

Latrobe City Council

Moe – Glengarry Road to Waterloo Road, Moe, Railway Level Crossing



Traffic Engineering Report

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EXECUTIVE SUMMARY

There are two access routes to the central area of Moe from the Princes Freeway and the residential areas to the south of the railway line. The western access route incorporates a railway level crossing between the Moe – Glengarry Road and Waterloo Road. B Double trucks are permitted to use Waterloo Road at the railway crossing in the northbound direction only.

The railway tracks are located within 20 metres from the Moe – Glengarry Road and the rear of semi trailers extend across the tracks while waiting at the intersection. A review was undertaken of the safety and traffic operation of the intersection and railway crossing.

The review included peak hour turning movement counts, assessment of the existing traffic operation and reported traffic accidents at the intersection of the Moe – Glengarry Road and Waterloo Road. The existing intersection operates satisfactorily with low levels of congestion and short traffic queues.

Four options were prepared for the upgrade of the intersection and railway level crossing to address the identified issues. These options included metered traffic signals at the intersection of the Moe – Glengarry Road and Waterloo Road, a modified intersection, large roundabout and full signalisation of the intersection.

The width of the pavement at the railway crossing would have to be increased if B Doubles trucks were permitted to use Waterloo Road in both directions. This would involve relocation of the boom barriers, flashing lights and warning bells on the east side of the crossing.

Assessment of options

The concept plans of the four options were discussed with VicRoads, VicTrack, Department of Transport, local community groups and Council staff. There was little support for the options involving the modification of the intersection and the large roundabout.

The metered traffic signals of the intersection of the Moe – Glengarry Road and Waterloo Road would be the lowest cost option. The traffic signals would be activated by the approaching train and any vehicles on the crossing in Waterloo Road would have a green light to clear the area prior to the boom barriers coming down. This option would maintain the current intersection operation when there was no train approaching the crossing.

The full signalisation of the intersection would increase the length of the traffic queues over the existing operation. The intersection traffic signals would include a train signal phase activated by the approaching train. The full signalisation is considered to be the best long term option.

The cost of the traffic signal options, including the VicTrack electrical works, varied from \$1,039,850 for the metered traffic signals to \$ 1,087,950 for the full signalisation of the intersection.

1. Introduction

There are two access routes to the central area of Moe from the Princes Freeway and the residential areas from south of the Melbourne – Traralgon railway line. The western access route incorporates the railway level crossing between the Moe – Glengarry Road and Waterloo Road. B Double trucks are permitted to use the railway crossing in the northbound direction only.

The Melbourne – Traralgon railway line is located midway between Moe – Glengarry Road and Waterloo Road with a clearance of approximately 20 metres between the tracks and the intersection. Semi trailers often have to queue across the tracks while waiting for a gap in the Moe – Glengarry Road traffic.

This Report reviews the safety of the level crossing and the traffic operation of the intersections either side of the railway line. During the course of the Study, intersection turning movement counts have been carried out, assessment of the reported casualty crashes in the area and preparation of concept plans for upgrading of the crossing. Discussions have been held with representatives of the Latrobe City Council, VicRoads, VicTrack and transport operators.

2. Existing Conditions

2.1 Road Conditions

2.1.1 Moe – Glengarry Road

Moe – Glengarry Road is a VicRoads declared main road and is classified as an arterial road in the Latrobe City Council Road Hierarchy. It extends from the Princes Freeway at the western end of Moe to Tyers north of Traralgon. In Moe, it includes Lloyd Street, Narracan Drive and John Field Drive.

It is a two lane, two way road with residential development on the south side and the railway reserve on the north. The pavement is 12.8 metres wide with a centreline marked. There is kerb and channel on the south side and an unsealed shoulder on the north side.



Photograph 1 Moe – Glengarry Road on west approach to intersection with railway crossing



Photograph 2 Waterloo Road west of the intersection with the railway crossing

2.1.2 Waterloo Road

Waterloo Road runs parallel to, and to the north of, the Melbourne – Traralgon railway line between Trafalgar and Moe. It is classified as a Rural Collector Road on the west side of the railway crossing in the Latrobe City Council Road Hierarchy Plan.

Waterloo Road is classified as an Urban Link Road in the section between the intersection with the railway crossing and Saviges Road.

West of the intersection with the railway crossing, Waterloo Road is a two lane, two way road with concrete kerb and channel on both sides. The pavement is 12.8 metres in width. The parkland on the north side extends to the Mitchells Road intersection with residential development further to the west.

East of the intersection with the railway crossing, there is a central median separating the short right turn lane and the through traffic lane in the southbound direction and the northbound lane. The development on the north side consists of the Apex Park and Moe Racecourse. The railway reserve occupies the south side of Waterloo Road.

The speed limit on the east approach to the railway crossing is 60 km/h. On the west approach, there is a 50 km/h speed limit in the residential area



Photograph 3 Waterloo Road east of the intersection with the railway crossing



Photograph 4 Railway level crossing between Moe – Glengarry Road and Waterloo Road.

2.1.3 Railway Level Crossing

The railway crossing is located midway between the intersections with the Moe – Glengarry Road and Waterloo Road. There is a single train track approximately 20 metres from each intersection.

There are boom barriers and flashing lights at the crossing. The pavement at the level crossing is 12 metres in width providing for two traffic lanes in the northbound and southbound directions. There is concrete kerb and channel on both sides of the road on both approaches.

At the intersection with Moe – Glengarry Road, there are right and left turn lanes on Waterloo Road controlled by a Give Way sign.

There is yellow box marking on the pavement in the westbound lanes on the approach to and across the railway crossing. Warning signs have been installed on the westbound approach advising vehicles to keep clear of the crossing.

Several vehicles, including trucks were observed queuing across the pavement at the crossing from the Moe – Glengarry Road intersection.



Photograph 5 Cars queuing across railway lines even with yellow box crossing marking.



Photograph 6 Semi trailer extending across railway lines when queued at Moe – Glengarry Road intersection.

The flashing lights and bells at the railway crossing start operating approximately 60 seconds before the train arrives at the crossing. The boom barriers come down 20 seconds prior to the train arriving at the crossing.

The boom barriers and flashing lights continue until 15 seconds after the train has passed through the crossing. The total time between the start and end of the flashing lights and bells at the crossing is 85 seconds.

2.2 Traffic Volumes

The Latrobe City Council carried out automatic traffic counts on the Moe – Glengarry Road (Lloyd Street) and Waterloo Road in June and September 2009 respectively. The traffic counts were carried out over a two week period and classified the vehicles in accordance with the Austroads Vehicle Classification System.

The two way, average weekday daily traffic volume on the Moe – Glengarry Road east of the level crossing was 6,260 vehicles per day. The proportion of commercial vehicles was 3.2 % of the total volume. On Waterloo Road east of the level crossing, the two way average weekday daily traffic volume was 8,535 vehicles per day. The proportion of commercial vehicles was three percent of the total volume.

The Austroads Vehicle Classification System was used to estimate the number of rigid trucks, semi trailers and B Double trucks using the roads. The breakdown of the vehicles using the Moe – Glengarry Road and Waterloo Road is summarised in **Table 2.1**.

It is understood that B Double trucks are permitted to use the Moe – Glengarry Road in both directions and Waterloo Road at the level crossing in the northbound direction only. There were several B Double trucks recorded using Waterloo Road in the westbound direction. These trucks would be delivering goods to the supermarkets from Saviges Road.

**Table 2.1 Traffic Counts at Level Crossing
(Source: Latrobe Council Counts 2009)**

Road	Vehicle Type	Daily Traffic Volumes (Vehicles / day)	
		Eastbound	Westbound
Moe – Glengarry Road West of Fowler Street	Cars	3,145	3,115
	Rigid trucks (including Buses)	104	100
	Semi Trailers	9	9
	B Double	2 / week	3 / week
Waterloo Road East of Railway Crossing	Cars	4,062	4,475
	Rigid trucks (Including Buses)	129	130
	Semi Trailers	23	25
	B Double	5	2

2.3 Intersection Turning Movements

An intersection turning movement count was carried out at the intersection of the Moe – Glengarry Road and Waterloo Road on Wednesday 10th February 2010 between 8.00 AM and 5.30 PM. The turning movements into and from the Waterloo Road approaches on the north side of the crossing were included in the count.

The pedestrians crossing Moe – Glengarry Road and Waterloo Road on the west side of the crossing were also recorded.

The morning and afternoon peak period turning movements are detailed in **Figures 2.1** and **2.2**. The results of the intersection turning movement count are attached in **Appendix A**.

2.4 Traffic growth

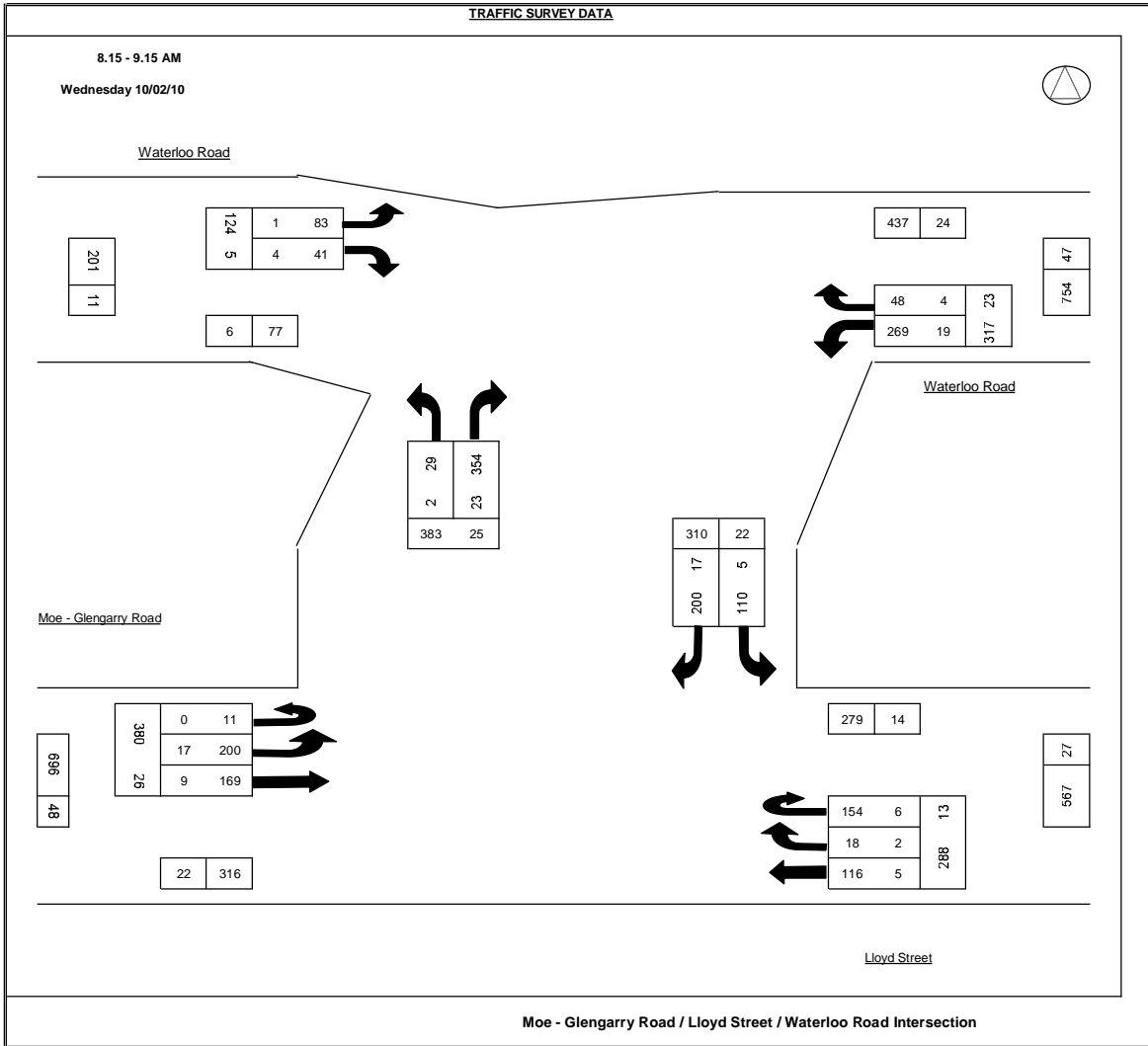
The population forecasts detailed in the Latrobe City Council Community Profile for the Moe – Moe South area predict that there will be an average growth rate of 0.86 % in the population between 2006 and 2021. It is expected that there will be an increase of 700 households in this period.

Assuming the traffic volumes in Moe increase at a rate comparable with the predicted population increase, the traffic volumes using the Moe – Glengarry Road and Waterloo Road in the Year 2021 are estimated in **Table 2.2**.

