Planning Proposal for Mixed Use / High Density Residential Development
39-49 Henry Street, Penrith

Traffic and Parking Assessment Report

Prepared for: 3945 Penrith and 4749 Penrith Pty Ltd

December 2017

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1. Introduction

This report has been prepared on behalf of 3945 Penrith and 4749 Penrith Pty Ltd to present the findings of a traffic and parking assessment of the planning proposal to provide a mixed use / high density residential development at the site known as No.39-49 Henry Street, Penrith.

The study has assessed existing traffic conditions, parking demands, access arrangements, future traffic conditions, service vehicle provision and design compliance.

The remainder of the report is set out as follows:

- Section 2 describes the existing traffic and parking conditions;
- Section 3 summarises the proposed development;
- Section 4 reviews the potential traffic impacts of the proposal;
- Section 5 provides a compliance assessment of the proposed car park areas and access arrangements; and
- Section 6 presents the conclusions

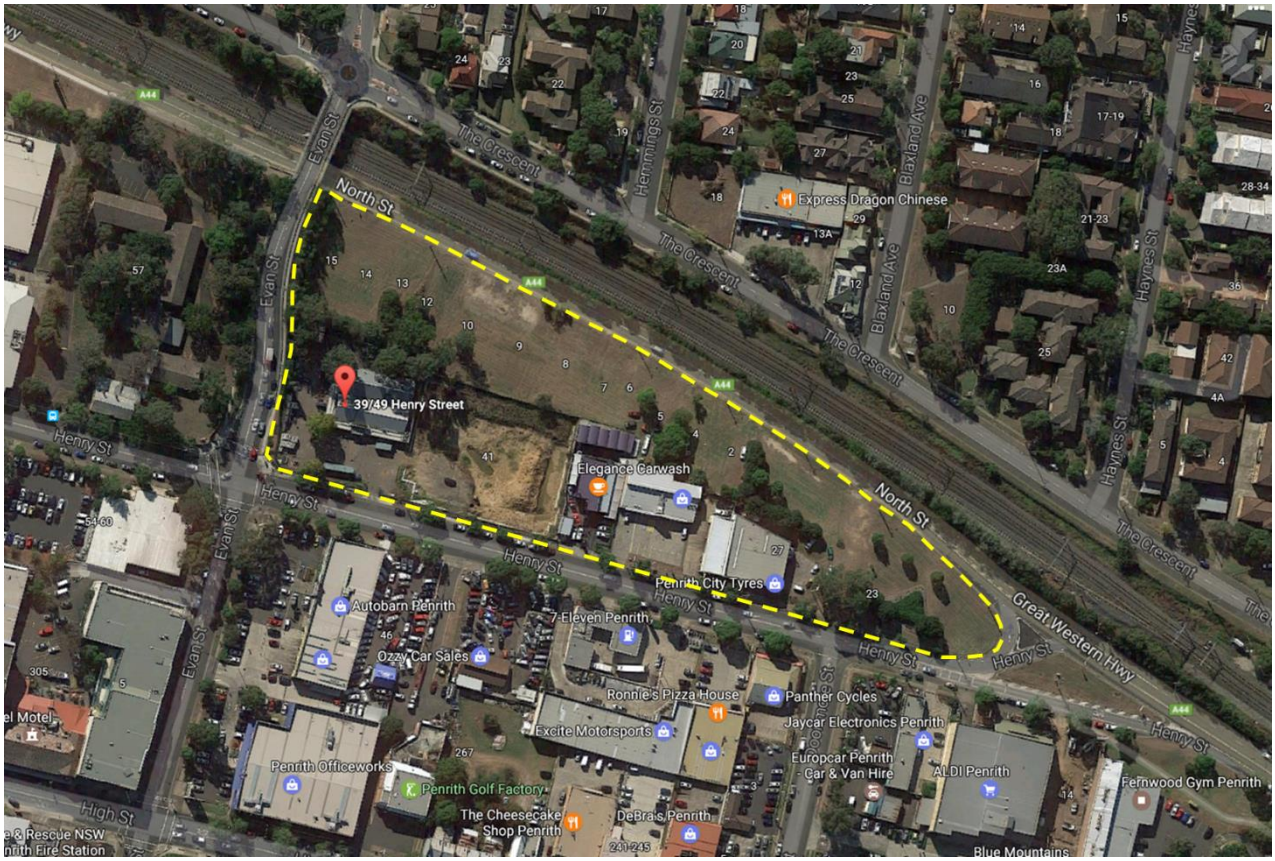
2. Existing Development / Conditions

The following presents a summary of existing site and traffic conditions.

2.1 Site Location

The site is bounded by Evan Street in the west, Henry Street in the south and North Street (western Railway Line) in the north. The location is within the Penrith Town Centre and is shown in **Figure 1**.

Figure 1 - Site Location



Source: Google maps

The existing site includes a number of existing and disused light industrial / commercial buildings all fronting Henry Street. These developments all include driveways from Henry Street with no access permitted from North Street (which becomes the Great Western Highway east of the site).

2.2 Classification Criteria

It is usual to classify roads according to a road hierarchy in order to determine their functional role within the road network. Changes to traffic flows on the roads can then be assessed within the context of the road hierarchy. Roads are classified according to the role they fulfil and the volume of traffic they should appropriately carry. The RTA has set down the following guidelines for the functional classification of roads.

- Arterial Road – typically a main road carrying over 15,000 vehicles per day and fulfilling a role as a major inter-regional link (over 1,500 vehicles per hour)

- Sub-arterial Road – defined as secondary inter-regional links, typically carrying volumes between 5,000 and 20,000 vehicles per day (500 to 2,000 vehicles per hour)
- Collector Road – provides a link between local roads and regional roads, typically carrying between 2,000 and 10,000 vehicles per day (250 to 1,000 vehicles per hour). At volumes greater than 5,000 vehicles per day, residential amenity begins to decline noticeably.
- Local Road – provides access to individual allotments, carrying low volumes, typically less than 2,000 vehicles per day (250 vehicles per hour).

2.3 Existing Road Network

North Street (Great Western Highway) – is the main east / west Arterial Road linking Penrith in the west with Parramatta and the Sydney CBD in the east. Across the northern boundary of the site the nature of North Street is that of a collector type street with a single travel lane in each direction and no on-street parking permitted. The road includes a carriageway width of approximately 7.5m and a posted speed limit of 60km/hr. Evan Street forms an overpass over North Street and is not connected. The intersection of North Street / Henry Street is signalised with a permanent eastbound lane available separate from these traffic signals for eastbound traffic in North Street.

Henry Street – is considered a Collector Road status as it provides direct access to North Street (Great Western Highway) and forms the main street of the Penrith Town Centre to the west. Across the frontage of the site the street includes a carriageway width of approximately 11.0m with unrestricted parallel parking on either side and a single travel lane in each direction. The street includes a posted speed limit of 50km/hr.

Evan Street – is arguably a local Collector Street as it provides access between Henry Street in the south with large residential areas on the northern side of the western Railway Line. The street provides one of the few rail crossings in the immediate area and thus its role in the road network is considered greater than a local street. cross the frontage of the site the street includes a carriageway width of approximately 11.0m with unrestricted parallel parking on either side and a single travel lane in each direction. The street includes a posted speed limit of 50km/hr. The intersection of Evan Street / Henry Street is under traffic signal control.

2.4 Existing Site Traffic Generation

As stated above the existing developments of this large site include both existing and disused light industrial / commercial developments. The Gross Floor Area of each existing site has been estimated below

Site A
(47-49 Henry Street): - Currently not in use, generates no traffic

Site B
(39-45 Henry Street): - Currently excavated, generates no traffic

Site C:

35-37 Henry Street (Elegance Carwash): - *GFA – 147m²*
31-33 Henry Street (Battery World and Family Centre): *GFA – 427m²*
25-29 Henry Street (Midas and Penrith City Tyres): *GFA – 521m²*

The RTA Guide to Traffic Generating Developments suggest the following applicable traffic generation rates for the existing uses:

Car Tyre Retail Outlet

- 1 per 100m² site area

Retail

- Retail (<10,000m²): 12.3 trips per 100m²

The RTA Guide does not provide any traffic generation rates for a car wash. However, from observations and photographs of the site, it was noted approximately 10 vehicles were present in the parking bays / car wash facility at most peak times. Thus, the peak rate has been assumed to be 10 vehicles.

The site area of the tyre centre is not known and thus the GFA of the building has been used. The estimated peak hour traffic generation of the existing developments is summarised below in **Table 1**:

Table 1 – Estimated Existing Site Peak Hour Traffic Generation (veh/hr)

				Existing Traffic Generation	
Site	**Description**	**GFA**	**Rate**	**AM**	**PM**
A		0	0	0	0
B		0	0	0	0
C	Elegance Carwash	*147m²*	10	10	10
C	Battery World and Family Centre	*427m²*	12.3/100m²	4*	52
C	Midas and Penrith City Tyres	*521m²*	1 per 100m²	6	6
			Total	**20**	**68**

*Staff arrival

From **Table 1** it has been estimated that the existing uses on site (currently occupied) would generate in the order of 20 and 68 AM / PM peak hour trips two – way respectively.

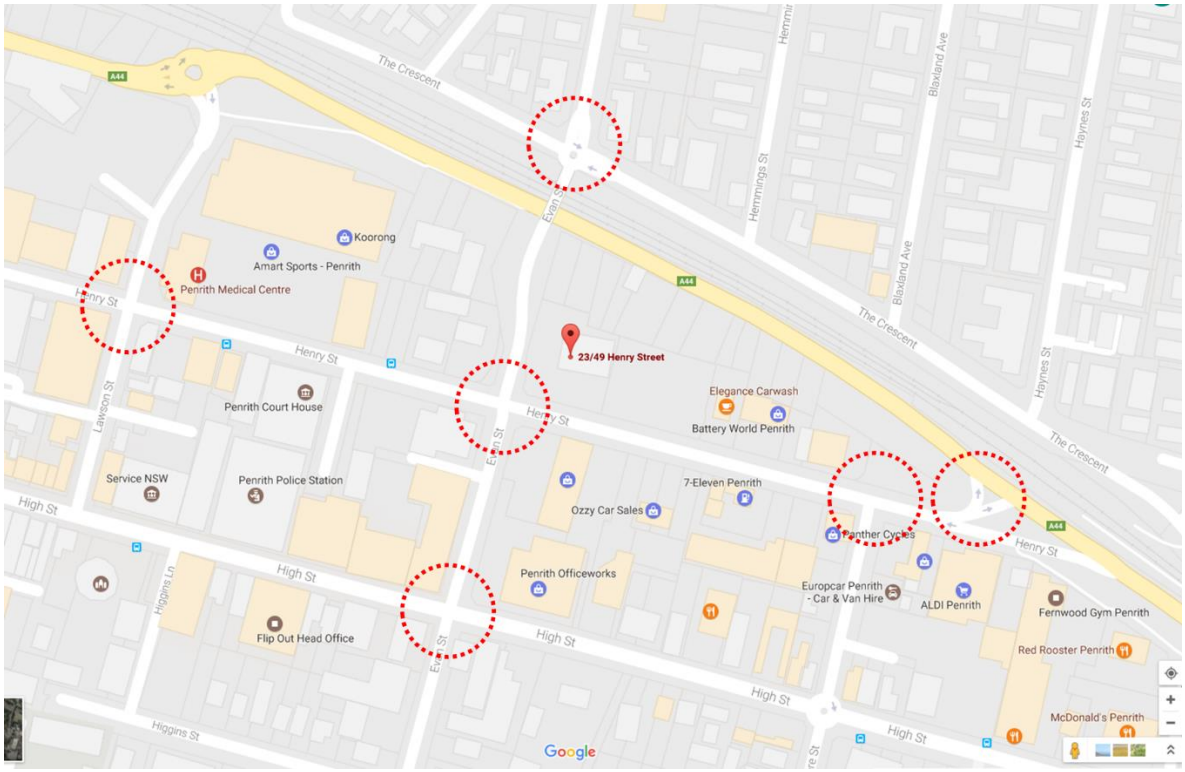
2.5 Existing Traffic Flows

To gauge existing traffic flows on the surrounding road network, morning and afternoon peak hour counts were undertaken at six (6) intersections surrounding the development site. Further, these counts were specifically undertaken on a Thursday to reflect the anticipated peak road network demands generated by the Penrith Town Centre coinciding with typical road network demands.

The locations of the intersection counts are shown in **Figure 2** and include:

1. The Crescent / Evan Street
2. Henry Street / Lawson Street
3. Henry Street / Evan Street
4. Henry Street / Doonmore Street
5. Henry Street / North Street
6. Henry Street / High Street

Figure 2 – AM / PM Peak Hour Intersection Count Locations



Copies of the intersection counts can be found in **Appendix A** of this report.

The peak flows by direction in each street at each intersection are summarised below.

