

Worsley Alumina Pty Ltd
Efficiency and Growth Project
Road Safety Plan

October 2008



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Executive Summary

Introduction

Worsley Alumina Pty Ltd engaged GHD to conduct this road safety study to examine issues related to the management and mitigation of road safety issues arising in accessing the accommodation camp and construction areas at the Worsley refinery, and the construction site at the Marradong mine project near Boddington during the construction phase of the Efficiency and Growth Project at Worsley Alumina.

Assessment of Existing Network

The assessment of the existing road network included Gastaldo Rd, Mornington Rd, Coalfields Highway, Raymond Rd, South West Highway, local Collie Roads, New Perth Bunbury Highway, Old Coast Rd, Mandurah Rd, Ennis Ave, Collie - Williams Rd, Pinjarra - Williams Rd, Bannister - Marradong Rd and Albany Highway.

Five year crash statistics were obtained from Main Roads WA. The data analysed did not highlight any significant crash problems at the intersections which included Australind/ Bypass Raymond Rd, SW Highway/ Coalfields Highway/ Raymond Rd and Coalfields Highway/ Gastaldo Rd. However, measures to address crash patterns are discussed and recommended. Scrutiny of crash statistics revealed that sections of Pinjarra - Williams Road have a higher crash rate than some of the surrounding roads investigated and may support the further consideration of upgrade to sections where poor geometry exists.

Assessment of the existing road network included an analysis of existing traffic volumes obtained from MRWA. Traffic volumes and turning counts for intersections such as Gastaldo Rd/ Coalfields Highway and SW Highway/ Coalfields Highway were undertaken by GHD. This data, in conjunction with workforce data provided by Worsley Alumina, assisted in the forecasting of traffic movements.

Current Worsley refinery employee numbers of 1459 and 751 contractors are expected to remain constant whilst the E&G Project workforce will peak around 2000 by November 2009; about 1000 of which will originate from the Mornington Rd campsite during weekdays.

A construction workforce of 300 is expected to require bussing from car parks in Raymond Rd and Coalfields Highway each working day. 700 construction workers are expected to travel by light vehicle to the refinery per workday representing approximately 600 light vehicles. Hourly exit from the refinery is expected to be around 200 vph for a three peak hour spread.

For Boddington, up to 360 construction workers are expected on site during peak construction time in late 2009; most of which will come from the accommodation camp in Goldmine Road. The construction workforce will be transported by bus to/ from the minesite. 100 workers are likely to travel by light vehicle, mostly on the Pinjarra Williams Road.

The table below presents current traffic volume, the forecast additional traffic volumes and forecast total traffic volumes during the next 3 years of the E&G Project:



Table 1 Current traffic volume, the forecast additional traffic volumes and forecast total traffic volumes during the next 3 years (E&G Project only, all movements)

Location	Year	Current Total Traffic (vpd)	Forecast Additional Traffic (vpd)	Forecast Total Traffic (vpd)	% Increase
Coalfields Highway SLK 22.63	2008	3910	1400	5310	35
Coalfields Highway SLK 18.75	2008	4987	1400	6400	28
Gastaldo Road	2008	1450	1400	3000	97
Mornington Road East	2008	347	100	450	29
South Western Highway SLK 131.80 (north of Coalfields)	2003	3250	280	3530	9
South Western Highway SLK 137.55 (south of Coalfields)	2006	5885	1120	7005	19
South Western Highway SLK 141.09 (south of Raymond)	2008	6572	430	7000	7
Raymond Road		N/A	688	+ 688	N/A
Pinjarra Williams Road (Pinjarra -Dwellingup)	2007	1211	120	1330	10
Pinjarra Williams Road (Dwellingup – Marradong)	2008	670	120	790	18
Bannister - Marradong Road	2008	865	262	1100	30
Goldmine Road	2006	261	74	335	28

Note: SLK refers to the distance in km from the start of the road. i.e SLK 22.63 is 22.63 km from SW Highway.

Truck movements associated with the E and G Project (Worsley) are anticipated to be in the order of 40 per day. Total movements including light, heavy vehicles, service vehicles and delivery vehicles are likely to be around 14 -1500 vpd.

The above table indicates a significant increase in traffic volumes in some cases. The forecast increase in traffic volume on Gastaldo Rd is nearly 100% whereas the forecast increase in traffic volumes on Coalfields Highway, Bannister - Marradong Road and Goldmine Road is of the order 30%. Forecasts are based on information provided by Worsley.

Surrounding major projects are currently underway including Boddington Gold Mine, and BlueWaters Power Stations. The current traffic data will also include Premier Coal trucks, Iluka, Forest Products Commission, livestock movements, general freight, etc. Forecast volumes may therefore fluctuate during the construction period. Whilst daily volumes are unlikely to exceed the capacity of the roads, peak hour activity becomes more of an issue to manage particularly at key intersections identified in this report. It is important therefore to involve the key traffic generating businesses in the overall traffic management



considerations for the region including local government and Main Roads to consider a coordinated approach.

Indicative volumes associated with the Bluewaters Project and existing coal mines in Collie are summarised in the following table:

Griffin	Workforce		Additional traffic
Construction workforce	Construction workforce 1000 (approx 6-700 from Bunbury, 200 in accommodation camp in Williams-Collie Rd)	Car Pooling, possibly 2 - 3 per car	6 – 700 vpd on Coalfields Highway
Mine site	400 (approx 200 will use Coalfields Hwy)		20 0vpd on Coalfields Hwy
Coal Trucks			40 B Double movements Coalfields Highway

The above table indicates that 900-1000 vpd are likely to be included in the current traffic volumes on Coalfields Highway.

Liaison with Boddington Gold Mine would indicate that the current construction work force will increase from 2000 to 3000 at the accommodation camp in Goldmine Road, adding significant traffic at the start and end of the week. Most will use Albany Highway. In addition 50 two way truck movements could occur over 4-5 months again mostly using Albany Highway. Following construction 20 acid trucks movements will be added to the Pinjarra - Williams Road during the latter half of 2009. A permanent workforce of 650 is planned and it is anticipated that approximately 66% is likely to come from the Boddington area.

Indicative volumes associated with Boddington Gold Mine are summarised in the following table.

Boddington Gold Mine	Workforce	Additional traffic
Construction workforce	2000 increasing to 3000 in the accommodation camp in Gold Mine Road.	2500 vpd at start and end of week (around 830 vpd in addition to current movements, most will use Albany Hwy)
Mine site truck movements (most oversize loads already completed)		50 trucks over next 4 - 5 months (most will use Albany Highway)



Following construction		40 acid truck movements on Pinjarra - Williams Road
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Short Term Measures

The assessment of the proposed travel routes, measured from a safety and operational perspective, resulted in the following short term measures considered achievable within the E&G project schedule and that would require Main Roads WA and local government approval and further discussion/ negotiation regarding funding and implementation:

Table 2 Possible Short-Term Measures

Location	Proposed Measure	Rank	Responsible Authority for Approval
Accommodation at camp/ refinery	Stagger peak departure times	H	Worsley
Entry to Refinery	Improved direction signage	H	Worsley
	Seal shoulder to allow truck to negotiate intersection	M	Worsley
Gastaldo Rd/ Coalfields Highway	Traffic control at peak Times	H	Main Roads
	Street lighting	H	Main Roads
	Modifications for HWL	H	Shire of Collie
	Drop tags on advanced warning signs	H	Main Roads
	Channelization (subject to approved design)	H	Main Roads
Raymond Rd/ Australind Bypass	Street lighting	H	Main Roads
	Traffic control (if required following monitoring)	H	Main Roads
Raymond Rd	Truck embayment	H	Main Roads
SW Highway/ Coalfields Hwy	Traffic control (if required following monitoring)	H	Main Roads



Location	Proposed Measure	Rank	Responsible Authority for Approval
Mornington Rd West/ Camp access	Sign/ line marking	M	Shire of Collie
	Sealing of 100m of carriageway	M	Shire of Collie
Mornington Rd West	Sight distance issues due to trees to be addressed along entire length of road.	H	Shire of Collie/ Shire of Harvey
Mornington Mills Rd Rail Crossing	Yellow hatching	H	Main Roads
Mornington Mills Rd/ Gastaldo Rd	Clear vegetation to north	H	Shire of Collie
	Construct left turn lane following feasibility design.	H	Shire of Collie (design)/ Main Roads (signs/ lines)
Mornington Mills Rd/ Tallanalla Rd	Advanced warning signs, street name tags, give way sign and give way marking	M	Main Roads
Lynch St/ Padstone Rd	Give way sign and line, and barrier line.	M	Main Roads
Moira Rd/ Atkinson St	Give way sign and line, and barrier line.	M	Main Roads
Mornington Mills Rd	Speed zone the road together with warning sign and advisory speed of bend at east end	H	Main Roads
Goldmine Rd	Remark line marking and install RRPM's	M	Shire of Boddington/ Main Roads
Goldmine Rd/ Bannister - Marradong Rd	Upgrade intersection	H	Main Roads
Pinjarra - Williams Rd (Marradong to Pinjarra)	Construct truck embayments	M	Main Roads
Pinjarra - Williams Rd Minesite access	Left turn lane and widening	H	Main Roads
Collie - Williams Rd	Centre line and rrpm's. Repair road surface. Clear debris from shoulders.	M	Main Roads/ Shire of Collie
Pinjarra/ Williams Rd/ Harvey/ Quindanning	Give way sign, line and seal north west corner of	M	Main Roads (Signs and



Location	Proposed Measure	Rank	Responsible Authority for Approval
Rd	intersection		lines) Shire of Boddington (sealing)
Farmers Ave, Robbins Road	Height of overhead power lines to be checked for high wide load	H	Western Power
Car parking area Coalfields Highway	Car parking area	H	Main Roads
Raymond Rd	Car parking Area	H	Main Roads
Worsley Back Rd/ Gastaldo Rd	Advanced warning signs, sealing 30m, chevron, tree pruning	H	Shire (sealing, pruning)/ Main Roads (signs)
Direction signs from Collie Townsite	Upgrade/ new direction signs to WAPL at key intersections from Collie.(Mornington Mills Rd route)	M	Shire of Collie
Coalfields Highway	110 km/ h speed zone to commence east of proposed parking area.	H	Main Roads

Possible measures

Measures that are questionable in terms of being affordable and achievable in the E&G Project timeframe and will require road authorities and stakeholders to consider further:

Table 3 Possible Measures for Further Consideration

Location	Proposed Measure	Rank	Responsible Authority
Raymond Road/ Australind Bypass	Acceleration lane to right if required on Bypass.	M	Main Roads
Mornington Mills Road/ Tallanalla Rd	Street lights	M	Shire of Collie
	Drainage design/ construction	L	Shire of Collie
Lynch St/ Padstone Rd	Street lighting	M	Shire of Collie
Pinjarra - Williams Rd (Marradong to Pinjarra)	Recovery zone review	H	Main Roads



Longer Term Measures

Longer term measures considered unachievable and unaffordable in the E&G Project timeframe and will require road authorities and stakeholders to consider further:

Table 4 Possible Long-Term Measures

Location	Proposed Measure	Rank	Responsible Authority
Coalfields Highway	Overtaking lanes	M	Main Roads
	Upgrade of Coalfields Highway, widening/ reconstruction	M	Main Roads
Coalfields Hwy/ SW Highway	Review long term traffic management measures, ie grade separation. Review speed limit adjacent to intersections on SW Highway	M	Main Roads
Mornington Road West	Construct road to acceptable standard and upgrade SW Highway/ Mornington Road West intersection.	M	Shire of Collie/Shire of Harvey/ Main Roads
Collie – Williams Rd	Widening to 7m and sealing shoulders	L	Shire of Collie/Main Roads
Pinjarra - Williams Rd (Quindanning to Marradong)	Widening to 7m and sealing shoulders	H	Main Roads
Pinjarra - Williams Rd (Marradong to Pinjarra)	Construction of overtaking lanes (4)	M	Main Roads

Car Pooling

It is understood that carpooling is already promoted for the existing workforce. Significant benefit could be achieved if car pooling is also promoted for the construction workforce. If the proposed car parking area in Raymond Road is increased then this could be used for a suitable pick up/ drop off area. It is also recommended that other suitable locations for pick up/ drop off be examined and developed.

Use of Buses

The use of buses to transport the construction workforce from the parking areas in Raymond Road and Coalfields Highway to the refinery is supported to reduce overall traffic impacts. The parking facilities must include a suitable waiting area for passengers including a shelter and adequate waiting areas for a bus to



access and turn. Buses will also be used to transport the construction workforce to and from the accommodation camp in Mornington Road. The development of a construction workforce bus service to/from Bunbury/ Collie/ Australind should also be further investigated and will require analysis of workforce origin suburbs to assess where to provide the service. It is also suggested that the construction workforce are consulted to determine whether they would use a bus service. It is understood that SW Coachlines is conducting a study to provide bus service for the likes of Worsley, Blue Waters, Muja, Premier Coal, etc. The use of buses will have significant benefit for associated traffic activity. As an example, one bus is equivalent to 41 cars assuming 1.2 people per car. The promotion of bus use from the parking areas proposed and a bus service to serve the surrounding areas should be pursued.

Consideration should also be given to providing a bus service for the existing workforce to maximise the benefits described above.

It is understood that a high proportion of the construction workforce at the Boddington Mine will be transported by bus to the accommodation camp in Goldmine Road and to and from the new mine which will have significant benefits for associated traffic activity. It is recommended that buses are used where possible to minimise associated traffic activity by travel to and from Boddington and to and from the Minesite.

Heavy Haulage Curfews

There would appear to be merit in imposing heavy haulage curfews on Gastaldo Road, Coalfields Highway and Pinjarra-Williams Road to reduce potential conflicts with peak workforce times. Cooperation with other users should be pursued to confirm the practicality and impacts on their operations. The movement of heavy vehicles will need to be managed to facilitate the curfew and holding areas will be necessary.

Community Campaigns

A community campaign is needed to drive home the importance of road safety and Worsley's commitment to the issue e.g. supporting public safety campaigns, especially during peak travel times like Christmas and Easter, through newspapers, radio or television adverts. Crashed cars could be appropriately placed along major highways as safety promotions and driving simulators could be purchased for community education.

A 31% reduction in road crashes was recorded following a Local Government Road Safety Campaign in two rural Shires (Yass Valley and Upper Lachlan Shire) involving, signage, school participation, radio, television, media coverage, web page links, newspaper features, emails, distribution of a road safety information brochure and telephone interviews. The Office of Road Safety, local authorities and Main Roads should be consulted and included in the consideration of this initiative.

Current Practice, Driver Behaviour and Management

In regard to current practice, it is recommended that the Human Resources execution plan containing documented procedures are implemented and promoted to Worsley employees to promote awareness of safe driving practices.

Road condition & signage, safer vehicles, slower speeds and driver behaviour represent the four cornerstones of safe travel. Driver behaviour issues and the management thereof have been obtained from the Main Roads WA website and appear in detail in this report.

Specialist authorities should be engaged, such as AHG, 46 Grogan Road, Perth International Airport, WA, 6105, Tel 9479 5754 to assist with driver training, driver behaviour, stress and fatigue management.



It is recommended that the local police are included in safety initiatives to include road safety talks to the workforce.

Furthermore, extend the awareness of safe driving practice to the Western Australian public in collaboration with the Perth based Office of Road Safety located at 40 Georges Terrace Perth WA. James Newton, Partnership Management Consultant with the Office of Road Safety can be contacted on 9222 8764 and mobile number 0434 325 603; and

It is recommended that Worsley's recently implemented Incident and Risk Driving Report continues to be promoted.

Consultation

Consultation with key stakeholders to identify concerns and priorities in traffic management was undertaken with Bechtel Australia, Main Roads WA, Collie Police, Shire of Boddington, Shire of Harvey, Boddington Police, Boddington Bauxite Mine Community Liaison Committee, Refinery Community Liaison Committee, Griffin Group, FESA Boddington, SES Collie and Boddington Gold Mine. Salient points arising from the meetings and discussions appear in this report.

The Worsley Alumina workforce were invited to comment on a range of recommendations around road conditions, preferred travel routes, public transport options, driver behaviour and controls such as heavy vehicle curfews.

A questionnaire survey was selected as an appropriate method of facilitating community/ stakeholder input on issues around road conditions and preferred travel routes. The questionnaire containing a map of the study area and brief questions to establish respondents' mode of travel, usual travel route and views on road and traffic issues and solutions, was emailed or posted out to addresses provided by a Worsley Alumina database. Members of the public who responded to newspaper articles by phoning in with comments were either sent the questionnaire or auditioned over the phone, depending on their preference. A total of 78 letters were posted out of which 19 responses and 6 "return to sender" were received. 73 emails were sent and 15 email responses were received. Respondent's letters and emails received are summarized in this report.

Network Overview

Old Coast road provides a good road geometry standard and includes overtaking lanes and long sections of dual carriageway. No additional measures are proposed. The route is preferable to SW Highway in view of the improved road geometry.

The Main Roads route for heavy vehicles from Kwinana is currently via Mandurah/ Fremantle Road, Pinjarra Road, SW Highway. Following completion of the New Perth Bunbury Highway (NPBH) the route will be Safety Bay Road, NPBH, Greenlands Road to SW Highway or continue along NPBH.

In view of the poor geometry of Mornington Rd West, the unsealed section and the poor intersection with SW Highway at its western end it is considered that this route should not be promoted. It would be preferable to advise staff, construction personnel, contractors etc to use Coalfields Highway and Gastaldo Road. The current traffic volumes on Mornington Road west are relatively low and in view of the poor geometric standard and safety issues along this route there is some potential to close this link until such time as it is upgraded. A number of options to prevent traffic from using Mornington Road are discussed in the report. In the longer term this road should be constructed to an acceptable standard, to include realigning of bends where possible and also improvements to the intersection with the South West Highway to include widening of the Highway to allow through traffic to pass right turning traffic. If this road is



constructed to an acceptable standard together with the upgrade of the intersection with SouthWest Highway then there will be significant benefits due to the reduction of traffic volumes on Gastaldo Road, Coalfields Highway and associated intersections.

Following discussion with the Shire of Boddington, the Boddington Police, Boddington mine and feedback from other users, it is clear there is significant concern about the safety of operation of the Pinjarra - Williams Road between Marradong and Pinjarra and between Marradong and Quindanning.

It is noted that a number of sections of Pinjarra-Williams Road between Marradong and Pinjarra are relatively short and would not provide adequate opportunity for a vehicle to pass a slow moving vehicle. Similarly the two way sections are short with only limited long two way sections. Improvement to this road by the provision of suitable passing lanes is supported and it is recommended that these are constructed as soon as possible.

Reference is also made to a report by representatives of the Boddington State Emergency Service which highlights crash statistics on Pinjarra - Williams Road (Marradong to Pinjarra) and also identifies clearzone issues associated with trees in close proximity to the road. Road widening to 8m and overtaking lanes are promoted in this report.

The geometry of Pinjarra-Williams Road (Marradong to Quindanning) is poor. In view of the 19 km sections of intermittent single lane and unsealed shoulders and the safety issues of large trucks, slippery or dusty shoulders and setting sun issues the upgrade of this road to include widening to two lanes is supported. Until this road is upgraded it is recommended that it is not promoted as a route to and from Collie. The safer alternative is to use Pinjarra - Williams Road to Williams and the Albany Highway and Bannister - Marradong Road.

