Endeavour Appin
Planning Proposal

Transport Impact Assessment

transportation planning, design and delivery

14S1076000 11/12/13

GTAconsultants

Endeavour Appin

Planning Proposal,

Transport Impact Assessment

Issue: B 11/12/13

Client: Walker Corporation
Reference: 14S1076000
GTA Consultants Office: NSW

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
B	11/12/13	Updated Final	Chris Slenders	Andrew Farran	Brett Maynard	

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1. Introduction

1.1 Background

A Planning Proposal is being prepared to rezone lands generally located to the west of the existing Appin township from rural uses to residential uses. The proposal is to be reviewed under the guidelines of the NSW Department of Planning's 'Gateway Process' and will be put on exhibition in the near future.

An indicative yield indicates that the site could accommodate approximately 300 residential lots, predominantly traditional low density detached dwelling lots, with a small proportion of medium density lots. Vehicle access to the central and southern parcels of land is proposed to be predominantly via Macquariedale Road, with the northern parcel to be accessed through the future North Appin subdivision (currently under construction).

GTA Consultants was commissioned by Walker Corporation in October 2013 to undertake a traffic impact assessment for the proposed development at key intersections along Appin Road.

1.2 Purpose of this Report

This report sets out an assessment of the anticipated transport implications of the proposed development, including consideration of the following:

i existing traffic conditions surrounding the site
ii pedestrian and bicycle requirements
iii the traffic generating characteristics of the proposed development
iv suitability of the proposed access arrangements for the site
v the transport impact of the development proposal on the surrounding road network.

1.3 References

In preparing this report, reference has been made to the following:

- an inspection of the site and its surrounds
- traffic surveys undertaken by Skyhigh Traffic Data Australia as referenced in the context of this report
- advice and correspondence with RMS regarding Appin Road conditions, crash history and future road proposals
- plans for the proposed development prepared by Walker Corporation, Drawing Number AR01.01, dated 12 August 2013
- South West Appin Rezoning Traffic Report, Masson Wilson Twiney, 27 April 2007
- Illawarra – South West Sydney Regional Transportation Model, Appin and Wilton Development Addendum Report, Gabites Porter, 14 November 2011
- Design Specifications, Subdivision & engineering Standards, Wollondilly Shire Council, August 2008
- Guide to Traffic Management, Part 4: Network Management, Austroads, July 2009
- other documents and data as referenced in this report.

2. Existing Conditions

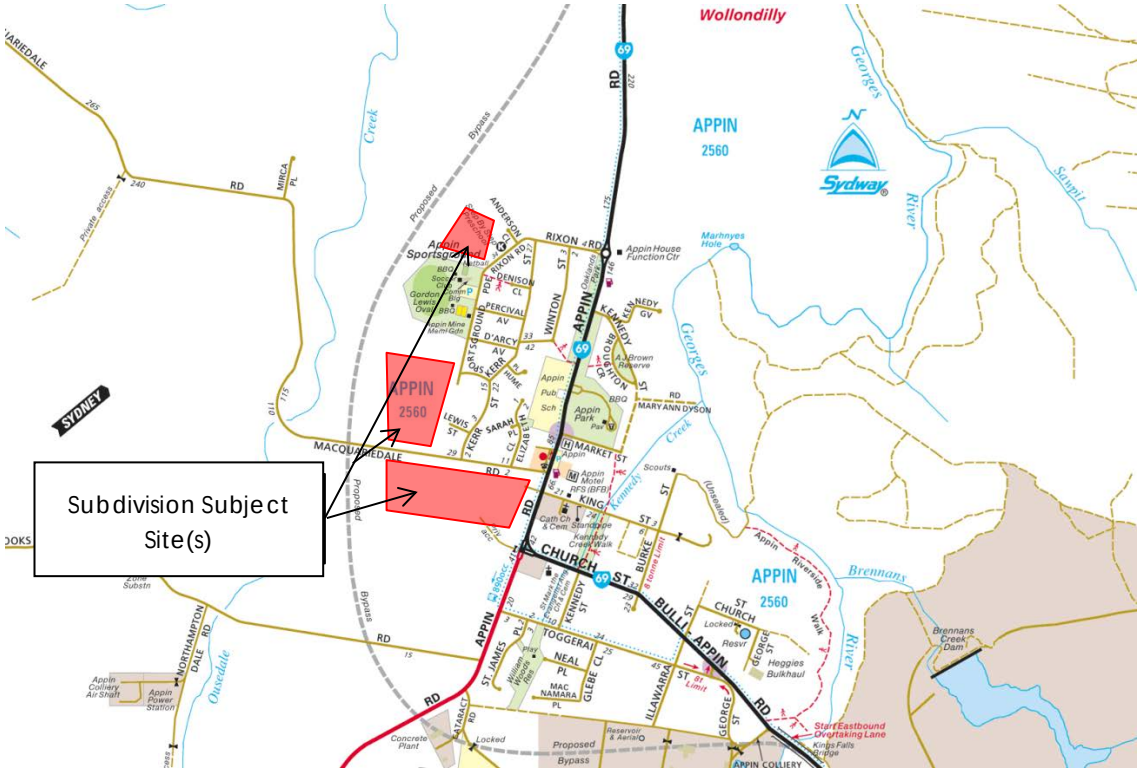
The subject site(s) are generally located along the west boundary of the Appin Township. The site is separated into three distinct precincts as follows:

- North: located north of the Appin Sportsground
- Central: located between the Appin Sportsground and Macquariedale Road
- South: located south of Macquariedale Road

The site currently has a land use classification as Rural Landscape (RU2) and is largely undeveloped land. The surrounding properties predominantly include rural and residential land uses with some commercial land use located around the Appin Road/ Macquariedale Road intersection.

The location of the subject site and its surrounding environs is shown in Figure 2.1.

Figure 2.1: Subject Site and Its Environs



Basemap source: Reproduced with permission from Sydway Publishing Pty Ltd

2.1 Road Network

2.1.1 Adjoining Roads

Appin Road

Appin Road (shown in Figure 2.2 and Figure 2.3) is classified by the RMS as a State Road (177) and in the vicinity of the site is aligned in a north-south direction. It is a two-way road configured with a single traffic lane in each direction, with a minimum carriageway width of 12.4 metres provided within the Appin Township.

Kerbside parking is not permitted in the section between Church Street and Market Street.

Automatic tube count traffic surveys commissioned by GTA along Appin Road indicate that on a typical weekday Appin Road carries approximately:

- 10,400 vehicles, between Church Street and King Street
- 3,350 vehicles, south of Church Street.

Figure 2.2: Appin Road, Looking North towards Church Street

Figure 2.3: Appin Road Looking South towards Macquariedale Street

Macquariedale Road

Macquariedale Road (shown in Figure 2.4) functions as a collector road and in the vicinity of the site is aligned in an east-west direction. It is a two-way road configured with a two-lane, 9.0 metre wide carriageway (approx.) near the intersection of Appin Road. It is noted the width of Macquariedale Road reduces somewhat to the west past edge of the township residential area. Macquariedale Road ends approximately 4km west of the township and as such, there is no significant through traffic to the west of Kerr Road. Unrestricted parking is generally permitted on both sides of the carriageway (except within approximately 75m of Appin Road which is subject to 'No Stopping' restrictions).

Automatic tube count surveys commissioned by GTA near the intersection with Appin Road indicate that Macquariedale Road carries approximately 1,200 vehicles on a typical weekday.

Figure 2.4: Macquariedale Road, viewed from Appin Road

King Street

King Street functions as a local road aligned in an east-west direction in the vicinity of the site. It is a two-way road configured with a two-lane, 11.2 metre wide carriageway (approx.). Unrestricted kerbside parking permitted is available on both sides of the carriageway.

