BETTER TRANSPORT FUTURES
MARK WAUGH

Project Design Note

Project: **BTF201649G LWP Huntlee Town Centre Threshold Analysis**

Subject: **Intersection [A-1] - Review of Upgrade Threshold**

Date: 28 April 2017

Ref: BTF201649L VARY L - Huntlee INT [A-1] TC Threshold Analysis DN01 Rev03.docx

1 Introduction and Background

Better Transport Futures (BTF) is acting under instructions from LWP Property Pty Limited LWP) to complete revised intersection modelling and analysis of the upgrade threshold for the intersection [A-1], the junction of Wine Country Drive, Bridge Street and the Hunter Expressway link road, known as intersection [A-1] (*Primary Source:: HUNTLEE NEW TOWN, Stage 1 Preferred Project Report (PPR), Traffic Modelling, Volume 1, Hyder Consulting Pty Ltd, July 2012.* **The Hyder Study**.)

The analysis takes into account the planned development in the Huntlee Town Centre known at this time. The sequence of approved upgrades approved to support the Huntlee development is illustrated in **Attachment A - Huntlee Proposed Upgrades** (Source: the Hyder Study)

The work was requested following new advice from NSW Roads and Maritime Services (RMS) with regard to nominated upgrade thresholds for the project. The original threshold for [A-1] included in the Hyder Study was 500 residential lots. The upgrade proposed was from a 1 lane to a 2 lane roundabout.

Following a review by RMS of the Works Authorisation Deed (WAD) of the approved plans for the 4 lane 2 way upgrade (condition E7 a (ii)) of Wine Country Drive, Stage 2), it was noted by RMS that:

"It is planned to construct the fourth leg of the roundabout to / from the commercial district as part of these works. The traffic generated as the commercial district develops, and the resultant impact on the roundabout has not been assessed within the submitted traffic report. It is noted that the signalised intersection [A-3] will also take trips from the commercial development."

RMS has given initial advice that at this time the conditions reflect that the roundabout will need to be upgraded to a 2 lane circulating roundabout concurrently with the 4 lane 2 way upgrade (Stage 2 of the Wine Country Drive upgrade).

However RMS also noted that:

"The delivery of this roundabout upgrade can be revised on submission of an updated traffic report demonstrating the roundabout capacity (i.e. demonstrating when it reaches a poor LoS (E)) due to the staged occupation of developments within the commercial district (with trip distribution to / from the fourth leg), and during the same period accounting for the projected release of dwelling subdivision certificates, plus any background growth."

2 Development Assumptions

For the purposes of this assessment exercise the following Development Schedule has been applied.

Table 1 - Huntlee Town Centre & Village 1 Development Schedule Assumptions

LOCATION	PROPOSED DEVELOPMENT	VALUE (Lots, GFA)
Village One	900 Residential Dwellings	900 dwellings
Huntlee Town Centre	Supermarket	2600 m^2
Huntlee Town Centre	small retail associated with Supermarket	800 m^2
Huntlee Town Centre	Tavern	800 m^2
Huntlee Town Centre	Commercial office space	1000 m^2
Huntlee Town Centre	Cafes, Restaurants	1250 m^2
Huntlee Town Centre	Service Station – incl. 100 m^2 convenience store	2500 m^2
Huntlee Town Centre	Child Care	1350 m^2
Huntlee Town Centre	Medical Suites/Rooms	1250 m^2

Source: Huntlee Pty Ltd March 2017

The above development schedule has been applied in the development traffic generation calculations used in this threshold analysis.

3 2016 Traffic Dataset

Traffic volume data collection was completed between 17th and 24th March 2016. Summaries of the collected data were included in previous traffic studies presented to Council and RMS, and are a primary data source for this current work. (Refer to **Attachment B - Traffic Surveys & Summary Data**.)

Of note is the fact that the 2016 recorded flows were generally around 15% less overall than previously collected data from before opening of the Hunter Expressway had occurred. (With the exception of PM northbound flows which are higher by a similar proportion.)

Also of note is the 7 day collection of traffic flows on Wine Country Drive immediately (50 metres) to the south of the subject intersection [A-1]. This data indicated the turning movement data collected on Thursday 17th March 2016 represented the highest PM peak data collected over the 7 day period, and was also 96% of the highest AM peak recorded flows over the same 7 day period.

The same peak hour data was some 25% to 40% more than the recorded Saturday peak movements.

It (the Thursday 17th March 2016 dataset) has consequently been applied in all recent Threshold Analysis work prepared by BTF under instructions from Huntlee Pty Ltd.

4 Assumptions on Traffic Movement Dataset for Analysis Purposes

The base data set applied in this updated threshold analysis of [A-1] is the Thursday 17th March 2016 dataset. In addition to the recorded flows a factor of 20% growth has been applied to the base flows, representing a 2% per annum growth factor as is now a standard requirement of RMS. This is applied at a level of growth (20%) which is consistent with other development investigations work in the area.

5 Development Traffic Generation

Traffic gene ration from the development schedule nominated in Table 1 above has been applied at the standard trip generations rates nominated in the Guide to Traffic Generating Developments (RTA October 2002 Version 2.2), and the Updated trip rates published in the RMS Technical Direction td13-04a (RMS, August 2013.) **Table 2 –Applied Trip Generation** summarises the traffic gene ration applied in this analysis.

Table 2 - Applied Trip Generation

PROPOSED DEVELOPMENT	**VALUE (Lots, GFA)**	**Trip Rate**		**Peak Trips**	
		AM	PM	AM	PM
Village One Residential Dwellings	900 dwellings	0.71	0.78	639	702
Huntlee Town Centre Stage 1					
Supermarket	2600 m^2	N/A[1]	12.3/100	-	320
small retail associated with Supermarket	800 m^2	N/A[1]	12.3/100	-	98
Tavern[2]	800 m^2	N/A[2]	N/A[2]	-	60
Commercial office space	1000 m^2	N/A	2/100	-	20
Cafes, Restaurants	1250 m^2		5/100	-	63
Service Station – (A(S) 2500 m^2, convenience store (A(F) 100 m^2)	2500 m^2	N/A	0.04(A(S) + 0.3 A(F)	-	52
Child Care[3] (160 child spaces assumed)	1350 m^2	1.4	0.7	90	45
Medical Suites/Rooms[4]	1250 m^2	N/A	4/100[4]	-	50
TOTAL Huntlee Town Centre Stage 1					**708**

Notes:

1. N/A: No rate available.
2. Tavern - Assumed as 15 staff maximum, 1 trip / 2 staff, plus 1 per 15m^2 licensed area & 100% turnover of parking in peak hour
3. Child Care – Assumed as 160 spaces AM Pre-school rate, PM Before After care (i.e. maximum rate at each peak)
4. Medical Centre – Assumed from the Guide & Cessnock Council parking rate of 1/25 m^2 & 100% turnover in peak.
5. Passing trade and / or linked trips – Assumed as 60% for service station and child care.