A detailed discussion on the above and other roads that make up the network, appear in this report.

Traffic Control

Traffic management measures have been considered to address evening peak hour construction traffic movements, specifically at the intersection of Gastaldo Road and Coalfields Highway where exiting traffic may have difficulty turning right into Coalfields Highway. In view of the likely high traffic numbers of traffic exiting Gastaldo Road, particularly on a Friday evening, it is proposed to have a traffic management plan available that may be initiated if required. The plan would include the use of traffic controllers to hold traffic on Coalfields Highway and Gastaldo Road for short periods and incorporate appropriate advanced warning, variable message signs and speed limit reduction. Main Roads are supportive of having a traffic management plan available for implementation only if required during evening peak times. A full documented plan is required for Main Roads formal approval.

Worsley sees traffic control as a last resort or contingency measure. It proposed to do everything else possible to manage and improve traffic flow but will plan for traffic control as a last resort to ensure the safety of all road users.

Street Lighting

Further to discussion with stakeholders and based on feedback from the consultation process there is a desire for improved street lighting at a number of key intersections to improve safety and operation during hours of darkness.

Main Roads have advised that street lighting is proposed at the intersection of Raymond Road/ Australind Bypass and Paris Road/ Australind Bypass.



It is therefore recommended that, as a possible short-term measure, street lighting is progressed at the following locations:

- » Gastaldo Road/ Coalfields Highway intersection, together with the proposed intersection upgrade.
- » Raymond Road/ Australind Bypass intersection (32% of crashes occur at night)
- » Proposed car park locations in Coalfields Highway and Raymond Road for improved security.

Furthermore, it is recommended that the Shire of Collie consider improvement of the delineation at night of the Mornington Mills Road/ Tallanalla Road.



1. Introduction

A traffic management study is required to examine all issues related to the management and mitigation of road safety issues during the construction phase of the Efficiency and Growth Project at Worsley Alumina.

This study is required to examine issues and options in relation to accessing:

- » The accommodation camp and construction areas at the Worsley Refinery; and
- » The construction site at the Marradong mine project near Boddington.

1.1 Scope of Work

The brief identifies the following scope of works:

- » A review of the work already done in the human resources execution plan for the project;
- » The development of a desktop model to understand traffic flows to the Worsley and Marradong construction sites and its interaction with existing and potential traffic flows;
- » The pattern of traffic movement (peak hours) and the potential volume of traffic over time (peak construction periods);
- » Consultation with key stakeholders to identify key concerns and key priorities in traffic management;
- » In determining the key travel routes, investigate road conditions and capabilities;
- » Including potential speed limits and roadside signage;
- » Potential accident black spots;
- » Potential points of high volume interaction;
- » The management of light vehicle traffic;
- » The management of heavy haulage traffic;
- » Alternative road networks;
- » Policing support;
- » Driver education and behaviour management;
- » The opportunity to mitigate risks through public transport options;
- » Public transport services and opportunities;
- » Identification of preferred travel routes; and
- » Emergency response capabilities and planning.



2. Assessment of Existing Road Network

The proposed works comprise the expansion of the Worsley Alumina refinery in Gastaldo Road, Collie and the construction of a new mine in Marradong and an accommodation camp.

2.1 Road Network

The site locations and road network surrounding the sites are shown on the map in Appendix A.

2.2 Crash Investigation at Intersections

Main Roads have provided the reported 5 year crash data for intersections as follows:

Table 2.1 5 Year Crash Data

Intersection Location	Number of Crashes	Comment
Australind Bypass/ Raymond Rd	22	6 right angle, 14 rear end, 4 wet, 7 at night
SW Highway/ Coalfields Highway, Burekup	5	4 right angle crashes, 1 at night, 4 wet weather. 3 involved trucks
Raymond Road/ SW Highway, Burekup	3	1 right turn through, 1 right angle, 1 wet weather
Coalfields Hwy/ Gastaldo Rd, Burekup	2	
Mornington Rd/ Gastaldo Rd, Collie	1	
Mornington Rd/ Tallanda Rd, Collie	0	
Lynch St/ Padstone Rd, Collie	0	
Moira Rd/ Atkinson St, Collie	2	1 involved a truck
Atkinson St/ Forrest St, Collie	0	
Prinsep St/ Forrest St, Collie	10	4 rear end, 2 right angle, 2 right through, 2 wet conditions and 2 at night.
Prinsep St/ Throssell St, Collie	13	5 rear end, 5 right angle, 3 wet conditions and 3 at night.
Paull St/ Gibbs Rd, Collie	0	
Williams-Collie/ Pinjarra- Williams Rd, Koomulmining	0	
Pinjarra Williams/ Harvey Quindanning Rd, Quindanning	0	
Pinjarra-Williams Rd/ Bannister-Marradong Rd,	0	



Intersection Location	Number of Crashes	Comment
Marradong		
Albany Highway/ Banister-Marradong Road, Bannister	0	
Mornington Road/ SW Highway	0	

The above table does not indicate a particular crash problem at most of the intersections analysed. The following intersections are considered in more detail:

2.2.1 SW Highway/ Coalfields Highway/ Raymond Road

There have been 8 crashes in total at the SW Highway/ Coalfields Highway/ Raymond Road intersection and one occurred at night, 5 occurred in wet weather conditions and 5 were right angle collisions. The incidence of wet weather collision is high and the skid resistance of the road surface should be checked to determine if this is a contributing factor..

2.2.2 Australind Bypass/ Raymond Road

There have been 22 reported crashes in 5 years with a high proportion of rear end collisions and night time crashes. 6 were right angle collisions. Opportunities to address the crash patterns include traffic signals or a large roundabout. It is understood that traffic signals are proposed to the south of the intersection to a subdivision and street lighting planned by Main Roads.

2.3 Mid Block Crash Data (1/1/03 to 31/12/07)

Table 2.2 No of Crashes per 10km section of Road

	Total	0-10km	10-20km	20-30km	30-40km	40-50km	50-64km
Pinjarra - Williams Road							
(SW Highway to Dwellingup	44	16	28				
Dwellingup to Bannister Marradong	46			21	8	6	11
Bannister Marradong Road	16	4	11	1			
Pinjarra - Williams Road							
(Bannister – Marradong Road to Harvey Quindanning Road)	15	1	6	5	3		
Pinjarra - Williams Road							
Harvey - Quindanning Road to Williams -Collie	12	1	7	4			



	Total	0-10km	10-20km	20-30km	30-40km	40-50km	50-64km
Road)							
Williams - Collie Road							
Coalfields Highway							
(SW Highway to Gastaldo Road	89	49	40				
(Gastaldo Road to Collie)	77			39	38		

Comment: The above table indicates that the highest number of crashes on the Pinjarra – Williams Road occur on the section of road 10 to 20km from SW Highway. This is likely to reflect the winding geometry.

A high number of crashes have been reported along the Coalfields Highway between SW Highway and Collie.

Table 2.3 Crash Severity and Type

	Total	PDO Minor	PDO Major	Medical	Hospital	Fatal	Dark ness	Run Off Road	Hit Animal
Pinjarra – Williams Road									
(SW Highway to Bannister Marradong Road)	90	6	50	10	22	2	30	38	17
Bannister Marradong Road	16	5	7	2	2	0	4	3	4
Pinjarra-Williams Road									
(Bannister - Marradong Road to Harvey Quindanning Road)	15	0	4	6	5	0	4	12	2
Pinjarra-Williams Road									
Harvey - Quindanning Road to Williams - Collie Road)	12	2	9	1	0	0	3	8	1



Coalfields Highway	166	5	53	20	10	1	24	18	11
(SW Highway to Collie)									

Comment: The above table indicates crashes involving major property damage are most common of the data assessed, specifically in Coalfields Highway and Pinjarra - Williams Road. 55% of crashes in Pinjarra-Williams Road SW Highway to Marradong involved major property damage and 24% hospitalisation. In Coalfields Highway 32% of crashes involved major property damage and 6% hospitalisation. 42% of crashes on Pinjarra - Williams Road (SW Highway to Bannister – Marradong Road) involve a vehicle running off the road and hitting an object. 3 fatalities have been reported, 2 on Pinjarra - Williams Road and 1 on Coalfields Highway.

Main Roads have provide separate data for Collie-Williams Roads which indicates 19 mid block crashes, 1 hospitalisation, 1 medical, 15 major property damage and 2 minor property damage, 4 occurred overnight, 9 involved collision with an animal. Gastaldo Road data indicates 10 mid block crashes, 1 hospitalisation, 1 medical, 7 major property damage and 1 minor property damage, 2 occurred at night, 2 involved collision with an animal.

Table 2.4 Crash Rate per Million Vehicle Km travelled Comparison

	Traffic Volumes (Vpd)	0 – 10 km	10 – 20 km	20 – 30 km	30 – 40 km	40 – 50 km	50 – 64 km
Pinjarra - Williams Road							
(SW Highway to Dwellingup)	1211	0.72	1.27				
(Dwellingup to Bannister-Marradong)	671			1.71	0.65	0.49	0.64
Bannister Marradong Road	865	0.25	0.70	0.06			
Pinjarra - Williams Road							
(Bannister – Marradong Road to Harvey Quindanning Road)	264	0.21	1.25	1.04	0.56		
(Harvey - Quindanning Road to Williams - Collie Road)	264	0.21	1.66	1.26			
Coalfields Highway							
(SW Highway to Gastaldo Road)	4987	0.54	0.44				
(Gastaldo Road to Collie)	3910			0.64	0.91		



Comment: The above table indicates that the sections of road with the highest crash rate are a 20 km section of Pinjarra - Williams Road 10 km either side of Dwellingup. Also a 10 km section of Pinjarra - Williams Road (Bannister - Marradong to Harvey Quindanning Rd) and a 10 km section of Pinjarra - Williams Rd (Harvey - Quindanning to Williams - Collie Road).

Table 2.5 Indication of Crash Times

	Pinjarra - Williams	Bannister - Marradong	Pinjarra - Williams	Pinjarra - Williams	Coalfields Hwy	Coalfields Highway	Total
Time	SW Highway to Bannister Marradong		Bannister - Marradong to Harvey - Quindanning	Harvey - Quindanning to Williams - Collie Road	SW Highway-Gastaldo Rd	Gastaldo Rd to Collie	
0-1	1		1	1	1	9	13
1-2	2		1				3
2-3	3						3
3-4	1					1	2
4-5	2	1					3
5-6	5	1		2	1		9
6-7	1		2		8	6	17
7-8	3		1	1	8	4	17
8-9	5				3	1	9
9-10	5				4	1	10
10-11	6			1	6	1	14
11-12	6	2			4	2	14
12-13	3	1	1	2	1	6	14
13-14	2		1		2	10	15
14-15	4		1		2	2	9
15-16	8		3	1	12	5	29
16-17	3	5	2	2	11	1	24
17-18	5	1	1	1	8	6	22
18-19	7	1			6	6	20
19-20	7	3			3	7	20
20-21	3				1	3	7
21-22	3		1	1	4	1	10



	Pinjarra - Williams	Bannister - Marradong	Pinjarra - Williams	Pinjarra - Williams	Coalfields Hwy	Coalfields Highway	Total
22-23	1	1			2	3	7
23-24	4				2	2	8
Total	90	16	15	12	89	77	299

Comment: The above table indicates that the most common times for crashes to occur are between 15h00 and 20h00. This preliminary crash investigation suggests that sections of Pinjarra - Williams Road would appear to have a higher crash rate than some of the surrounding roads investigated and would appear to support the further consideration of upgrade to sections where poor geometry exists. A thorough examination of each crash location or crash cluster location would be required, however the recommendations made later in this report are likely to provide significant benefits to the number of crashes occurring.

Note:

Worsley acknowledges that no warranties or undertakings express or implied, statutory or otherwise, as to the condition, quality or fitness for the purposes are provided with the above information. It is the responsibility of Worsley to ensure that the information supplied, meets their own requirements.

The information is made available in good faith and is derived from sources believed to be reliable and accurate. Nevertheless, the reliability and accuracy of the information provided cannot be guaranteed and GHD, its employees and agents expressly disclaim liability for any act or omission done in reliance on the information provided or for any consequences whether direct or indirect, of any such act or omission.

2.4 Traffic Volumes

2.4.1 Existing Traffic Volumes

Existing traffic volumes obtained from Main Roads are shown in Table 2.6 below.

Table 2.6 Existing Traffic Volumes

Location	Year	Vehicles per Day
Coalfields Highway SLK 22.63 (1.53 km east of Gastaldo Road)	2008	3910
SLK18.75 (2.35 km west of Gastaldo Road)	2008	4987
Gastaldo Road	2008	1450
Mornington Road West	2008	272
Mornington Road East	2008	347
Bannister - Marradong Road	2007/2008	745/865
Pinjarra Williams Road (Pinjarra - Dwellingup)	2007	1211



Location	Year	Vehicles per Day
Pinjarra Williams Road (Dwellingup - Marradong)	2006/2008	545/671
Pinjarra Williams Road (South of Bannister - Marradong)	2008	264
Soldiers Road (Goldmine Road)	2006	261
South Western Highway SLK 131.80 (5.13km north of Coalfields Highway)	2003	3250
South Western Highway SLK 137.55 (0.62km south of Coalfields Highway)	2006	5885
South Western Highway SLK 141.09 (4.16km south of Coalfields Highway)	2008	6572

2.4.2 Existing Turning Counts

Gastaldo Road/ Coalfields Highway

An intersection turning count was undertaken on Wednesday 26 June 2008 between 16h00 and 18h00. Peak activity was recorded between 16h45 and 17h45. The longest queues in Gastaldo Road were observed to be up to 12 vehicles. Typical queue lengths were 5 vehicles. Heavy vehicle proportion on Coalfields Highway was approximately 5%.

Table 2.7 below indicates data for this intersection turning count.

Table 2.7 Turning Count Gastaldo Road/ Coalfields Highway

	Left	Through	Right
Gastaldo Road	9		151
Coalfields Highway East		343	3
Coalfields Highway West	1	117	

SW Highway/Coalfields Highway

An intersection turning count was undertaken on Wednesday 30 June 2008 between 16h00 and 18h00 and the peak activity was recorded between 16h45pm and 17h45pm. The longest queue in Coalfields Highway was 20 cars between 17h30 and 17h45. Typical queue lengths were 5-12 vehicles. Heavy vehicle proportion on Coalfields Highway Road was approximately 5%.

Table 2.8 below indicates data for this intersection turning count.

Table 2.8 Turning Count SW Highway/ Coalfields Highway

	Left	Through	Right
SW Highway South		131	170



	Left	Through	Right
SW Highway North	33	163	
Coalfields Highway East	367		31

2.5 Forecast Traffic Movements

Table 2.5 hereunder indicates the forecast traffic movements associated with the expansion of the refinery and the Boddington Mine.

2.5.1 Worsley

It is understood that the current employee numbers at WAPL are 1459 and 761 Contractors. Worsley Alumina advise that numbers will not change on completion of the project.

It is understood that up to 2000 construction workers could be on site during the peak time of which around 1000 will come from the accommodation camp in Mornington Road and a further 1000 people from elsewhere. Numbers should peak by November 2009.

Workforce from the accommodation camp will be transported by bus to the refinery, $1000 / 50 = 20$ buses (80 two way bus movements per day)

Workforce of 300 transported from car parks in Raymond Road and Coalfields Highway $300 / 50 = 6$ buses (24 two way bus movements per day)

700 workers by light vehicle = approximately 600 light vehicles (assuming 1.2 per light vehicle based on Metropolitan Transport Strategy figure) represents 1200 two way light vehicle movements per day. If exit is spread over three evening peak hours then hourly exit is around 200 vph.

Truck movements are likely to be in the order of 40 trucks per day i.e. 80 two way truck movements per day.

There will also be other local vehicle movements.

Total traffic movements are likely to be around 1400 -1500 vpd.

2.5.2 Boddington

It is understood that up to 360 construction workers could be on site during the peak time, most which will come from the accommodation camp in Goldmine Road. Numbers should peak around January/ February 09.

There will be a daily bussing requirement from the Boddington Camp to Marradong and Saddleback. A requirement arises for weekly bussing on Fridays from Boddington to Perth and for return on Sunday and Monday. It is expected that 90% of the work force will be in the camp with a peak work force of 300 – 400. There is no bussing contract in place for this requirement, as yet.

The actual number of staff who will be transported to the camp from elsewhere is not yet known.

Workforce from the accommodation camp will be transported by bus to the minesite, $300 / 50 = 6$ buses (24 two way bus movements per day)



Assumed 100 workers by light vehicle = approximately 84 light vehicles (assuming 1.2 per light vehicle) equates to 168 two way light vehicle movements per day. Large numbers are anticipated on Pinjarra Road - Williams Road from Pinjarra direction.

Truck movements are likely to be 20 trucks per day (40 two way truck movements per day); these will be mostly B-Doubles to and from Perth, Fremantle and Bunbury.

There will also be other local vehicle movements, 50 vpd assumed.

Total traffic movements are likely to be around 300 vpd

The following table indicates potential traffic movements on the road network.

Table 2.9 Existing and Forecast Traffic Volumes

Location	Year	Vehicles per Day	Additional Traffic	Forecast Total Vehicles per Day
Coalfields Highway SLK22.63	2008	3910	300 cars parked/ 50 seats x 2 = 12 buses two way am and 12 buses two way pm. 40 trucks x 2 = 80 trucks/ day. Staff/workforce 600 vpd/ in/ out Buses to camp 20 x 2 x 2 = 80 Total around 1400 vpd	Approx 5350
SLK18.75	2008	4987	As above	Approx 6400
Gastaldo Road	2008	1450	As above	Approx 3000
Mornington Road East	2008	347	Estimated 100 vpd to/ from Collie	Approx 450
South Western Highway SLK 131.80 (north of Coalfields)	2003	3250	20% assumed to use SW Highway north. 1400 x 20% = 280 vpd	3530
South Western Highway SLK 137.55 (south of Coalfields)	2006	5885	80% assumed to use SW Highway (Coalfields to Raymond). 1400 x 80% = 1120 vpd	7005
South Western Highway SLK 141.09 (south of Raymond)	2008	6572	1120 – 688 (using Raymond Rd) = 430 vpd	7000
Raymond Road			100 cars parked/ 50 x 2 x 2 = 8 buses two way 80 trucks per day two way 50% of work force assumed 600 vehicles x 2 x 50% = 600 vpd Total 688 vpd	+688



Location	Year	Vehicles per Day	Additional Traffic	Forecast Total Vehicles per Day
Pinjarra Williams Road (Pinjarra - Dwellingup)	2007	1211	168 light vehicles x 60% per day assumed = 100 vpd. 20 trucks per day two way Total 120 vpd	1330 (+ 40 trucks from BGM)
Pinjarra Williams Road (Dwellingup – Marradong)	2008	670	168 light vehicles x 60% per day assumed = 100 vpd. 20 trucks per day two way Total 120 vpd	790 (+ 40 trucks from BGM)
Bannister - Marradong Road	2008	865	300 workforce/ 50 x 2 x 2 = 24 bus movements. 168 light vehicle movements assumed/ day 20 trucks per day two way assumed. Associated movements 50 vpd Total 262 vpd	1100
Goldmine Road	2006	261	300/ 50 seats x 2 x 2 =24 bus movements/ day 50 light vehicle movements assumed/ day. Total 74 vpd	335

2.6 Proposed Routes

2.6.1 Worsley Refinery and Marradong Minesite

It is understood there will be significant travel between the Construction Workers camp in Mornington Road west of Gastaldo Road and the refinery. Most movements will be buses.

