



Urban Road Congestion Program

Options Assessment

Pennant Hills Road / North Rocks Road, Carlingford

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1 Introduction

The Easing Sydney's Congestion (ESC) Program Office has been commissioned by Network Development to investigate the feasibility of intersection upgrades at ten locations across Greater Sydney with funding provided through the Urban Road Congestion Program (URCP).

The Urban Roads Congestion Program focuses on areas of the road network where traffic congestion is likely to impact the operational efficiency of the wider network. The proposed upgrades targeting intersections or road sections generally aim to improve both safety and efficiency by countering the build-up of delay for motorists and public transport during peak periods.

1.1 Background

The study locations identified as part of URCP have previously been assessed by ESC under various funding streams. Of the ten, two previously passed through Concept / Detailed Design stages, three passed through Strategic Design and the remaining five remained at Initiation only.

The development of these projects did not progress through to the delivery stage for a variety of reasons, though primarily due to competing project candidates assessed through the said funding streams demonstrated greater value for the customer and thus took higher priority.

URCP will review prior study undertaken, identify gaps in assessment or lack thereof, reassess previously identified schemes and look to develop new ideas and options, considering changing traffic conditions over the past few years.

Recommendations will be made as to which schemes should progress through further development towards delivery, and those which do not warrant further investigation at this time.

1.2 Study area

The ten intersections are located across Greater Sydney, as shown in Table 1. The assessment of each intersection is detailed in a separate report. The intersection of Pennant Hills Road / North Rocks Road in Carlingford is the subject of this document.

Intersection	Suburb	Prior Assessment
Pennant Hills Road / North Rocks Road	Carlingford	Strategic
Pennant Hills Rd / Carlingford Rd / Rembrandt St	Carlingford	Strategic
Pennant Hills Road / Baker Street	Carlingford	Initiation
Forest Road / Stoney Creek Road	Peakhurst	Initiation
Forest Road / Bonds Road / Boundary Road	Peakhurst	Concept
The Horsley Drive / Cumberland Highway	Smithfield	Strategic
The Horsley Drive / Nelson Street / Court Road	Fairfield	Initiation
The Horsley Drive / Polding Street	Fairfield	Initiation
Henry Lawson Drive / Rabaul Road / Haig Avenue	Georges Hall	Concept
Princes Highway / Bates Drive	Kareela	Initiation

Table 1 Study locations

1.3 Program objectives

The URCP is strongly aligned with two of the key outcomes listed in Future Transport 2056:

- Safety and performance – the program will develop projects to improve efficiency and reliability of the road network, and provide benefits to multiple modes (including general traffic, public transport, freight)
- A strong economy – the program will develop projects to improve travel times and provide customers with more reliable journeys to metropolitan centres, strategic centres and employment areas.

The intention of the URCP Intersection Option Assessment reports is to present recommended and considered options for each intersection included in the program.

The reports would also provide recommendations as to which improvement options should progress through further development towards delivery, and those which do not warrant further investigation at this time.

2 Methodology

This section details ,at a high level, the overarching methodology adopted for assessing the ten intersections listed in Table 1.

2.1 Gap analysis

Gap analysis was undertaken to gain comprehension of all works carried out to date at each intersection, given the varying nature of the level of detail and timeframes over which previous studies were undertaken.

Gap analysis reviewed the status of any available traffic modelling, including whether the assessment year would be recent enough to be considered suitable for URCP. Previous options tested in modelling were checked for consistency against any designs developed, as was the availability of any future year traffic assessments.

Prior traffic survey availability was ascertained with a view to confirming whether any available data would be suitable for use in this updated assessment.

Results and reporting were reviewed, including whether any Benefit Cost Ratio (BCR) assessments had been undertaken, whether a traffic report had been written and whether the said reporting was suitable for Review of Environmental Factors (REF) input.

Finally, the availability of any crash data or analysis was reviewed to assist in the identification of crash trends and safety concerns at each of the intersections.

2.2 Data collection

Intersection turn count and queue length surveys were commissioned as part of URCP in November 2019 at the following intersections:

- The Horsley Drive / Polding Street
- The Horsey Drive / Nelson Street
- Pennant Hills Road / North Rocks Road
- Henry Lawson Drive / Rabaul Road / Haig Avenue

These intersections were either lacking survey data from previous assessments, or data was deemed aged (pre-2017) and thus requiring further validation prior to reusing in this study.

Whilst survey data at some other intersections dated back to 2016, reviews of SCATS detector counts suggested little change in traffic volumes over the past few years, and as such those 2016 turn counts were deemed suitable for use and considered to be reflective of current day conditions.

2.3 Assessment approach

Assessment has been undertaken to determine whether intersections warrant further investigation and scheme development, or no further investigation is recommended at this time. The assessment comprises certain key investigations to achieve this, as discussed below:

2.3.1 Traffic assessment

SIDRA Intersections 8.0 was used to assess traffic performance of proposed options at each of the intersections under investigation. Base models reflecting existing conditions were developed, using previously developed models as a starting point where available.

Base modelling was developed in accordance with TfNSW Traffic Modelling Guidelines for AM and PM weekday peak hours, which in turn were identified as the hour with the highest overall intersection traffic volumes at each site.

All sites were assessed as isolated intersections, except for Henry Lawson Drive intersections with Rabaul Road and Haig Avenue, the intersections of Pennant Hills Road with Carlingford Road and Rembrandt Street and the intersections of The Horsley Drive with Nelson Street and Alan Street which were assessed as a network.

SCATS traffic signal data was used to inform intersection phasing, controller settings and phase durations, ensuring timings were taken for the day upon which respective intersection turn counts were taken.

The project team drew upon collective knowledge of the sites to inform any further site-specific considerations with regards to operation, including pedestrian activity, driver behaviour and public transport operation.

2.3.2 Crash analysis

Detailed crash reports were obtained for all sites for the five-year period July 2014 – June 2019, in order to identify any crash trends. Analysis considers locations at which certain crash types have occurred multiple times, times of day during which crashes are occurring, lighting conditions and a variety of other factors.

2.3.3 Design constraints

Early identification of key design constraints was undertaken through development of sketches of options identified at each intersection.

Designs developed remain in the early stages, however, identify key considerations such as land-take and property acquisition, some utility impacts and swept path analysis.

Should schemes progress further into development, further assessment could be undertaken to highlight constraints not identified during early design stages.

Assessment undertaken at for Pennant Hills Road / North Rocks Road intersection is presented in the following sections.

3 Pennant Hills Road / North Rocks Road

This section details the assessment undertaken at the intersection of Pennant Hills Road / North Rocks Road, Carlingford.



Figure 1: Site image (Source: NEARMAP 2020)

3.1 Existing conditions

The intersection of Pennant Hills Road / North Rocks Road is one of key intersections along Pennant Hills Road; a designated B-double route that connects Wahroonga in the north of Sydney metropolitan area to Parramatta in the west. The intersection also is located within a close proximity of the key M2 Motorway.

The area surrounding the intersection is predominantly residential with a few community services, schools and the Carlingford Oval playground in the vicinity. These land uses are concentrated in the north eastern corner of the intersection.

The project team visited site on multiple occasions throughout the development of the previous ESC study, and noted the following key observations with regards to existing performance:

- Queuing and delays for southbound traffic on Pennant Hills Road in the AM peak largely due to the high through traffic demand which has two through lanes with the kerbside lane shared with the left turn. Total approach volumes in AM peak are approximately 2,000 vehicles per hour (82% as through movement), making it the busiest approach in the AM.
- Southbound delays are also observed in the PM peak, though less significant than in the AM. The delays in the PM are largely caused by the right turn into North Rocks Road. Total PM peak demand per hour is lower than in the AM peak (close

to 1,700 vehicles) whilst the demand for the right turn remains similar to the AM peak (close to 300 vehicles).

- Congested conditions for northbound traffic on Pennant Hills Road were mainly observed in the PM peak with a total demand of about 1,930 vehicles at approach (compared to 1,700 in the AM peak) underlining the tidal characteristics of the intersection.
- The through lanes on the southern approach are at times impacted by vehicles queuing out of the short turn lanes to either side. This particularly affects the AM peak, which has a higher demand of right turners than the PM peak (215 vs 49).
- Access to service stations, community facilities and schools located along Pennant Hills Road to the north of North Rocks Road likely further contribute to the congested conditions along the corridor north of the intersection.
- Congestion on the western approach of North Rocks Road primarily due to high demand for the right turn to Pennant Hills Road south with average queues of approximately 120 metres in the peak hours. The right turn has one short dedicated lane and one shared left, through and right lane leading to inefficiencies at the approach.
- Queuing and delays on eastern arm of North Rocks Road in both peaks; this approach has the lowest traffic demand in both peaks. With the intersection currently operating split phasing for North Rocks Road, relatively less green time is allocated to reduce overall intersection congestion and delay.
- No pedestrian crossing on the southern approach of Pennant Hills Road means pedestrians may need to navigate through multiple crossings to reach the other side of Pennant Hills Road.

Whilst overall pedestrian volumes at the intersection tend to be low it is noted that three schools are located within 500 metres east of the intersection, leading to higher concentrations of pedestrians in the AM peak. This is particularly the case when students travel by bus, walking from the stop located on Pennant Hills Road south of the intersection towards the schools.

- Pedestrian island on north western corner of intersection is very small and presents a potential safety hazard. This is particularly relevant for aforementioned pedestrian peaks prior to school starting in the morning.

3.2 Base model performance

Figure 2 shows the existing layout of the intersection while the base year traffic volumes are presented in Figure 3 and Figure 4. A comparison was done between 2016 and 2019 traffic volumes and the higher 2016 volumes were used as a conservative approach.