The Guide does not quote AM peak flows for most town centre type land uses as this is not a period of peak activity for patrons. The critical peak in terms of traffic generation is the evening (PM) peak with an estimated 60% of all trips being generated by the proposed supermarket and its associated specialty shops. The PM peak will see the combined impact of Village One residential trips and town centre trips occurring at the same time.

The Guide does not quote AM peak flows for most town centre type land uses as this is not a period of peak activity for patrons.

Consequently this analysis has concentrated on the impact of the evening (PM) peak to determine the worst case for the purposes of evaluating the town centre flow impacts on the nominated intersection upgrade threshold of 900 residential dwellings.

6 Trip Distribution and Assignment

Village One Residential Trips

The trip distribution on the Hunter Expressway, Wine Country Drive and New England Highway was previously estimated using the Hunter traffic model as documented in the Hyder Study.

The following trip distribution has been previously assumed for assessing full development and is as agreed with NSW RMS:

- About 67% trips via Branxton (Hunter Expressway) Interchange. Of that:
  - 38% trips travel to east via Hunter Expressway;
  - 18% trips travel via New England Highway to Maitland;
  - 11% trips travel to west via Hunter Expressway to Singleton and the Upper Hunter;
- 22% trips travel to south via Wine Country Drive to Cessnock; and
- 11% trips travel to north via Wine Country Drive to Branxton.

For Stage 1 assessment, Huntlee trips to Branxton (North) via Wine Country Drive were reduced to 6%.

The following was the adopted trip distribution was assumed for Stage 1 Huntlee development traffic:

- About 72% trips via Branxton (Hunter Expressway) interchange. Of that:
  - 40% trips travel to east via Hunter Expressway;
  - 20% trips travel via New England Highway to Maitland;
  - 12% trips travel to west via Hunter Expressway to Singleton and the Upper Hunter;
- 22% trips travel to south via Wine Country Drive to Cessnock; and
- 6% trips travel to north via Wine Country Drive to Branxton. It is proposed to monitor Huntlee trip distribution at key approach roads as development progress.

Town Centre Trips

Town Centre trips will not have the same trip distribution and assignment characteristics as the residential components of the Huntlee Development. There will be a significant influence on elements such as the retail uses (supermarket cafes, restaurants, specialty retail), the tavern, service station etc. which are all subject to competition from neighbouring centres such as Rutherford, Cessnock, and Singleton. This is because each of these centres has comparable and in fact more retail on offer than will be at the Huntlee Town Centre, certainly in its initial stages of development.

Notwithstanding this, the following assumptions have been made in relation to the catchment for the Huntlee Town Centre land use:

- Apply ABS 2011 population and average household size data across the catchment, which is nominated as Branxton (1826), Huntlee Village One (2340), North Rothbury(838), Rothbury(452), Greta (2483) and Lochinvar (941)
- Apply 50% only of Lochinvar and Rothbury population as they are equidistant between Branxton and Rutherford and Cessnock respectively
- Village One population applies the 2.6 persons per household (average value) nominated for the Hunter Region in the 2011 ABS statistics.
- Apply a distribution of trips that is proportion to the approach routes for the catchment.

The above assumptions arrive at the following distribution of trips:

- About 22% of trips travel to/from north via Wine Country Drive (Bridge St) to Branxton.
- 36% trips travel via New England Highway / Hunter Expressway to / from east (Greta, Lochinvar)
- 42% trips travel to/from south via Wine Country Drive (Village One, North Rothbury, Rothbury)

The above distribution places a greater emphasis on local trips to local services and facilities (Branxton, Rothbury and Village One.) This is considered a more realistic representation of trip distribution than adopted in the Hyder Study which relied predominantly on the impacts associated with the dominant residential land use.

It has been noted previously that analysis will need to be monitored over time, as the Huntlee development is implemented, to ascertain whether the bias in traffic flows to the north is as strong as has been assumed in the past.

Trip Assignment

Trip Assignment assumptions adopted for this analysis are as follows:

- Residential – AM 90% OUT, 10% IN
  PM 10% OUT, 90% IN
- Town Centre – PM 90% OUT, 10% IN

The generated trips have been assigned in the following way in this updated analysis:

- PM analysis only conducted to reflect the critical Thursday PM peak which is the worst casse combination of residential and town centre trip generations.
- Village One Residential Dwellings – Assigned via intersection [A-5], then routed through [A-1]
- Huntlee town centre components – Assigned via intersections [A-1] and [A-3]:
  - North traffic 67% via [A-1] 33% via [A-3}
  - South traffic 100% via [A-1]

Of note in these assumptions is the reverse effect of the two main components of the Huntlee development on traffic assignment. This reflects the dominant trip production from residential estates in the AM, and AM attraction to an employment and activity centre such as Huntlee, with the reverse assignment at the end of the business day.

7 Trip Containment and Linked Trips

Of note from the RTA Guide to Traffic Generating Developments is the application of a standard containment for local travel of 25% of trips. The Hyder Study consciously changed this containment level, setting it initially at ZERO, and then a maximum of 10% for a Stage 1 yield of around 2500 lots. This is in spite of the fact that Town Centre (employment generating) activities such as supermarkets, schools, hotels etc., will be developed within the Stage 1 development timeframes.

Latter stages of the development have increased levels of containment represented in the Hyder Study, which contemplated a scenario where up to 35% containment might be achieved with a more focussed bias toward alternate transport modes.

Notwithstanding that the level of containment or linked trips could be higher for a fully developed Stage 1 development, for the purposes of this analysis **no containment has been assumed,** and linked trips (including passing trade) has only been applied to facilities such as the service station and child care facilities. This approach will yield a more conservative (higher) estimate of traffic impacts.

Finally it should be noted that the assumption in this updated analysis is that residential trip generation from Village One and town centre trip generation are separate. Limited allowance only has been made for example for linked trips whereby someone may combine their return (evening) commute trip from a remote employment location with a trip to the supermarket or other facilities in the town centre. Linked trips of this nature are quite common and are likely to contribute to an even greater reduction in trips and volumes on the local road network.