There will also be significant movements as follows:

- » Trucks travelling from Perth to the refinery via Ennis Ave, Mandurah Road, Old Coast Road, Raymond Road, Coalfields Highway;
- » General traffic SW Highway, Coalfields Highway and Gastaldo Road or via the new Perth Bunbury Highway;
- » Trucks/ light vehicles travelling from Collie via local roads in Collie, Mornington Road east (Mornington Mills Road);
- » Trucks travelling from Bunbury Port via Australind Bypass, Raymond Road, Coalfields Road and Gastaldo Road;



- » Light and heavy vehicle movements travelling between the refinery to Marradong via Mornington Road, local roads through Collie, Williams - Collie Road, Pinjarra - Williams Road, Bannister - Marradong Road;
- » Trucks travelling between the existing minesite in Pinjarra - Williams Road and the new minesite off Bannister Marradong Road;
- » Light vehicle and bus movement between the new minesite and the accommodation camp in Goldmine Road and to Albany Highway via Bannister - Marradong Road and movements via Pinjarra - Williams Road to SW Highway; and
- » Perth to Marradong via Thomas Road, Albany Highway, Bannister - Marradong Road.

2.7 Route Assessment

The following assessment has been undertaken of the above routes from a safety and operational perspective.

2.7.1 Construction Workers Camp in Mornington Road west to Refinery

The existing road surface is in poor condition in some locations and requires crack seal. The road is sealed to the camp access and is 6 m wide. Mornington Road to the west of the camp is unsealed.

The intersection could be improved to barrier lines and give way control and resealing of the road pavement.

Possible short-term measures:

- » Intersection to be marked with a barrier line and giveaway marking and giveaway sign;
- » Resurface and repair road surface; and
- » Seal road for a distance of 100 m to the west of the camp access to overcome dust issues.

2.7.2 Mornington Road West/ Gastaldo Road Intersection

The intersection of Mornington Road West and Gastaldo Road is channelized and has street lights. The geometry is good.

Intersection analysis has been undertaken based on assumed movements from the accommodation camp and total traffic on Gastaldo Road for the am peak hour and it indicates that delays for exiting traffic are likely to extend to 1 minute in view of the volume of traffic on Gastaldo Road.

Traffic surveys have just been completed by the Shire of Collie and peak activity occurs on Gastaldo Road between 05h00 and 06h00. Current official start times at the refinery are 06h00, 06h30, 07h00 and 07h30. If bus activity occurs well before 06h00 or after 07h00 then delays will be significantly less.

There is an opportunity to modify the intersection to create a continuous left turn lane into Gastaldo Road from Mornington Road West. However this is not considered a practical solution in view of the length required (330 m), safety implication for traffic wishing to turn right into Mornington Mills Road and estimated costs of around \$100,000. Feasibility for the design would need to be undertaken if this option is to be pursued.



Possible short-term measure:

Stagger departure times from Accommodation Camp.

2.7.3 Mornington Road West

A site inspection indicates the sealed and unsealed sections as follows:

Section	Road Surface
Gastaldo Road (0) for a distance of 400 m.	Sealed
400 m to 9.7 km	Unsealed
9.7 km to 23.8 km at SW Highway	Sealed

It is understood that there has been discussion about sealing this road to complete the whole route to SW Highway south of Harvey to facilitate access.

The Shire of Harvey have advised that the last 3 kms of Mornington Road to Harvey's boundary will be sealed to a 7m standard scheduled for February 2009.

Worsley have provide a number of responses from Worsley workforce regarding traffic and safety and Mornington Road West features heavily due to its poor geometry, the fact that it is unsealed, dust and mud, poor sight distance and overhanging trees.

In view of the geometry of this route and the poor intersection with SW Highway at its western end it is considered that this route should not be promoted. It would be preferable to advise staff, construction personnel, contractors etc to use Coalfields Highway and Gastaldo Road. The Police and Main Roads are not supportive of promoting this route in its current state.

The current traffic volumes using Mornington Road west is 272 vpd, the am peak is 46 vph and pm peak hour 25 vph. It is expected that most of this traffic is associated with Worsley.

Surveys indicates 94% of traffic turns right from Gastaldo Road onto Coalfields Highway and 8% of this traffic turns right from Coalfields Highway onto SW Highway. Using these proportions and assuming an additional 1500 vph leave the refinery on a peak Friday afternoon would result in a demand for approximately 110 additional vehicles per hour travelling from the Refinery northbound on SW Highway added to 11 vph currently exiting via Gastaldo Road added to the existing 25 vph on Mornington Road west. If Mornington Road West is upgraded, then potentially 146 vph could use this route on a peak Friday afternoon. The overall reduction in traffic using Gastaldo Road/ Coalfields Highway should Mornington Road be upgraded is potentially 121 vph. Clearly there is likely to be some benefits for Gastaldo Road/ Coalfields Highway intersection if Mornington Road is upgraded during the construction period.

The current traffic volumes on Mornington Road west are relatively low and in view of the poor geometric standard and safety issues along this route there is some potential to close this link until such time as it is upgraded. As this is an established route this option is not recommended.

The longer term solution is to upgrade the route and geometry including the intersection with SW Highway.

Options to prevent traffic from using Mornington Road include:



- » Road closure – Would require Council approval, advertising for an appropriate period and statutory approval obtained. A disadvantage of closing the road is the potential impact for emergency access/ exit being hindered and access to properties.
- » In the short term the current safety hazards should be addressed and Worsley Staff encouraged not to use Gastaldo Road. A prominent sign reminding Worsley staff not to use this route could be sited at the Mornington Road/ Gastaldo Road intersection.
- » Temporary traffic management set up at peak times. This is unlikely to be practical and is not supported. Would require Shire approval.
- » Temporary traffic management in place at all times during construction to prevent access to Mornington Road, i.e. barriers, signs. Would require Shire approval. Subject to appropriate consultation, Shire approval and appropriate traffic management of this option could be further considered.

Possible short-term measures:

- » Encourage Worsley Alumina staff to use the preferred route of Gastaldo Road and Coalfields Highway; and
- » Arrange for existing sight distance issues to be addressed i.e. removal or pruning of trees.

Possible long-term measures

In the longer term this road should be constructed to an acceptable standard, to include realigning of bends where possible and also improvements to the intersection with the South West Highway to include widening of the Highway to allow through traffic to pass right turning traffic. If this road is constructed to an acceptable standard together with the upgrade of the intersection with SouthWest Highway then there will be significant benefits due to the reduction of traffic volumes on Gastaldo Road, Coalfields Highway and associated intersections. The treatment of the rail crossing should also be considered.

2.7.4 Route A: Perth to Refinery

Trucks travelling from Perth to the refinery via Ennis Ave, Mandurah Road, Old Coast Road, Raymond Road, Coalfields Highway, Gastaldo Road.

Bechtel have advised that this route is the planned route and discussions have been held with Main Road regarding traffic management for HWL. Western Power are currently adjusting power lines to either raise or place underground.

Key intersections along the route are discussed in the following sections.

2.7.4.1 Old Coast Road

Old Coast road provides a good road geometry standard and includes overtaking lanes and long sections of dual carriageway. No additional measures are proposed. The route is preferable to SW Highway in view of the improved road geometry.

2.7.4.2 Australind Bypass/ Raymond Road

The intersection includes a seagull island and two lanes in each direction on Australind Bypass. The intersection is stop sign controlled.

The crash history indicates 22 reported crashes in 5 years, 6 right angle, 14 rear end, 4 in wet conditions, 7 at night.



This intersection has been discussed with Main Roads and street lighting will be installed by them; no additional traffic management measures are considered warranted at this stage. Removal of the informal parking area on Raymond Road will improve the safety of the approach and for traffic entering Raymond Road from the Highway.

Main Roads advise funding is not definite but it is hoped to install street lighting to AS at this location in 2009/10 financial year.

A traffic survey was undertaken on 24 July 2008 between 16h00 and 18h00 and no significant delays in Raymond Road were observed. The directional split from Raymond Road to the north and south was approximately 50/ 50.

Possible improvements could include an acceleration lane to the north, longer term plans include major works associated with the Bunbury Outer Ring Road.

Main Roads do not support traffic signals in view of the longer term planning for this intersection i.e. grade separation. Furthermore, in the shorter term, traffic signals are proposed at a new intersection on the Bypass just south of Raymond Road to Treendale which will reduce the right turn demand from Raymond Road into Australind via the Bypass and Paris Road

Possible short-term measures:

- » Main Roads to monitor the performance and operation of the intersection during the Worsley construction phase and temporary traffic management be considered if required;
- » Install street lighting as soon as possible;
- » Stagger departure times of the workforce at Worsley to minimise impacts.

A traffic survey was undertaken on 24 July 2008 between 16h00 and 18h00 and no significant delays in Raymond Road were observed. The directional split from Raymond Road to the north and south was approximately 50/ 50.

Possible long-term measure:

Consider the need for an acceleration lane for the right turn onto Australind Bypass.

2.7.5 Route B: Perth to Refinery

The Main Roads route for heavy vehicles from Kwinana is currently via Mandurah/ Fremantle Road, Pinjarra Road, SW Highway. Following completion of the New Perth Bunbury Highway (NPBH) the route will be Safety Bay Road, NPBH, Greenlands Road to SW Highway or continue along NPBH.

A detailed assessment for High Wide loads previously undertaken for this route is included in Appendix B for information.

For general traffic the current route is considered to be an acceptable standard, however there are a number of locations where there are no overtaking opportunities. Compared with Old Coast Road this is the less desirable route. Use of the NPBH will significantly improve traffic safety and journey times.

Key intersections along the route are discussed in the following sections.

The New Perth Bunbury Highway is planned to open in December 2009.



2.7.5.1 Coalfields Highway/ South West Highway Intersection

The intersection is channelised with one lane in each direction on SW Highway. An acceleration lane exists on SW Highway for traffic turning right from Coalfields Highway. A left turn lane exists for southbound traffic on SW Highway. There is a left and right turn lane in Coalfields Highway. A rail crossing exists in Coalfields Highway in close proximity to the intersection.

The crash history indicates 5 crashes in 5 years, 3 involved trucks, 4 were right angle collisions and 4 occurred at night. Traffic volumes on Coalfields Highway are in the order of 4000 vpd and 6600 vpd on SW Highway.

An evening peak hour turning movement count indicated up to 20 vehicles queuing in Coalfields Highway between 17h30 and 17h45. The longest delays are caused by trains passing and not traffic on SW Highway. 93% of all traffic turned left from Coalfields Highway onto SW Highway and 7% turned right.

Analysis has been undertaken to identify likely impacts of the additional traffic generated by the refinery construction works. If 600 vph depart the refinery and volumes are added to the existing volumes, a queue of 380 m and delays of up to 37 secs in Coalfields Highway are forecast. If 1500 vph depart the refinery then unacceptable delays and queues are forecast. It is therefore concluded that if no more than 600 additional vehicles per hour are released from the refinery at peak end of week, significant congestion at SW Highway may be avoided.

Main Roads advise that Westnet plan to undertake works at the rail crossing in October 2008 and the traffic management issues are currently being considered. John Holland is the Contractor.

Possible short-term measures:

- » Stagger departure times to minimise impacts, and no more than 600 vph depart the refinery over a peak end-of-week period;
- » Main Roads are not supportive of traffic management measures at this intersection in view of the fact that it is a major intersection of two highways and delays to SW Highway traffic is not desirable; and
- » Monitor the operation and performance of the intersection during peak times to determine whether additional traffic management measures are necessary. (A full traffic management plan would need to be prepared for Main Roads approval. To this end, a sketch is provided in Appendix D).

Possible long-term measures:

- » As longer term traffic volumes increase on Coalfields Highway and SW Highway and in view of the likely high demand for a crossing movement between Coalfields Highway and Raymond Road, consideration should be given to the implementation of additional measures i.e. grade separation, road and rail. Main Roads do not support traffic signals at the Coalfields Highway/ SW Highway intersection and Raymond Road/ SW Highway intersection in view of the isolation of the locations and crash risk; and
- » Consider revision of the speed limit to 80 km/h on SW Highway in the vicinity of the intersection.

2.7.5.2 Coalfields Highway (SW Highway to Gastaldo Road)

The road is a single carriageway and carries around 4000 vpd. The capacity of a road of this nature for a reasonable level of service is around 12,000 vpd.



The geometry is poor in some locations, due to grades and bends and there are a number of different speed zones along the road. Truck speed is generally low on the uphill grades. There are some overtaking opportunities with the provision of overtaking lanes.

The speed limit adjacent to Gastaldo Road is 100 km/h. Benefits would be gained by rationalising the speed zoning to 90 km/h.

Rationalisation of speed limit is not supported by Main Roads. The road is speed zoned in accordance with current standards and road geometry. All bends have been signed to the Australian Standard.

There are plans to upgrade the Highway to include overtaking lanes.

The only programmed work is the finalisation of the widening to develop half metre sealed shoulders on the only remaining narrow section from where the widening currently finishes through to Allanson townsite - approximately 1 km. Other works, including the widening/reconstruction through the causeway section at the head of the Wellington Dam catchment, are not on Main Roads program at this stage.

Possible short-term measures:

No short term measures are proposed.

Possible long-term measure:

Main Roads to implement works for additional overtaking lanes to allow light vehicles to overtake slow moving heavy vehicles.

2.7.5.3 Gastaldo Road/ Coalfields Highway intersection

The intersection has a left turn lane on Coalfields Highway, and channelization in Gastaldo Road incorporating a left and right turn lane. There is localised widening on the south side of Coalfields Highway to allow a westbound vehicle to pass a right turning vehicle. As traffic volumes using the intersection are likely to increase significantly, ie up to an additional 1500 vph entering or exiting from/ to Gastaldo Road during peak times or 600 vph during typical weekday peak hours, the existing layout is likely to be inadequate.

There is an existing sight distance issue for traffic exiting Gastaldo Road due to the recently constructed left turn lane, i.e. left turning traffic obstructs the view of traffic exiting Gastaldo Road.

An evening peak hour traffic survey was undertaken between 16h00 and 18h00 and existing queues in Gastaldo Road extended to 12 vehicles, typically around 5 vehicles. Delays of around 30 seconds were observed.

The projected turning movements at the intersection have been modelled using Sidra to identify the likely performance. Analysis indicates queues in Gastaldo Road of around 360 m and delays of around 75 secs. At peak end of week times, assuming an additional 1500 vph exiting Gastaldo Road, queues and delays are forecast to extend to unacceptable levels. Traffic control would therefore be necessary at peak times. Main Roads are supportive of setting up appropriate traffic management to implement at peak times if required.

It is understood, from an interview with Catalano Contractor, that delays are currently experienced by trucks turning right from Gastaldo Road into Coalfields Highway. This situation should be monitored and a longer term solution may be to construct a U turn facility to allow a truck to turn left from Gastaldo Road then turn right into a suitable U turn facility on Coalfields Highway. Investigation would be required to identify a suitable site. Alternatively, an acceleration lane may be created as part of the channelization.



A further issue at this intersection is the requirement for a High Wide Load to negotiate the intersection. This has been tracked assuming an 8 m and a 10 m corridor and the plan shown in Appendix B indicates the requirements. The central island in Gastaldo Road would need to be trafficable, a give way sign and two keep left signs to be removable and the street name sign to be relocated.

Possible short-term measures:

- » Stagger departure times from the refinery;
- » Install street lighting; and
- » Apply temporary traffic management at peak times in accordance with an approved traffic management plan similar to the indicative sketch shown in Appendix D. Traffic Controllers to hold Coalfields Highway traffic. Temporary speed zoning applied on Coalfields Highway. Include VMS signs and additional high profile warning signs.

Other possible options for further development in the short term as follows:

- » Full channelization to include an acceleration lane, if practical, for traffic turning right onto Coalfields Highway; and
- » Modify left turn lane on Coalfields Highway i.e. widen to improve sight distance for exiting traffic.

2.7.5.4 Gastaldo Road

The road is single carriageway and carries around 1400 vpd. There are a number of speed zones throughout its length ranging from 60 km/h to 110 km/h, as a result there is potential for confusion about the actual speed limit. Benefits would be gained by rationalising the speed limit.

Possible short-term measure:

Main Roads to review the speed zoning along Gastaldo Road with a view to rationalising. (Currently underway)

Possible long-term measures:

No longer term measures are proposed.

2.7.5.5 Entry to Refinery

It is noted that the direction signage is poor at the main entrance and difficult to read without stopping.

It is also noted that large vehicles run over the unsealed shoulder when travelling into the refinery if a vehicle is waiting to exit.

Possible short-term measures:

- » Improve the direction signage by an advanced sign clearly stating the key locations and direction; and
- » Seal the road shoulder to improve the tracking for larger vehicles through the intersection. An approximate area of 15 m² is involved.

2.7.5.6 Worsley Back Road/ Gastaldo Road

Worsley Back Road is unsealed and has poor geometry approaching Gastaldo Road due to grade and horizontal geometry. Overhanging trees are also potentially hazardous. The delineation of the intersection for traffic approaching from both Worsley Back Road and Gastaldo Road is poor.



Possible short-term measures:

Install advanced warning signs of the intersection in Worsley Back Road and Gastaldo Road, together with a stop sign at the intersection. Install intersection warning signs in Gastaldo Road. A section of Worsley Back Road (30m) should also be sealed on the approach to the intersection. An elevated chevron should also be installed in Gastaldo Road to ensure that the terminating road is clear for approaching traffic on the uphill approach. It is also recommended that trees are pruned on the bend and on the approach within Worsley Back Road to improve sight distance and reduce the risk of being struck.

Ranking: High

2.7.6 Route C: Collie to Refinery

The route is Gastaldo Road, Mornington Road East, Lynch St, Padstone Rd, Moira Rd, Atkinson St, Forrest St, Prinsep St and Throssell St.

2.7.6.1 Mornington Road East/ Gastaldo Road intersection

The edge of seal on the southwest corner of the intersection is in poor condition and requires repair.

A rail line crossing is located in Mornington Road east approximately 35m back from the intersection. In order to minimise the risk of traffic queuing back over the crossing it is recommended that a yellow hatched box is installed. Refer Main Roads WA Railway Crossing Protection in Western Australia.

The sight distance at the intersection to the north is restricted by vegetation and needs to be cleared.

Concern has been raised by employees about the need for a left turn pocket from Gastaldo Road into Mornington Road East. This is due to the current high volumes and forecast increase in volumes from the E and G project and the heightened rear end collision potential on Gastaldo Road. The concern with constructing a left turn pocket is the close proximity to the rail line in Mornington Road, however if train activity is managed to avoid peak hour traffic activity and a design may be achieved to satisfy geometric and sight distance requirements, then this could be considered.

