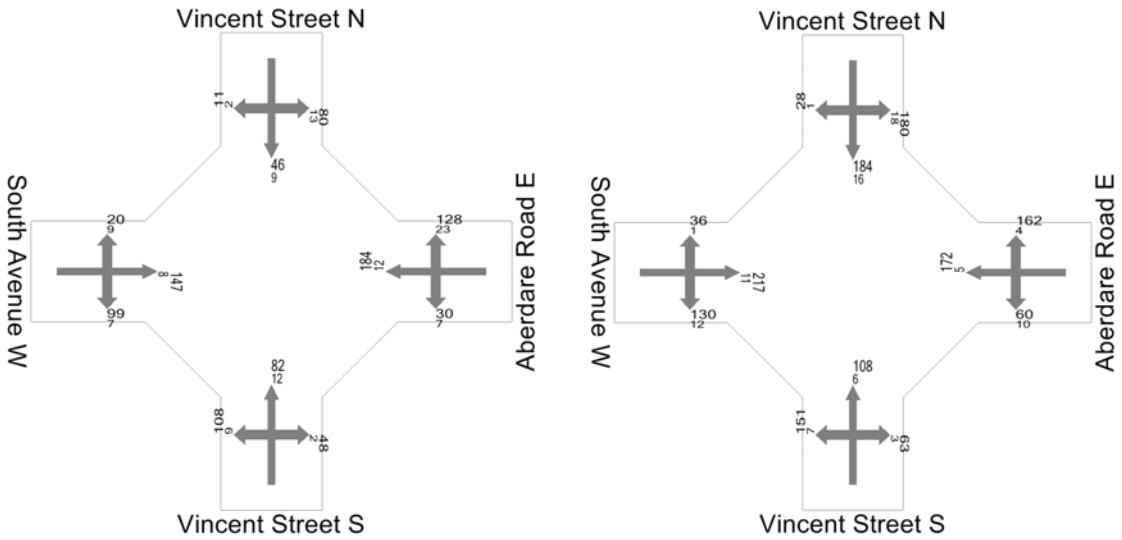
Figure 5 Aberdare Road / Vincent Street intersection layout



- The speed limit along Vincent Street and Aberdare Road has been modelled to be 60 kph and Snape Street/South Avenue has been modelled to be 50 kph; and
- The classified turn counts during the morning and evening peak periods are as shown in Figure 6.

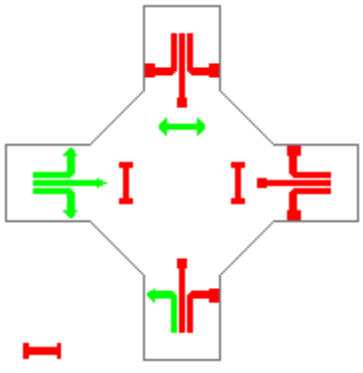
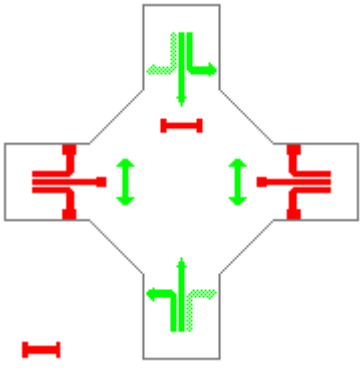
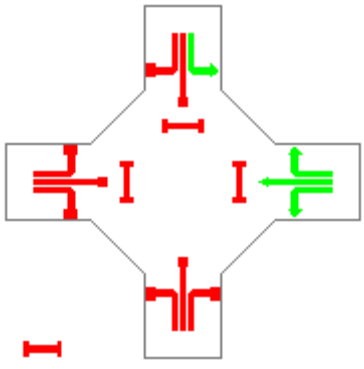
Figure 6 Aberdare Road / Vincent Street AM and PM peak classified turn counts

AM Peak **PM Peak**



- The phase arrangement employed in the SIDRA analysis has been based from the Traffic Signal Plan for the intersection (reference number TCS VV2356) provided by RTA and an on-site survey of signal operations conducted by Australian Traffic Survey (ATS) on 6 September 2007 for a ten (10) minute period during the evening peak. The phase arrangement employed for the morning and evening peak periods is highlighted in Figure 7.

Figure 7 Phase arrangement employed for Aberdare Road / Vincent Street signalised intersection for the morning and evening peak periods.

Phase A	Phase B	Phase C
		

- A fixed cycle time of 90 seconds was employed for both the morning and evening peak periods. This cycle time was determined from the average cycle time calculated from the on-site survey undertaken by ATS and the practical cycle time calculated by SIDRA. The phase times were optimised in SIDRA; and
- The default pedestrian volume of 50 pedestrians / hour on the North, East and West approach has been employed.

Analysis Results

The results in Table 5 and Table 6 indicate that currently during the morning and evening peak periods the intersection operates with a satisfactory level of service (LOS C), relatively minor vehicle delays and some spare capacity.

The longest queue lengths are observed on Snape Street west approach with a 95% back of queue of approximately 85 metres and 125 meters in the morning and evening peak periods respectively. As a result of the short length of Snape Street between Vincent Street and South Avenue, the queues on this approach are likely to impact on the connecting roads South Street and West Avenue.

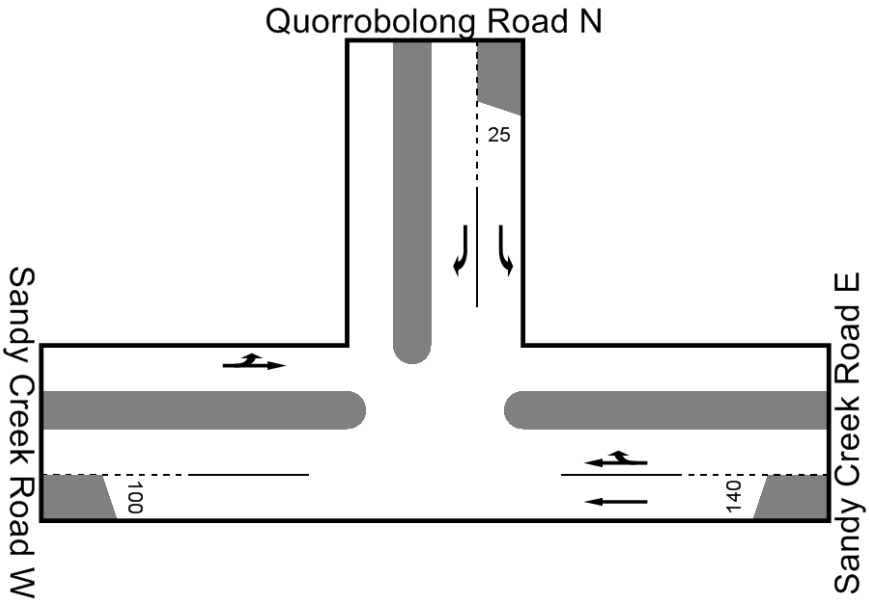
Quorrobolong Road / Sandy Creek Road Intersection

Modelling Assumptions

The principal assumptions employed in modelling this priority intersection include:

- The intersection layout has been based from on-site observations and measurements for lane widths, turn bay lengths etc and is as shown in Figure 8.

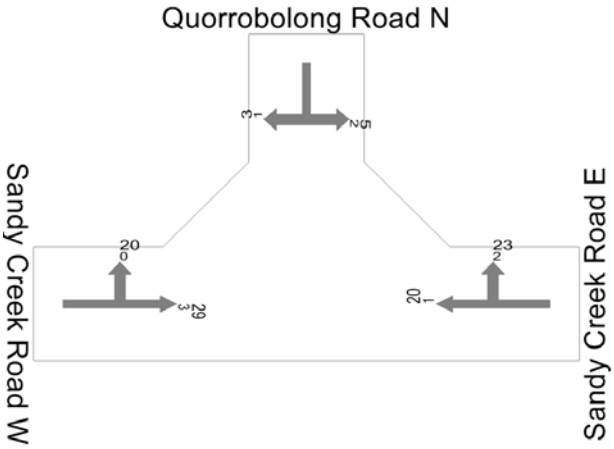
Figure 8 Quorrobolong Road / Sandy Creek Road intersection



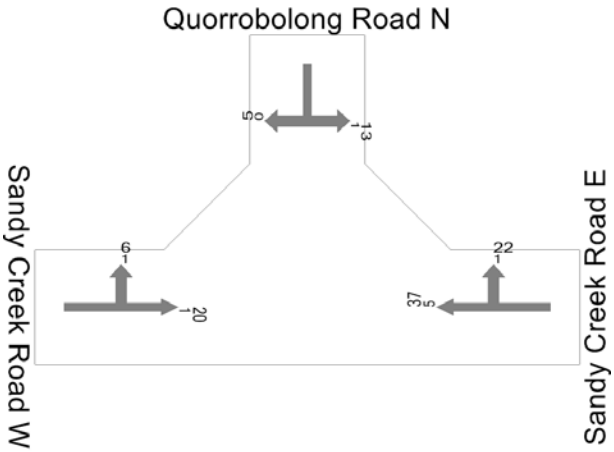
- The speed limit along Quorrobolong Road and Sandy Creek Road has been modelled to be 100km/h; and
- The classified turn counts during the morning and evening peak periods are as shown in Figure 9.

Figure 9 Quorrobolong Road / Sandy Creek Road AM and PM peak classified turn counts

AM Peak



PM Peak



Analysis Results

The results in Table 5 and Table 6 indicate that currently during the morning and evening peak periods the intersection operates with a good level of service (LOS A/B), minor vehicle delays and significant spare capacity.

2.4 Vincent Street Railway Level Crossing

GHD have undertaken a Stage 5: Existing Conditions Road Safety Audit Assessment for an existing rail level crossing on South Maitland Rail Line at Vincent Street Kitchener, which is owned and operated by Austar Coal Mine. The Stage 5 Road Safety Audit for the Vincent Street Rail Level Crossing is provided in Appendix A.

The level crossing is located between Baddeley Park (north side) and the intersection with Racecourse Road (south side) on Vincent Street. Key existing details and features of the level crossing are as follows:

- Rail alignment angled to road (approximately 60 degrees);
- “Stop sign” level crossing control;
- 60km/h sign posted speed limit for Vincent Street and part of Quorrobolong Road to the south;
- Street lighting each side of the level crossing (diagonal); and
- Signage and line marking generally appropriate for a level crossing with “stop sign” control for a straight road.

The Road Safety Audit determined that the existing road and rail traffic warrants an upgrade from the stop sign control to a Type F flashing light control.

2.5 Existing Crash History

The RTA provided crash history for the period beginning January 2001 to December 2006 for the local road network surrounding the proposed Surface Infrastructure Site. A plan of recorded crashes is provided in Appendix A. The five-year crash history provided by the RTA has been analysed to identify any historical crash trends from the location and type of crashes. The analysis has been performed for:

- Quorrobolong Road;
- Sandy Creek Road between Quorrobolong Road and Lake Road;
- Quorrobolong Road / Sandy Creek Road intersection;
- Maitland Road / Duffie Drive intersection;
- Aberdare Road / Vincent Street / Snape Street intersection; and
- Wollombi Road / West Avenue intersection.

The Crash data is provided in Appendix B, and is summarised in Table 7.

Table 7 Crash Analysis Summary

Location	No. of injury crashes	No. of non injury crashes	Total number of crashes	Total number of injuries	Majority of crashes
Quorrobolong Road	6	8	14	6	Left carriageway and hit non-vehicular object
Sandy Creek Road (between Quorrobolong Rd and Lake Rd)	7	7	14	8	Left carriageway and hit non-vehicular object
Quorrobolong Rd / Sandy Creek Rd intersection	1	0	1	1	Right turn collision with oncoming through vehicle
Maitland Rd / Duffie Dr intersection	13	7	20	25	Proceeding along lane and colliding with adjacent turning vehicle / turning right and colliding with adjacent through vehicle
Aberdare Rd / Vincent St / Snape St intersection	6	10	16	9	Proceeding along lane and colliding with adjacent turning vehicle / right turn collision with oncoming vehicle
Wollombi Rd / West Ave intersection	6	1	7	8	Right turn collision with oncoming through vehicle / Rear end collision

The key points relating to each of the above locations are:

- Of the 14 crashes along Quorrobolong Road, only one involved a second vehicle, with the remaining accidents involving the key vehicle leaving the carriageway and colliding with a road side object;
- Two accidents were recorded on the winding section of Quorrobolong Road 300m south of the proposed access point. Both crashes involved single vehicle leaving the carriageway to the left on a right hand bend;
- No crashes resulting in injuries were recorded within one kilometre of the proposed access point;
- Ten crashes involved a single vehicle leaving the carriageway and colliding with a road side object on Sandy Creek Road;
- Speed was a factor in six crashes on Sandy Creek Road;
- Eight crashes occurred in the 3 km winding section of Sandy Creek Road;
- Of the 20 crashes at the Maitland Road / Duffie Drive intersection, 18 involved the key vehicle turning right out of Duffie Drive and colliding with through traffic along Maitland Road;
- Nine crashes occurred in the 4:00 to 5:00 pm evening peak at the Maitland Road / Duffie Drive intersection; and
- There were no recorded crashes along the route of West Avenue/South Street/ Snape Street in the given period.