8 Previous [A-1] Intersection Analysis

The existing [A-1] intersection operating under roundabout control was the focus of recent traffic movement surveys as outlined above.

The significant movements at this junction currently are the movement to and from the HEX link road, which is where the vast majority of traffic was assumed to be heading, according to the Hyder Study.

A series of threshold tests were performed using the flow increments assigned at the Stage 1 access via the only [A-5] intersection, to give an indication of technical performance of the one lane roundabout.

The outcome of the previous review was that a one lane roundabout was modelled as being capable of operating far beyond the originally nominated 500 residential lot threshold. The 1200 lot threshold tested still showed a Level of Service 'A' performance, meaning the roundabout is very likely to be able to cater for significantly more traffic flows that those created by 1200 lots of Huntlee development.

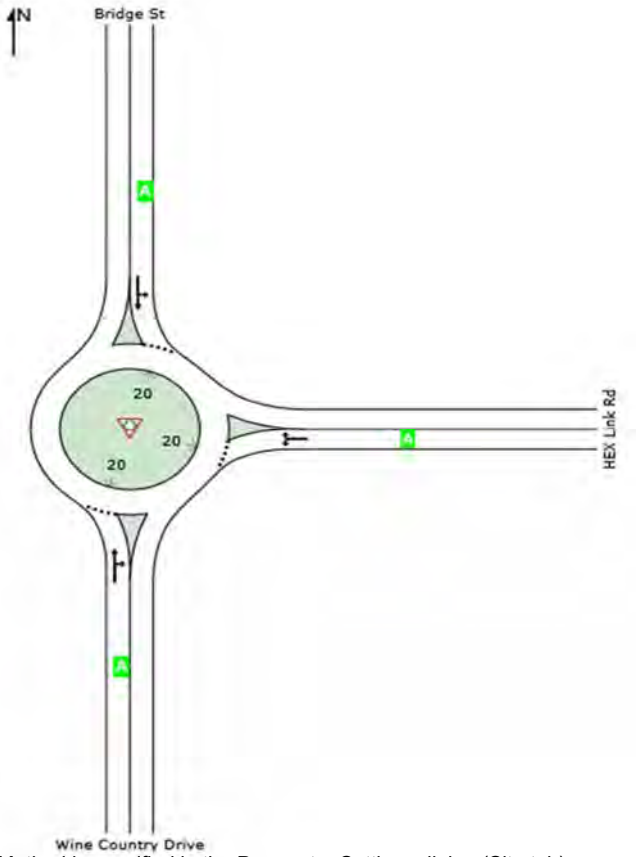
Also noted at the time was the significant influence that the introduction of the [A-6] Huntlee Stage 1 (Village One) second access will have on traffic assignment from Village One, which has the potential to more than halve the flows using the [A-1] roundabout. A sample of the previous analysis results is illustrated below.

Figure 1 Intersection Approach Level of Service - AM

Site: 101 [A-1 Roundabout AM 1200]

All Movement Classes

	South	East	North	Intersection
LOS	A	A	A	A



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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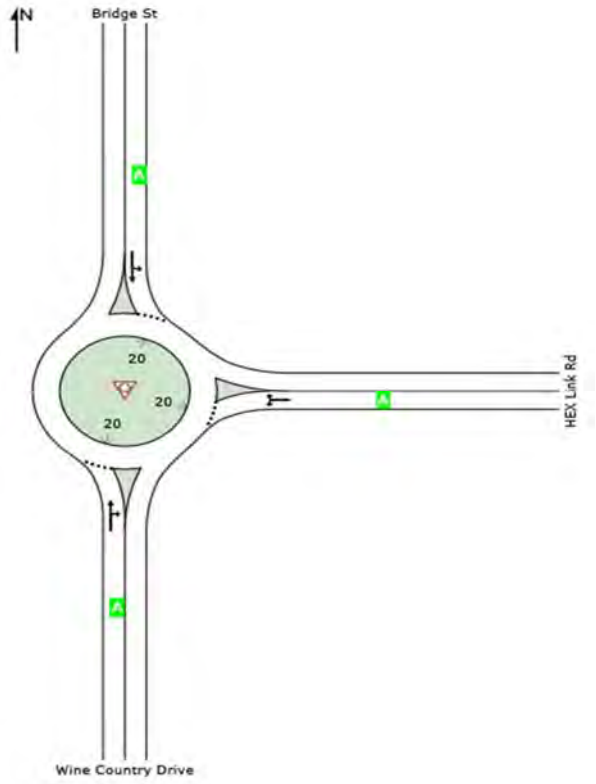
Figure 2 Intersection Approach Level of Service - PM



Site: 101 [A-1 Roundabout PM 1200]

All Movement Classes

	South	East	North	Intersection
LOS	A	A	A	A

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
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9 Updated [A-1] Intersection Analysis

The following factors have been applied in updating the analysis for intersection [A-1]:

1. Introduction of the 4th (western) leg to provide Town Centre access
2. Application of Village One Stage 1 traffic generation at the RMS nominated level of 900 dwellings
3. Application of the Huntlee Town Centre development Schedule
4. Application of the trip distribution and assignment assumptions noted in this paper.
5. Review of the PM peak operation as the critical combined peak of residential and town centre flows (effectively a Thursday evening peak hour))

The results of the PM Peak analysis are summarised in **Table 2 – Updated [A-1] Intersection Analysis** and illustrated overleaf.

