Cardno

Shaping the Future

TRAFFIC STUDY
WONGA ROAD, PICTON

FINAL REPORT

Prepared for
Wollondilly Shire Council

transportation | traffic | engineering | planning

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Final Draft	3 February 2011	John Gill	JG	Connie Lau	CL

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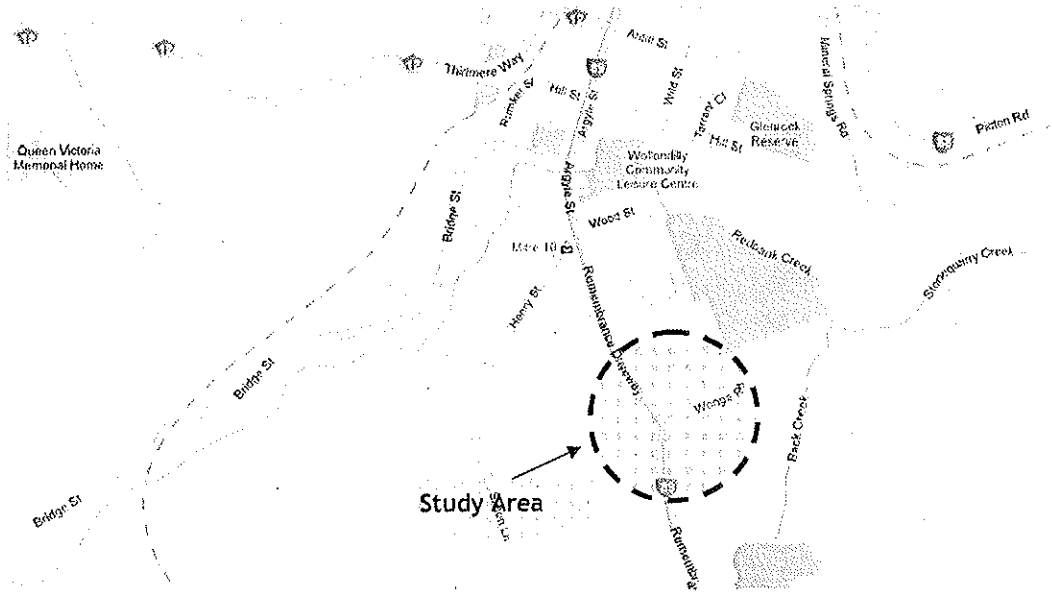
1 INTRODUCTION

Cardno was commissioned by Wollondilly Shire Council to investigate the impact on the Remembrance Driveway/Wonga Road intersection due to several potential changes to the use of property with access to Remembrance Driveway and Wong Road in the vicinity of the intersection.

The study area is shown in **Figure 1**.

Figure 1 Study Area



Google maps

1.1 SCOPE OF WORKS

The scope of works included:

- Estimating the changes in numbers and types of vehicles movements through the Remembrance Driveway/Wonga Road intersection as a result of changes to the use of lots along Wonga Road and Remembrance Driveway that may have an impact on traffic through the intersection;
- Preparing a traffic model of future traffic flows through the Remembrance Road/Wonga Road intersection;
- Recommending traffic management works to safely accommodate the changes in traffic through the Remembrance Road/Wonga Road intersection; and
- Estimating the costs of traffic management works identified above and recommending strategies for Council to meet the costs of these works.

1.2 REFERENCE AND COUNCIL DOCUMENTS

The following documents have been referenced as part of this study:

- AUSTROADS Parts 5, 6, 13, 14
- NSW RTA Guide to Traffic Generating Developments (2002)

The following background documents were provided by Wollondilly Shire Council;

- Maps and aerial photos
- Data sets and modelling from 2006 to 2036 at 5 year intervals Wollondilly Shire wide and at a local level for the Picton Tahmoor Thirlmere locality using the TRAX modelling software
- Information on the estimated number and type of vehicle movements generated from the existing Animal Shelter, Community Nursery and Theiss Depot in Wonga Road.
- Information on the estimated number and type of vehicle movements generated from the Council Works Depot
- A copy of the traffic study prepared in support of a Development Application for a Bus Depot at Lots 910 and 911 DP 1121899
- A copy of the intersection plan from the Bus Depot DA
- Information about the existing Earth Moving Establishment at Lot 2 DP 570466
- Information about the place of public worship currently under construction on Lot 11 DP 1092179
- Information from the Department of Education and Picton High School regarding bus pickups and drop offs for Picton High School and staff and student parking requirements

2 EXISTING ROAD AND TRAFFIC CONDITIONS

2.1 ROADS

The two roads in this study are Remembrance Driveway and Wonga Road, Picton.

Remembrance Driveway is classified by the RTA as a Regional Road as it is a major traffic route in the area carrying traffic between the local areas of Bargo, Tahmoor, Picton and Camden.

Remembrance Driveway has been constructed as a two lane rural road with two 3.5 m lanes and a narrow paved shoulder less than 300mm wide. The posted speed limit through the Wonga Road intersection is 60km/hr

Wonga Road is classified by the RTA as a Local Road. Wonga Road is a dead end street approximately 400m long. It provides access to several local residents and businesses.

Wonga Road has been constructed as a paved rural local road about 5-6m wide, with no paved shoulder or kerb and gutter. The speed limit is 50km/hr in accordance with the NSW 50km/hr Default Urban Speed Limit (DUSL).

The Remembrance Driveway/Wonga Road intersection has been constructed as a Channelised Rural (CHR) intersection in that the intersection is lane marked with a right turn lane for northbound traffic turning right into Wonga Road, approximately 3m wide and 30m long. There is no deceleration lane for the left turn from Remembrance Driveway into Wonga Road. Wonga Road has a short section of double BB lane marking at the approach to the intersection. The intersection is controlled by a STOP sign on Wonga Road.

A type CHR intersection is usually provided where the legs of the intersection are at odd angles, there are heavy turning movements and where the safety record of the intersection is shown to be susceptible to particular accident types, such as opposing side swipe and head on crashes, right turn opposing and high speed, rear end collisions. The Remembrance Driveway/Wonga Road intersection is a dog-leg intersection with frequent movement of heavy vehicle movements through the intersection.