The existing intersection of Maitland Road and Duffie Drive provides the most significant safety concern. The current right turn provision onto Maitland Drive is resulting in ninety per cent of crashes at the intersection. Further investigation of the intersection would be required to determine what mitigation measures could improve the safety of the intersection.

2.6 Public Transport

There are currently no public transport services operating in the vicinity of the proposed development. Rover Coaches operate school buses on weekdays along Quorrobolong Road with one AM service and three PM services.

3. Proposed Development

3.1 General Description

The proposed development involves constructing an additional Surface Infrastructure Site to provide access to the mine for personnel, bathhouse, administration offices, car parking and other services. The location of the site on Quorrobolong Road is shown in Figure 1. The existing pit top facility will be maintained and continue to function as the main access point for mining equipment and maintenance of the mine. The Austar Coal Mine Conceptual Plan for the proposed development is shown in Appendix D. Features of the proposed development include:

- Surface Infrastructure Site facilities catering for up to 180 employees;
- A car park area with a capacity to accommodate approximately 175 parking spaces;
- A two way sealed access driveway with mountable grass verges;
- Stores warehouse; and
- Administration building.

3.2 Access

Access to the Surface Infrastructure Site is via Quorrobolong Road. An Austroads rural type AUR (formally Austroads Type B) intersection layout is recommended at the access point on Quorrobolong Road (shown in Appendix E). The rural type AUR layout provides an auxiliary lane for vehicles to pass stationary vehicles decelerating or queuing to turn right into the site. The provision of lighting at the intersection will improve the visibility of the intersection for vehicles accessing the site during night shifts.

3.3 Sight Distances

3.3.1 Sight Distance Requirements

One of the critical issues relating to a proposed property access is whether it has sufficient horizontal and vertical sight distances with the existing intersecting road. The specific sight distance criteria used in this assessment has been derived from the Austroads "*Guide to Traffic Engineering Practice, Part 5: Intersections at Grade"* (2005). Approach Sight Distance and Safe Intersection Sight Distance were measured from the proposed location of the access. Sight distances for the proposed access are shown below in Table 8.

Approach Sight Distance (ASD)

ASD is the minimum level of sight distance that should be available at all intersections. It is the distance travelled by a vehicle between the time the driver receives a stimulus signifying a need to stop and the time the vehicle comes to rest. ASD is measured from a driver's eye height (1.05m) to 0.0m, which ensures that a driver is able to see any line marking and kerbing at the intersection.

Safe Intersection Sight Distance (SISD)

SISD provides sufficient sight distance for a driver of a vehicle on the major road to observe a vehicle from the property access that could potentially create a collision situation (e.g. in the worst case, stalling across the traffic lanes), and to react by decelerating to a stop before reaching the collision point. SISD is measured horizontally along the carriageway from the approaching vehicle to the conflict point, and vertically from the driver's eye height (1.05m) to driver's eye height (1.05m).

Table 8 Proposed Access – Sight Distances

	Approach Sight Distance - ASD			**Safe Intersection Sight Distance – SISD**		
	Available	Minimum	Desirable	Available	Minimum	Desirable
Quorrobolong Road Northbound	240m	157m	170m	240m	240m	253m
Quorrobolong Road Southbound	333m	157m	170m	315m	240m	253m

Table 8 demonstrates that sight distance at the proposed access meets the minimum requirement in both directions, but is less than the desirable for northbound traffic. The erection of a left side road junction (W2-4) warning sign for northbound traffic will provide an early warning of the upcoming intersection. Lighting the intersection at night would further assist drivers to recognise the intersection location. Photo 3 and Photo 4 show the line of sight from the proposed access in the north and south direction respectively.

Photo 3 View north from the proposed access

Photo 4 View south from the proposed access

3.4 Service Vehicles

In addition to employee-generated traffic, service vehicles during normal operations will be waste service and delivery vehicles to the store warehouse.

It has been assumed that the majority of service or delivery vehicles will access the site throughout the working day with only 10% of service vehicle movements occurring in the peak traffic periods.

3.5 Parking

The Conceptual Plan for the Kitchener Surface Infrastructure Site, provided in Appendix D, demonstrates a designated parking area 45 meters wide by 90 meters long. Given the area of this space and the road configuration adjoining it, the parking area would be suitable for approximately 175 parking spaces. The estimated number of vehicles expected to occupy a car park at any one time is based on existing shift times and the assumption that 10% of people will car pool with others as advised by Austar Coal Mine Pty. Ltd. The greatest parking demand is expected during the period of overlap between the weekday night shift and weekday day shift. Table 9 demonstrates the estimated parking requirements.

Table 9 Estimated parking requirements

Shift	Current employees	Projected employees [1]	Parking spaces required at shift overlap after 10% car pool reduction [2]
Night Crew: 11:30pm to 8:00am.	33	48	43
Day Crew: 6:30am to 3:00pm	33	48	43
General day staff: assumed 7:00am to 4:00pm	15	22	20
Other staff: assumed 7:00am to 4:00pm [3]	45	65	58
Total	126	183	164

Notes

1. The projected employee numbers is based on a pro rata increase from the overall staff increase from 190 employees to 275 employees.
2. Austar advised that 10% of employees car pool with other employees. It has been assumed that this reduction can be applied equally for all shifts.
3. Austar provided designated shift times for 145 places from the 190 current employees. The additional 45 employees were added to the general day staff to be conservative.

The estimated required parking spaces given in Table 9 indicates that the planned car parking arrangements will be sufficient for the development in the period where three distinct shifts overlap. The three shifts overlap for a one hour period between 7:00am and 8:00am. For the majority of each of the three shifts there will be sufficient space for additional visitor vehicles to park.

4. Traffic Impact of the Proposed Development

4.1 Construction Impacts

Assuming the DA for the proposed Surface Infrastructure Site on Quorrobolong Road is approved, the start of construction has been programmed to commence in January 2009, with an anticipated completion in December 2012.

Austar Mine Pty. Ltd. have provided a broad construction schedule outlining the key construction activities and the number of personnel anticipated to be working at each activity. The information provided was sufficient to estimate the additional peak hour employee generated light vehicle movements. The information provided for heavy vehicle and delivery movements was not sufficient to determine peak hour capacity impacts from heavy vehicles.

The number of trips generated will be extended over a three (3) year period minimising the overall impact on the surrounding road network. Table 10 provides a summary of the construction activities that will occur at similar times and the number of light vehicle movements likely to be generated on a daily basis.

Table 10 Summary of construction activities and associated light vehicles

Year	Construction Activities	No. Light Vehicles (per day)
2009	Earthworks/Fencing	6
2009	Construct Mucking Shaft/Services To Site (Phoenix)/Build Switch Yard	22
2009/10	Construct Upcast Ventilation/Construct M&M Shaft/Warehouse and yard	31
2010/11	Construct M&M Shaft/Construct ventilation fans/Construct egress winder/landscaping	24
2011/12	Construct M&M winder/Bath house and admin building/relocate services	36
2011/12	Construct M&M winder/Bath house and admin building/final roads and pads	37

Includes a 10% contingency from the information provided by Austar program and construction activity schedule.

Table 10 highlights that the overall number of daily light vehicle trips generated as a result of the construction activities is low. As the proportion of total trips occurring during the peak hours of operation is likely to be nominal, as well as temporary / short term movements, it is not considered necessary to conduct SIDRA analysis to determine the impacts on the surrounding key intersections.

It is expected that heavy vehicle deliveries would not be concentrated in the peak period. The impact to the capacity of the road network from heavy vehicles is expected to be low relative to operational road network capacity impacts. Where the construction activity will impact on the road network, for example the delivery of wide or high vehicles (such as, excavators, cranes, tip trucks etc) to / from the Quorrobolong Site or concentrated delivery periods (such as large concrete pours) appropriate traffic management plans should be developed to minimise the impacts and ensure the safety of road users.

The routes available for heavy vehicles are limited by load restriction on Sandy Creek Road and Duffie Drive. Vehicles travelling towards the southeast will be forced to travel north to Lake Road via Aberdare Road.

4.2 Operational Impacts

In order to assess the likely operational impacts of the proposed Austar Coal Mine Surface Infrastructure Site, it is necessary to establish a future assessment year and to understand the operation of the site.

4.2.1 Traffic Impacts in 2013 without development

As discussed in Section 4.1 the construction of the site is anticipated to be complete in December 2012. Therefore for the purpose of this study it is proposed to assess the traffic impacts of development in 2013 when the Surface Infrastructure Site is programmed to be completed and fully operational.

To achieve 2013 base flows, the Year 2007 turn volumes have been increased by a factor of 1.12, employing a conservative 2% linear growth per annum over six (6) years). A 2% annual growth was adopted due to the absence of a conclusive growth rate from historical RTA AADT volume data.

Road network level of service

The projected level of service for the key roads surrounding the Quorrobolong Site (as listed in Section 2.2) during the surveyed morning (8.00 – 9.00 AM) and evening (4.00 – 5.00 PM) peak hour(s) for the year 2013 without the development is highlighted in the Table 11.

The analysis indicates that at West Avenue/South Avenue/Snape Street, Vincent Street and Aberdare Road will continue to operate with spare capacity.

Wollombi Road east and west of West Avenue is shown to be approaching capacity (LOS D) and is likely to experience unstable traffic flow conditions during the peak hour operations.

Table 11 Peak hour level of service on the surrounding road network in 2013 without development

Road / Street	Type	Number of Lanes	AADT	%HV	AM Peak (8-9AM)							PM Peak (4-5PM)						
					North/ East-bound	LOS	West/ Southbound	LOS	Combined	LOS	HV%	North/ Eastbound	LOS	West/ Southbound	LOS	Combined	LOS	HV%
Wollombi Road West of West Avenue	Urban	1	13219	4%	876	D	538	C	1413		7%	725	D	977	D	1701		3%
Wollombi Road East of West Avenue	Urban	1	20385	5%	512	C	293	B	805		9%	389	C	520	C	908		4%
South Avenue	Urban	1	4665	4%	325	B	365	B	690		8%	456	C	408	C	864		5%
Vincent Street North	Urban	1	9090	9%	307	B	180	A	487		16%	355	B	478	C	833		6%
Aberdare Street	Urban	1	11617	6%	334	B	430	C	764		10%	551	C	463	C	1014		6%
Qurrobolong Road	Rural	1	744	6%	50		12		63	A	9%	34		21		55	A	6%
Sandy Creek Road East of Qurrobolong Road	Rural	1	1387	6%	44		52		95	A	9%	39		73		112	A	8%

Intersection performance

The base future 2013 flows have been modelled in SIDRA to demonstrate the impact to key intersections from potential road user growth alone.

Table 12 and Table 13 details the performance of the three (3) key intersections (in terms of level of service, degree of saturation, average vehicle delay and 95% back of queue) for the future year 2013 (when the site is forecasted to be fully operational) during the morning and evening peak periods respectively without the development.