Table 2 – Updated [A-1] Intersection Analysis

Peak Period	Intersection Level of Service (LoS)	Intersection Average Delay (sec)	Worst Movement Level of Service (LoS)	Worst Movement Average Delay (sec)	Worst Movement 95% Queue (m)
PM	C	29	D	50.3	380

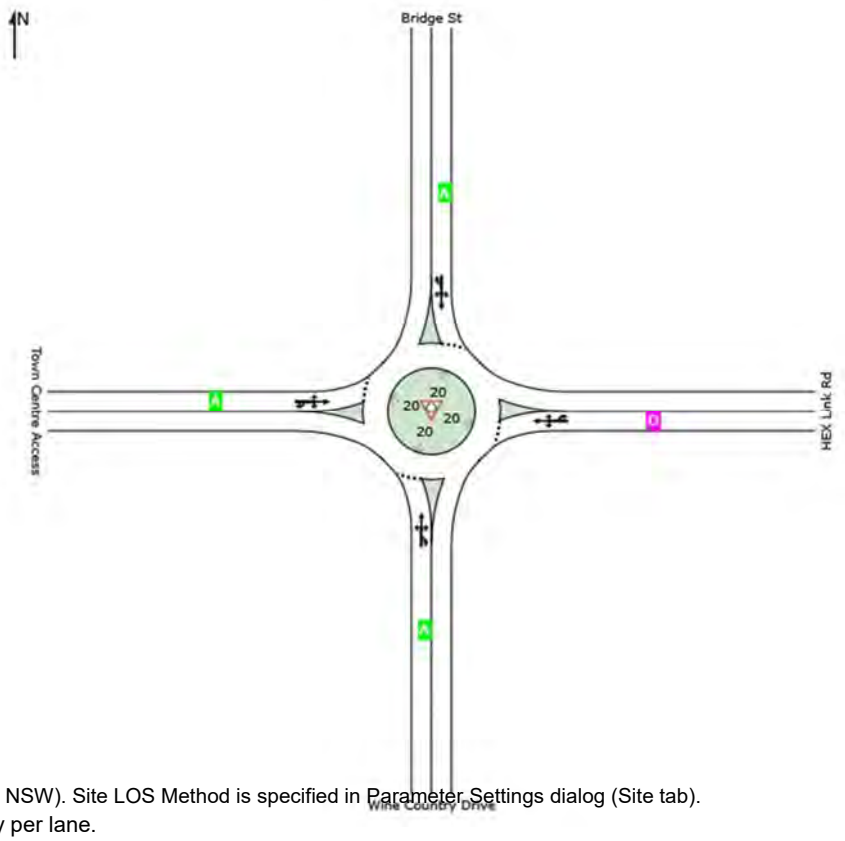
More detailed results are attached and available in electronic form as required by the road authorities.

Figure 3 Intersection Approach Level of Service – PM with Stage 1 Town Centre Development Schedule

Site: 101 [A-1 PM 900 + TC Mod D&A- 4 leg - 280417]

All Movement Classes

	South	East	North	West	Intersection
LOS	A	D	A	A	C



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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10 References

The following reference documents have been utilised for the intersection thresholds review:

Project References

- Hyder for Huntlee Pty Ltd, July-August 2012, Huntlee New Town Stage 1 Preferred Project Report, Traffic Modelling, Volumes 1 & 2, and Addendums.
- BTF for Huntlee Pty Ltd, Intersection & Road Upgrade Threshold Analysis Review, (BTF201649G LWP Huntlee 2016 Threshold Analysis DN01 Rev05, August 2016)

Technical manuals

- Austroads, 2013, *Guide to Traffic Management (2nd Edition)* **(The Guide)**
- Austroads, 2009, *Guide to Road Design*
- Austroads, 2009, *Guide to Road Safety*
- NSW RMS, (October 2002), RTA Guide to Traffic Generating Developments.
- NSW RMS, (August 2013), RMS Technical Direction td13-04a (Updated Trip Rates)

11 CONCLUSION AND RECOMMENDATION

This technical review has been undertaken to update the previous analysis of the [A-1] roundabout which is currently operating as a 3 leg 1 lane roundabout.

The analysis considers the addition of the 4th leg to provide access to the Huntlee Town Centre, and the recently nominated 900 residential dwelling threshold for other approved staging consideration.

It also allows for the Stage 1 Huntlee Town Centre development schedule with trip generation, distribution and assignment appropriate for this style of traffic generating development.

The conclusions drawn from the review are as follows:

- The overall approach to traffic assessment is still on a sound base, with appropriate trip distributions, revised trip generation and allowance for background growth being made.
- Traffic generation rates applied for the development using the Guide and RMS revised trip generation rates (RMS 2013) applied.
- Residential trip distribution assumptions remain unchanged from those agreed in the Hyder Study conducted at the time of considering the Huntlee Stage 1 application in 2012.
- Town Centre trip distribution assumptions derived from local catchment analysis.
- Site access assumptions have been reviewed, and the proposed 4th leg added to Intersection [A-1] as one of two major town centre access points, with two further left in left out access points being provided for the immediate access needs of the Huntlee town centre.
- Intersection analysis for the critical PM peak indicates the existing 1 lane roundabout can operate at a satisfactory level of service 'C' for the nominated combined development schedule.

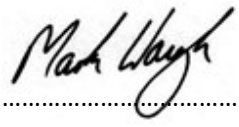
The conclusion from this updated analysis of the impacts on intersection [A-1] is that upgrade of the roundabout from 1 lane to 2 lane operation is not required for the nominated level of town centre activity and the 900 dwelling Village One residential threshold.

It is recommended that the staging thresholds be adjusted to acknowledge the level of town centre development that is nominated here to be part of the revised development threshold for intersection [A-1]

12 ADDITIONAL INFORMATION

We trust this review is sufficient for your discussions with the road authorities. Should you have any questions or require additional information please contact me.

Yours faithfully



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J Mark Waugh

Director

Attachment A – Huntlee Indicative Development Potential
Attachment B – Log of Intersection Modelling Scenarios
Attachment C – Traffic Surveys & Summary Data