King Street is shown in Figure 2.5 and carries approximately 270 vehicles per day[1].

Figure 2.5: King Street, viewed from Appin Road

2.1.2 Surrounding Intersections

The following intersections currently exist in the vicinity of the site:

- Appin Road/ Macquariedale Road (unsignalised)
- Appin Road/ King Street (unsignalised).
- Appin Road/ Church Street (unsignalised).

2.2 Traffic Volumes

GTA Consultants commissioned intersection turning movement counts and mid-block automatic tube traffic movement counts on key roads in the vicinity of the site. The intersection turning movement counts were conducted on Wednesday 30 October 2013 between 7:00am and 9:00am and 4:00pm and 6:00pm at the following intersections:

- Appin Road/ Macquariedale Road
- Appin Road/ King Street
- Appin Road/ Church Street

The mid-block tube counts were conducted over a seven day period beginning Wednesday 30 October 2013 the following locations:

- Appin Road, south of Church Street
- Appin Road, between Church Street and King Street
- Macquariedale Road, west of Appin Road

The AM and PM peak hour traffic volumes are summarised in Figure 2.6 and Figure 2.7, with full results contained in **Appendix A**.

[1] Based on the peak hour traffic counts commissioned by GTA on Wednesday 30 October 2013 and assuming a peak-to-daily ratio of 10% for local roads.

Figure 2.6: Existing AM Peak Hour Traffic Volumes

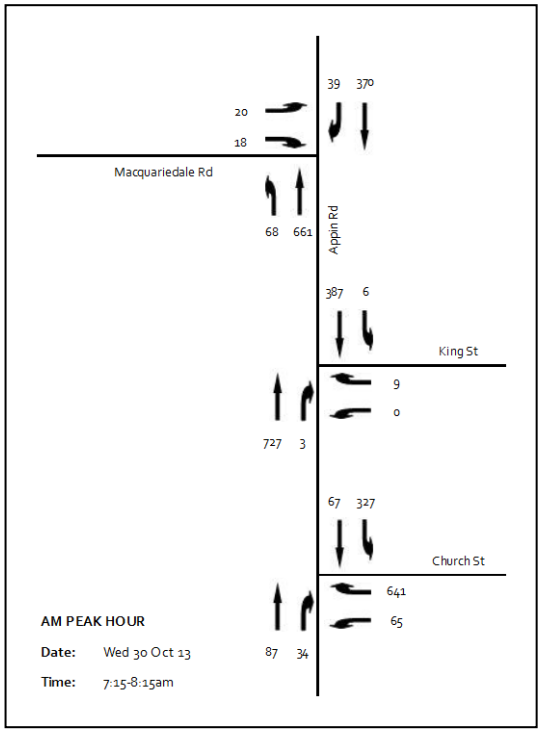
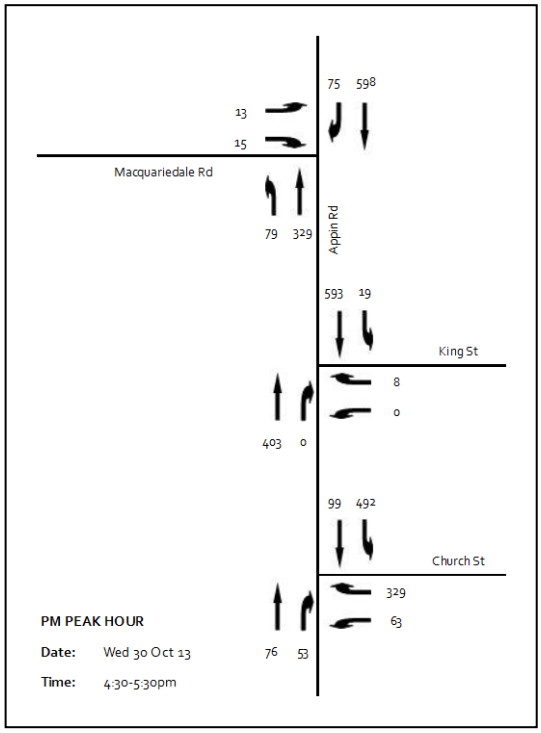


Figure 2.7: Existing PM Peak Hour Traffic Volumes



2.3 Intersection Operation

The operation of the key intersections within the study area have been assessed using SIDRA INTERSECTION[2], a computer based modelling package which calculates intersection performance.

The commonly used measure of intersection performance, as defined by the RMS, is vehicle delay. SIDRA INTERSECTION determines the average delay that vehicles encounter and provides a measure of the level of service.

Table 2.1 shows the criteria that SIDRA INTERSECTION adopts in assessing the level of service.

[2] Program used under license from Akcelik & Associates Pty Ltd.

Table 2.1: SIDRA INTERSECTION Level of Service Criteria

Level of Service (LOS)	Average Delay per vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Sign
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

Table 2.2 presents a summary of the existing intersection operation, with full results presented in Appendix B of this report.

The intersection of Appin Road/ Macquariedale Road was assessed as having a short right turn bay based on the wide carriageway where through traffic would generally be able to pass around a vehicle waiting to turn right. This is consistent with observed intersection operation.

Table 2.2: Existing Operating Conditions

Intersection	Peak	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Appin Road/ Macquariedale Road	AM	South	0.42	1	0	A
		North	0.21	1	2	A
		West	0.13	17	3	B
	PM	South	0.23	1	0	A
		North	0.34	1	2	A
		West	0.08	15	2	B
Appin Road/ King Street	AM	South	0.42	3	5	A
		East	0.06	25	1	B
		North	0.23	0	0	A
	PM	South	0.23	0	0	A
		East	0.04	18	0	B
		North	0.35	0	0	A
Appin Road/ Church Street	AM	South	0.17	15	5	B
		East	0.43	7	0	A
		North	0.20	8	4	A
	PM	South	0.09	13	0	A
		East	0.24	7	0	A
		North	0.30	7	4	A

On the basis of the above assessment, all study intersections currently operate satisfactorily, with minimal queues and delays on all approaches.

2.4 Public Transport

Appin is serviced by the 887 bus route that operates between Campbelltown Railway Station and Wollongong. The services from the stops just south of Macquariedale Street are summarised as follows:

- 12 services on a weekday between 6:34am and 7:13pm from Wollongong to Campbelltown.
- 10 services on a weekday between 7:01am and 7:01pm from Campbelltown to Wollongong.

2.5 Bicycle Network

Wollondilly Shire Council has a designated cycleway/ shared pathway network within Appin. The roads adjacent to the proposed development sites are part of this network, including Appin Road and Macquariedale Road.

The Appin cycleway/ shared path network is shown in Figure 2.8.

Figure 2.8: Appin Cycleway/ Shared Pathway Network

Source: Wollondilly Shire Council

3. Development Proposal

3.1 Land Uses

The planning proposal identifies an indicative residential subdivision yield of approximately 300 residential lots. The lots will be separated over three precincts generally as summarised in Table 3.1. The indicative plans for the proposed subdivision are provided in Figure 3.1

Table 3.1: Indicative Development Schedule

Precinct	Approximate No. of Lots
North	42
Central	64
South	194
Total	**300**

3.2 Vehicle Access

Vehicle access to the various land parcels will be provided as follows:

- Northern Precinct: via the internal road network of the North Appin subdivision
- Central Precinct: via Macquariedale Road
- Southern Precinct: via Macquariedale Road

In addition to the above, it is proposed to provide a temporary west leg to the Appin Road/ King Street intersection to facilitate access to approximately 20 medium density lots in the southern precinct as a means to 'launch' the subdivision project. The intersection will be configured as a priority controlled 4-way intersection with single approach and departure lanes to be provided on the new western intersection leg.