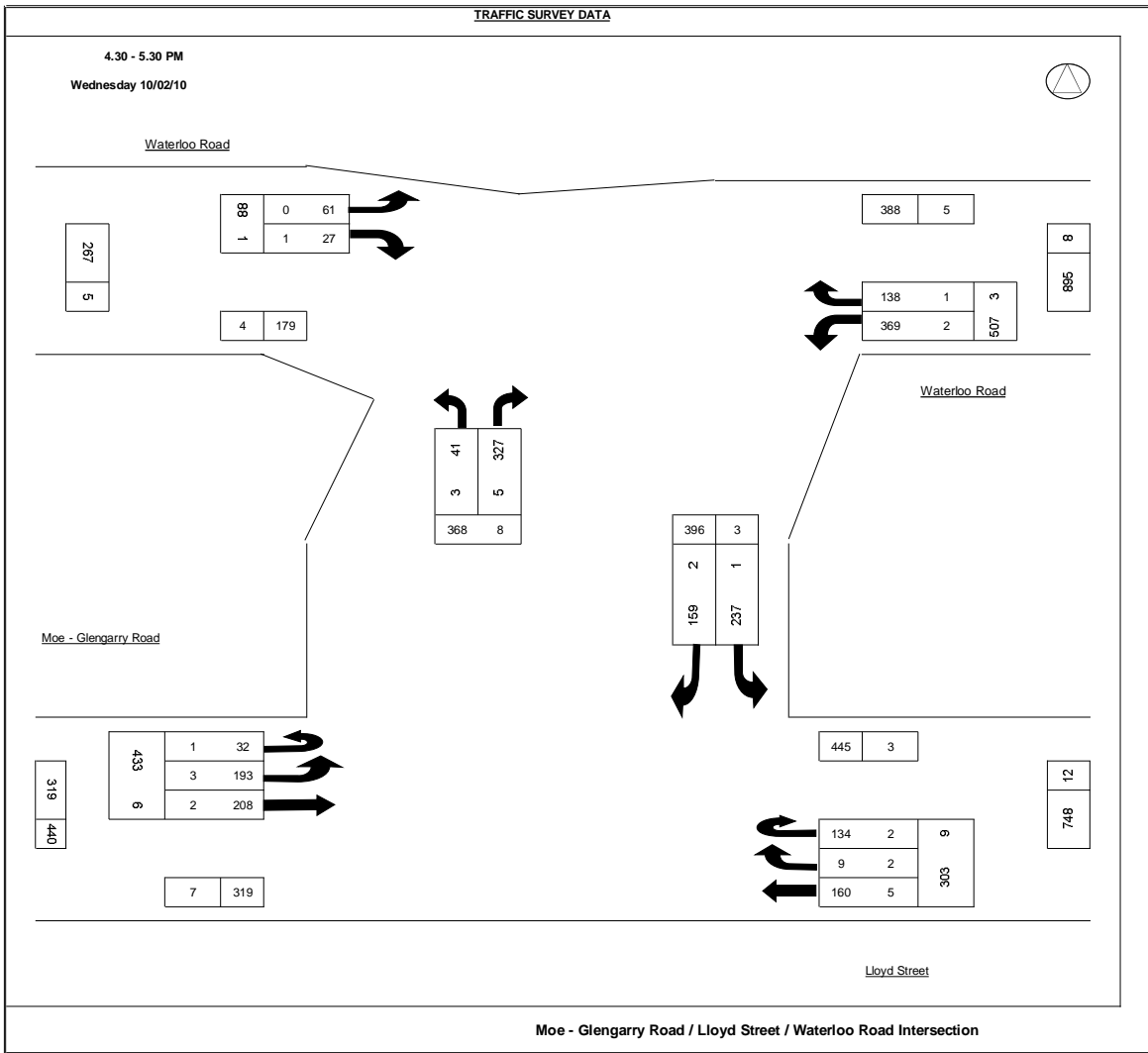
Table 2.2 Predicted 2021 Traffic Volumes

Road	Vehicle Type	Daily Traffic Volumes (Vehicles / day)	
		Eastbound	Westbound
Moe – Glengarry Road West of Fowler Street	Total vehicles Proportion of Heavy Vehicles	3,445	3,425
Waterloo Road East of Railway Crossing	Total vehicles Proportion of Heavy Vehicles	4,465	4,915

**Figure 2.1 Moe - Glengarry Road / Waterloo Road Intersection
 Intersection Turning Movements 8.15 - 9.15 AM**



**Figure 2.2 Moe - Glengarry Road / Waterloo Road Intersection
 Intersection Turning Movements 4.30 - 5.30 PM**



2.5 Traffic operation of intersection

The peak period traffic operation of the existing intersection of Waterloo Road and the Moe – Glengarry Road was analysed using the aaSIDRA 4.0 software with the existing 2010 and the predicted 2021 traffic volumes.

The results of the intersection analysis are detailed in **Appendix B** and summarised in **Table 2.3**.

The results of the analysis indicates that the Degree of Saturation (DoS) varies from 0.0 to 0.48 for the existing 2010 and the predicted 2021 traffic volumes. The highest Degree of Saturation was for the right turn from Waterloo Road with a peak traffic queue of four vehicles.

The peak traffic queue observed during the surveys was nine vehicles during the afternoon peak period when a large southbound truck had been delayed while turning right from Waterloo Road.

Table 2.3 Moe – Glengarry Road / Waterloo Road intersection analysis

Approach	Movement	Year 2010 Volumes				Year 2021 Volumes			
		AM Peak (8.15–9.15)		PM Peak (4.30–5.30)		AM Peak (8.15–9.15)		PM Peak (4.30–5.30)	
		DoS	95%ile Queue	DoS	95%ile Queue	DoS	95%ile Queue	DoS	95%ile Queue
Moe – Glengarry Road East	Left Turn Through	0.136 0.091	0 0	0.131 0.114	0 0	0.150 0.109	0 0	0.144 0.125	0 0
Moe – Glengarry Road East	Through Right Turn	0.067 0.304	0 2	0.091 0.291	0 1.8	0.073 0.370	0 2.7	0.099 0.349	0 2.3
Waterloo Road South	Left Turn Right Turn	0.089 0.472	0.5 3.7	0.170 0.302	1 1.9	0.091 0.476	0.5 4	0.191 0.360	1.2 2.5

2.6 Train Services

There are a total of 42 trains which use the railway crossing each day. There are 18 passenger trains to Melbourne between 5.10 AM and 7.35 PM and 21 passenger trains to Traralgon between 6.250 AM and 1.15 AM. There are an average of three freight trains per day using the crossing.

The trains use the crossing at approximately one hour intervals throughout the day.

2.7 ALCAM Safety Assessment

The Australian Level Crossing Assessment Model (ALCAM) is a safety assessment tool used to prioritise railway level crossings according to their comparative safety risk. It considers the physical properties of each site and the related human behaviours to provide a comparative 'Risk Score'.

The Risk Score is multiplied by the Exposure Rating for each site to determine a Total Risk Exposure Score which is used to rank each of the level crossings. The Exposure Rating for the site includes factors for the train volumes, road traffic volumes and consequence.

The ALCAM Rating Report for the level crossing at Waterloo Road was obtained from Ash Twomey, who is an ALCAM Analyst at VicTrack, Asset Management Section.

A copy of the ALCAM Rating Report is attached in **Appendix C**. The ALCAM Likelihood Factor was 178 which was described as a High Likelihood. The ALCAM Risk Score was 544,327,560

The safety issues identified from the ALCAM assessment were traffic queued on tracks and long vehicle overhangs on the tracks.

The ALCAM Assessment of the proposed improvements to the level crossing assumed that the short stacking and queuing across the railway tracks would be removed. Also, the signs and linemarking would be brought up to the current standard. The ALCAM Likelihood Factor would be reduced to 39.

The Consequence Factor would remain as 10. This factor is the maximum consequence value as the crossing is used by school buses. The ALCAM Risk Score is determined by

$$\text{ALCAM Risk Score} = \text{ALCAM Likelihood Factor} \times \text{Rail Volumes} \times \text{Road Volumes} \times \text{Consequence Multiplier}$$

The ALCAM Risk Score of the proposed works is $39 \times 42 \times 8540 \times 10 = 139,885,200$

2.8 Casualty Crash History

The reported casualty crashes for the period between 1st July 2004 and 30th June 2009 on the Moe – Glengarry Road and Waterloo Road were obtained from the VicRoads CRASHSTATS database. There were no reported casualty crashes at the railway crossing during this period.

There was a casualty crash involving a car colliding with a train in 1987. The crash occurred at 11.40 AM on a Thursday in daylight and dry road conditions. One person required medical treatment.

There have been no casualty crashes reported at the intersection of Waterloo Road and the Moe – Glengarry Road in the period between 1st July 2004 and 30th June 2009.

2.9 Pedestrian and Bicycle Facilities

There are school pedestrian crossings across Waterloo Road and the Moe – Glengarry Road on the west side of the railway crossing. These crossings operate during 8.00 – 9.00 AM and 3.00 – 4.00 PM with school crossing supervisors.

The number of the pedestrians using the crossings of Waterloo Road and the Moe – Glengarry Road during the peak periods are summarised in **Table 2.4**.

Table 2.4 Pedestrians using Crossings of Waterloo Road and Moe – Glengarry Road

Time	Pedestrians using crossings							
	Moe – Glengarry Road				Waterloo Road			
	Northbound		Southbound		Northbound		Southbound	
	Adults	Children	Adults	Children	Adults	Children	Adults	Children
7.30 – 7.45 AM	1		1					
7.45 – 8.00 AM	1	1			1	1	1	
8.00 – 8.15 AM	2	3		5	2	3		5
8.15 – 8.30 AM	2	2		1	2	2		1
8.30 – 8.45 AM								
8.45 – 9.00 AM	3	1			4			
9.00 – 9.15 AM	2				1			
9.15 – 9.30 AM	3	1			3	1		
Total 7.30 – 9.30 AM	14	6	1	6	13	7	3	6
3.00 – 3.15 PM	4			2	4		3	2
3.15 – 3.30 PM	3				3			
3.30 – 3.45 PM	3		2		3		2	
3.45 – 4.00 PM	1	4	1		1	4	1	
4.00 – 4.15 PM	3	1			3	2		
4.15 – 4.30 PM	1	1	1		1	1	1	
Total 3.00 – 4.30 PM	15	6	3	2	15	7	7	2

2.10 Bus services

There are no regular bus services which use the railway crossing. Several school bus services use the crossing during the morning and afternoon peak periods.

3. Options for Upgrading Railway Crossing

3.1 General

The objective of the Study was to develop innovative, low cost options to improve the safety and operation of the level crossing in the short to medium term. The level crossing is located on the Regional Fast rail network and any changes to the signalling and level crossing infrastructure requires approval from the operator of the computer based interlocking software. Invensys hold sole rights to the computer based interlocking software which controls the operation of the railway signalling. The operation of the railway signalling on the approaches to the level crossing has restricted the development of low cost, innovative solutions.

The review of the traffic operation of the railway level crossing indicated that ‘short stacking’ of semi trailers while waiting at the intersection of Moe – Glengarry Road intersection was the major problem. Most southbound vehicles on Waterloo Road were observed to be taking notice of the yellow box marking at the railway crossing.

The traffic operation of the intersection of Moe – Glengarry Road and Waterloo Road was operating satisfactory. Widening of the pavement at the railway crossing by two metres would be required if B Double trucks were allowed to use the crossing in both directions. A total pavement width of 14.0 metres would be required at the crossing. A copy of the B Double turning templates superimposed on the widening required for Option A are attached in **Appendix D**.

The widening of the pavement at the railway crossing was discussed with Peter Mills of VicTrack, Signal Track and Overhead Projects Group. Widening by two metres on the east side would enable one boom barrier on each approach to be used. Widening of the existing crossing by greater than two metres would incur significant additional costs as twin boom barriers with a central median on each approach would be required.

Four options were prepared for upgrading the railway level crossing to address the ‘short stacking’ of the large vehicles which are detailed as follows. Copies of the concept plans for all options are attached in **Appendix D**.

- Option A Metered signals linked to the train operation to clear the vehicles from the crossing.
- Option B Change in priority at intersection of Moe – Glengarry Road and Waterloo Road.
- Option C Large roundabout at railway crossing.
- Option D Full signalisation of the railway crossing and intersections on both sides.

An additional option was considered to provide for the B Double trucks involving the widening and upgrading of Waterloo Road between Moe and Trafalgar. This proposal has been considered as Option E.

3.2 Option A Metered signals linked to train operation

Option A incorporates the installation of traffic signals on both approaches of Waterloo Road and Moe – Glengarry Road linked to the operation of the railway level crossing bells, flashing lights and boom barriers.

The approaching train activates the bells and flashing lights at the level crossing approximately 60 seconds before the train arrives at the crossing. It is proposed that when the bells and flashing lights start at the crossing, the traffic signals on the approaches of Moe – Glengarry Road and Waterloo Road would turn to red and the southbound queued traffic would have 40 seconds to clear the railway crossing before the boom barriers came down.

The use of metered traffic signals has recently been installed on the approaches to the railway crossing on the Baxter – Tooradin Road on the Frankston – Stony Point railway line near the Baxter station. Traffic signals activated by the approaching trains have been installed on the approaches to the roundabout at the intersection of Baxter – Tooradin Road / Fultons Road / Hawkins Road. At the times when the trains are not approaching the level crossing, the traffic signals do not operate.

If B Doubles were approved to use Waterloo Road in both directions at the crossing, widening of the pavement would be required with relocation of the boom barriers, flashing lights and bells on the east side.

Presence loops could be installed in the southbound traffic lane on the north side of the crossing to activate the traffic signals to reduce the traffic queues in the peak period. This would improve the traffic operation of the intersection of Waterloo Road and Moe – Glengarry Road even when the train was not approaching the crossing

At the times when a train was approaching the crossing, the through traffic movements on both approaches of Moe – Glengarry Road would be delayed. However, this option is not predicted to adversely affect the traffic operation of the intersection.

3.3 Option B Modified intersection at Moe – Glengarry Road and Waterloo Road

Option B involves changing the priority from the Moe – Glengarry Road at the top of the tee intersection to the Waterloo Road approaches. The through traffic on both approaches on Moe – Glengarry Road would have to give way to the southbound traffic using Waterloo Road.

The realignment of the pavement at the railway crossing would require extensive alterations to the boom barriers and flashing lights.