Table 2 – Existing Weekday Peak Period Volumes in vicinity of site (veh/hr)

		AM		PM	
Road	**Location**	**NB/EB**	**SB/WB**	**NB/EB**	**SB/WB**
The Crescent	West of Evan Street	1	69	1	100
	East of Even Street	193	276	233	283
Lawson Street	North of Henry Street	159	172	170	251
	South of Henry Street	133	280	233	304
Henry Street	West of Lawson Street	343	389	543	549
	East of Lawson Street	372	552	660	656
	West of Evan Street	327	662	796	606
	East of Evan Street	331	362	569	380
	West of Doonmore Street	311	372	610	390
	East of Doonmore Street	183	327	437	353
Doonmore Street	South of Henry Street	67	150	104	240
North Street	West of Henry Street	358	453	607	567
	East of Henry Street	538	776	1.037	910

From **Table 2** it can be seen that existing flows on surrounding roads are in generally in line with their classification.

2.6 Existing Intersection Operating Conditions

All intersections surveyed have been analysed using the Sidra Network analysis program. Sidra Intersection determines the average delay that vehicles encounter, the degree of saturation of the intersection, and the level of service. The degree of saturation is the ratio of the arrival rate of vehicles to the capacity of the approach. Sidra Intersection provides analysis of the operating conditions which can be compared to the performance criteria set out in **Table 3**.

Table 3 – Level of Service Criteria

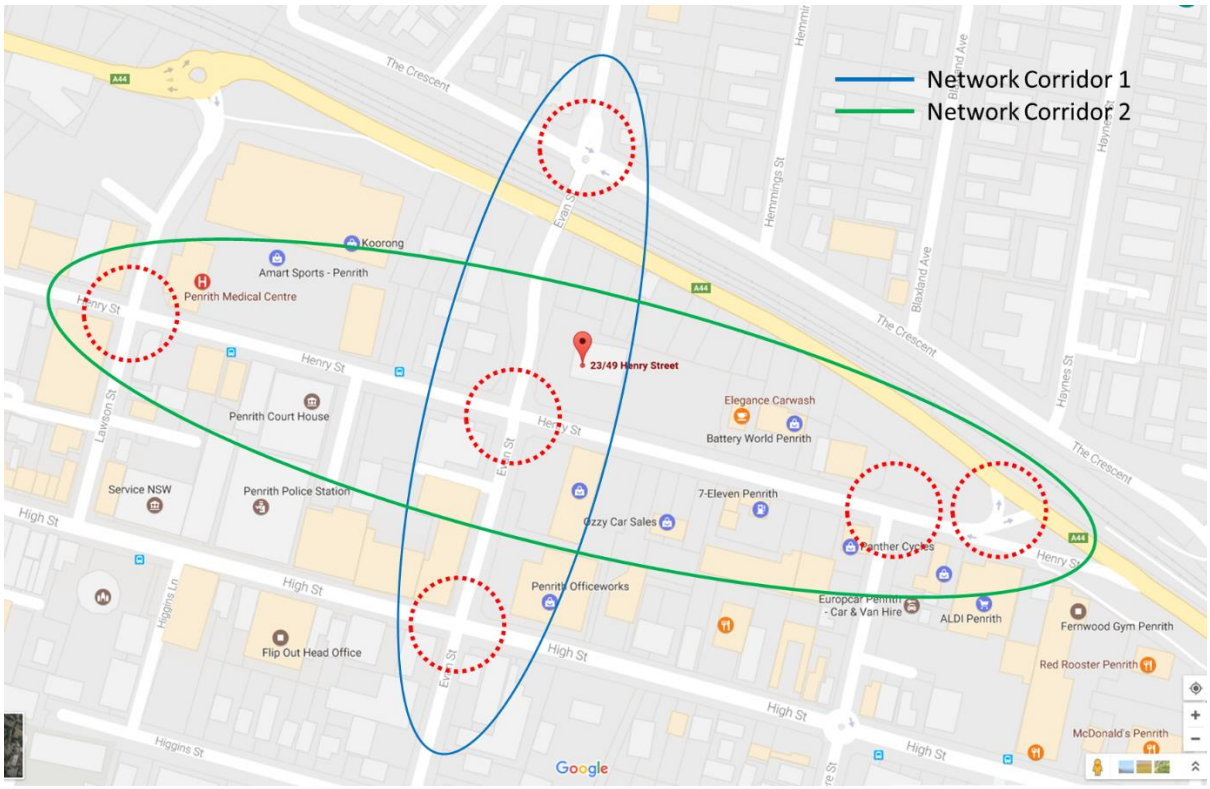
Level of Service	Average Delay per Vehicle (secs/veh)	Signals & Roundabouts	Give Way & Stop Signs
A	less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & Spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	> 70	Extra capacity required	Extreme delay, traffic signals or other major treatment required

Adapted from RTA Guide to Traffic Generating Developments, 2002.

For roundabouts and priority intersections, the reported average delay is for the individual movement with the highest average delay per vehicle. At signalised intersections, the reported average delay is over all movements.

The intersections identified for counts were chosen to not only provide an assessment of existing operating conditions surrounding the development site but to enable the development of SIDRA Network corridor models. The two (2) corridors prepared in SIDRA Network are shown below.

Figure 3 – SIDRA Network Adopted Corridors



The existing weekday and weekend day intersection operating conditions are presented in **Table 4**. Average delay is expressed in seconds per vehicle.

Table 4 – Existing Weekday AM / PM Intersection Operating Conditions

		Morning Peak		Evening Peak	
Intersection	**Control**	**Av Delay**	**LOS**	**Av Delay**	**LOS**
The Crescent / Evan Street	Roundabout	27.8	B	18.1	B
Henry Street / Lawson Street	Signals	11.8	A	12.9	A
Henry Street / Evan Street	Signals	20.8	B	50.0	D
Henry Street / Doonmore Street	Priority	7.2	A	7.5	A
Henry Street / North Street	Signals	6.5	A	9.7	A
High Street / Evan Street	Signals	14.3	B	16.4	B

Avg Delay (sec/veh) is over all movements at signals, and for worst movement at priority and roundabouts

From **Table 4** it is noted that all intersections surrounding the development currently operate at a satisfactory level of service during both the AM and PM peak periods on a weekday with spare capacity.

2.7 Public Transport - Buses

The site is located within a 400m walking distance to a large number of existing bus stops which provide local / regional bus services. The distance to each bus within 400m walking distance to the development site is shown below.

Figure 4 – Existing Bus Stops within 400m Walking Distance to Development Site

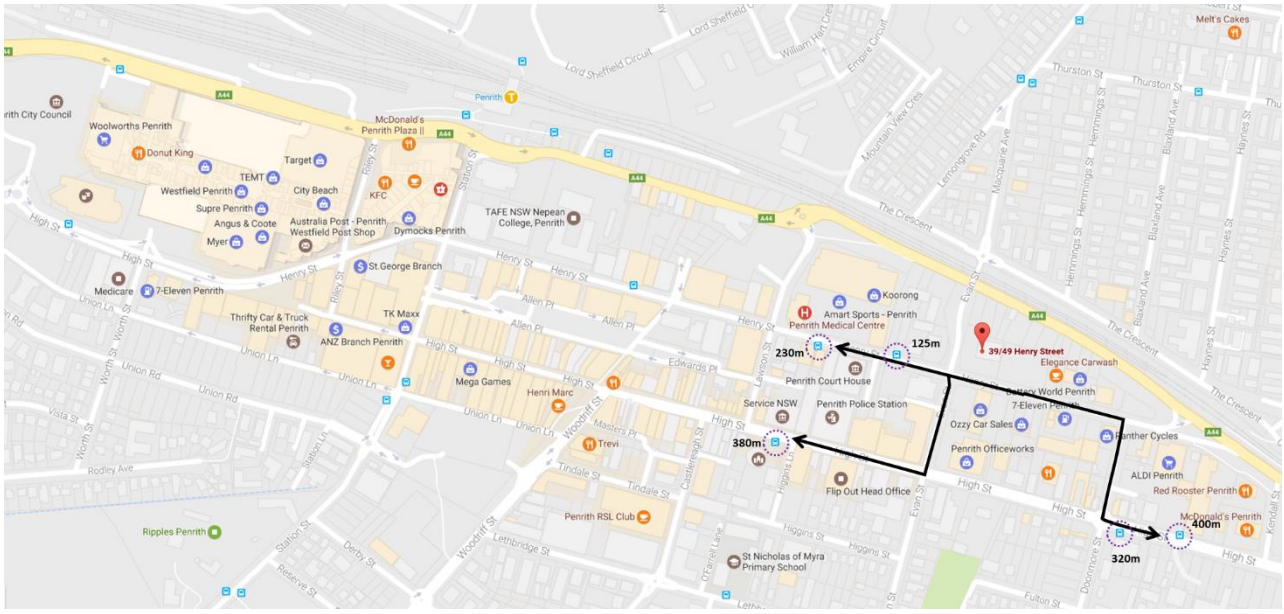
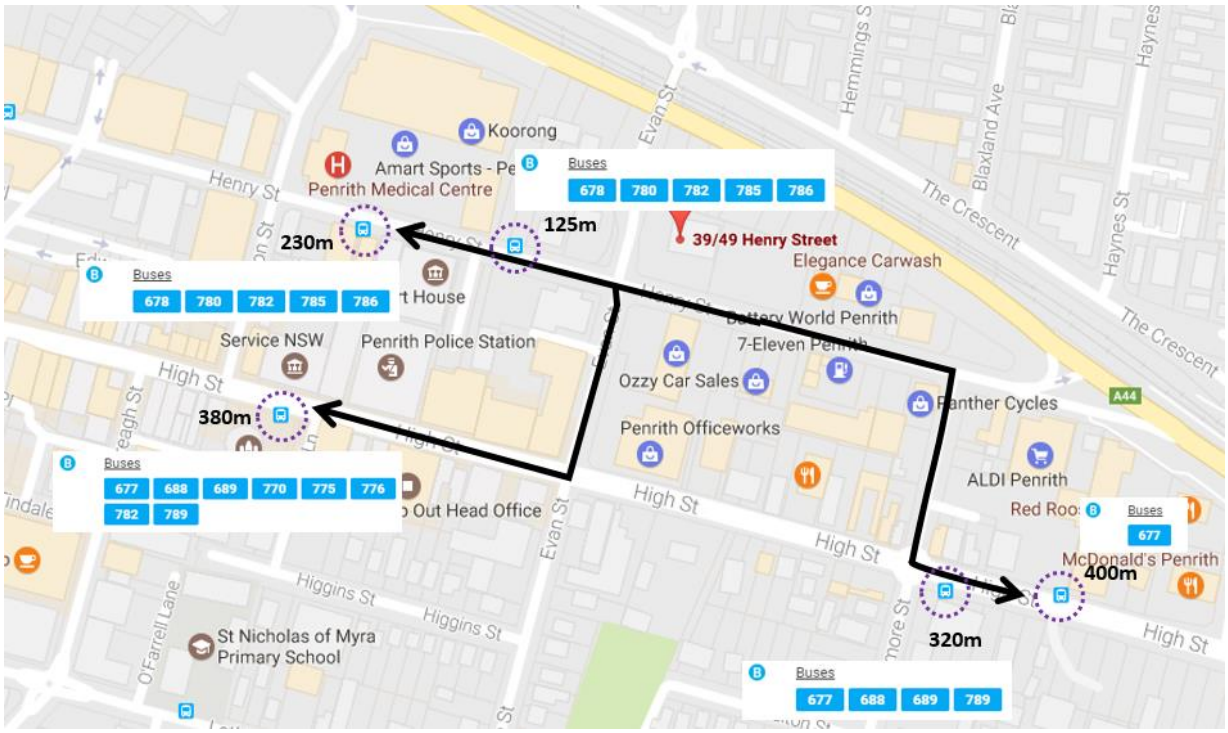


Figure 5 – Existing Bus Services at Bus Stops within 400m Walking Distance to Development Site



The existing services which operate from all bus stops within 400m walking distance to the development site are summarised below:

Table 5 - Bus Routes Operating Past Development Site

Route Number	Operator	Origin	Via	Destination
677	Busways	Richmond	Londonderry	Penrith
678	Busways	Richmond	Agnes Banks	Penrith
689	CDC	Penrith	Emu Plains	Leonay
770	Busways	Penrith	Claremont Meadows	Mount Druitt
775	Busways	Penrith	St Marys	Mount Druitt
776	Busways	Penrith	St Marys	Mount Druitt
782	Busways	Penrith	Cambridge Green	St Marys
785	Busways	Penrith	Cambridge Green	Werrington
786	Busways	Penrith	Greygums Rd	Cranebrook
789	Busways	Penrith	Orchard Hills	Luddenham

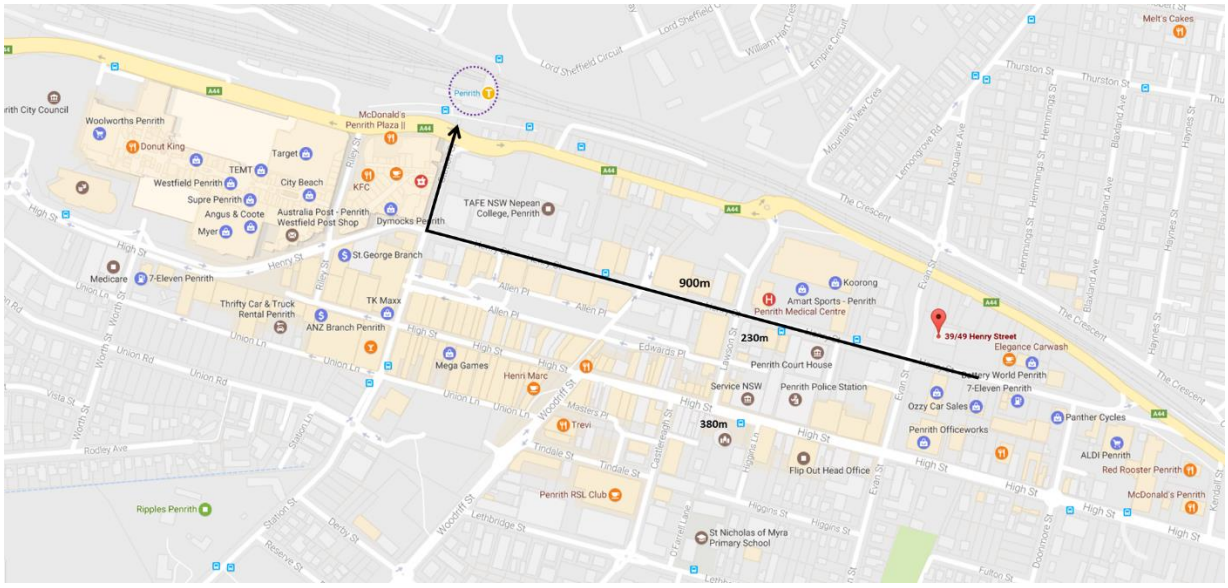
From **Table 5** it can be seen that the site is located within easy walking distance to a significant number of local and regional bus services.