Once vehicle access is provided to the southern precinct from Macquariedale Road, the connection to Appin Road at King Street would be downgraded to a pedestrian and cyclist access only.

It is understood that in the longer term it is proposed to rezone and develop the land to the south of the southern precinct for residential uses. It is envisaged that vehicle access to these rezoned lands would be provided via a new western leg to the existing Appin Road/ Church Street intersection. It is anticipated that intersection works would also be required to increase capacity at this intersection as part of any future rezoning of the lands to the south of the site.

The proposed vehicle access arrangements for the site are provided in Figure 3.1, including the interim and potential future vehicle access points.

Figure 3.1: Indicative Subdivision Layout

4. Sustainable Transport Infrastructure

4.1 Public Transport

It is not proposed to provide public transport routes through the subdivision. It is understood that there are concerns from residents over increased traffic volumes should Rixon Road be linked to the central precinct. Notwithstanding, a future bus route could be provided along Appin Road and Macquariedale Road servicing the needs of the majority of residents.

4.2 Walking and Cycling

Pedestrian paths would be provided on one side of each of the roads within the future residential subdivision, which is generally consistent with the Wollondilly Shire Council Design Specifications 'Subdivisions and Engineering Standards'.

The general layout of the subdivision would be a grid formation which minimises walking and cycling distances. While it is not proposed to provide direct vehicle links to the north (Sportsground Parade) from the central precinct, it is recommended to construct a non-vehicular link to facilitate a walking and cycling between the site and the existing residential catchment to the north of the site. This would also provide a direct pedestrian and bicycle link between the central precinct and the existing recreational facilities to the north of the site.

A pedestrian and bicycle link would be maintained to the Appin Road/ King Street intersection following the temporary connection's closure to vehicles.

5. Traffic Impact Assessment

5.1 Preamble

5.1.1 Assessment Scenarios

The traffic impact of the proposed development has been assessed in two stages:

- Existing and development traffic
- Existing and development traffic with an allowance future background road network traffic growth (+15 years).

As stated in the development proposal, access to the subdivision is expected to occur over three phases:

- temporary west leg access to the Appin Road/ King Street intersection
- access via Macquariedale Road and closure (to vehicles) of the temporary west leg access to Appin Road/ King Street
- West leg and intersection upgrade to Appin Road/ Church Street.

Also of relevance is the proposed Appin bypass road. An easement has been reserved that runs to the west of the proposed subdivision precincts. This will provide a link from the north of Appin to the south-east, diverting through traffic around the Appin Township. There is no estimated timeframe for construction of this link, however it is unlikely that it will be constructed in the next 10 years (as there has been no funding commitment from RMS).

5.1.2 Intersection Upgrades

The recommended intersection upgrade has been determined based on traffic capacity, with consideration for road safety, through assessment of existing and future traffic volumes.

It is proposed to provide a channelised right turn bay from the north leg on Appin Road for vehicles to access Macquariedale Road. This would occur in a similar configuration to the existing right turn bay at Market Street to the north of the subject intersection.

Additional linemarking may be required on Macquariedale Road including a centreline and a 'keep clear' zone at the access to the retail car park to the north-west of the intersection.

5.2 Traffic Generation

Traffic generation estimates for the proposed development have been sourced from RMS Technical Direction (TD 2013/04) *Guide to Traffic Generating Developments, Updated traffic surveys*. The guide indicates the following in regard to vehicle trips per low density residential dwellings in regional areas:

- Daily: 7.4 per dwelling
- Weekday morning peak hour trips: 0.71 per dwelling
- Weekday evening peak hour trips: 0.78 per dwelling.

Further to this, the following traffic distribution is assumed:

- 20% inbound, 80% outbound, morning period
- 80% inbound, 20% outbound, evening period

Estimates of peak hour and daily traffic volumes resulting from the proposal are set out in Table 5.1.

Table 5.1: Development Traffic Generation (based on an indicative yield of 300 dwellings)

Precinct	Lots	Traffic Generation Rate (Movements/Dwelling)			Vehicle Movements		
		AM	PM	Daily	AM (In/ Out)	PM (In/ Out)	Daily
North	42	0.71	0.78	7.4	30 (6/ 24)	33 (26/ 7)	311
Central	64				45 (9/ 36)	50 (40/ 10)	474
South	194				138 (28 / 110)	151 (121 / 30)	1,436
Total					**213**	**234**	**2,220**

Table 5.1 indicates that the overall site could be expected to generate in the order of 230 peak hour movements and 2,200 daily movements.

5.3 Distribution and Assignment

The directional distribution and assignment of traffic generated by the proposed development will be influenced by a number of factors, including the:

i configuration of the arterial road network in the immediate vicinity of the site
ii existing operation of intersections providing access between the local and arterial road network
iii distribution of households in the vicinity of the site
iv surrounding employment centres, retail centres and schools in relation to the site
v configuration of access points to the site.

Having consideration for the above, as well as the distribution modelled in the 'Illawarra-South West Sydney Regional Transportation Model' (November 2011) and the existing turning movements at the surrounding intersections, the following directional distributions have been assumed:

- Appin Road, northbound 70%
- Appin Road southbound 30%
    - Church Street 25%
    - Appin Road, south of Church Street 5%

Based on the above, Figure 5.1 and Figure 5.2 have been prepared to show the estimated marginal increase in turning movements in the vicinity of the subject sites following full development (and prior to the addition of the west leg to Church Street as part of the potential future rezoning to the south of the site).

Figure 5.1: AM Peak Hour Site Generated Traffic Volumes

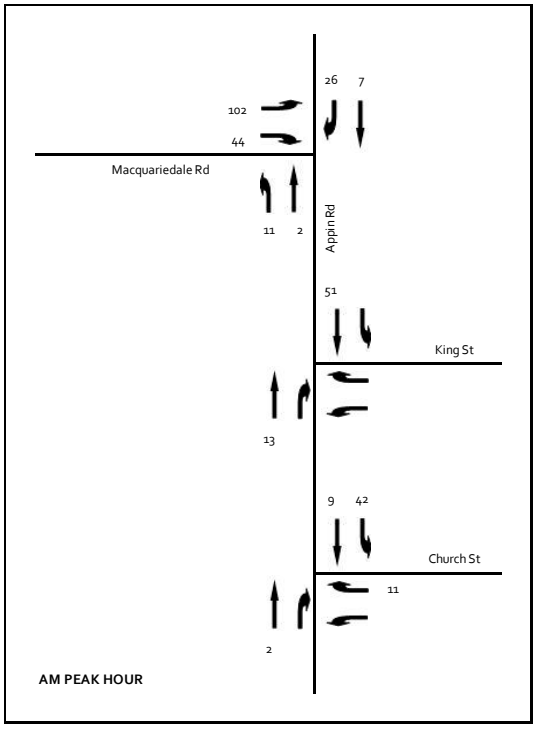
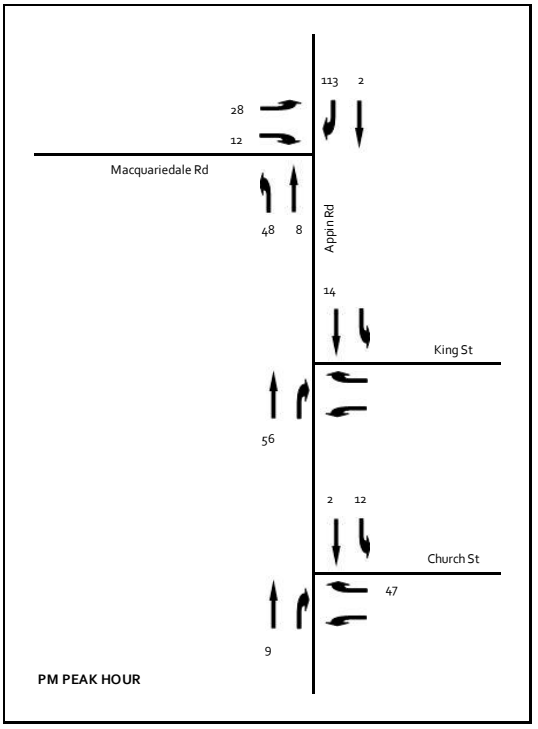