The objective of the change in priority at the intersection is to address the ‘short stacking’ of the southbound large vehicles. The change in priority would improve the left and right turn movements on the Waterloo Road south approach. The results of the peak hour assessment of the traffic operation of the modified intersection using aaSIDRA 4.0 are summarised in **Table 3.1**

**Table 3.1 Moe – Glengarry Road / Waterloo Road intersection analysis
Option B Modified Intersection**

Approach	Movement	Existing Layout Year 2010 Volumes				Option B Year 2010 Volumes			
		AM Peak (8.15–9.15)		PM Peak (4.30–5.30)		AM Peak (8.15–9.15)		PM Peak (4.30–5.30)	
		DoS	95%ile Queue	DoS	95%ile Queue	DoS	95%ile Queue	DoS	95%ile Queue
Moe – Glengarry Road West	Left Turn	0.136	0	0.131	0	0.136	0	0.131	0
		0.091	0	0.114	0	0.284	1.7	0.400	2.9
Moe – Glengarry Road East	Through	0.067	0	0.091	0	0.190	1.0	0.258	1.5
		0.304	2	0.291	1.8	0.436	3.1	0.381	2.5
Waterloo Road South	Right Turn	0.089	0.5	0.170	1	0.068	0	0.135	0
		0.472	3.7	0.302	1.9	0.130	0	0.092	0

It is predicted that there would be an increase in the Degree of Saturation and length of the traffic queues on the Moe – Glengarry Road through movement on the west approach and on the through and east movements on the east approach. The traffic operation of the modified intersection would be satisfactory with low degrees of saturation and traffic queues.

3.4 Option C Large roundabout at railway crossing

Option C involves the construction of a new crossing to the east of the existing to form a large roundabout. Relocation of the existing boom barriers and flashing lights and warning bells would be required at the existing crossing and new signalling equipment would be required at the new crossing.

The proposed roundabout would provide for B Doubles in both directions. However, the eastbound through traffic on Moe – Glengarry Road and the westbound through traffic on Waterloo Road would have to cross the railway line twice in negotiating the roundabout.

A section of the existing westbound pavement would be retained to provide access to the residential properties on the south side of the Moe – Glengarry Road at the intersection.

It is predicted that the proposed roundabout would operate satisfactorily during the peak periods. The predicted Level of Service of the proposed roundabout would vary from A to B.

The results of the peak hour assessment of the traffic operation of the roundabout using aaSIDRA 4.0 are summarised in **Table 3.2**

**Table 3.2 Moe – Glengarry Road / Waterloo Road intersection analysis
Option C Roundabout**

Approach	Movement	Existing Layout Year 2010 Volumes				Option C Year 2010 Volumes			
		AM Peak (8.15–9.15)		PM Peak (4.30–5.30)		AM Peak (8.15–9.15)		PM Peak (4.30–5.30)	
		DoS	95%ile Queue	DoS	95%ile Queue	DoS	95%ile Queue	DoS	95%ile Queue
Moe – Glengarry Road West	Left Turn Through	0.136	0	0.131	0	0.392	2.8	0.433	3.2
		0.091	0	0.114	0	0.392	2.8	0.433	3.2
Moe – Glengarry Road East	Through Right Turn	0.067	0	0.091	0	0.259	2.0	0.258	1.5
		0.304	2.0	0.291	1.8	0.258	2.0	0.381	2.5
Waterloo Road South	Left Turn Right Turn	0.089	0.5	0.170	1.0				
		0.472	3.7	0.302	1.9				
Waterloo Road West	Left Turn Right Turn					0.165	1.1	0.111	0.7
						0.165	1.1	0.111	0.7
Waterloo Road East	Left Turn Right Turn					0.331	2.2	0.480	3.8
						0.331	2.2	0.480	3.8

3.5 Option D Full signalisation of level crossing and intersections

Option D involves the installation of traffic signals at the intersection of Moe – Glengarry Road and Waterloo Road and the railway crossing. A separate train phase would be included in the operation of the traffic signals activated by the approaching train detector.

The results of the peak hour assessment of the traffic operation of the intersection traffic signals using aaSIDRA 4.0 are summarised in **Table 3.3**

**Table 3.3 Moe – Glengarry Road / Waterloo Road intersection analysis
Option D Intersection traffic signals**

Approach	Movement	Existing Layout Year 2010 Volumes				Option D Year 2010 Volumes			
		AM Peak (8.15–9.15)		PM Peak (4.30–5.30)		AM Peak (8.15–9.15)		PM Peak (4.30–5.30)	
		DoS	95%ile Queue	DoS	95%ile Queue	DoS	95%ile Queue	DoS	95%ile Queue
Moe – Glengarry Road West	Left Turn Through	0.136	0	0.131	0	0.255	5.2	0.213	4.4
		0.091	0	0.114	0	0.425	6.4	0.425	6.4
Moe – Glengarry Road East	Through Right Turn	0.067	0	0.091	0	0.112	2.4	0.176	3.9
		0.304	2.0	0.291	1.8	0.657	9.1	0.463	5.7
Waterloo Road North	Left Turn Right Turn	0.089	0.5	0.170	1.0	0.120	2.5	0.162	3.4
		0.472	3.7	0.302	1.9	0.649	8.3	0.477	7.9

Widening of the pavement at the railway crossing would be required to cater for the B Double trucks in both directions. The width of the crossing would be the same as for the metered traffic signals with a total pavement width of 14.0 metres. Relocation of the existing boom barriers and flashing lights and warning bells would be required on the east side of the crossing.

The operation of the traffic signals when a train was approaching would be similar to the metered signals. The train signalling software would send a message to the traffic signal controller to call up the phase stopping the traffic on Waterloo Road.

The installation of the traffic signals would operate satisfactorily with low levels of degrees of saturation. It is predicted that the traffic queues on the Moe – Glengarry Road approaches would be approximately six or seven vehicles. The queue in the right turn lane at the Waterloo Road north approach is predicted to be approximately nine vehicles. This predicted traffic queue is similar to the maximum queue length observed with the existing operation.

3.6 Option E Upgrading Waterloo Road between Moe and Trafalgar

B Doubles are not permitted to use the Waterloo Road railway crossing in the southbound direction. Widening of the pavement at the crossing and the relocation of the boom barriers and other electrical assets on the east side of Waterloo Road would be required to enable the B Double trucks to use the crossing in the south direction.

An alternative option would be to direct the B Double trucks to use Waterloo Road between Trafalgar and Moe. There are three level crossings between Trafalgar and Moe which all have flashing lights at the crossing activated by the approaching trains.

The municipal boundary between Baw Baw Shire and Latrobe City is located seven kilometres from Trafalgar. It is understood that Baw Baw Shire currently do not permit B Double trucks to use Waterloo Road. Approval to the use of roads by B Double trucks is based on a specific application.

Waterloo Road is a two lane, two way road with unsealed shoulders. Over most of the length, the abutting development on the north side is farmland. The pavement is 6.2 metres in width with unsealed shoulders of 1.1 metres on the north side and 1.4 metres on the south side. There were several trees located within 4.4 metres from the edge of the traffic lane.

The use of Waterloo Road by B Double trucks would require upgrading the pavement to a Rural Collector Road standard. This standard is based on providing enough width for a semi trailer to pass a car with minimum clearance. The Rural Collector roads have a sealed pavement of seven metres and a formation width of eight metres.

This option is based on upgrading Waterloo Road between Mitchells Road in Moe and the level crossing at Telephone Road. It assumes that approval to the use of Waterloo Road within Baw Baw Shire would be obtained. Upgrading of Waterloo Road would require widening on the south side by 2.4 metres over 6.15 km.

3.7 Additional warning signs at railway crossing

There is a Railway Level Crossing warning sign (W7-4) with a separate ‘On Side Road’ (W8-3) sign on Waterloo Road east approach to the railway level crossing. At the level crossing, yellow box markings with ‘Keep Tracks Clear’ signs have been installed.

It is recommended that an additional warning sign ‘Intersection Beyond Crossing’ sign (W4-V107) sign be installed on the east approach of Waterloo Road. The storage distance of 25 metres should be included on the warning sign.

3.8 Estimated Costs

3.8.1 Roadwork Costs

The estimated costs of the roadworks for each of the options to improve the railway crossing are based on the unit rates of construction detailed in **Table 3.4**.

Table 3.4 Construction Unit Rates

Item	Unit	Rate
Project Management (% of Construction Works)	Item	8 %
Design and Investigation (% of Construction Works)	Item	4 %
Construction Works		
Earthworks		
Earthworks Cut to waste off site	m ³	\$20
Removal of concrete kerb and channel	m	\$20
Drainage		
Supply and install 375 mm dia RCP	metre	\$ 150
Supply and install SEP	metre	\$ 1,250
Convert SEP to JP	metre	\$ 1,500
Pavement Construction		
Supply and place pavement 400 mm thick including a 40 mm asphalt surfacing	m ²	\$ 45 (Day) \$ 80 (Night)
Supply and cast kerb and channel	metre	\$ 40
Supply and place concrete paving in central median	m ²	\$ 30
Pavement Markings and Road Furniture		
100 mm Solid line Linemarking	metre	\$ 1.50
Supply and place RRPM's	No	\$ 10

The roadworks on the approaches to the railway crossing will have to be carried out at night. The cost of the pavement construction has been increased to cover the night works.

3.8.2 Railway relocation and signalling costs

The estimated costs of changes to the railway signalling software and relocation of the boom barriers and flashing lights for each of the options were obtained from VicTrack Signal, Track and Overhead Projects Group.

Preliminary cost estimates were obtained based on similar projects carried out by the VicTrack Projects Group. A detailed cost estimate was obtained for the options incorporating the installation of the metered traffic signals or the full signalisation at the intersection of Moe

– Glengarry Road and Waterloo Road. A copy of the detailed cost estimate is attached in **Appendix E**.

The VicTrack cost estimate comprised two stages.

Stage 1 Panel 1 Process

The first stage includes the preparation of detailed civil and concept signalling designs, preparation of the focusing diagrams, conduct of a risk workshop and stakeholder consultation and approval. The estimated cost of the Panel 1 process to define the scope of the works for the main design and construct phase is \$ 75,560

Stage 2 Design and Construct Phase

Stage 2 is the project implementation phase based on the outcome of the Panel 1 Process. The estimated cost of the implementation includes changes to the Westrace Software for the train signalling. The estimated cost is \$ 754,590.

The following costs were estimated for the relocation of the flashing lights and boom barriers for each of the Options.

Option A	Metered signals	\$ 0.83 million (Detailed estimate)
Option B	Modified intersection	\$ 2 million
Option C	Roundabout	\$ 1.7 million (Melba Highway at Yarra Glen)
Option D	Full signalisation	\$ 0.83 million if widening < two metres \$ 1.6 million if central median and twin boom barriers

3.8.3 Estimated cost of Options

The estimated cost of each of the options are detailed in **Appendix E** and summarised in **Table 3.5**.

The total estimated costs of the options, including the VicTrack electrical costs, vary from \$1,039,850 to \$ 2,296,535. The lowest cost option was to include metered traffic signals on the approaches to the intersection which would be activated by an approaching train.

The options include road widening, relocation of the boom barriers and flashing lights on the east side to permit B Doubles to use the Waterloo Road railway crossing.

The estimated cost to upgrade Waterloo Road between the railway crossing near Telephone Road and Mitchells Road in Moe would be \$ 1,014,150. This estimated cost is based on widening the pavement on the south side, extending the culvert near the municipal boundary and contingency, project management and design costs.

Table 3.5 Estimated costs of options to upgrade Waterloo Road railway crossing

Works	Estimated Costs			
	Option A Metered Traffic Signals	Option B Modified Intersection	Option C Roundabout	Option D Full signalisation
Project Management & Design and Investigation	\$ 17,720	\$ 25,060	\$ 20,970	\$ 21,785
General Contract	\$ 14,500	\$ 21,000	\$ 21,000	\$ 15,500
Earthworks	\$ 16,150	\$ 46,400	\$ 44,050	\$ 17,150
Pavement	\$ 46,900	\$ 128,325	\$ 108,500	\$ 48,500
Pavement Markings	\$ 1,525	\$ 13,100	\$ 1,225	\$ 8,200
Traffic Signals	\$ 68,600	0	0	\$ 92,200
Subtotal	\$ 165,395	\$ 233,885	\$ 195,745	\$ 203,335
Contingency	\$ 44,305	\$ 62,650	\$ 52,435	\$ 54,465
Roadwork Costs	\$ 209,700	\$ 296,535	\$ 248,180	\$ 257,800
Electrical works by VicTrack	\$ 830,150	\$ 2,000,000	\$ 1,700,000	\$ 830,150
Total Estimated Cost	\$ 1,039,850	\$ 2,296,535	\$ 1,948,180	\$ 1,087,950

3.9 Summary of options

The existing layout of the railway crossing does not provide adequate width for B Double trucks to travel in both directions. Also the width between the train tracks and the intersection of Waterloo Road and the Moe – Glengarry Road is insufficient for large trucks to queue without encroaching onto the tracks.

The existing intersection of Waterloo Road and Moe – Glengarry Road is controlled by Give Way signs. The traffic operation of the intersection is satisfactory with 85th percentile traffic queues of up to four vehicles during the peak periods on the Waterloo Road south approach. The longest traffic queues on the Waterloo Road south approach were nine vehicles. This traffic queue cleared quickly.

Four options were prepared to address these issues which included the installation of traffic signals and modification of the layout of Waterloo Road. All the options would maintain a satisfactory level of service at the intersection. The installation of the full signalisation of the intersection would almost double the traffic queues on all the approaches.

The lowest cost option would be the installation of metered traffic signals on the approaches to the intersection activated by an approaching train. At the times when a train was not approaching the crossing, the intersection would be maintained by the existing Give Way signs.

The estimated cost of the lowest cost option which included metered signalisation of the intersection is \$ 1,039,850 which includes the cost to relocate the electrical works by VicTrack to provide for the B Double trucks.

The full signalisation of the intersection would increase the traffic queues on the approaches. This proposal is considered to be the best long term option for the upgrading of the intersection and railway crossing.

4. Stakeholder Discussions

4.1 VicRoads

The options prepared to address the identified issues at the Waterloo Road railway crossing and the operation of the Waterloo Road and Moe – Glengarry Road intersection were discussed with representatives of the VicRoads Eastern Region.