Attachment A – Huntlee Proposed Upgrades

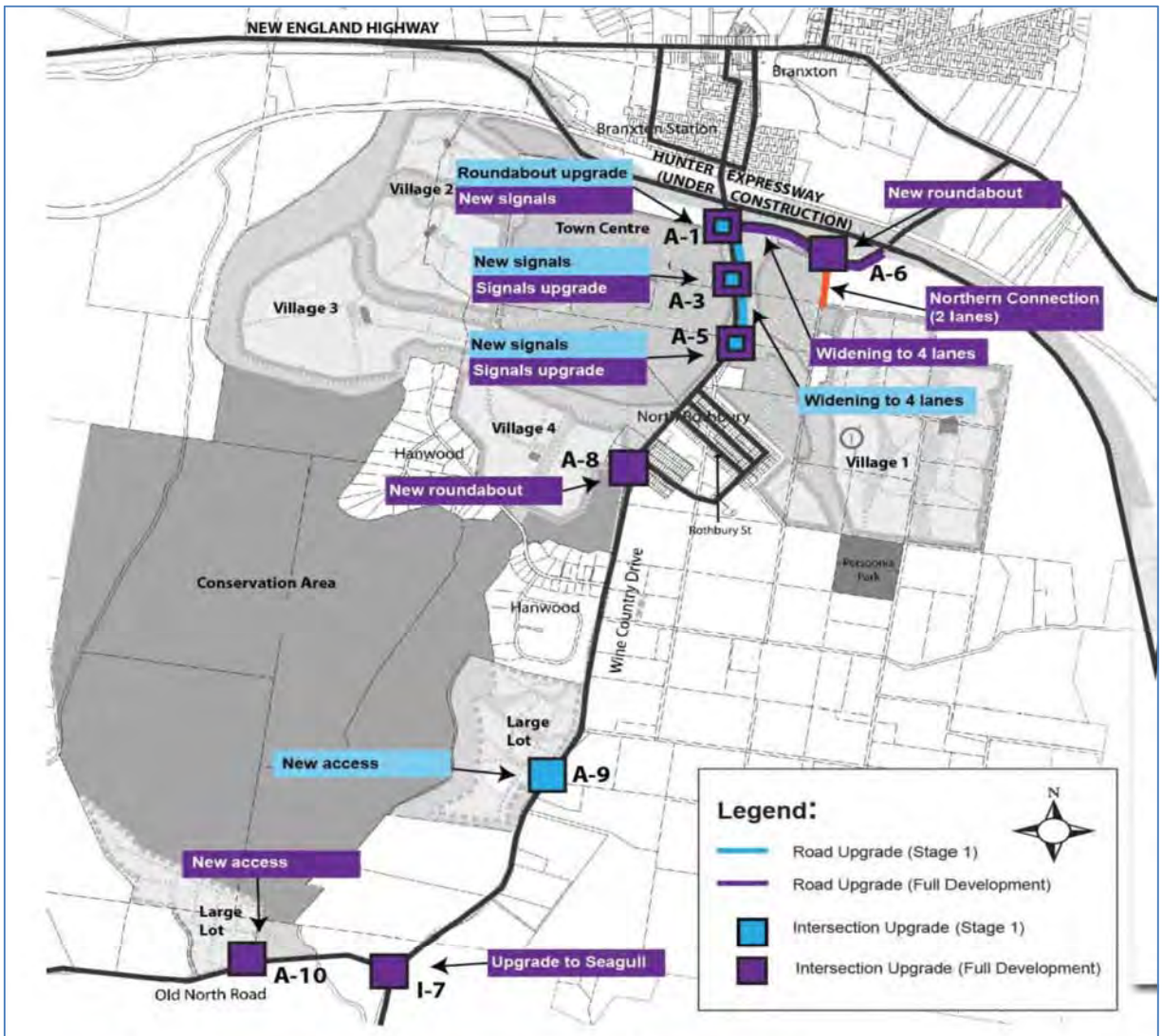


Figure E-2 Proposed Road and Intersection Upgrade (full development)

Attachment B – Traffic Surveys & Summary Data

TURNING MOVEMENT SURVEY

Bridge St and Wine Country Dr, Branxton
Thursday, March 17, 2016
Saturday, March 19, 2016

Weather:	Overcast
Suburban:	Carnegie
Customer:	BTF

Survey Start	
AM:	7:00
PM:	15:00
Weekend	10:00

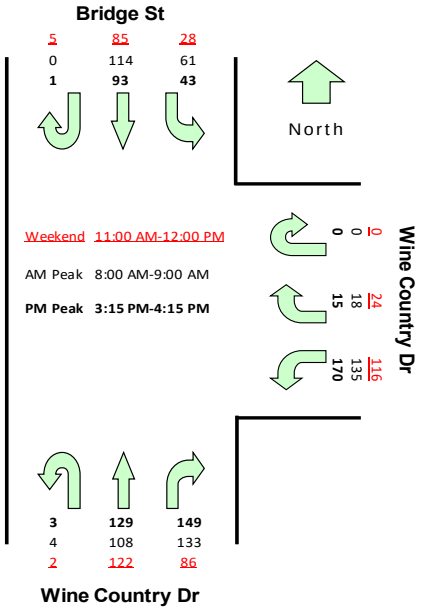
Peakhour	
AM:	8:00 AM-9:00 AM
PM:	3:15 PM-4:15 PM
Weekend	11:00 AM-12:00 PM

All vehicles

Time		North Approach Bridge St			East Approach Wine Country D			South Approach Wine Country D			Hourly Total	
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	Hour	Peak
7:00	7:15	0	13	7	0	2	31	3	35	10	494	
7:15	7:30	0	17	15	0	2	36	3	25	16	513	
7:30	7:45	0	32	18	0	8	41	2	36	17	549	
7:45	8:00	0	33	8	0	6	32	0	30	16	550	
8:00	8:15	0	21	19	0	3	29	2	33	13	573	Peak
8:15	8:30	0	29	12	0	5	41	0	42	21	549	
8:30	8:45	0	28	12	0	3	39	2	29	42	495	
8:45	9:00	0	36	18	0	7	26	0	29	32	450	
9:00	9:15	0	19	11	0	2	21	0	22	21	385	
9:15	9:30	0	22	10	0	4	21	2	22	15		
9:30	9:45	0	21	7	0	3	27	0	25	27		
9:45	10:00	0	8	7	0	1	19	0	26	22		
15:00	15:15	0	22	11	0	8	31	0	30	31	597	
15:15	15:30	1	35	11	0	5	46	0	33	34	603	Peak
15:30	15:45	0	19	16	0	6	38	1	44	32	580	
15:45	16:00	0	22	6	0	3	42	1	34	35	566	
16:00	16:15	0	17	10	0	1	44	1	38	28	557	
16:15	16:30	0	15	13	0	7	36	1	35	35	418	
16:30	16:45	0	25	12	0	6	43	1	31	24	276	
16:45	17:00	0	13	12	0	7	41	0	45	16	134	
17:00	17:15	0	25	10	0	9	38	1	37	33	516	
17:15	17:30	0	26	13	0	10	42	0	33	37		
17:30	17:45	0	20	9	0	11	34	0	35	19		
17:45	18:00	0	2	4	0	6	27	0	20	15		
10:00	10:15	0	12	7	0	0	25	1	25	15	403	
10:15	10:30	0	23	4	0	2	37	0	15	20	427	
10:30	10:45	0	19	6	0	2	28	0	30	20	435	
10:45	11:00	1	20	7	0	7	25	1	23	28	447	
11:00	11:15	3	19	7	0	5	37	1	14	23	468	Peak
11:15	11:30	1	22	10	0	6	18	1	18	33	462	
11:30	11:45	1	26	5	0	6	30	0	21	28	443	
11:45	12:00	0	18	6	0	7	31	0	33	38	422	
12:00	12:15	0	14	6	0	3	27	0	22	31	386	
12:15	12:30	0	21	2	0	1	28	0	20	18	388	
12:30	12:45	0	15	7	0	4	20	1	20	29	369	
12:45	13:00	0	11	5	0	6	30	0	22	23	365	
13:00	13:15	0	16	8	0	4	28	1	24	24	349	
13:15	13:30	1	12	8	0	2	15	0	17	16		
13:30	13:45	0	18	4	0	7	25	0	28	10		
13:45	14:00	0	7	7	0	6	25	0	21	15		