Possible short-term measures:

- » Install a yellow hatch box. Refer Main Roads WA Railway Crossing Protection in Western Australia;
- » Clear vegetation on the north side of the intersection to improve sight distance along Gastaldo Road;
- » Do not encourage trucks to use this route in view of the geometry and impacts within the Collie Townsite;
- » Rationalise train operation times to avoid peak traffic activity (06h00 - 08h00 and 15h00 -18h00); and
- » Undertake a feasibility design for a left turn pocket in Gastaldo Road.

2.7.6.2 Mornington Road East (Mornington Mills Road)

The speed limit along Mornington Road is not clear.

At the east end of Mornington Road there is a bend sign facing eastbound traffic which is damaged and needs replacing; an advisory speed limit should be considered for the bend based on Main Roads assessment.

The night inspection indicated poor delineation of the bend at the east end.

Possible short-term measures:



- » Install appropriate speed limit signs at each end of Mornington Road east;
- » Replace bend sign at east end of Mornington Road and provide advisory speed; and
- » Remark the centre line and barrier line and install raised reflective pavement markers on the bend at the east end of Mornington Road East.

Possible long-term measures:

No longer term measures are proposed.

2.7.6.3 Mornington Road/ Tallanalla Road intersection

There are no intersection warning signs on Tallanalla Road for either approach; these should be installed to improve driver awareness of the intersection.

There is road surface deformation on the southwest side of the intersection, the culvert is also damaged. There may be potential for water damage and the drainage should be investigated with a view to improvement.

The line marking at the intersection is worn and provides poor delineation and needs replacing.

The night inspection indicates poor delineation of the intersection. The small finger board sign to Worsley Refinery cannot be seen.

The intersection should not be promoted for additional truck use.

Possible short-term measures:

- » Install advanced intersection warning signs with name tags in Tallanalla Road for each approach;
- » Install larger reflective sign to Worsley Refinery; and
- » Remark all line marking at the intersection, to include a give way marking and barrier lines and install a give way sign.

Possible long-term measures:

- » Consider the installation of street lighting at the intersection; and
- » The Shire to investigate the drainage of the intersection with a view to improving the run off and vertical geometry.

2.7.6.4 Lynch Street/ Padstone Road

In view of the increased traffic volumes it is recommended that a giveway sign and line markings are installed in Lynch Street.

There are no intersection warning signs on Padstone Road for either approach; these should be installed to improve driver awareness of the intersection.

Possible short-term measures:

- » Install advanced warning signs with name tags in Padstone Road for each approach;
- » Install reflective direction sign to Worsley Refinery; and
- » Install a giveway sign and give way marking together with a barrier line in Lynch Street.

Possible long-term measure:



Consider the installation of street lighting at the intersection.

2.7.6.5 Moira Road/ Atkinson Street

In view of the likely increase in traffic volumes it is recommended that the barrier line is remarked and a giveaway sign and marking are installed in Moira Road to guide traffic utilising the intersection. Main Roads have advised that Townsite intersections are not normally marked in view of the on going maintenance requirement. However if traffic volumes increase on this route, line marking at the intersection would be of benefit.

Possible short-term measures:

- » Install reflective direction sign to Worsley Refinery; and
- » Remark the barrier line and install a giveaway sign and give way marking together with a barrier line in Moira Road.

Possible long-term measures:

No measures are proposed.

Speed Limit

As discussed the speed limit in Mornington Road East is not apparent and requires signing.

2.7.7 Route D: Bunbury Port to Refinery

Trucks travelling from Bunbury Port via Australind Bypass, Raymond Road, Coalfields Road and Gastaldo Road.

The key intersection on this route is Raymond Road/ Australind Bypass and has been discussed as part of Route A.

2.7.8 Route E Refinery to Minesite in Marradong

Light and heavy vehicle movements travelling between the refinery to Marradong via Mornington Road, local roads through Collie, Williams - Collie Road, Pinjarra - Williams Road and Bannister - Marradong Road.

2.7.8.1 Collie Townsite

The route between the refinery and Collie Town site is discussed as part of Route C.

2.7.8.2 Williams - Collie Road

It is understood that Main Roads will adopt responsibility for this road, possibly in 2009.

(Note: SLK referred to in the following section indicates the 'straight line kilometre' distance measured from the start of the road, i.e. SLK 7.3 indicates a distance of 7.3km from Coalfields Highway.

SLK 7.3

Road surface condition is poor and could be hazardous for motorcyclists. Surface repairs are required.

SLK 8.9

At the time of the inspection mud was apparent on the road, dragged from an adjacent driveway. This should be cleared and the adjacent driveway sealed for a short distance.



SLK 10 - 24

There is no centre line or raised reflective pavement markers.

A possible measure is for these to be installed to improve delineation, particularly at night.

Approx 20.5 SLK to 21.8 SLK

It would appear that the shoulders have been regraded and as a result these are soft and there is debris on the road. The edge of seal is in poor condition at some locations. Dust may be an issue in the summer.

The carriageway width is 6m and it is likely therefore that two opposing trucks will travel onto the shoulder to pass each other.

As a possible measure, undertake adequate maintenance of the shoulders to avoid issues of dust and loose material.

SLK 39 - 40.9

The tree canopy should be checked and pruned to ensure overhanging branches are not struck by passing trucks.

SLK 48, 53.8, 58 - 59,

The road surface is poor at a number of locations. The worst location is between SLK 58 and 59 which appears to be a failure between the old single lane surface and the new widening which creates a rut. This is likely to create a hazard for traffic particularly motorcyclists. This situation would be exacerbated at night.

A possible measure is to repair/ resurface the road surface .

Dead trees on shoulder approximate locations, SLK 34.5, 41.8, 42.1, 45.7, 46.9, 47, 49.9, 50.5,

It was noted that a number of fallen dead trees or branches are located on the shoulder at various locations.

A possible measure would be for these to be removed.

Low lying areas

It was observed that in some low lying areas water was present adjacent to the road.

A possible measure is to consult the Shire regarding the potential for flooding and the need for warning signs.

Speed Limit

The posted speed along Williams - Collie Road would appear to be appropriate throughout its length.

Night Time Inspection

The night time inspection indicated that the delineation along Williams - Collie Road appears reasonable although a centre line marking is required as discussed. If night time travel increases then the 6m carriageway width could be potentially hazardous for two opposing trucks.

Possible short-term measures:

- » Remove all dead trees from the shoulders;
- » Install centre line marking where missing;



- » Repair/ resurface road where required; and
- » Consider appropriate treatment of the unsealed shoulders to minimise mud on the road and dust in the summer.

Possible long-term measures:

- » Review the road surface condition and resurface where required; and
- » Consider widening the existing carriageway to 7.0 m and sealing the shoulders.

2.7.8.3 Pinjarra - Williams Road/ Harvey - Quindanning Road intersection

There is evidence of traffic turning left from Harvey - Quindanning Road travelling over the unsealed shoulder which results in gravel being deposited on the intersection. There is no give way sign on the terminating road.

Possible short-term measures:

- » Seal the road shoulder at the northwest corner and install a giveaway sign on the northern approach of Pinjarra - Williams Road; and
- » Whilst not a safety issue, it was noted that the Heritage Trail sign at the intersection is worn and needs replacing.

2.7.8.4 Pinjarra - Williams Road between Quindanning and Marradong

There are a number of locations along this section of road that have a sealed carriageway suitable for one lane only, opposing traffic have to use the unsealed shoulders. The 19 km section of road is signed with appropriate advanced warning signs. This is considered a potential safety issue particularly due to dust, soft shoulders and mud. This would be exacerbated during night time operation. It was also observed that this section of road is particularly difficult to negotiate at times of sunset.

In view of the proposed increase in activity along this road it is recommended that the seal width is increased suitable for two-way traffic. Austroads Rural Road Design indicates a cross section of 2 x 3.1 m traffic lanes, and 2 x 1.5 m shoulders of which 0.5 m should be sealed.

Possible short-term measures:

Discourage the use of this route in the short term in view of the poor geometry, as any increase in traffic volumes is likely to increase the safety risk. The route via SW Highway is longer but is considered to be of a better standard. Alternatively use Pinjarra - Williams Road to Albany Highway, Williams then via Albany Highway to Bannister - Marradong Road.

Possible long-term measures:

Increase the carriageway width to a minimum 7.0m wide to accommodate increased traffic and improve the safety of traffic travelling along this road.

Speed Limit

The posted speed along Williams - Pinjarra Road would appear to be appropriate throughout its length. However could be a safety issue along the narrow single lane sections due to the soft or dusty unsealed shoulder and in poor light conditions.



Night Time Inspection

2.7.8.5 Pinjarra - Williams Road

The night time inspection indicated that the delineation along Pinjarra - Williams Road appears reasonable. However no centre lines are located between Marradong and Quindanning only temporary reflectors. As discussed above it is considered that the seal for the section of road between Marradong and Quindanning should be widened to accommodate two-way traffic and should include a centre line and raised reflective pavement markers.

It is apparent from warning signs that log trucks use the road together with mine traffic.

Bannister - Marradong Road

The delineation and geometry of this road would appear to be adequate for the speed and volume of the road. Delineation and signage provide good guidance for traffic using this road.

2.7.9 Route F: Existing Minesite Marradong to new Minesite Marradong

Trucks travel between the existing minesite in Pinjarra - Williams Road and the new minesite off Pinjarra - Williams Road.

The current minesite is centred on the Saddleback Timber Reserve. Access is via a sealed road off the Pinjarra - Williams Road approximately 5km southwest of the intersection with the Bannister - Marradong Road.

The new minesite is located in the Marradong Timber Reserve. The access point during construction will be off the Pinjarra - Williams Road approximately 400 m east of the intersection with Red Hill Road Marradong.

The permanent mine entrance will be off Pinjarra - Williams Road approximately 200 m east of the intersection of Lower Hotham Road Marradong.

Possible short-term measure:

Minesite access to include left turn pocket and widening on Pinjarra - Williams Road to allow through traffic to pass turning traffic.

2.7.9.1 Pinjarra - Williams Road/ Bannister - Marradong Road Intersection

The crash history indicates no reported crashes over the last 5 years. It was observed on site that the direction sign in Pinjarra - Williams Road south of the intersection is obscured by vegetation, this should be cleared.

Possible short-term measure:

Remove vegetation from verge in Pinjarra - Williams Road on the approach to Bannister - Marradong Road in front of the direction sign.

2.7.10 Route G: New Minesite to Accommodation Camp in Goldmine Road and to Albany Highway

Light vehicle and bus movement between the new minesite and the accommodation camp in Goldmine Road and to Albany Highway via Bannister - Marradong Road and movements via Pinjarra - Williams Road to SW Highway.



2.7.10.1 Goldmine Road/ Bannister - Marradong Road

Bannister - Marradong Road is a single carriageway with one lane in each direction.

The intersection is giveaway controlled and has giveaway signs doubled up in Goldmine Road.

The road currently carries in the order of 750 vpd, and traffic volumes will increase due to traffic entering/ exiting the camp site and travelling on Bannister - Marradong Road.

There is currently no widening of Bannister - Marradong Road at the intersection to allow through traffic to pass right turning traffic. Austroads Guide to Engineering Practice Part 5 Intersections at Grade indicates that widening is preferred on a high speed and/or heavy vehicle routes to enhance safety.

It is understood from Main Roads that land resumption is required in order to accommodate any widening and this is currently being pursued by them for BGM. Until the land resumption issue is resolved the road cannot be widened.

Possible short-term measures:

Modify the intersection to achieve widening on Bannister - Marradong Road to allow through traffic to pass right turning traffic, together with a left turn pocket in Bannister - Marradong Road. (Subject to land resumption)

Possible long-term measures:

No longer term measures are proposed.

2.7.10.2 Goldmine Road/ Camp Access

Channelisation is required at the intersection to improve its operation and safety, including right and left turn pockets into the camp. The advanced intersection warning signs also need replacing. It is understood that a plan has previously been prepared for this intersection for the BGM.

The line marking needs replacing in some sections of Goldmine Road together with the installation of RRPM's.

Possible short-term measures:

- » Modify the intersection to achieve channelisation to allow through traffic to pass right turning traffic, together with a left turn pocket in Goldmine Road; and
- » Re-mark the line marking in some sections of Goldmine Road together with the installation of RRPM's

Possible long-term measures:

No longer term measures are proposed.

2.7.10.3 Pinjarra Road - Williams Road New Minesite Access

The new intersection on Pinjarra - Williams Road with the minesite access road should incorporate a left turn pocket and widening to allow through traffic to pass right turning traffic into the mine. This should be provided for both the temporary construction access and the permanent minesite access. Main Roads are currently discussing with Worsley Alumina regarding a conveyor connection.

2.7.10.4 Farmers Ave/ Robins Road (High Wide Load Route)

It is understood that the High Wide Load (HWL) route is proposed via Farmers Ave and Robbins Road to the mine site.



Farmers Ave is 6 m wide.

It is understood from the Shire of Boddington that the northern section of Robins Road will be sealed. Robins Road will be closed midway at the request of the mine, the closure date is to be confirmed. A site inspection indicates that there are a number of overhead powerlines along Farmers Avenue which will need to be checked for clearance. It would seem likely that these will need to be raised or installed underground. There are also tree canopies which will probably require pruning.

Short-term measure:

Check the height of overhead power lines along Farmers Avenue prior to the use of this route for HWL.

2.7.11 Route H: Perth to Marradong

Perth to Marradong via Thomas Road, Albany Highway and Bannister - Marradong Road.

2.7.11.1 Albany Highway/ Banister Marradong Road Intersection

The intersection has channelization including a right turn pocket in Albany Highway and the crash history indicates no reported crashes in 5 years. Safety issues are not therefore indicated. No traffic management measures proposed.

2.7.11.2 Pinjarra - Williams Road (Marradong to Pinjarra)

The road is currently around 7m wide and the posted speed is generally 110 km/h.

Observations of Pinjarra - Williams Road (Marradong to Pinjarra) indicate there are 43 opportunities to overtake eastbound and 49 westbound with 30 sections of two way over 65 km. It must be noted that a number of sections are relatively short and would not provide adequate opportunity for a vehicle to pass a slow moving vehicle. Similarly the two way sections are generally short with only limited long two way sections.

The available traffic data indicates 1200 vpd (in 2007) on the Pinjarra – Williams Road between Pinjarra and Dwellingup including around 36 large trucks and 106 small trucks. On the section east of Dwellingup around 545 vpd were recorded in 2006, 59 trucks in total of which 5 were long vehicles or road trains and 10 were semi trailers or larger. Current data indicates 670vpd.

The proposed Boddington Mine is likely to add around 120 vpd including 20 trucks. The nominated truck route from Perth is via Thomas Road and Albany Highway. However, it is likely there will be some additional truck movement between Pinjarra and Boddington. It is understood on BGM plan to truck copper concentrate, adding 20 trucks a day to the Bunbury Port via Pinjarra - Williams Road.. Clearly, it would be beneficial to minimise safety risks along Pinjarra - Williams Road by the implementation of improved passing opportunities, i.e. by the construction of passing lanes.

Trucks associated with the BGM are planned to use Albany Highway. Workforce numbers during construction will increase from 2000 to 3000 over the next 6 months and it is anticipated that some additional traffic will use Pinjarra - Williams Road to Pinjarra.

It is noted that a number of trees along the route are within the recovery zone i.e. within 6 m of the traffic lane. The route should be assessed in accordance with Main Roads WA Guidelines for Assessing Trees within Recovery Zones on Established Roads.



Site observations indicate that improved overtaking opportunities would provide significant safety benefit along the route at busy times and the development of overtaking (climbing) lanes could be supported, particularly in view of the size of heavy vehicles using the route and likely increased traffic volumes.

It is understood that Main Roads propose embayments for trucks to pull off the road to allow following traffic to pass and as an interim measure, this measure is supported.

Possible short-term measures:

Install truck embayments are installed.

Possible long-term measures:

- » Identify appropriate locations and prepare functional designs for the construction of overtaking lanes (4) to improve the opportunity for light vehicles to overtake slow moving trucks. The length of the lanes should be in accordance with Austroads Rural Road Design (i.e. between 620 m and 1070 m); and
- » Check the road in accordance with the procedures in Main Roads Guidelines for Assessing Trees within Recovery Zones on Established Roads to include assessment of the road side Environmental Value.

2.7.12 Waterloo Road/ SW Highway

This intersection was inspected as part of the study.

The site inspection indicates SW Highway is a single carriageway with 1 lane in each direction. There is a left turn pocket for west bound traffic turning into Waterloo Road. The speed zone on SW Highway is 100 km/h. There is localised widening on the north side of SW Highway to allow through traffic to pass a right turning vehicle however this is in close proximity to the service station forecourt.

There is a service station directly opposite the intersection with no channelisation to facilitate turning traffic. The location of the service station opposite the intersection would appear to have potential for conflicting turning movements and would also appear to be a less than desirable location for this land use. However the 5 year crash history indicates only 3 crashes which would not suggest a high priority.

It is understood that a fatality occurred here recently. Main Roads prepare a report for all fatal crashes which investigates the road and road environment and makes recommendations for any improvements. The report is prepared for the Coroners office, Main Roads and appropriate local authority. Main Roads will need to be contacted regarding any outcomes. The circumstances of the fatality are not known.

Log trucks were observed to exit Waterloo Road onto SW Highway.

Possible measures:

The current site appears to be constrained for significant improvements. Suggestions include:

- » The longer term opportunities could be examined to include relocation of the service station to a more suitable location and full channelization of the intersection to facilitate turning traffic;
- » Realign Waterloo Road further west to allow full channelisation of the intersection and the service station; and
- » Acquire land on the south side of SW Highway to allow an improved intersection to Waterloo Road and the Service Station.



3. Assessment of Proposed Measures

The following proposed measures and issues related to the management and mitigation of road safety issues are assessed:

3.1 Truck Holding Areas

It is understood there is a requirement for a truck holding area to accommodate up to 6 trucks. In view of the truck route via Old Coast Road, Australind Bypass and Raymond Road, the preferred location is in Raymond Road.

A suitable location is 2.6 km east of Australind Bypass, where the road is straight and sight distance is good.

Raymond Road is 6.6 m wide with 2 x 1.2 m sealed shoulders. The verge width on the north side is approximately 5.4 m wide prior to a drainage channel which is approximately 6 m wide.

Main Roads have indicated their support for a truck holding area subject too the usual design considerations.

Main Roads raised no objection to the development of truck holding bays on Raymond Road provided a suitable location can be found when considering the irrigation channels within the road reserve on the northern side. Main Roads is not in a position to assist funding in any way for the development/construction of these bays.

It is noted that embayments are present in Old Coast Road, the closest being 12 km north of Raymond Road. Existing embayments could be utilised before constructing an additional facility.

Possible short-term measure:

Construct a truck holding area in Raymond Road (if required) using bitumen stabilised limestone approximately 2.6 km east of Australind Bypass. The adjacent drainage ditch will require appropriate modification to accommodate such an embayment.

3.2 Car Parking Areas

It is proposed to develop car parking areas to allow up to 300 cars to be parked away from the site to reduce the traffic impact in Coalfields Highway and Gastaldo Road. This will provide significant benefits for the operation of key intersections at peak times. Sites are proposed off Raymond Road near Australind Bypass and off Coalfields Highway near SW Highway.