Table 12 Morning peak intersection performance for the future year 2013 without the development

Location	Degree of Saturation	Average Delay (sec/veh)	Level of Service (LOS)	95% Back of Queue (m)
Wollombi Road / West Avenue				
West Avenue	0.333	9.4	A	16
Wollombi Road NE	0.189	0.3	A	0
Wollombi Road SW	1.019	38.5	C	284
All Vehicles	**1.019**	**25.4**	**NA**	**284**
Aberdare Road / Vincent Street				
Vincent Street N	0.324	26.7	B	34
Aberdare Road E	0.626	36.3	C	94
Vincent Street S	0.587	29.1	C	66
Snape Street W	0.604	32.5	C	97
All Vehicles	**0.626**	**32.2**	**C**	**97**
Quorrobolong Road / Sandy Creek Road				
Quorrobolong Road N	0.012	15.3	B	1
Sandy Creek Road E	0.036	7.6	A	1
Sandy Creek Road W	0.032	4.8	A	0
All Vehicles	**0.036**	**7.0**	**NA**	**1**

Source: GHD - SIDRA analysis

Table 13 Evening peak intersection performance for the future year 2013 without the development

Location	Degree of Saturation	Average Delay (sec/veh)	Level of Service (LOS)	95% Back of Queue (m)
Wollombi Road / West Avenue				
West Avenue	0.803	19.7	B	72
Wollombi Road NE	0.312	0.1	A	0
Wollombi Road SW	1.635	292.6	F	709
All Vehicles	**1.637**	**128.9**	**NA**	**709**
Aberdare Road / Vincent Street				
Vincent Street N	0.671	29.9	C	94
Aberdare Road E	0.845	46.5	D	114
Vincent Street S	0.842	33.9	C	88
Snape Street W	0.829	39.5	C	154
All Vehicles	**0.845**	**37.5**	**C**	**154**
Quorrobolong Road / Sandy Creek Road				
Quorrobolong Road N	0.020	13.2	A	0
Sandy Creek Road E	0.038	4.8	A	2
Sandy Creek Road W	0.017	3.4	A	0
All Vehicles	**0.038**	**5.9**	**NA**	**2**

Source: GHD - SIDRA analysis

The results in Table 12 and Table 13 indicate the following for the three (3) key intersections during the morning and evening peak periods:

- The intersection of Wollombi Road / West Avenue is shown to operate satisfactory (LOS C) during the morning peak and at capacity (LOS F) during the evening peak. The critical approach / movement is shown to be right turn / through movements on the southwest approach, similar to the existing scenario, as a result of the high right turn movements, the shared through and right turn lane and resultant queuing. The results indicate that with traffic growth alone without the proposed development, mitigation measures at this intersection, in particular the southwest approach, should be considered;
- The intersection of Aberdare Road / Vincent Street is shown to operate satisfactorily (LOS C) with spare capacity during the morning peak, however is shown to be approaching capacity (LOS D) during the evening peak. Even though the intersection is shown to be approaching capacity (LOS D) during the evening peak period this is still considered to be an acceptable level of service for peak hour operation; and

- The intersection of Quorrobolong Road / Sandy Creek Road is shown to operate with a good level of service (LOS A), minor vehicle delays and significant spare capacity during both the morning and evening peak periods.

4.2.2 Traffic Impacts in 2013 with the development

The additional trips generated as a result of the operation of the Austar Surface Infrastructure Site on the surrounding road network have been based on the following assumptions / information provided by Austar:

- The maximum number of employees to work at the Quorrobolong Site is estimated to be 275 staff;
- The Surface Infrastructure Site will be operational over a 24-hour period with four (4) shifts occurring over the day. The shift times are based on existing shifts for the current mining operation. The shifts that will impact the morning and evening peak periods as staff leave and/or arrive to work are highlighted in Table 14;
- Staff travelling to the site have been classified into following four different routes based on staff's origin:
  - Route 1: Staff located to the north west of the site (e.g. Cessnock, Paxton) will travel along Wollombi Road, turn right into Snape Street, right into Vincent Street then onto Quorrobolong Road;
  - Route 2: Staff located to the north east of the site (e.g. Kurri Kurri, Weston, Abermain) will travel along Cessnock Road, turn left into Duffie Drive, Right into Aberdare Street, left into Vincent Street then onto Quorrobolong Road;
  - Route 3: Staff located to the East of the site (e.g Newcastle, Maitland, Port Stephens) will travel along John Renshaw Drive, turn left into Railway Street, following Stanford Street, Leggets Drive, turn left into Lake Road, right into Sandy Creek Road and right into Quorrobolong Road; and
  - Route 4: Staff located to the south east of the site (e.g. Lake Macquarie, Central Coast, Charlestown, Toronto, Belmont) will travel along Freemans Drive, turn left into Sandy Creek Road and right into Quorrobolong Road.
- The reverse routes apply for travelling home from the site;
- The forecasted trip distribution to / from the site on the surrounding road network for light vehicle movements is as detailed in Table 15; and
- The number of daily heavy vehicle movements is forecasted to be approximately ten (10) vehicles per day. For the purpose of this study it has been assumed that 10% of these trips is likely to occur during the peak hour(s). All heavy vehicle movements will access the site via the key haulage routes, including:
  - Wollombi Road and West Avenue to / from areas in the northwest; and
  - Aberdare Road to / from areas in the northeast / southeast.

Table 14 AM and PM peak shifts and estimated staff numbers

Peak	Shift	Estimated Staff Number Travelling
AM Peak	Night Shift 11.30pm to 8.00am	48
	Maintenance Shift 10.00am to 6.00pm	7
PM Peak	Day Shift 6.30am to 3.00pm	27#
	Afternoon shift 4.30pm to 1.00am	51

20% of the 135 day shift staff (27) are assumed to overflow into the PM peak (4-5PM)

Table 15 Assumed trip distributions to / from the site

Road	Direction of travel (to and from)	Trip Distribution (%)
Quorrobolong Road – North of site access	N, NE, NW	50%
Quorrobolong Road – South of site access	SE, E	50%
Sandy Creek Road	SE, E	50%
Aberdare Road	NE	15%
Vincent Street – north of intersection with Aberdare Road	N	5%
Snape Street / South Avenue / West Avenue	NW	30%
Wollombi Avenue	NW	20%

Note: 10% of traffic generated by the Surface Infrastructure Site is expected to distribute onto the local network between the intersection of Vincent Street / Aberdare Road / Snape Street and the intersection of Wollombi Road and West Avenue.

A spreadsheet model has been used to assign the additional vehicle trips (light and heavy) on the road network. The morning and evening peak traffic assignment / distribution for operations is presented in Appendix C.

Road network level of service

The projected level of service for the key roads surrounding the Quorrobolong Site (as listed in Section 2.2) during the surveyed morning (8.00 – 9.00 AM) and evening (4.00 – 5.00 PM) peak hour(s) for the year 2013 with the development is highlighted in Table 16.

The analysis demonstrates that there is no decrease in level of service category (A to F) of the network from that determined for 2013 without the development.

Table 16 Peak hour level of service on the surrounding road network in 2013 with development

Road / Street	Type	Number of Lanes	AADT	%HV	AM Peak (8-9AM)							PM Peak (4-5PM)						
					North/ Eastbound	LOS	West/ Southbound	LOS	Combined	LOS	HV%	North/ Eastbound	LOS	West/ Southbound	LOS	Combined	LOS	HV%
Wollombi Road West of West Avenue	Urban	1	13290	4%	877	D	548	C	1424		7%	735	D	982	D	1716		3%
Wollombi Road East of West Avenue	Urban	1	20390	5%	512	C	293	B	805		9%	389	C	520	C	908		4%
South Avenue	Urban	1	4776	4%	327	B	379	B	706		8%	472	C	416	C	888		5%
Vincent Street North	Urban	1	9113	9%	309	B	180	A	489		16%	356	B	482	C	838		6%
Aberdare Street	Urban	1	11675	6%	341	B	431	C	772		10%	555	C	471	C	1026		6%
Qurrobolong Road (North of site)	Rural	1	936	7%	74		16		91	A	6%	47		46		93	A	4%
Sandy Creek Road East of Qurrobolong Road	Rural	1	1564	5%	68		56		123	A	7%	35		65		100	A	9%

Intersection performance

These trips have been added to the base future year (2013) flows to assess the operational impacts of the Austar Surface Infrastructure Site at the key intersections surrounding the site using SIDRA.

Table 17 and Table 18 detail the performance of the three (3) key intersections (in terms of level of service, degree of saturation, average vehicle delay and 95% back of queue) for the future year 2013 (when the site is forecasted to be fully operational) during the morning and evening peak periods respectively.

Table 17 Morning peak intersection performance for the future year 2013

Location	Degree of Saturation	Average Delay (sec/veh)	Level of Service (LOS)	95% Back of Queue (m)
Wollombi Road / West Avenue				
West Avenue	0.346	9.5	A	16
Wollombi Road NE	0.189	0.3	A	0
Wollombi Road SW	1.029	41.7	C	284
All Vehicles	**1.029**	**27.3**	**NA**	**284**
Aberdare Road / Vincent Street				
Vincent Street N	0.318	26.0	B	34
Aberdare Road E	0.628	36.3	C	94
Vincent Street S	0.597	28.5	C	69
Snape Street W	0.631	33.5	C	99
All Vehicles	**0.631**	**32.1**	**C**	**99**
Quorrobolong Road / Sandy Creek Road				
Quorrobolong Road N	0.041	13.6	A	1
Sandy Creek Road E	0.043	8.1	A	2
Sandy Creek Road W	0.032	4.8	A	0
All Vehicles	**0.043**	**8.2**	**NA**	**2**

Source: GHD - SIDRA analysis

Table 18 Evening peak intersection performance for the future year 2013

Location	Degree of Saturation	Average Delay (sec/veh)	Level of Service (LOS)	95% Back of Queue (m)
Wollombi Road / West Avenue				
West Avenue	0.811	20.1	B	75
Wollombi Road NE	0.312	0.1	A	0
Wollombi Road SW	1.689	320	F	760
All Vehicles	**1.689**	**141.3**	**NA**	**760**
Aberdare Road / Vincent Street				
Vincent Street N	0.681	30.1	C	96
Aberdare Road E	0.868	48.0	D	120
Vincent Street S	0.879	35.9	C	94
Snape Street W	0.861	42.7	D	166
All Vehicles	**0.879**	**39.2**	**C**	**166**
Quorrobolong Road / Sandy Creek Road				
Quorrobolong Road N	0.035	13.0	A	1
Sandy Creek Road E	0.064	6.9	A	2
Sandy Creek Road W	0.017	3.4	A	0
All Vehicles	**0.064**	**7.6**	**NA**	**2**

Source: GHD - SIDRA analysis

The results in Table 17 and Table 18 indicate the following for the three (3) key intersections during the morning and evening peak periods:

- The intersection of Wollombi Road / West Avenue is shown to operate at approaching capacity (LOS D) during the morning peak and at capacity (LOS F) during the evening peak. The critical approach / movement is shown to be right turn / through movements on the southwest approach, similar to the existing scenario, as a result of the high right turn movements, the shared through and right turn lane and resultant queuing. The proposed Quorrobolong site has been forecasted to generate an additional three (3) vehicles and 21 vehicles on this approach during the morning and evening peak periods respectively, which is considered to be nominal (1% and 6%) compared to the total approach traffic volume. As stated in Section 2.3.2, under *Wollombi Road / West Avenue intersection – Results Analysis*, it is considered that with or without the proposed development mitigation measures at this intersection, in particular the southwest approach, should be considered;
- The intersection of Aberdare Road / Vincent Street is shown to operate satisfactorily (LOS C) with spare capacity during the morning peak, however is shown to be approaching capacity (LOS D) during the evening peak. Similar to that discussed for Wollombi Road / West Avenue intersection, the overall proportion of trips generated at this intersection as a result of the proposed Quorrobolong Site (approximately 30 trips) is considered to be nominal relative to the total intersection volume. Even though the intersection is shown to be approaching capacity (LOS D) during the evening peak period this is still considered to be an acceptable level of service for peak hour operation; and
- The intersection of Quorrobolong Road / Sandy Creek Road is shown to operate with a good level of service (LOS A), minor vehicle delays and significant spare capacity during both the morning and evening peak periods.

4.2.3 Vincent Street Railway Level Crossing

The increase in traffic generated by the proposed Surface Infrastructure Site does not change the warrant for a Type F flashing light control required from the existing road and rail traffic.

4.2.4 Road safety impacts from mine subsidence

In the unlikely event that mine subsidence occurred at either Quorrobolong Road or Sandy Creek Road as a result of new mining activity, road closures would be required in accordance with Cessnock City Council's requirements and the RTA publication, Traffic Control at Work Sites.

5. Key Findings

The key findings in this traffic study are:

- The Wollombi Road / West Avenue intersection currently operates at an unsatisfactory level of service (LOS F);
- Mitigation measures should be considered for the right turn /through movement on the southwest approach on the Wollombi Road / West Avenue intersection based on existing peak pm requirements;
- The Aberdare Road / Vincent Street intersection currently operates with a satisfactory level of service (LOS C);
- A type F flashing light control is required at the Vincent Street railway level crossing based on the existing road and rail traffic;
- Crash data has shown that the right turn movement from Duffie Drive to Maitland Road comprised 90% of the 20 crashes at that intersection over a 5 year period;
- Heavy vehicle access to the site is limited by 20 tonne road limits on Sandy Creek Road and Duffie Drive;
- An Austroads type AUR intersection would provide an auxiliary passing lane for through traffic on Quorrobolong Road around right turning traffic into the proposed site;
- The proposed access location to the Surface Infrastructure Site provides adequate Safe Intersection Sight Distance (SISD) and Approach Sight Distance (ASD), however the desirable sight distance is not satisfied for northbound traffic on Quorrobolong Road;
- The surrounding road network performs with a satisfactory level of service with and without the development in 2013;
- The intersection of Sandy Creek Road and Quorrobolong Road performs with a good level of service (LOS B) with the development; and
- The intersection of Aberdare Road / Vincent Street is predicted to operate with a satisfactory level of service (LOS C) in 2013 with and without the development.