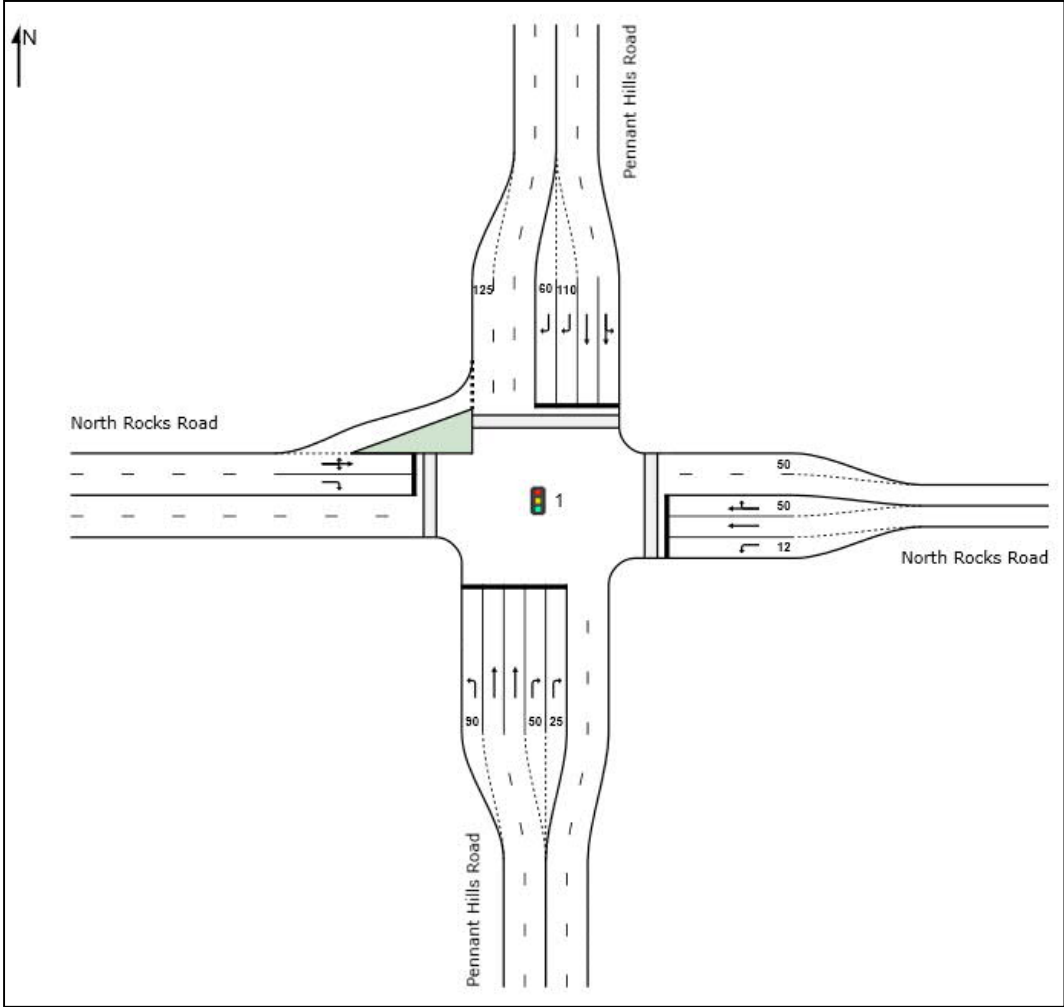


Figure 2: Existing intersection layout

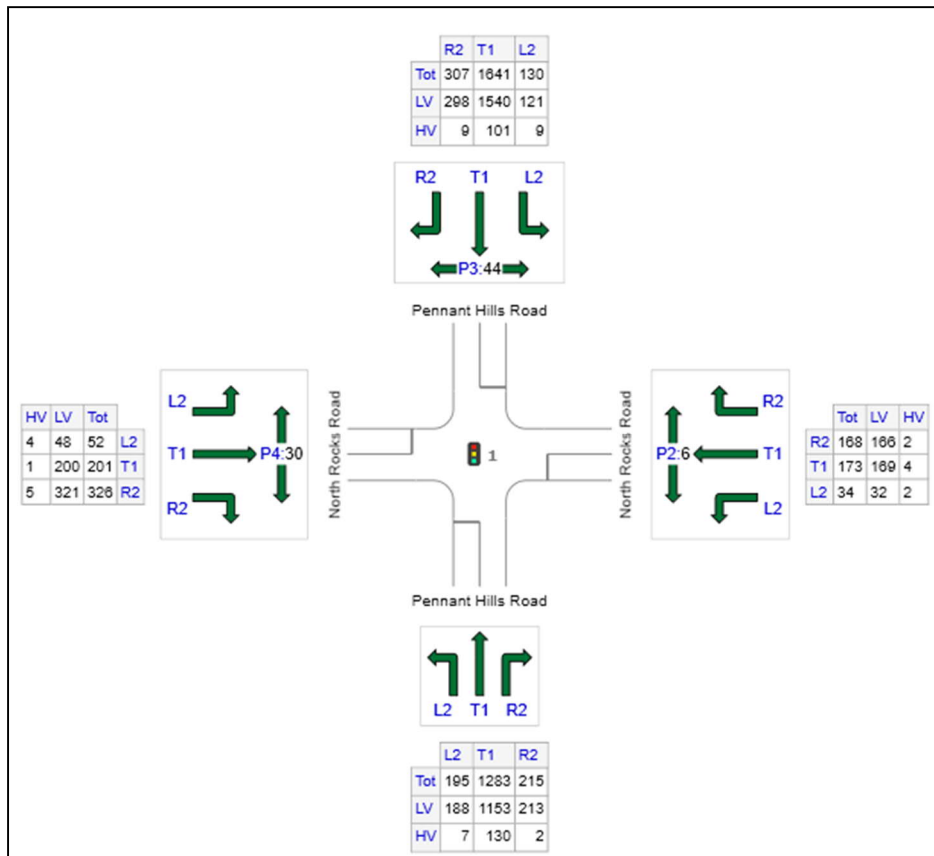


Figure 3: AM peak hour traffic counts (base year)

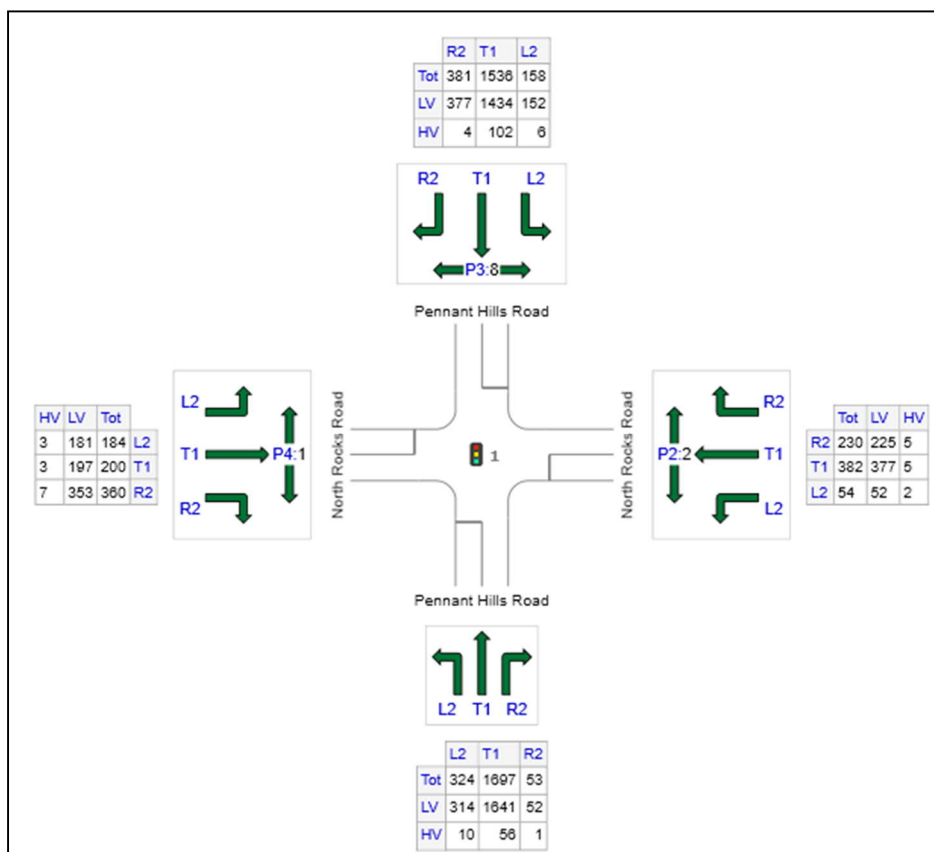


Figure 4: PM peak hour traffic counts (base year)

Figure 5 shows a screenshot of the SCATS phasing diagram for the intersection (TCS 642) and Figure 6 presents the existing phasing arrangement as adopted in the SIDRA base models. The intersection currently operates with a diamond phasing on Pennant Hills Road, and split approaches on North Rocks Road.



Figure 5: SCATS diagram (TCS 642)

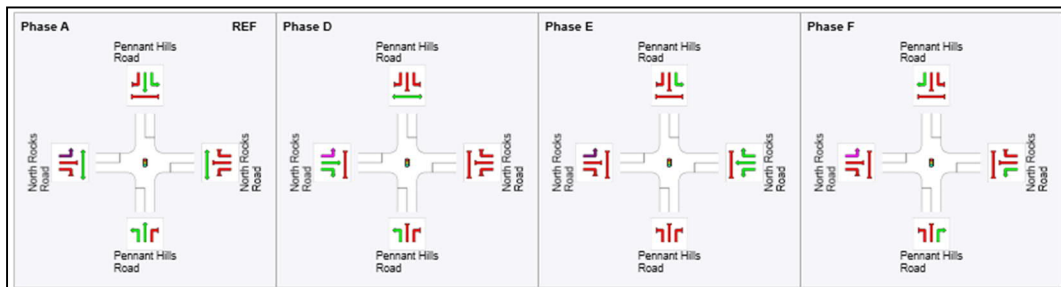


Figure 6: Signal phasing arrangement (existing)

Averaged phase times adopted in the Base modelling are provided in Table 2 below.

Peak	Green time (s)				Cycle time (s)
	A	D	E	F	
AM	81 (54%)	28 (19%)	22 (14%)	20 (13%)	150
PM	82 (55%)	27 (18%)	23 (15%)	18 (12%)	150

Table 2: Intersection green times

Table 3 summarises the SIDRA intersection performance under the base year conditions.

Approach	Existing AM			Existing PM		
	DoS	Delays (s)	LoS	DoS	Delays (s)	LoS
Pennant Hills Road (S)	0.98	46	D	1.02	82	F
North Rocks Road (E)	1.00	127	F	1.02	152	F
Pennant Hills Road (N)	1.01	114	F	0.97	49	D
North Rocks Road (W)	1.01	124	F	1.00	126	F
Intersection	1.01	92	F	1.02	82	F

Table 3: Base year model performance

The SIDRA analysis shows that the intersection currently operates at LoS F in both peaks, with an average delay of about 82-92 seconds and is operating at capacity on most approaches. The highest delays are indicated for North Rocks Road, which runs a split approach.

Pennant Hills Road traffic volumes are tidal in nature, with the northern approach showing highest traffic volumes in the morning peak and the southern approach showing highest traffic volumes in the afternoon peak. Subsequently the northern approach shows average delays of 114 seconds in the AM peak and 49 seconds in the PM peak, whilst the southern approach has average delays of 46 seconds in the AM peak and 82 seconds in the PM peak.

Detailed SIDRA modelling outputs are provided in **Appendix A**.

3.3 Future 'Do-Nothing' performance

Traffic forecast was applied in testing the future year scenarios. It should be noted that the forecast demands account for the planned opening of NorthConnex in late 2020, a major motorway tunnel scheme linking Sydney's northern precincts to the Orbital network. Each of the two tunnels will initially operate with two lanes and a breakdown lane, with long term capacity for three lanes per direction. The tunnel portals are located within 1km to the north of the intersection, with direct access to Pennant Hills Road, and the scheme is therefore expected to have a level of impact on traffic patterns at the intersection.

The 10-year horizon forecast adopted for modelling was generated based on information from the Sydney Strategic Traffic Forecasting Model (STFM); the STFM model outputs took into consideration the planned opening of NorthConnex and associated changes of traffic demand.

The applied forecast demand flows at the intersection are shown in Figure 7 and Figure 8 for the AM and PM peaks respectively.