Consideration of the provision of these two car parks over the provision of one car park off Coalfields Highway only, as follows:

- » Two car parks will serve the workforce living in different areas, i.e Australind area and locations off SW Highway and Coalfields Highway;
- » If only a single car park in Coalfields is provided, the workforce from Australind may continue driving on to the refinery and benefits will be reduced;
- » A new car park off Raymond Road will improve the safety of the location by relocating the existing bays away from the intersection with Australind Bypass;



- » Two car parks will reduce the traffic activity at the Raymond Road/ SW Highway intersection;
- » Response from consultation with the workforce indicates support for satellite parking areas; and
- » The potential for expansion and increase in capacity is enhanced by the provision of two parking areas.

On balance, it is considered that the provision of two car parks is preferred over the provision of one car park off Coalfields Highway only.

3.2.1 Car parking off Raymond Road

Main Roads are supportive of rationalising the current poor situation of verge parking near Australind Bypass. It was suggested that the land to the east of that currently proposed could be investigated and either use the current road reserve for access or possibly create a new access. The intersection to the new parking area would probably require widening on Raymond Road to allow through traffic to pass right turning traffic.

The land considered is actually part of the Main Roads reserve and was resumed to facilitate the future grade separated interchange proposed for this location.

Main Roads raises no objection to the use of this land up until the expansion is complete provided any work carried out would be at no cost to Main Roads, any access onto Raymond Road would be made safe as possible for both through traffic and entering/ exiting traffic, any works carried will not effect existing drainage and the site is to be returned to 'As Was' once the expansion is complete.

Possible short-term measure:

Design a parking area to incorporate bus pick-up/ drop off zone and space for 100 to 150 car bays.

3.2.2 Car parking area Coalfields Highway

A site has been identified in Coalfields Highway which was the subject of a former application to Main Roads for a service station.

Main Roads raise no significant concerns and plans are currently with them.

Possible short-term measures:

Construct a car parking area off Coalfields Highway.

- » Localised widening should be achieved to allow through westbound traffic to pass right turning buses; and
- » Consider relocating the 110 km/h speed limit zone to the east of the new car park.

3.3 Car Pooling

The Metropolitan Transport Strategy indicates that the average car occupancy is 1.2 persons per car. If this can be increased, there will be benefits in reducing vehicle trips during peak hours.

It is understood that carpooling is already promoted for the existing workforce. Significant benefit could be achieved if car pooling is also promoted for the construction workforce. If the proposed car parking area off Raymond Road is increased then this could be used for a suitable pick up/ drop off area. It is also recommended that other suitable locations for pick up/ drop off be examined and developed.



Following discussion with the Shire of Harvey it is understood that many Worsley employees appear to be making use of public parking off Paris Rd near Leisure Drive Community Centre in Australind for car pooling purposes; this has impacted on the availability of parking for the public and needs to be addressed by Worsley.

Possible short-term measure:

Examine and develop other suitable locations for pick up/ drop off.

3.4 Use of Buses

3.4.1 Worsley refinery

It is understood that it is intended to use buses to transport the E&G construction workforce from the parking areas in Raymond Road and Coalfields Highway to the refinery and this is supported to reduce overall traffic impacts. The parking facilities must include a suitable waiting area for passengers including a shelter and adequate waiting areas for a bus to access and turn. Buses will also be used to transport the workforce to and from the accommodation camp in Mornington Road.

The development of an E&G construction workforce bus service to/ from Bunbury/ Collie/ Australind should also be further investigated and will require analysis of workforce origin suburbs to assess where to provide the service. It is also suggested that the workforce are consulted to determine whether they would use a bus service.

It is suggested that a bus service is also considered for the permanent WAPL workforce.

It is understood from discussion with Main Roads that SW Coachlines is conducting a study to provide bus service for the likes of Worsley, Blue Waters, Muja, Premier Coal, etc. The use of buses will have significant benefit for associated traffic activity, as an example one bus is equivalent to 41 cars assuming 1.2 people per car. The promotion of bus use from the parking areas proposed and a bus service to serve the surrounding areas should be pursued.

3.4.2 Boddington

It is understood that a high proportion of the E&G construction workforce staff will be transported by bus to the accommodation camp in Goldmine Road and to and from the new mine which will have significant benefits for associated traffic activity.

It is recommended that buses are used where possible to minimise associated traffic activity by travel to and from Boddington and to and from the Minesite.

3.5 Community Campaigns

A community campaign is needed to drive home the importance of road safety and Worsley's commitment to the issue. Eg: Supporting public safety campaigns, especially during peak travel times like Christmas and Easter, through newspapers, radio or television adverts; crashed cars could be appropriately placed along major highways as safety promotions; driving simulators could be purchased for community education and fun etc.

Similar campaigns have been used successfully elsewhere and could be pursued. GHD staff attended a Local Roads Conference in 2006 and a presentation was made about a Local Government Road Safety



Campaign in two rural Shires (Yass Valley and Upper Lachlan Shire) involving, signage, school participation, radio, television, media coverage, web page links, newspaper features, emails, distribution of a road safety information brochure and telephone interviews. A 31% reduction in road crashes was recorded following the campaign. The Office of Road Safety, local authorities and Main Roads should be consulted and included in the consideration of this initiative.

It is understood that Community groups may want to set up driver reviver stations on Friday evenings at the refinery and mine as fundraising opportunities.

The practicalities would need to be considered, ie appropriate locations, capacity of parking area, locations need to be identified, design of area, hours of operation, internal promotion etc. The fundamental issue of community groups entering the refinery and mine areas requires careful examination to ensure that the initiative is not counter productive. The Office of Road Safety should be consulted and included in the consideration of this initiative.

3.6 Human Resources Execution Plan & Current Practice

Worsley Alumina currently has in place:

- » A procedure for traffic management on site. This procedure defines the requirements for the management of site traffic to assist in the elimination of vehicle and mobile plant incidents;
- » A procedure for vehicle journey management. This document provides a framework for managing the risks associated with vehicle journeys for all personnel who travel as part of their assigned project tasks;
- » A traffic management site plan. The purpose of this plan is to eliminate or minimise the risk of fatalities, injuries and incidents arising from the operation and interaction of traffic and pedestrians; and
- » Incident at Risk Driving Report – It is understood that Worsley have introduced this form which provides the opportunity for staff to report incidents.

Possible short-term measures

- » Continue the awareness of safe driving practices to include all staff. These documents should be promoted to all staff;
- » Engage specialist authorities, such as the Office of Road Safety and AHG, 46 Grogan Road, Perth International Airport, WA, 6105, Tel 9479 5754 to assist with driver training, driver behaviour, stress and fatigue management;
- » It is recommended that the local police are included in safety initiatives to include road safety talks to the workforce;
- » Extend the awareness of safe driving practice to the Western Australian public in collaboration with the Perth based Office of Road Safety located at 40 Georges Terrace Perth WA.. James Newton, Partnership Management Consultant with the Office of Road Safety can be contacted on 9222 8764 and mobile number 0434 325 603; and
- » It is recommended that the Incident at Risk Driving Report is continued to be promoted.

3.7 Traffic Control

Traffic management measures have been considered to address evening peak hour construction traffic movements, specifically at the intersection of Gastaldo Road and Coalfields Highway where exiting traffic



may have difficulty turning right into Coalfields Highway. In view of the likely high traffic numbers of traffic exiting Gastaldo Road, particularly on a Friday evening it is proposed to have a traffic management plan available that may be initiated if required. The plan would include the use of traffic controllers to hold traffic on Coalfields Highway and Gastaldo Road for short periods and incorporate appropriate advanced warning, variable message signs and speed limit reduction. Main Roads are supportive of having a traffic management plan available for implementation only if required during evening peak times. A full documented plan is required for Main Roads formal approval.

Worsley sees traffic control as a last resort or contingency measure. It proposed to do everything else possible to manage and improve traffic flow but will plan for traffic control as a last resort to ensure the safety of all road users.

An indicative sketch is shown in Appendix D and shows the likely traffic control and signage requirements.

Traffic control has also been discussed with Main Roads at Coalfields Highway/South West Highway intersection and Raymond Road /Australind Bypass intersection however they are not supportive of temporary traffic management measures at these locations.

3.8 Street Lighting

Further to discussion with stakeholders and based on feedback from the consultation process, there is a desire for improved street lighting at a number of key intersections to improve their safety and operation during hours of darkness.

Main Roads have advised that street lighting is proposed at the intersection of Raymond Road/ Australind Bypass and Paris Road/ Australind Bypass.

It is therefore recommended that, as a possible short-term measure, street lighting is progressed at the following locations:

- » Gastaldo Road/ Coalfields Highway intersection, together with the proposed intersection upgrade;
- » Raymond Road/ Australind Bypass intersection (32% of crashes occur at night); and
- » Proposed car park locations in Coalfields Highway and Raymond Road for improved security.

The following location is recommended for further consideration by the Shire of Collie, to improve the delineation at night.

- » Mornington Mills Road/Tallanalla Road



4. Network Overview

4.1 Main Roads Report June 2008

In June 2008 Main Roads prepared a Powerpoint presentation outlining statistics for the surrounding road network including most recent traffic data and planned improvements, both funded and unfunded.

Relevant issues are summarised as follows:

4.1.1 Max Length of freight vehicles

The South West maximum length of freight vehicles is 27.5m.

4.1.2 New Perth Bunbury Highway (Plan shown in Appendix C)

Freeway standard from Safety Bay Road to South Yunderup Road (32 kms)

Interchanges at:

- » Safety Bay Road;
- » Karnup Road;
- » Paganoni Road;
- » Lakes Road;
- » Pinjarra Road; and
- » Rural highway (Dual carriageway) from South Yunderup Road to Old Coast Road near Lake Clifton (38.5 kms).

At grade intersections including:

- » Greenlands Road;
- » Old Bunbury Road; and
- » Old Coast Road.

4.1.3 Pinjarra - Williams Rd

Pinjarra - Dwellingup, 22 km:

- » Aug 03 – 953 vpd (22 Class 6 trucks and above);
- » Nov 04 – 1242 vpd (22);
- » Oct 06 – 1295 vpd (30);
- » Oct 07 – 1211 vpd (28);
- » 7m seal width - Widening & alignment improvements & climbing lane desirable – some widening funded (3 km);

Dwellingup - Marradong 43 km:

- » Aug 98 – 445 vpd (15 Class 6 trucks and above);



- » Feb 04 – 594 vpd (14);
- » Aug 06 – 545 vpd (12); and
- » 7m seal width - No major upgrades planned - parking bays & possible passing bay planned.

4.1.4 Bannister Marradong Rd

Has a 7m seal width – no major upgrades proposed.

Marradong - Boddington, 7 km:

- » Jan 04 – 632 vpd (18 Class 6 trucks and above);
- » Oct 06 – 810 vpd (15); and
- » Aug 07 – 745 vpd (23).

Boddington - Soldiers Rd, 1.7km:

- » Nov 03 – 396 vpd (10 Class 6 trucks and above);
- » Oct 06 – 860 vpd (17); and
- » Sept 07 – 1058 vpd (25).

Soldiers Rd - Albany Hwy, 12km:

- » Nov 03 – 252 vpd (10 Class 6 trucks and above);
- » Oct 06 – 412 vpd (26); and
- » Oct 07 – 640 vpd (57).

Table 4.1 Town Traffic Comparison

TOWN	TRAFFIC vpd	LARGE TRUCKS
Pinjarra	9800	410
Waroona	6000	420
Donnybrook	5000	340
Bridgetown	4000	150
Margaret River	9800	70
Dwellingup	1800	22
Boddington	1600	17 – 25



Table 4.2 Weekend Comparison

	Cars	Small Trucks	Large Trucks	Total vpd
Dwellingup west Weekday	1069	106	36	1211
Weekend	1130	70	9	1209
Boddington Weekday	925	67	33	1025
Weekend	683	27	3	713

4.1.5 Pinjarra - Williams Road – Current / Completed Works

- » Greens Hill Guardrail – June/July 2008;
- » Edge lining / curve sign upgrade – mid 2007;
- » Reseal 3.5 km April 2008 (Bannister - Marradong Rd); and
- » Shoulder sealing 3 km May/June 2008 \$400,000 from Safer Roads Program.

4.1.6 Pinjarra Williams Road - Works Funded 2008/09

Parking bays (i.e area for trucks to pull off and allow following traffic to pass, wide sealed shoulders and a section of sealed shoulder on Bannister - Marradong Road).

4.1.7 Pinjarra Williams Road (Marradong to Quindanning)

- » Planning & Design for widening single lane seal; and
- » \$200,000 Safer Roads Program 2008/09.

4.1.8 Pinjarra Williams Road, (Dwellingup-Pinjarra)

- » Planning for Greens Hill improvements; and
- » Planning for widening/ improvements.

4.1.9 Pinjarra - Williams Road, (Marradong - Pinjarra) Unfunded Work

- » Climbing lanes;
- » Greens Hills upgrade incl. Climbing Lane (Eastbound); and
- » Widening / shoulder sealing (some curve improvement).



4.1.10 Pinjarra - Williams Road, (Marradong - Quindanning) Unfunded Work

Widen single lane seal.

4.2 Discussion

Following discussion with the Shire of Boddington, the Boddington Police, Boddington mine and feedback from other users, it is clear there is significant concern about the safety of operation of the Pinjarra - Williams Road between Marradong and Pinjarra and between Marradong and Quindanning.

Observations of Pinjarra - Williams Road (Marradong to Pinjarra) indicate there are 43 opportunities to overtake eastbound and 49 westbound with 30 sections of two way over 65 km. It must be noted that a number of sections are relatively short and would not provide adequate opportunity for a vehicle to pass a slow moving vehicle. Similarly the two way sections are short with only limited long two way sections.

The available traffic data indicates 1200 vpd (in 2007) on the Pinjarra - Williams Road between Pinjarra and Dwellingup and around 36 large trucks and 106 small trucks. On the section east of Dwellingup around 545 vpd were recorded in 2006.

The proposed Boddington Mine is likely to add 120 vpd including 20 trucks.

Improvement to this road by the provision of suitable passing lanes is supported and it is recommended that these are constructed as soon as possible.

Reference is also made to a report by representatives of the Boddington State Emergency Service which highlights crash statistics on Pinjarra - Williams Road and also identifies clearzone issues associated with trees in close proximity to the road. Road widening to 8m and overtaking lanes are promoted in this report.

Main Roads WA Guidelines for Assessing Trees within Recovery Zones on Established Roads indicates approximately 45% of serious and fatal crashes on rural roads were due to vehicles with trees. A recovery zone is a portion within a clear zone for the purpose of vehicle recovery and is free of solid objects. The Guidelines indicate a 4 m Recovery Zone when traffic volumes are less than 1000 vpd. It is recommended that the road is carefully checked in accordance with the procedures in the Guidelines to include assessment of the road side Environmental Value.

The section of Pinjarra - Williams Road between Marradong and Quindanning carries in the order of 270 vpd. In view of the 19 km sections of intermittent single lane and unsealed shoulders and the safety issues of large trucks, slippery or dusty shoulders and setting sun issues the upgrade of this road to include widening to two lanes is supported.

Until this road is upgraded it is recommended that it is not promoted as a route to and from Collie. The safer alternative is to use Pinjarra - Williams Road to Williams the Albany Highway and Bannister - Marradong Road.



5. Driver Behaviour and Management

Road condition & signage, safer vehicles, slower speeds and driver behaviour represent the four cornerstones of safe travel. This section deals with driver behaviour issues and the management thereof.

Information appearing hereunder has been obtained from the Main Roads WA website.

5.1 Tips on Safe Driving

Most deaths or injuries on the roads could have been prevented by defensive or safe driving. Defensive or safe driving means leaving time and space in reserve so that the unexpected does not result in an emergency or crash. This reserve of time and space can be reached by:

- » Leaving a long following distance;
- » Maintaining a 'cushion of safety' or buffer zone on both sides, front and rear;
- » Slowing down at approaches to intersections; and
- » Looking ahead a long way instead of the immediate vicinity only.

5.1.1 Courtesy and Care

Some tips for courtesy and care on the roads include:

- » Let the other person go ahead when in doubt;
- » Allow sufficient safety margins;
- » Exercise safe driving practices and follow all road rules;
- » Do not drive when impaired by alcohol or other drugs, legal or illegal, or by fatigue;
- » Watch out for pedestrians at intersections and share the road with them;
- » Turning motorists must give way to pedestrians;
- » Do not travel too close to another car as this blocks your line of sight and means you may not have time to stop when necessary; and
- » Leave a margin for error and drive at a lower speed.

5.1.2 Intersections

Approach all roundabouts, traffic signals and intersections with caution and be prepared to slow down or stop.

5.1.3 Turning

When waiting to make a turn on a dual highway or turning across oncoming traffic always keep your car wheels pointing straight ahead.



5.1.4 Maintenance

Keep your vehicle in good mechanical order by having regular vehicle safety checks, paying particular attention to brakes, tyres and seatbelts.

5.1.5 Weather

Rain, fog, mist and high winds are some special conditions that require driver adjustments. In these conditions roads can be more slippery and visibility impaired.

Pump brakes gently when stopping on wet or slippery roads to avoid locked wheels. If driving through deep water, test your brakes by pumping them gently after you leave the water to make sure they are dry and working

You should stop when glare from the setting or rising sun interferes with visibility. Be aware that wildlife feeds at these times and is more likely to stray onto roads.

If you skid, gently steer towards the direction of the skid and lightly apply the brakes - do not wrench the wheel back and slam on the brakes as this can send the vehicle more out of control.

5.1.6 Seatbelts

The driver is responsible for all child passengers and is held responsible if seat belts or restraints are not worn. Wearing a seat belt reduces the risk of death or serious injury by about 50 percent.

5.1.7 Overtaking

If the driver in front is going at about the same speed as you, there is no need to overtake. If in any doubt, do not overtake. Never overtake on the crest of a hill, at a curve, near a corner, at intersections or on a pedestrian railway crossing. Never cross an unbroken line. When another driver signals their intention to change lanes or turn do not speed up to prevent them from doing so. Help them out.

5.1.8 Fatigue

Avoid driving when you are tired, stressed or worried. Before long trips get a good sleep and take a break from driving every two hours. Avoid driving during normal sleeping hours. Watch out for symptoms of fatigue. These include highway hypnosis or fading out, restlessness, boredom, lazy steering, aches and pains, and sore or tired eyes. At the first sign of these symptoms stop and rest until recovered.

Driver fatigue is a major cause of serious road crashes in Western Australia. It is considered a factor in one in five fatal crashes.

Driver fatigue is avoidable. Many drivers will start a trip while feeling fatigued and often continue to drive when they are feeling tired, even when they know it is much safer to stop.

Danger Signs of Fatigue include:

- » Sore or heavy eyes;
- » Day dreaming;
- » Constant yawning;
- » Cramps or stiffness;



- » Time taken to react is increased;
- » Your speed varies for no apparent reason; and
- » Your vehicle wanders over the centre line or on to the road edge.

The following can be done to prevent the onset of fatigue:

- » Plan your trip to allow time for breaks;
- » Take a ten minute break every two hours, and a longer break every four hours where you can get out of the car, walk around and have a coffee or tea;
- » Get plenty of sleep before you set off;
- » Start early in the day when you are well rested;
- » Try to travel during the day when you are most alert and visibility is good.
Share the driving if you can;
- » Don't drink and drive;
- » Eat properly, and at your regular meal times. Foods high in fat promote drowsiness; and
- » Stay somewhere overnight so you can arrive alive - even if it is the next day.