6. Recommendations

This traffic study has uncovered road network recommendations required regardless of the proposed development and those directly related to the proposed development.

General road network recommendations that are recommended based on existing traffic volumes and behaviours and not a result of the proposed development are:

- Upgrade the Wollombi Road / West Avenue intersection to provide a designated right turn lane into West Avenue. Formalising this traffic movement may improve the existing traffic problems associated with the right turn movement using the through lane and through vehicles passing in the bicycle lane / parking area; and
- Install a type F flashing light control at the Vincent Street railway level crossing.

The following recommendations are directly related to the proposed development:

- An Austroads type AUR intersection treatment with an auxiliary passing lane for through traffic on Quorrobolong Road around right tuning traffic at the proposed Surface Infrastructure Site access;
- Provide lighting at the proposed Surface Infrastructure Site access intersection on Quorrobolong Road;
- Erect a left side road junction (W2-4) warning sign for northbound traffic approaching the proposed Surface Infrastructure Site facility access intersection to compensate for less than desirable Safe Intersection Site Distance (SISD); and
- Prepare a traffic management plan for oversize vehicle movements during construction of the Stage 3 development.

7. References

- AUSTROADS (1998) Guide to Traffic Engineering Practice – Part 2: Roadway Capacity;
- AUSTROADS (2005) Guide to Traffic Engineering Practice – Part 5: Intersections at Grade;
- RTA (2002) Guide to Traffic Generating Developments;
- Cessnock City Council DCP Part C.1: General Guidelines; and
- RTA (2004) Traffic Volume Data for Hunter Region.

Appendix A

Report on Vincent Street Rail Level Crossing

Stage 5 Road Safety Audit

CLIENTS | PEOPLE | PERFORMANCE

Austar Coal Mine Pty Ltd

Report on
Vincent Street Rail Level Crossing

Stage 5 Road Safety Audit

June 2008

Revision 1

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Executive Summary

GHD has been engaged by the Austar Coal Mine Pty Ltd to undertake a Stage 5: Existing Conditions Road Safety Audit Assessment for an existing rail level crossing on South Maitland Rail Line at Vincent Street, Kitchener, which is owned and operated by Austar Coal Mine.

The objectives of this study is:

- To prepare a road safety audit report that satisfies the requirements of the RTA;
- Identify deficiencies and to assess the suitability of road and rail infrastructure and arrangements at the level crossing;
- Benchmark existing road and rail infrastructure against known design standards; and
- Highlight critical issues.

Road Safety Audit

An initial Road Safety Audit (day and night) was undertaken on Thursday 15 February 2007. The purpose of the audit was to identify potential road safety risks at the level crossing location. A subsequent site visit was carried out on Thursday 22 November 2007.

Table E-1 and Table E-2 provide a summary of hazards identified during the road safety audit including their relevant risk ratings.

Table E-1 Standards – Specific Sites

Section Reference	Problem	Risk Rating
4.1.1	Level crossing control	High
4.1.2	Barrier line on northern approach	High
4.1.3	Approach signage	High

Table E-2 Maintenance

Section Reference	Problem	Risk Rating
4.2.1	Line marking and pavement markings	High
4.2.2	Relocate ‘railway’ sign	High
4.2.3	Overgrown shrubs in rail corridor	High

1. Introduction

GHD has been engaged by the Austar Coal Mine Pty Ltd to undertake a Stage 5: Existing Conditions Road Safety Audit Assessment for an existing rail level crossing on South Maitland Rail Line at Vincent Street, Kitchener.

Austar Coal Mine owns and operates the first eight kilometres of the South Maitland Rail Line, which includes the level crossing at Kitchener.

1.1 Description of Site

The level crossing is located south of Cessnock at the southern end of Vincent Street. It is located between Baddeley Park (north-side) and intersection with Racecourse Road (south-side). Quorrobolong Road extends to the south from the level crossing. See location figure below.

Figure 1-1 Level Crossing Location

Existing details and features for the level crossing is as follows (see Figure 01 in Appendix A):

- Straight road alignment and level grading (approx) on approaches and through the level crossing. Intersection with Racecourse Road approximately 100 m to the south;
- Straight rail alignment on approaches and through the level crossing;
- Rail alignment angled to road (60 degrees approx);
- 'Stop sign' level crossing control;

- 60 km/hr sign posted speed limit for Vincent Street and part of Quorrobolong Road to the south;
- 30 km/hr speed limit for South Maitland rail line through level crossing;
- Existing residences adjacent to the level crossing – NE and NW corners;
- School bus route;
- No pedestrian facilities;
- Street lighting each side of the level crossing (diagonal);
- Existing power poles and overhead cables on westside of roadway; and
- Signage and line-marking generally appropriate for a level crossing with ‘stop sign’ control for a straight road.

Photo 1-1 Northern Approach to Level Crossing

Photo 1-2 Southern Approach to Level Crossing

Photo 1-3 View to The West Along Rail Line From Level Crossing

Photo 1-4 View to The East Along Rail Line From Level Crossing

1.2 Rail Environment

The Vincent Street level crossing is located on the South Maitland Rail Line between Bellbird and Weston. The South Maitland Railway Line was first constructed in 1893 and has been used to transport coal to Newcastle for many years. Austar has a commercial arrangement with South Maitland Rail Line to transport coal from the washery at Pelton to the Port of Newcastle. Austar is the only mine left operating in the area that uses the line.

Rail transport currently accounts for approximately 98 percent of coal transported from the Pelton/Ellalong Colliery. The Pelton rail system was upgraded in 1988 and this allows the use of four SRA 48 Class diesel locomotives and 38 wagons, making a train unit of 2,200 tonnes" (HLA 1995). The existing approval allows for the transport of up to 2.94 million tonnes of coal per annum. However, coal production rates are currently much lower due to quota restrictions at the Port of Newcastle.

The current coal chain logistical constraints governing Austar's operation provide for a maximum of 4 x laden coal train movements per day to the Port of Newcastle. This equates to 4 x empty 'westerly' movements and 4 x laden 'easterly' movements through the Vincent Street level crossing subject to this study. In total, the South Maitland Railway line would see a maximum of 8 x rail movements across a given 24 hour period. These constraints are expected to remain until 2009.

In 2009, it is expected that the current logistical constraints will have been resolved such that the full 2.94Mt per annum capacity allowed under the consent can be utilised. In practice, this will enable up to 6 x laden coal trains per day or a total of 12 rail movements over a 24-hour period.

This report has been prepared as part of the Environmental Assessment (EA) under Part 3A of the EP&A Act 1979. The assessment takes into account additional traffic that will be generated as a result of the 3rd Stage of development at the mine. A new pit top facility is proposed to the south of Kitchener on Quorrobolong Road and is programmed to be operational in 2013. A proportion of vehicles accessing the new facility will utilise the railway crossing at Vincent Street. A full traffic impact assessment has been prepared as part of the Part 3A Environmental Assessment. The traffic generation figures used in this report have been sourced from that traffic study.

There will be no increase in the volume of coal transported beyond the existing approved 3 Mtpa. The assessment assumes that coal chain constraints that currently limit the number of rail movements along the South Maitland Rail Line will be resolved.

Coal chain constraints beyond Austar's control between the end of the South Maitland Rail Line and the Port of Newcastle restrict train movements to and from the Port. Generally, delivery can only be completed for approx 85% of the time or on average 6 days a week. Therefore, for the purpose of this audit, a total of 48 train movements per week (8 x 6 days = 48) have been allowed for existing usage and through to year 2009. 72 train movements per week have been adopted for 2009 and beyond (12 x 6 days = 72).

The maximum speed limit for trains through the Vincent Street level crossing is 30 km/hr.

1.3 Road Traffic

Traffic volumes are important in understanding the level of use for the particular road and audit site. The traffic volume data (AADT) is also used to calculate the warrants for the type of level crossing control (eg stop sign, flashing lights etc).

Cessnock City Council was approached for any traffic data in the vicinity of the Vincent Street level crossing. Council were able to supply traffic data for a location 100m north of the Vincent Street level crossing, which was recorded by way of tube counts over a week long period between Saturday 14 December 2002 and Saturday 21 December 2002.

Traffic data recorded at this location provided a 5 day average count of 1994 vehicle trips per day (VTPD).

For the purpose of this study a 2% annual rate of increase has been assumed for traffic volumes in Vincent Street so as to provide an up-to-date 2007 AADT figure and a 2013 AADT figure for when the new pit top facility is programmed to be operational. Additional traffic numbers for the Vincent Street level crossing generated by the new pit top facility are then added to the 2013 AADT figure the purpose of checking against relevant standards for the required type of level crossing control.

Existing and projected traffic data is as follows:

- Dec 2002 1994 AADT;
- Dec 2007 2193 AADT (2% linear growth);
- Dec 2009 2273 AADT (2% linear growth); and
- Dec 2013 2433 AADT (2% linear growth).

The Traffic Assessment Report indicates that an additional 177 (AADT) vehicles will use the Vincent Street level crossing once the new pit top facility is operational with access via Quorrobolong Road. Therefore, a year 2013 AADT figure including additional traffic from the new pit top facility = 2610 AADT.

2. The Audit's Objectives, Process and Evaluation Criteria

2.1 Objectives of the Road Safety Audit

The Road Safety Audit was carried out in accordance with the RTA Accident Reduction Guide – Part 2 Road Safety Audits and the Austroads Road Safety Audit Manual.

The objective of a Stage 5 Road Safety Audit is to identify potential safety deficiencies for the existing rail level crossing on Vincent Street, Kitchener.

2.2 Understanding of the Road Safety Audit Process

Vincent Street was driven in both directions during daytime and nighttime conditions as part of the audit. The rail crossing, including sight distances along the rail at the crossing were inspected on foot. It should be noted that the audit findings are restricted to the conditions of the route, as they existed on the date of the site visit.

Deficiencies can generally be related to "Standards" and "Maintenance" and definitions of these deficiencies are as follows:

Standards

"Standards" refers to road features, which are inappropriate, wrong or outdated. On existing roads, this also covers items, which may have been acceptable under an older design standard (or under older traffic or road safety engineering knowledge), but are no longer considered safe or acceptable under the new standards (or more recent knowledge), even if they have been well maintained.

It is noted that some road infrastructure may deviate from standards but have alternative (non-standard) controls in place, which deal with potential hazards adequately. Only standard items, which inadequately address potential hazards, are mention in this report.

Maintenance

"Maintenance" refers to those road features, which would be considered acceptable except for their poor condition. For example, worn road marking which if it were not worn would be considered acceptable.

2.3 Criteria Used to Assess the Levels of Risk

Risk levels have been assigned for each deficiency identified along the route by the audit team and are based on the criteria set in the Austroads guide.

Austroads Road Safety Audit, second edition, 2002, provides definitions for four different levels of risk, namely, "intolerable", "high", "medium" or "low". Extracts from Austroads are provided in Appendix B and summarised in Table 2-1.

Table 2-1 Summary of Levels of Risk

		Frequency			
		Frequent	Probable	Occasional	Improbable
Severity	**Catastrophic**	Intolerable	Intolerable	Intolerable	High
	Serious	Intolerable	Intolerable	High	Medium
	Minor	Intolerable	High	Medium	Low
	Limited	High	Medium	Low	Low

It is noted that as a consequence of the Austroads guide not adopting a more objective risk ratings process, the risk rating reported in all Road Safety Audits are subjective. As a result, the audit findings can be skewed towards reporting risks as “high” and “intolerable”. It should be noted that the process is relatively crude and that care should be taken by the appropriate decision maker when using these results to justify an outcome.

3. Audit Timing and Support Material

3.1 Site Visit

An initial Road Safety Audit (day and night) was undertaken on Thursday 15 February 2007. The purpose of the audit was to identify potential road safety risks at the level crossing location.

A subsequent visit was carried out on Thursday 22 November 2007 to establish if any improvements had been made to the level crossing and road approaches or any existing features had been altered in anyway so as to increase potential road safety risks.