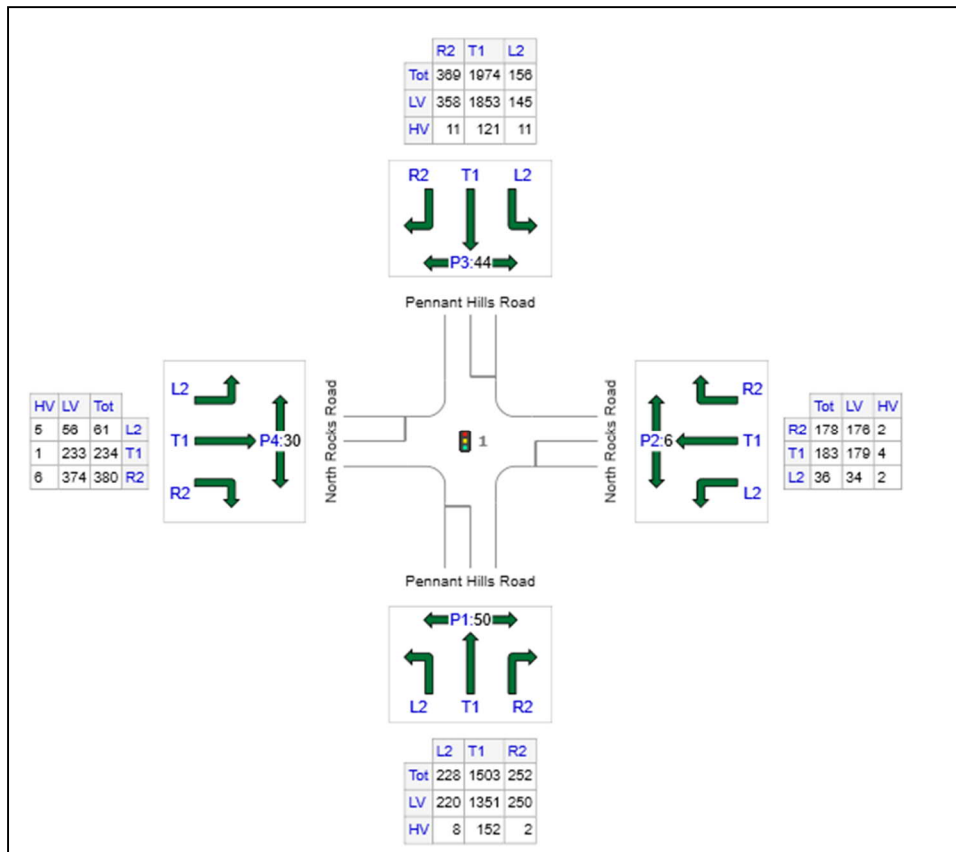


Figure 7: AM peak forecast demands (future year)

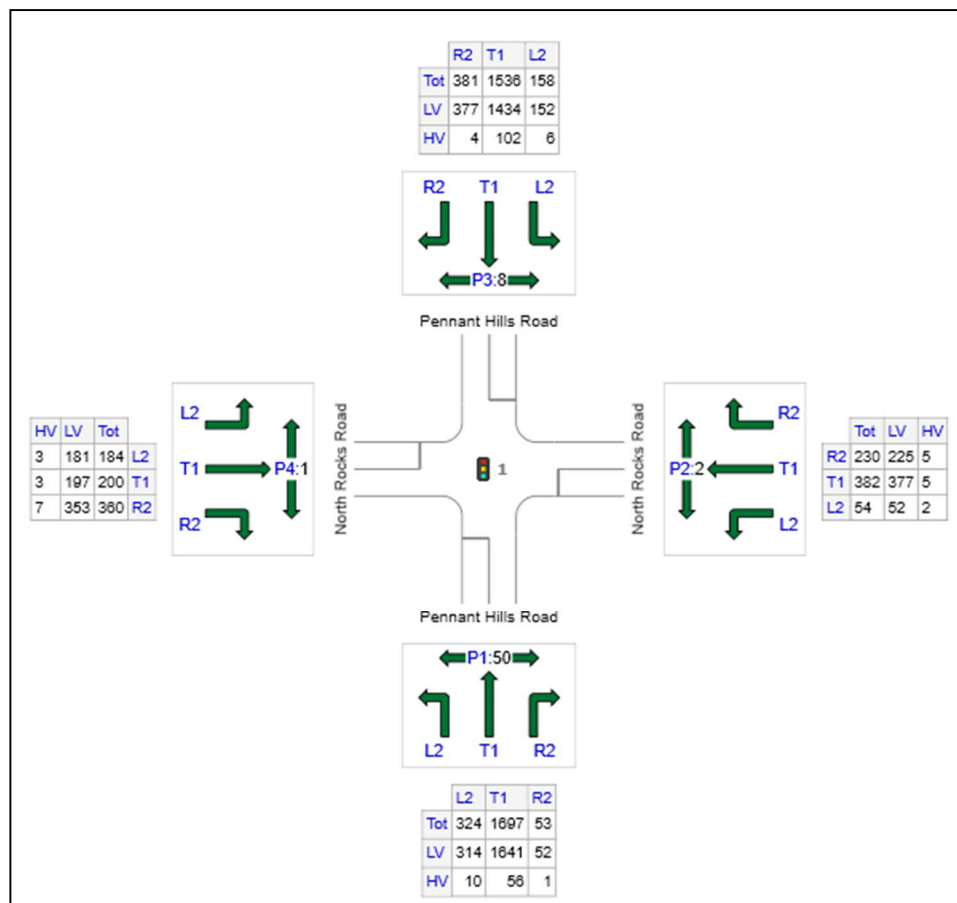


Figure 8: PM peak forecast demands (future year)

Table 4 shows a summary of the do-nothing scenario models outputs.

Approach	Future AM			Future PM		
	DoS	Delays (s)	LoS	DoS	Delays (s)	LoS
Pennant Hills Road (S)	1.16	150	F	1.27	308	F
North Rocks Road (E)	1.29	543	F	1.41	747	F
Pennant Hills Road (N)	1.09	206	F	0.97	83	F
North Rocks Road (W)	1.28	569	F	1.23	469	F
Intersection	1.29	255	F	1.41	298	F

Table 4: Future ‘Do-Nothing’ model performance

The do-nothing assessment for the future forecast year shows that the intersection is expected to experience significant delays, with average delays of 254 seconds in the AM peak and 298 seconds in the PM peak.

Average delays of 543-747 seconds are expected on North Rocks (E) during the peak hours while average delays of 469-569 seconds are expected on North Rocks (W).

Detailed SIDRA modelling outputs are provided in **Appendix A**.

3.4 Crash analysis

Crash data was reviewed for the five-year period July 2014 – June 2019 in order to identify trends at the intersection. A summary illustration of crashes at the intersection during this period is provided in Figure 9.

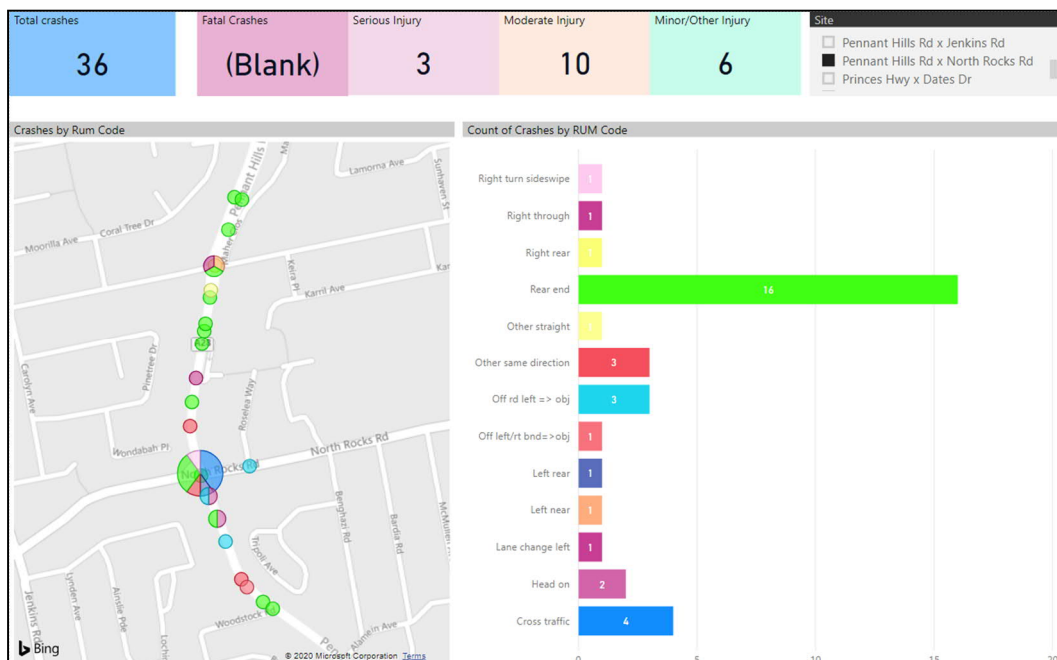


Figure 9: Intersection five-year crash summary

A total of 36 crashes were reported between July 2014 and June 2019 in the area of Pennant Hills Road, approximately 550 metres north and 300 metres south of the intersection, and 100 metres east and west along North Rocks Road.

40% of these occurred within the intersection itself, whilst 60% occurred on the corridors leading to/from the intersection. 44% of all crashes (16 total) were rear-end collisions of vehicles travelling in the same lane, indicating that congested conditions along the corridor and at times through the intersection present a safety risk.

11% of all crashes (4 total) were cross-traffic collisions occurring within the intersection itself; two of these affected southbound vehicles travelling through a red-light colliding with westbound vehicles.

Three serious injuries, 10 moderate injuries and six minor injuries have been reported in vicinity of the intersection.

3.5 Improvement objectives

The following key objectives are identified where improvement investigations were focused around:

- Improve performance of North Rocks Road approaches and the intersection with signal phasing arrangements (i.e. diamond phase operation) and potentially allowing green time reallocation.
- Provide additional capacity on Pennant Hills Road to accommodate the anticipated change of traffic demands resulting from background growth and opening of NorthConnex.
- Improve the conditions for pedestrians by adding a new crossing on the southern approach.

3.6 Optioneering

Throughout the scheme development process, several measures have been tested for feasibility to determine the proposed options identified in Section 3.7. Those which have not been deemed feasible are listed below, with rationale for their omission:

- **Pennant Hills Road Widening to six lanes at approaches:**

Widening on Pennant Hills Road north to accommodate a high entry angle left turn lane, three full lanes and an additional short (300 metres) through lane besides the two right turn lanes. The intervention would require widening to allow for four departure lanes on Pennant Hills Road south, with the kerbside lane merging at approximately 180 metres downstream.

Widening on Pennant Hills Road south to accommodate one 300 metres shared left and through lane, three full dedicated through lanes and two short right turn lanes (100 metres and 50 metres respectively). The intervention would also require the provision of one 180 metres and three continuous departure lanes.