STOP, REVIVE, SURVIVE.

FREE COFFEE FOR DRIVER and DRIVER REVIVER STOPS are two initiatives helping you to STOP, REVIVE, SURVIVE.

FREE COFFEE FOR DRIVER is a road safety programme involving over 100 roadhouses across Western Australia. Stop at your nearest roadhouse displaying this sign and the driver can have a break with a free coffee or tea. This service is donated by each roadhouse to help get you and your passengers to your destination alive and well.

Drivers who are on a long journey of two hours or more are welcome to one free cup of tea or coffee, per vehicle, at each stop.

DRIVER REVIVER STOPS operate over Christmas and Easter and are available throughout Western Australia. They provide a safe place where drivers can stop for an essential rest break and enjoy a free cup of tea or coffee and a chocolate.

ONCE FATIGUE HAS SET IN NOTHING CAN IMPROVE YOUR CONCENTRATION. THERE IS ONLY ONE THING YOU CAN DO. STOP AND TAKE A COMPLETE BREAK FROM DRIVING. SLEEP IS THE ONLY ANSWER.

5.2 Managing Fatigue and Transport

The following is an extract from a submission to the House of Representatives Standing Committee on Communications, Transport and the Arts, The Parliament of the Commonwealth of Australia, entitled MANAGING FATIGUE AND TRANSPORT.

5.2.1 Inadequate Sleep and Traffic Accidents

Fatigue is an increasingly widely recognised risk factor for motor vehicle accidents. Victorian coroners' reports attribute 9% of fatal truck accidents to fatigue (1). When an expanded definition of fatigue is used



which includes inattention and excessive driving hours this proportion increases to 20% (1). This finding is consistent with New South Wales Road and Traffic Authority reports that estimate that fatigue was involved in 16.9% and 17.7% of all motor vehicle accidents in 1993 and 1994 respectively (2). These estimates are likely to be conservative, as fatigue could conceivably be a contributing factor in accidents attributed to other causes such as speed and alcohol. It is notable that the time of peaks of occurrence of accidents (relative to the total number of vehicles on the road) coincides with the times of day when sleepiness is greatest: in the early hours of the morning, and shortly after midday (3).

A survey by the US Insurance Institute for Highway Safety reveals that 20% of drivers interviewed admitted to having fallen asleep at the wheel (4). While fatigue, or more specifically excessive sleepiness, is a common human experience, it is not easily measured unlike speed or blood alcohol levels and so the usual methods of policing and prevention do not apply. A different approach based on public education and changes in work practices is required. In this submission the causes and consequences of inadequate sleep and their relationship to traffic accidents are discussed and a preventative strategy is outlined.

5.2.2 Normal sleep requirements

Adequate sleep is necessary for normal, physical and neuropsychological function (see below). For sleep to be restorative it must be of:

- » Sufficient duration;
- » Appropriate timing; and
- » Adequate quality.

5.2.3 Duration of sleep

Requirement for sleep decreases during childhood stabilising in young adulthood. Normal duration of sleep in adults varies from individual to individual with an average requirement of 7.5 hours per night and a normal range of 5.5 to 9.5 hours. There are 2 otherwise normal people with sleep requirements that may be shorter or longer than this range. Individuals will know their own sleep requirements from their life's experience. They know that if they consistently fail to have this length of sleep a sleep debt accumulates which requires to be repaid by naps or by a lengthy sleep.

5.2.4 Timing of sleep

There is a circadian variation in the propensity to sleep. Sleepiness peaks between 2 am and 6 am, decreasing during the day to a trough at midday followed by a small peak in the mid afternoon and a further decline to a minimal level of sleepiness in the evening, before climbing beyond 10 pm back towards the 2 am to 6 am peak. This circadian rhythm with peaks for sleepiness after lunch and in the early hours of the morning is readily understood as most individuals can relate it to their everyday experience. It is also the bane of the existence of night shift workers because even though night shift modifies this circadian rhythm it does not ablate it.

5.2.5 Sleep quality

Sleep is a homogenous state but is composed of different stages which occur cyclically throughout the night. For sleep to be refreshing sleep architecture needs to be normal with all the sleep stages represented in their usual proportion and with minimal disruption from arousals or awakening.



5.2.6 Causes of inadequate sleep

» Inadequate duration

Sleep duration can be inadequate if an individual deprives him/herself of their normal sleep requirement because of other priorities or demands related to work, family life or leisure activities. Individuals who require lengthy sleep are at particular risk because of the difficulty they have fitting their sleep requirements with other demands on their time. Insomnia (or difficulty achieving sleep) is a very common sleep-related disorder which can result in foreshortened sleep with consequent daytime sleepiness. Sedative drugs used to treat this problem often have lengthy half lives with persistent effects into the following day. This compounds the effects on daytime function.

» Inappropriate timing

Shift work and jet lag are examples of commonplace circadian rhythm disturbances associated with excessive sleepiness where the inclination to sleep is great while the subject is attempting to stay awake and remain vigilant, and conversely the inclination is low when attempting to achieve sleep.

» Impaired quality

Impaired sleep quality should be suspected whenever an individual complains of excessive sleepiness despite sleep of apparently normal length and timing. There are many medical conditions associated with impaired sleep quality because of 3 physiological, neurological or metabolic disturbance, dyspnoea or pain. In addition there are several specific sleep disorders that impair quality. Obstructive sleep apnoea is common example affecting 4% of middle-aged men and 2% of middle-aged women to a clinically significant degree (5). This condition, which is associated with heavy snoring, involves recurrent episodes of obstruction of the throat during sleep which are terminated by arousal hence disrupt sleep. Such patients usually present with complaints of excessive daytime sleepiness.

5.2.7 Consequences of Inadequate Sleep

Whether because of inadequate duration, timing, or quality, inadequate sleep results in excessive daytime sleepiness, inattention, impaired vigilance, impaired concentration, increased reaction times, and memory and mood disturbance. All these consequences have adverse implications for driving performance. Such adverse consequences are compounded by coexistent alcohol intake and by speeding which necessitates improved vigilance and reaction times rather than the converse.

» Sleepiness

Even mild restriction in the hours of sleep (5 hours a night rather than 7½) results in progressive daytime sleepiness which is evident on the first day following a night of sleep restriction and worsens with successive such nights. The resulting sleepiness is only recoverable by rest. One night of rest following 1 week of sleep restriction only partially reverses the problem. Artificial fragmentation of sleep also rapidly results in an increasing tendency to fall asleep. Sleepiness is also influenced by time of day, increasing significantly in the early hours of the morning.

» Inattention, impaired vigilance

Sleep restriction also impairs vigilance. Lapses in performance of psychomotor vigilance tasks increase rapidly over the first 3 days of modest sleep restriction as described above, with a further increase towards the end of a week of such restriction. Under these circumstances there is, as with sleepiness, only partial recovery after 1 night of unrestricted sleep. Vigilance also demonstrates a circadian change, diminishing in the early hours of the morning relative to during the day.



» Reaction times

Reaction times progressively slow with increasing sleep deprivation, lengthening by approximately 50% over a 40-hour period of total sleep deprivation. Reaction times lengthen by approximately 20% in the early hours of the morning relative to during daylight hours.

» Mood

Profile of mood scores change with sleep restriction with a marked decrease in mood after 1 day of sleep restriction, progressively decreasing on the following 6 days of a 4 week-long sleep restriction period. Recovery is only partial after 1 normal night's sleep; several nights of unrestricted sleep are required for full recovery.

5.2.8 Inadequate sleep and driving

Given these effects of inadequate sleep on psychomotor performance it is not surprising that inadequate sleep should contribute so strongly to accident risks. It is well recognised that accident risks and peaks in the circadian cycle of sleepiness coincide. When corrected for the number of vehicles on the road the risk of traffic accidents is substantially greater between 4 and 6 am with individuals at 13 times more likely to have a sleep-related crash than at any other time of day. Fatigue and inattention are thought to be factors in 30% of all vehicle accidents.

Coroners' reports suggest that fatigue is causal in 9% of fatal truck accidents and inattention in a further 11%. Insurance industry surveys reveal that 20% of drivers admit to having fallen asleep at the wheel.

In obstructive sleep apnoea, a condition known to be associated with disrupted sleep, the risk of vehicle accident is between 5 and 10 times that of patients without obstructive sleep apnoea. The risk of serious work-related accidents is approximately 80% greater for night than morning shift workers.

How should the problem be addressed?

Because the problem of excessive sleepiness is not easily measured, policing is difficult. Reliance has to be placed on education of public, employers and workers, health screening programs for occupational drivers, and road and car design to circumvent the problem or lessen its consequences.

» Public education

The principle on which an education program should be instructed is to promote understanding of the need for sleep of adequate duration and appropriate timing for optimal neuropsychological function. Employers and workers need to respect the need for sleep. Employers must be educated and advised on how to design rosters which best oblige the need for sleep of adequate duration and timing. This is an aspect of their duty of care. Equally importantly, workers need to be advised of their responsibility to use the time made available to them for sleep for this purpose so that they are fit for duty.

The public education campaign should also point out the need to seek medical advice where sleepiness persists despite sleep of apparently adequate duration and timing as this indicates the possibility of a sleep disorder requiring treatment. 5 The campaign should also point out the interactive nature of the effects of fatigue, alcohol and speed in increasing risks. Too often these have been treated as separate considerations without any regard for their capacity to compound one another.



» Health screening programs

Occupational drivers, in particular, should be regularly screened for disorders that can contribute to excessive sleepiness. At a basic level such screening could be part of a medical history. Occupational medical histories should always seek a history of snoring and/or excessive daytime sleepiness. It appears likely that they do not at present. If so then education of medical practitioners and other occupational health professionals is required to ensure that such questions are asked as a matter of routine.

Screening using questionnaires designed in consultation with relevant experts e.g. the Executive of the Australasian Sleep Association, would represent a low cost method of screening for sleep disorders that may require further investigation.

It has been estimated that 10% of the population have a sleep disorder, predominantly insomnia or obstructive sleep apnoea. It is important to recognise that while sleepiness affects all people from time to time these patients are sleepy all the time, at least to some degree. Hence, while they may represent 10% of the population they represent a far greater proportion of the problem relating to sleepiness on our roads because of the unrelenting nature of their sleepiness. Occupational drivers, because of the proportion of time they spend on the roads and the nature of the vehicles they drive (including taxis, buses and trucks) are of particular concern. It is for this reason that this group should be primarily targeted by screening campaigns.

5.2.9 Conclusions

Inadequate sleep can occur as a result of problems related to its duration, timing or quality.

- » Consequences of inadequate sleep include impaired vigilance, concentration, reaction times, mood and memory;
- » It is associated with increased accident risk;
- » Increased public awareness of the problem is essential;
- » Specific sleep disorders require medical management; and
- » Road and vehicle design needs to take these problems into account.

5.2.10 Driver Behaviour Initiatives

The following driver behaviour initiatives are recommended;

- » Continue promotion of awareness of safe driving practices to include all staff;
- » Involve the Office of Road Safety in the development of strategies and consider a holistic approach to the regional issues;
- » Engage specialist companies to assist with driver training, driver behaviour, stress and fatigue management i.e. AHG in 46 Grogan Road, Perth International Airport, WA, 6105, Tel 9479 5754; and
- » Include the local police in safety initiatives such as road safety talks to the workforce.

5.2.11 Other Initiatives

The following additional initiatives are recommended:



- » Rationalise train operation times, if possible, to avoid peak traffic activity (06h00 – 08h00 am and 16h00 – 18h00) in Mornington Road East;
- » Encourage the workforce to drive on dipped headlights during the day; and
- » Consider the trialing and sponsoring of 'Shoo Roo' device or similar.

5.2.12 Police Enforcement

The following initiatives are recommended:

- » Conduct a programme to increase the use of a Multinova camera in Gastaldo Road. Place the camera in conspicuous locations and use conspicuous signs to alert the workforce of this program;
- » Encourage police presence where practical and commensurate with other duties during peak hour departure on Friday afternoons; and
- » Encourage police presence, from time to time during curfew hours, to enforce restricted travel on HWL and trucks over 19m long and wider than 2.5 m.



6. Consultation

6.1 Consultation with Key Stakeholders

Consultation with key stakeholders to identify concerns and priorities in traffic management was undertaken as follows:

6.1.1 Bechtel Australia

A meeting was held on 1 July 2008 with Bechtel who manage the traffic and logistics for the project.

Bruce Egerton (Procurement and Contracts Manager) and Michael Rose Manager of Purchasing, Traffic and Logistics) were in attendance and the following summary is provided:

- » 5000 - 6000 trucks will deliver material to the project over the contract period (31 months).
- » The routes are Ennis Ave, Mandurah Road, Old Coast Road, Raymond Road, Coalfields Highway, Gastaldo Road. This route will carry an additional 30 - 40 trucks each way per day. 300 - 350 HWL's are likely over the period.
- » The route to Boddington is via Thomas Road, Albany Highway, Bannister Marradong Road. This route will carry an additional 300 trucks each way over the contract period, of which 10 - 20% will be oversized. The height of loads will be cut down to ensure clearance under power lines.
- » No route planning has included the New Perth Bunbury Highway, only existing routes.
- » The maximum vehicle size will be 18m x 6m high x 6m wide.(Module 5m high)
- » The headroom is restricted on Mandurah Road due to a pedestrian bridge just north of Gordon Road. Higher loads will be transported from Bunbury.
- » Bechtel are currently working with Western Power to raise or underground a number of powerlines along the Kwinana - Australind route.
- » Detailed traffic management planning is underway including discussions with Main Roads.
- » Buses are planned to transport staff to and from Perth. 2 - 3 per week, + 10 - 15 local buses per day + 30 - 35 buses per day from the camp to the refinery.
- » No trucks will arrive on site prior to 08h00 to avoid conflict with employees.
- » Regular plans will be provided for truck movements including dates and times.
- » Drivers will be banned from using Mornington Road west.
- » There is a conveyor between the existing minesite and Worsley and a 4wd track.
- » Approximately 1500 people will be located in the camp at Worsley.
- » Truck activity will be planned from Kwinana/ AMC to reduce the need for truck holding areas.
- » The potential location of a truck holding area at Brunswick junction would not be of great benefit in view of the truck route to be used, a holding area in Raymond Road would be of more benefit.
- » A laydown area is currently being provided on the Worsley site.



6.1.2 Collie Police

A meeting was held with Collie Police on 25 June 2006 and the following was discussed:

- » 8 m wide loads have accessed Coalfields Highway in the past;
- » The extent of public highway along Gastaldo Road is not known at this stage and needs to be confirmed to allow speed limits to be enforced;
- » Police have concerns about the range of speed limits along both Gastaldo Road and Coalfields Highway and would like to see this rationalised, i.e. to 80 or 90 km/h;
- » Multinova speed camera will be installed in Gastaldo Road from time to time;
- » It was suggested that employees who use company vehicles sign a declaration to give the Police authority to give infringements to the owner to force them to think about their driver behaviour. Other penalties could be considered by the employer. The Police will speak to their own legal services about this;
- » The Police prefer that Coalfields Highway is used rather than Mornington Road west;
- » Kangaroos are a problem for night time travel. There was discussion about Worsley sponsoring a device called a Shoo Roo or similar device (whistle);
- » The Boyup Brook/ Donnybrook road was also identified as a problem at night due to the presence of kangaroos;
- » A problem was identified in Coalfields Highway at its west end where light vehicles overtake trucks crossing a barrier line in view of the lack of an overtaking lane;
- » A truck holding area was suggested in Brunswick junction near the rail station; and
- » Other developments in the Collie area have increased traffic at peak times (16h45 – 18h00) thereby causing greater delays.

6.1.3 Shire of Collie

A meeting was held with the Shire of Collie on 01 July 2008. The following salient issues were raised:

- » The Coalfields Highway Gastaldo Road intersection is an area of concern;
- » Mornington Road west maintenance (grader work mostly) is ongoing but the sealing of this road is unlikely to take place within the next 3 to 4 years due to limited resources of the Shire. Adequate financial assistance from Worsley Alumina could bring the road upgrade forward.
- » An increase in the number of vehicles through Collie was noted;
- » The Collie Basin Structure Plan and the concept of a Collie bypass road was mentioned.
- » Current planned road works are documented as follows:

Name	Section	Job #	Type	Total \$
Gastaldo Road	SLK 0.00 – 1.00	2507	Reconstruct failed section approx 300m	90,000



Name	Section	Job #	Type	Total \$
			from Coalfields Hwy – Asphalt remainder	
Mornington Road	SLK 13.7 - 15.80	2508	Construct	264,000
Mornington Road	SLK 13.7 – 20.08	9321	Maintenance Grading	50,000
Worsley Back Road	SLK 1.00 – 2.00	2519	Construct 1 km west of second railway crossing	141,518
Worsley Back Road	SLK 0.00 – 9.94	9329	Maintenance Grading	54,000

Note: SLK indicates the distance from the start of the road, i.e Gastaldo Road SLK 0 - 1 is the 1km section of road measured from Coalfields Highway.

6.1.4 Site Inspection with Main Roads

A site inspection of the preferred routes was conducted with Main Roads on 02 July 2008 and the following treatments were considered:

» Coalfields Highway

Rationalisation of the speed limit is not supported. The road is speed zoned in accordance with current standards and road geometry. All bends have been signed to Australian Standard. There are plans to upgrade the Highway to include climbing lanes, Main Roads will check and confirm the locations and timing.

» Gastaldo Road/ Coalfield Highway

Preferred treatment to manage peak hour traffic is to provide traffic control together with temporary speed zoning on Coalfields Highway. Traffic controllers are to be used with appropriate signage.

Stage departures to minimise peak traffic.

Traffic signals would require solid median islands and street lighting, not a preferred option.

Longer term traffic management to include channelisation with painted right turn pocket.

» Gastaldo Road

The speed zoning will be reviewed by Main Roads and is likely to be changed.

Shire of Collie will resurface a section of Gastaldo Road this financial year.

» Mornington Mills Road

Main Roads will speed zone the road, probably to 100 km/h, and provide advisory speed limit of bend at eastern end.

Yellow hatching over the rail line is supported to minimise the risk of queuing onto the line.

» Mornington Mills Road/ Gastaldo Road

Main Roads support improving sight distance to the north by pruning or removing vegetation.

» Mornington Mills Road/ Tallanalla Road



Main Roads support installation of a give way sign and give way marking.

- » Mornington Mills Road to Padstone Road

Main Roads will mark and sign the uncontrolled intersections along this section of road.

Townsite intersections will not be marked.

- » Collie - Williams Road.

This road will be speed zoned and centre lined by Main Roads, possibly within the next 12 months. The road will be the responsibility of Main Roads ultimately.

- » SW Highway/ Coalfields Highway

No traffic management measures are supported. Main Roads prefer that other measures are undertaken to mitigate traffic volumes including the staggering of departure times for the workforce from the accommodation camp/refinery at peak times.

- » Rail Crossing in Coalfields Highway at SW Highway.

It is proposed to undertake works on the rail crossing; this will be undertaken under traffic management, as Coalfields Highway must remain open at all times. A bypass will probably be constructed at the intersection.