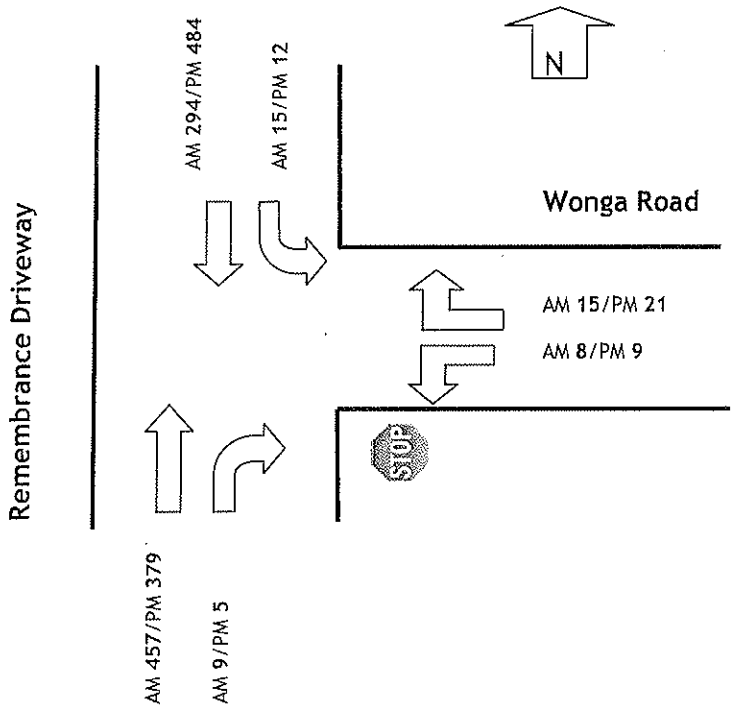
2.2 TRAFFIC

Intersection Traffic Counts:

The most recent traffic counts at the Remembrance Driveway/Wonga Road intersection were taken 16th November 2005 for a Traffic Impact Study to accompany a development application for *Rural Industry; Installation of Fuel Tanks and Silt Ponds New Shed and Extension to Existing Shed; Formalising Primary Product Stockpiles and Ancillary Activities at Lot 2 DP 570466 Wonga Road Picton* prepared by Barry Saxton Traffic Services.

The AM and PM peak hour traffic counts from this report are shown in **Figure 2**.

Figure 2 AM/PM Peak Hour Traffic Movements (16 Nov 2005)



Mid Block Traffic Counts:

The most recently available mid-block traffic counts along Remembrance Driveway and Wonga Road are summarised in **Table 1**.

Table 1 Mid-block traffic counts

Station	Location	2009
Remembrance Driveway	North of Remembrance Dr/Wonga Rd intersection	AADT (2003) NB: 5,050 vehicles/day SB: 4,829 vehicles/day
Wonga Road	East of Remembrance Dr/Wonga Rd intersection	AADT (2009) EB 183 vehicles/day WB 182 vehicles/day

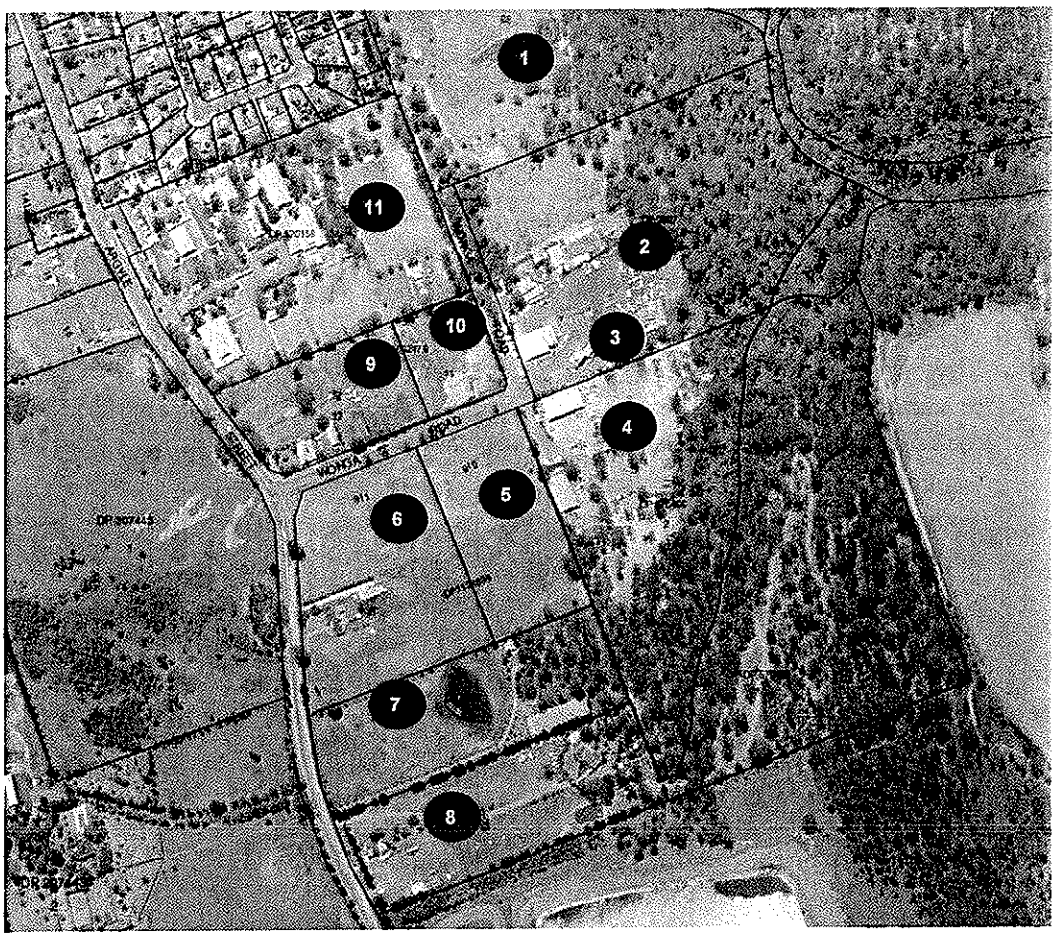
3 FUTURE TRAFFIC CONDITIONS

3.1 TRAFFIC MOVEMENTS BY AREA

Future Traffic movements through the Remembrance Driveway/Wonga Road intersection will depend on changes to the use of the lots along Remembrance Driveway and Wonga Road in the immediate vicinity of the intersection as shown in **Figure 3**. Areas 1 to 11 shown in **Figure 3** will have the greatest impact because they will increase the turning movements for light and heavy vehicles through the intersection.