2.8 Public Transport - Trains

In addition, the development site is located within 900m walking distance to Penrith Railway Station located on the main Sydney Rail Network Western Line. This rail station is of regional significance and includes both a large commuter car park and bus interchange.

The walking distance to the rail station is shown below.

Figure 6 – Walking Distance to Penrith Rail Station



This station provides a train every 5-10 minutes during the morning peak to the east and the same to the west in the PM peak.

2.9 Penrith LGA Vehicle Ownership Profile

As the co-author of the published research paper "Adequacy of car parking policies for flats units and apartments in the Sydney region", this paper included an assessment of vehicle ownership levels from the 2006 census for all 340,000 flats, units and apartments within the Sydney Metropolitan Region. The purpose of the research paper amongst other matters was to determine vehicle ownership levels of FUA's for each local government area within Sydney. This research paper has been updated to account for 2011 Census data which is now available.

From the research paper, the 2006 census data shows the following average vehicle ownership for FUA's within the Penrith LGA.

Table 6 – 2006 Census Penrith LGA FUA Vehicle Ownership Profiles

Year	LGA	No. of Vehicles per Dwelling				Total No of Vehicles	Total No. FUA Dwellings	Avg. Veh / Dwelling
		0	1	2	3+			
2006	Penrith	1380	1621	319	85	2513	3405	0.74

From **Table 6** it can be seen from the 2006 Census data the average vehicle ownership for FUA's was **0.74** vehicles per dwelling.

Since the original research paper was prepared, data from the 2011 Census has been obtained (2016 Census data is not available at the time of writing this report) and is compared with the original data from 2006 below.

Table 7 – 2006 vs 2011 Census Penrith LGA FUA Vehicle Ownership Profiles

Year	LGA	No. of Vehicles per Dwelling				Total No of Vehicles	Total No. FUA Dwellings	Avg. Veh / Dwelling
		0	1	2	3+			
2006	Penrith	1380	1621	319	85	2513	3405	0.74
2011	Penrith	1025	2112	670	172	3968	3979	1.00

From **Table 7** it can be seen that vehicle ownership for FUA's has increased to on average one (1) vehicle per dwelling.

2.9.1 Penrith LGA Vehicle Ownership Profile

Data from the 2011 Census was extracted to examine patterns of vehicle ownership in Penrith LGA. The focus of this analysis is on Flats Units or Apartment (FUA), with disaggregation by bedroom numbers. Data was derived from Tablebuilder, census data product of ABS which permits the user to extract Census information in a tailored manner.

Aggregations applied to the data were:

- Dwelling structure – the following FUA variables are aggregated to single FUA

Dwelling structure variable – FUA-related	Aggregation
Flat, unit or apartment attached to a house	FUA
Flat, unit or apartment in a four or more storey block	FUA
Flat, unit or apartment in a one or two storey block	FUA
Flat, unit or apartment in a three storey block	FUA
House or flat attached to a shop, office, etc.	Shop top

The classification 'House or flat attached to shop, office, etc.' is not treated as FUA.

- Number of bedrooms were aggregated at beyond 4 bedrooms to 5+ bedrooms
- Number of vehicles were aggregated at beyond 4 vehicles to 5+ vehicles
- Not stated and not applicable are excluded from the analysis.

The following table provides a count of the number of dwellings in particular vehicle ownership bands by number of bedrooms for FUAs in Penrith LGA.

Table 8 – 2011 Census Penrith LGA FUA Vehicle Ownership Profiles

	No veh	1 veh	2 veh	3 veh	4 veh	5+ veh	Total
Studio	54	18	0	0	0	0	72
1 bed	183	198	13	0	0	0	394
2 bed	716	1,490	319	28	3	7	2,563
3 bed	67	308	255	65	16	0	711
4 bed	5	64	80	20	12	0	181
5+ bed	0	34	3	18	3	0	58
Total	**1,025**	**2,112**	**670**	**131**	**34**	**7**	**3,979**

The above table indicates that the most frequent sized FUA in Penrith in the 2011 Census was two (2) bed dwelling (2,563 dwellings out of 3,979 dwellings); and the most frequent vehicle ownership was one (1) vehicle (2,112 dwellings out of 3,979 dwellings).

The following table summarises the vehicles by bedrooms size distributions as percentages of dwellings. It also includes the average number of vehicles by bedroom size.

Table 9 – 2011 Census No. Vehicles Per Dwelling Size for Penrith LGA FUA's

	No veh	1 veh	2 veh	3 veh	4 veh	5+ veh	Total	Veh/dwelling
Studio	75%	25%	0%	0%	0%	0%	100%	0.25
1 bed	46%	50%	3%	0%	0%	0%	100%	0.57
2 bed	28%	58%	12%	1%	0%	0%	100%	0.89
3 bed	9%	43%	36%	9%	2%	0%	100%	1.51
4 bed	3%	35%	44%	11%	7%	0%	100%	1.83
5+ bed	0%	59%	5%	31%	5%	0%	100%	1.83
Total	**26%**	**53%**	**17%**	**3%**	**1%**	**0%**	**100%**	**1.01**

The above table indicates that:

- 58% of FUAs in Penrith are two (2) bedroom dwellings and generally own one (1) vehicle per dwelling
- 26% of all FUAs in the Penrith LGA have no vehicles
- Only 4% of FUAs in Penrith had 3 or more vehicles
- No FUAs on Census Night were recorded as having 5 or more vehicles
- Two (2) bedroom FUAs had 0.89 vehicles per dwelling on average
- Overall and on average, there was 1 vehicle per dwelling in FUA s in Penrith.

3. The Proposed Development

The key components of the planning proposal on matters relating to traffic, parking and access are described below.

- Demolition of all existing buildings on-site.
- Rationalisation of existing driveways to 2-3 driveways in Henry Street;
- Construction of a mixed-use development including four (4) buildings with the following anticipated potential yield by building
- Site A – 1 Building
    - Retail: 502m^2
    - Hotel: 100 rooms (7,218m^2)
    - Residential:
        - 32 x one bedroom dwellings
        - 150 x two bedroom dwellings
        - 32 x three bedroom dwellings
        - Total = 214 dwellings
    - Parking: 309 spaces

- Site B – 1 Building
    - Retail: 1,138m^2
    - Commercial: 447m^2
    - Childcare (1000m^2) 71 kids + 15 staff
    - Residential:
        - 35 x one bedroom dwellings
        - 162 x two bedroom dwellings
        - 35 x three bedroom dwellings
        - Total = 231 dwellings
    - Parking: 250 spaces

- Site C – 2 Buildings
    - Retail: 1,594m^2
    - Commercial: 2,484m^2
    - Residential:
        - 39 x one bedroom dwellings
        - 181 x two bedroom dwellings
        - 39 x three bedroom dwellings
        - Total = 281 dwellings
    - Parking: 316 spaces

- Overall parking provision as per the RMS requirements for High Density Dwellings within a Metropolitan City Centre
- No large retail spaces would be proposed as part of the development. All retail would include small shops / chemist / hair dresser type uses.
- Bicycle parking provision in accordance with the DCP

- Adaptable units with accessible parking spaces as per the requirements of Council's DCP.
- Common loading dock areas for efficiency of use for each building
- Two – way driveway access from Henry Street for each building.

Plans of the proposed development can be found in **Appendix B** of this report.

4. Potential Traffic Impacts

4.1 Introduction

The following presents an assessment of the potential traffic impacts of the proposal using the Roads and Traffic Authority Guide to Traffic Generating Developments standard approach.

4.2 Existing Site Traffic Generation

As stated above, the existing site has been estimated to generate in the order of 20 and 68 AM / PM peak hour trips two – way respectively.

4.3 Development Traffic Generation

The following traffic generation rates have been adopted for the proposed development.

Residential

The development includes high density residential within a short walking distance to the Penrith Town Centre and a wide variety of public transport options.

The RTA Technical Direction 2013-04a suggests a rate of 0.19 AM peak hour trips per dwelling and 0.15 PM peak hour trips per dwelling.

Therefore, the potential yield of 726 dwellings would generate some 138 AM and 109 PM peak hour trips two- way.

Commercial

The RTA Technical Direction 2013-04a suggests a rate of 1.6 trips per 100m^2 GFA in the AM peak and 1.2 per 100m^2 GFA in the PM peak for office (commercial uses).

Therefore, the total potential commercial yield of the development 2,931m^2 has the potential to generate approximately 47 AM and 36 PM peak hour trips two-way.

Retail

As stated above, the retail uses on the site would not include any supermarkets or large floorplate retail stores and consist of smaller type retail. However, for consistency and to provide a conservative estimate of traffic generation the RMS rate has been applied.

Therefore, the total retail potential of the site of 3,234m^2 could generate some 388 PM peak hour trips. The AM trips for a weekday will be estimated at a rate of 2 staff per 100m^2 of retail floorspace.

Hotel

The RTA Guide to Traffic Generating Developments does not provide any traffic generation rates for hotels (it does provide a parking rate). The guide suggests surveys of a similar type of use. For this planning proposal, it has conservatively assumed that an 85% occupancy rate (85 rooms) would generate 50% or its traffic during the PM peak. This equates to a total of 42 trips two way in the PM peak.

Child Care

The purpose of this assessment it has been assumed the child care component would operate as a 'long day care' centre. For such a centre, the RTA Guide to Traffic Generating Developments recommends 0.8 trips per child in the AM peak and 0.7 trips per child in the PM peak. This equates to an AM / PM peak hour traffic generation of 57 and 50 trips two way respectively.

However, the above assumes a stand-alone child care centre. Given the child care centre would exist within a development of some 700 dwellings, it is likely that the centre would be fully accommodated by residents of the development who would not require the use of a car to travel to / from the child care centre. Or, trips would be made via an existing commuter car trip on the network.

Therefore, it has been assumed the child care centre component would not generate any additional net traffic on the network.

Total Traffic Generation

The estimated net traffic generation of the proposed development is summarised below:

Table 10 – Estimated Total Net Traffic Generation of the Proposal

			Estimated Traffic Generation	
Proposed Use	**GFA / No.**	**Rate**	**AM**	**PM**
Site A				
Retail	502m²	12.3/100m²	10*	62
Hotel	100 rooms	42/100 rooms	8*	42
Residential				
One bedroom	32	0.19/0.15	6	5
Two bedroom	150	0.19/0.15	29	4
Three bedroom	32	0.19/0.15	6	5
		Sub Total	**59**	**118**
Site B				
Retail	1,138m²	12.3/100m²	23*	140
Commercial	447m²	1.6/100 & 1.2/100	7	5
Residential				
One bedroom	35	0.19/0.15	7	5
Two bedroom	162	0.19/0.15	31	24
Three bedroom	35	0.19/0.15	7	5
		Sub Total	**75**	**179**

Site C				
Retail	1,594m²	12.3/100m²	32	196
Commercial	2,484m²	1.6/100 & 1.2/100	40	30
Residential				
One bedroom	39	0.19/0.15	7	6
Two bedroom	181	0.19/0.15	34	27
Three bedroom	39	0.19/0.15	7	6
		Sub Total	**120**	**265**
Existing				
			-20	**-68**
		Grand Total	**234**	**494**

* Assumed 2 staff / 100m²
**staff arrival estimate

From **Table 10** it is estimated the proposed development conservatively would generate an additional 234 AM peak and 494 PM peak hour trips. These estimates are considered conservative as the major proportion of the trips would be generated by the retail components which would serve the population of the site. Uses such as cafes, chemists, hairdresser and the like would not necessary be traffic generators in their own right but ancillary retail for the development itself.