Figure 5.2: PM Peak Hour Site Generated Traffic Volumes



5.4 Future Traffic Volumes

Background Traffic Growth

The *Illawarra-South West Sydney Transportation Model, Appin and Wilton Development* report assesses the likely future increases in traffic volumes for the surrounding areas. The forecast growth rates presented below include the traffic generation associated with the Appin North subdivision and this proposed rezoning.

This equates to a compound growth rate of 1% per annum. The model indicates that the majority of future traffic is anticipated to be distributed to the north of Appin. In addition, it is noted that the majority of background growth is anticipated to be generated by the North Appin residential subdivision development (currently under construction). As such, greater increases in traffic are anticipated to the north of the Appin township than within Appin itself. Specifically for this site, the Report indicates an increase in traffic volumes on Appin Road (between Bulli to Appin) of 17% over 15 years. Table 5.2 provides a summary of the existing (2013) and future (+15 years) traffic volumes on Appin Road in the vicinity of the subject sites.

Table 5.2: Appin Road Existing and Future Traffic Volumes

Location	Traffic Volumes			
	Existing	Background Growth	Site Generated [1]	Future
Appin Road (south of Macquariedale Road)	10,400vpd [2]	+1,100vpd (+11%)	+670vpd (+6%)	12,170vpd (+17%)
Appin Road (between Appin and Campbelltown)	9,100vpd [3]	+4,550vpd (50%)	+1,550vpd (+17%)	15,200vpd (+67%)

[1] Based on traffic generated by the site distributed to the south of Macquariedale Road (30% * 2,220 = 666vpd) and north of Appin (70% * 2,220 = 1,554vpd).
[2] Based on 7-day tube counts commissioned by GTA in October 2013.
[3] Based on 2006 traffic volumes data presented in the *Illawarra-South West Sydney Transportation Model, Appin and Wilton Development* report.

Table 5.2 indicates that traffic volumes on Appin Road south of Macquariedale Road are anticipated to increase by 1,770vpd over the next 15 years, including 670vpd generated by the subject site and 1,100vpd in background growth. Traffic volumes on Appin Road between Appin and Campbelltown are anticipated to increase by 6,100vpd over a 15 year period, including 1,550vpd generated by the subject site and 4,550vpd in background growth.

Based on the above, for assessment purposes, the existing Appin Road traffic volumes in the vicinity of the site have been growthed by 11% to represent the +15 year scenario.

Resultant Traffic Volumes

The post-development vehicle turning movements of the study intersections with full lot yield of all precincts and the 11% increase in through traffic volumes is presented in Figure 5.3 and Figure 5.4 for the AM and PM peak hour periods, respectively.

Figure 5.3: AM Peak Period, 11% Increase in Through Volumes

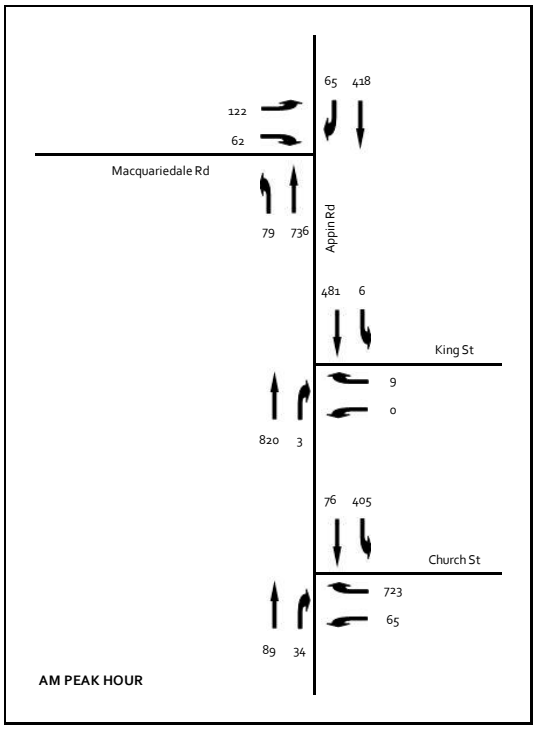
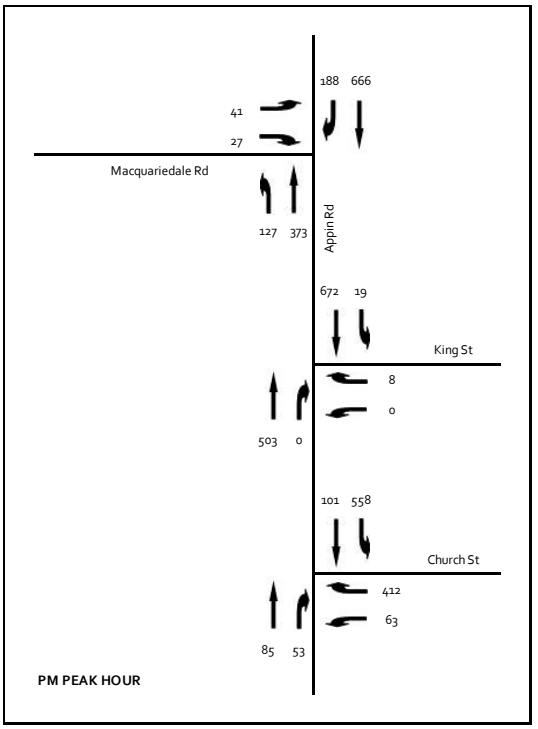


Figure 5.4: PM Peak Period, 11% Increase in Through Volumes



5.5 Traffic Impact

Peak Hour Assessment

The turning movement volumes at each of the study intersections have been assessed using SIDRA Intersection. The assessment assumes the provision of a right turn lane from Appin Road into Macquariedale Road as previously discussed. The right turn lane would ensure that right turning traffic does not impede through southbound movements on Appin Road and provides greater safety for these turning vehicles.

The results of the SIDRA Intersection assessment is summarised in Table 5.3

Table 5.3: Post Development Assessment with 11% Additional Through Traffic

Intersection	Peak	Leg	Degree of Saturation (DOS)	Average Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Appin Road/ Macquariedale Road	AM	South	0.47	1	0	A
		North	0.24	2	3	A
		West	0.71	32	27	C
	PM	South	0.29	2	0	A
		North	0.38	2	7	A
		West	0.25	19	6	B
Appin Road/ King Street	AM	South	0.47	0	0	A
		East	0.07	29	1	C
		North	0.28	0	0	A
	PM	South	0.29	0	0	A
		East	0.05	24	1	B
		North	0.40	0	0	A
Appin Road/ Church Street	AM	South	0.21	17	6	B
		East	0.48	7	0	A
		North	0.25	8	6	A
	PM	South	0.11	13	3	A
		East	0.29	7	0	A
		North	0.34	7	4	A

The results in Table 5.3 show that the study intersections would still operate satisfactorily after full development and with additional through traffic volumes on Appin Road. It is noted that the greatest delays (and corresponding Level of Service C), would be experienced by vehicles exiting Macquarie Road and King Street. These movements would still operate within acceptable limits. As such, the proposed intersection arrangements are considered appropriate for peak period operation.