Peak Time		North Approach Bridge St			East Approach Wine Country D			South Approach Wine Country D			Peak
Period Start	Period End	U	T	L	U	R	L	U	R	T	total
8:00	9:00	0	114	61	0	18	135	4	133	108	573
15:15	16:15	1	93	43	0	15	170	3	149	129	603
11:00	12:00	5	85	28	0	24	116	2	86	122	468

Graphic


Bridge St
5
85
28
0
114
61
1
93
43
North
Weekend 11:00 AM-12:00 PM
AM Peak 8:00 AM-9:00 AM
PM Peak 3:15 PM-4:15 PM
0
0
0
Wine Country Dr
24
18
15
116
135
170
3
129
149
4
108
133
2
122
86
Wine Country Dr

Light Vehicles

Time		North Approach Bridge St			East Approach Wine Country D			South Approach Wine Country D		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	13	7	0	2	24	1	34	9
7:15	7:30	0	15	15	0	2	28	3	23	11
7:30	7:45	0	27	15	0	6	34	0	32	14
7:45	8:00	0	30	8	0	6	27	0	26	13
8:00	8:15	0	20	15	0	3	24	1	26	13
8:15	8:30	0	27	12	0	5	32	0	37	19
8:30	8:45	0	27	11	0	3	30	2	26	40
8:45	9:00	0	34	18	0	7	18	0	25	28
9:00	9:15	0	18	10	0	1	16	0	18	19
9:15	9:30	0	20	10	0	3	20	1	16	14
9:30	9:45	0	20	6	0	2	23	0	21	26
9:45	10:00	0	7	6	0	1	15	0	17	22
15:00	15:15	0	21	11	0	8	27	0	25	28
15:15	15:30	1	33	10	0	5	42	0	28	33
15:30	15:45	0	18	15	0	6	31	0	37	31
15:45	16:00	0	21	6	0	3	38	0	29	33
16:00	16:15	0	15	9	0	1	42	0	34	25
16:15	16:30	0	13	9	0	7	35	1	31	35
16:30	16:45	0	25	10	0	6	43	0	29	24
16:45	17:00	0	13	12	0	7	39	0	42	15
17:00	17:15	0	23	9	0	9	35	0	35	32
17:15	17:30	0	26	13	0	10	41	0	31	36
17:30	17:45	0	19	9	0	10	34	0	33	19
17:45	18:00	0	2	4	0	6	27	0	20	15
10:00	10:15	0	12	7	0	0	21	0	24	14
10:15	10:30	0	23	4	0	2	36	0	15	19
10:30	10:45	0	19	6	0	2	28	0	30	20
10:45	11:00	1	19	7	0	6	25	1	22	27
11:00	11:15	3	19	6	0	5	36	1	14	23
11:15	11:30	1	22	10	0	6	17	1	18	33
11:30	11:45	1	25	4	0	6	29	0	20	28
11:45	12:00	0	18	6	0	7	30	0	32	38
12:00	12:15	0	14	6	0	3	27	0	22	30
12:15	12:30	0	21	2	0	1	26	0	20	18
12:30	12:45	0	15	7	0	4	18	1	20	29
12:45	13:00	0	10	5	0	4	28	0	21	22
13:00	13:15	0	16	7	0	4	28	1	21	24
13:15	13:30	1	12	8	0	2	15	0	17	16
13:30	13:45	0	18	4	0	7	24	0	27	10
13:45	14:00	0	7	7	0	6	24	0	20	15

Heavy Vehicles

Time		North Approach Bridge St			East Approach Wine Country D			South Approach Wine Country D		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:00	7:15	0	0	0	0	0	7	2	1	1
7:15	7:30	0	2	0	0	0	8	0	2	5
7:30	7:45	0	5	3	0	2	7	2	4	3
7:45	8:00	0	3	0	0	0	5	0	4	3
8:00	8:15	0	1	4	0	0	5	1	7	0
8:15	8:30	0	2	0	0	0	9	0	5	2
8:30	8:45	0	1	1	0	0	9	0	3	2
8:45	9:00	0	2	0	0	0	8	0	4	4
9:00	9:15	0	1	1	0	1	5	0	4	2
9:15	9:30	0	2	0	0	1	1	1	6	1
9:30	9:45	0	1	1	0	1	4	0	4	1
9:45	10:00	0	1	1	0	0	4	0	9	0
15:00	15:15	0	1	0	0	0	4	0	5	3
15:15	15:30	0	2	1	0	0	4	0	5	1
15:30	15:45	0	1	1	0	0	7	1	7	1
15:45	16:00	0	1	0	0	0	4	1	5	2
16:00	16:15	0	2	1	0	0	2	1	4	3
16:15	16:30	0	2	4	0	0	1	0	4	0
16:30	16:45	0	0	2	0	0	0	1	2	0
16:45	17:00	0	0	0	0	0	2	0	3	1
17:00	17:15	0	2	1	0	0	3	1	2	1
17:15	17:30	0	0	0	0	0	1	0	2	1
17:30	17:45	0	1	0	0	1	0	0	2	0
17:45	18:00	0	0	0	0	0	0	0	0	0
10:00	10:15	0	0	0	0	0	4	1	1	1
10:15	10:30	0	0	0	0	0	1	0	0	1
10:30	10:45	0	0	0	0	0	0	0	0	0
10:45	11:00	0	1	0	0	1	0	0	1	1
11:00	11:15	0	0	1	0	0	1	0	0	0
11:15	11:30	0	0	0	0	0	1	0	0	0
11:30	11:45	0	1	1	0	0	1	0	1	0
11:45	12:00	0	0	0	0	0	1	0	1	0
12:00	12:15	0	0	0	0	0	0	0	0	1
12:15	12:30	0	0	0	0	0	2	0	0	0
12:30	12:45	0	0	0	0	0	2	0	0	0
12:45	13:00	0	1	0	0	2	2	0	1	1
13:00	13:15	0	0	1	0	0	0	0	3	0
13:15	13:30	0	0	0	0	0	0	0	0	0
13:30	13:45	0	0	0	0	0	1	0	1	0
13:45	14:00	0	0	0	0	0	1	0	1	0