It was noted that the level crossing and approaches remained the same as found on Thursday 15 February 2007, except for some additional tree/shrub growth to the west of the level crossing adjacent to the rail line. See Photo 1-3 above.

Weather conditions were fine at the time of both site visits.

GHD have used two auditors for this Stage 5 Road Safety Audit – Graeme Robinson and Chad Carey. Their details and involvement are as follows:

Lead Auditor: Graeme Robinson, GHD Newcastle

Graeme has over 35 years experience in civil design, particularly in the area of major RTA road projects, has completed the IPWEA/RTA Road Safety Auditor course and is a level 2 road safety auditor. Graeme has completed recent stage 3, 4 and 5 audits in Sydney, Hunter and Upper Hunter regions.

Graeme carried out the day/night audit, completed this audit report and has been the primary contact for the audit.

Senior Auditor: Chad Carey, GHD Sydney

Chad Carey is a Senior Civil Engineer and is an accredited Level 3 (Senior Lead Auditor) Road Safety Auditor on the IPWEA/RTA register. Chad has six years experience in the planning, design and construction of transportation and industrial projects within Australia and Europe. Chad has completed recent stage 3, 4 and 5 audits throughout NSW.

Chad's role has been to review this report and findings.

3.2 Supporting Material

The following information was referenced and used as part of this audit:

- RTA Traffic Engineering Manual Section 6: Rail Level Crossings (Draft 1994);
- Austroads Road Safety Audit Manual (2nd Edition 2002);
- RTA Accident Reduction Guide – Part 2 Road Safety Audits; and
- Standards Australia AS1742 parts 1, 2 and 7.

4. Road Safety Audit Findings

4.1 Standards Specific Sites

4.1.1 Level Crossing Control

Table 6C.2 (Appendix C) of Section 6 of the RTA Traffic Engineering Manual for Rail Crossings requires a sight distance (S3) of 147m minimum for a train speed of 30 km/hr and semi trailer vehicle type. Existing sight distance available at the crossing from the hold lines, each side of the crossing, exceeds this minimum requirement (refer Figure 01 in Appendix A).

Please refer Section 4.2.3 for a 'maintenance' requirement regarding sight line up the rail corridor.

Although sight distance requirements are met, Table 6.4.1 in the RTA manual provides an indicative warrant for crossing control where currently a stop sign control is in place.

The table recommends installation of Type F flashing lights for a crossing with a single track where 'VT' value is in excess of 50,000. The VT value is the multiplication of the volume of train movements per week by the AADT.

The 'VT' value for existing and future usage is as follows:

- Dec 2007 for 48 train movements per week (48 x 2193 AADT) VT = 105,264;
- Dec 2009 for 72 train movements per week (72 x 2273 AADT) VT = 163,656; and
- Dec 2013 for 72 train movements per week (72 x 2610 AADT) VT = 187,920.

The 'VT' value is in excess of the flashing light warrant condition for all scenarios.

There is a remote risk that vehicles could collide with a passing train due to the volume of traffic relative to the current controls.

It is recommended that the stop sign control be replaced with Type F flashing lights at this level crossing.

Level of Risk	Severity:	Serious
	Likelihood:	Occasional
	Risk Rating:	High

4.1.2 Barrier Line Northern Approach

Section 6 of the RTA Traffic Engineering Manual for Rail Crossings and AS 1742.7 recommends that barrier lines extend back to at least the advance sign W7-7 which equates to 130 – 170 metres (60 km/hr) prior to the level crossing hold line.

The barrier line on the northern approach to the level crossing only extends back 55 metres from the hold line. There is risk that road users may attempt overtaking manoeuvres on the approach to the intersection and risk not being able to stop at the hold line.

It is recommended that the approach barrier line on the northern approach to the crossing be extended back to a point at least 120 metres prior or the hold line.

Level of Risk	Severity:	Serious
	Likelihood:	Occasional
	Risk Rating:	High

4.1.3 Approach Signage

AS 1742.7 2007 (refer page 35) requires a minimum level of signage for stop sign control. This includes a RX-2 assembly adjacent the crossing and warning signs W7-7 at least 130m (60 km/hr) prior to the hold line.

Both approaches have out of date signage and no W7-7 and therefore signage is not to required standard. The risk is that road users will not identify signage and not behave in a safe manner.

It is recommended that:

- Remove out of date signs W8-1 from both approaches;
- Add sign G9 - 48 to the RX-2 assembly (2) adjacent the hold lines;
- Sign W7-7(R) be installed on the northern approach at 130m minimum from the hold line;
- Sign W7-7(R) be added to sign W7-3 on the southern approach or erected separately prior to sign W7-3 (max 50m); and
- Erect signs W7-7(R) and W8-3(L) on the LHS of Racecourse Rd prior to intersection.

Level of Risk	Severity:	Serious
	Likelihood:	Occasional
	Risk Rating:	High

4.2 Maintenance General

4.2.1 Line-Marking and Pavement Markings

Hold lines, barrier lines and ‘RAIL X’ pavement markings at the level crossing are either faded from wear, obscured by tyre marks or road maintenance (patching).

There is a risk that road users will not see the markings or hold lines early enough to stop in a safe manner at the level crossing.

It is recommended that line-marking and pavement markings be reinstated. In particular the following:

- Hold lines on both sides of the rail crossing;
- Barrier line on southern approach; and
- ‘RAIL X’ marking on southern approach.

Level of Risk	Severity:	Serious
	Likelihood:	Occasional
	Risk Rating:	High

4.2.2 Relocate ‘Railway’ Sign Southern Approach

Long rectangle sign ‘RAILWAY’ on the LHS on the southern approach is poorly positioned and restricts driver sight line along railway track to the west.

There is a risk that road users will not see an on coming train as early as they should due to the poor location of the sign.

It is recommended that the sign be relocated either forward or back to open up sight line up the rail track.

Level of Risk	Severity:	Serious
	Likelihood:	Occasional
	Risk Rating:	High

4.2.3 Overgrown Shrubs In Rail Corridor

Overgrown shrubs to the west of the level crossing are partially restricting the sight line for vehicles that have approached the level crossing from the south and have stopped at the hold line. As discussed in Section 4.1.1, a sight distance (S3) of 147m minimum for a train speed of 30 km/hr and semi trailer vehicle type is required. These shrubs, positioning some 30 to 40 m from the level crossing will eventually block the required sight distance from the level crossing.

There is a risk that road users approaching from the south will not see an on coming train as early as they should due to overgrown shrubs to the west of the level crossing.

It is recommended that the overgrown shrubs be removed from the sight line corridor.

Level of Risk	Severity:	Serious
	Likelihood:	Occasional
	Risk Rating:	High

5. Recommendation

The road safety audit findings in section 4 make a number of recommendations involving improvements to signage and line-marking at the level crossing. The findings also recommend the upgrade of level crossing control at the level crossing.

It is recognised that the upgrade of the level crossing control will take a longer period of time to complete due to design, approval and construction phases and the complexities associated with this type of infrastructure upgrade.

Therefore, it is recommended that the modifications be staged in two parts. Priority should be given to the stage 1 works so that they are implemented and completed within a time period that will be agreed with the RTA. This will deliver improved levels of safety sooner than the stage 2 works.

The stage 2 works will involve the installation of crossing control at the level crossing and will take longer to finalise due largely to a range of government departments likely to be involved in the approval, design and construction processes.

The recommendations are as follows:

Table 5-1 Stage 1 Works

Location	Problem	Recommended Works
Northern approach	Barrier line length on northern approach too short	Extend barrier line on northern approach so correct length.
Both approaches	Out of date approach signage	Replace and add signage to required standards.
Both approaches	Line and pavement markings faded or obscured from wear	Reinstate line and pavement markings where required.
Southern approach	Existing 'RAILWAY' sign restricts sight line up rail line	Relocate 'RAILWAY' sign on southern approach so as to not impede sight line.
Western rail approach	Overgrown shrubs in sight line	Remove shrubs from sight line corridor.

Table 5-2 Stage 2 Works

Location	Problem	Recommended Works
Vincent Street Kitchener	Level crossing control not to required standard	Upgrade level crossing control to Type F flashing lights.

6. Audit Statement

I certify that in carrying out this audit I have inspected the site in both day and night time conditions. We have endeavoured to identify features in order to improve safety, although it must be recognised that safety cannot be guaranteed since no road can be regarded as absolutely safe.

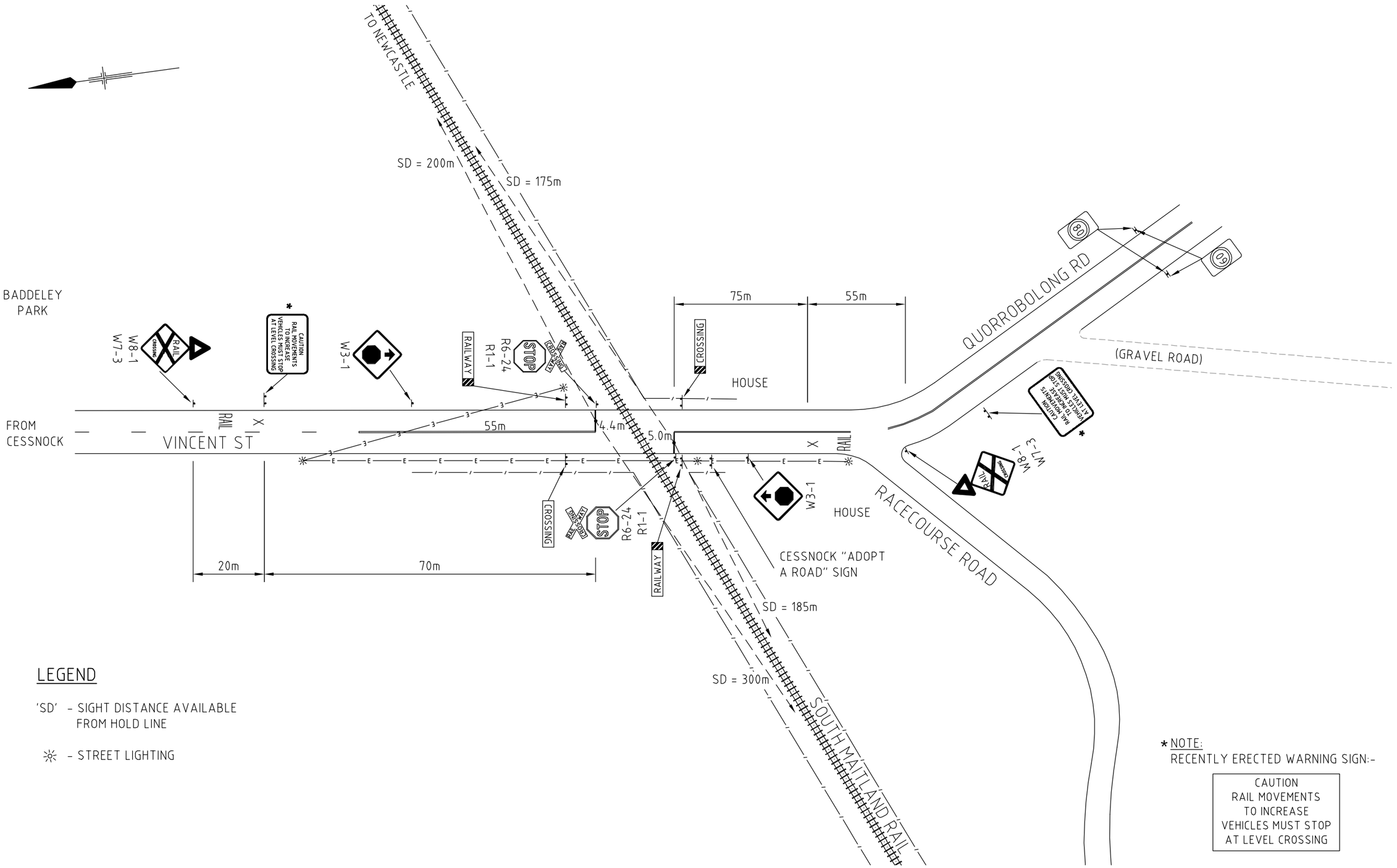
The problems identified have been noted in this report and readers are urged to seek further specific technical advice on matters raised and not rely solely on the report.