However, the retail traffic generation has not been reduced to provide a conservative estimate of net traffic impacts.

4.4 Future Traffic Flows

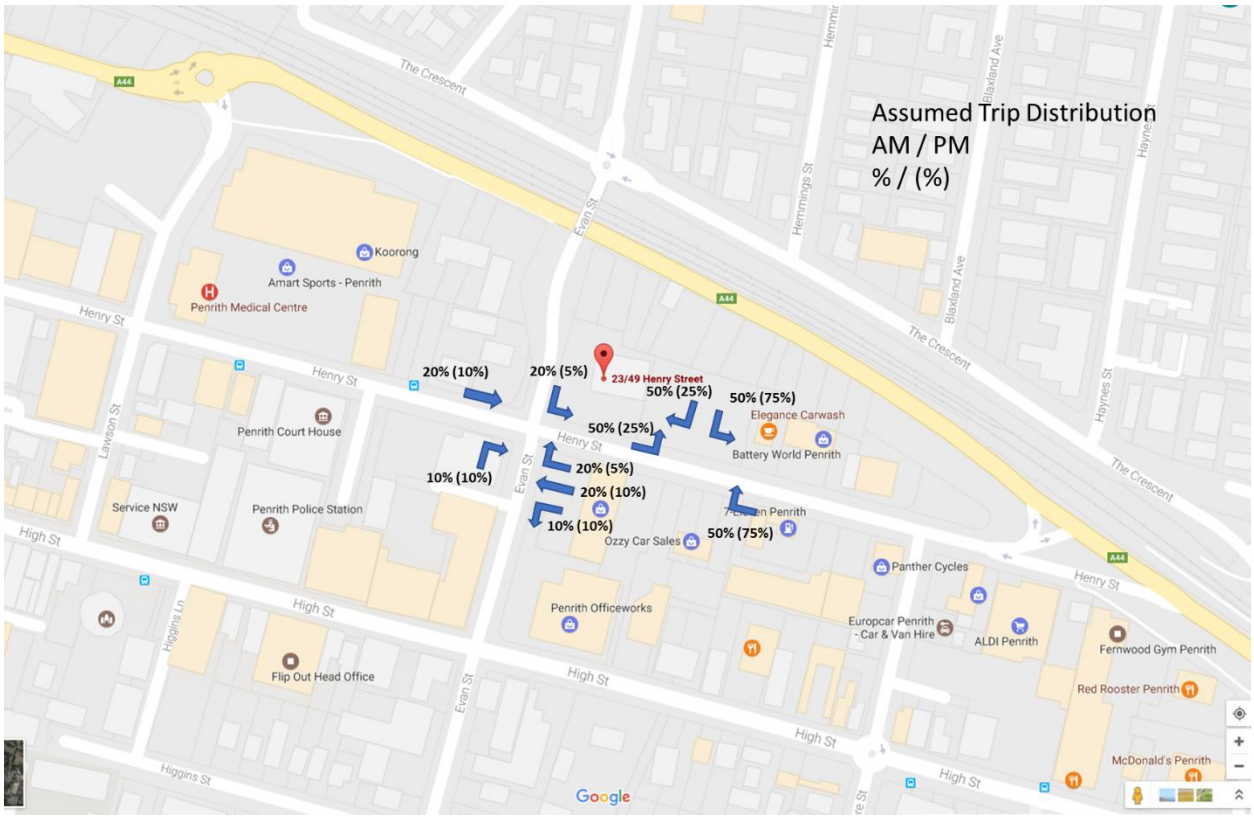
The traffic generated by the proposal has given consideration to the proportion of traffic In Henry Street and the distribution of traffic at the intersection of Henry Street / Evan Street.

In the AM peak, the traffic flows in Henry Street were approximately 50/50 east and west. However, in the PM peak, this increased to 70% to the east and 30% to the west.

Whilst at the intersection of Evan Street there were high proportion flows to and from the north via the overpass, this generally was generated by residential traffic and not necessarily a draw of traffic from this development. Parker Street is expected to be the preferred street to travel to areas in the north such as Windsor and Richmond for employment.

The assumed trip distribution of traffic generated by the site is shown below:

Figure 7 – Adopted Net Traffic Trip Distribution



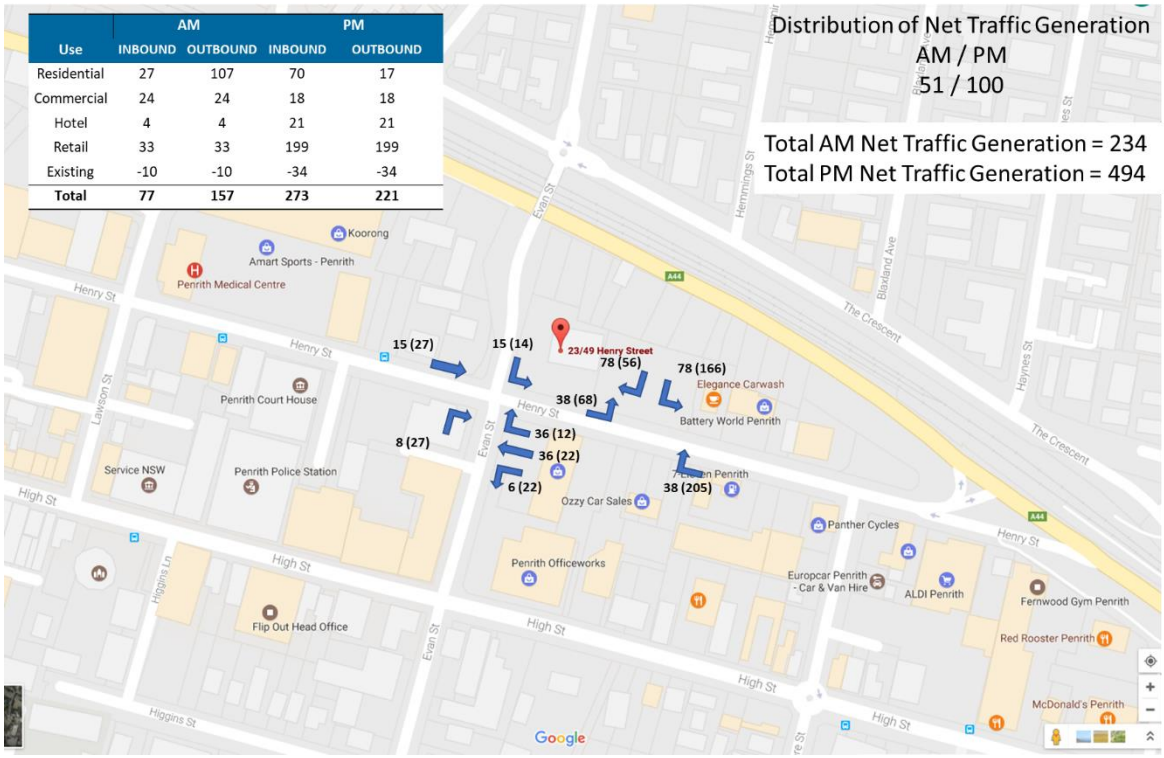
For residential uses, 80% of the traffic would be outbound in the AM and 20% inbound. The reverse would occur during the PM peak. For all other uses, a 50/50 split of inbound / outbound net traffic generation has been assumed. That is, the flows into and out of this intersection for each peak period have been used to distribute traffic to and from the development via surrounding streets.

The resulting AM and PM inbound and outbound net traffic generation of the planning proposal is summarised below:

Table 11 – AM / PM Distribution of Net Traffic Generation of the Proposal

	AM		PM	
Use	**INBOUND**	**OUTBOUND**	**INBOUND**	**OUTBOUND**
Residential	27	107	70	17
Commercial	24	24	18	18
Hotel	4	4	21	21
Retail	33	33	199	199
Existing	-10	-10	-34	-34
Total	**77**	**157**	**273**	**221**

Figure 8 – Inbound / Outbound Net Traffic Generation by Direction



The net traffic generation by assumed trip distribution has been added to existing volumes on the surrounding road network. The resulting future traffic flows by location is presented below.

Table 12 – Future Weekday Peak Period Volumes in vicinity of site (veh/hr)

		AM		PM	
Road	**Location**	**NB/EB**	**SB/WB**	**NB/EB**	**SB/WB**
The Crescent	West of Evan Street	8	85	8	106
	East of Even Street	208	284	239	290
Lawson Street	North of Henry Street	159	172	170	251
	South of Henry Street	133	280	233	304
Henry Street	West of Lawson Street	364	404	575	576
	East of Lawson Street	387	583	687	678
	West of Evan Street	342	693	824	628
	East of Evan Street	369	430	637	436
	West of Doonmore Street	389	410	776	590
	East of Doonmore Street	261	365	503	558
Doonmore Street	South of Henry Street	67	150	104	240
North Street	West of Henry Street	358	453	607	567
	East of Henry Street	616	814	1.203	1,105

From **Table 12** it can be seen that future traffic flows are below those which are expected as maximums for each surrounding road type. Therefore, the traffic generated by the development would not result in traffic volumes beyond the expected capacity of each street surveyed.

4.5 Future Intersection Operation

The future traffic flows on the surrounding road network have been assessed in SIDRA. The resulting future intersection operation is presented below.

Table 13 – Future Weekday AM / PM Intersection Operating Conditions

		Morning Peak		Evening Peak	
Intersection	Control	Av Delay	LOS	Av Delay	LOS
The Crescent / Evan Street	Roundabout	31.0	C	18.7	B
Henry Street / Lawson Street	Signals	12.2	A	13.3	A
Henry Street / Evan Street	Signals	29.0	C	51.4	D
Henry Street / Doonmore Street	Priority	7.5	A	9.8	A
Henry Street / North Street	Signals	7.5	A	12.7	A
High Street / Evan Street	Signals	14.6	B	16.7	A

Avg Delay (sec/veh) is over all movements at signals, and for worst movement at priority and roundabouts

From **Table 13** it is noted that intersections surveyed as part of this report would continue to operate at a satisfactory level of service during both the AM and PM peak periods. This includes the conservative traffic generation assumptions for the retail / retail components of the project.

Therefore, the potential traffic impacts of the proposal are considered satisfactory.

The Level of Service by approach of all intersections analysed for future traffic conditions are provided in **Appendix C** of this report.

5. Future Traffic Conditions Sensitivity Testing

Following consultation with representatives of Penrith Council, alternative traffic generation rates and future design year (10-year timeframe) have been tested.

Penrith Council representatives requested the following to be tested for this proposal:

- A traffic generation rate of **0.33 trips per dwelling** is to be adopted for all residential dwellings proposed.
- Intersection modelling is to include an assessment of the year 2027 which assumes a 2% per annum growth rate of background traffic.
- 20% of the weekday PM peak traffic generation of the retail component is to be assumed to occur in the weekday AM peak intersection assessment.

Whilst the report which underpins the 0.33 peak hour trips per dwelling was not made available, the following presents a summary of the assessment of this alternative traffic generation rate.

5.1 2027 Intersection Operation – No Development

To gauge future traffic conditions in 2027, a 2% growth rate was applied to the existing traffic volumes and is presented below.

The existing intersection operating conditions (from **Table 4**) is repeated below.

Table 14 – Existing Weekday AM / PM Intersection Operating Conditions

		Morning Peak		Evening Peak	
Intersection	Control	Av Delay	LOS	Av Delay	LOS
The Crescent / Evan Street	Roundabout	27.8	B	18.1	B
Henry Street / Lawson Street	Signals	11.8	A	12.9	A
Henry Street / Evan Street	Signals	20.8	B	50.0	D
Henry Street / Doonmore Street	Priority	7.2	A	7.5	A
Henry Street / North Street	Signals	6.5	A	9.7	A
High Street / Evan Street	Signals	14.3	B	16.4	B

Avg Delay (sec/veh) is over all movements at signals, and for worst movement at priority and roundabouts

Applying a 2% growth rate to existing traffic flows would result in the following intersection operating conditions.

Table 15 – 2027 Future Weekday AM / PM Intersection Operating Conditions – 2% Growth Rate – No Development

Intersection	Control	Morning Peak		Evening Peak	
		Av Delay	LOS	Av Delay	LOS
The Crescent / Evan Street	Roundabout	>70	F	46.0	D
Henry Street / Lawson Street	Signals	12.8	A	>70	F
Henry Street / Evan Street	Signals	>70	F	>70	F
Henry Street / Doonmore Street	Priority	7.7	A	8.2	A
Henry Street / North Street	Signals	7.3	A	13.2	A
High Street / Evan Street	Signals	>70	F	>70	F

Avg Delay (sec/veh) is over all movements at signals, and for worst movement at priority and roundabouts

From **Table 15** the following is noted:

- The intersection of The Crescent / Evan Street would fail in the AM peak and operate near capacity in the PM peak without the development in 2027.
- The intersection of Henry Street / Lawson Street would fail in the PM peak without the development in 2027.
- The intersection of Henry Street / Evan Street would fail in both the AM and PM peak periods in 2027 without the development.
- The intersection of High Street / Evan Street would fail in both the AM and PM peak periods in 2027 without the development.