TRANS TRAFFIC SURVEY
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Site Wine Country Road

Direction Combined

Back to Site Summary Page

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	7 days		Weekday		Weekend	
Date	21-03-16	22-03-16	23-03-16	17-03-16	18-03-16	19-03-16	20-03-16	Total	Average	Total	Average	Total	Average
AM Peak	09:00	10:00	10:00	06:00	07:00	09:00	11:00	N/A	09:00	N/A	06:00	N/A	09:00
PM Peak	15:00	16:00	12:00	16:00	16:00	19:00	17:00	N/A	16:00	N/A	12:00	N/A	16:00
00:00	13	17	21	26	38	32	46	193	28	115	23	78	39
01:00	12	16	11	18	11	24	28	120	17	68	14	52	26
02:00	8	7	5	12	13	16	19	80	11	45	9	35	18
03:00	11	14	15	20	10	8	8	86	12	70	14	16	8
04:00	76	82	83	68	82	35	21	447	64	391	78	56	28
05:00	230	253	242	239	263	113	72	1412	202	1227	245	185	93
06:00	329	344	361	346	325	122	79	1906	272	1705	341	201	101
07:00	392	426	429	439	391	191	152	2420	346	2077	415	343	172
08:00	468	505	467	486	444	255	128	2753	393	2370	474	383	192
09:00	360	369	374	431	366	288	251	2439	348	1900	380	539	270
10:00	315	321	302	420	347	373	293	2371	339	1705	341	666	333
11:00	314	340	344	401	378	386	397	2560	366	1777	355	783	392
12:00	270	321	327	390	347	363	374	2392	342	1655	331	737	369
13:00	292	347	363	435	443	327	295	2502	357	1880	376	622	311
14:00	375	394	380	446	443	360	328	2726	389	2038	408	688	344
15:00	467	517	473	527	442	259	337	3022	432	2426	485	596	298
16:00	440	492	451	43	459	303	306	2494	356	1885	377	609	305
17:00	440	452	486	0	484	301	275	2438	348	1862	372	576	288
18:00	228	291	308	0	310	256	186	1579	226	1137	227	442	221
19:00	163	219	204	188	246	186	120	1326	189	1020	204	306	153
20:00	97	104	127	145	103	107	80	763	109	576	115	187	94
21:00	66	76	74	83	89	78	60	526	75	388	78	138	69
22:00	49	53	77	65	80	105	27	456	65	324	65	132	66
23:00	26	41	36	23	48	49	23	246	35	174	35	72	36
Total	5441	6001	5960	5251	6162	4537	3905	37257	5321	28815	5762	8442	4226
% Heavy	7.68%	9.30%	8.84%	11.52%	6.93%	2.82%	1.33%	7.29%		8.80%		2.13%	