Accommodating six lanes at both approaches, plus the additional left turn slip lane on the northern approach, requires significant property acquisition in the area. Comparing to the current layout, the width of the carriageway (both directions) on either side of the intersection would be increased by approximately ten metres. This would in turn warrant a staged pedestrian crossing, further adding to the need for space to accommodate the central island. The short departure lanes may also introduce more operational risks due to merging traffic.

- **Widening on North Rocks Road east to accommodate two continuous dedicated right and through lanes, one 60 metres through lane and one 50 metres left turn lane.**

This layout provides increased stop line capacity on eastern approach, especially for the left and through-movements, but also demands property acquisition to larger geometric footprint. However, traffic demands of said movements are not high enough to justify additional lane in either peaks.

- **Installation of bus priority on the Pennant Hills Road north approach for southbound buses**

The available space for a bus priority lane would only cover the distance between the diverge of the left turn slip lane and the stop line, which may not deliver sufficient desirable benefits for buses.

- **Increasing the size of the corner island on the north-west corner**

This improvement measure aimed at providing enough storage for pedestrians and improve the safety. During the development process, it was deemed not feasible due to the presence of the telecommunication pits on the verge of the north-west corner which would require substantial costs to relocate.

Following an evaluation of each proposed intervention in isolation and/or combination with other measures, three combined options were taken forward and tested in SIDRA. The assessed options are set out in more detail in the following section.

3.7 Proposed options

Options presented in this chapter include improvement measures, which are considered to have merits for detailed discussion.

3.7.1 Option 1

Option 1 (Figure 10) includes changes to the north-eastern part of the intersection only:

- Widening to allow for a dedicated westbound right turn lane along North Rocks Road east for approximately 80 metres. The left turn movement would share the kerbside lane with the through traffic.
- Provision of a slip lane on the northern approach of Pennant Hills Road of approximately 60 metres.
- Extension of the downstream departure lane to accommodate a shared left and through kerbside lane (currently dedicated left-turn) for northbound traffic.

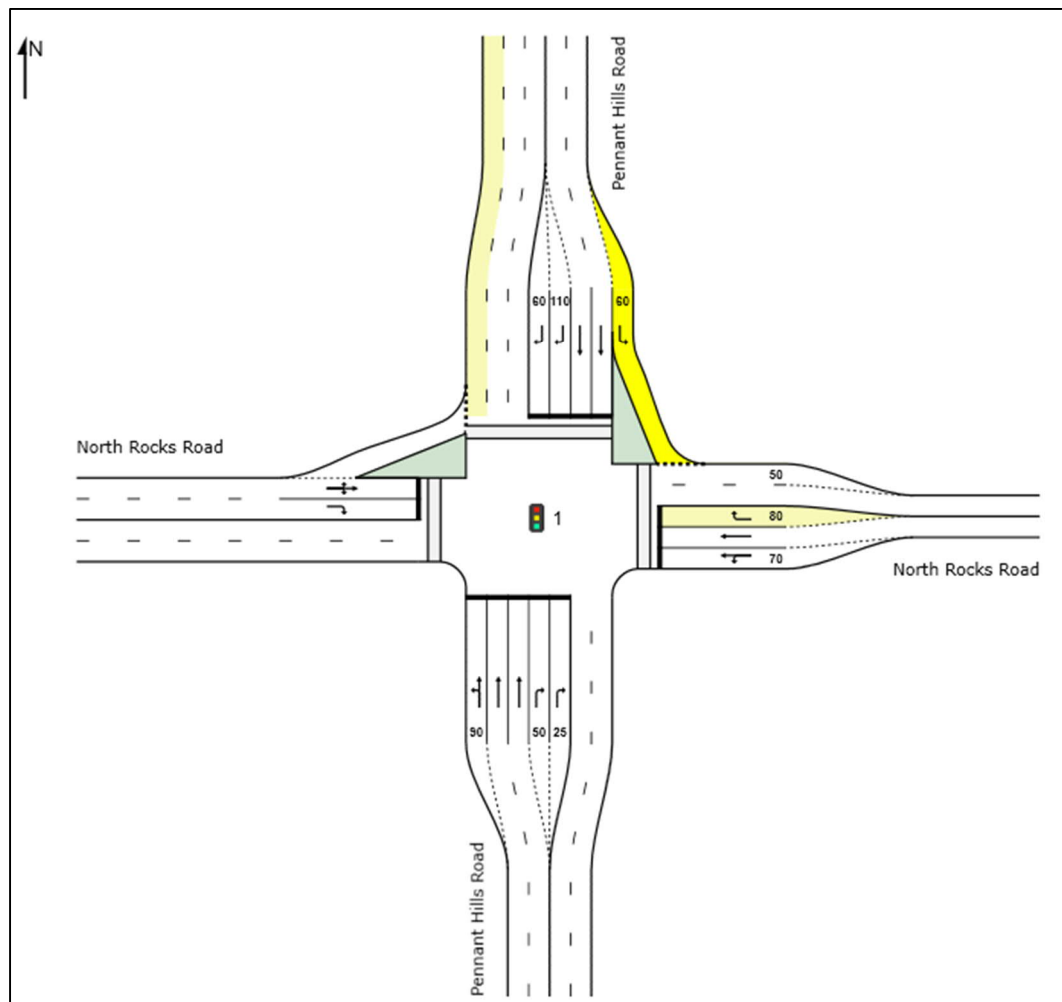


Figure 10: Option 1 layout

3.7.2 Option 2

Option 2 (Figure 11) includes widening on Pennant Hills Road whilst minimising the land resumption required for the intersection upgrade in the north-eastern corner.

- Provision of one additional through lane on Pennant Hills Road north, coupled by an additional downstream departure lane for nearly 120 m.
- Provision of a slip lane on the northern approach of Pennant Hills Road of approximately 60 metres. (similar to Option 1)
- Widening to allow for a dedicated westbound right turn lane along North Rocks Road east for approximately 80 metres. The left turn movement would share the kerbside lane with the through traffic. (similar to Option 1)
- Lengthening of the right turn lanes on the southern approach to 50 metres and 100 metres.
- Extension of the downstream departure lane to accommodate a shared left and through kerbside lane (currently dedicated left-turn) for northbound traffic. (similar to Option 1)
- Adding a new pedestrian crossing on the southern approach.

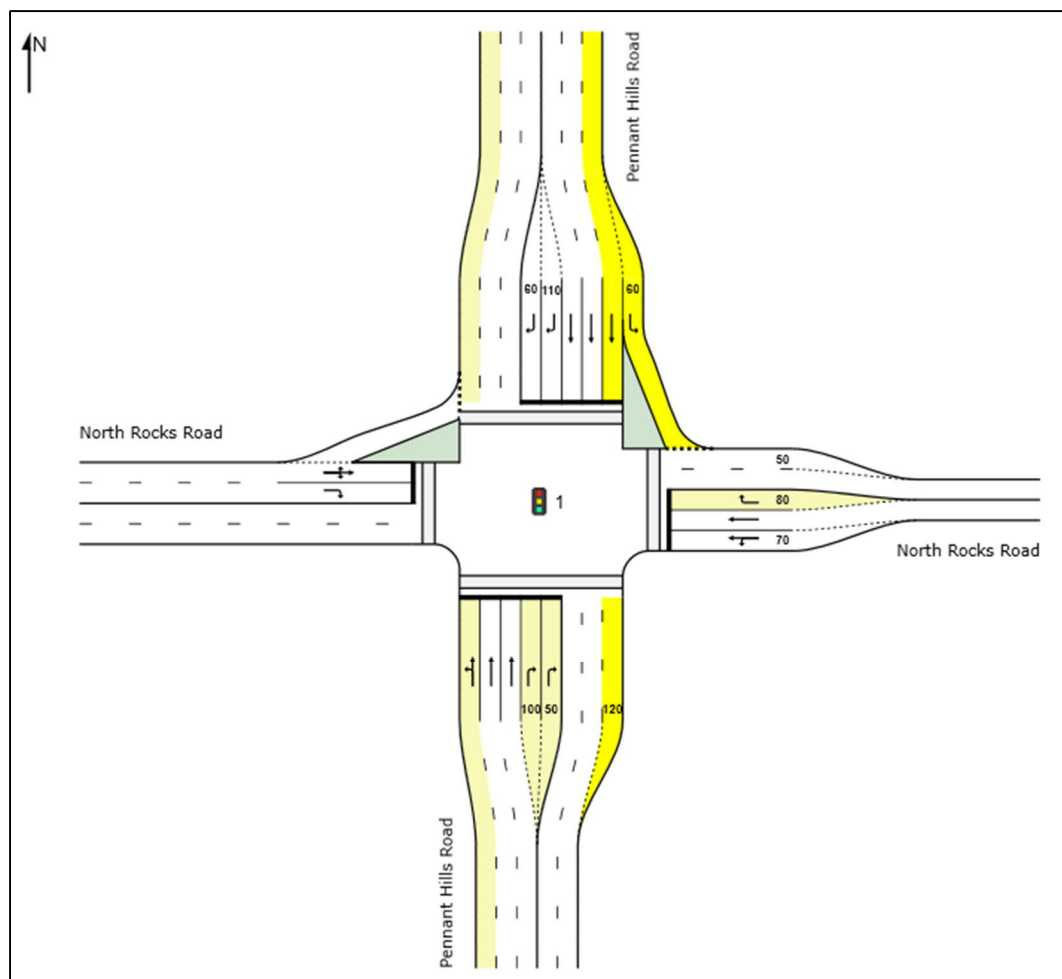


Figure 11: Option 2 layout

3.7.3 Option 3

Option 3 (Figure 12) includes all design aspects of Option 2, plus the following additions:

- An additional 80 metres right turn lane on the western approach of North Rocks Road.
- Change of lane configuration on North Rocks Road west to accommodate a diamond phasing arrangement for North Rocks Road (proposed phasing shown in Figure 13).