Signed:..... Dated: 15 February 2008

Graeme Robinson, GHD Newcastle

Appendix A

Location Figure



LEGEND

'SD' – SIGHT DISTANCE AVAILABLE FROM HOLD LINE

☼ – STREET LIGHTING

* NOTE:
RECENTLY ERECTED WARNING SIGN:–

CAUTION
RAIL MOVEMENTS
TO INCREASE
VEHICLES MUST STOP
AT LEVEL CROSSING

GHD CLIENTS | PEOPLE | PERFORMANCE

AUSTAR COAL MINE
ROAD SAFETY AUDIT
VINCENT ST, KITCHENER
SITE PLAN
scale | N.T.S for A3 date | 2007

job no. | 22-13256
rev no. | A

Figure 01

352 King Street Newcastle NSW 2300 Australia **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com.au **W** www.ghd.com.au

Plot Date: 23 March, 2007 - 1:55 PM Cad File No: G:\22\13256\CADD\Figures\ 22-13256-FIG001.dwg

Appendix B

Austroads Checklist

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
6.1 Road alignment and cross section				
1. Visibility; sight distance				
Is sight distance adequate for the speed of traffic using the route?	✓			
Is adequate sight distance provided for intersections and crossings? (eg. Pedestrian, cyclist, cattle, railway)	✓			Some shrubs require trimming
Is adequate sight distance provided at all private driveways and property entrances?	✓			
2. Design Speed				
Is the horizontal and vertical alignment suitable for the (85^{th} percentile) traffic speed?	✓			
If not are: • Warning signs installed? • Advisory speed signs installed?			✓	
Are the posted advisory speeds for curves appropriate?			✓	
3. Speed limit/speed zoning				
Is the speed limit compatible with the function, road geometry, land use and sight distance?	✓			
4. Overtaking				
Are safe overtaking opportunities provided?			✓	
5. Readability by drivers				
Is the road free of elements, which may cause confusion? For example: • Is alignment of the roadway clearly defined? • Has disused pavement (if any) been removed or treated? • Have old pavement markings been removed properly? • Do tree lines follow the road alignment? • Does the line of street lights or the poles follow the road alignment?	✓			
Is the road free of misleading curves or combinations of curves?	✓			
6. Widths				

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
Are medians and islands of adequate width for the likely users?			✓	
Are traffic lane and carriageway widths adequate for the traffic volume and mix?	✓			
Are bridge widths adequate?			✓	
7. Shoulders				
Are shoulders wide enough to allow drivers to regain control of errant vehicles?	✓			
Are shoulders wide enough for broken down or emergency vehicles to stop safely?	✓			
Are shoulders sealed?	✓			Some are sealed.
Are shoulders trafficable for all vehicles and road users? (i.e. are shoulders in good condition)	✓			
Is the transition from road to shoulder safe? (no drop offs)	✓			
8. Crossfalls				
Is appropriate superelevation provided on curves?			✓	
Is any adverse crossfall safely managed (for cars, trucks etc)	✓			
Do crossfalls (carriageway and shoulder) provide adequate drainage?	✓			
9. Batter Slopes				
Are batter slopes traversable by cars and trucks, which run off the road?	✓			
10. Drains				
Are roadside drains and culvert end walls traversable?	✓			
6.2 Auxiliary lanes				
1. Tapers				
Are starting and finishing tapers located and aligned correctly?			✓	
Is there sufficient sight distance to the end of the auxiliary lane?			✓	

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
2. Shoulders				
Are appropriate shoulder widths provided at merges?			✓	
Have shoulder widths been maintained beside the auxiliary lane?			✓	
3. Signs and markings				
Have all signs been installed in accordance with the appropriate guidelines?	✓			Some signage requires update
Are all signs conspicuous and clear?	✓			
Does all linemarking conform to these guidelines (particularly three merge arrows)?		✓		Some barrier lines are insufficient.
Is there advance warning of approaching auxiliary lanes?			✓	
4. Turning				
Have right turns from the through lane been avoided?			✓	
Is there advance warning of turn lanes?			✓	
6.3 Intersections				
1. Location				
Are all intersections located safely with respect to the horizontal and vertical alignment?		✓		
Where intersections occur at the end of high speed environments (eg. At approaches to towns), are there traffic control devices to alert drivers?		✓		Flashing lights required at level crossing
2. Visibility; sight distance				
Is the presence of each intersection obvious to all road users?	✓			
Is the sight distance appropriate for all movements and all users?	✓			
Is there stopping sight distance to the rear of any queue or slow moving turning vehicles?	✓			
Has the appropriate sight distance been provided for entering and leaving vehicles?	✓			
3. Controls and delineation				
Are pavement markings and intersection control signs satisfactory?		✓		

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
Are vehicle paths through intersections delineated satisfactory?	✓			
Are all lanes properly marked (including any arrows)?	✓			
4. Layout				
Are all conflict points between vehicles safely managed?		✓		
Is the intersection layout obvious to all road users?	✓			
Is the alignment of kerbs obvious and appropriate?	✓			
Is the alignment of traffic islands obvious and appropriate?			✓	
Is the alignment of medians obvious and appropriate?			✓	
Can all likely vehicle types be accommodated?	✓			
Are merge tapers long enough?			✓	
Is the intersection free of capacity problems, which may produce safety problems?	✓	✓		
6.4 Signs and lighting				
1. Lighting				
Is lighting required and if so, has it been adequately provided?	✓			
Is the road free of features which interrupt illumination (eg. Trees or overbridges)?	✓			
Is the road free of lighting poles, which are a fixed roadside hazard?	✓			
Are frangible or slip base poles provided?			✓	
Ambient lighting: If it creates special lighting needs, have these been satisfied?			✓	
Is the lighting scheme free of confusing or misleading effects on signals or signs?	✓			
Is the scheme free of any lighting black patches?	✓			
2. General sign issues				
Are all necessary regulatory, warning and direction signs in place? Are they conspicuous and clear?	✓			Update of some signs required
Are the correct signs used for each situation, and is each sign necessary?	✓			As above

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
Are all signs effective for all likely conditions (eg. Day, night, rain fog, rising or setting sun, oncoming headlights, poor lighting)?	✓			
If restrictions apply for any class vehicle, are drivers adequately advised?			✓	
If restrictions apply for any class of vehicle, are drivers advised of alternative routes?			✓	
3. Sign legibility				
In daylight and darkness, are signs satisfactory regarding visibility: • Clarity of message? • Readability/legibility at the required distance?	✓			
Is sign retroflectivity or illumination satisfactory?	✓			
Are signs able to be seen without being hidden by their background or adjacent distractions?	✓			
Is driver confusion due to too many signs avoided?	✓			
4. Sign supports				
Are sign supports out of the clear zone?	✓			
If not are they: • Frangible? • Shielded by barriers (eg. Guard fence, crash cushions)?	✓			
6.5 Markings and delineation				
1. General Issues				
Is the linemarking and delineation: • Appropriate for the function of the road? • Consistent along the route? • Likely to be effective under all expected conditions? (day, night, wet, day, fog, rising and setting sun position, oncoming headlights, etc)	✓			Some barrier lines of inappropriate length.
Is the pavement free of excessive markings? (eg. Unnecessary turn arrows, unnecessary barrier lines, etc)	✓			

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
2. Centrelines, edgelines, lane lines				
Are centrelines, edgelines, and lane lines provided? If not, do drivers have adequate guidance?	✓			
Are RRPM's required?			✓	
If RRPM's are installed, are they correctly placed, correct colours, in good condition?			✓	
Are profiled (audible) edgelines provided where required?			✓	
Is the linemarking in good condition?	✓			Some hold lines need repainting.
Is there sufficient contrast between linemarking and pavement colour?	✓			As above
3. Guideposts and reflectors				
Are guideposts appropriately installed?	✓			
Are delineators clearly visible?	✓			
Are the delineators on guard fences, crash barriers and bridge railings consistent with those on guideposts?	✓			
4. Curve warning and delineation				
Are curve warning signs and advisory speed signs installed where required?	✓			
Are advisory speed signs consistent along the route?	✓			
Are the signs correctly located in relation to the curve? (ie. Not to far in advance)	✓			
Are the signs large enough?	✓			
Are chevron alignment markers (CAMs) installed where required?			✓	
Is the positioning of CAMs satisfactory to provide guidance around the curve?	✓			
Are the CAMs the correct size?	✓			
Are CAMs confined to curves (not used to delineate islands etc)?	✓			
6.6 Crash barriers and clear zones				
1. Clear zones				
Is the clear zone width traversable (ie. drivable)?	✓			

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
Is the clear zone width free of rigid fixtures? (if not, can all of these rigid fixtures be removed or shielded?)	✓			
Are all powerpoles, trees, etc, at a safe distance from the traffic paths?	✓			
Is the appropriate treatment or shielding provided for any objects within the clear zone?	✓			
2. Crash barriers				
Are crash barriers installed where necessary?			✓	
Are crash barriers installed at all necessary locations in accordance with the relevant guidelines?			✓	
Are the barrier systems suitable for the purpose?			✓	
Are the crash barriers correctly installed?			✓	
Is the length of crash barrier at each installation adequate?			✓	
Is guard fence attached correctly to bridge railings?			✓	
Is there sufficient width between the barrier and the edge line to contain a broken down vehicle?			✓	
3. End treatments				
Are end treatments constructed correctly?			✓	
Is there a safe run off area behind breakaway terminals?			✓	
4. Fences				
Are pedestrian fences frangible?			✓	
Are vehicles safe from being 'speared' by horizontal fence railings located within the clear zone?			✓	
6.7 Traffic signals				
1. Operations				
Are traffic signals operating correctly?			✓	
Are the number, location and type of signal displays appropriate for the mix and traffic environment?			✓	
Where necessary, are there provisions for visually impaired pedestrians (eg. Audio-tactile push buttons, tactile markings)?			✓	
Where necessary, are there provisions for elderly or disabled pedestrians (eg. Extended green or clearance phase)?			✓	

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
Is the controller located in a safe position? (ie. where it is unlikely to be hit, but maintenance access is safe)			✓	
Is the condition (especially skid resistance) of the road surface on the approaches satisfactory?			✓	
2. Visibility				
Are traffic signals clearly visible to approaching motorists?			✓	
Is there adequate stopping sight distance to the ends of possible vehicle queues?			✓	
Have any visibility problems that could be caused by the rising or setting sun been addressed?			✓	
Are signal displays shielded so that they can be seen only by motorists for whom they are intended?			✓	
Where signal displays are not visible from an adequate distance, are signal warning signs and/or flashing lights installed?			✓	
Where signals are mounted high for visibility over crests, is there adequate stopping sight distance to the ends of traffic queues?			✓	
Is the primary signal free from obstructions on the nearside footway to approaching drivers? (trees, light poles, signs, bus stops etc)			✓	
6.8 Pedestrians and cyclists				
1. General Issues				
Are there appropriate travel paths and crossing points for pedestrians and cyclists?			✓	Pedestrain facility not required or provided
Are safety fences installed where necessary to guide pedestrians and cyclists to crossings or overpasses?			✓	
Are safety barriers installed where necessary to separate vehicle, pedestrian and cyclist flows?			✓	
Are pedestrian and bicycle facilities suitable for night use?			✓	
2. Pedestrians				
Is there adequate separation distance between vehicular and traffic and pedestrians on footways?			✓	
Is there an adequate number of pedestrian crossings along the route?			✓	
At crossing points is fencing oriented so pedestrians face oncoming traffic?			✓	

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
Is there adequate provision for the elderly, the disabled, children, wheelchairs and baby carriages (eg. Holding rails, kerb and median crossings, ramps)?			✓	
Are adequate handrails provided where necessary (eg. On bridges, ramps)?			✓	
Is signing about pedestrians near schools adequate and effective?			✓	
Is the distance from the stop lines to a cross walk sufficient for truck drivers to see pedestrians?			✓	
3. Cyclists				
Is the pavement width adequate for the number of cyclists using the route?	✓			On-road
Is the bicycle route continuous (ie. free of squeeze points or gaps)?	✓			
Are drainage pit grates ' bicycle safe'?			✓	
4. Public Transport				
Are bus stops safely located with adequate visibility and clearance to the traffic lane?			✓	
Are bus stops in rural areas sign posted in advance?			✓	
Are shelters and seats located safely to ensure that sight lines are not impeded? Is clearance to the road adequate?			✓	
Is the height and shape of the kerb at bus stops suitable for pedestrians and bus drivers?			✓	
6.9 Bridges and culverts				
1. Design features				
Are bridges and culverts the full formation width?			✓	
Are bridge culvert carriageway widths consistent with approach conditions?			✓	
Is the approach alignment compatible with the 85th percentile travel speed?			✓	
Have warning signs been erected if either of the above two conditions (ie. width and speed) are not met?			✓	
2. Crash barriers				
Are there suitable traffic barriers on bridges and culverts and their approaches to shield errant vehicles?			✓	