- » Raymond Road

This road is now controlled by Main Roads. Main Roads are supportive of a truck embayment for eastbound trucks along a straight section, subject to appropriate design.

- » Car parking in Raymond Road

Main Roads are supportive of rationalising the current poor situation of verge parking near Australind Bypass. It was suggested that the land to the east of that currently proposed could be investigated and either use the current road reserve for access or possibly create a new access. Intersection to a new parking area would probably require widening on Raymond Road to allow through traffic to pass right turning traffic.

- » Raymond Road/ Australind Bypass Intersection

Street lighting is proposed at both this intersection and Paris Road/ Australind Bypass intersection; timing to be confirmed by Main Roads. No other improvement is considered necessary at this stage.

- » Car parking area Coalfields Highway

No significant concerns, plans currently with Main Roads.

6.1.5 Meeting with Catalano

A meeting was held with Catalano's on 11 July 2008. The following points were raised:

- » The traffic procession on Coalfields Highway at 6:30 is of concern;
- » Three notable accidents on the Coalfields Highway involving Catalano's trucks in which the other party was at fault;
- » Approximately 14 Catalano trucks per day each doing 3 trips per day on Coalfields Highway;



- » Observed typical poor behaviour of drivers (not necessarily Worsley Employees) of light vehicles includes: Overtaking on lhs on gravel, overtaking on barrier line, high speed and poor perception of slower moving trucks resulting in rear-ending;
- » Possible solution would be to erect signage to warn drivers that trucks move at slow speeds (typically 20 km/h uphill);
- » Insufficient overtaking opportunities for vehicles on Coalfields Highway;
- » Catalano's service their trucks regularly on a schedule to ensure that no mechanical breakages endanger the lives of others. Care is taken to avoid spillages onto roads;
- » Problem area of Gastaldo/ Coalfields Hwy intersection: Trucks not able to turn right into Coalfields Hwy without a lengthy wait due to oncoming traffic, at any time of day;
- » Regarding parking bays, Catalano's are of the opinion that a truck embayment at the base of the hill (Coalfields Hwy/ South West highway) will be of benefit to their trucks whereas one off Raymond Rd, less so;
- » Parking bays need to be adequately surfaced to suit the heavy trucks pulling off from the parking bay;
- » Sufficient room to be allowed for at truck embayments although Catalano's are likely to schedule their truck movements to accommodate for the curfew;
- » Regarding Mornington Rd West, Catalano's suggest upgrading this road from SW Highway to Gastaldo Road and using it exclusively for heavy vehicles; thereby removing the problem of slow moving vehicles from Coalfields Highway; and
- » Catalano's have no issues on the Collie - Williams Rd due to low volumes of traffic and their once a week movement only of an acid truck.

6.1.6 Shire of Boddington

A meeting was held with the Shire President and CEO at the Shire of Boddington on 10 July 2008. The following was discussed:

- » Lower Hotham Road provides route to Quindanning - Harvey Road, intersection sight distance at intersection with Pinjarra Williams Road could be improved by clearing;
- » Goldmine Road/ Bannister Marradong Road intersection and Camp access/Goldmine Road intersection. Intersection designs were previously designed for the Goldmine works but have not been implemented. Included turn pockets and widening. There is currently potential for rear end collisions due to queuing to access the camp site and crest on the westbound approach;
- » Connell Wagner have recently been commissioned to undertake a traffic study for the townsite to be completed in 2-3 months;
- » HWL route via Farmers Ave and Robbins Road is currently not suitable. Robbins Road will be sealed from the northern end. Robbins Road will be closed midway at the request of the mine, the closure date is to be confirmed;
- » Pinjarra - Williams Road to Dwellingup is a major safety concern due to a lack of passing opportunities and trees in close proximity to the traffic lane. Large number of staff will travel along this road from the Pinjarra area. Travel during sunrise/ sunset is also hazardous. Additional passing lanes are required;
- » Pinjarra-Williams to Quindanning is of a poor standard;



- » Suggestions have been made for improved access on Ashcroft Road;
- » Traffic volumes have increased on the Pinjarra – Williams Road due to the activity in the area. Goldmine will add 26 two way truck movements; and
- » The Shire would like to be kept informed of the outcomes of the study.
- » The following summarises the Shire's works programme:
 - Farmers Avenue - Footpath works 2008/09 – To be completed by private contractor in March 2009. Contract not yet let – No other works planned;
 - Robins Road – 2008/09 Construct and Seal from Farmers Avenue to Council Waste Disposal Site (Approx 3.2 kms) – Contract to private construction company to be completed by December 2008;
 - Morts Road – 2008/09 Reconstruct gravel road at north western end of Morts Road – Commence September 2008 – No other works planned;
 - Redhill Road – No planned works;
 - Lower Hotham Road – Current road of regional significance and works depend on grant funding. Most recent funding application denied – No works expected to receive funding in near future; and
 - Gold Mine Road - No planned works.

6.1.7 Shire of Harvey

A meeting was held with the Shire of Harvey on 10 July 2008 and the following was discussed:

- » Drivers will want to take the shortest route to their destination; usually this is irrespective of road conditions. Shire of Harvey would like to see that traffic stay off Beela Rd. Mornington Rd is also considered hazardous;
- » No plans to upgrade the first portion of Mornington Rd near the SW Highway;
- » Plans are underway for a short section of Mornington Rd to be upgraded this summer where the road is narrow and edge wear has occurred;
- » A formal parking bay near Australind Bypass/ Raymond Road is encouraged. Meadowlands community consultation would be advisable;
- » A truck embayment along Raymond Road (in road reserve along north side) would be supported by the Shire;
- » Many Worsley employees appear to be making use of public parking off Paris Rd near Leisure Drive Community Centre in Australind for car pooling purposes; this has impacted on the availability of parking for the public and would need to be addressed by Worsley;
- » The Shire have confirmed their works program in the vicinity as: 2.5kms of reconstruction to 7m sealed standard on Harvey Quindanning Rd, scheduled for early 2009. The last 3kms of Mornington Rd.to Harvey's boundary will be sealed to a 7m standard scheduled for Feb. 2009; and
- » Peter Kay (9729 0300) will be available for any discussions in Peter Anderson's absence whilst he is on holiday for the next 11 weeks.

6.1.8 Boddington Police

Sgt Mick Sears of the Boddington Police was contacted on 11 July 2008 and the following comments recorded:



- » There has been a rapid increase in traffic volumes in the area to and from Boddington due to the surrounding developments. This has also resulted in an increase in truck movements;
- » Pinjarra – Williams Road (Marradong to Pinjarra) is of concern due to speeding traffic and also the lack of passing opportunities. The provision of holding areas was mentioned to allow trucks to pull in and following traffic to pass. To be followed up with Main Roads by GHD. The Police are aware there is no current funding for overtaking lanes;
- » The workforce numbers are significant at the BGM (2700) which results in a large amount of associated activity and will increase due to the current project;
- » Traffic and safety are of concern on the Albany Highway from Perth, Pinjarra – Williams Road to Pinjarra and through the Townsite due to increased activity;
- » The management of driver behaviour is of concern to the Police; a number of drink driving offences are occurring by the mining workforce. The Police talk to the workforce about driver behaviour as a safety initiative;
- » Quindanning Hotel is a popular destination for workers;
- » The busiest times for traffic numbers and traffic offences are between 2pm and 8pm on a Friday; and
- » There is current discussion about staggering departure times to spread and minimise the peak traffic impacts.

6.1.9 Meeting with Main Roads WA on 22 July 2008

6.1.9.1 Points of Discussion

The overall recommendations were discussed with Main Roads and the following points noted:

- » Gastaldo/ Coalfields Highway intersection: Widening of left turn pocket (currently sight lines for traffic exiting Gastaldo onto Coalfields are affected by traffic turning left off Coalfields onto Gastaldo) is costly option that MRWA have declined. High cost probably due to existing service relocation or aboriginal heritage issue (unlikely). However, this land belongs to WAPL and if WAPL were to fund the widening of the left turn pocket, then MRWA would be in support of this treatment;
- » Gastaldo/ Coalfields Highway intersection: Not a MRWA priority because Gastaldo is a WAPL sideroad. Standard of lighting required to be determined. Full lighting or flag lighting only 50/50 funding arrangement with Shire if instigated by Shire of Collie. WAPL funding would ensure this happens earlier but high cost expected due to power supply;
- » Australind Bypass/ Raymond Rd: Cost of lighting probably closer to \$200,000. If WAPL were to fund this, installation of flag lighting could be installed in the short term;
- » Mornington/ Gastaldo intersection (West side of stagger): Acceleration lane onto Gastaldo is likely to cause complications for the opposite intersection of the stagger for Mornington through traffic to Collie. MRWA not in favour of this treatment;
- » Mornington/ Gastaldo intersection (East side of stagger): Construction of a left turn pocket for Gastaldo traffic turning left into Mornington Rd East supported subject to design;
- » Collie Roads signs and lines: WAPL funding favoured by MRWA but maintenance thereof to be agreed with MRWA or Shire;



- » Pinjarra/ Williams (Marradong to Pinjarra): Tactile edge lines have limited value because they restrict the travel widths and increase the possibility of head on collisions between wide vehicles. Sealing of shoulders before installing tactile edge lines is the MRWA preferred approach. Truck embayments are envisioned within the forthcoming year;
- » NB a plan of permit routes (networks 1 - 5) exists online on MRWA website; and
- » SW Coachlines is conducting a study to provide bus service for the likes of Worsley, Blue Waters, Muja, Premier Coal, etc.

Main Roads have advised of the road network accessibility for permit vehicles as follows:

- » Pinjarra - Williams Road (Marradong to Williams- Collie Road no permit vehicle access.
- » Williams-Collie no permit vehicle access.
- » Albany Highway Network 4/ 5 vehicles.
- » Coalfield Highway Network 3/ 4/ 5 vehicles.
- » Pinjarra - Williams Road (Greenfields Rd to Marradong) Network 4 vehicles.
- » Bannister – Marradong Road Network 4 vehicles.
- » Gastaldo Road Network 3 Vehicles

Vehicle categories are as follows:

Network 3 Vehicles

- » Prime-mover, semi trailer towing 5 axle dog trailer (19 m - 27.5 m)

Network 4 Vehicles

- » Prime-mover, semi trailer towing 6 axle dog trailer (19 m - 27.5 m)

Network 5 Vehicles

- » Prime-mover, semi trailer towing 5 axle dog trailer (27.5 m - 36.5 m)
- » Prime-mover, semi trailer towing 5 axle dog trailer and a converter dolly (27.5 m - 36.5 m)
- » B-Double towing a convertor dolly (27.5 m - 36.5 m)
- » B-triple (27.5 m - 36.5 m)

6.1.9.2 Main Roads Current Plans

The following summarises Main Roads current plans for road works in the region:

- » Pinjarra - Williams Road (Marradong to Quindanning)

Planning & Design for widening single lane seal and \$200,000 Safer Roads Program 2008/09.

\$200,000 is available in Main Roads 2008/09 budget under the Safer Roads Program to undertake planning and some design for the widening of this section to two lanes. There is currently no confirmation of actual construction funding however such will be considered in 2009/10 and if funded will likely be allocated over a few years.

- » Pinjarra - Williams Road, (Dwellingup - Pinjarra)

Planning for Greens Hill improvements



Main Roads is currently undertaking preliminary planning to identify possible solutions to provide an upgrade at this location. There is no timeframe for funding to undertake construction.

Planning for widening/ improvements.

The section has some priority however at present apart from recently completed widening (3km) there is no funding to undertake further widening on this section.

Truck embayments are envisioned within the forthcoming year;

Main Roads has funding in 2008/09 to complete parking bays between Dwellingup and Boddington. Three parking bays are proposed and are programmed for construction in the near future (prior to Christmas). No parking bays are funded on the Pinjarra to Dwellingup section.

- » Pinjarra - Williams Road, (Marradong - Pinjarra) Unfunded Work

Climbing Lanes; (no planning commenced, funding very unlikely)

Greens Hills upgrade incl. Climbing Lane (Eastbound); and (as above, planning in progress, no construction funding)

Widening / Shoulder Sealing (some curve improvement). (some planning commenced, no construction funding)

For all the above Main Roads is undertaking some planning works however there is no funding available at this time and hence no indication of likely timeframes for construction.

- » Pinjarra - Williams Road, (Marradong - Quindanning) Unfunded Work

Widen Single Lane Seal. As above

Specific maintenance/road works, costs and the timing for any works on:

- » Pinjarra - Williams Road (Bannister - Marradong Rd to SW Highway)

Reseal of the road between over 18 km (4 km west of Dwellingup to 14 km east of Dwellingup) likely in 2009/10 or 2010/11. Currently assessing the cost of sealing the shoulders (0.5m) later this year as part of preseal works however unless gravel can be obtained locally this is unlikely to proceed.

- » Pinjarra-Williams Road (Bannister - Marradong Road to Harvey Quindanning Road)

Normal upkeep of the gravel shoulders only

- » Williams - Collie Road

Nil

- » Coalfields Highway (Paull Rd to SW Highway)

Shoulder sealing (0.5m) is proposed in 2008/09 west of Allanson for around 2 km to complete this interim treatment which commenced 2 years ago just west of the Wellington Dam turnoff.

- » Bannister - Marradong Road

Reseal proposed around 2010/11 for 6 km west of Albany Hwy

Reseal proposed around 2009/10 for 2.5 km west of Boddington. Sealing of the shoulders (0.5m) is programmed for later this year as part of preseal repairs.

- » Raymond Road.



Nil (resealed in 2007/08)

6.1.10 Worsley Alumina Community Liaison Committee, Mining Sector (WACLCL), Chairman

A number of suggestions were raised by (WACLCL), these are summarized in this section, with appropriate responses by GHD.

- » Installation of appropriately located slow passing lanes between Boddington and Burnside Road catering for both directions, not just at Green's Hill.
Response: Overtaking lanes supported and recommended.
- » Consideration given for BGM to install a private access road from their site through the old Hedges mine site to the Pinjarra/Williams Road. This option would utilise the Hedges haul road and access alignments giving a shorter haul route and bypassing Boddington townsite.
Response: Opportunities to reduce traffic through Boddington Townsite would be supported and could be further considered by BGM.
- » The junction of Soldiers Road and Bannister-Marradong Road must be upgraded to allow for increased traffic volumes all directions and the safe passage of through traffic not using Soldiers Road.
Response: Intersection improvement supported and recommended.
- » I believe there have been schematic plans prepared some time ago for a bypass road deviating around Dwellingup townsite; this could be revisited.
- » I have had a comment passed onto me that there are or may become some anomalies occurring with the length of vehicles permitted to use the Pinjarra/ Williams Road and that some existing vehicles servicing rural industry may be disadvantaged. This is rumour only and may or may not have any substance but should be clarified.
- » When considering the proposed closure of Robins Road because of bauxite mining in the area, Ashcroft Road should be considered for upgrade to at least the same standard as an alternative to Robins Road for land owners and residents of the Morts Road area.
Response: The creation of additional accesses to Pinjarra - Williams Road increases potential conflict. It is understood that Robins Road will be sealed from Farmers Ave which will facilitate access to Morts Road.
- » There are some concerns that if mining is to occur on both sides of Morts Road any future plans to attempt to close Morts Road be opposed in lieu of deviating the road around the ore pods.
Response: It is important to maintain access for land owners and implications and opportunities for access would need to be carefully considered.

Comments at the first bullet point are with the support of the Worsley Alumina Community Liaison Committee, Mining Sector. All other comments are either the Chairman's or drawn from comments from the community.

6.1.11 Interview with Refinery CLC's Chairwoman

The following salient issues arose from an interview with Refinery CLC's Chairwoman on 11 July 2008:

- » Coalfields Hwy issues: lack of passing lanes, reduce speed limit to 100 km/ hr, encourage car pooling;



- » Mornington Road West; alignment and width of original section needs to be addressed;
- » Gastaldo Rd Coalfields Hwy intersection is major area of concern;
- » Wellington Dam Turnoff from Coalfields Hwy does not allow for vehicles to enter at peak times. Sight lines are also poor; and
- » Curfew hours should also allow for school busses.

6.1.12 The Griffin Group

The Griffin Group has advised the following in relation to the construction of the 4 new Power Stations in Collie:

- » Griffin is building up to four coal fired power stations near Collie. Construction is already underway on the first two. There is already a significant construction workforce making the trip along Coalfields Highway up the hill and down again each day;
- » Up to 1000 contractors are currently on site for the construction of PS 1 and 2. It is estimated that 6-700 construction workforce come from Bunbury and car pooling is promoted. If an average of 2 persons per car are assumed then this would result in 3-350 cars each way;
- » By Aug/Sept 2009 construction workforce numbers will be down to 400;
- » Numbers will then peak again at around 600 for the construction of 3 and 4, in 2011. Power Station 3 will be commissioned in 2012 and 4 in 2014;
- » Around 200 construction workforce are in the accommodation camp in Collie-Williams Road located 6-7km outside Collie.
- » Current traffic movements are in the order of 600vpd (two way) through Collie;
- » 50% of current work force live in Collie and 50% Bunbury area;
- » Main traffic route for construction traffic is Coalfields Highway;
- » Rail is the preferred transport for the Mine Expansion for Coal Export. However, in view of infrastructure limitations, there may be some additional road traffic;
- » There are 40 B-Double movements through Collie each day for existing contracts. Truck movements will not increase;
- » Existing peak construction traffic movements will not increase;
- » Car pooling is encouraged by the company;
- » Truck fleet is well maintained with air suspension; and
- » Old Coast Road and SW Highway are used depending on size of load.

6.1.13 Boddington Goldmine

A telephone discussion was held with Neil Wolfgang who advised the following:

- » The current construction workforce is 2000;
- » This will increase to 3000 for a period of 6 months;



- » The workforce currently use their own vehicles to access the accommodation camp in Goldmine Road and are bussed to the mine site;
- » Most traffic use Albany Highway to and from Perth;
- » A permanent workforce of 650 is planned and it is anticipated that around 66% will come from the Boddington area;
- » 20 acid truck movements (40 two way) will be added to the Pinjarra-Williams Road to and from Bunbury following construction during the latter half of 2009, on-going for a number of years;
- » Most of the oversize loads have already been transported to site;
- » Currently up to 50 two way truck movements could occur and will continue over the next 4-5 months, most use the Albany Highway, Bannister-Marradong Road, Goldmine Road route. These vehicles are semitrailers and B-Doubles; and
- » Not aware of existing safety issues associated with the transportation of materials and equipment as these are well managed by the company.

6.1.14 FESA Boddington

A telephone conversation was held with FESA in Boddington who advised as follows:

- » No issues are anticipated regarding emergency response due to the mineworks.
- » The requirement for heavy lifting equipment will be pursued.
- » The lack of adequate passing opportunities on Pinjarra - Williams Road (Bannister - Marradong Road to Dwellingup) was emphasized. Complaints are often received about peak hour travel.
- » Improvement could be made to the Bauxite mine intersection to include turning lanes and an acceleration lane from the access road into Pinjarra – Williams Road.