Attachment C – Updated PM SIDRA Intersection Modelling

LANE LEVEL OF SERVICE

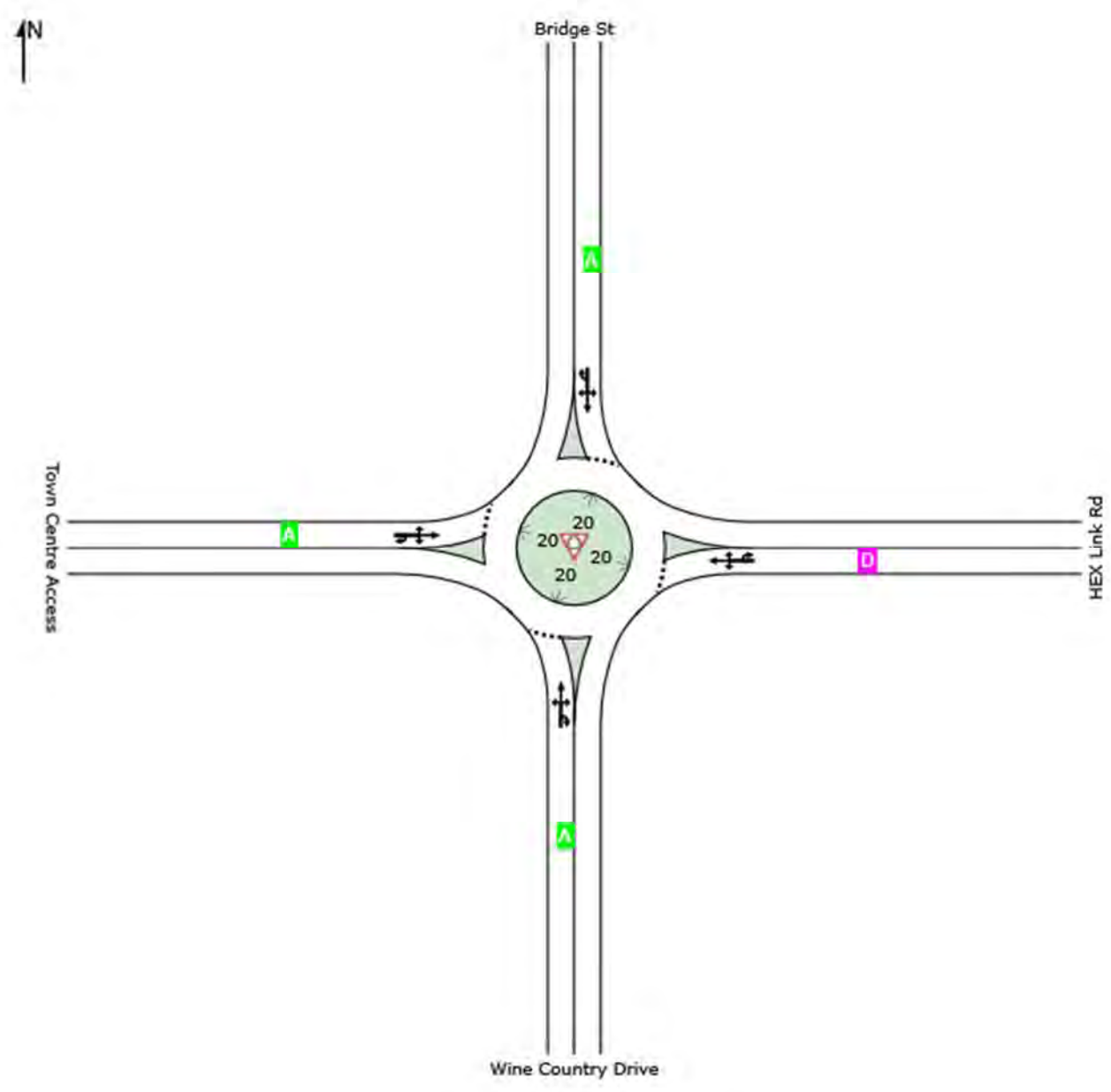
Lane Level of Service

Site: 101 [A-1 PM 900 + TC Mod D&A- 4 leg - 280417]

A-1
Roundabout

All Movement Classes

	South	East	North	West	Intersection
LOS	A	D	A	A	C



Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

INTERSECTION SUMMARY

Site: 101 [A-1 PM 900 + TC Mod D&A- 4 leg - 280417]

A-1
Roundabout

Intersection Performance - Hourly Values		
Performance Measure	**Vehicles**	**Persons**
Travel Speed (Average)	40.6 km/h	40.6 km/h
Travel Distance (Total)	2032.2 veh-km/h	2438.7 pers-km/h
Travel Time (Total)	50.1 veh-h/h	60.1 pers-h/h
Demand Flows (Total)	1980 veh/h	2376 pers/h
Percent Heavy Vehicles (Demand)	0.0 %	
Degree of Saturation	1.013	
Practical Spare Capacity	-16.1 %	
Effective Intersection Capacity	1955 veh/h	
Control Delay (Total)	15.90 veh-h/h	19.07 pers-h/h
Control Delay (Average)	28.9 sec	28.9 sec
Control Delay (Worst Lane)	43.4 sec	
Control Delay (Worst Movement)	50.3 sec	50.3 sec
Geometric Delay (Average)	4.9 sec	
Stop-Line Delay (Average)	24.0 sec	
Idling Time (Average)	12.8 sec	
Intersection Level of Service (LOS)	LOS C	
95% Back of Queue - Vehicles (Worst Lane)	54.3 veh	
95% Back of Queue - Distance (Worst Lane)	380.1 m	
Queue Storage Ratio (Worst Lane)	0.31	
Total Effective Stops	2525 veh/h	3030 pers/h
Effective Stop Rate	1.28 per veh	1.28 per pers
Proportion Queued	0.81	0.81
Performance Index	159.2	159.2
Cost (Total)	1502.15 $/h	1502.15 $/h
Fuel Consumption (Total)	189.5 L/h	
Carbon Dioxide (Total)	445.3 kg/h	
Hydrocarbons (Total)	0.040 kg/h	
Carbon Monoxide (Total)	0.495 kg/h	
NOx (Total)	0.141 kg/h	

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Intersection LOS value for Vehicles is based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Intersection Performance - Annual Values		
Performance Measure	**Vehicles**	**Persons**
Demand Flows (Total)	950,400 veh/y	1,140,480 pers/y
Delay	7,630 veh-h/y	9,156 pers-h/y
Effective Stops	1,211,904 veh/y	1,454,284 pers/y
Travel Distance	975,473 veh-km/y	1,170,567 pers-km/y
Travel Time	24,036 veh-h/y	28,843 pers-h/y
Cost	721,031 $/y	721,031 $/y
Fuel Consumption	90,949 L/y	
Carbon Dioxide	213,730 kg/y	
Hydrocarbons	19 kg/y	
Carbon Monoxide	237 kg/y	
NOx	68 kg/y	

MOVEMENT SUMMARY

Site: 101 [A-1 PM 900 + TC Mod D&A- 4 leg - 280417]

A-1
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Wine Country Drive											
1	L2	11	0.0	0.394	5.3	LOS A	2.9	20.1	0.55	0.64	51.6
2	T1	172	0.0	0.394	5.5	LOS A	2.9	20.1	0.55	0.64	52.8
3	R2	266	0.0	0.394	10.2	LOS A	2.9	20.1	0.55	0.64	52.8
3u	U	5	0.0	0.394	12.2	LOS A	2.9	20.1	0.55	0.64	53.7
Approach		454	0.0	0.394	8.3	LOS A	2.9	20.1	0.55	0.64	52.8
East: HEX Link Rd											
4	L2	1017	0.0	1.013	43.3	LOS D	54.3	380.1	1.00	1.72	34.7
5	T1	137	0.0	1.013	43.6	LOS D	54.3	380.1	1.00	1.72	35.3
6	R2	19	0.0	1.013	48.2	LOS D	54.3	380.1	1.00	1.72	35.3
6u	U	1	0.0	1.013	50.3	LOS D	54.3	380.1	1.00	1.72	35.7
Approach		1174	0.0	1.013	43.4	LOS D	54.3	380.1	1.00	1.72	34.8
North: Bridge St											
7	L2	55	0.0	0.298	5.6	LOS A	1.9	13.3	0.54	0.62	52.6
8	T1	189	0.0	0.298	5.8	LOS A	1.9	13.3	0.54	0.62	53.8
9	R2	73	0.0	0.298	10.4	LOS A	1.9	13.3	0.54	0.62	53.8
9u	U	2	0.0	0.298	12.5	LOS A	1.9	13.3	0.54	0.62	54.8
Approach		319	0.0	0.298	6.9	LOS A	1.9	13.3	0.54	0.62	53.6
West: Town Centre Access											
10	L2	8	0.0	0.036	6.0	LOS A	0.2	1.4	0.57	0.61	52.2
11	T1	14	0.0	0.036	6.3	LOS A	0.2	1.4	0.57	0.61	53.4
12	R2	11	0.0	0.036	10.9	LOS A	0.2	1.4	0.57	0.61	53.4
12u	U	1	0.0	0.036	13.0	LOS A	0.2	1.4	0.57	0.61	54.4
Approach		34	0.0	0.036	7.9	LOS A	0.2	1.4	0.57	0.61	53.1
All Vehicles		1980	0.0	1.013	28.9	LOS C	54.3	380.1	0.81	1.28	40.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.