See **Appendix A** for further details of each lot included in Areas 1 to 11 with respect to the lots land and owner, area, classification, use and issues about each lot.

Figure 3 **Lots with traffic impact on Wonga Road**



The changes in usage of Areas 1 to 11 as they affect traffic movements on Remembrance Driveway/Wonga Road are:

Area 1 - Open Space and minor uses to proposed usage as the WSC Works Depot and parking for the Picton High School

- The proposal is to use Area 1 (Lot 68 DP 3007-WSC) for parking for the Picton High School and for the Wollondilly Shire Council (WSC) Depot.
- The proposal is to close all vehicular access to Picton High School from Remembrance Drive and to provide all staff and student parking in Area 1 - see comments for Area 11.

Traffic movements to and from Area 1 in the morning and evening peak hours have been estimated as follows:

- About 120 staff vehicles, 40 student vehicles and 10 miscellaneous vehicles (cleaners, visitors, gardeners, ancillary staff) have been assumed to arrive in the morning peak hour 8:30am-9:30am and 20 per cent (say 30 vehicles) of these vehicles will depart in the same period.
- About 120 staff vehicles, 40 student vehicles and 10 miscellaneous vehicles have been assumed to depart in the evening peak hour 3:30pm-4:30pm and 20 per cent (say 30 vehicles) of these vehicles will arrive in the same period.
- Area 1 will also be used for parking by Council's Works Depot which is proposed to be relocated from its current site on Margaret Street, Picton. A traffic count at the entrance to the Margaret Street Works Depot counted a total of 132 vehicle movements into (66 vehicles) and out (66 vehicles) of the works depot during the day of which 10% were heavy vehicles. Assuming 10% of these vehicles were in the peak hours then it is further assumed that 10 vehicles will enter and 4 vehicles will leave in the morning peak hour and 10 vehicles will leave and 4 vehicles will arrive in the evening peak hour.
- It is noted that an additional 40 vehicles, which belong to the staff, would access the Council's Margaret Street Works Depot daily and park at the adjoining Council's land. Because they do not access through the depot entrance they are not included in the traffic count. These staffs enter the car park before the AM peak and leave the Works Depot before the PM peak hence they would not have been included in the AM and PM peak hour traffic counts.
- **Table 2** summarises the expected increase in traffic movements due to Area 1 being used for parking by Picton High School and for the WSC Depot. Bus movements to and from the school are included in Area 5. The assumption has been made that of the 64 buses leaving Area 5 each morning 20+ buses will return to the Bus Depot via the school after picking up students from the surrounding area. In the afternoon 20+ buses will leave the bus depot pickup students at the school and return to the depot after dropping off the students at their homes or drop-off points.

Table 2 Increase in Vehicle Movements to Areas 1

Use	AM Peak Hour		PM Peak Hour		% Heavy Vehicles
	IN	OUT	IN	OUT	
Staff and Student Parking	170	30	30	170	0%
Council Works Depot	10	4	4	10	10%
TOTAL	180	34	34	180	2%

Area 2 - Nursery and Animal Shelter plus parking for plant and equipment for WSC Depot

- The proposal is to keep the existing nursery and animal shelter in Area 2 (Lot 1 DP 1118401-WSC), but add additional parking for the WSC Depot in addition to the parking already included in Area 1.
- All traffic movements to the WSC Depot have been accounted for in **Table 1** based on the traffic count at the entrance to the existing Margaret Street Works Depot. Therefore there will be no additional traffic from the parking spaces for the WSC in Area 2
- The nursery and animal shelter are not expected to generate any additional traffic in the morning or evening peak hours

Area 3 - Waste Services Depot, workshop, transfer station and office

- The lease of the property by Thiess will expire 2012.
- There is a possibility of expanding the Transfer Station, however this is expected to have only a minimal impact on peak hour traffic as vehicles to and from the Transfer Station are mostly during the day and on weekends. Thiess expects the number of vehicles to the Transfer Station may increase from around 30 vehicles per day at present, to 60 vehicles per day in the future
- In summary there will be no increase in traffic in Area 3.

Area 4 - Earthworks contractor and retail nursery and wholesale sand and soil supply

- Area 4 (Lot 2 DP 570466-Godfrey) is currently occupied by an earthworks contractor.
- WSC has approved the use of Area 4 for a retail nursery and for wholesale sand and soil supply. Traffic for these uses has been generated on the basis that the site will be rezoned IN2 (Light Industrial). The RTA Guide to Traffic Generating Developments estimates traffic from a light industrial area (assume Warehouse) will be generated at the rate of 4 two-way vehicle movements per day per 100 m^2 or 0.5 vehicle movements per peak hour per 100m^2 GFA. On this basis the site could generate approximately 10 two-way vehicle trips in the morning and evening peak hours for a 2,000m^2 warehouse building. Trips to and from the site have assumed to be split 80/20 with 80% into the site in the morning peak hour and 20% out the site during the same period. The reverse for the evening peak hour.

- The nursery could generate significant trips but the peak period for a nursery is on weekends. The RTA Guide to Traffic Generating Developments estimates that the peak hour traffic movements for a plant nursery is 57 + 0.7 two way vehicle trips /100m^2 per hour. On this basis and assuming the plant nursery will occupy one hectare the plant nursery will generate approximately 127 vehicle trips per hour per hectare at peak times on weekends
- In summary, Area 4 could generate up to 8 additional vehicle trips to Area 4 and 2 additional vehicle trips from Area 4 in the morning peak hour with the traffic movements reversed in the evening peak hour.

Area 5 - Proposed use as Bus Depot

- WSC has given Deferred Commencement Consent (DA D527-07P5 – 15 June 2009) to Williams River Steel for a Bus Depot to occupy Area 5 (Lot 910 DP 1121899 – Picton Bus Lines
- The proposed development of Area 5 as a Bus Depot contains provision for 48 car parking spaces and 64 bus parking spaces.
- The *RTA Guide to Traffic Generating Developments* does not give a traffic generation rate for a Bus Depot. In this study it has been assumed that all 64 buses will depart from the site in the peak hour and return in the peak hour. This is a very conservation estimate but would be a worst case with respect to traffic movements through the Remembrance Driveway intersection. Approximately 20+ of these buses will return via Picton High School in the morning peak hour and leave via Picton High School in the afternoon peak hour.
- For the car movements by drivers and staff it has been assumed that 80% of the 48 parking spaces will be accessed in the peak hours. That is approximately 40 two-way car movements to and from Area 5 in the peak hours with 80% of these movements (32 vehicles) inbound and 8 vehicles outbound in the morning peak hour and the reverse in the evening peak hour
- An attempt was made to extract car and bus movements to and from Area 5 from a Traffic Impact Study prepared Barry Saxton Traffic Services April 2007 – 'Proposed Steel Framed Buildings for the Relocation of Picton Buslines', however the data provided in this report could not be readily related to car and bus movements in the peak hours and hence was not used.
- In summary the Bus Depot will generate 64 bus movements to and from the Bus Depot in the morning and evening peak hours plus 32 cars arriving and 8 cars departing in the morning peak hour and 32 cars departing and 8 cars arriving in the afternoon peak hour.