The intersection of Appin Road/ Macquariedale Road is the critical intersection in the study area. Any access points from Macquariedale Road to the subdivisions would subsequently have lower turning movement volumes and as such, subject to conventional design treatments, would operate with minimal queuing and delays.

The northern precinct is anticipated to generate some 30 peak hour movements onto the road network of the Appin North subdivision (currently under construction). This level of additional traffic generation is not envisaged to compromise the future operation of the adjacent road network.

Daily Assessment

After the full development of the central and southern precincts with the proposed road network arrangement, it is expected that Macquariedale Road would carry approximately 3,000 vehicles per day. Given its functional role as a collector road, this volume of traffic is considered acceptable. Moreover, the use of Macquariedale Road by vehicles accessing adjacent residential uses and local roads is consistent with this functional role in the road network.

Interim Scenario

Vehicle access to the site is proposed to be initially provided from a new temporary western leg to the existing Appin Road / King Street intersection. The western leg would formalise the existing informal vehicle access that is currently provided at this location (servicing the rear of the properties fronting Macquariedale Road). As previously noted the temporary access would service approximately 20 medium density dwellings. Adopting the traffic generation rates presented above the new leg to the intersection could be expected to generate up to 16 movements during each of the peak hours. This level of additional traffic generation is not anticipated to compromise the safety or capacity of the intersection.

Future Scenario

As previously discussed it is envisaged that in the future, the lands immediately to the south of the site will be rezoned for residential use. As part of the development of these lands, it is anticipated that vehicle access will be provided via a new leg to the existing Appin Road/ Church Street intersection. It is anticipated that in conjunction with providing the new leg, works would be undertaken to provide increased capacity at the intersection. The likely redistribution of development traffic and any appropriate traffic management responses would need to be considered as part of this future intersection design.

5.6 Summary

The above traffic assessment indicates that, subject to the proposed upgrade works at the Appin Road/ Macquariedale Road intersection, there is sufficient capacity to accommodate the development traffic assuming an additional 11% increase in background through traffic on Appin Road.

As part of the anticipated future development of the land to the south of the site, a future vehicle access is anticipated to be provided at the existing Appin Road/ Church Street intersection. This potential future access would provide additional capacity for vehicles accessing the rezoned lands.

In addition, the Appin Bypass located to the west of the site would reduce traffic on Appin Road and further increase capacity at the Appin Road/ Macquariedale Road intersection.

6. Conclusion

Based on the analysis and discussions presented within this report, the following conclusions are made:

i The Walker Corporation plans to develop land along the western perimeter of the Appin township into approximately 300 residential lots spread over three (northern, central and southern) precincts.

ii It is intended to launch the project with some initial 20 lots in the central precinct. This would be accessed by a temporary west leg at the intersection of Appin Road/ King Street.

iii Development of the northern precinct is limited to the construction of a separate subdivision to the north. The completion of the road network within the separate subdivision will facilitate access to the general road network.

iv Development additional lots in the central and southern precinct would include local roads with access via Macquariedale Road, at which point the temporary access at the Appin Road/ King Street intersection would be closed to vehicular traffic and retained for pedestrian and bicycle access only.

v Pedestrian and bicycle facilities would be provided throughout the future development. Pedestrian and cyclist links will be provided from the sites to the existing external networks.

vi It is proposed to provide a linemarked and formalised right turn bay on the north leg of Appin Road/ Macquariedale Road intersection to mitigate any potential capacity constraint effects on Appin Road, as well as improving road safety.

vii The rezoned lands are anticipated to generate some 230 and 2,200 peak hour and daily vehicle movements, respectively.

viii Background traffic volumes on Appin Road are anticipated to increase 11% over 15 years in the vicinity of the subject site(s) and 50% over 15 years between Appin and Campbelltown.

ix The study intersections were assessed with SIDRA INTERSECTION and found to operate satisfactorily with a Level of Service C or better (assuming 11% growth in background through traffic).

x Macquariedale Road is expected to carry approximately 3,000 vehicles per day under the proposed road network arrangements.

xi Additional capacity would be created at the Appin Road/ Macquariedale Road intersection as a result of either or both of:

- The construction of the proposed Appin Bypass.
- Potential future site access at the Appin Road/ Church Street (to be delivered as part of a future residential rezoning to the south of the site).

xii On the basis of the analysis and information set out in this report in terms of traffic impacts, it is concluded that the proposed subdivision development would not be expected to result in any adverse impacts on the local or state road networks.

Appendix A

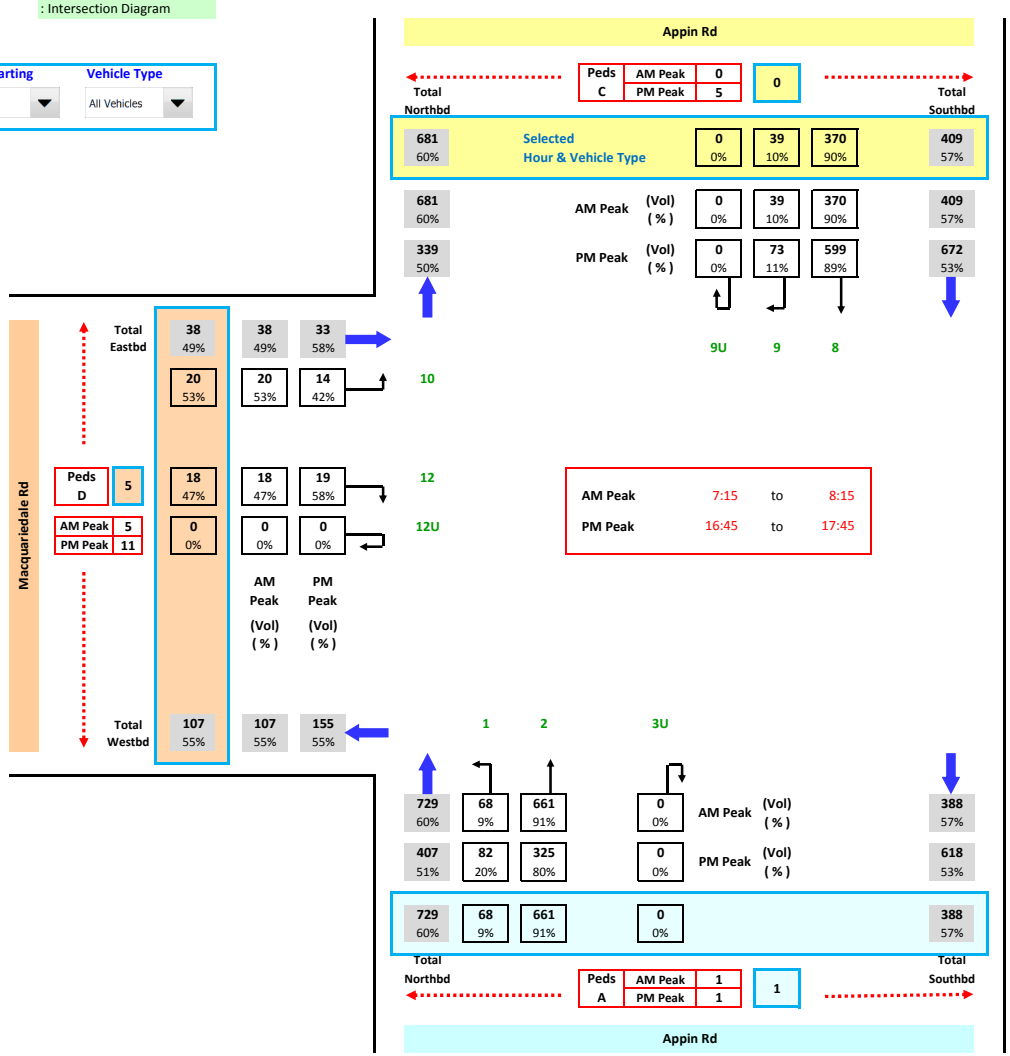
Survey Results

Job No. : N1239
Client : GTA
Suburb : Appin
Location : 3. Appin Rd / Macquariedale Rd