Overall, application of a 2% uniform growth rate for a 10 year design period without construction of the poposed development would result in unsatisfactory operating conditions at:

- The Crescent / Evan Street
- Henry Street / Evan Street
- High Street / Evan Street

All these intersections would require upgrade to accommodate future traffic demands without the development .

5.2 Alternative Rate Traffic Generation Estimates

Applying Penrith Council's traffic generation rate for the residential component and the AM weekday period retail component would result in the following traffic generation by use.

Table 16 – Future Total Net Traffic Generation of the Proposal – Penrith Council Rates

			Estimated Traffic Generation	
Proposed Use	**GFA / No.**	**Alternative Rates**	**AM**	**PM**
Site A				
Retail	502m²	12.3/100m²	12	62
Hotel	100 rooms	42/100 rooms	8	42
Residential				
One bedroom	32	0.33	11	11
Two bedroom	150	0.33	50	50
Three bedroom	32	0.33	11	11
		Sub Total	**91**	**174**
Site B				
Retail	1,138m²	12.3/100m²	28	140
Commercial	447m²	1.6/100 & 1.2/100	7	5
Residential				
One bedroom	35	0.33	12	12
Two bedroom	162	0.33	53	53
Three bedroom	35	0.33	12	12
		Sub Total	**112**	**222**
Site C				
Retail	1,594m²	12.3/100m²	39	196
Commercial	2,484m²	1.6/100 & 1.2/100	40	30
Residential				
One bedroom	39	0.33	13	13
Two bedroom	181	0.33	60	60
Three bedroom	39	0.33	13	13
		Sub Total	**165**	**312**
Existing				
			-20	**-68**
		Grand Total	**347**	**639**

From **Table 16** it can be seen that applying Penrith Council traffic generation rates would result in a net AM traffic generation of **347** vehicle trips and **639** vehicle trips during a weekday PM peak hour. This compares with **239** AM and **494** PM peak hour trips applying the RMS traffic generation rates for high density development. Overall the application of rates provided by Penrith Council would equate to a net increase of 48% of site traffic generation.

5.3 2027 Intersection Operating Conditions

The site traffic generation estimated in **Table 16** has been added to 2027 traffic flows using the same distribution as shown in **Figure 7**. The future intersection operating conditions of this scenario is presented below.

Table 17 – 2027 Future Weekday AM / PM Intersection Operating Conditions – 2% Growth Rate – With Development

Intersection	Control	Morning Peak		Evening Peak	
		Av Delay	LOS	Av Delay	LOS
The Crescent / Evan Street	Roundabout	>70	F	>70	F
Henry Street / Lawson Street	Signals	32.8	C	>70	F
Henry Street / Evan Street	Signals	>70	F	>70	F
Henry Street / Doonmore Street	Priority	8.3	A	13.4	A
Henry Street / North Street	Signals	7.7	A	15.7	B
High Street / Evan Street	Signals	>70	F	>70	F

Avg Delay (sec/veh) is over all movements at signals, and for worst movement at priority and roundabouts

Applying Penrith Council's traffic generation rates (+10 years 2% growth) for the residential component and the AM retail component, the following is noted from **Table 17**:

- The operating conditions in the AM peak at The Crescent / Evan Street would continue to fail as it would without the development.
- The PM peak operating conditions would result in LOS F at The Crescent / Evan Street down from LOS D without the development. However, this assumes no upgrade of the intersection has been undertaken to accommodate the forecast background traffic growth which results in failure of the intersection in the AM without the development.
- The intersection of Henry Street / Lawson Street would continue to operate satisfactorily in the AM peak. No change to the PM peak without development conditions would occur and the intersection would continue to fail.
- No change in operating conditions with the development would occur at the intersection of Henry Street / Evan Street would occur in either peak period to that which would occur in 2027without the development.
- No change in operating conditions would occur at the intersection of Henry Street / Doonmore Street in either peak period.
- The intersection of Henry Street / North Street would continue to operate at LOS A in the AM peak and there would be a slight change to LOS B (from LOS A) in the PM peak.
- No change to future operating conditions would occur following completion of the development in either peak period at the intersection of High Street / Evan Street.

Overall, in all but one location applying Council's traffic generation rates for the residential component and the retail component (AM peak) would result in no change to surrounding intersection operating conditions to that which would occur if the 2% growth rate per annum was achieved by the year 2027.

The application of Council's rates would result in poorer intersection operating conditions in the PM peak at the intersection of The Crescent / Evan Street (compared with LOS D without the development). However, as recommended by the RTA Guide to Traffic Generating Developments, a priority / roundabout controlled intersection operating at LOS D requires capacity improvements.

6. Parking, Access and Design Compliance Assessment

6.1 Parking Provision – Residential Component

The planning proposal includes parking provision in accordance with the RMS Guide to Traffic Generating Developments for the residential component. That is, the following rates are proposed for the development:

- 1-bedroom dwelling 0.4 spaces per dwelling
- 2-bedroom dwelling 0.7 spaces per dwelling
- 3-bedroom dwelling 1.2 spaces per dwelling

Therefore, the residential component of the development applying the RMS Guide to Traffic Generating parking rates for high density developments would require the following parking provision.

Table 18 – Proposed Development Parking Provision for Residential Component (excluding visitor parking)

Proposed Use	GFA / No.	RMS Parking Rate	Parking Spaces Req.
Site A			
One bedroom	32	0.4 spaces per dwelling	13
Two bedroom	150	0.7 spaces per dwelling	105
Three bedroom	32	1.2 spaces per dwelling	39
Sub Total		**Sub Total**	**157**
Site B			
One bedroom	35	0.4 spaces per dwelling	14
Two bedroom	162	0.7 spaces per dwelling	114
Three bedroom	35	1.2 spaces per dwelling	42
Sub Total		**Sub Total**	**170**
Site C			
One bedroom	39	0.4 spaces per dwelling	16
Two bedroom	181	0.7 spaces per dwelling	127
Three bedroom	39	1.2 spaces per dwelling	47
Sub Total		**Sub Total**	**190**
		Grand Total	**517**

From **Table 18** it can be seen that application of the RMS parking rates for high density residential developments (metropolitan centre) would require 517 parking spaces for residents of the dwellings.

The justification for application of the RMS parking rates for this development is presented below.

6.2 Penrith Flat / Unit / Apartment Vehicle Ownership Assessment

As detailed in Section 2.9 of this report, residents of the 3,968 flats, units and apartments within the Penrith LGA exhibited an average vehicle ownership of 1.00 vehicles per dwelling (Census 2011) which was up from 0.74 vehicles per dwelling in 2006 (where 2,513 FUA's were occupied).

Further, the vehicle ownership profile of occupiers of units of increasing size is presented below:

Table 19 – 2011 Census No. Vehicles Per Dwelling Size for Penrith LGA FUA's

	Avg. Veh/dwelling	No veh
Studio	0.25	75%
1 bed	0.57	46%
2 bed	0.89	28%
3 bed	1.51	9%
4 bed	1.83	3%
5+ bed	1.83	0%
Total	**1.01**	**26%**

Of note 76% of studio apartments and 46% of one bedroom apartments did not have any vehicles parked overnight either within the development or on-street.

Applying the 2011 Census rates of vehicle ownership for each dwelling size to the proposed dwellings of the planning proposal would equate to the following need for vehicles to park within the developments.

Table 20 – Census Vehicle Ownership Applied to Planning Proposal by Dwelling Size

Proposed Use	GFA / No.	% No. Vehicles	Dwellings Potentially Owning a Vehicle	Avg. Vehicles / Dwelling Ownership	Parking Spaces Req.
Site A					
One bedroom	32	46% (15 dwellings)	17	0.57	10
Two bedroom	150	28% (42 dwellings)	108	0.89	97
Three bedroom	32	9% (3 dwellings)	29	1.51	44
Sub Total	**214**	**Sub Total**	**154**	**Sub Total**	**151**
Site B					
One bedroom	35	46% (16 dwellings)	19	0.57	11
Two bedroom	162	28% (45 dwellings)	117	0.89	105
Three bedroom	35	9% (3 dwellings)	32	1.51	49
Sub Total	**232**	**Sub Total**	**168**	**Sub Total**	**165**
Site C					
One bedroom	39	46% (18 dwellings)	21	0.57	12
Two bedroom	181	28% (51 dwellings)	130	0.89	116
Three bedroom	39	9% (4 dwellings)	35	1.51	53
Sub Total	**259**	**Sub Total**	**206**	**Sub Total**	**181**
				Grand Total	**497 spaces**

From **Table 20** it is noted that application of Census 2011 vehicle ownership levels by dwelling size would require approximately 497 parking spaces which is below the RMS requirement for 517 spaces. Therefore, it is clear that application of the RMS parking rates for high density developments would more than cater for the expected parking demands of residents of this development.

Of further note the average vehicle ownership levels recorded in the Census are across the Penrith LGA as a whole and would include both developments close to public transport nodes and those which are not and therefore more reliant on private vehicle use.

Thus, the application of the census vehicle ownership rates in the above assessment are considered a conservative estimate of parking demands of this planning proposal given the easy access to a number of high frequency bus and rail operations.

Overall, the application of the RMS High Density parking rates for a metropolitan centre for the residential component is considered appropriate.

6.3 Parking Provision – Non-Residential Uses

The following presents the proposed parking provision rates for non-residential uses:

6.3.1 Commercial

The proposed parking rate for commercial uses would be 1 space per 100m^2 which complies with the Penrith DCP for office premises within the Penrith City Centre.

6.3.2 Residential Visitors

Visitor parking provision for the residential dwellings is proposed at a rate of 1 space per 7 dwellings in line with the requirements of the RTA Guide to Traffic Generating Developments for high density developments. This visitor rate having regard to the developments public transport accessibility is considered appropriate.

6.3.3 Child Care

The Penrith DPC recommends a parking rate of 1 space per 4 children for a child care centre. This would equate to a need to provide some 18 parking spaces for the child care centre component.

However, as stated above this rate would generally apply to a stand along centre and not appropriate to a centre located within a large development which provides parking opportunities for other uses such as retail and commercial. Therefore, this is an opportunity to provide dual use parking for the child care / retail / commercial components to reduce the need to provide separate parking provision for each.

Further, employees of the site would be attracted to using the child care centre being located so close to their place of employment. In these instances only one space would be required for staff / child care centre parking. Granted, some child care centre parking would be required to accommodate pick up / drop off of any child who does not reside in the development.

It is recommended that the future parking provision for the child care centre gives consideration to the availability of both retail and commercial parking during peak times.

The overall parking provision proposed for the development is shown below.

Table 21 - Future Total Net Traffic Generation of the Proposal – Penrith Council Rates

Proposed Use	GFA / No.	Rate	Parking Req.
Site A			
Retail	502m²	1/30m²	17
Hotel	100 rooms	1 / room	100
Child Care	72 child	1 / 4 children	18
Residential			
One bedroom	32	0.4 / unit	13
Two bedroom	150	0.7 / unit	105
Three bedroom	32	1.2 / unit	31
Residential Visitor	214	1 / 7 units	31
		Sub Total	**353**
Site B			
Retail	1,138m²	1/30m²	38
Commercial	447m²	1/100m²	4
Residential			
One bedroom	35	0.4 / unit	14
Two bedroom	162	0.7 / unit	113
Three bedroom	35	1.2 / unit	42
Residential Visitor	231	1 / 7 units	33
		Sub Total	**244**
Site C			
Retail	1,594m²	1/30m²	53
Commercial	2,484m²	1/100m²	25
Residential			
One bedroom	39	0.4 / unit	16
Two bedroom	181	0.7 / unit	127
Three bedroom	39	1.2 / unit	47
Residential Visitor	269	1 / 7 units	33
		Sub Total	**301**
		Grand Total	**898**

Overall, application of the above parking rates would require provision for 898 parking spaces across the development as a whole.

6.3.4 Service Vehicle Parking Provision

The scale of the development provides the opportunity for shared centralised service vehicle parking areas and loading docks to minimise impact of large vehicles travelling through the site. It is expected such opportunities would be explored at the time of the development application for each building and following confirmation of the sizing of the retail / commercial areas.

6.3.5 Bicycle Parking

Adequate bicycle parking and appropriate end of trip facilities (showers, lockers, security) should form key design outcomes for the development application of each building. It is expected that bicycle parking provision would be in accordance with Council's DCP rates.