Areas 6, 7, 8 & 9 - Residential Properties

- Areas 6, 7, 8 & 9 are currently residential and are not expected to change in the short term. However by 2036 they are proposed to be redeveloped as "Light Industrial" (IN2 using the WSC Zoning Category). Under current Council policy for IN2 these areas would be developed with a Site Area Ratio of 50% and a Floor Space Ratio (FSR) of 1:1. However a further traffic study is required to assess the impact of this level of development on the local road network.
- The traffic generation rate for a "Light Industrial" development using the RTA Guide to Traffic Generating Developments is covered under the "Warehousing" category for an Industrial area.

The traffic generation rate for "Warehousing" is 0.5 trips per 100m2 GFA in the peak hour. On this basis the four areas would generate approximately 909 two-way vehicle trips in the peak hour.

- The land area for Areas 6, 7, 8 & 9 is 18.159ha or 181,590m2 as follows

Area 6 – Lot 911 DP 1121899 – Picton Bus Lines (3.138ha)
Area 7 – Lot 11 DP 3007 – Walker (3.001ha)
Area 8 – Lot 1 DP570466 – Kalpaxis (10.31ha)
Area 9 – Lot 12 DP 1092179 – Hilder (1.71ha)

Area 10 - Future Church site

- Area 10 (Lot 11 DP1092179 – Picton Gospell Trust) was previously undeveloped, however a church is currently under construction that will accommodate 630 people and 132 car parking spaces
- The peak times for church services are on Sundays or evening and hence generally occur outside normal school and business hours
- In summary there will be no additional vehicle movements from Area 10 in the morning or evening peak hours

Area 11 - Picton High School

- Traffic movements to and from the Picton High School - Area 11 (Lot 2 DP 520158) – will have a significant impact on traffic movements through the Remembrance Driveway/Wonga Road intersection because it is proposed to close all vehicle access (cars and buses) to the school from Remembrance Driveway. The proposal is for all vehicle access to be from Wonga Road with staff and student parking relocated to Area 1
- In 2010 Picton High School had about 1,300 students and 120 staff.
- In 2010 approximately 21 School buses arrived at the school from 8:15am-8:50am and departed from 3.30pm-4:00pm. Bus pick-ups and set-downs was within the school grounds
- In 2010 there were 120 staff vehicles. For this study it has been assumed that all 120 vehicles arrived at the school during the morning peak hour 8:30am-9.30am and left during the afternoon peak hour 3:30pm-4:30pm
- In 2010 there were 40 student cars. For this study it has been assumed that all 40 student vehicles arrived and departed from the school in the morning and evening peak hours as for teaches.
- For this study it has been assumed that another 10 vehicles arrived and departed from the school in the peak hours due to visitors, ancillary staff, cleaners, gardeners etc attending the school at these times.
- While 170 (120 staff + 40 students + 10 others) cars arrived in the morning peak hour it was assumed that approximately 20% (17 cars) of these vehicles would leave the school in the same period. The reverse situation was assumed to occur in the afternoon peak hour.

- It has been assumed that all other visitations to the school by vehicle will be during the day and hence outside peak hours.
- The movement of buses to and from the school in the peak hours has already been included in the bus movements from Area 5 above. It has been assumed that all school buses serving the Picton High School will originate from the Area 5 Bus Depot.
- All students and staff will park in Area 1.
- The number of students attending the school is projected to increase by about 2% per year for the foreseeable future. It has been assumed this increase will include extra staff and students for the Trade School, the Hospitality TTC centre and the care for the DYP facility
- This study has not reduced existing traffic movements through the Remembrance Driveway/Wonga Road intersection due to the closure of the vehicular access to the school from Remembrance Driveway
- In Summary, **Area 1** will also be used for parking by Council's Works Depot which is proposed to be relocated from its current site on Margaret Street, Picton. A traffic count at the entrance to the Margaret Street Works Depot counted a total of 132 vehicle movements; 66 vehicles into the works depot and 66 vehicles out of the works depot during the day of which 10% were heavy vehicles. Assuming 10% of these vehicles were in the peak hours then it is further assumed that 10 vehicles will enter and 4 vehicles will leave in the morning peak hour and 10 vehicles will leave and 4 vehicles will arrive in the evening peak hour.
- **It is** noted that an additional 40 vehicles access the Council's Margaret Street Works Depot and park their cars on the adjoining Council land. Because they do not access through the entrance to the Works Depot they are not included in the traffic count. These staffs enter the car park before the AM peak and leave the Works Depot before the PM peak hence they are not included in the AM and PM peak hour traffic counts.
- **Table 2** summarises the expected increase in traffic movements due to Area 1 being used for parking by Picton High School and by the WSC Works Depot. Bus movements to and from the school are included in Area 5. The assumption is that of the 64 buses leaving Area 5 each morning 20+ buses will return to the Bus Depot via the school after picking up students from the surrounding area. In the afternoon 20+ buses will leave the bus depot pickup students at the school and return to the depot after dropping off the students at their homes or drop-off points.
- **Table 2** therefore summarises the additional vehicle movements on Wonga Road, to and from the Picton High School due to the proposed changes to vehicle access to the school and the relocation of the school parking

3.2 SUMMARY OF FUTURE TRAFFIC MOVEMENTS

Table 3 summarises the future traffic movements through the Remembrance Driveway/Wonga Road intersection due to all proposed changes in land use identified in Section 3.1. These increases are expected in the short term if the proposed changes are implemented by 2015.

Table 4 summarises the increase in traffic movements in the long term over the next 26 years (by 2036). School enrolments and background traffic movements have been assumed to increase by 2% per annum during this period.