6.1.15 SES Collie

- » The bus accident simulation at WAPL was cancelled due to bad weather but the simulated evacuation of Collie Hospital is imminent. Main concern is the availability of sufficient firemen, police and volunteers to close off roads and divert traffic.
- » In regard to the increased traffic on the roads from E&G Project, SES are concerned that Blue Waters construction is still in progress and the combined number of vehicles in both directions on the back roads of Collie will lead to increased risks for school children and school buses;
- » Signage and markings of intersections on the back roads of Collie (Collie Pinjarra road) are considered to be inadequate;
- » Roads are more congested thereby reducing response time for emergency vehicles (taken from questionnaire);
- » Drivers tend to become more impatient and increased risk of accidents (taken from questionnaire);
- » Road conditions are becoming worse due to increased heavy traffic (taken from questionnaire);
- » Suggestion to divert all traffic to Worsley from Perth end via road from Wokalup Research Station. This will decrease traffic coming up the hill on Coalfields Highway (taken from questionnaire).



6.2 Suggestions from Worsley Alumina Workforce

The Worsley Alumina workforce were invited to comment on a range of recommendations around road conditions, preferred travel routes, public transport options, driver behaviour and controls such as heavy vehicle curfews. The full list of 78 email responses is included in Appendix F.

6.2.1 Comments and responses:

Comments received from the Worsley Alumina workforce are generally summarized and suggested responses provided thereto, as follows:

- » Build a new permanent office at Construction site and relocate non essential staff. Alternatively, other off site location. Suggested response: Could have benefits for on site movement and the practicality could be considered by Worsley.
- » Speed limits, traffic control, exclusive turn lane Mornington Rd, use of buses, lighting Mornington/Gastaldo, improve delineation, stagger work hours, increase police presence. Segregate incoming traffic movement from outgoing traffic at car park entrances. Suggested response: Above suggestions are generally being addressed.
- » Increased truck traffic on Pinjarra Road-Williams Road a hazard. Suggested response: Measures are being recommended for Pinjarra-Williams Road. Main Roads also have longer term plans for additional overtaking lanes between Pinjarra and Marradong. This route is not considered to be of a good standard and improvements are required.
- » Increase use of buses and provide security at car park. Suggested response: Locations for parking areas should be developed to maximize use by including a bus transfer.
- » Increased traffic on Mornington Road of concern and seal road. Overhanging trees. Straighten bends. Suggested response: Mornington Road is not a preferred route to SW Highway. The intersection with SW Highway is poor and constrained by the rail crossing in close proximity to the intersection. Workforce should be encouraged not to use this road. In the short term, overhanging trees should be pruned. In the longer term the road should be upgraded to acceptable standards and the intersection with SW Highway upgraded.
- » Fog; poor delineation; headlights to be used in poor conditions; install highly visible warning signs; left turn lane into Mornington Road; seal and widen Mornington Road. Suggested response: Agreed that fog is a problem, Main Roads have installed tactile edge lines along Coalfields Highway and have upgraded signs to Australian Standards. Main Roads do not support additional measures. A left turn lane in Gastaldo Road at Mornington Road is not supported in view of the limited clearance to the rail crossing.
- » Safety Issues at Raymond Road/ Australind Bypass due to informal verge parking area. Suggested response: Agreed, as part of the provision of a car parking area this existing area should be removed.
- » Increase number of bus pick up points. Suggested response: Bus pick up points to be investigated and bus transport to be developed.
- » Bus Sponsored by Worsley. Suggested response: The provision of a bus sponsored by Worsley is supported and will have benefits for safety and reduced traffic. Pick up locations to be developed.
- » Pinjarra Williams Road (Marradong to Quindanning) single lane sections safety concerns. Road needs upgrading. Suggested response: It is agreed that this road is of a poor standard and requires upgrading to an acceptable standard.



- » Staggered start/finish time. Suggested response: This will provide benefits for traffic activity and intersection operation at peak times.
- » Upgrade Mornington Road west, currently a safety hazard. Suggested response: Requires upgrade of intersection with SW Highway also.
- » Reduce speed limit on Gastaldo Rd. Suggested response: Being reviewed by Main Roads.
- » Provide a regular bus service. Suggested response: Will provide benefits by reducing traffic movements.
- » Remove all people in service functions currently on site and place them in Bunbury. Suggested response: Would provide traffic benefits however practicality for consideration by Worsley.
- » Extend the overtaking lanes along Coalfields Hwy incorporating a "Turn Left Only Lane" being displayed half way along the 2 lanes with maybe an island separating the lanes. Suggested response: Additional overtaking lanes could be supported together with improvement to the left turn lane.
- » Extend the stop line from Gastaldo Road a little to allow drivers to have a better vision. It would be so much easier to work out where the traffic is going and therefore allowing drivers who are entering the highway better vision. Suggested response: Modifications recommended.
- » 'Cats Eyes' on left hand edge of road would increase visibility in bad weather i.e. mist/fog and reduce the need to slow down so you can drive between the 'Cats Eyes'. Suggested response: Delineation improvements are generally supported with guideposts and edge lines adopted by Main Roads.
- » Street lighting installed at intersection of Raymond and Old Coast Rd – visibility is very poor. Suggested response: Planned by Main Roads.
- » Parking lot at Raymond Rd too close to corner – remove existing parking lot. Suggested response: Recommended as part of study.
- » Slip road for the left turn off into Mornington Road East. Suggested response: Feasibility design required.
- » Gastaldo Rd turnoff from Coalfields Hwy very dark. Suggested response: Street lights recommended as part of this study.
- » Visibility poor at corner of Mornington and Gastaldo Rds travelling onto Gastaldo Rd. Even though speed limit has been reduced to 90 km/h. More cars could cause this to be hazardous. Suggested response: Improvements recommended.
- » Overtaking lanes to start at base of Coalfields Highway. Suggested response: Supported, requires Main Roads approval and funding.
- » Widen Pinjarra-Williams (Marradong to Quindanning. Suggested response: Recommended as part of this study.



- » Brighter centre lines and more 'Cats Eyes'. Suggested response: Improvements to delineation, line marking and RRPM's recommended.
- » Police presence on highway in peak hour. Suggested response: Initiative recommended commensurate with other duties.
- » Anti Kangaroo whistles as give away. Suggested response: Supported and could be considered by Worsley.
- » Passing lanes on Pinjarra - Williams Road (Pinjarra to Marradong). Suggested response: Recommended as part of this study.

6.2.2 Car Pooling

The following initiatives relate to car pooling for consideration by Worsley Alumina:

- » Fuel vouchers at random every week to people that car pool as incentive for others to car pool;
- » Fuel allowances for car poolers;
- » Better off-site parking facilities for car poolers;
- » Incentive to car pool by Worsley; and
- » Additional car pool parking areas in Australind – Raymond Rd/ Australind Bypass is nearly full by 06h00, as are other areas in Australind.

6.2.3 Acknowledgement and Elevation of Issues to the Appropriate Authorities

Worsley Alumina has undertaken to contact respondents in acknowledgement of their input and to advise the outcome of the survey.

It is recommended that issues raised by respondents that are not dealt with in this survey being outside the scope of the study, are elevated by Worsley Alumina to the attention of the appropriate authorities.

6.3 Suggestions from Public

6.3.1 Questionnaire Survey

A questionnaire survey was selected as an appropriate method of facilitating community/ stakeholder input on issues around road conditions and preferred travel routes. The questionnaire containing a map of the study area and brief questions to establish respondents' mode of travel, usual travel route and views on road and traffic issues and solutions, was emailed or posted out to addresses provided by a Worsley Alumina database.

Members of the public who responded to newspaper articles by phoning in with comments were either sent the questionnaire or auditioned over the phone, depending on their preference.

A total of 78 letters were posted out of which 19 responses and 6 "return to sender" were received. 73 emails were sent and 15 email responses were received.

Respondent's letters and emails received are attached in Appendix G.



6.3.2 Summary of Respondent's Issues and Comments

Issues raised and comments received from stakeholders, in response to the questionnaire survey, are summarized hereunder. A suggested response follows the issues raised.

- » Entering, and leaving driveway onto Coalfields Rd from Lot. 2983; Traffic lights at Cnr Coalfields Hwy & Gastaldo Rd. Response: Main Roads are not supportive of traffic signals;
- » No traffic enforcement when traffic is heavy. Suggested response: Recommendations are made in relation to enforcement;
- » Too many slow moving vehicles; more passing lanes; restrict over width trucks to non busy road times; reduce max speed to 100 km/h; slip road into Worsley Refinery of Highway; impatient driving attitude of Worsley workers. Suggested response: Recommendations are made for overtaking lanes and curfews are in place by Worsley. Speed limits have been considered together with intersection improvements.
- » Cars pulling out in front of traffic from Gastaldo Rd onto Coalfields Highway at high speeds. Response: Improvements recommended; volume of traffic on afternoon shift change. Suggested response: Staggered departure times and traffic management recommended.
- » Gastaldo Rd, rough surface; lower the 110 km/h speed limit along Gastaldo rd; "T" Junction at Worsley Rd & Gastaldo Rd dangerous. Suggested response: Road surface repairs to be carried out by the Shire of Collie. Speed limit review of Gastaldo Road to be undertaken by Main Roads. Improvements are made for Old Worsley Rd and Gastaldo Rd intersection.
- » Turning left onto Coalfields Hwy, entry point onto Gastaldo Rd, visibility either way on foggy mornings, visibility to the west, car headlights, can't see who's turning off, and who is going straight ahead, access road from Coalfields Hwy onto road going towards Worsley, for traffic from Bunbury. Suggested response: Intersection improvements recommended. Daylight headlights supported.
- » Heavy vehicle use on Coalfields Hwy; between 06h00 and 20h00 Hwy is very busy; proposed shift changes at Worsley and Blue Water; water ponding on Coalfields Hwy during heavy rainfall; some trees along Gastaldo Rd are to close, require trimming back; entrance of Gastaldo Rd for 1st km, needs resurfacing; decent car/ truck wash station to clean vehicles would be beneficial; installation of lights at Gastaldo Road. Suggested response: Intersection improvements recommended and traffic management at peak times. Some road surface repairs are planned by the Shire of Collie this financial year. Main Roads are not supportive of traffic signals at Gastaldo Rd/ Coalfields Highway. Speed review along Gastaldo Road to be undertaken by Main Roads.
- » T-Junction of Coalfields Hwy and Gastaldo Rd, lights could be installed, slipway widened, straightening of road on turning into Gastaldo Rd; T-Junction of Worsley Back Rd & Gastaldo Rd, corners cut back, speed limit reduced, better signage, barrier sign installed; potholes on Gastaldo Rd needs to be repaired and regularly checked due to increase of traffic. Suggested response: Note previous responses.
- » Intersection at Gastaldo Rd and Coalfields Hwy; speeding, and lack of patience; rising and setting sun. Suggested response: Note previous responses.
- » Heavy vehicles moving slowly; overtaking lanes should be on straight sections, not on downhill sections and bends; not enough warning for Worsley turn off; "Switch on Headlights" sign needed on Coalfields Hwy. Suggested response: Note previous responses. Intersection warning signs recommended for Old Worsley Road.
- » Sun shining in eyes on return trip; Raymond Rd - Australind Bypass Rd intersection poor visibility of turning; Raymond Rd - Australind By Pass Rd intersection traffic parking too close to corner; education,



close monitoring by Police, stress management procedures. Suggested response: Consideration to be given to creating new parking area and relocating existing parking area in Raymond Road in close proximity to Australind Bypass. Longer term plans to upgrade the Raymond Rd/Australind Bypass intersection.

- » Leaving our farm onto an already very busy road there is no opportunity to enter traffic; turning across oncoming traffic to enter back into our farm requires all following traffic to stop; the road needs a slip lane going east and west added on the north side with an apron to the farm gate. On the south side the road needs to have a turning lane added. Alternatively, access to our farm could be established off the "Old Worsley Road. Suggested response: Longer term measures require support of Main Roads. Shire should be contacted regarding alternative access.
- » Slip lane heading east is insufficient in vehicle capacity and needs to be enlarged and lit (electric light) for night time visibility; the turnoffs from Old Coast Road into Raymond Road are extremely unsafe for night time driving, corner needs to be lit (electric light), signs indicating the way to Collie (and hence Worsley Refinery) are totally inadequate - the signs are easy to miss; turning lanes on Coalfields Highway travelling west from Collie should also be considered. Suggested response: It is recommended that street lighting is installed at the intersection of Gastaldo Rd/ Coalfields Highway and Raymond Rd/ Australind Bypass. Longer term recommendations are made for intersection improvements.
- » High volume of traffic AM & PM; unsealed narrow alternative routes to Coalfield & SW Hwy. Suggested response: Note previous responses. Section in report covers Mornington Road west.
- » Speed; police, speed cameras, new Perth Bunbury Hwy will greatly assist; change from median separated dual lane to single lane with no median separation. Suggested response: Increased Police enforcement recommended.
- » Mornington Rd to Wokalup needs bitumizing. Suggested response: Section in report covers Mornington Road west.
- » Seal Mornington Road. Suggested response. Note previous response.
- » Mornington Road West poor road condition; muddy/ potholes in winter; dusty/low visibility in summer; traffic travelling too fast. Suggested response. Note previous response.
- » Mornington Rd West 10km of gravel road must be bitumised as a matter of urgency, white lines, centre and side should be painted, and speed limit reduced to 80 km/h; Kangaroos vs vehicles; school bus travels along this road; traffic not expecting oncoming vehicles. Suggested response: Note previous response regarding Mornington Road west.
- » Mornington Road West gets quickly degraded into a corrugated single lane entity which is very dusty in summer, and very slippery in winter; road needs to be bitumised as soon as possible; many drivers from Harvey and Northwestern end of Worsley use this route, significant shift traffic on it; lots of learner drivers on road, due to school in vicinity; buses entering and departing college to Wokalup farm site; speed limit of 70 km/h to be imposed; suggest school zone be created in area of college at foothills of Mornington Rd and South western Hwy; policing of speed limits; installation of boom gate crossings on the railway line. Suggested response: Note previous response regarding Mornington Road west.
- » Mornington Road West kangaroos & cows; road not wide enough; gravel road, dust and mud; last part of Mornington rd could be bitumised. Suggested response: Note previous response regarding Mornington Road west.



- » Complete Seal of Mornington Road. Suggested response: Note previous response regarding Mornington Road west.
- » Intersection with Coalfields Road, divided road right hand turn from both Victor & Wellington Dam Roads; refuge space in middle of road, with solid wedge-shaped obstacle to separate traffic at this point; slow vehicles, trucks, motor homes from camping areas; poor visibility as Coalfields Hwy traffic rounds bend, at 100km/h reaction time is short to get onto Coalfields road from Wellington Dam Rd. Suggested response: Suggest this be brought to the attention of the Shire and Main Roads.
- » “Concealed Driveway” sign placed either side of his property on Coalfields Hwy Lot 2983. Suggested response: Suggest this matter be brought to the attention of Shire and Main Roads.
- » Stop sign needed at junction Mornington Rd & Harris River Rd. Response: Sign and line marking recommended; overtaking lane on Roelands Hill to be extended approx. 0.5 km up to parking bay; another overtaking lane between 14 and 16 KL section. Suggested response: Longer term plans by main Roads for improvements.
- » Drivers shouldn’t be in such a hurry & use common sense. Suggested response: Driver behaviour training necessary.
- » More buses available from and to refinery ie. Roelands to refinery, Australind to refinery, Eaton to refinery, reducing car volume. Suggested response: Recommendations made in relation to use of buses.
- » Use buses to transport workers; encourage workers to carpool. Suggested response: Recommendations made in relation to use of buses and car pooling.
- » Unable to pass on priority on road, Boddington-Hwy, Boddington-Mandurah, Boddington-Quindanning; verges for vehicles to pull off; travel slower going into Boddington & out of township. Suggested response: Longer term plans for upgrades.
- » Traffic Management need to be addressed i.e. times for heavy vehicle movement; more police presence during expansion; contact Main Roads for some input. Suggested response: Recommendations made in relation to traffic management, curfews and enforcement.
- » Buses to commute workers to & from Collie to reduce vehicles on road. Suggested response: Note previous responses.
- » Worsley to provide bus service for workers, to and from Worsley. Suggested response: Note previous responses.
- » Congestion of roads for emergency vehicles, reducing response time; road condition becoming worse due to increased heavy traffic; divert all traffic to Worsley (from Perth end) via road from Wokalup Research Station, this will decrease traffic coming up “the hill. Suggested response: Traffic management recommended for peak times. Alternative routes need to be of a high standard to be considered viable.
- » There will need to be constructive dialogue between all road authorities (Main Roads WA and the Shires of Collie and Harvey). Suggested response: Is being undertaken as part of this project.
- » Maintain staggered shift changes; provide transport for workers. Suggested response: Note previous responses.
- » Poor visibility at intersection of Pinjarra - Williams Rd, and Lower Hotham rd, looking towards Pinjarra; Farmers Ave – Boddington, narrow local road, will have increased traffic, needs upgrading. Suggested



response: Recommendations made in relation to HWL. Pruning to be undertaken where required to improve sight distance at intersections.

- » No passing opportunities for 75 km, between Boddington & Pinjarra (Boddington and Burnside Road); install reflective line marking for heavy fog; use of Bannister Road, Bannister/Marradong and Pinjarra - Williams Road between Soldiers Road and Hedges access road should not be permitted for transport of copper from BGM; signage and driver awareness for hilly and narrow road. Suggested response: Longer term plans for climbing lanes. Delineation recently improved by Main Roads.
- » Danger at "T" section of Harris River Road and Mornington Mill Rd; speed & traffic; needs bigger and better signage on intersection, signs further back from intersection; possible double lines all the way, no overtaking. Suggested response. Sign and line marking recommended.
- » No heavy vehicles to use McKinley Str; people speed to and from work, and has had two accidents in her garden; people think that McKinley St is start of freeway. Suggested response: Significant additional traffic volumes not anticipated to use this road.
- » Pinjarra-Williams Rd, between mine & Quindanning narrow bitumen; not suitable for large truck traffic. Suggested response: Agreed, poor standard road, and recommended for upgrade.
- » Seal Mungalup Pile Roads, seal Harvey Quindanning road, seal Tallanalla Road. Suggested response: For Shire to consider.
- » Provide passing lanes between Boddington & Burnside Rd turnoff; avoid driving during sunrise and sunset; Green Hill, upper railway crossing bad alignment; clear forest to widen road; stagger shift change times; increase mobile coverage; widen Boddington Main Street. Suggested response: Refer previous responses and main body of report.

6.3.3 Acknowledgement and Elevation of Issues to the Appropriate Authorities

Worsley Alumina has undertaken to contact respondents in acknowledgement of their input and to advise the outcome of the survey.

It is recommended that issues raised by respondents in the questionnaire survey, which are not dealt with being outside the scope of the study, are elevated by Worsley Alumina to the attention of the appropriate authorities.



Appendix A
Location Plan



Appendix B

HWL Assessment for SW Highway, Coalfields Highway, Gastaldo Road and Bunbury Port to Raymond Road

(Note: All estimates in this section are no longer current and are for information only)



Appendix C
New Perth-Bunbury Highway



Appendix D
Possible Short-Term Measures



Appendix E
Possible Long-Term Measures



Appendix F
Worsley Alumina Workforce Responses



Appendix G
Public Questionnaire Survey Responses



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