7. Conclusions

This report has reviewed the potential traffic impacts of the planning proposal for a mixed use development at the site known as 39-49 Henry Street, Penrith. The findings of this review are presented below:

1. The development site is extremely well served by public transport.
2. Access to a wide range of bus services would be available to residents / workers of the development site within a 400m walking distance.
3. The site is located within 900m of Penrith Rail Station which provides 5-10miniute frequency train services during peak periods.
4. Intersections surrounding the development site would continue to operate at a satisfactory level of service during both the morning and afternoon weekday peak periods.
5. Future traffic flows on roads immediately surrounding the development would remain within expected maximum ranges for each road type.
6. The proposed application of the RMS High Density parking rates for this development is considered appropriate and reflects both the developments accessibility to services / transport and the expected vehicle ownership rates of future residents.
7. A visitor parking rate for the residential component in accordance with the RMS Guide to Traffic Generating Developments for high density developments is considered appropriate given the sites accessibility to public transport options and services.
8. Parking provision for non-residential uses would comply with the Penrith DCP and is considered appropriate.
9. Service vehicle parking should consider efficiencies gained with centralised loading dock / service vehicle parking areas to minimise the impacts of large vehicles travelling throughout the site.

Overall the traffic impacts of the proposal are considered acceptable.

8. Appendix A – Intersection Counts

9. Appendix B – Plans of Proposed Development

10. Appendix C – LOS by Approach for Future Conditions

LANE LEVEL OF SERVICE

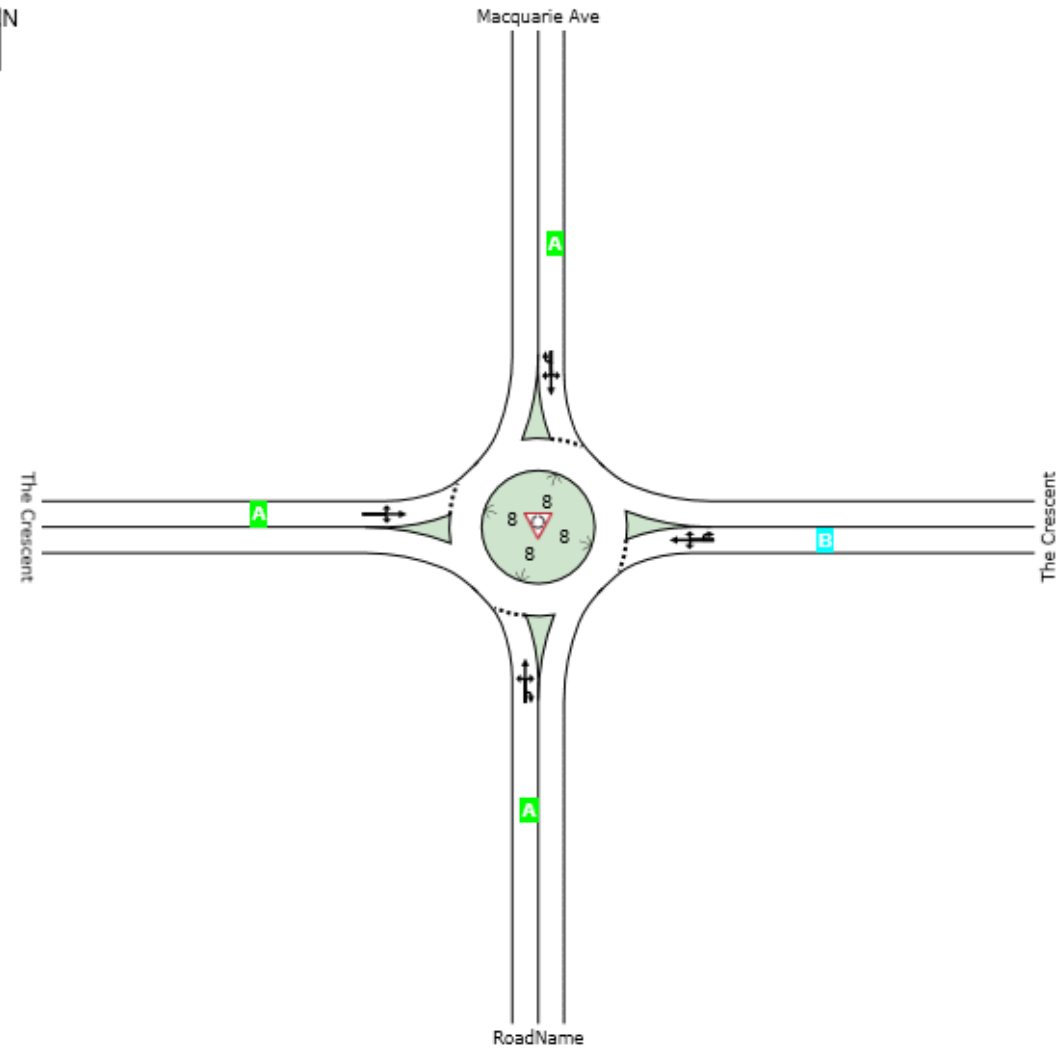
Lane Level of Service

Site: 101 [The Crescent_Evan_AM_Thu_Fut_Original]

New Site
Roundabout

All Movement Classes

	South	East	North	West	Intersection
LOS	A	B	A	A	A



LANE LEVEL OF SERVICE

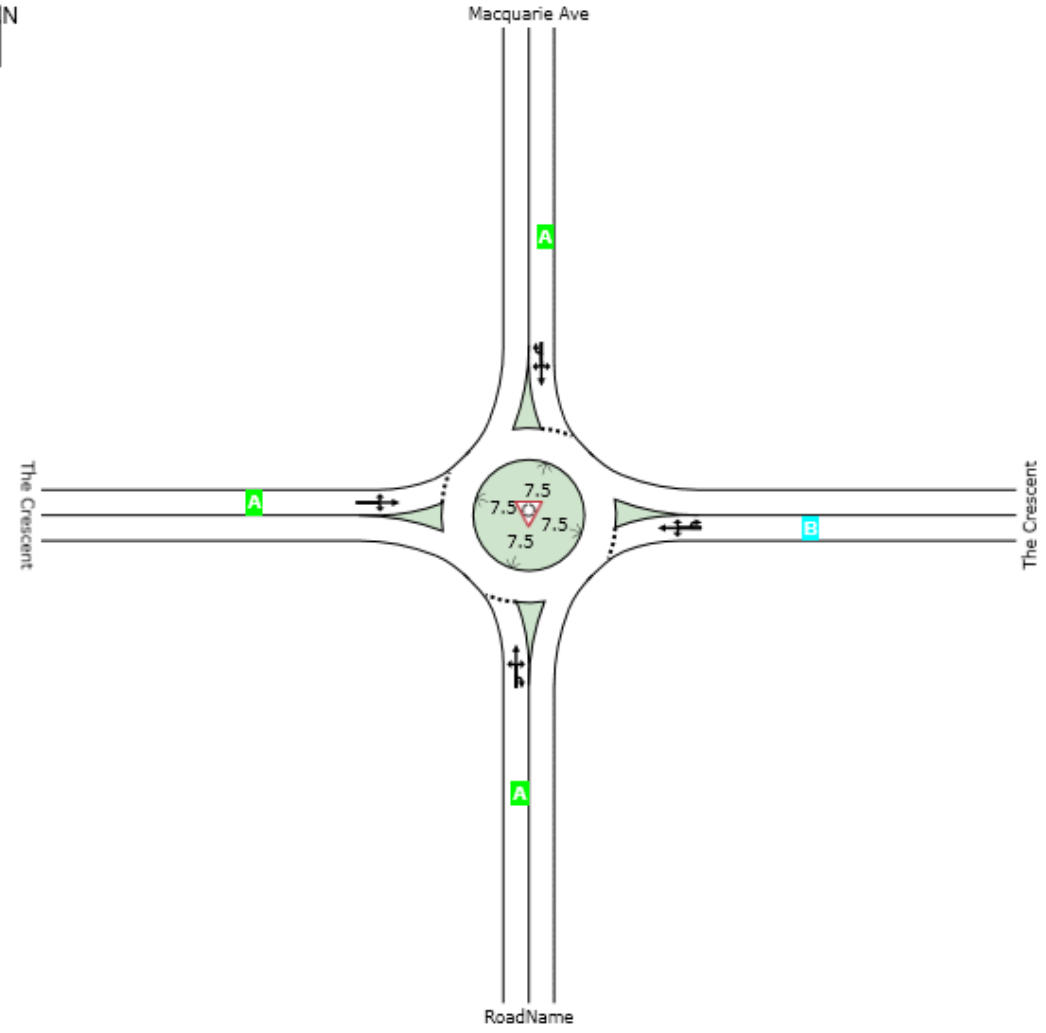
Lane Level of Service

Site: 101 [The Crescent_Evan_PM_Thu_Fut_Original]

New Site
Roundabout

All Movement Classes

	South	East	North	West	Intersection
LOS	A	B	A	A	A



LANE LEVEL OF SERVICE

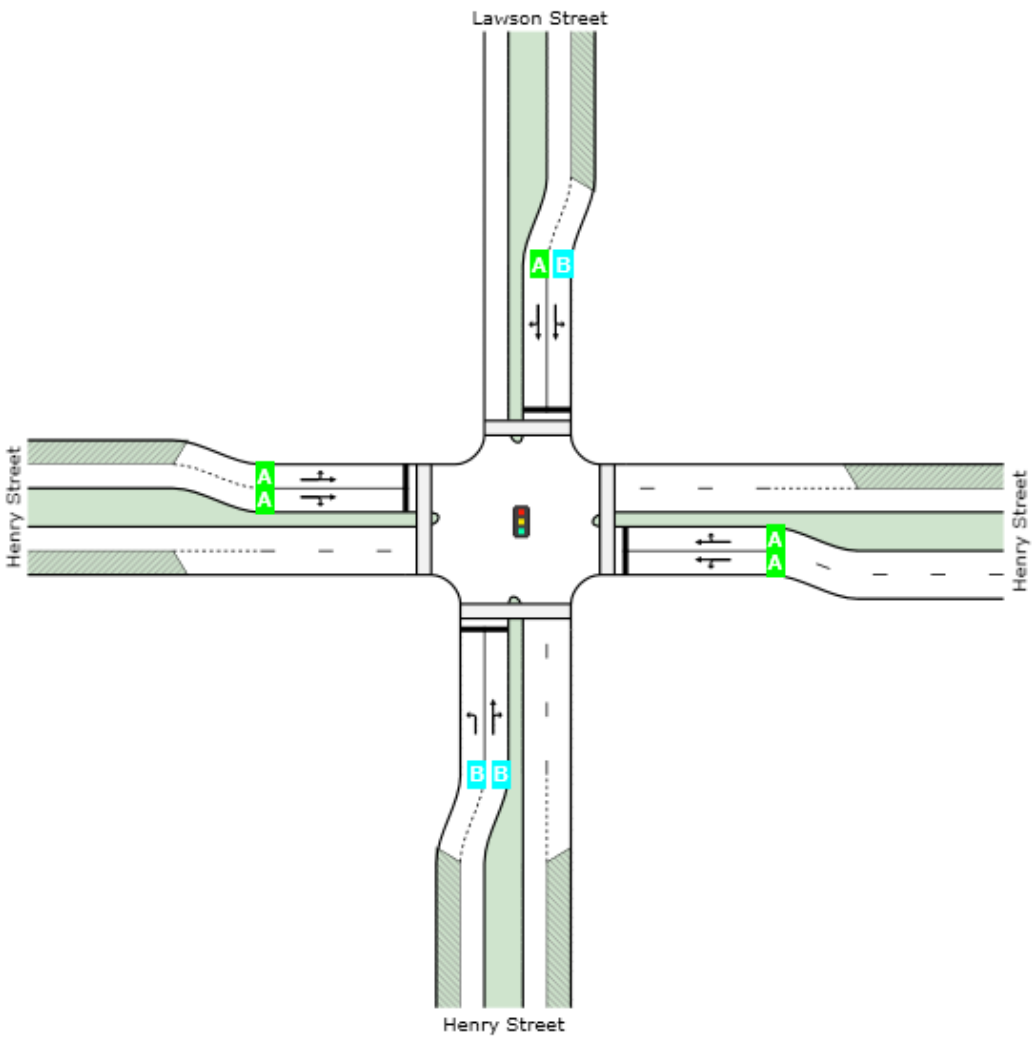
Lane Level of Service

Site: 101 [Henry_Lawson_AM_Thu_Fut_Original]

New Site
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Practical Cycle Time)