VicRoads supported the low cost option of clearing the trucks from the railway crossing when a train was approaching. They did not consider the modified intersection of the roundabout option should be considered.

VicRoads funding responsibility is for works on main roads. Moe – Glengarry Road is the only VicRoads declared main road. VicRoads indicated that they would not fund the works at the railway crossing or for upgrading of Waterloo Road between Moe and Trafalgar.

4.2 Latrobe City Council

The options were discussed with representatives of the Latrobe City Council. There was no support for the modified intersection and the roundabout options. The Council staff indicated support for the metered traffic signals option.

4.3 VicTrack

The options were discussed with Peter Mills, Senior Project Manager of VicTrack, Signal, Track and Overhead Projects Group. He explained that the railway line was part of the Regional Fast Rail Project and the level crossing at Waterloo Road was protected by three main line signals. The main line signals are interlocked with the control of the level crossing which is in turn controlled by Computer Interlockings (train control) systems.

He indicated that VicTrack would not contribute to the funding of any works at the railway crossing.

He considered the Option A (Metered Traffic Signals) would be the lowest cost option. This option would require Traffic Light Coordination (TLC) with the signalling system. The TLC system is designed to send a call to the traffic light system approximately 30 seconds before the train activates the crossing equipment and a further 25 seconds before the train enters the crossing.

The coordination of the traffic signals with the train signalling system has been used at several locations. Metered traffic signals have recently been installed at the level crossing on Baxter – Tooradin Road at Baxter.

The widening of the level crossing to accommodate B Double trucks was discussed. The widening would require relocation of the boom barrier and flashing lights on the east side. The costs of relocating the VicTrack assets for the proposed widening was discussed.

It was proposed to install a roundabout at the level crossing on the Melba Highway at Yarra Glen. The estimated cost of relocating the boom barriers and flashing lights was \$ 1.7 million. The estimated cost of relocating the VicTrack assets to widen McGregor Road in Pakenham was estimated to be \$ 2.1 million.

The critical aspect in the widening of the pavement was the length of the boom barriers. If the boom barriers exceeded 8.54 metres, a central median would be required with two barriers on each carriageway. A site meeting was held to check the width of the level crossing and the length of the boom barrier required with the proposed two metre widening on the east side.

It was determined that the length of the boom barrier would be less than the maximum for one barrier with the proposed two metre widening. A detailed cost estimate for the relocation of the VicTrack assets and the changes required to the train signalling software was prepared by VicTrack.

The ALCAM safety assessment of the Waterloo Road level crossing was discussed with Ash Twomey of VicTrack Asset Management Group. She calculated the Risk Rating Score of the existing crossing and of the proposed metered traffic signals at the Moe – Glengarry Road and Waterloo Road intersection.

4.4 Latrobe Valley Bus Lines

The options for upgrading the Waterloo Road railway crossing was discussed with Cameron Cuthbertson of the Latrobe Valley Bus Lines. He indicated that there were no regular bus services which used the Waterloo Road level crossing. There were several school bus services which used the Waterloo Road crossing.

He supported any options to improve the traffic operation and safety at the railway level crossing.

4.5 Community for Moe

The upgrading of the railway crossing at Waterloo Road and the operation of the intersection of Waterloo Road and Moe – Glengarry Road was discussed with Tony Flynn of the Committee for Moe.

He indicated that some members of the Committee for Moe had raised concerns about the traffic congestion at the intersection of Waterloo Road and Moe – Glengarry Road and the potential of being caught on the railway crossing by the traffic queues as a train approached.

His preferred option was the full signalisation of the intersection (Option D), as everyone would get increased flow. He considered that the metered traffic signals (Option A) would not increase the flow across the crossing and would not change the operation of the intersection.

Option B involving the modified intersection would improve the flow across the crossing but would disadvantage Lloyd Street. There was no support for Option C involving the construction of the large roundabout.

He indicated that the operation of the intersection of Waterloo Road and the Moe – Glengarry Road had been discussed at meetings of the Moe Police Community Consultation Committee. There was concern about vehicles on Waterloo Road being caught on the crossing as a train approached

4.6 Department of Transport

The options for upgrading the Waterloo Road railway crossing was discussed with Wayne Berryman and Fiona Xuereb of the Department of Transport. They indicated that the Department of Transport was concerned with the operation of the bus services in Moe.

There were no regular bus services and only several school bus services which used the railway crossing.

The review of the bus services in Moe did not include any changes to the bus services which would use the railway crossing.

4.7 Resident of Moe Peter Aboltins

A resident of Moe, Peter Aboltins rang to discuss the options for the upgrading the Waterloo Road level crossing. He is a Member of the Committee for Moe and requested that an overpass of the railway line between the Princes Freeway and Waterloo Road at the western end of Moe should be considered as part of the Study.

It was explained that grade separation options would not be considered as there would not be funds available for these works in the foreseeable future.

5. Summary and Conclusions

- q The railway level crossing at Waterloo Road just north of the Moe - Glengarry Road is one of two access routes to the central area of Moe from the Princes freeway and the residential areas to the south of the railway line. The railway line is located close to the Moe – Glengarry Road and large trucks queue across the tracks while waiting at the intersection.
- q B Double trucks are only permitted to use Waterloo Road at the railway crossing in the northbound direction. Widening of the pavement at the crossing by two metres would be required if B Double trucks were allowed to use Waterloo Road in both directions. Widening of the crossing would require relocation of the boom barriers, flashing lights and warning bells on the east side of the crossing
- q A review of the safety and the traffic operation of the intersection of the Moe – Glengarry Road and Waterloo Road was undertaken. The review included intersection turning movement counts, assessment of the traffic operation, reported casualty crashes and the Australian Level Crossing Assessment Model (ALCAM).
- q The traffic operation of the existing intersection was satisfactory with low levels of congestion and short traffic queues. There were no reported casualty crashes at the intersection of the Moe – Glengarry Road and Waterloo Road in the last five year period.
- q The existing railway crossing has an ALCAM Likelihood Factor of 178 and a Risk Score of 544,327,560. It was assumed that the proposed improvements to the level crossing would remove the short stacking and traffic queuing problems. The ALCAM Likelihood Factor of the proposed improvements would be 39 and the Risk Score of 139,885,200.
- q Four options were prepared for upgrading the intersection and railway crossing to address the identified issues. The options included the metered traffic signals of the intersection activated by an approaching train, modified intersection, large roundabout and full signalisation of the intersection.
- q The use of traffic signals at the intersection of Moe – Glengarry Road and Waterloo Road linked into the train signalling system was discussed with VicTrack. A detailed cost estimate was obtained for modifications to the train signalling system and the relocation of the boom barriers and flashing lights.
- q The metered traffic signals option had the lowest cost but would only operate when a train was approaching. The existing operation of the intersection would be retained when a train was not approaching the crossing.
- q The full signalisation of the intersection was considered to be the most appropriate long term option. The costs of modifications to the train signalling system and relocation of the VicTrack assets for the modified intersection and roundabout would make these options not viable.
- q The cost of the traffic signal options, including the VicTrack electrical works, varied from \$1,039,850 for the metered traffic signals to \$ 1,087,950 for the full signalisation of the intersection.

Appendix A Traffic Counts

Appendix B Intersection Analysis

MOVEMENT SUMMARY

Site: Year 2010 AM Peak

Moe - Glengarry Road / Waterloo Road Moe
Existing Layout & AM Peak Volumes
8.15 - 9.15 AM

Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South Waterloo Road South												
1	L	122	5.2	0.089	9.4	LOS A	0.5	3.7	0.38	0.65	47.3	
3	R	228	7.8	0.472	18.9	LOS C	3.7	27.9	0.74	1.03	39.7	
Approach		351	6.9	0.472	15.6	LOS C	3.7	27.9	0.61	0.90	42.0	
East Moe - Glengarry Road West												
4	L	240	7.5	0.136	8.5	LOS A	0.0	0.0	0.00	0.67	49.0	
5	T	174	3.0	0.091	0.0	LOS A	0.0	0.0	0.00	0.00	60.0	
Approach		414	5.6	0.136	4.9	LOS A	0.0	0.0	0.00	0.39	53.1	
West Moe - Glengarry Rd East												
11	T	127	4.1	0.067	0.0	LOS A	0.0	0.0	0.00	0.00	60.0	
12	R	189	4.4	0.304	13.7	LOS B	2.0	14.4	0.64	0.88	43.7	
Approach		317	4.3	0.304	8.2	LOS B	2.0	14.4	0.38	0.53	49.1	
All Vehicles		1081	5.6	0.472	9.4	NA	3.7	27.9	0.31	0.59	47.8	

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).

Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Yr 2010 PM Peak

Moe - Glengarry Road / Waterloo Road Moe
Existing Layout & PM Peak Volumes
4.30 - 5.30 PM
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South Waterloo Road South												
1	L	251	0.4	0.170	9.0	LOS A	1.0	7.3	0.35	0.64	47.4	
3	R	169	1.2	0.302	14.6	LOS B	1.9	13.6	0.66	0.92	42.9	
Approach		420	0.8	0.301	11.3	LOS B	1.9	13.6	0.48	0.76	45.5	
East Moe - Glengarry Road West												
4	L	241	1.7	0.131	8.3	LOS A	0.0	0.0	0.00	0.67	49.0	
5	T	221	1.0	0.114	0.0	LOS A	0.0	0.0	0.00	0.00	60.0	
Approach		462	1.4	0.131	4.3	LOS A	0.0	0.0	0.00	0.35	53.7	
West Moe - Glengarry Road East												
11	T	174	3.0	0.091	0.0	LOS A	0.0	0.0	0.00	0.00	60.0	
12	R	155	2.7	0.291	15.3	LOS C	1.8	13.0	0.67	0.93	42.3	
Approach		328	2.9	0.292	7.2	LOS C	1.8	13.0	0.32	0.44	50.1	
All Vehicles		1211	1.6	0.302	7.5	NA	1.9	13.6	0.25	0.51	49.6	

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).

Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Year 2021 AM Peak

Moe - Glengarry Road / Waterloo Road Moe
Existing Layout & Yr 2021 AM Peak Volumes
8.15 - 9.15 AM
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South Waterloo Road South												
1	L	135	5.5	0.091	9.1	LOS A	0.5	3.8	0.32	0.63	47.5	
3	R	252	7.9	0.476	17.8	LOS C	4.0	29.6	0.73	1.03	40.5	
Approach		386	7.1	0.476	14.8	LOS C	4.0	29.6	0.59	0.89	42.7	
East Moe - Glengarry Road West												
4	L	264	7.6	0.150	8.5	LOS A	0.0	0.0	0.00	0.67	49.0	
5	T	206	5.1	0.109	0.0	LOS A	0.0	0.0	0.00	0.00	60.0	
Approach		471	6.5	0.150	4.8	LOS A	0.0	0.0	0.00	0.37	53.3	
West Moe - Glengarry Road East												
11	T	139	3.8	0.073	0.0	LOS A	0.0	0.0	0.00	0.00	60.0	
12	R	208	4.5	0.370	15.6	LOS C	2.7	19.3	0.68	0.96	42.1	
Approach		347	4.2	0.370	9.4	LOS C	2.7	19.3	0.41	0.58	47.8	
All Vehicles		1204	6.0	0.476	9.3	NA	4.0	29.6	0.31	0.60	47.9	

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).

Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Year 2021 PM Peak

Moe - Glengarry Road / Waterloo Road Moe
Existing Layout & Yr 2021 PM Peak Volumes
4.30 - 5.30 PM
Giveaway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South Waterloo Road South												
1	L	275	0.4	0.191	9.1	LOS A	1.2	8.2	0.38	0.66	47.3	
3	R	186	1.1	0.360	16.2	LOS C	2.5	17.4	0.70	0.96	41.5	
Approach		461	0.7	0.360	12.0	LOS C	2.5	17.4	0.51	0.78	44.8	
East Moe - Glengarry Road West												
4	L	264	1.6	0.144	8.3	LOS A	0.0	0.0	0.00	0.67	49.0	
5	T	243	0.9	0.125	0.0	LOS A	0.0	0.0	0.00	0.00	60.0	
Approach		507	1.2	0.144	4.3	LOS A	0.0	0.0	0.00	0.35	53.7	
West Moe - Glengarry Road East												
11	T	191	2.8	0.099	0.0	LOS A	0.0	0.0	0.00	0.00	60.0	
12	R	169	2.5	0.349	17.0	LOS C	2.3	16.5	0.70	0.96	40.9	
Approach		360	2.6	0.349	8.0	LOS C	2.3	16.5	0.33	0.45	49.2	
All Vehicles		1328	1.4	0.360	8.0	NA	2.5	17.4	0.26	0.53	49.1	

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).

Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Year 2010 AM Peak

Moe - Glengarry Road / Waterloo Road Moe
Option B & AM Peak Volumes
8.15 - 9.15 AM

Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South Waterloo Road South												
1	L	122	5.2	0.068	8.4	LOS A	0.0	0.0	0.00	0.67	49.0	
3	R	228	7.8	0.130	8.5	LOS A	0.0	0.0	0.00	0.66	49.0	
Approach		351	6.9	0.130	8.5	LOS A	0.0	0.0	0.00	0.66	49.0	
East Moe - Glengarry Road West												
4	L	240	7.5	0.136	8.5	LOS A	0.0	0.0	0.00	0.67	49.0	
5	T	174	3.0	0.284	11.4	LOS B	1.7	12.1	0.57	0.79	45.8	
Approach		414	5.6	0.284	9.7	LOS B	1.7	12.1	0.24	0.72	47.6	
West Moe - Glengarry Rd East												
11	T	127	4.1	0.190	10.2	LOS B	1.0	7.5	0.50	0.71	47.0	
12	R	189	4.4	0.436	19.8	LOS C	3.1	22.5	0.76	1.02	38.9	
Approach		317	4.3	0.436	15.9	LOS C	3.1	22.5	0.65	0.89	41.8	
All Vehicles		1081	5.6	0.436	11.1	NA	3.1	22.5	0.28	0.75	46.1	

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).

Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Year 2010 PM Peak

Moe - Glengarry Road / Waterloo Road Moe
Option B & PM Peak Volumes
4.30 - 5.30 PM

Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South		Waterloo Road South										
1	L	251	0.4	0.135	8.2	LOS A	0.0	0.0	0.00	0.67	49.0	
3	R	169	1.2	0.092	8.2	LOS A	0.0	0.0	0.00	0.66	49.0	
Approach		420	0.8	0.135	8.2	LOS A	0.0	0.0	0.00	0.67	49.0	
East		Moe - Glengarry Road West										
4	L	241	1.7	0.131	8.3	LOS A	0.0	0.0	0.00	0.67	49.0	
5	T	221	1.0	0.400	13.7	LOS B	2.9	20.6	0.65	0.92	43.5	
Approach		462	1.4	0.401	10.9	LOS B	2.9	20.6	0.31	0.79	46.2	
West		Moe - Glengarry Rd East										
11	T	174	3.0	0.258	10.3	LOS B	1.5	10.6	0.52	0.72	46.8	
12	R	155	2.7	0.381	19.8	LOS C	2.5	17.7	0.76	1.00	38.9	
Approach		328	2.9	0.381	14.8	LOS C	2.5	17.7	0.63	0.85	42.7	
All Vehicles		1211	1.6	0.400	11.0	NA	2.9	20.6	0.29	0.76	46.1	

LOS (Aver. Int. Delay): NA. The average intersection delay is not a good LOS measure for two-way sign control due to zero delays associated with major road movements.

Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).

Approach LOS values are based on the worst delay for any vehicle movement.

MOVEMENT SUMMARY

Site: Year 2010 AM Peak

Moe - Glengarry Road / Waterloo Road Moe
Option C - 2010 AM Peak Volumes
8.15 - 9.15 AM
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East Moe - Glengarry Road East											
5	T	127	4.1	0.259	4.7	LOS A	2.0	14.4	0.50	0.45	49.5
6	R	189	4.4	0.258	13.7	LOS B	2.0	14.4	0.50	0.78	45.4
Approach		317	4.3	0.259	10.1	LOS B	2.0	14.4	0.50	0.65	46.9
North East Waterloo Road East											
24	L	105	5.0	0.331	7.5	LOS A	2.2	16.6	0.44	0.59	48.5
26	R	254	7.9	0.331	11.7	LOS B	2.2	16.6	0.44	0.69	45.7
Approach		359	7.0	0.331	10.5	LOS B	2.2	16.6	0.44	0.66	46.4
North West Waterloo Road West											
27	L	106	3.0	0.165	8.2	LOS A	1.1	7.7	0.60	0.68	48.1
29	R	31	10.3	0.165	15.6	LOS B	1.1	7.7	0.60	0.85	44.1
Approach		137	4.6	0.165	9.8	LOS B	1.1	7.7	0.60	0.72	47.1
West Moe - Glengarry Road East											
10	L	240	7.5	0.392	5.9	LOS A	2.8	20.7	0.47	0.52	49.9
11	T	187	5.1	0.392	5.9	LOS A	2.8	20.7	0.47	0.52	49.8
Approach		427	6.4	0.392	5.9	LOS A	2.8	20.7	0.47	0.52	49.9
All Vehicles		1240	5.9	0.392	8.7	LOS A	2.8	20.7	0.48	0.62	47.7

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: Year 2010 PM Peak

Moe - Glengarry Road / Waterloo Road Moe
Option C - 2010 PM Peak Volumes
4.30 - 5.30 PM
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
East Moe - Glengarry Road East												
5	T	174	3.0	0.274	4.8	LOS A	2.2	15.7	0.53	0.47	49.4	
6	R	155	2.7	0.274	13.8	LOS B	2.2	15.7	0.53	0.81	45.5	
Approach		328	2.9	0.275	9.1	LOS B	2.2	15.7	0.53	0.63	47.4	
North East Waterloo Road East												
24	L	234	0.5	0.480	7.6	LOS A	3.8	27.0	0.52	0.63	48.0	
26	R	303	0.7	0.480	12.1	LOS B	3.8	27.0	0.52	0.72	45.2	
Approach		537	0.6	0.480	10.1	LOS B	3.8	27.0	0.52	0.68	46.3	
North West Waterloo Road West												
27	L	81	0.0	0.111	7.7	LOS A	0.7	4.9	0.58	0.65	48.4	
29	R	13	8.3	0.111	15.3	LOS B	0.7	4.9	0.58	0.84	44.4	
Approach		94	1.1	0.111	8.7	LOS B	0.7	4.9	0.58	0.67	47.8	
West Moe - Glengarry Road West												
10	L	241	1.7	0.433	6.3	LOS A	3.2	22.4	0.52	0.57	49.4	
11	T	221	1.0	0.433	6.1	LOS A	3.2	22.4	0.52	0.55	49.4	
Approach		462	1.4	0.433	6.2	LOS A	3.2	22.4	0.52	0.56	49.4	
All Vehicles		1421	1.4	0.480	8.5	LOS A	3.8	27.0	0.53	0.63	47.6	

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
Level of Service (Worst Movement): LOS B. LOS Method for individual vehicle movements: Delay (HCM).
Approach LOS values are based on the worst delay for any vehicle movement.
Roundabout LOS Method: Same as Signalised Intersections.
Roundabout Capacity Model: SIDRA Standard.

MOVEMENT SUMMARY

Site: Year 2010 AM Peak

Moe - Glengarry Road / Waterloo Road Moe
 Option D 2010 AM Peak Volumes
 8.15 - 9.15 AM
 Signals - Fixed Time Cycle Time = 60 seconds

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East Moe - Glengarry Rd East											
5	T	127	4.1	0.112	5.5	LOS A	2.4	17.2	0.45	0.37	50.2
6	R	265	31.7	0.657	32.7	LOS C	9.1	81.3	0.94	0.86	32.2
Approach		393	22.8	0.657	23.9	LOS C	9.1	81.3	0.78	0.70	36.5
North Waterloo Road North											
7	L	122	5.2	0.120	14.9	LOS B	2.5	18.0	0.49	0.74	42.7
9	R	228	7.8	0.649	34.2	LOS C	8.3	62.0	0.97	0.85	31.0
Approach		351	6.9	0.649	27.5	LOS C	8.3	62.0	0.80	0.81	34.3
West Moe - Glengarry Rd West											
10	L	240	7.5	0.255	16.7	LOS B	5.2	38.9	0.57	0.77	41.3
11	T	187	5.1	0.425	21.9	LOS C	6.4	46.8	0.90	0.73	35.5
Approach		427	6.4	0.425	19.0	LOS B	6.4	46.8	0.72	0.75	38.6
All Vehicles		1171	12.1	0.657	23.2	LOS C	9.1	81.3	0.76	0.75	36.5

Level of Service (Aver. Int. Delay): LOS C. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
 Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
 Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P3	Across E approach	53	18.4	LOS B	0.1	0.1	0.78	0.78
P5	Across N approach	53	16.9	LOS B	0.1	0.1	0.75	0.75
P7	Across W approach	53	18.4	LOS B	0.1	0.1	0.78	0.78
All Pedestrians		159	17.9				0.77	0.77

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
 Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

MOVEMENT SUMMARY

Site: Year 2010 PM Peak

Moe - Glengarry Road / Waterloo Road Moe
 Option D 2010 PM Peak Volumes
 4.30 - 5.30 PM
 Signals - Fixed Time Cycle Time = 60 seconds

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East Moe - Glengarry Rd East											
5	T	174	3.0	0.176	8.3	LOS A	3.9	27.7	0.56	0.46	46.8
6	R	155	2.7	0.463	33.2	LOS C	5.7	41.1	0.94	0.80	31.3
Approach		328	2.9	0.463	20.0	LOS C	5.7	41.1	0.74	0.62	38.0
North Waterloo Road North											
7	L	169	1.2	0.162	14.9	LOS B	3.4	24.2	0.50	0.75	42.6
9	R	251	0.4	0.477	28.0	LOS C	7.9	55.8	0.88	0.81	33.9
Approach		420	0.8	0.478	22.7	LOS C	7.9	55.8	0.73	0.79	36.9
West Moe - Glengarry Rd West											
10	L	241	1.7	0.213	13.7	LOS B	4.4	31.0	0.47	0.75	43.6
11	T	187	5.1	0.425	21.9	LOS C	6.4	46.8	0.90	0.73	35.5
Approach		428	3.2	0.425	17.3	LOS B	6.4	46.8	0.66	0.74	39.7
All Vehicles		1177	2.2	0.477	20.0	LOS B	7.9	55.8	0.70	0.72	38.2

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).
 Level of Service (Worst Movement): LOS C. LOS Method for individual vehicle movements: Delay (HCM).
 Approach LOS values are based on average delay for all vehicle movements.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P3	Across E approach	53	14.7	LOS B	0.1	0.1	0.70	0.70
P5	Across N approach	53	16.9	LOS B	0.1	0.1	0.75	0.75
P7	Across W approach	53	14.7	LOS B	0.1	0.1	0.70	0.70
All Pedestrians		159	15.4				0.72	0.72

Level of Service (Aver. Int. Delay): LOS B. Based on average delay for all pedestrian movements. LOS Method: Delay (HCM).
 Level of Service (Worst Movement): LOS B. LOS Method for individual pedestrian movements: Delay (HCM).

Appendix C ALCAM Safety Assessment

RX1616 Lloyd St (Waterloo Rd 129.45 PAKENHAM - BAINSDALE Existing Road
 Moa

Characteristics	Condition	Points	Score	% of total
CONTROL DETAILS				
11 Effectiveness of equipment inspection and maintenance	good	9	9	100%
12 Length of approach from traffic	low	3	0	33%
ROAD GEOMETRY				
21 Proximity to intersection/control point	<40m	5	7	33%
22 Proximity to lighting/shunting yard	<100-50m	3	3	17%
23 Proximity to station	>200m	9	9	100%
24 Possibility of short stacking	high	5	5	33%
25 Number of lanes (highest number of lanes in any one app)	one	0	0	00%
27 Vulnerability to road user fatigue	low	9	9	100%
ROAD TRAFFIC CONTROL				
31 Presence of adjacent distractions	low	9	9	100%
32 Condition of traffic control at crossing	good	9	9	100%
33 Visibility of Traffic Control at Crossing	good	9	9	100%
34 Distance from advance warning to crossing	good	9	9	100%
35 Conformance with standard AS 1742.7	partly	3	11	34%
ROAD VEHICLES				
41 Heavy vehicle proportion	low	9	9	100%
42 Level of Service (Vehicle Congestion)	LVIA-Free Flow	9	9	100%
43 Queuing from adjacent intersections	high	5	5	33%
44 Road traffic speed (approach speed desirable)	<20km/h	9	9	100%
RAIL VEHICLES				
51 Train volume- two way (high island)	medium-high	4	2	12%
52 Train volume- two way (at island)	low	9	9	100%
53 Seasonal/irregular train patterns	regular use	9	9	100%
54 Slowest train speed at crossing (typical)	200km/h	3	7	30%
55 Longest train length (typical)	>500-1000m	9	7	30%
56 High Train Speed	101 to 120km/h	4	3	15%
CROSSING GEOMETRY				
61 Number of operational rail tracks	one	9	9	100%
62 Road surface on immediate approach/departure not crossing	good	9	9	100%
63 Is the crossing on a hump, dip or rough surface?	no	9	9	100%
VISIBILITY				
71 Sight-advance visibility of crossing in approach	>100%	9	9	100%
72 Sight-approach visibility to train (vehicle approaching cross)	<50%	5	5	14%
73 Sight-visibility to train (vehicle stopped at crossing)	<50%	5	0	00%
74 Possible sun glare sighting crossing on road approach	No sun glare	9	9	100%
75 Possible sun glare sighting train	Sun glare	3	3	13%
76 Temporary visual impediments- sighting of crossing	no	9	9	100%
77 Temporary visual impediments- sighting of train	no	9	9	100%
			178	100%

Controls (Estimated AADT)
 ADDITIONAL / IMPROVEMENTS: "Real Track/Real" signs
 "Real Track/Real" signs and cross hatching of crossing
 CONTROLS AT CROSSING: Active control-HALF height flashing lights
 CROSSING ENVIRONMENT: Maintenance program for vegetation-
 Street lighting at crossing
 HUMAN FACTORS: Public response phone number
 TRAIN RELATED: Whistle board, location sign for train

Crossing Volumes Road: 7281
 Rail: 42

Consequences e. Schol bus route
 Consequence Value: 10

Outputs ALCAM Likelihood Factor: **178** (High Likelihood) ALCAM Risk Score: **544,327,560**

Flags:

- High Speed Trains
- Non-Compliance to Standard
- Queueing
- Short Stopking

Measures:

Unaware	
could not see signal (e.g. busy road layout)	2
could not see traffic control	2
could not see train from road approach (EM)	0
could not see train from at crossing (EM)	0
vandalism	0
failure (wrong side) of active protection	0
Failure (right side) of active protection	0
shunting	0
simultaneous trains from both directions	0
passing period on starting bus	0
fatigue	0
Road standard / road driver expectation (ie. high quality road / low quality crossing)	0
Unable to Avoid	
unable to stop in time (e.g. could not see crossing in time)	11
vehicle stuck on tracks (infrastructure)	0
Vehicle stopped on tracks (vehicle / driver behaviour)	20
Unwilling to Recognise	
traffic queued on tracks	40
long vehicle overhangs on tracks	60
seeing train or mistaking train speed	7
driving through passive control without braking	0
driving through flashing lights	0
driving around boom gates	20
178	

RE: ALCAM Assessment

Subject: RE: ALCAM Assessment
From: "Twomey, Ash" <Ash.Twomey@VICTRACK.com.au>
Date: Mon, 10 May 2010 18:53:34 +1000
To: "Robert Stamp" <rwstamp@optusnet.com.au>
CC: "Mills, Peter" <Peter.Mills@VICTRACK.com.au>

Hi Robert,

Apologies for the delay but hopefully this is the information you were looking for.