Table 3 Summary of Short Term (2015) Increase in Traffic Movements

Use	AM Peak Hour 8.30-9.30am		PM Peak Hour 3.30-4.30pm		% Heavy Vehicles
	IN	OUT	IN	OUT	
Area 1 – Parking	180	34	34	180	2%
Area 2 – WSC Depot	0	0	0	0	0
Area 3 – Thiess	0	0	0	0	0
Area 4 – Retail nursery	8	2	2	8	0
Area 5 – Bus Depot	96	72	72	96	76%
Areas 6, 7, 8 & 9 - Residential	0	0	0	0	0
Area 10 - Church	0	0	0	0	0
Area 11 – Picton High School (Included in Areas 1 and 5)	0	0	0	0	0
TOTAL	**284**	**108**	**108**	**284**	**33%**

Table 4 **Summary of Long Term (2036) Increase in Traffic Movements**

Use	AM Peak Hour 8.30-9.30am		PM Peak Hour 3.30-4.30pm		% Heavy Vehicles
	IN	OUT	IN	OUT	
Area 1 – Parking (Increased by 2% per annum)*	300	57	57	300	2%
Area 2 – WSC Depot	0	0	0	0	0
Area 3 – Thiess	0	0	0	0	0
Area 4 – Retail nursery	8	2	2	8	0
Area 5 – Bus Depot	96	72	72	96	76%
Areas 6, 7, 8 & 9 - Residential	0	0	0	0	0
Area 10 - Church	0	0	0	0	0
Area 11 – Picton High School (Included in Areas 1 and 5)	0	0	0	0	0
TOTAL	**404**	**131**	**131**	**404**	**25%**

*(2% per annum for 26 years is an increase of 1.67 times exiting values)

3.3 FUTURE INTERSECTION TURNING MOVEMENTS

Future intersection turning movements through the Remembrance Driveway/Wonga Road intersection were determined by adding the traffic movements in **Table 3** and **Table 4** to the existing traffic movements through the intersection.

The traffic movements in **Table 3** and **Table 4** were distributed to each turning movement in proportion to the existing turning movements. The per cent distribution of traffic entering and leaving Wonga Road is shown in Figure 4.

Figure 4 Per Cent Distribution of Existing Traffic Entering and Leaving Wonga Road (16 Nov 2005)

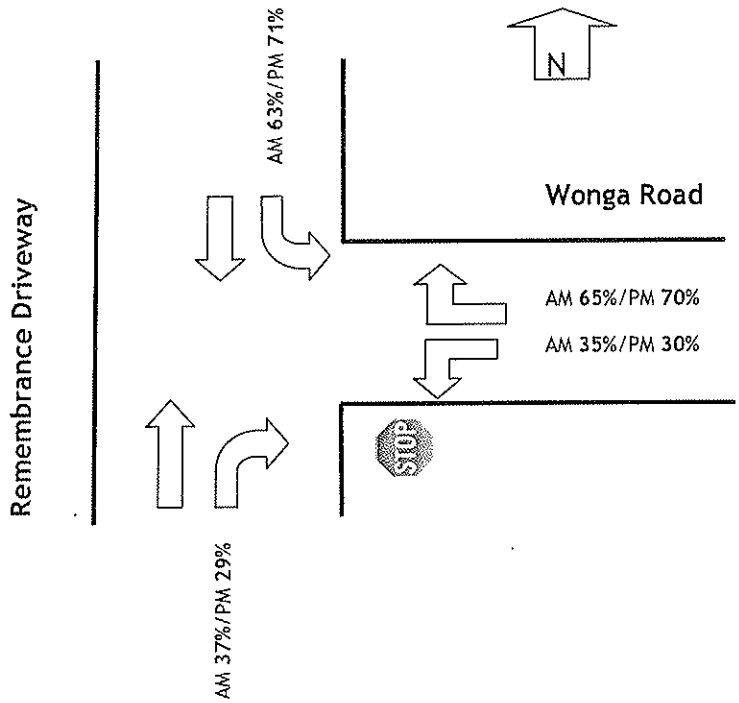


Figure 5 shows the Short Term intersection traffic movement option assuming all changes in land use were completed by 2015. Figure 5 is the sum of the existing 2005 traffic movements (Figure 2) plus the additional traffic from Table 3 – see Appendix B for calculation details.

Figure 6 shows the Long Term intersection traffic movement option assuming all changes in land use were completed by 2036. Figure 6 is the sums of the existing 2005 traffic movements (Figure 2) plus the additional traffic from Table 4 – see Appendix B for calculation details. Through traffic movements on Remembrance Driveway have been increased by 2% per year from 2010 to 2036 assuming there has been little to no increase in traffic on Remembrance Driveway since 2005.