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
Is the connection between the barrier and the bridge safe?			✓	
Is the bridge free of kerbing which would reduce the effectiveness of barriers or rails?			✓	
3. Miscellaneous				
Are pedestrian facilities on the bridge appropriate and safe?			✓	
Is fishing from the bridge prohibited? If not, has provision been made for safe fishing?			✓	
Does delineation continue over the bridge?			✓	
6.10 Pavement				
1. Pavement defects				
Is the pavement free of defects (eg. Excessive roughness or rutting, potholes, loose material, etc) which could result in safety problems (eg. loss of steering control)?	✓			
Is the condition of the pavement edges satisfactory?	✓			
Is the transition from pavement to shoulder free of dangerous edge drop offs?	✓			
2. Skid resistance				
Does the pavement appear to have adequate skid resistance, particularly on curves, steep grades and approaches to intersections?	✓			
Has skid resistance testing been carried out where necessary?		✓		
3. Ponding				
Is the pavement free of loose stones and other material?	✓			
4. Loose stones/material				
Is the pavement free of loose stones and other material?	✓			
6.11 Parking				
1. General Issues				
Are the provisions for or restrictions on parking satisfactory in relation to traffic safety?			✓	No on-road parking on route audited.
Is the frequency of the parking turnover compatible with the safety of the route?			✓	

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
Is there sufficient parking for delivery vehicles so that safety problems due to double parking do not occur?			✓	
Are parking manoeuvres along the route possible without causing safety problems? (eg angle parking)			✓	
Is the sight distance at intersections and along the route, unaffected by parked vehicles?			✓	
6.12 Provision for heavy vehicles				
1. Design Issues				
Are overtaking opportunities available for heavy vehicles where volumes are high?			✓	No overtaking at crossings
Does the route generally cater for the size of vehicle likely to use it?	✓			
Is there adequate manoeuvring room for large vehicles along the route, at intersections, roundabouts etc?	✓			
Is access to rest areas and truck parking areas adequate for the size of vehicle expected? (consider acceleration, deceleration, shoulder widths etc.)			✓	
2. Pavement/shoulder quality				
Are shoulders sealed at bends to provide additional pavement for long vehicles?			✓	
Is the pavement width adequate for heavy vehicles?	✓			
In general, is the pavement quality sufficient for the safe travel of heavy and oversized vehicles?	✓			
On truck routes, are reflective devices appropriate for truck drivers' eye heights?	✓			
6.13 Floodways and causeways				
1. Ponding, flooding				
Are all sections of the route free from ponding or flow across the road during wet weather?	✓			
If there is ponding or flow across the road during wet weather, is there appropriate signposting?			✓	
Are floodways and causeways correctly signposted?			✓	
2. Safety devices				
Are all culverts or drainage structures located outside the clear roadside recovery area?			✓	

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
If not, are they shielded from the possibility of vehicle collision?			✓	
6.14 Miscellanous				
1. Landscaping				
Is landscaping in accordance with guidelines (eg. clearances, sight distance)?	✓			
Will existing clearances and sight distances be maintained following future plant growth?		✓		Some shrubs require trimming
Does the landscaping at roundabouts avoid visibility problems?			✓	
2. Temporary works				
Are all locations free of construction or maintenance equipment that are no longer required?	✓			
Are all locations free of signs or temporary traffic control devices that are no longer required?	✓			
3. Headlight glare				
Have any problems that could be caused by headlight glare been addressed (eg. a two way service road close to main traffic lanes, the use of glare fencing or screening)?	✓			
4. Roadside activities				
Are the road boundaries free of any activities that are likely to distract drivers?	✓			
Are all advertising signs installed so that they do not constitute a hazard?	✓			
5. Errant vehicles				
Is the roadside furniture on the verges and footways free of damage from errant vehicles, which could indicate a possible problem, hazard or conflict at the site?	✓			
6. Other safety issues				
Is the embankment stability safe?			✓	
Is the route free of unsafe overhanging branches?	✓			
Is the route free of visibility obstructions caused by long grass?	✓			
Are any high wind areas safely dealt with?			✓	
If back to back median kerbing is used is it: • Adequately delineated?			✓	

Checklist 6: Road safety audits of existing roads

Issues	Yes	No	NA	Comment
• Obvious where it starts? • Obvious at intersections? • Unlikely to be a hazard to pedestrians?				
7. Rest Areas				
Is the location of rest areas and truck parking areas along the route appropriate?			✓	
Is there adequate sight distance to the exit and entry points from rest areas and truck parking areas at all times of the day?			✓	
8. Animals				
Is the route free from large numbers of animals (eg. cattle, sheep, kangaroos, koalas, wombats, etc)?			✓	
If not, is it protected by animal proof fencing?			✓	

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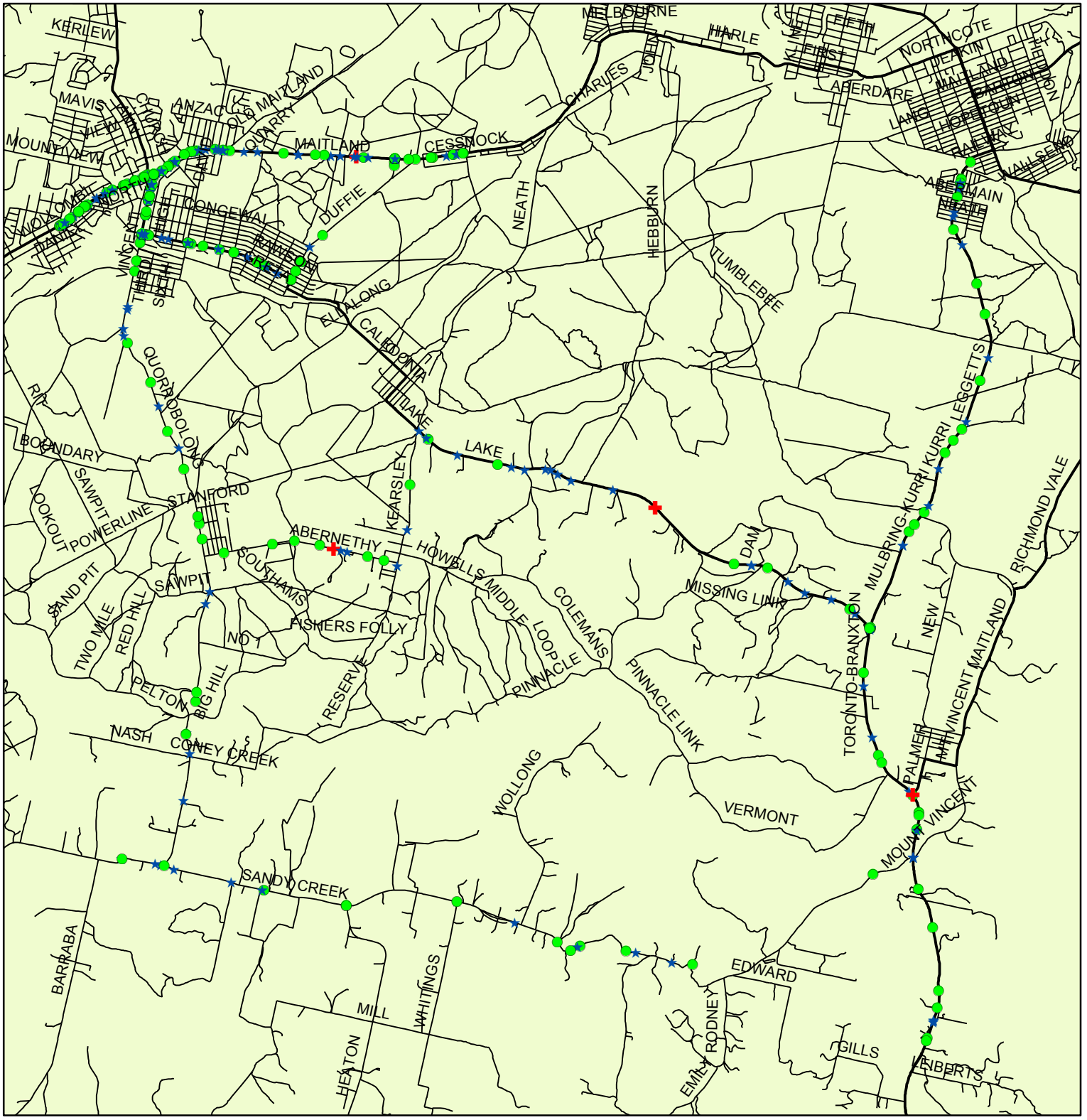
Appendix B

Crash Data

Surrounding Road Network

All Crashes 2001-2006
Cessnock Region
Traffic Impact Assessment - GHD Exercise



0 2,400 4,800 7,200 9,600 Metres

N

W E

S

Legend

Cessnock Region Traffic Impact Assessment (GHD Excercise)

Crashes - Current as of 16th July 2007 (01-07)

- Fatal
- Injury
- Towaway
- State/Regional Roads
- Local Roads

Finalised data shown is from 1 January 2001
* Data from 1 January 2006 onwards is PROVISIONAL ONLY *

Jason Gillett
5th September 2007

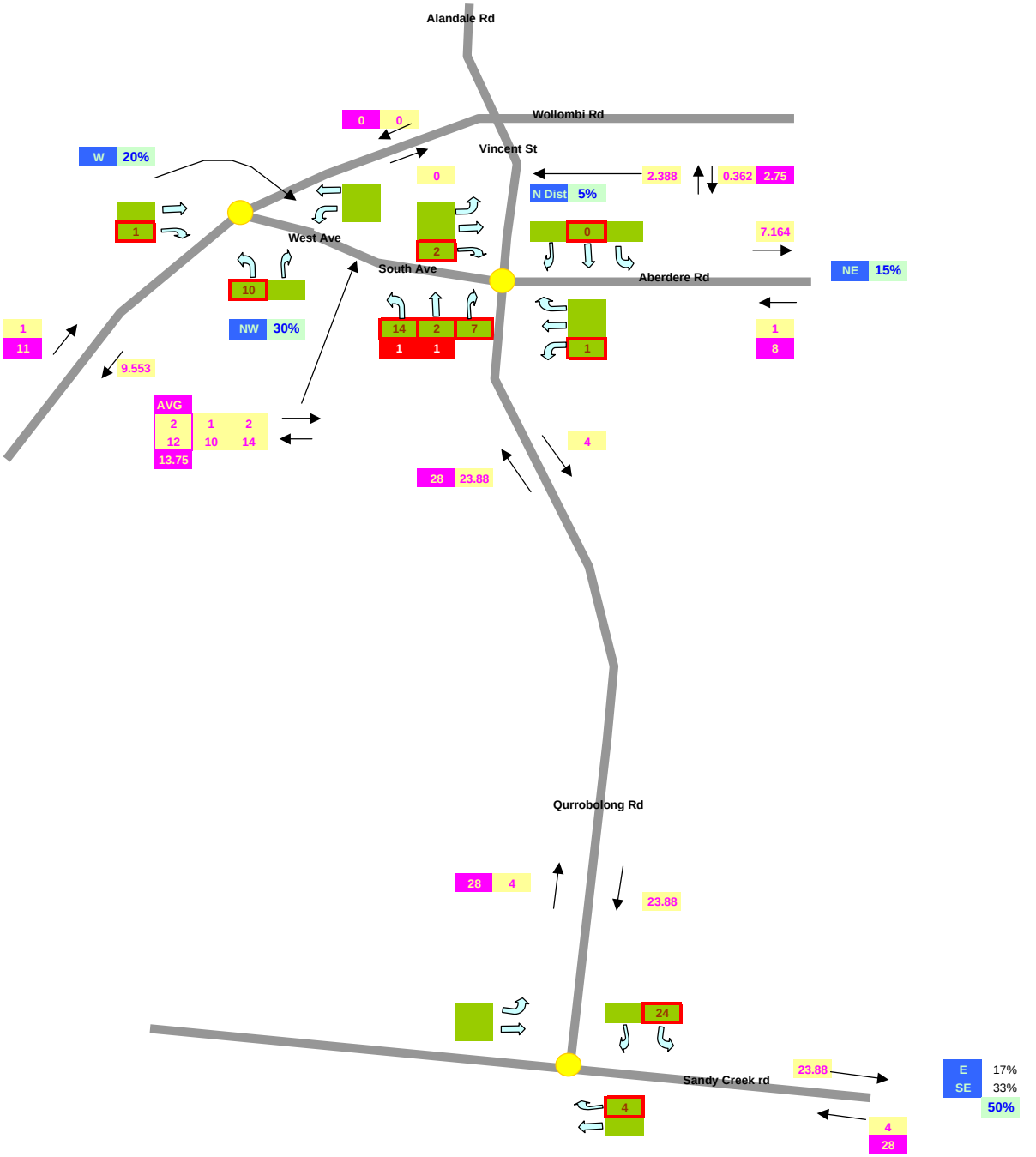
Appendix C

Traffic Distribution

Trip Distribution (AM Peak 8-9AM)