In Summary, following the proposed works the ALCAM Likelihood factor would reduce from 178 to 39. The key contributors to this reduction was the assumption that the metered traffic lights would completely removed the short stacking and queuing risks at this location. The proposals also assumed that all the signs and line marking would be brought up to the current standard.

The Consequence factor remains the same (10 which is the max consequence multiple) as this crossing was already rated as being a school bus route.

>From a traffic perspective the road volume you supplied us with is higher than the number on the system so the proposal incorporates the updated road traffic count (8540 v 7281).

Your estimate of rail volumes (34 trains per day was used in this proposal). This is lower than the number currently recorded on the system (42 trains). Have you also accounted for freight traffic?

I have broken down the risk score below so you can see the before and after risk score. This is just an estimate but it should provide you with some idea of the impact the works would have,

ALCAM Risk Score = ALCAM Likelihood Factor * (Rail volumes * Road volumes) * Consequence multiplier

Current Risk Score: $178 * (42 * 7281) * 10 = 544,327,560$
Proposed Risk Score: $39 * (34 * 8540) * 10 = 113,240,400$

If you have any questions or if you need any more information, please feel free to contact me,

Regards,

Ash Twomey

ALCAM Analyst

Asset Management

VicTrack

Level 7, 1010 LaTrobe St

Docklands VIC 3008

Tel: (03) 9619 8699 Fax: (03) 9619 8851

E-mail: ash.twomey@victrack.com.au

Web: www.victrack.com.au

-----Original Message-----

From: Robert Stamp [<mailto:rwstamp@optusnet.com.au>]
Sent: Monday, 10 May 2010 5:05 PM
To: Twomey, Ash

RE: ALCAM Assessment

Subject: ALCAM Assessment

Ash,

Do you require any further information on the Waterloo Road level crossing to carry out the ALCAM assessment?

Regards

Robert Stamp

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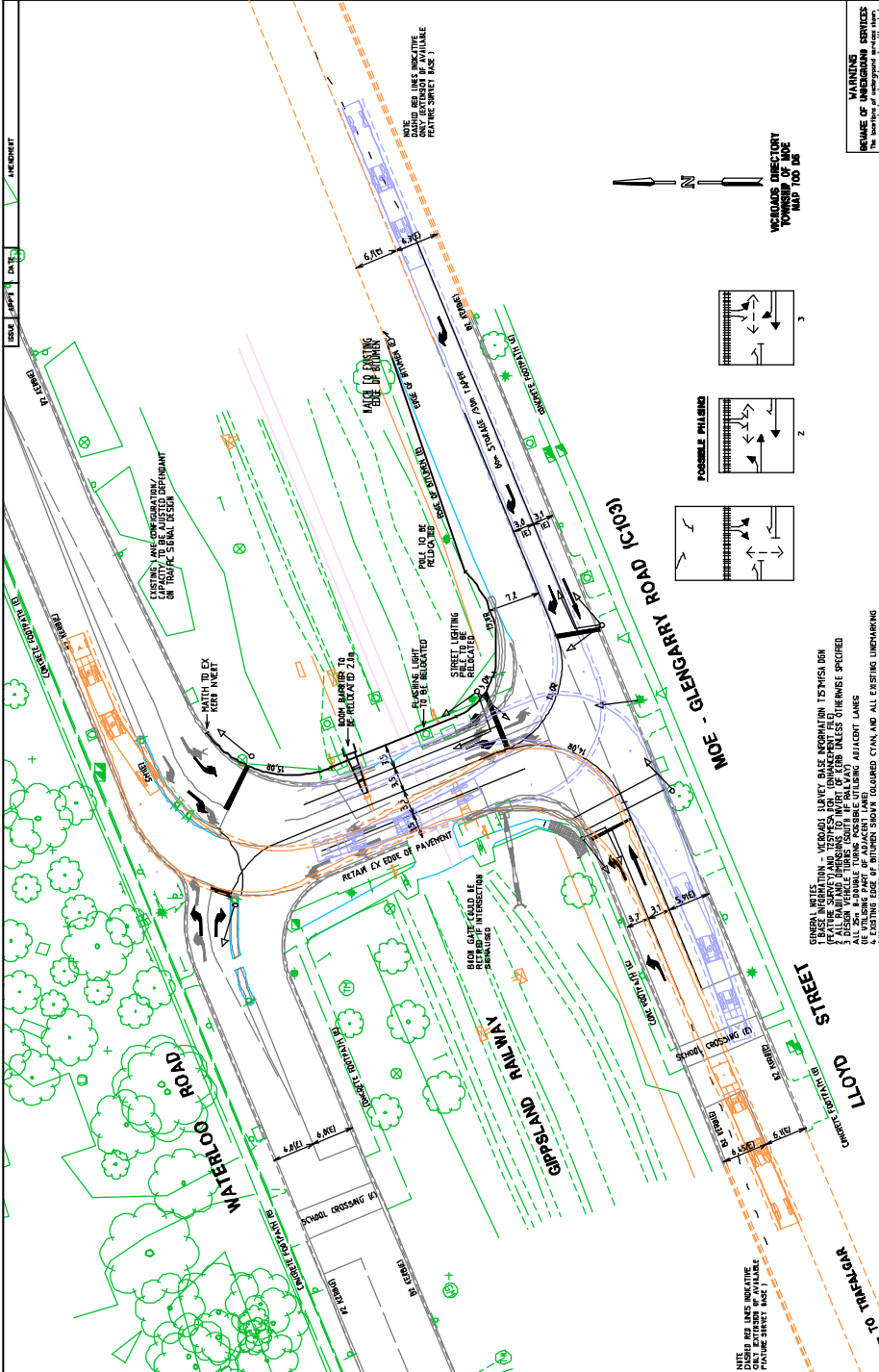
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Appendix D Concept Plans



LEGEND

[Symbol] TO BE MAINTAINED
 [Symbol] TO BE REMOVED
 [Symbol] TO BE RELOCATED
 [Symbol] TO BE RELOCATED TO ADJACENT LANES
 [Symbol] TO BE RELOCATED TO ADJACENT LANES (SEE NOTE 1)
 [Symbol] TO BE RELOCATED TO ADJACENT LANES (SEE NOTE 2)
 [Symbol] TO BE RELOCATED TO ADJACENT LANES (SEE NOTE 3)
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 [Symbol] TO BE RELOCATED TO ADJACENT LANES (SEE NOTE 5)

GENERAL NOTES

1. ALL DIMENSIONS UNLESS OTHERWISE SPECIFIED
2. ALL DIMENSIONS TO CENTER LINE UNLESS OTHERWISE SPECIFIED
3. ALL DIMENSIONS TO FACE UNLESS OTHERWISE SPECIFIED
4. ALL DIMENSIONS TO FACE UNLESS OTHERWISE SPECIFIED
5. ALL DIMENSIONS TO FACE UNLESS OTHERWISE SPECIFIED

PLANNING AND DESIGN SERVICES

The location of underground services shown on this plan are based on information provided to the designer by the client and/or other sources. The location of any other services is the responsibility of the client.

WARNING

UNDERGROUND SERVICES

EXISTING AND PROPOSED SERVICES

NOTES

EXISTING AND PROPOSED SERVICES

EXISTING AND PROPOSED SERVICES

GENERAL NOTES

1. ALL DIMENSIONS UNLESS OTHERWISE SPECIFIED
 2. ALL DIMENSIONS TO CENTER LINE UNLESS OTHERWISE SPECIFIED
 3. ALL DIMENSIONS TO FACE UNLESS OTHERWISE SPECIFIED
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 5. ALL DIMENSIONS TO FACE UNLESS OTHERWISE SPECIFIED

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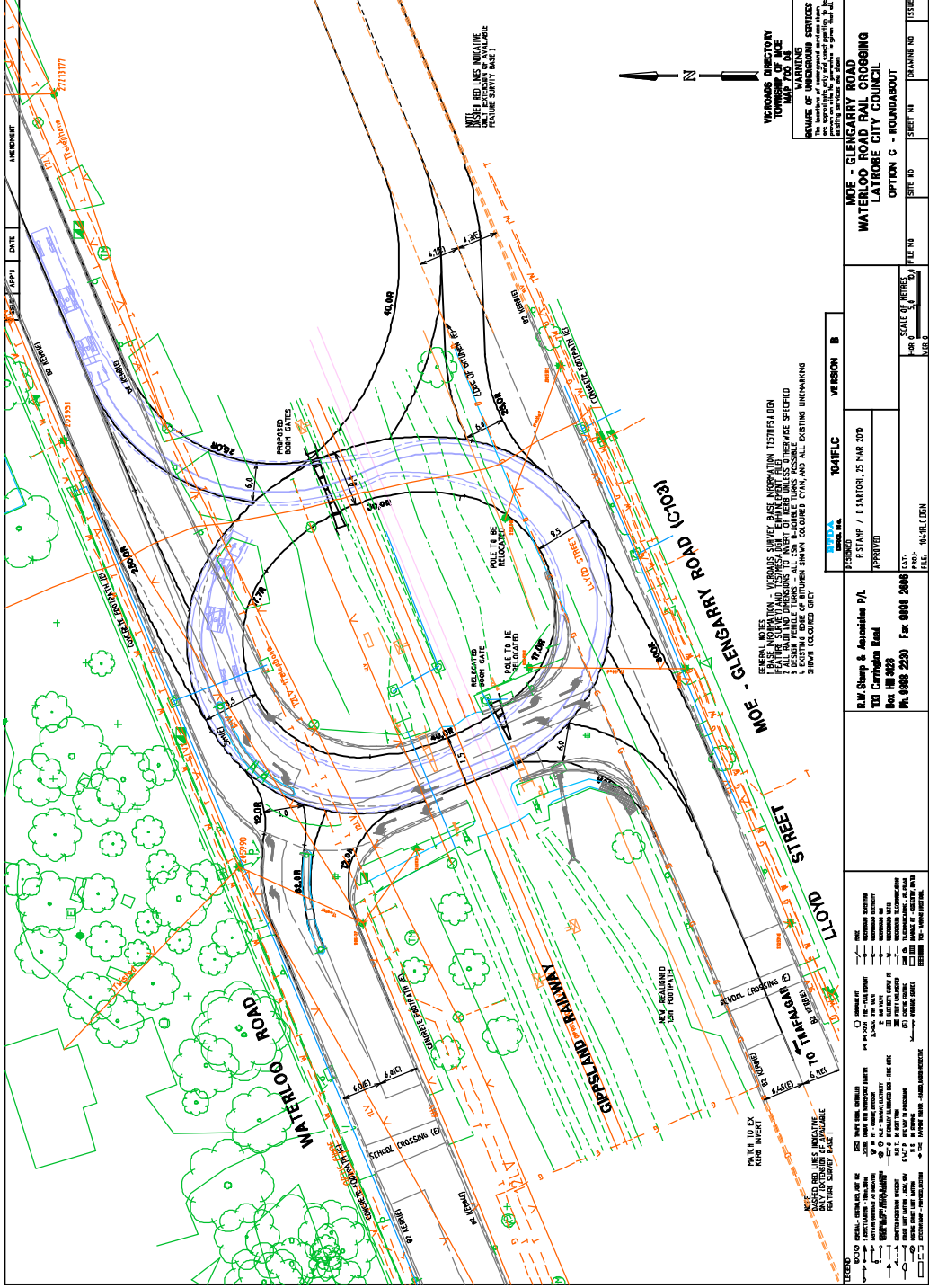
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MOE - GENGARLY ROAD WATERLOO ROAD NAIL CROSSING		SHEET NO.	
OPTION D - FULL SIGNALISATION		DRAWING NO.	
FILE NO.		DRAWING NO.	
SCALE OF PLAN		SCALE OF PROFILES	
1:100		1:10	
DATE		DRAWN BY	
25 MAR 2010		[Name]	
PROJECT		DRAWN BY	
[Project Name]		[Name]	
DESIGNED BY		DRAWN BY	
[Name]		[Name]	
CHECKED BY		DRAWN BY	
[Name]		[Name]	
APPROVED BY		DRAWN BY	
[Name]		[Name]	
DATE		DRAWN BY	
[Date]		[Name]	
PROJECT		DRAWN BY	
[Project Name]		[Name]	
DESIGNED BY		DRAWN BY	
[Name]		[Name]	
CHECKED BY		DRAWN BY	
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[Symbol]	TO BE RELOCATED TO ADJACENT LANES (SEE NOTE 5)



THESE RED LINES INDICATIVE
 OF ALL UTILITY LINE POSITIONS
 IN THIS PROJECT AREA
 (SEE MAP T02 01)

GENERAL NOTES
 1. ALL INFORMATION AND VERIFICATION IS THE RESPONSIBILITY OF THE ENGINEER.
 2. THE DESIGN IS BASED ON THE INFORMATION PROVIDED.
 3. ALL UTILITY LINES TO BE DELETED OR OTHERWISE SPECIFIED.
 4. EXISTING SIDE OF BITHEN SHOWN, COLOURED CYAN AND ALL EXISTING UNMARKING
 SHOWN COLOURED GREY.