Figure 5 **Short Term (2015) am/pm Peak Hour Traffic Movements**

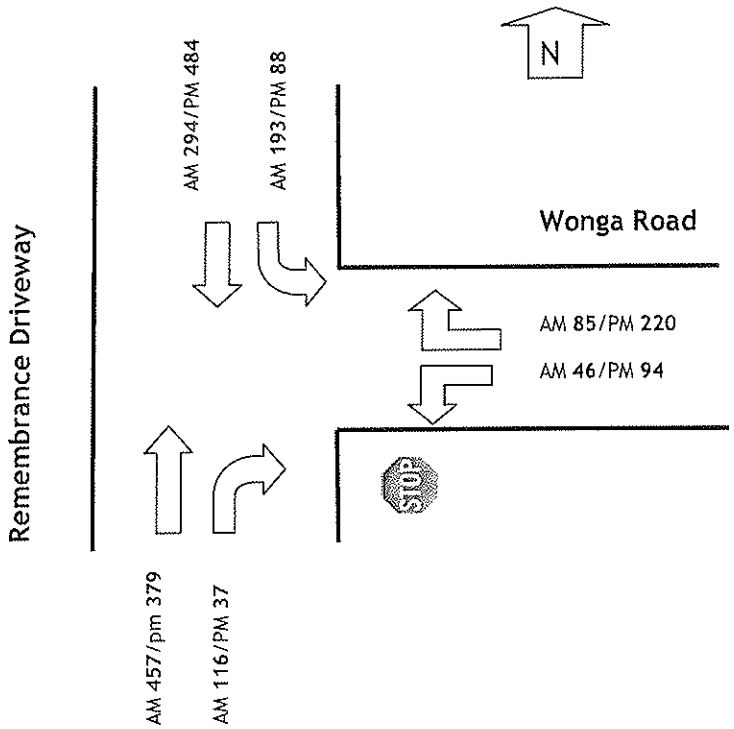
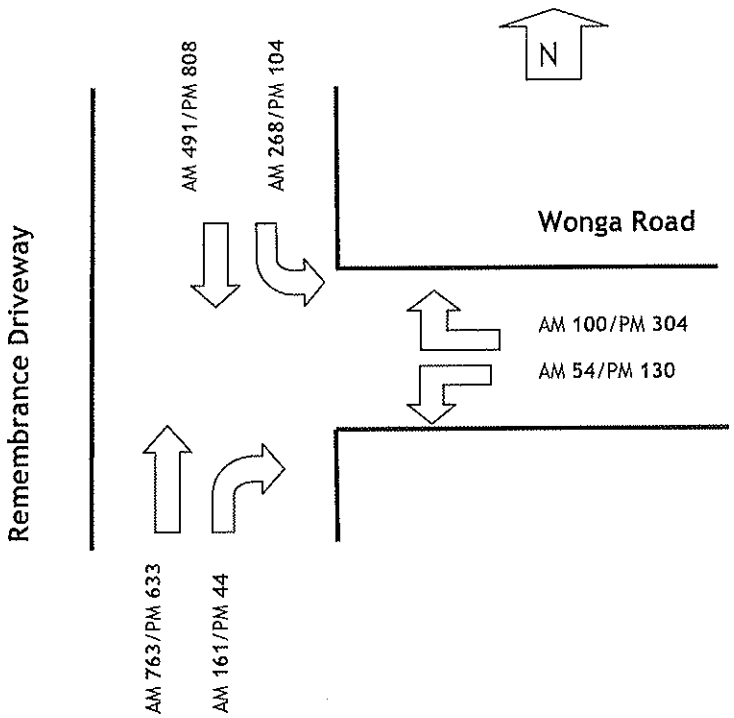


Figure 6 **Long Term (2036) am/pm Peak Hour Traffic Movements**



3.4 ANALYSIS OF FUTURE INTERSECTION TURNING MOVEMENTS

The short and Long Term intersection turning movements in Figure 5 and Figure 6 were analysed for the following five intersection configuration options using SIDRA 3.2.

Option 1: Existing intersection configuration with STOP sign control on Wonga Road – see Figure 7

Option 2: Two lanes on Wonga Road approaching the intersection with STOP sign control on Wonga Road – see Figure 8

Option 3: Traffic Signals – see Figure 9

Option 4: Roundabout – see Figure 10

Option 5: Seagull – see Figure 11

Figure 7: Option 1 Existing Configuration

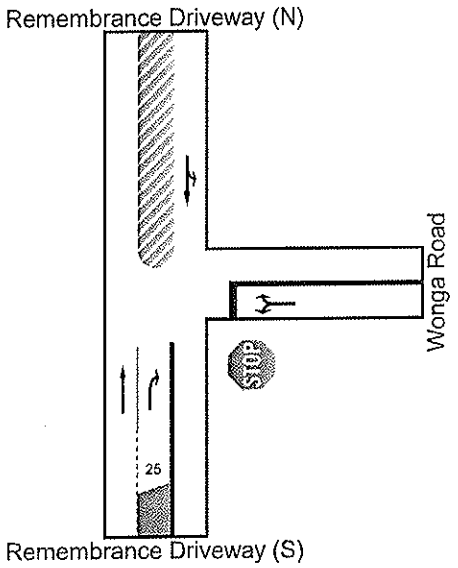


Figure 8: **Option 2 with two lane approach on Wonga Road**

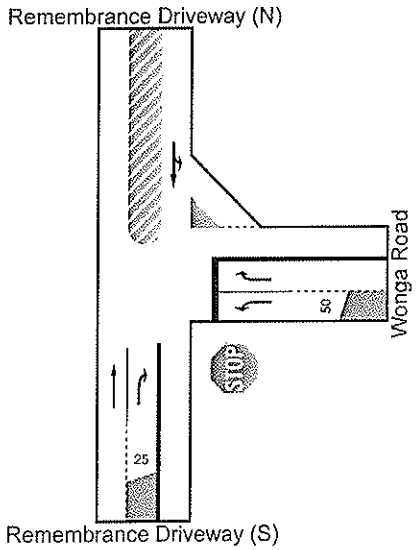


Figure 9: **Option 3 Traffic Signals**

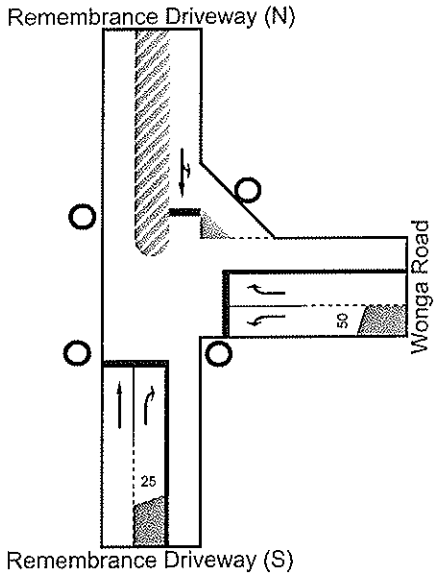


Figure 10: **Option 4 Roundabout**

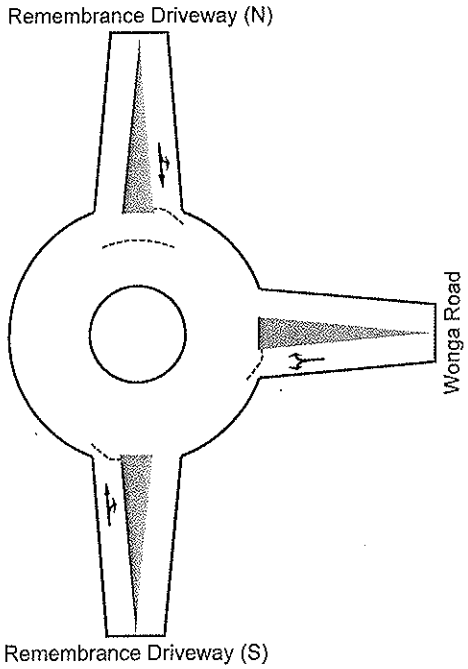
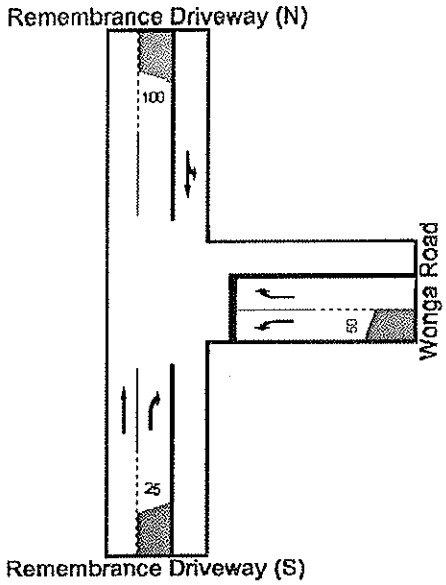