All Movement Classes

	South	East	North	West	Intersection
LOS	B	A	B	A	A



LANE LEVEL OF SERVICE

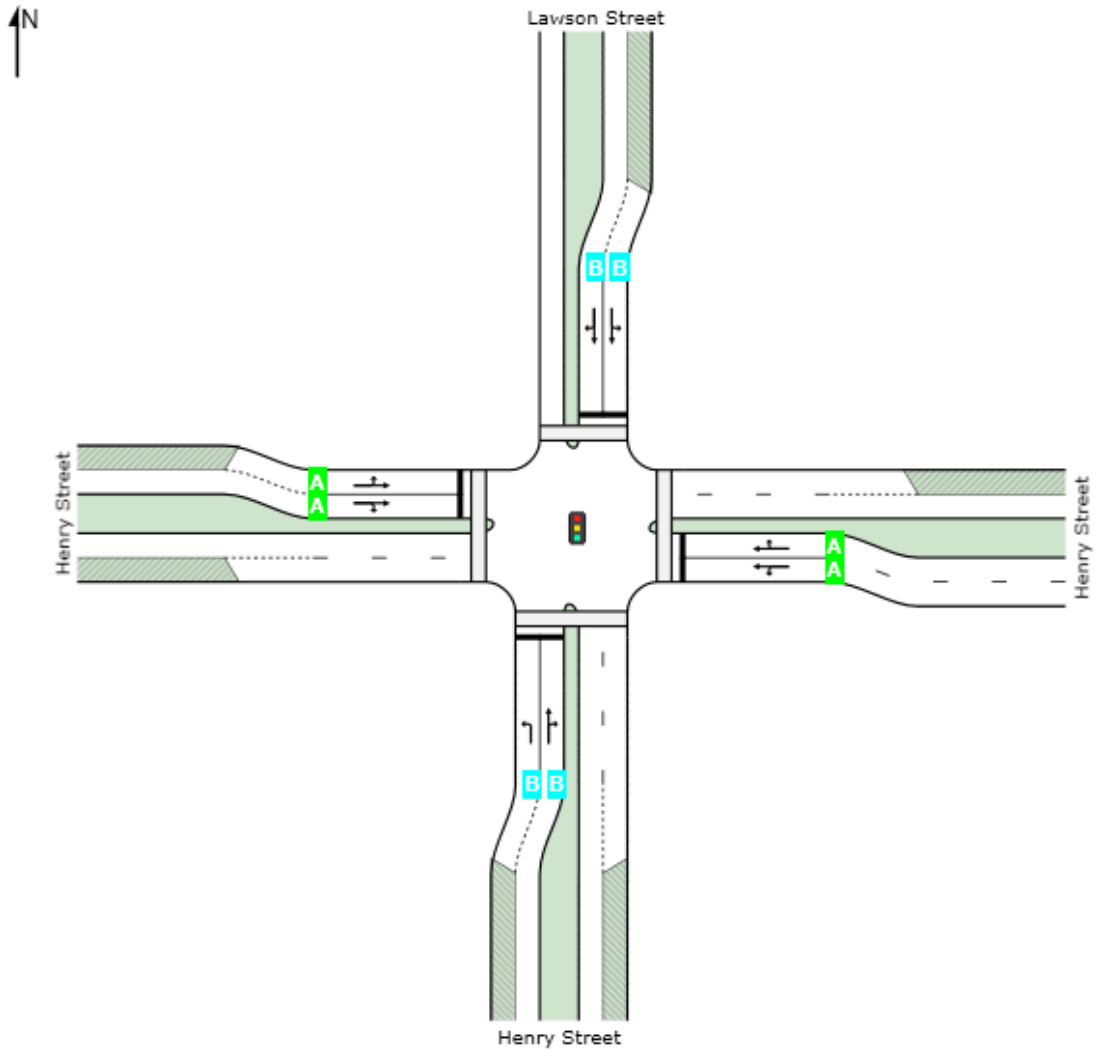
Lane Level of Service

Site: 101 [Henry_Lawson_PM_Thu_Fut_Original]

New Site
Signals - Fixed Time Isolated Cycle Time = 40 seconds (Practical Cycle Time)

All Movement Classes

	South	East	North	West	Intersection
LOS	B	A	B	A	A



LANE LEVEL OF SERVICE

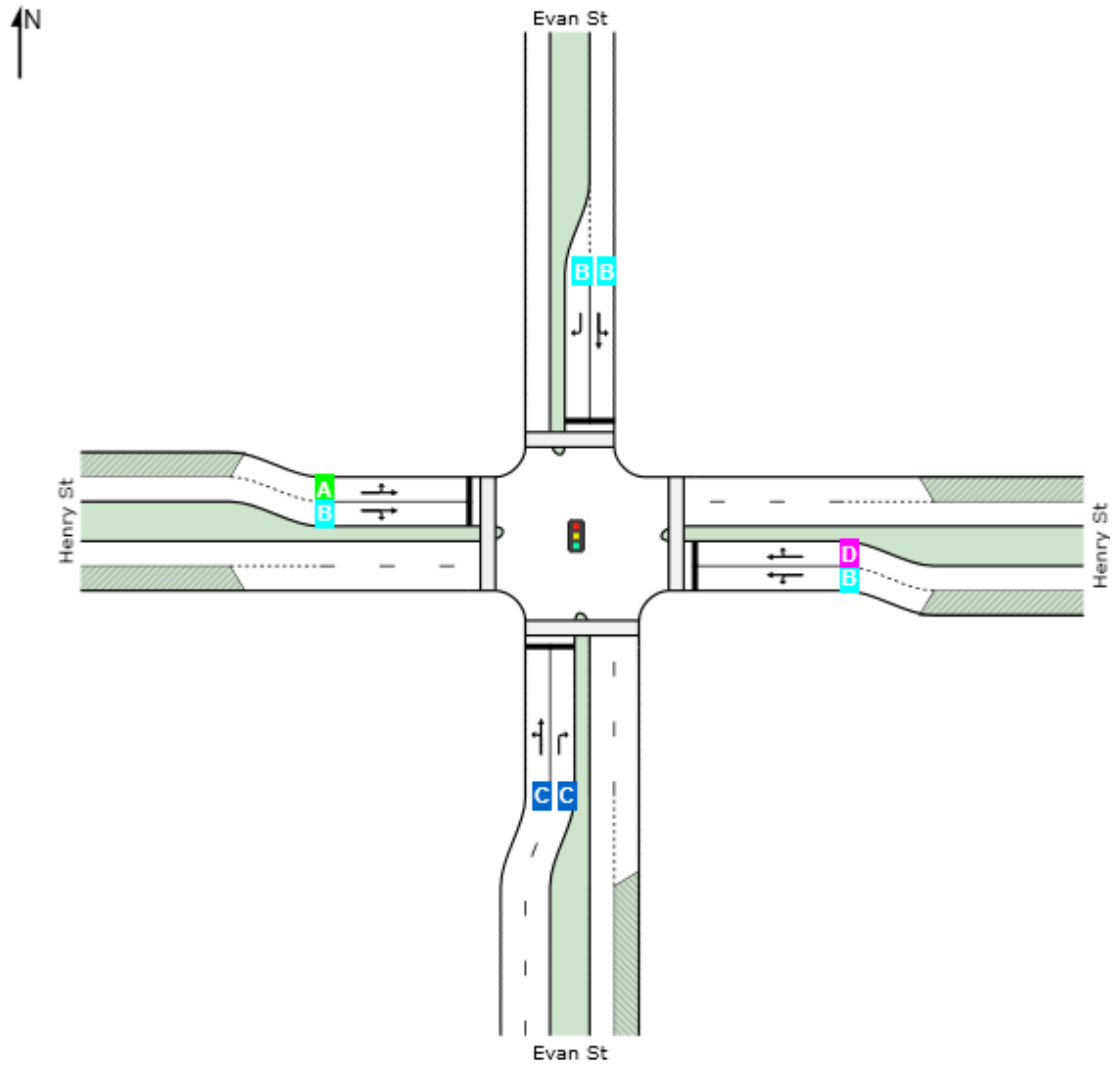
Lane Level of Service

Site: 101 [Henry_Evan_AM_Thu_Fut_Original]

New Site
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Practical Cycle Time)

All Movement Classes

	South	East	North	West	Intersection
LOS	C	C	B	B	C



LANE LEVEL OF SERVICE

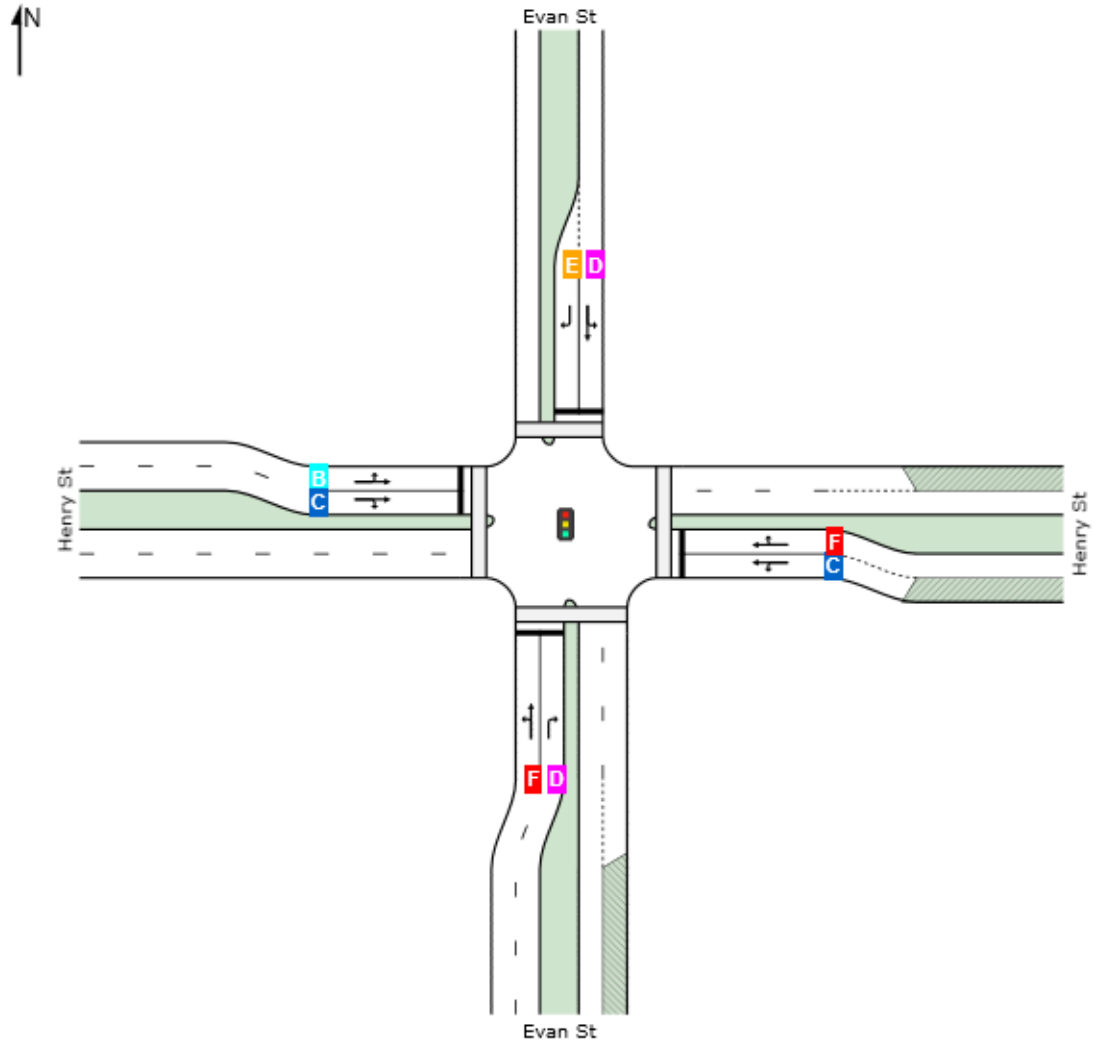
Lane Level of Service

Site: 101 [Henry_Evan_PM_Thu_Fut_Original]

New Site
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Practical Cycle Time)

All Movement Classes

	South	East	North	West	Intersection
LOS	F	E	D	B	D



LANE LEVEL OF SERVICE

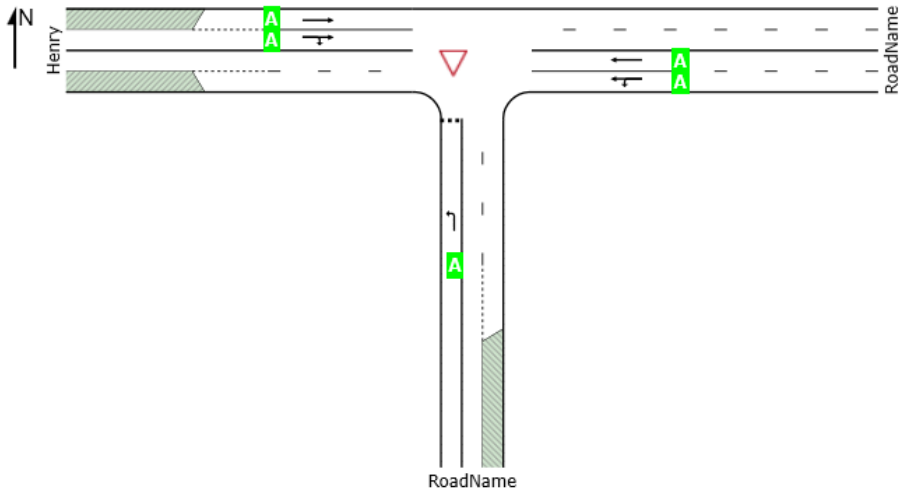
Lane Level of Service

Site: 101 [Henry_Doonmore_AM_Thu_Fut_Original]