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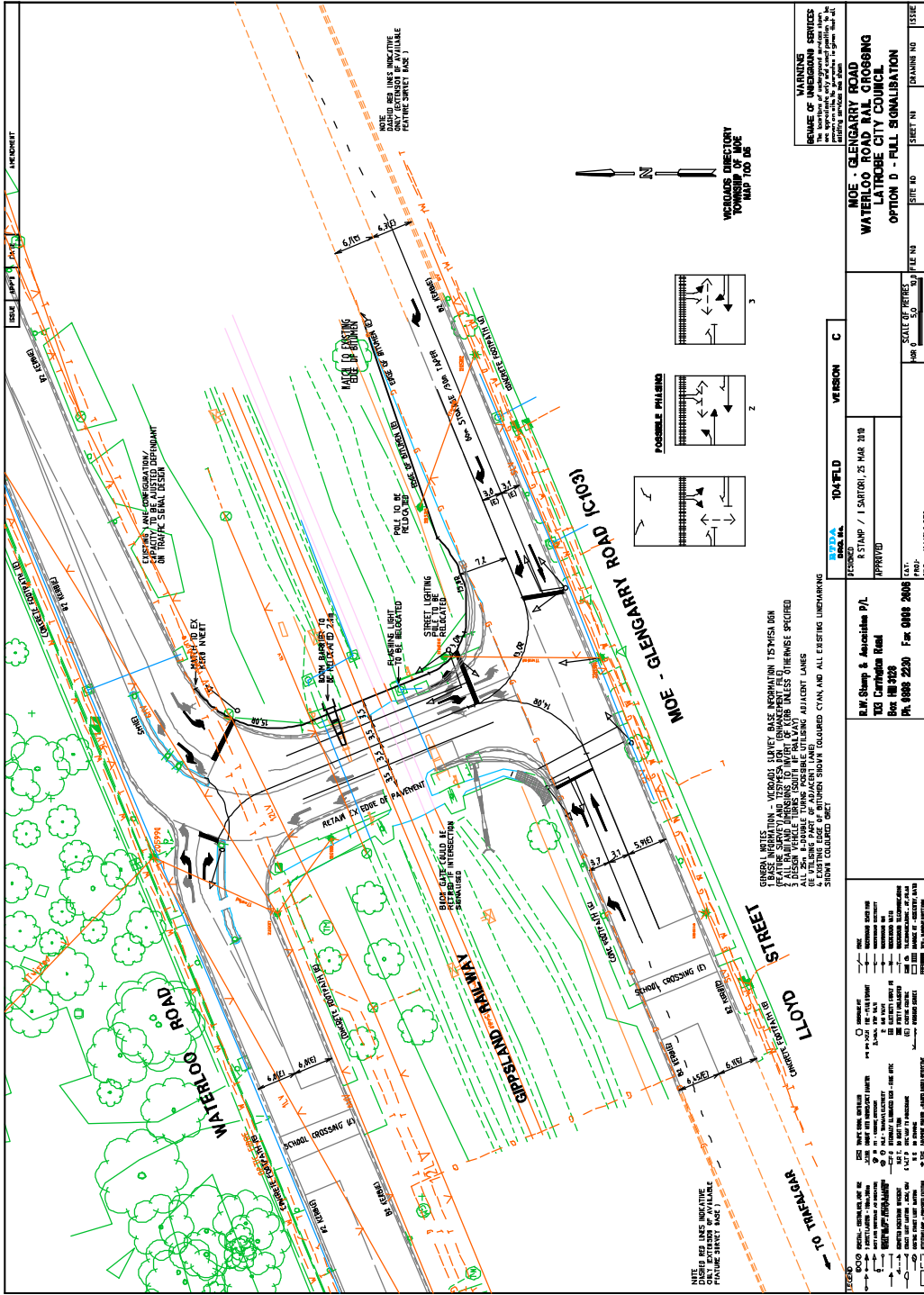
VERSION B
 14/05/2019
 R.W. Stamp & Associates P/L
 100 Curlew Road
 Box 88 3028
 PA. 8808 2200 Fax 0818 2605

PROJECT TITLE
 MOE - GLANGRORY ROAD
 WATERLOO ROAD RAIL CROSSING
 OPTION C - ROUNDABOUT

SCALE OF PAPER
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DATE
 15 MAR 2019

SHEET NO
 T02 01



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HOUSE OF WARNINGS SERVICES
 The location of underground services shown on this drawing is based on the information provided by the client and is not to be taken as a guarantee of the location of any services.

LEGEND
 - Dotted line: WARNING SERVICES
 - Solid line: WARNING SERVICES
 - Dashed line: WARNING SERVICES

NOTE:
 DOTTED RED LINES INDICATIVE OF UNDERGROUND SERVICES. DOTTED RED LINES INDICATIVE OF UNDERGROUND SERVICES. DOTTED RED LINES INDICATIVE OF UNDERGROUND SERVICES.

GENERAL NOTES:
 1. ALL ROAD MARKINGS TO BE RELOCATED TO ADJACENT LANES AND EXISTING EDGE OF BITUMEN SHOULD BE RELOCATED TO NEW EDGE OF BITUMEN.
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VERSION C
 10-1-2024

PROJECT:
 Moe - Gengary Road
 Waterloo Road NAL Crossing
 La Trobe City Council
 Option D - Full Signalisation

CLIENT:
 La Trobe City Council

PREPARED BY:
 R.W. Stamp & Associates P/L
 100 Carleton Road
 Box 900
 Parkes NSW 2886
 Tel: (61) 02 6282 2200 Fax: (61) 02 6282 2005

DATE: 25 MAR 2024
PROJECT NO.: 2024/001
DRWING NO.: 001

SCALE:
 1:50

DATE: 25 MAR 2024
PROJECT NO.: 2024/001
DRWING NO.: 001

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DATE: 25 MAR 2024
PROJECT NO.: 2024/001
DRWING NO.: 001

SCALE:
 1:50

DATE: 25 MAR 2024
PROJECT NO.: 2024/001
DRWING NO.: 001

SCALE:
 1:50

Appendix E Estimated Costs



Asset Management
Level 3, 1010 LaTrobe Street
GPO Box 1681
MELBOURNE VIC 3001

4th of May 2010

Mr Robert Stamp
R W Stamp & Associates Pty Ltd
103 Carrington Road Box Hill Vic 3128
Tel: 9898 2230
Fax: 9893 2606
Mobile: 0402 319 852

Dear Robert,

Ref- Lloyd St / Waterloo Rd (129.445km) Traffic Light Co-ordination and relocation/modification to the Level Crossing infrastructure for minor (2m) road widening on the Moe end.

In response to your email dated the 2nd of April and subsequent site inspection/meeting on the 28th of April, I am pleased to provide the attached proposal. Our proposal provides the estimated scope of works and costs to complete the works based on current industry rates and stakeholder requirements.


VicTrack will be engaged to deliver this project as a Cost Reimbursable plus the VicTrack 6.5% margin. VicTrack will adopt an "open-book" policy. (Note - VicTrack have added a recommended contingency of 20% for the Panel 2 (Design, Construct Test & Commission) works based on the outcome of the stakeholder approval process.

Once the proposed Panel 1 process is completed, a defined scope of works to complete the project will be attained and thus a defined cost forecast can be re-estimated with a reduced contingency).

The attached proposal is valid for 90 days from the above date.

Please do not hesitate to contact me for further information and/or clarification on this matter.

Regards


Matthew Kinga
Manager Signal, Track & Overhead Projects
VicTrack
Tel: 9618 8837
Mob: 0417 113 739

Lloyd Street/Waterloo Rd Moe level crossing upgrade proposal



Lloyd Street Waterloo Road, Moe.

Budgetary Estimate for the provision of a Traffic Light Co-ordination and relocation / modification to the Level Crossing infrastructure for minor (2m) road widening on the Moe end.

1. Scope of Works

The following scope of works and budgetary estimate is based your email dated the 23rd of April and subsequent site inspection/meeting on the 26th of April. The proposed site, level crossing approaches and existing signalling operational systems and arrangements have been reviewed/inspected which forms the following proposal.

The works include the following:-

1. Detailed civil and concept signalling designs, focussing diagram, risk workshop, stakeholder consultation and approval via our Panel 1 process.
2. Design, supply, installation, testing and commissioning (pending stakeholder approval) of the
 - Traffic Light Co-ordination (TLC) system which requires multiple Computer Based Interlocking. Updates to sites on the approaches. Note - VicTrack have made an allowance (PC sum) of \$250,000 in the estimate pending a price (as requested) from Inverys for the works. Once received, a revised proposal will be issued.
 - The relocation of the existing Boom Barrier (Moe end) approximately 2m from its existing position.
 - New Boom Barrier arms to both sides.
 - Relocation and replacement of the two existing Flashing Light masts and equipment (Moe end) pending the outcome of the updated civil and focussing diagrams.
 - Rewiring to the relocated and replaced assets.
 - Supply & install the new Signal Panel (2m section).
3. Management of the TLC implementation from Inverys. This work is to be sub-let to Inverys hold all rights to software systems updates to their CBI systems.
4. Safe working, site access, maintenance attendance/support, commissioning and post commissioning implementation (Note: Rail Safe working for the roads contractor is included however any work within 5m from the edge of rail shall be completed at night - outside train running hours).
5. VicTrack project development, planning and management, technical support and project implementation.

The level crossing is located on the Regional Passenger Rail (RPR) network and any works changes to signalling and/or level crossing infrastructure is limited to night works only. This involves any works on the line or within 5m from the nearest rail. We have estimated the works to be commissioned during night works.

VicTrack will be engaged to deliver this project as a Cost Reimbursable plus the VicTrack 6.5% margin. VicTrack will adopt an open-book policy with actual costs charged. (Note - VicTrack has added a recommended contingency of 20% for the Panel 2 works based on the outcome of the stakeholder approval process).

Once the proposed Panel 1 process is completed, a defined scope of work to complete the project will be attained and thus a defined cost forecast can be re-estimated with a reduced contingency.





2. Budget Estimate

The following estimate is based on the above scope of works, correspondence received to date and subsequent site meeting/inspection. Our intention is to follow our proven Panel 1 and Panel 2 stakeholder approval and project deliver process using our per-qualified contractors as used for the previous 3 years.

The Panel 1 process will define the design & construct scope of work and attain Stakeholder approval to a much greater detail for VicTrack to produce a revised (more accurate) estimate to complete the project. It is recommended to proceed immediately with the Panel 1 process to define the scope of works, and final civil and signalling arrangements which will in-turn allow VicTrack to better estimate the final cost.

Estimate

a. Panel 1 process (defined scope and stakeholder approval)

The Panel 1 system is a standard VicTrack proven process to attain stakeholder (MT/M/line/ARTC/Vicroads, etc) approval against a defined scope (signalling & civil for planned upgrades). VicTrack has been using this for the past 3 years which provides the scope for D&C contractors to tender against. This system delivers a fixed scope for tendering purposes (minimal variations post award based on maintaining the agreed scope) and a mechanism for works to proceed in stakeholder property much faster than starting from a base concept stage.

The following estimate for Lloyd Street/Waterloo Road Mo is to deliver the Panel 1 report to attain stakeholder approval and a defined scope of works for the main design & construct phase. Once the Panel 1 report is finalised and approval attained, VicTrack will review and refine the final estimate to complete the works.

	No	Qty	Unit	Jrit Rate	Estimated	Comments
4 May 10					cost	
Panel 1 Report and associated costs						
Panel 1 Report - Traffic Light Co-ordination and relocation/upgrade of EPOs and Flashing Light	1	1	no.	\$37,000	\$37,000	Includes civil, electrical signalling, four signal panels, works, risk assessment, etc.
Stakeholder Costs - Vline Panel 1	1	1	no.	\$7,500	\$7,500	Site inspections, workshop attendance, participation, approval and access fees
					\$44,500	CUSTOMER - Panel 1 report
VicTrack Margin	1	6.5%	%		\$2,883	VicTrack Operating Margin
RECOMMENDED CONTINGENCY	1	20%	%		\$8,900	
					\$55,283	CUSTOMER - Panel 1 report
PANEL 1: VicTrack Project Development, Planning & Management	1	1	no.	\$19,270	\$19,270	
PANEL 1 ESTIMATE				Total	\$75,553	excluding GST

VicTrack will only charge the Actual Cost to deliver this project as a Cost Reimbursable plus the VicTrack 6.5% margin. VicTrack will adopt an open-book policy to validate all actual costs incurred.



b. Budget estimate for the Design & Construct phase based on the preliminary sketch provided.

Based on the outcome of the stakeholder approval process, VicTrack has estimated the following stage 2 estimate. This will be refined once the Panel 1 sign off has occurred.

	No	Qty	Unit	Unit Rate	Estimated cost	Comments
4-May 10						
cost						
Stage 2 - Project Implementation based on the outcome of the Panel 1 finalisation						
Estimated Design & Construct cost	1	1	no.	\$239,041	\$239,041	
Stakeholder Costs	1	1	no.	\$17,760	\$17,760	MLINE - Site works
Safeworking on site Rail & Road	1	1	no.	\$27,000	\$27,000	Construction, Test & Commissioning phase
TRACKWORK	1	1	no.	\$16,260	\$16,260	CENTRAL PANELS AND INSTALLATION
POWER CONNECTION	1	1	no.	\$0	\$0	
INVENSY'S WESTRACE SOFTWARE CHANGES - PC SUM TO BE CONFIRMED	1	1	no.	\$250,000	\$250,000	TO BE CONFIRMED BY INVENSY'S
					\$550,071	SUBTOTAL D&C
Victrack Margin	1	6.5	%		\$35,785	Vic track operating margin
RECOMMENDED CONTINGENCY	1	20	%		\$110,014	Vic track operating margin
					\$695,870	SUBTOTAL D&C
Panel 2 : VicTrack Project Development, Planning & Management	1	1	no.	\$37,600	\$37,600	
Panel 2 : VicTrack Project Site Inspectors	1	1	no.	\$21,150	\$21,150	
Design, Construct Test & Commission estimate pending the outcome of the Panel 1 report.				Total	\$754,530	excluding GST

- * Excludes the traffic signal infrastructure, installation and commissioning. The traffic signal controller interfaces to the Level Crossing Control Equipment enclosure via a 10pr communications cable routed into a local pit adjacent to the enclosure. The signalling contractor will provide the interface pit and 10m of additional cable (located in the pit) for the Traffic Signal Contractor to access and lead back and terminate to the controller.