Figure 11: **Option 5 Seagull**



Results of the analysis are summarised in **Tables 5, 6** and **7**. The interpretation of Level of Service and the significance of delays and queue lengths are summarised in **Appendix D**

- **Table 5** shows that the existing intersection is adequately handling existing traffic movements through the intersection as all critical traffic movements are operating at LoS **A** and with minimal queue lengths
- **Table 6** shows that in the Short Term the two STOP sign controlled intersections (Options 1 & 2) both fail as the Wonga Road left and right turn movements are projected to operate at LoS F in the PM peak hour, with queues over 350m. However the traffic signal, roundabout and seagull intersections (Options 3, 4 & 5) are projected to operate at a satisfactory level of service with acceptable delays and queue lengths.
- **Table 7** shows that in the Long Term the results are similar to the results for the Short Term traffic movements in Table 7 with the exception that the delays and queue lengths are considerably longer, increasing theoretically from several hundred metres to over a thousand metres.

Table 5: Existing Traffic

Intersection Option	Peak Hour	Comments	Remembrance Dr, Right Turn	Wonga Rd, Left Turn	Wonga Rd, Right Turn
1 (Existing STOP)	AM	Intersection adequate	LoS A, Q 0m	LoS A, Q 1m	LoS A, Q 1m
	PM	Intersection adequate	LoS A, Q 0m	LoS B, Q 2m	LoS B, Q 2m

LoS – Level of Service, **Q** – Queue Length (m)

Table 6: Short Term Traffic

Option	Peak Hour	Comments	Remembrance Dr, Right Turn	Wonga Rd, Left Turn	Wonga Rd, Right Turn
1 (Existing STOP)	AM	Intersection adequate	LoS A, Q 7m	LoS D, Q 43m	LoS D, Q 43m
	PM	Intersection fails due to Wonga Rd Traffic	LoS B, Q 4m	LoS F, Q 350m	LoS F, Q 350m
2 (Modified STOP)	AM	Intersection adequate	LoS A, Q 7m	LoS B, Q 5m	LoS D, Q 29m
	PM	Intersection fails due to Right Turn Wonga Rd	LoS B, Q 4m	LoS B, Q 9m	LoS F, Q 104m
3 (Traffic Signals)	AM	Intersection adequate	LoS B, Q 20m	LoS B, Q 9m	LoS B, Q 17m
	PM	Intersection adequate	LoS B, Q 8m	LoS B, Q 16m	LoS B, Q 42m
4 (Roundabout)	AM	Intersection adequate	LoS A, Q 37m	LoS A, Q 13m	LoS A, Q 13m
	PM	Intersection adequate	LoS B, Q 30m	LoS A, Q 31m	LoS B, Q 31m
5 (Seagull)	AM	Intersection adequate	LoS A, Q 7m	LoS B, Q 5m	LoS B, Q 7m
	PM	Intersection adequate	LoS B, Q 4m	LoS B, Q 0m	LoS B, Q 17m

LoS – Level of Service, **Q** – Queue Length (m)

Table 7: Long Term Traffic

Option		Comments	Remembrance Dr, Right Turn	Wonga Rd, Left Turn	Wonga Rd, Right Turn
1 (Existing STOP)	AM	Intersection fails due to Wonga Rd Traffic	LoS B, Q 15m	LoS F, Q 492m	LoS F, Q 492m
	PM	Intersection fails due to Wonga Rd Traffic	LoS B, Q 8m	LoS F, Q 1896m	LoS F, Q 1896m
2 (Modified STOP)	AM	Intersection fails due to Right Turn Wonga Rd	LoS B, Q 15m	LoS B, Q 8m	LoS F, Q 96m
	PM	Intersection fails due to Right Turn Wonga Rd	LoS B, Q 8m	LoS C, Q 30m	LoS F, Q 248m
3 (Traffic Signals)	AM	Intersection adequate	LoS C, Q 38m	LoS C, Q 15m	LoS C, Q 27m
	PM	Intersection adequate	LoS C, Q 18m	LoS C, Q 38m	LoS C, Q 99m
4 (Roundabout)	AM	Intersection adequate	LoS B, Q 84m	LoS B, Q 19m	LoS B, Q 19m
	PM	Intersection adequate	LoS B, Q 112m	LoS C, Q 112m	LoS C, Q 112m
5 (Seagull)	AM	Intersection adequate	LoS B, Q 15m	LoS B, Q 8m	LoS B, Q 12m
	PM	Intersection adequate	LoS B, Q 8m	LoS C, Q 30m	LoS C, Q 43m

LoS – Level of Service, **Q** – Queue Length (m)

3.5 SENSITIVITY TEST

The Short and Long Term traffic movements in **Table 3 & 4** were based on a worst case scenario in which all 64 buses in the Bus Depot left the Bus Depot and arrived back at the Bus Depot in the peak morning hour and the peak evening hour. The School Principal mentioned (11 Nov 2010) that 21 School Buses service Picton High School in the morning, arriving between 8:15am and 8:50am in the morning and leaving 3:30pm and 4:00pm in the afternoon. The assumption was that these 21 School Buses would originate from the new Bus Depot. The remaining buses were assumed to service other schools in the area over a similar period.

A sensitivity test was undertaken to test if only half the number of buses left and returned in the peak hours i.e. 32 buses instead of 64 buses. The results of the sensitivity test, in **Appendix C, Tables C1** and **C2** show that

- In the Short Term the existing intersection will fail when the vehicular access to the school is closed and all school traffic is forced to use Wonga Road. However the intersection would continue to operate at a satisfactory level of service in the Short Term if Wonga Road was widened to two lanes on the approach to the intersection. The unknown factor is when the Bus Depot will operate at full capacity as the STOP sign controlled intersection will fail when the Bus Depot is operating at full capacity.
- In the Long Term a STOP sign controlled "T" intersection will fail even if the Bus Depot is operating at 50% capacity.