Day/Date : Wed, 30th October 2013
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram

SKYHIGH - THE TRAFFIC SURVEY COMPANY

Hour Starting	Vehicle Type
7:15	All Vehicles

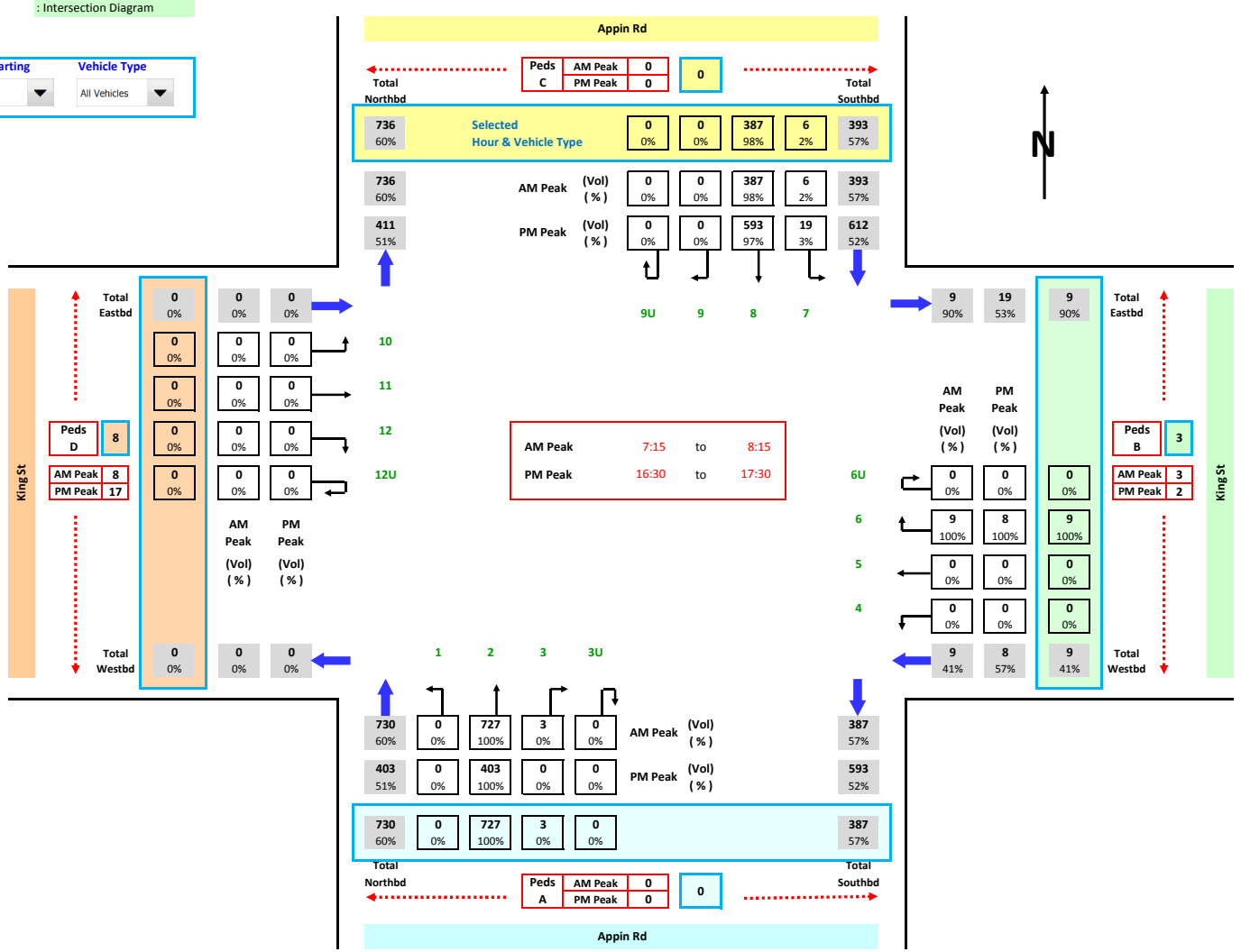


Job No. : N1239
Client : GTA
Suburb : Appin
Location : 2. Appin Rd / King St

Day/Date : Wed, 30th October 2013
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram

SKYHIGH - THE TRAFFIC SURVEY COMPANY

Hour Starting	Vehicle Type
7:15	All Vehicles

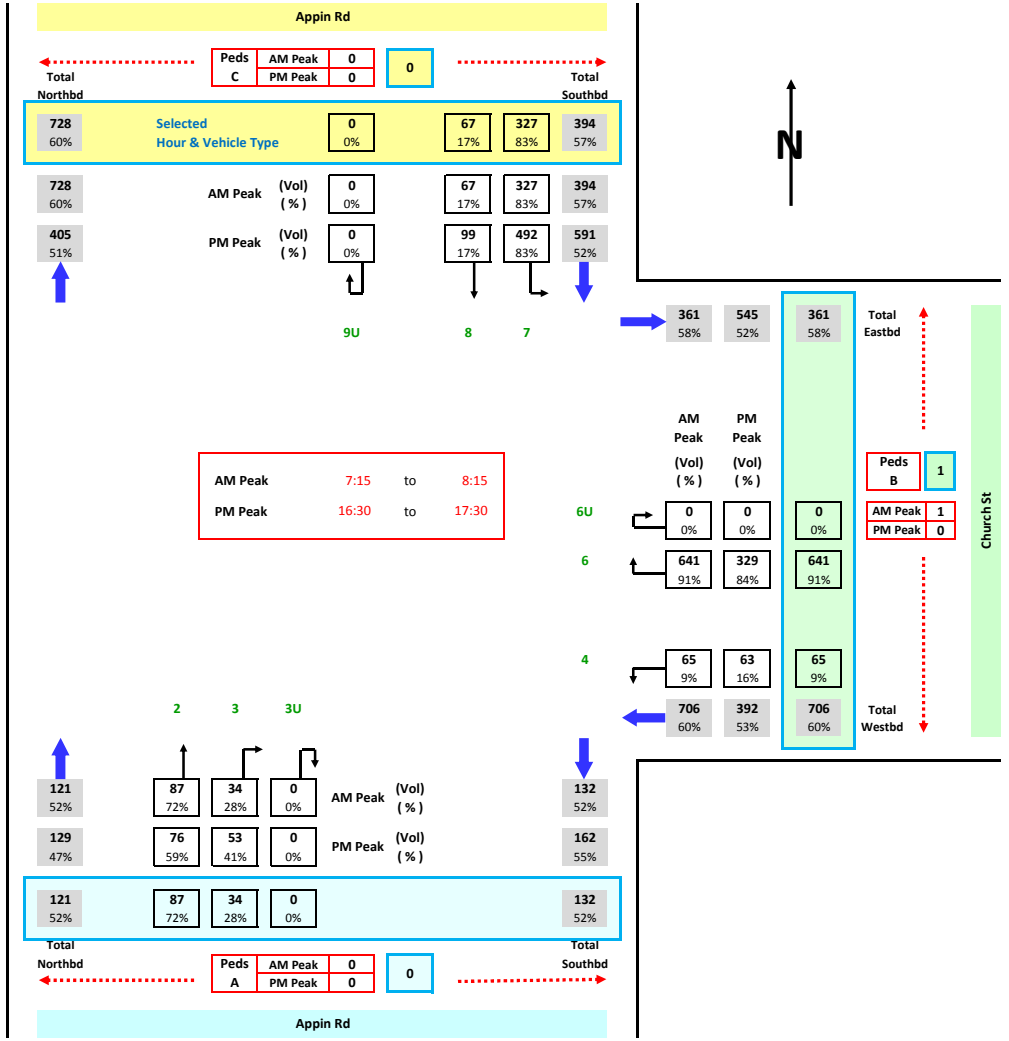


Job No. : N1239
Client : GTA
Suburb : Appin
Location : 1. Appin Rd / Church St

Day/Date : Wed, 30th October 2013
Weather : Fine
Description : Classified Intersection Count
: Intersection Diagram