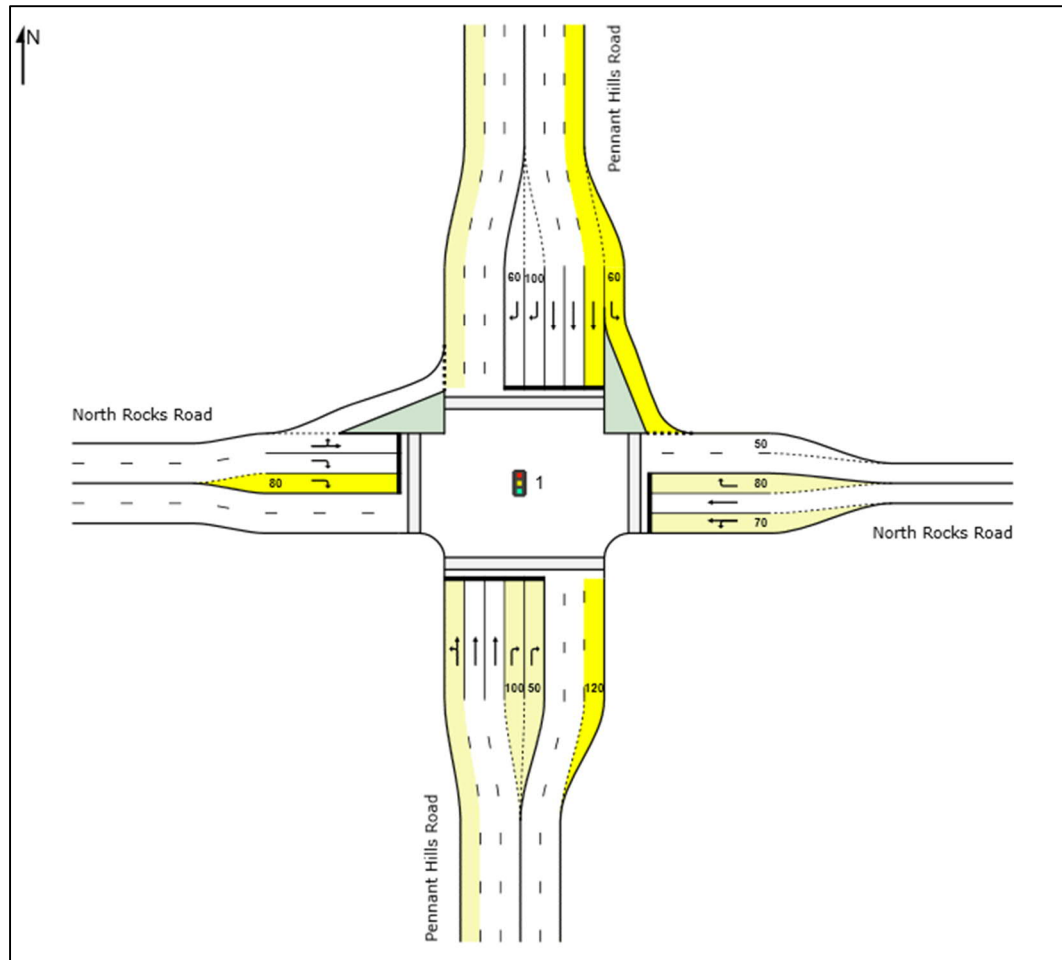


Figure 12: Option 3 layout

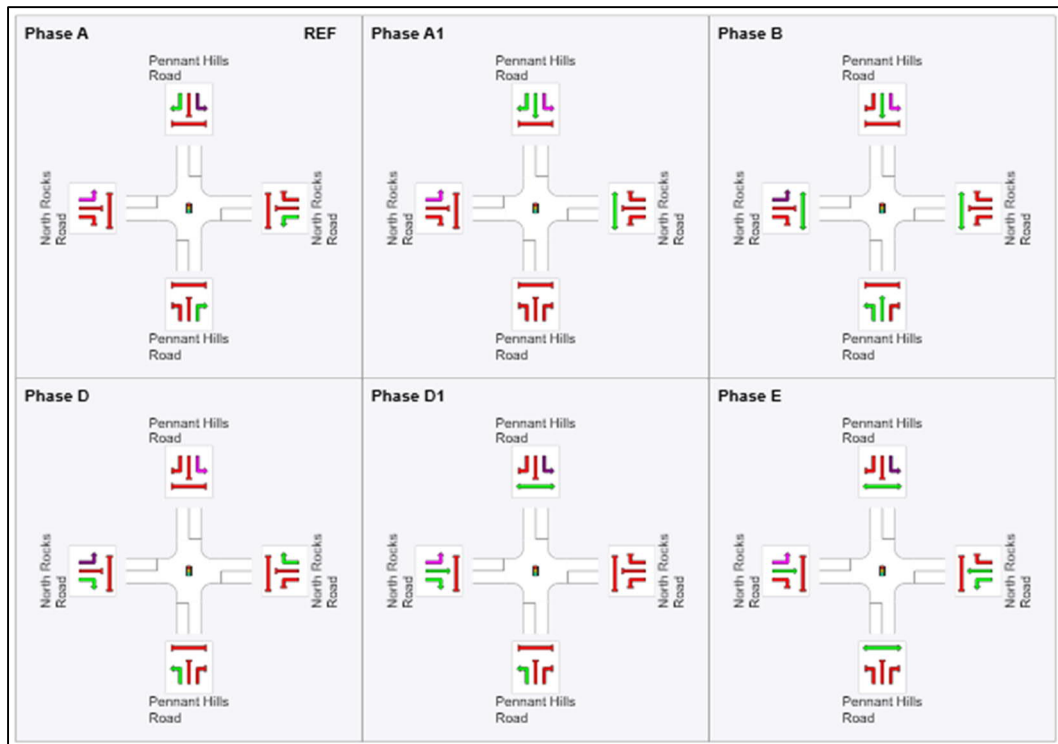


Figure 13: Proposed signal phasing arrangement for Option 3

3.8 Option Performance

Results of the SIDRA assessment for the base and all options are shown in Table 5 and Table 6. Detailed SIDRA modelling outputs are provided in **Appendix A**.

Movement		Base / Do Nothing		Option 1		Option 2		Option 3	
		Delays	LoS	Delays	LoS	Delays	LoS	Delays	LoS
AM	Pennant Hills Road (S)	46	D	47	D	45	D	43	D
	North Rocks Road (E)	127	F	133	F	65	E	71	F
	Pennant Hills Road (N)	114	F	124	F	54	D	40	C
	North Rocks Road (W)	124	F	127	F	85	F	79	F
	Intersection	92	F	98	F	56	D	48	D
PM	Pennant Hills Road (S)	82	F	53	D	48	D	39	C
	North Rocks Road (E)	152	F	86	F	65	E	69	E
	Pennant Hills Road (N)	49	D	47	D	45	D	36	C
	North Rocks Road (W)	126	F	76	F	67	E	66	E
	Intersection	82	F	57	E	51	D	44	D

Table 5: Performance comparison (base year)

Movement		Base / Do Nothing		Option 1		Option 2		Option 3	
		Delays	LoS	Delays	LoS	Delays	LoS	Delays	LoS
AM	Pennant Hills Road (S)	150	F	87	F	53	D	45	D
	North Rocks Road (E)	543	F	335	F	66	E	76	F
	Pennant Hills Road (N)	206	F	369	F	123	F	56	D
	North Rocks Road (W)	569	F	378	F	121	F	100	F
	Intersection	255	F	267	F	94	F	59	E
PM	Pennant Hills Road (S)	307	F	209	F	90	F	59	E
	North Rocks Road (E)	747	F	181	F	71	F	70	E
	Pennant Hills Road (N)	83	F	265	F	58	E	44	D
	North Rocks Road (W)	469	F	163	F	81	F	72	F
	Intersection	298	F	221	F	74	F	57	E

Table 6: Performance comparison (future year)

3.9 Option Appraisal

3.9.1 Option 1

The anticipated impacts of Option 1 are summarised as:

- Under Option 1, the intersection is forecast to be operating over capacity in the base year AM peak (DoS 1.05) and in both future peak scenarios (DoS 1.32 in AM peak and 1.11 in PM peak); with the model showing LoS F for those scenarios.
- For the future AM peak, significant delays are estimated for Pennant Hills Road north (369 seconds) and North Rocks Road west (378 seconds).
- For the future PM peak, highest delays are shown on Pennant Hills Road north (265 seconds) and Pennant Hills Road south (223 seconds).
- Proposed interventions on the eastern approach deliver considerable improvements by favouring the through and right turn movements, which account for over 85% of the total approach demands in the future scenario.

Overall efficiency gains would allow for slight reductions in green time on the eastern approach, which could be allocated to other critical approaches instead.

The changes on the eastern approach would however require property acquisitions to accommodate the extension for the right turn lane and the kerbside lane.

- Interventions of Option 1 focusing on the north-eastern side of the intersection, remains insufficient to cater for the forecast demands whilst triggering considerable land acquisition requirements.

3.9.2 Option 2

The anticipated impacts of Option 2 are summarised as:

- Reduction in the average delays on Pennant Hills Road by up to 60 seconds in the base year scenarios and by up to 217 seconds in the future scenarios.
- Reduction in the average delays on North Rocks Road by up to 87 seconds in the base year scenarios and by up to 11 minutes in the future scenarios.
- Reduction in the average delays at the intersection by up to 36 seconds in the base year scenarios and by up to 224 seconds in the future scenarios.
- Reduction in the average queue distance by up to 970 metres on the southern approach and by up to 370 metres on the northern approach compared to the existing layout in the future scenarios.
- Reduction in the average queue distance by up to 350 metres on the eastern approach and by up to 230 metres on the western approach compared to the existing layout in the future scenarios.
- Extending the right turn lanes on the southern approach can reduce the likelihood of traffic spilling into the through lanes; the estimated queue lengths in the two future scenarios would be largely contained within the turning lanes.
- The expected time savings and performance improvements are expected to be considerably higher in Option 2 than Option 1, given the scale of civil works improvements proposed in Option 2.
- Option 2 also improves the conditions for pedestrians by providing the missing crossing on the southern approach.

3.9.3 Option 3

The anticipated impacts of Option 3 are summarised as:

- Reduction in the average delays on Pennant Hills Road by up to 74 seconds in the base year scenarios and by up to 248 seconds in the future scenarios.
- Reduction in the average delays on North Rocks Road by up to 83 seconds in the base year scenarios and by up to 11 minutes in the future scenarios.
- Reduction in the average delays at the intersection by up to 44 seconds in the base year scenarios and by up to 241 seconds in the future scenarios.
- Reduction in the average queue distance by up to 1,020 metres on the southern approach and by up to 440 metres on the northern approach compared to the existing layout in the future scenarios.
- Reduction in the average queue distance by up to 340 metres on the eastern approach and by up to 360 metres on the western approach compared to the existing layout in the future scenarios.
- Whilst very similar in terms of general findings to Option 2, Option 3 delivers further improvements with average intersection delays for the future forecast year estimated to be 35 seconds lower in the AM peak and 17 seconds lower in the PM peak than in Option 2.
- Accommodating two dedicated right turn lanes on the western approach and enabling a diamond phasing for North Rocks Road delivers further improvements to intersection efficiencies. The additional capacity also provides opportunities for reallocating of the green time to approaches with higher delays.
- Option 3 also improves the conditions for pedestrians by providing the missing crossing on the southern approach (similar to Option 2).

3.10 Summary and Recommendation

Three options were tested to improve intersection efficiency and accommodate for forecast traffic flows including background growth and the planned opening of NorthConnex. The assessments show that the intersection is likely to experience significant delays in the future forecast year without intervention; and requires additional capacity provision on all approaches to ensure a satisfactory operation.

Interventions of Option 1 focusing on the north-eastern side of the intersection, remains insufficient to cater for the forecast demands whilst triggering considerable land acquisition requirements.

The improvements provided in Option 2 and Option 3 are focused on the heavy movements on Pennant Hills Road which provides much better outcomes in terms of performance and time savings compared to Option 1.

The additional right turn lane on the western approach (Option 3) increases the capacity on that approach and also accommodates a diamond phasing arrangement on that approach increasing the flexibility and efficiency of the traffic phasing compared to Option 2. The additional capacity also provides opportunities for reallocating of the green time to approaches with higher delays.

Option 3 is expected to operate with LoS E in the forecast year and keep delays on all approaches within reasonable levels. It is therefore recommended to proceed with Option 3.