4 INTERSECTION TREATMENT CONCEPT PLAN

The recommended intersection treatment in the short term (2015) is a Seagull Intersection as shown in **Appendix F**.

In the long term, all 3 options (i.e. seagull, roundabout and signalized intersection) will perform at an acceptable level. However, in the long term the intersection treatment should also take into account the intersections:

- Ease of Use
- Safety Issues
- Cost
- Life expectancy
- Time for Approval by Council
- Time for Approval by RTA
- Does it meet RTA Warrants
- Is the purchase of private property required

For example

- A signalized intersection is the easiest and safest option for pedestrians. Pedestrians can cross the road under signal control and buses do not need to accelerate to merge into passing through traffic on Remembrance Driveway after turning right from Wonga Road into Remembrance Driveway. The Wonga Road intersection is located some distance from local residences which means there are no reasons for school children to use the intersection in the short term.

- The cost of the signalised and roundabout options is expected to be considerably higher than a standard seagull or roundabout intersection. Also a roundabout at this location will require the purchase of private property which further adds to the cost of the intersection.

- In the long term traffic signals will be able to accommodate higher volumes of traffic than either the Seagull or Roundabout options. Also a roundabout has a tendency to increase delays at "T" intersections when there is a high volume of traffic entering the intersection from the "T" part of the intersection because traffic entering the roundabout on the through road must give way to traffic on their right entering the intersection from the "T".

- RTA approval is required for the installation of traffic signals. This can take considerable time as the RTA requires that the warrant for the traffic signals is met for the forecast traffic movements.

5 SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY

In summary:

- The report estimated the change in traffic movements through the Remembrance Driveway/Wonga Road intersection as a result of changes to the use of lots (designated as Areas 1 to 9) along Wonga Road and Remembrance Driveway.
- The report prepared a traffic model of future traffic flows through the Remembrance Driveway / Wonga Road intersection. The traffic model considered Short Term (say 2015) and Long Term (say 2036) traffic movements through the intersection. The Short Term model added projected traffic movements to the existing traffic movements. The Long Term model added the projected traffic movements to the existing traffic movements but the future traffic movements were increased by 2% per annum from 2010 to 2036 (i.e. by 1.67 times). Through traffic on Remembrance Driveway was also increased by 2% per annum.
- The report did not consider the long term option (2036) of redeveloping Areas 6, 7 8 & 9 to Light Industrial because of the significant impact this could have on local roads. This option will need further investigation
- The report analysed five options for upgrading the Remembrance Driveway/Wonga Road intersection using SIDRA 3.2. The options were
  - No changes to the intersection – STOP sign control on Wonga Road,
  - Wonga Road widened to two lanes at the approach to the intersection with STO sign control
  - Traffic Signals
  - A Roundabout
  - A Seagull Intersection
- Results of the analysis at each intersection were as follows
  - The STOP sign controlled intersection would fail as soon as the vehicular access to the school from Remembrance Driveway was closed
  - A sensitivity test confirmed if only half the number of buses used the intersection in the peak hours the existing STOP sign controlled intersection would still fail.

RECOMMENDATIONS

In the Short Term (2015) it is recommended that:

- The Remembrance Driveway/Wonga Road intersection should be upgraded as either a signalised, roundabout or seagull intersection as soon as possible before the access to the school from Remembrance Driveway is closed. Traffic signals are preferred because they would be safer for pedestrians and buses but they would require approval from the RTA as they would be operating in an isolated location.
- A seagull intersection is also acceptable and this may require widening of the Wonga Road/Remembrance Driveway intersection. The plan in **Appendix F** shows a concept design for a seagull intersection. It has the following features:
  - The intersection has been designed as a rural seagull intersection on Remembrance Driveway based on the RTA Road Design Guide for a design speed of 80km/hr.
  - The existing centreline of the both roads is to be maintained
  - No new pavement works are required on Wonga Road. However, the existing line marking may need to be redone.
  - The southern side of the intersection on Remembrance Driveway will remain unchanged.
  - The northern side of the intersection on Remembrance Driveway will need some slight pavement widening and revised line marking.
  - If new pavement and line marking is required, it is recommended that the existing asphalt be striped and re-laid to provide a consistent surface that is less prone to pot holing due to joints in the pavement
  - There may be the need to trim back the existing bank on the western side of the road to ensure that there is sufficient space for the additional pavement and existing drainage overland flow path.
  - Land acquisition should not be needed to construct the proposed road widening unless the bank on the western side of the road is laid back to a point where it leaves the road reserve.
  - There does not seem to be a need to relocate any services as part of the road widening. This assumption is based on a site inspection and is made without the support of dial before you dig or further services investigation.
  - The concept design is not for construction. Further ground survey and detailed design will be needed prior to construction.
  - The intersection design will compliment the road works proposed by the bus depot, which are mainly focused on the eastern side of Remembrance Driveway.

In the Long Term (2036), Remembrance Drive/Wonga Road intersection should be upgraded to a signalized intersection when Remembrance Drive is widened to 4 lanes. Whilst the modelling results suggested that a seagull intersection or roundabout would perform satisfactorily in 2036, a signalised intersection is recommended because it is safer for pedestrians and buses and is easier to use. Another

reason is that a signalised intersection has the capacity to carry higher traffic flows than either a Seagull or Roundabout intersection especially if WSC proceeds to re-zone property around the intersection to Light Industrial use.

It is noted that Council is considering rezoning Areas 6, 7, 8 and 9 to light industrial zones (IN2). The Remembrance Drive/Wonga Road intersection (even if the intersection is upgraded to a 4 lane, signalised intersection) will not have the capacity to accommodate the full 1:1 Floor Space Ratio currently permitted in Light Industrial zone under Councils DCP. The FSR of these areas may need to be reduced depending on the following variables:

- Whether there is a new road south of Wonga Road to accommodate the additional traffic from Areas 6-9
- Number of lanes at Remembrance Driveway
- Intersection treatment of the new road and Remembrance Driveway
- Type and phasing of the traffic signal (if any)
- The access of the school if they are to be moved to Wonga Road or retained on Remembrance Drive

Each of the above scenarios will have implications on the FSR of the light industrial zone. It is recommended that Council undertake the above investigation before rezoning the site.