Note - VicTrack have included a 20% contingency for the D&C works pending the outcome of the Panel 1 report and final scope of works.

VicTrack will only charge the actual cost to deliver this project as a Cost Reimbursable plus the VicTrack 6.5% margin. VicTrack will adopt an open-book policy to validate all actual costs incurred.

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Therefore, based on the Panel 1 and Design/Construction estimates as detailed above, the overall estimate is as follows:-

- a. Panel 1 works = \$75,533 (Est. - 12 weeks)
- b. Design & Construct = \$754,589 (Est. - 23 weeks)
- c. Total Estimate "a" + "b" = \$830,152. (35 weeks in total)

Therefore, based on the above and following assumptions & estimate clarifications, the total estimate for the project is \$830,152 excluding GST.

3. Estimated Timeline to complete the works.

The estimated time required to deliver this project is as follows:-

Panel 1 works = 12 Weeks

- Project commencement & MOU (1 weeks)
- Panel 1 process (7 weeks) - Stakeholder approval to Design & Construct tender.
- Stakeholder approval (4 weeks)

Design & Construct scope and tender documentation. (2 weeks - during the Panel 1 process)

Design & Construct = 23 Weeks

- Panel 2 tender period. (3 - weeks)
- Tender evaluation and award (major contract). (2 - weeks)
- Estimated Design & Construct project timeline. (18 - weeks)
- Note: 23 weeks to commence during Post commissioning works - closeout is not included in the timeline

It is therefore estimated a total of 35 weeks from approval for VicTrack to proceed will be needed to deliver this Upgrade.

4. Assumptions

- a) Council/VicRoads to manage the relocation of all services (Cables, Water, Gas etc) to facilitate the new position for the relocated BPM Bampfs. Council/VicRoads shall ensure the services are relocated before the proposed signalling site works commencement.
- b) This offer assumes no additional signalling interfaces will be required.
- c) A recommended 20% contingency has been applied to the Panel 2 estimate (at this stage) based on the preliminary sketch supplied and the possibility of significant scope variations pending the outcome of the Panel 1 report and stakeholder approval.
- d) VicTrack have applied our standard 3.5% fee to cover our costs to deliver this project however the fee is applicable to costs only.

5. Estimate Clarifications

The following cost items have not been included within the concept estimate


- Reconstruction of the road drainage pit on the South side (east corner) as part of the road construction works
- Excludes the traffic signal infrastructure, installation and commissioning. The traffic signal controller interfaces to the Level Crossing Control equipment enclosure via a 10pin communications cable routed into a local pit adjacent to the enclosures. The signalling contractor will provide the interface pit and 10m of additional cable (bored in the pit) for the Traffic Signals contractor to access and feed back and terminate to the controller.
- Costs associated with Road works as required interfacing to the new road width. (Curb, channel, road signs and any other associated road furniture)
- Revised line marking and restoration to the existing cross hatching due to the widening.
- Relocation of services other than rail related. (Site inspection did not identify any obvious issues)
- It is assumed the rail alignment will remain within the current boundaries.
- Delay from industrial action
- Impact of market forces on tender prices (This could be a significant risk due to the limited resources in the sector)
- Provision for GST
- The final estimate will be adjusted once the Panel 1 process is completed.

Disclaimer

VicTrack has no control over the cost of labour, materials, equipment or services furnished by others, or over Contractors' methods of determining prices, or over competitive bidding or market conditions.

Any opinion or estimate of costs by VicTrack is made on the basis of our experience and represents VicTrack's judgement. VicTrack cannot and does not, however, guarantee that proposals, bids or actual costs will not vary from the budgets and estimates provided in this proposal.

VicTrack will however, endeavour to deliver the project at the lowest possible cost to Launceston City Council & VicRoads.


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Moe - Glengarry Road / Waterloo Road Intersection

Option A Metered Traffic Signals at Intersection

Item	Description	Unit	Quantity	Rate	Cost
1	Project Management	Item			\$11,814
1.1	Design & Investigation	Item			\$5,907
2	General Contract				
2.1	Survey	Item			\$2,000
2.2	Site Establishment	Item			\$3,000
2.3	Site Management and Supervision	Item			\$3,000
2.4	Prepare and Maintain Quality System	Item			\$2,500
2.3	Traffic Control	Item			\$4,000
2	Earthworks				
2.1	Removal of concrete kerb and channel	m	70	\$20	\$1,400
2.2	Excavation cut to waste	m ³	125	\$30	\$3,750
2.3	Treat unsuitable material	Item			\$1,000
2.4	Relocate Power pole	Item			\$10,000
3	Pavement				
3.1	Supply and place pavement 400 mm thick	m ²	175	\$80	\$14,000
3.2	Install 375 mm diameter RCP	m	25	\$150	\$3,750
3.3	Install concrete kerb and channel	m	450	\$40	\$18,000
3.4	Install Side Entry Pit	No	4	\$1,250	\$5,000
3.5	Modify SEP to JP	No	2	\$1,500	\$3,000
3.6	Supply and place subsurface drains	m	70	\$45	\$3,150
4	Pavement Markings and Road Furniture				
4.1	Stop bars 600 mm wide	m	35	\$35	\$1,225
4.2	Supply and place RRPM's	No	30	\$10	\$300
4.3	100 mm solid lines	m		\$2	\$0
4.4	Supply and install guideposts	No	0	\$15	\$0
5	Signal Installation				
5.1	Supply and install JUMA	No	2	\$8,500	\$17,000
5.2	Supply and install Pedestal 2B	No	6	\$1,000	\$6,000
5.3	Install conduit pits	No	12	\$100	\$1,200
5.4	Install conduits	m	250	\$20	\$5,000
5.5	Lanterns 3 aspect	No	12	\$800	\$9,600
5.6	Lanterns 6 aspect	No	3	\$1,600	\$4,800
5.7	New controller	Item			\$25,000
	Subtotal				\$147,675
	Contingency 30 %				\$44,303
	Total				\$209,699
	Electrical works by VicTrack				
	Panel 1 Process	Item			\$75,563
	Design & Construct Stage	Item			\$754,589
	Subtotal				\$830,152
	Total Cost				\$1,039,851

Moe - Glengarry Road / Waterloo Road Intersection

Option B Modified Priority at Intersection

Item	Description	Unit	Quantity	Rate	Cost
1	Project Management	Item			\$16,706
1.1	Design & Investigation	Item			\$8,353
2	General Contract				
2.1	Survey	Item			\$5,000
2.2	Site Establishment	Item			\$3,000
2.3	Site Management and Supervision	Item			\$5,000
2.4	Prepare and Maintain Quality System	Item			\$4,000
2.3	Traffic Control	Item			\$4,000
2	Earthworks				
2.1	Removal of concrete kerb and channel	m	220	\$20	\$4,400
2.2	Excavation cut to waste	m ³	900	\$30	\$27,000
2.3	Treat unsuitable material	Item			\$5,000
2.4	Relocate Power pole	Item			\$10,000
3	Pavement				
3.1	Supply and place pavement 400 mm thick	m ²	1625	\$45	\$73,125
3.2	Install 375 mm diameter RCP	m	20	\$150	\$3,000
3.3	Install concrete kerb and channel	m	520	\$40	\$20,800
3.4	Install Side Entry Pit	No	4	\$1,250	\$5,000
3.5	Modify SEP to JP	No	2	\$1,500	\$3,000
3.6	Supply and place subsurface drains	m	520	\$45	\$23,400
4	Pavement Markings and Road Furniture				
4.1	Stop bars 600 mm wide	m	20	\$35	\$700
4.2	Supply and place RRPM's	No	30	\$10	\$300
4.3	100 mm solid lines	m	335	1.5	\$503
4.4	Turn arrows	No	16	\$500	\$8,000
4.5	Supply and place chevron markings	m ²	36	\$100	\$3,600
5	Signal Installation				
5.1	Supply and install JUMA	No		\$8,500	\$0
5.2	Supply and install Pedestal 2B	No		\$1,000	\$0
5.3	Install conduit pits	No		\$100	\$0
5.4	Install conduits	m		\$20	\$0
5.5	Lanterns 3 aspect	No		\$800	\$0
5.6	Lanterns 6 aspect	No		\$1,600	\$0
5.7	New controller	Item			
	Subtotal				\$208,828
	Contingency 30 %				\$62,648
	Total				\$296,535
	Electrical works by VicTrack				
	Subtotal				\$2,000,000
	Total Cost				\$2,296,535

Moe - Glengarry Road / Waterloo Road Intersection

Option C Roundabout at railway crossing

Item	Description	Unit	Quantity	Rate	Cost
1	Project Management	Item			\$13,982
1.1	Design & Investigation	Item			\$6,991
2	General Contract				
2.1	Survey	Item			\$5,000
2.2	Site Establishment	Item			\$3,000
2.3	Site Management and Supervision	Item			\$5,000
2.4	Prepare and Maintain Quality System	Item			\$4,000
2.3	Traffic Control	Item			\$4,000
2	Earthworks				
2.1	Removal of concrete kerb and channel	m	65	\$20	\$1,300
2.2	Excavation cut to waste	m ³	425	\$30	\$12,750
2.3	Treat unsuitable material	Item			\$5,000
2.4	Relocate Power pole	Item			\$25,000
3	Pavement				
3.1	Supply and place pavement 400 mm thick	m ²	650	\$45	\$29,250
3.2	Install 375 mm diameter RCP	m	10	\$150	\$1,500
3.3	Install concrete kerb and channel	m	600	\$40	\$24,000
3.4	Supply and place 100 mm thick concrete	m ²	625	\$30	\$18,750
3.4	Install Side Entry Pit	No	4	\$1,250	\$5,000
3.5	Modify SEP to JP	No	2	\$1,500	\$3,000
3.6	Supply and place subsurface drains	m	600	\$45	\$27,000
4	Pavement Markings and Road Furniture				
4.1	Stop bars 600 mm wide	m	35	\$35	\$1,225
4.2	Supply and place RRPM's	No	0	\$10	\$0
4.3	100 mm solid lines	m		\$2	\$0
4.4	Supply and install guideposts	No	0	\$15	\$0
5	Signal Installation				
5.1	Supply and install JUMA	No		\$8,500	\$0
5.2	Supply and install Pedestal 2B	No		\$1,000	\$0
5.3	Install conduit pits	No		\$100	\$0
5.4	Install conduits	m		\$20	\$0
5.5	Lanterns 3 aspect	No		\$800	\$0
5.6	Lanterns 6 aspect	No		\$1,600	\$0
5.7	New controller	Item			
	Subtotal				\$174,775
	Contingency 30 %				\$52,433
	Total				\$248,181
	Electrical works by VicTrack				
	Subtotal				\$1,700,000
	Total Cost				\$1,948,181

Moe - Glengarry Road / Waterloo Road Intersection

Option D Full Signalisation of Intersection

Item	Description	Unit	Quantity	Rate	Cost
1	Project Management	Item			\$14,524
1.1	Design & Investigation	Item			\$7,262
2	General Contract				
2.1	Survey	Item			\$3,000
2.2	Site Establishment	Item			\$3,000
2.3	Site Management and Supervision	Item			\$3,000
2.4	Prepare and Maintain Quality System	Item			\$2,500
2.3	Traffic Control	Item			\$4,000
2	Earthworks				
2.1	Removal of concrete kerb and channel	m	70	\$20	\$1,400
2.2	Excavation cut to waste	m ³	125	\$30	\$3,750
2.3	Treat unsuitable material	Item			\$2,000
2.4	Relocate Power pole	Item			\$10,000
3	Pavement				
3.1	Supply and place pavement 400 mm thick	m ²	175	\$80	\$14,000
3.2	Install 375 mm diameter RCP	m	25	\$150	\$3,750
3.3	Install concrete kerb and channel	m	450	\$40	\$18,000
3.4	Install pram crossings	No	2	\$800	\$1,600
3.5	Install Side Entry Pit	No	4	\$1,250	\$5,000
3.6	Modify SEP to JP	No	2	\$1,500	\$3,000
3.7	Supply and place subsurface drains	m	70	\$45	\$3,150
4	Pavement Markings and Road Furniture				
4.1	Stop bars 600 mm wide	m	35	\$35	\$1,225
4.2	Supply and place RRPm's	No	30	\$10	\$300
4.3	100 mm solid lines	m	350	1.5	\$525
4.4	Turn arrows	No	12	\$500	\$6,000
4.5	100 mm pedestrian lines	m	100	1.5	\$150
5	Signal Installation				
5.1	Supply and install JUMA	No	3	\$8,500	\$25,500
5.2	Supply and install Pedestal 2B	No	8	\$1,000	\$8,000
5.3	Install conduit pits	No	15	\$100	\$1,500
5.4	Install conduits	m	220	\$20	\$4,400
5.5	Lanterns 3 aspect	No	15	\$800	\$12,000
5.6	Lanterns 6 aspect	No	3	\$1,600	\$4,800
5.7	Pedestrian lanterns	No	5	\$400	\$2,000
5.8	Supply and install detector pits	No	8	\$500	\$4,000
5.9	Programming Controller	Item			\$5,000
5.1	New controller	Item			\$25,000
	Subtotal				\$181,550
	Contingency 30 %				\$54,465
	Total				\$257,801
	Electrical works by VicTrack				
	Panel 1 Process	Item			\$75,563
	Design & Construct Stage	Item			\$754,589
	Subtotal				\$830,152
	Total Cost				\$1,087,953