New Site
Giveway / Yield (Two-Way)

All Movement Classes

	South	East	West	Intersection
LOS	A	NA	NA	NA



LANE LEVEL OF SERVICE

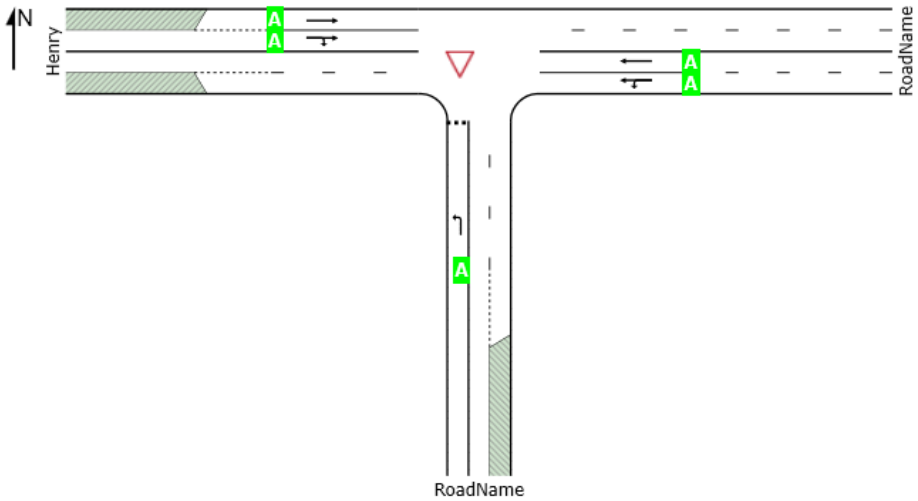
Lane Level of Service

Site: 101 [Henry_Doonmore_PM_Thu_Fut_Original]

New Site
Giveway / Yield (Two-Way)

All Movement Classes

	South	East	West	Intersection
LOS	A	NA	NA	NA



LANE LEVEL OF SERVICE

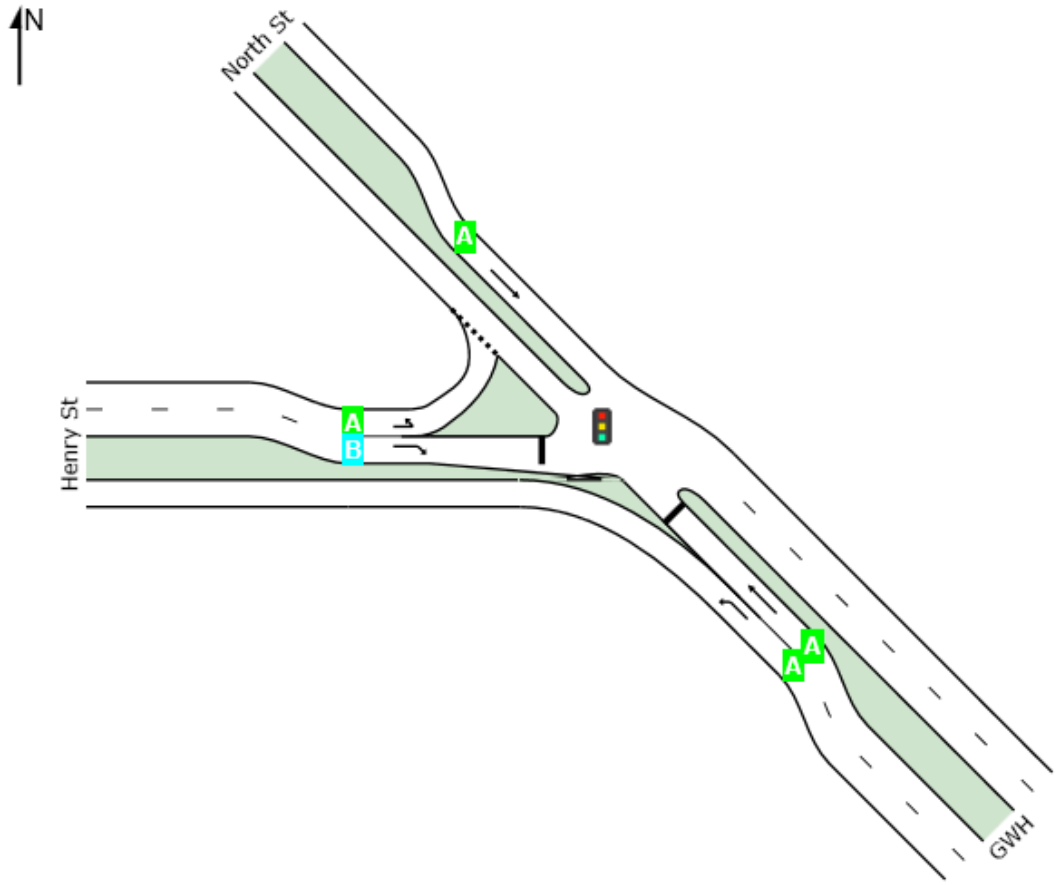
Lane Level of Service

Site: 101 [Henry_GWH_AM_Thu_Fut_Original]

New Site
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Practical Cycle Time)

All Movement Classes

	Southeast	Northwest	West	Intersection
LOS	A	A	B	A



LANE LEVEL OF SERVICE

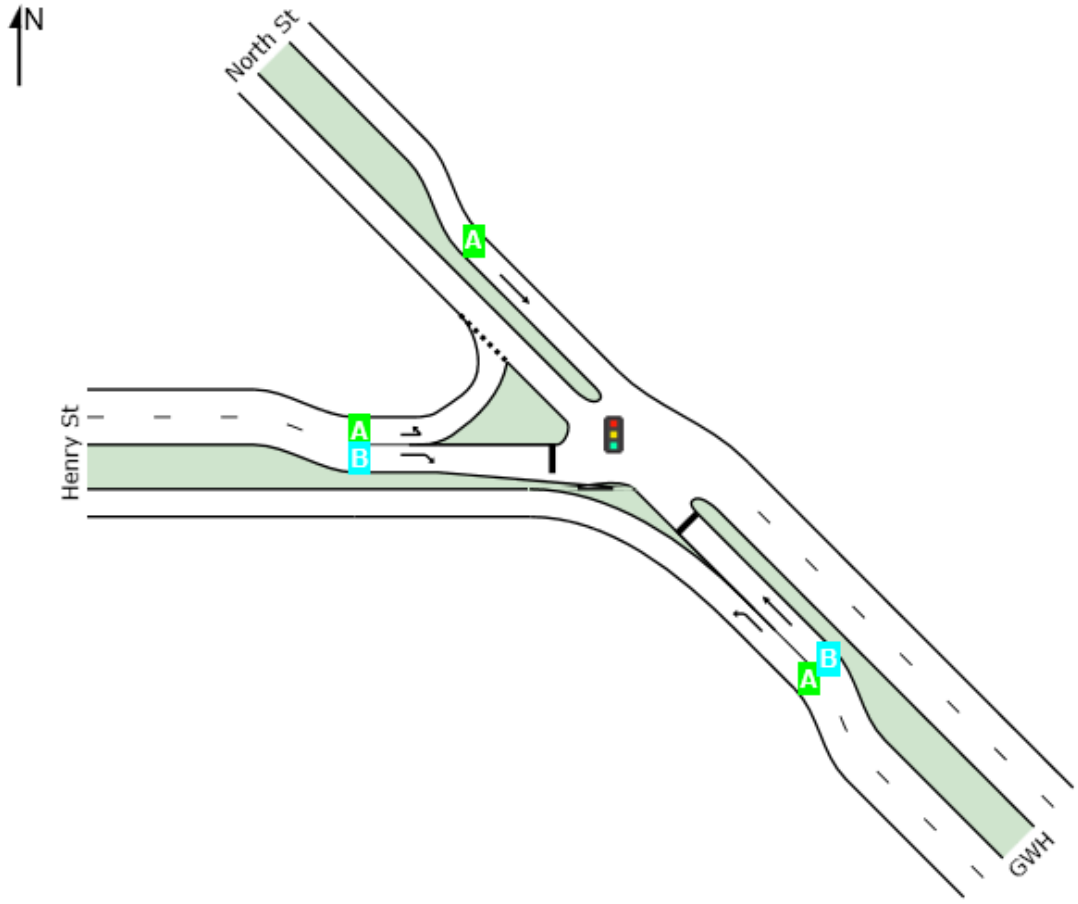
Lane Level of Service

Site: 101 [Henry_GWH_PM_Thu_Fut_Original]

New Site
Signals - Fixed Time Isolated Cycle Time = 50 seconds (Practical Cycle Time)

All Movement Classes

	Southeast	Northwest	West	Intersection
LOS	A	A	B	A



LANE LEVEL OF SERVICE

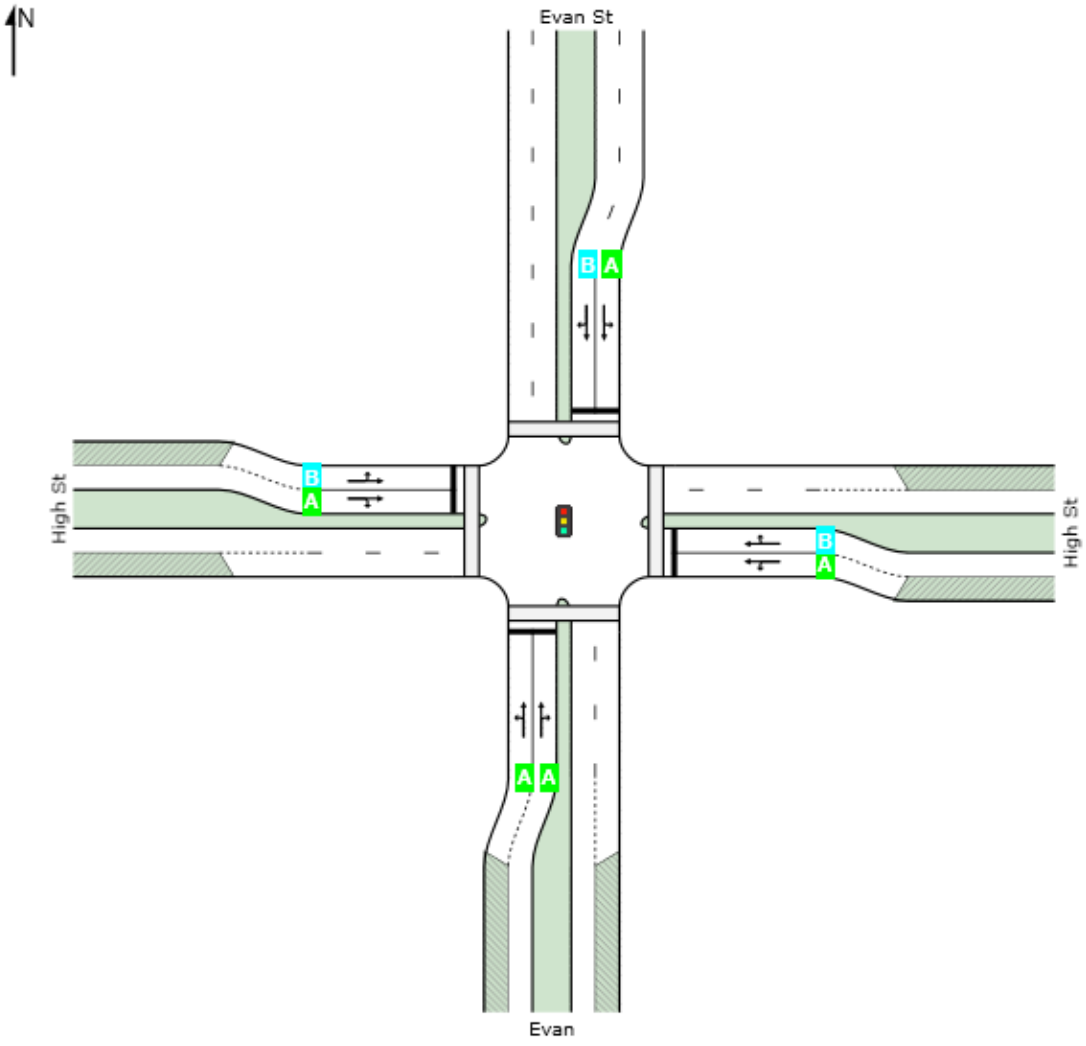
Lane Level of Service

Site: 101 [High_Evan_AM_Thu_Fut_Original]

New Site
Signals - Fixed Time Isolated Cycle Time = 30 seconds (Practical Cycle Time)

All Movement Classes

	South	East	North	West	Intersection
LOS	A	A	B	A	B



LANE LEVEL OF SERVICE

Lane Level of Service

Site: 101 [High_Evan_PM_Thu_Fut_Original]

New Site
Signals - Fixed Time Isolated Cycle Time = 40 seconds (Practical Cycle Time)

All Movement Classes

	South	East	North	West	Intersection
LOS	A	B	B	B	B