Appendix A – SIDRA Modelling Outputs

INTERSECTION SUMMARY

Site: 1 [Base Year AM (Do Nothing)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Phase Times)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	22.6 km/h	1.8 km/h	22.4 km/h
Travel Distance (Total)	4820.8 veh-km/h	3.3 ped-km/h	5788.3 pers-km/h
Travel Time (Total)	213.5 veh-h/h	1.8 ped-h/h	257.9 pers-h/h
Demand Flows (Total)	4725 veh/h	80 ped/h	5750 pers/h
Percent Heavy Vehicles (Demand)	5.8 %		
Degree of Saturation	1.008	0.092	
Practical Spare Capacity	-10.7 %		
Effective Intersection Capacity	4687 veh/h		
Control Delay (Total)	120.91 veh-h/h	1.10 ped-h/h	146.19 pers-h/h
Control Delay (Average)	92.1 sec	49.3 sec	91.5 sec
Control Delay (Worst Lane)	146.5 sec		
Control Delay (Worst Movement)	141.3 sec	69.2 sec	141.3 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	90.4 sec		
Idling Time (Average)	91.4 sec		
Intersection Level of Service (LOS)	LOS F	LOS E	
Aver. Back of Queue - Vehicles (Worst Lane)	62.2 veh		
Aver. Back of Queue - Distance (Worst Lane)	458.7 m		
Queue Storage Ratio (Worst Lane)	0.92		
Total Effective Stops	5278 veh/h	63 ped/h	6396 pers/h
Effective Stop Rate	1.12	0.79	1.11
Proportion Queued	0.94	0.79	0.94
Performance Index	710.0	2.1	712.1
Cost (Total)	6449.99 \$/h	40.93 \$/h	6490.92 \$/h
Fuel Consumption (Total)	681.4 L/h		
Carbon Dioxide (Total)	1620.8 kg/h		
Hydrocarbons (Total)	0.160 kg/h		
Carbon Monoxide (Total)	1.643 kg/h		
NOx (Total)	3.329 kg/h		

Site Level of Service (LOS) Method: Delay (SIDRA). 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 2 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 4.0% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,268,000 veh/y	38,400 ped/y	2,760,000 pers/y
Delay	58,036 veh-h/y	526 ped-h/y	70,169 pers-h/y
Effective Stops	2,533,268 veh/y	30,288 ped/y	3,070,209 pers/y
Travel Distance	2,313,993 veh-km/y	1,570 ped-km/y	2,778,362 pers-km/y
Travel Time	102,457 veh-h/y	862 ped-h/y	123,810 pers-h/y
Cost	3,095,995 \$/y	19,645 \$/y	3,115,641 \$/y
Fuel Consumption	327,051 L/y		
Carbon Dioxide	778,003 kg/y		
Hydrocarbons	77 kg/y		
Carbon Monoxide	789 kg/y		
NOx	1,598 kg/y		

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MOVEMENT SUMMARY

Site: 1 [Base Year AM (Do Nothing)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	Aver. Vehicles	Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	195	3.6	0.160	15.0	LOS B	3.1	22.4	0.39	0.68	0.39	47.0
2	T1	1283	10.1	0.904	40.2	LOS D	34.6	262.9	0.87	0.85	0.94	36.2
3	R2	215	0.9	0.984	112.5	LOS F	9.5	67.1	0.99	1.05	1.60	20.9
Approach		1693	8.2	0.984	46.4	LOS D	34.6	262.9	0.83	0.85	0.96	34.0
East: North Rocks Road												
4	L2	34	5.9	0.084	54.3	LOS D	1.2	8.8	0.82	0.72	0.82	31.2
5	T1	173	2.3	0.997	131.9	LOS F	11.5	81.2	1.00	1.28	1.91	19.1
6	R2	168	1.2	0.997	137.3	LOS F	11.5	81.2	1.00	1.23	1.88	18.4
Approach		375	2.1	0.997	127.3	LOS F	11.5	81.2	0.98	1.21	1.80	19.5
North: Pennant Hills Road												
7	L2	130	6.9	1.008	107.7	LOS F	57.8	426.3	1.00	1.25	1.56	19.0
8	T1	1641	6.2	1.008	113.6	LOS F	62.2	458.7	1.00	1.32	1.57	19.5
9	R2	307	2.9	0.974	118.7	LOS F	9.1	65.3	1.00	1.14	1.78	20.2
Approach		2078	5.7	1.008	114.0	LOS F	62.2	458.7	1.00	1.29	1.60	19.5
West: North Rocks Road												
10	L2	52	7.7	1.006	107.1	LOS F	16.3	115.8	1.00	1.16	1.83	16.7
11	T1	201	0.5	1.006	101.5	LOS F	16.3	115.8	1.00	1.16	1.83	16.8
12	R2	326	1.5	1.006	141.3	LOS F	19.6	139.0	1.00	1.23	1.84	17.5
Approach		579	1.7	1.006	124.4	LOS F	19.6	139.0	1.00	1.20	1.83	17.2
All Vehicles		4725	5.8	1.008	92.1	LOS F	62.2	458.7	0.94	1.12	1.42	22.6

Site Level of Service (LOS) Method: Delay (SIDRA). 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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian	Distance m	Prop. Queued	Effective Stop Rate
P2	East Full Crossing	6	26.4	LOS C	0.0	0.0	0.59	0.59
P3	North Full Crossing	44	69.2	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	30	24.7	LOS C	0.1	0.1	0.57	0.57
All Pedestrians		80	49.3	LOS E			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

Site: 1 [Base Year PM (Do Nothing)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Phase Times)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	25.2 km/h	1.7 km/h	25.1 km/h
Travel Distance (Total)	4719.9 veh-km/h	0.5 ped-km/h	5664.4 pers-km/h
Travel Time (Total)	187.6 veh-h/h	0.3 ped-h/h	225.4 pers-h/h
Demand Flows (Total)	4626 veh/h	11 ped/h	5562 pers/h
Percent Heavy Vehicles (Demand)	3.7 %		
Degree of Saturation	1.022	0.017	
Practical Spare Capacity	-11.9 %		
Effective Intersection Capacity	4527 veh/h		
Control Delay (Total)	105.29 veh-h/h	0.17 ped-h/h	126.52 pers-h/h
Control Delay (Average)	81.9 sec	57.2 sec	81.9 sec
Control Delay (Worst Lane)	162.6 sec		
Control Delay (Worst Movement)	164.0 sec	69.1 sec	164.0 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	80.2 sec		
Idling Time (Average)	75.5 sec		
Intersection Level of Service (LOS)	LOS F	LOS E	
Aver. Back of Queue - Vehicles (Worst Lane)	76.3 veh		
Aver. Back of Queue - Distance (Worst Lane)	549.5 m		
Queue Storage Ratio (Worst Lane)	1.10		
Total Effective Stops	4825 veh/h	9 ped/h	5799 pers/h
Effective Stop Rate	1.04	0.86	1.04
Proportion Queued	0.89	0.86	0.89
Performance Index	612.9	0.3	613.2
Cost (Total)	5529.15 \$/h	6.29 \$/h	5535.43 \$/h
Fuel Consumption (Total)	585.6 L/h		
Carbon Dioxide (Total)	1387.3 kg/h		
Hydrocarbons (Total)	0.132 kg/h		
Carbon Monoxide (Total)	1.418 kg/h		
NOx (Total)	2.047 kg/h		

Site Level of Service (LOS) Method: Delay (SIDRA). 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 0.3% 0.1% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,220,480 veh/y	5,280 ped/y	2,669,856 pers/y
Delay	50,539 veh-h/y	84 ped-h/y	60,730 pers-h/y
Effective Stops	2,316,011 veh/y	4,523 ped/y	2,783,737 pers/y
Travel Distance	2,265,558 veh-km/y	227 ped-km/y	2,718,896 pers-km/y
Travel Time	90,040 veh-h/y	132 ped-h/y	108,180 pers-h/y
Cost	2,653,990 \$/y	3,018 \$/y	2,657,008 \$/y
Fuel Consumption	281,093 L/y		
Carbon Dioxide	665,913 kg/y		
Hydrocarbons	63 kg/y		
Carbon Monoxide	681 kg/y		
NOx	982 kg/y		

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MOVEMENT SUMMARY

 Site: 1 [Base Year PM (Do Nothing)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	Aver. Vehicles veh	Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	301	3.0	0.241	14.8	LOS B	4.9	35.4	0.40	0.70	0.40	47.1
2	T1	1574	3.3	1.022	95.3	LOS F	76.3	549.5	0.91	1.16	1.32	23.4
3	R2	49	2.0	0.232	75.7	LOS E	1.6	11.2	0.96	0.72	0.96	26.5
Approach		1924	3.2	1.022	82.2	LOS F	76.3	549.5	0.83	1.08	1.17	25.5
East: North Rocks Road												
4	L2	34	2.9	0.082	54.2	LOS D	1.2	8.5	0.82	0.72	0.82	31.2
5	T1	243	1.2	1.020	158.2	LOS F	14.1	100.0	1.00	1.39	2.03	16.6
6	R2	146	2.1	1.020	164.0	LOS F	14.0	99.9	1.00	1.38	2.03	16.2
Approach		423	1.7	1.020	151.8	LOS F	14.1	100.0	0.99	1.33	1.93	17.1
North: Pennant Hills Road												
7	L2	130	3.8	0.789	41.1	LOS D	26.6	195.6	0.89	0.86	1.12	36.8
8	T1	1255	6.6	0.789	32.8	LOS C	26.6	195.6	0.86	0.80	0.97	38.8
9	R2	311	1.0	0.973	117.9	LOS F	9.2	64.8	1.00	1.13	1.77	20.3
Approach		1696	5.4	0.973	49.1	LOS D	26.6	195.6	0.89	0.87	1.13	33.2
West: North Rocks Road												
10	L2	144	1.4	1.000	115.0	LOS F	15.9	112.9	1.00	1.24	1.79	17.8
11	T1	157	1.3	1.000	109.4	LOS F	15.9	112.9	1.00	1.24	1.79	17.9
12	R2	282	1.8	1.000	140.8	LOS F	19.0	135.1	1.00	1.22	1.80	18.2
Approach		583	1.5	1.000	126.0	LOS F	19.0	135.1	1.00	1.23	1.80	18.0
All Vehicles		4626	3.7	1.022	81.9	LOS F	76.3	549.5	0.89	1.04	1.30	25.2

Site Level of Service (LOS) Method: Delay (SIDRA). 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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P2	East Full Crossing	2	25.8	LOS C	0.0	0.0	0.59	0.59
P3	North Full Crossing	8	69.1	LOS F	0.0	0.0	0.96	0.96
P4	West Full Crossing	1	24.1	LOS C	0.0	0.0	0.57	0.57
All Pedestrians		11	57.2	LOS E			0.86	0.86