Hour Starting	Vehicle Type
7:15	All Vehicles

SKYHIGH - THE TRAFFIC SURVEY COMPANY



Appendix B

SIDRA INTERSECTION Results

MOVEMENT SUMMARY

Site: Appin Road/ Macquariedale Road Ex AM

14S1076000
Appin Road/ Macquariedale Road Existing 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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Appin Road											
1	L	72	0.0	0.419	6.4	LOS A	0.0	0.0	0.00	0.88	43.3
2	T	696	10.0	0.419	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		767	9.1	0.419	0.6	NA	0.0	0.0	0.00	0.08	49.3
North: Appin Road											
8	T	389	10.0	0.213	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
9	R	41	0.0	0.084	10.8	LOS A	0.2	1.6	0.63	0.82	39.7
Approach		431	9.0	0.213	1.0	NA	0.2	1.6	0.06	0.08	48.8
West: Macquariedale Road											
10	L	21	0.0	0.133	17.1	LOS B	0.4	2.9	0.76	0.91	35.4
12	R	19	0.0	0.133	17.2	LOS B	0.4	2.9	0.76	0.91	35.4
Approach		40	0.0	0.133	17.1	LOS B	0.4	2.9	0.76	0.91	35.4
All Vehicles		1238	8.8	0.419	1.3	NA	0.4	2.9	0.05	0.11	48.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Appin Road/ Macquariedale Road Ex PM

14S1076000
Appin Road/ Macquariedale Road Existing 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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Appin Road											
1	L	83	0.0	0.234	6.4	LOS A	0.0	0.0	0.00	0.84	43.3
2	T	346	10.0	0.234	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		429	8.1	0.234	1.2	NA	0.0	0.0	0.00	0.16	48.5
North: Appin Road											
8	T	629	10.0	0.344	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
9	R	79	0.0	0.122	8.2	LOS A	0.3	2.0	0.47	0.68	41.6
Approach		708	8.9	0.344	0.9	NA	0.3	2.0	0.05	0.08	48.9
West: Macquariedale Road											
10	L	14	0.0	0.084	14.8	LOS B	0.3	1.9	0.64	0.72	36.8
12	R	16	0.0	0.084	15.0	LOS B	0.3	1.9	0.64	0.87	36.8
Approach		29	0.0	0.084	14.9	LOS B	0.3	1.9	0.64	0.80	36.8
All Vehicles		1167	8.4	0.344	1.4	NA	0.3	2.0	0.05	0.13	48.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

14S1076000
Appin Road/ King Street Existing 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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Appin Road											
2	T	765	10.0	0.418	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
3	R	3	0.0	0.005	7.9	LOS A	0.0	0.1	0.45	0.58	41.7
Approach		768	10.0	0.418	0.0	NA	0.0	0.1	0.00	0.00	50.0
East: King Street											
4	L	1	0.0	0.050	21.4	LOS B	0.1	1.0	0.79	0.73	33.0
6	R	9	0.0	0.050	21.4	LOS B	0.1	1.0	0.79	0.92	33.0
Approach		11	0.0	0.050	21.4	LOS B	0.1	1.0	0.79	0.90	33.0
North: Appin Road											
7	L	6	0.0	0.226	6.4	LOS A	0.0	0.0	0.00	0.91	43.3
8	T	407	10.0	0.226	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		414	9.8	0.226	0.1	NA	0.0	0.0	0.00	0.01	49.9
All Vehicles		1193	9.8	0.418	0.2	NA	0.1	1.0	0.01	0.01	49.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

14S1076000
Appin Road/ King Street Existing 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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Appin Road											
2	T	424	10.0	0.232	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
3	R	1	0.0	0.002	9.3	LOS A	0.0	0.0	0.57	0.60	40.9
Approach		425	10.0	0.232	0.0	NA	0.0	0.0	0.00	0.00	50.0
East: King Street											
4	L	1	0.0	0.037	18.3	LOS B	0.1	0.8	0.76	0.82	34.7
6	R	8	0.0	0.037	18.3	LOS B	0.1	0.8	0.76	0.91	34.7
Approach		9	0.0	0.037	18.3	LOS B	0.1	0.8	0.76	0.90	34.7
North: Appin Road											
7	L	20	0.0	0.352	6.4	LOS A	0.0	0.0	0.00	0.91	43.3
8	T	624	10.0	0.352	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		644	9.7	0.352	0.2	NA	0.0	0.0	0.00	0.03	49.8
All Vehicles		1079	9.7	0.352	0.3	NA	0.1	0.8	0.01	0.03	49.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Appin Road/ Church Street Ex AM

14S1076000
Appin Road/ Church Street Existing AM
Stop (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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Appin Street											
2	T	92	10.0	0.170	15.0	LOS B	0.6	4.7	0.65	1.00	37.9
3	R	36	2.0	0.063	15.1	LOS B	0.2	1.7	0.70	0.98	37.6
Approach		127	7.8	0.170	15.0	LOS B	0.6	4.7	0.66	1.00	37.8
East: Church Street											
4	L	68	10.0	0.429	6.7	LOS A	0.0	0.0	0.00	0.61	43.3
6	R	675	10.0	0.429	6.6	LOS A	0.0	0.0	0.00	0.61	43.3
Approach		743	10.0	0.429	6.6	NA	0.0	0.0	0.00	0.61	43.3
North: Appin Road											
7	L	344	10.0	0.199	5.8	LOS A	0.0	0.0	0.00	0.52	44.1
8	T	71	10.0	0.150	16.1	LOS B	0.5	4.0	0.69	1.00	37.2
Approach		415	10.0	0.199	7.5	LOS A	0.5	4.0	0.12	0.61	42.8
All Vehicles		1285	9.8	0.429	7.8	NA	0.6	4.7	0.10	0.65	42.6

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Appin Road/ Church Street Ex PM

14S1076000
Appin Road/ Church Street Existing PM
Stop (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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Appin Street											
2	T	80	10.0	0.087	11.3	LOS A	0.3	2.6	0.44	0.90	40.3
3	R	56	2.0	0.084	14.1	LOS A	0.3	2.4	0.65	0.98	38.2
Approach		136	6.7	0.087	12.5	LOS A	0.3	2.6	0.53	0.93	39.4
East: Church Street											
4	L	66	10.0	0.238	6.7	LOS A	0.0	0.0	0.00	0.61	43.3
6	R	346	10.0	0.238	6.6	LOS A	0.0	0.0	0.00	0.61	43.3
Approach		413	10.0	0.238	6.6	NA	0.0	0.0	0.00	0.61	43.3
North: Appin Road											
7	L	518	10.0	0.299	5.8	LOS A	0.0	0.0	0.00	0.52	44.1
8	T	104	10.0	0.125	11.9	LOS A	0.5	3.7	0.49	0.93	40.0
Approach		622	10.0	0.299	6.8	LOS A	0.5	3.7	0.08	0.59	43.4
All Vehicles		1171	9.6	0.299	7.4	NA	0.5	3.7	0.11	0.64	42.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Appin Road/ Macquariedale Road Future AM + 11% thru