Light Vehicle Analysis

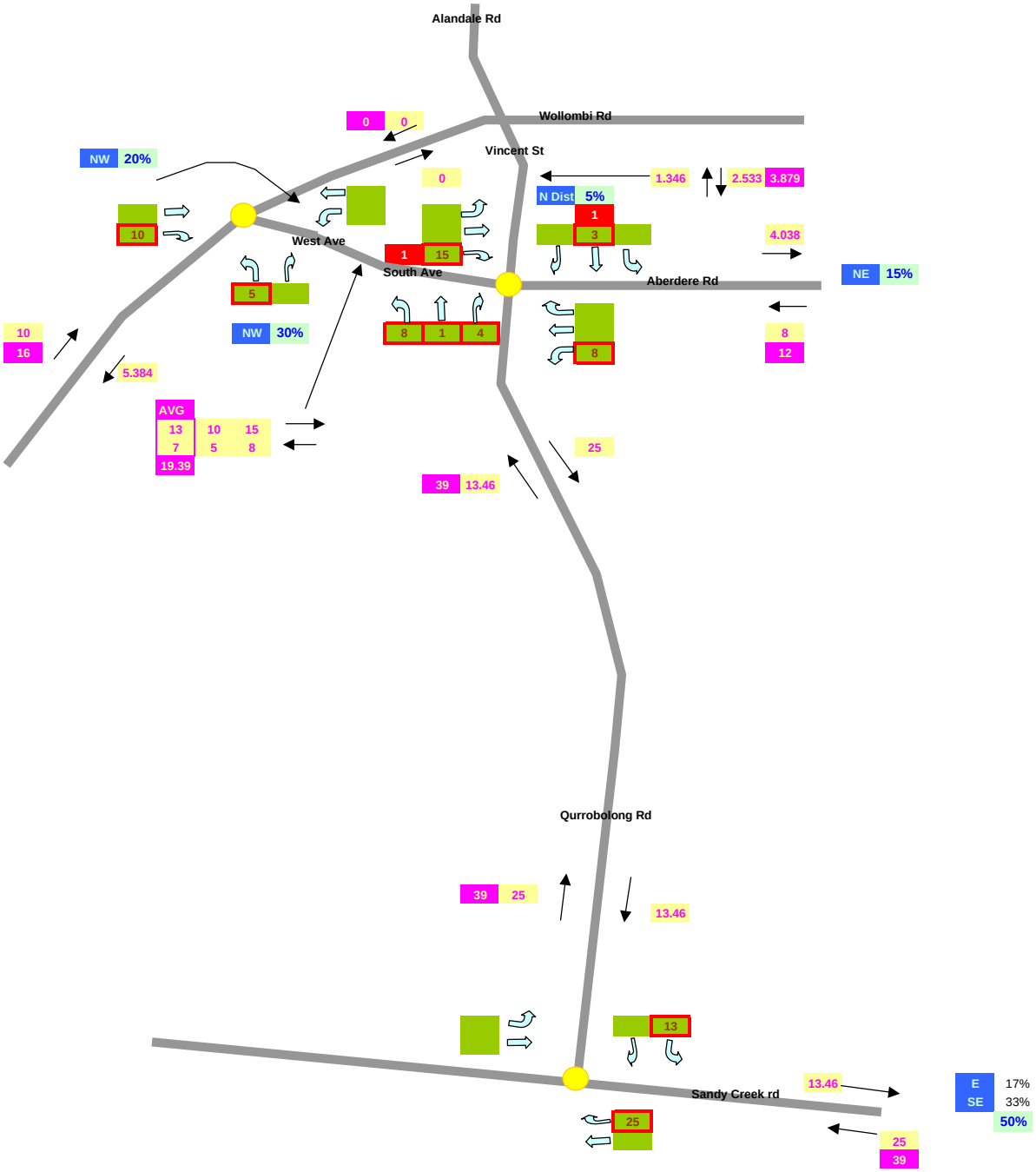
Number of Total Staff (24 Hour Shift)		275
Number of staff travelling during AM Peak period		
From	Nigh Shift 11.30pm to 8.00am	48
To	Maintenance Shift - 10am-6pm (9am-10pm)	7



Trip Distribution (PM Peak 4-5PM)

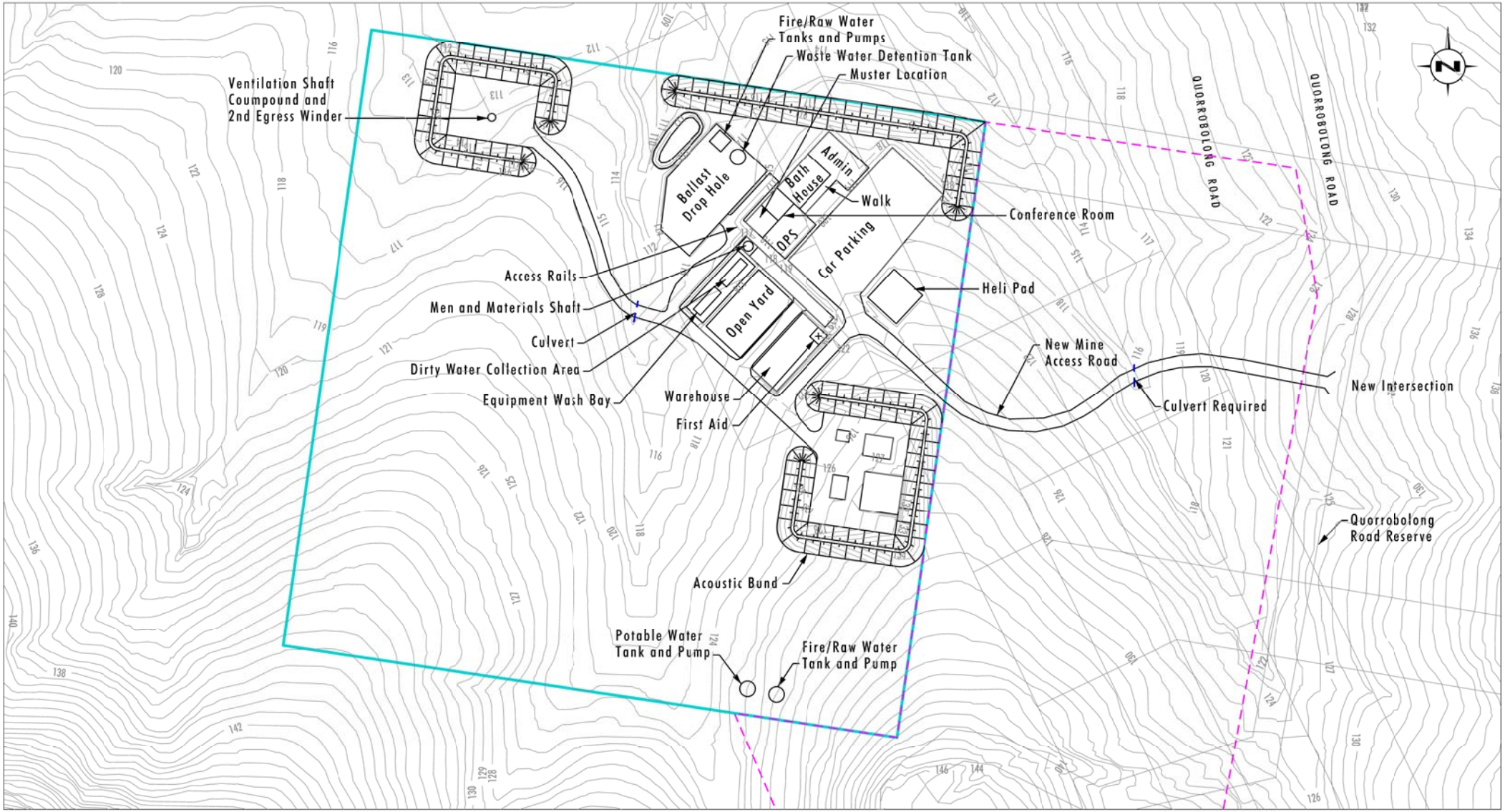
Light Vehicle Analysis

Number of Total Staff (24 Hour Shift)		275
Number of staff travelling during PM Peak period		
From	Day Shift - 6.30am-3pm (3-4PM) 20%	27
To	Afternoon Shift - 4.30pm-1am	51



Appendix D

Conceptual Layout for Proposed Surface Infrastructure Site



Legend

- Surface Infrastructure Site
- Proposed Mine Plan
- Proposed Land Acquisition

FIGURE 1.3

Conceptual Layout for Proposed Surface Infrastructure Site

Note: Contour Interval 1m

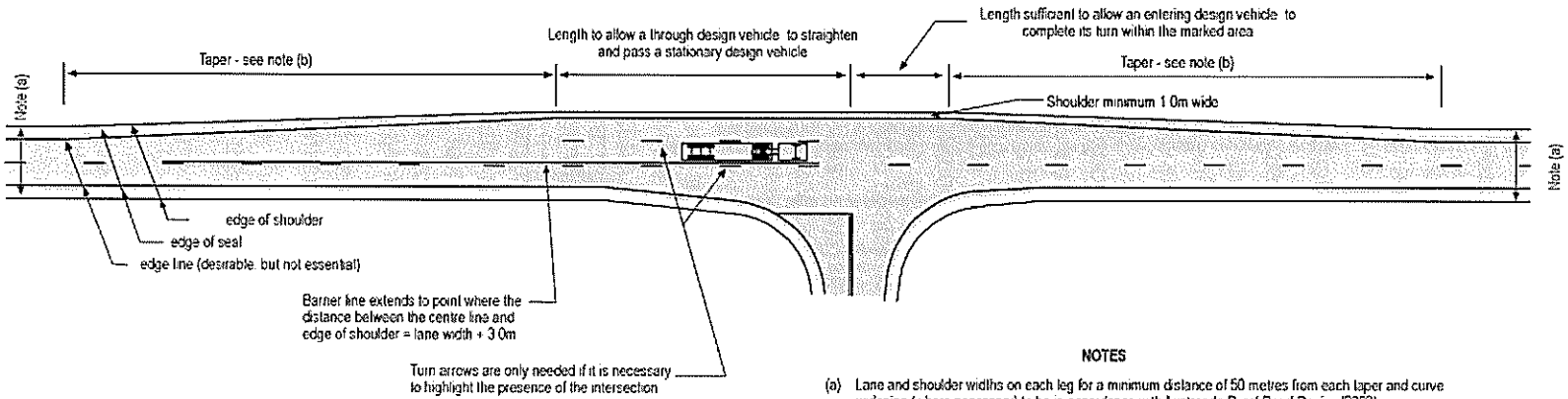
Appendix E

Access Intersection

Austroads type AUR intersection

This layout is

1. *Suited to rural areas having high speed, low volume traffic and a volume of turning traffic sufficient to make a rear-end conflict likely. (Refer Figure 6.41)*
2. *Is designed to store one right turning design vehicle and allow another design vehicle to pass*



AUR = AUxiliary lane Right turn treatment

NOTES

(a) Lane and shoulder widths on each leg for a minimum distance of 50 metres from each taper and curve widening (where necessary) to be in accordance with Austroads *Rural Road Design* (2003)

(b) Taper length is determined on the basis that some reduction in speed of through traffic occurs

(c) On arterial/sub-arterial roads a semi-trailer is the minimum design vehicle used to define the turning path. Turning speed is 5-15km/h. Turning paths may cross the centreline of the street or road being entered provided a barrier line is not required for that leg, and traffic volumes make such a manoeuvre appropriate

(d) Sight distance to be appropriate for the 85th percentile free speed of each approach movement. Furniture (especially signs) and planting are not to interfere with sight distance requirements.

(e) All furniture to be located outside the shoulder. Furniture (guideposts, kerbs, etc.) can be used to control the area of conflict.

(f) All non-frangible furniture and drainage headwalls to be located outside the clear zone or be protected.

(g) Signs and markings to be in accordance with Australian Standards. Do **not** use continuity lines on tapers

(h) Where longer storage is necessary, a channelised layout is preferred. Where a right turn lane is required on the terminating leg, the "AUL" layout can be used

Figure 2.4 — Rural Type AUR Layout (This layout is not applicable in New Zealand)

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