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

Site: 1 [Base Year AM (Option 1)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	18.7 km/h	1.8 km/h	18.5 km/h
Travel Distance (Total)	3588.8 veh-km/h	3.3 ped-km/h	4309.8 pers-km/h
Travel Time (Total)	192.3 veh-h/h	1.9 ped-h/h	232.6 pers-h/h
Demand Flows (Total)	4725 veh/h	80 ped/h	5750 pers/h
Percent Heavy Vehicles (Demand)	5.8 %		
Degree of Saturation	1.053	0.092	
Practical Spare Capacity	-14.5 %		
Effective Intersection Capacity	4489 veh/h		
Control Delay (Total)	128.04 veh-h/h	1.11 ped-h/h	154.75 pers-h/h
Control Delay (Average)	97.6 sec	49.8 sec	96.9 sec
Control Delay (Worst Lane)	204.7 sec		
Control Delay (Worst Movement)	204.7 sec	69.2 sec	204.7 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	95.9 sec		
Idling Time (Average)	91.0 sec		
Intersection Level of Service (LOS)	LOS F	LOS E	
95% Back of Queue - Vehicles (Worst Lane)	104.5 veh		
95% Back of Queue - Distance (Worst Lane)	770.0 m		
Queue Storage Ratio (Worst Lane)	1.18		
Total Effective Stops	5183 veh/h	64 ped/h	6284 pers/h
Effective Stop Rate	1.10	0.79	1.09
Proportion Queued	0.91	0.79	0.91
Performance Index	589.0	2.2	591.2
Cost (Total)	5990.81 \$/h	42.52 \$/h	6033.33 \$/h
Fuel Consumption (Total)	588.3 L/h		
Carbon Dioxide (Total)	1397.9 kg/h		
Hydrocarbons (Total)	0.143 kg/h		
Carbon Monoxide (Total)	1.384 kg/h		
NOx (Total)	2.856 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 4.2% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,268,000 veh/y	38,400 ped/y	2,760,000 pers/y
Delay	61,457 veh-h/y	532 ped-h/y	74,281 pers-h/y
Effective Stops	2,488,017 veh/y	30,519 ped/y	3,016,139 pers/y
Travel Distance	1,722,604 veh-km/y	1,570 ped-km/y	2,068,695 pers-km/y
Travel Time	92,295 veh-h/y	895 ped-h/y	111,650 pers-h/y
Cost	2,875,588 \$/y	20,411 \$/y	2,895,999 \$/y
Fuel Consumption	282,376 L/y		
Carbon Dioxide	670,980 kg/y		
Hydrocarbons	68 kg/y		
Carbon Monoxide	664 kg/y		
NOx	1,371 kg/y		

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MOVEMENT SUMMARY

Site: 1 [Base Year AM (Option 1)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	195	3.6	0.652	33.5	LOS C	24.1	179.8	0.75	0.73	0.75	34.2
2	T1	1283	10.1	0.652	29.2	LOS C	27.5	209.6	0.77	0.70	0.77	35.6
3	R2	215	0.9	1.047	164.7	LOS F	20.4	144.1	0.99	1.19	1.91	13.5
Approach		1693	8.2	1.047	46.9	LOS D	27.5	209.6	0.79	0.76	0.91	28.8
East: North Rocks Road												
4	L2	34	5.9	0.608	78.4	LOS F	7.7	55.4	1.00	0.79	1.01	23.6
5	T1	173	2.3	0.608	73.3	LOS F	7.7	55.4	1.00	0.79	1.01	25.6
6	R2	168	1.2	1.053	204.7	LOS F	22.5	159.1	1.00	1.42	2.29	12.6
Approach		375	2.1	1.053	132.6	LOS F	22.5	159.1	1.00	1.07	1.58	17.3
North: Pennant Hills Road												
7	L2	130	6.9	0.104	10.9	LOS A	2.5	18.3	0.33	0.63	0.33	49.3
8	T1	1641	6.2	1.019	138.9	LOS F	104.5	770.0	1.00	1.46	1.68	14.2
9	R2	307	2.9	0.904	93.8	LOS F	12.9	92.3	1.00	1.00	1.45	20.2
Approach		2078	5.7	1.019	124.2	LOS F	104.5	770.0	0.96	1.34	1.56	15.8
West: North Rocks Road												
10	L2	52	7.7	1.003	115.7	LOS F	25.5	181.5	1.00	1.22	1.81	14.6
11	T1	201	0.5	1.003	110.0	LOS F	25.5	181.5	1.00	1.22	1.81	16.0
12	R2	326	1.5	1.003	140.0	LOS F	31.5	223.8	1.00	1.23	1.82	13.6
Approach		579	1.7	1.003	127.4	LOS F	31.5	223.8	1.00	1.23	1.81	14.6
All Vehicles		4725	5.8	1.053	97.6	LOS F	104.5	770.0	0.91	1.10	1.36	18.7

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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Queue Distance m	Prop. Queued	Effective Stop Rate
P2	East Full Crossing	6	27.6	LOS C	0.0	0.0	0.61	0.61
P3	North Full Crossing	44	69.2	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	30	25.8	LOS C	0.1	0.1	0.59	0.59
All Pedestrians		80	49.8	LOS E			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

Site: 1 [Base Year PM (Option 1)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	26.6 km/h	1.7 km/h	26.5 km/h
Travel Distance (Total)	3509.6 veh-km/h	0.5 ped-km/h	4211.9 pers-km/h
Travel Time (Total)	132.0 veh-h/h	0.3 ped-h/h	158.7 pers-h/h
Demand Flows (Total)	4626 veh/h	11 ped/h	5562 pers/h
Percent Heavy Vehicles (Demand)	3.7 %		
Degree of Saturation	0.920	0.011	
Practical Spare Capacity	-2.2 %		
Effective Intersection Capacity	5026 veh/h		
Control Delay (Total)	73.01 veh-h/h	0.17 ped-h/h	87.78 pers-h/h
Control Delay (Average)	56.8 sec	56.2 sec	56.8 sec
Control Delay (Worst Lane)	97.5 sec		
Control Delay (Worst Movement)	97.5 sec	66.3 sec	97.5 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	55.1 sec		
Idling Time (Average)	49.9 sec		
Intersection Level of Service (LOS)	LOS E	LOS E	
95% Back of Queue - Vehicles (Worst Lane)	58.3 veh		
95% Back of Queue - Distance (Worst Lane)	419.9 m		
Queue Storage Ratio (Worst Lane)	0.86		
Total Effective Stops	4209 veh/h	9 ped/h	5060 pers/h
Effective Stop Rate	0.91	0.85	0.91
Proportion Queued	0.90	0.85	0.90
Performance Index	452.1	0.3	452.4
Cost (Total)	4041.34 \$/h	6.41 \$/h	4047.75 \$/h
Fuel Consumption (Total)	457.0 L/h		
Carbon Dioxide (Total)	1082.2 kg/h		
Hydrocarbons (Total)	0.103 kg/h		
Carbon Monoxide (Total)	1.115 kg/h		
NOx (Total)	1.718 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.1 %

Number of Iterations: 4 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 6.9% 0.2% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,220,480 veh/y	5,280 ped/y	2,669,856 pers/y
Delay	35,044 veh-h/y	82 ped-h/y	42,135 pers-h/y
Effective Stops	2,020,311 veh/y	4,513 ped/y	2,428,886 pers/y
Travel Distance	1,684,588 veh-km/y	227 ped-km/y	2,021,733 pers-km/y
Travel Time	63,362 veh-h/y	135 ped-h/y	76,169 pers-h/y
Cost	1,939,842 \$/y	3,079 \$/y	1,942,921 \$/y
Fuel Consumption	219,337 L/y		
Carbon Dioxide	519,469 kg/y		
Hydrocarbons	49 kg/y		
Carbon Monoxide	535 kg/y		
NOx	825 kg/y		

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MOVEMENT SUMMARY

Site: 1 [Base Year PM (Option 1)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	301	3.0	0.903	57.0	LOS E	39.3	282.4	0.82	0.90	1.01	25.8
2	T1	1574	3.3	0.903	51.9	LOS D	58.3	419.9	0.91	0.94	1.06	27.1
3	R2	49	2.0	0.215	74.5	LOS F	2.5	18.1	0.96	0.72	0.96	23.6
Approach		1924	3.2	0.903	53.3	LOS D	58.3	419.9	0.89	0.93	1.05	26.8
East: North Rocks Road												
4	L2	34	2.9	0.814	84.4	LOS F	10.9	77.6	1.00	0.92	1.22	22.6
5	T1	243	1.2	0.814	79.1	LOS F	10.9	77.6	1.00	0.92	1.22	24.5
6	R2	146	2.1	0.920	97.5	LOS F	12.5	89.0	1.00	1.05	1.52	21.6
Approach		423	1.7	0.920	85.9	LOS F	12.5	89.0	1.00	0.96	1.32	23.3
North: Pennant Hills Road												
7	L2	130	3.8	0.092	7.4	LOS A	1.4	9.8	0.21	0.61	0.21	52.1
8	T1	1255	6.6	0.840	39.5	LOS C	39.5	292.1	0.89	0.84	0.93	31.3
9	R2	311	1.0	0.903	93.5	LOS F	13.0	91.7	1.00	1.00	1.44	20.3
Approach		1696	5.4	0.903	46.9	LOS D	39.5	292.1	0.86	0.85	0.97	29.3
West: North Rocks Road												
10	L2	144	1.4	0.843	78.1	LOS F	21.8	154.4	1.00	1.04	1.60	23.5
11	T1	157	1.3	0.843	72.5	LOS F	21.8	154.4	1.00	1.04	1.60	25.3
12	R2	282	1.8	0.843	77.2	LOS F	21.8	154.4	1.00	0.93	1.18	21.2
Approach		583	1.5	0.843	76.2	LOS F	21.8	154.4	1.00	0.99	1.39	23.0
All Vehicles		4626	3.7	0.920	56.8	LOS E	58.3	419.9	0.90	0.91	1.09	26.6

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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Queue Distance m	Prop. Queued	Effective Stop Rate
P2	East Full Crossing	2	30.1	LOS D	0.0	0.0	0.63	0.63
P3	North Full Crossing	8	66.3	LOS F	0.0	0.0	0.94	0.94
P4	West Full Crossing	1	28.2	LOS C	0.0	0.0	0.61	0.61
All Pedestrians		11	56.2	LOS E			0.85	0.85