14S1076000
Appin Road/ Macquariedale Road
Post Development AM Peak +11% through volumes
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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Appin Road											
1	L	83	0.0	0.468	6.4	LOS A	0.0	0.0	0.00	0.88	43.3
2	T	775	10.0	0.468	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		858	9.0	0.468	0.6	NA	0.0	0.0	0.00	0.08	49.3
North: Appin Road											
8	T	440	10.0	0.240	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
9	R	68	0.0	0.155	12.1	LOS A	0.4	3.0	0.70	0.89	38.7
Approach		508	8.7	0.240	1.6	NA	0.4	3.0	0.09	0.12	48.1
West: Macquariedale Road											
10	L	128	0.0	0.714	31.6	LOS C	3.8	26.8	0.91	1.26	28.4
12	R	65	0.0	0.714	31.8	LOS C	3.8	26.8	0.91	1.22	28.3
Approach		194	0.0	0.714	31.7	LOS C	3.8	26.8	0.91	1.25	28.3
All Vehicles		1560	7.8	0.714	4.8	NA	3.8	26.8	0.14	0.24	44.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Appin Road/ Macquariedale Road Future PM + 11% thru

14S1076000
Appin Road/ Macquariedale Road
Post Development PM Peak +11% through volumes
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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Appin Road											
1	L	134	0.0	0.286	6.4	LOS A	0.0	0.0	0.00	0.81	43.3
2	T	393	10.0	0.286	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		526	7.5	0.286	1.6	NA	0.0	0.0	0.00	0.21	48.1
North: Appin Road											
8	T	701	10.0	0.383	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
9	R	198	0.0	0.322	9.3	LOS A	0.9	6.5	0.56	0.80	40.8
Approach		899	7.8	0.383	2.1	NA	0.9	6.5	0.12	0.18	47.6
West: Macquariedale Road											
10	L	43	0.0	0.245	18.4	LOS B	0.8	5.8	0.72	0.87	34.6
12	R	28	0.0	0.245	18.5	LOS B	0.8	5.8	0.72	0.92	34.6
Approach		72	0.0	0.245	18.5	LOS B	0.8	5.8	0.72	0.89	34.6
All Vehicles		1497	7.3	0.383	2.7	NA	0.9	6.5	0.11	0.22	46.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Appin Road/ King Street PD
AM +11% thru

14S1076000
Appin Road/ King Street
Post Development AM Peak +11% through volumes
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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Appin Road											
2	T	863	10.0	0.471	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
3	R	3	0.0	0.005	8.4	LOS A	0.0	0.1	0.51	0.60	41.5
Approach		866	10.0	0.471	0.0	NA	0.0	0.1	0.00	0.00	50.0
East: King Street											
4	L	1	0.0	0.071	28.6	LOS C	0.2	1.4	0.86	0.83	29.6
6	R	9	0.0	0.071	28.6	LOS C	0.2	1.4	0.86	0.95	29.6
Approach		11	0.0	0.071	28.6	LOS C	0.2	1.4	0.86	0.93	29.6
North: Appin Road											
7	L	6	0.0	0.280	6.4	LOS A	0.0	0.0	0.00	0.92	43.3
8	T	506	10.0	0.280	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		513	9.9	0.280	0.1	NA	0.0	0.0	0.00	0.01	49.9
All Vehicles		1389	9.9	0.471	0.3	NA	0.2	1.4	0.01	0.01	49.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Appin Road/ King Street PD
PM +11% thru

14S1076000
Appin Road/ King Street
Post Development PM Peak +11% through volume
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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Appin Road											
2	T	529	10.0	0.289	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
3	R	1	0.0	0.002	10.0	LOS A	0.0	0.0	0.60	0.62	40.3
Approach		531	10.0	0.289	0.0	NA	0.0	0.0	0.00	0.00	50.0
East: King Street											
4	L	1	0.0	0.051	23.6	LOS B	0.1	1.0	0.83	0.90	31.8
6	R	8	0.0	0.051	23.7	LOS B	0.1	1.0	0.83	0.93	31.8
Approach		9	0.0	0.051	23.6	LOS B	0.1	1.0	0.83	0.93	31.8
North: Appin Road											
7	L	20	0.0	0.397	6.4	LOS A	0.0	0.0	0.00	0.91	43.3
8	T	707	10.0	0.397	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		727	9.7	0.397	0.2	NA	0.0	0.0	0.00	0.02	49.8
All Vehicles		1267	9.8	0.397	0.3	NA	0.1	1.0	0.01	0.02	49.7

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Appin Road/ Church Street
PD AM +11%

14S1076000
Appin Road/ Church Street
Post Development AM Peak +11% through volumes
Stop (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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Appin Street											
2	T	94	10.0	0.207	16.8	LOS B	0.8	5.7	0.72	1.01	36.8
3	R	36	2.0	0.079	17.1	LOS B	0.3	2.1	0.76	1.00	36.3
Approach		129	7.8	0.207	16.9	LOS B	0.8	5.7	0.73	1.01	36.7
East: Church Street											
4	L	68	10.0	0.479	6.7	LOS A	0.0	0.0	0.00	0.61	43.3
6	R	761	10.0	0.479	6.6	LOS A	0.0	0.0	0.00	0.61	43.3
Approach		829	10.0	0.479	6.6	NA	0.0	0.0	0.00	0.61	43.3
North: Appin Road											
7	L	426	10.0	0.246	5.8	LOS A	0.0	0.0	0.00	0.52	44.1
8	T	80	10.0	0.206	18.3	LOS B	0.7	5.5	0.76	1.01	35.9
Approach		506	10.0	0.246	7.8	LOS A	0.7	5.5	0.12	0.60	42.6
All Vehicles		1465	9.8	0.479	7.9	NA	0.8	5.7	0.11	0.64	42.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Appin Road/ Church Street
PD PM +11%

14S1076000
Appin Road/ Church Street
Post Development PM Peak +11% through volumes
Stop (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	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Appin Street											
2	T	89	10.0	0.111	12.1	LOS A	0.4	3.2	0.50	0.93	39.9
3	R	56	2.0	0.102	15.7	LOS B	0.4	2.8	0.72	1.00	37.2
Approach		145	6.9	0.111	13.4	LOS A	0.4	3.2	0.59	0.96	38.8
East: Church Street											
4	L	66	10.0	0.288	6.7	LOS A	0.0	0.0	0.00	0.61	43.3
6	R	434	10.0	0.288	6.6	LOS A	0.0	0.0	0.00	0.61	43.3
Approach		500	10.0	0.288	6.6	NA	0.0	0.0	0.00	0.61	43.3
North: Appin Road											
7	L	587	10.0	0.339	5.8	LOS A	0.0	0.0	0.00	0.52	44.1
8	T	106	10.0	0.145	12.8	LOS A	0.6	4.2	0.55	0.96	39.4
Approach		694	10.0	0.339	6.8	LOS A	0.6	4.2	0.08	0.59	43.3
All Vehicles		1339	9.7	0.339	7.5	NA	0.6	4.2	0.11	0.64	42.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

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