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

 Site: 1 [Base Year AM (Option 2)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	26.9 km/h	1.7 km/h	26.4 km/h
Travel Distance (Total)	3591.1 veh-km/h	5.8 ped-km/h	4315.1 pers-km/h
Travel Time (Total)	133.4 veh-h/h	3.5 ped-h/h	163.6 pers-h/h
Demand Flows (Total)	4725 veh/h	130 ped/h	5800 pers/h
Percent Heavy Vehicles (Demand)	5.8 %		
Degree of Saturation	0.895	0.104	
Practical Spare Capacity	0.6 %		
Effective Intersection Capacity	5280 veh/h		
Control Delay (Total)	73.07 veh-h/h	2.15 ped-h/h	89.83 pers-h/h
Control Delay (Average)	55.7 sec	59.6 sec	55.8 sec
Control Delay (Worst Lane)	85.9 sec		
Control Delay (Worst Movement)	89.6 sec	69.3 sec	89.6 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	54.0 sec		
Idling Time (Average)	49.1 sec		
Intersection Level of Service (LOS)	LOS D	LOS E	
Aver. Back of Queue - Vehicles (Worst Lane)	31.1 veh		
Aver. Back of Queue - Distance (Worst Lane)	229.5 m		
Queue Storage Ratio (Worst Lane)	0.57		
Total Effective Stops	4134 veh/h	115 ped/h	5075 pers/h
Effective Stop Rate	0.87	0.88	0.88
Proportion Queued	0.92	0.88	0.92
Performance Index	426.8	4.1	430.9
Cost (Total)	4162.39 \$/h	79.87 \$/h	4242.26 \$/h
Fuel Consumption (Total)	501.4 L/h		
Carbon Dioxide (Total)	1192.8 kg/h		
Hydrocarbons (Total)	0.113 kg/h		
Carbon Monoxide (Total)	1.225 kg/h		
NOx (Total)	2.624 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 23.5% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,268,000 veh/y	62,400 ped/y	2,784,000 pers/y
Delay	35,073 veh-h/y	1,033 ped-h/y	43,120 pers-h/y
Effective Stops	1,984,264 veh/y	55,106 ped/y	2,436,222 pers/y
Travel Distance	1,723,718 veh-km/y	2,802 ped-km/y	2,071,264 pers-km/y
Travel Time	64,040 veh-h/y	1,682 ped-h/y	78,529 pers-h/y
Cost	1,997,946 \$/y	38,339 \$/y	2,036,286 \$/y
Fuel Consumption	240,681 L/y		
Carbon Dioxide	572,523 kg/y		
Hydrocarbons	54 kg/y		
Carbon Monoxide	588 kg/y		
NOx	1,259 kg/y		

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MOVEMENT SUMMARY

 Site: 1 [Base Year AM (Option 2)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	Aver. Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	195	3.6	0.697	44.8	LOS D	18.5	137.9	0.89	0.82	0.89	29.7
2	T1	1283	10.1	0.697	39.8	LOS C	18.6	141.5	0.89	0.80	0.89	31.0
3	R2	215	0.9	0.765	77.7	LOS F	7.4	52.0	0.99	0.84	1.08	23.1
Approach		1693	8.2	0.765	45.2	LOS D	18.6	141.5	0.90	0.81	0.91	29.4
East: North Rocks Road												
4	L2	34	5.9	0.358	67.6	LOS E	3.9	28.4	0.94	0.76	0.94	25.8
5	T1	173	2.3	0.358	61.3	LOS E	4.4	31.6	0.94	0.75	0.94	28.3
6	R2	168	1.2	0.570	69.1	LOS E	7.1	49.9	0.98	0.81	0.98	26.7
Approach		375	2.1	0.570	65.3	LOS E	7.1	49.9	0.96	0.78	0.96	27.3
North: Pennant Hills Road												
7	L2	130	6.9	0.104	10.3	LOS A	1.4	10.5	0.31	0.63	0.31	49.7
8	T1	1641	6.2	0.895	51.8	LOS D	31.1	229.5	0.94	0.92	1.04	27.3
9	R2	307	2.9	0.844	85.9	LOS F	7.4	53.4	1.00	0.92	1.27	21.4
Approach		2078	5.7	0.895	54.3	LOS D	31.1	229.5	0.91	0.91	1.03	27.0
West: North Rocks Road												
10	L2	52	7.7	0.891	89.6	LOS F	14.6	103.6	1.00	1.07	1.61	21.7
11	T1	201	0.5	0.891	83.9	LOS F	14.6	103.6	1.00	1.07	1.61	23.5
12	R2	326	1.5	0.891	85.0	LOS F	14.6	103.6	1.00	0.99	1.32	20.1
Approach		579	1.7	0.891	85.0	LOS F	14.6	103.6	1.00	1.03	1.45	21.5
All Vehicles		4725	5.8	0.895	55.7	LOS D	31.1	229.5	0.92	0.87	1.03	26.9

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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	50	69.3	LOS F	0.2	0.2	0.96	0.96
P2	East Full Crossing	6	36.1	LOS D	0.0	0.0	0.69	0.69
P3	North Full Crossing	44	69.2	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	30	34.0	LOS D	0.1	0.1	0.67	0.67
All Pedestrians		130	59.6	LOS E			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

 **Site: 1 [Base Year PM (Option 2)]**

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	28.3 km/h	1.6 km/h	28.0 km/h
Travel Distance (Total)	3511.5 veh-km/h	2.9 ped-km/h	4216.7 pers-km/h
Travel Time (Total)	124.2 veh-h/h	1.8 ped-h/h	150.8 pers-h/h
Demand Flows (Total)	4626 veh/h	61 ped/h	5612 pers/h
Percent Heavy Vehicles (Demand)	3.7 %		
Degree of Saturation	0.836	0.104	
Practical Spare Capacity	7.7 %		
Effective Intersection Capacity	5536 veh/h		
Control Delay (Total)	65.17 veh-h/h	1.14 ped-h/h	79.35 pers-h/h
Control Delay (Average)	50.7 sec	67.5 sec	50.9 sec
Control Delay (Worst Lane)	81.6 sec		
Control Delay (Worst Movement)	81.6 sec	69.3 sec	81.6 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	49.0 sec		
Idling Time (Average)	44.4 sec		
Intersection Level of Service (LOS)	LOS D	LOS F	
Aver. Back of Queue - Vehicles (Worst Lane)	26.1 veh		
Aver. Back of Queue - Distance (Worst Lane)	187.7 m		
Queue Storage Ratio (Worst Lane)	0.63		
Total Effective Stops	3914 veh/h	58 ped/h	4755 pers/h
Effective Stop Rate	0.85	0.95	0.85
Proportion Queued	0.93	0.95	0.93
Performance Index	407.2	2.1	409.3
Cost (Total)	3782.05 \$/h	41.49 \$/h	3823.54 \$/h
Fuel Consumption (Total)	444.5 L/h		
Carbon Dioxide (Total)	1053.0 kg/h		
Hydrocarbons (Total)	0.099 kg/h		
Carbon Monoxide (Total)	1.099 kg/h		
NOx (Total)	1.688 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 30.3% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,220,480 veh/y	29,280 ped/y	2,693,856 pers/y
Delay	31,281 veh-h/y	549 ped-h/y	38,086 pers-h/y
Effective Stops	1,878,825 veh/y	27,758 ped/y	2,282,349 pers/y
Travel Distance	1,685,512 veh-km/y	1,401 ped-km/y	2,024,016 pers-km/y
Travel Time	59,606 veh-h/y	874 ped-h/y	72,401 pers-h/y
Cost	1,815,382 \$/y	19,918 \$/y	1,835,300 \$/y
Fuel Consumption	213,378 L/y		
Carbon Dioxide	505,421 kg/y		
Hydrocarbons	48 kg/y		
Carbon Monoxide	527 kg/y		
NOx	810 kg/y		

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MOVEMENT SUMMARY

 Site: 1 [Base Year PM (Option 2)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	Aver. Vehicles veh	Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	301	3.0	0.836	50.9	LOS D	26.0	186.7	0.97	0.91	1.00	27.6
2	T1	1574	3.3	0.836	46.2	LOS D	26.1	187.7	0.97	0.90	1.01	28.8
3	R2	49	2.0	0.187	72.1	LOS F	1.5	10.8	0.94	0.72	0.94	24.1
Approach		1924	3.2	0.836	47.6	LOS D	26.1	187.7	0.97	0.90	1.00	28.5
East: North Rocks Road												
4	L2	34	2.9	0.470	68.7	LOS E	5.4	38.7	0.96	0.78	0.96	25.7
5	T1	243	1.2	0.470	62.6	LOS E	6.0	42.3	0.96	0.78	0.96	28.0
6	R2	146	2.1	0.499	68.3	LOS E	6.0	43.1	0.96	0.80	0.96	26.8
Approach		423	1.7	0.499	65.0	LOS E	6.0	43.1	0.96	0.79	0.96	27.4
North: Pennant Hills Road												
7	L2	130	3.8	0.092	7.2	LOS A	0.8	5.7	0.20	0.60	0.20	52.2
8	T1	1255	6.6	0.702	40.0	LOS C	18.7	138.3	0.87	0.76	0.87	31.2
9	R2	311	1.0	0.790	81.6	LOS F	7.3	51.3	1.00	0.88	1.16	22.1
Approach		1696	5.4	0.790	45.1	LOS D	18.7	138.3	0.84	0.77	0.87	29.9
West: North Rocks Road												
10	L2	144	1.4	0.772	67.6	LOS E	12.2	86.4	1.00	0.96	1.41	25.7
11	T1	157	1.3	0.772	62.0	LOS E	12.2	86.4	1.00	0.96	1.41	27.6
12	R2	282	1.8	0.769	69.3	LOS E	12.4	88.0	1.00	0.88	1.06	22.7
Approach		583	1.5	0.772	66.9	LOS E	12.4	88.0	1.00	0.92	1.24	24.8
All Vehicles		4626	3.7	0.836	50.7	LOS D	26.1	187.7	0.93	0.85	0.98	28.3

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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	50	69.3	LOS F	0.2	0.2	0.96	0.96
P2	East Full Crossing	2	37.5	LOS D	0.0	0.0	0.71	0.71
P3	North Full Crossing	8	68.2	LOS F	0.0	0.0	0.95	0.95
P4	West Full Crossing	1	35.4	LOS D	0.0	0.0	0.69	0.69
All Pedestrians		61	67.5	LOS F			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

 **Site: 1 [Base Year AM (Option 3)]**

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	29.2 km/h	1.7 km/h	28.6 km/h
Travel Distance (Total)	3591.8 veh-km/h	5.9 ped-km/h	4316.1 pers-km/h
Travel Time (Total)	123.0 veh-h/h	3.5 ped-h/h	151.1 pers-h/h
Demand Flows (Total)	4725 veh/h	130 ped/h	5800 pers/h
Percent Heavy Vehicles (Demand)	5.8 %		
Degree of Saturation	0.805	0.104	
Practical Spare Capacity	11.8 %		
Effective Intersection Capacity	5870 veh/h		
Control Delay (Total)	62.68 veh-h/h	2.14 ped-h/h	77.36 pers-h/h
Control Delay (Average)	47.8 sec	59.2 sec	48.0 sec
Control Delay (Worst Lane)	81.6 sec		
Control Delay (Worst Movement)	84.5 sec	69.3 sec	84.5 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	46.1 sec		
Idling Time (Average)	41.6 sec		
Intersection Level of Service (LOS)	LOS D	LOS E	
Aver. Back of Queue - Vehicles (Worst Lane)	25.2 veh		
Aver. Back of Queue - Distance (Worst Lane)	185.4 m		
Queue Storage Ratio (Worst Lane)	0.46		
Total Effective Stops	3752 veh/h	114 ped/h	4616 pers/h
Effective Stop Rate	0.79	0.88	0.80
Proportion Queued	0.88	0.88	0.88
Performance Index	373.3	4.1	377.5
Cost (Total)	3794.21 \$/h	80.07 \$/h	3874.28 \$/h
Fuel Consumption (Total)	477.8 L/h		
Carbon Dioxide (Total)	1136.9 kg/h		
Hydrocarbons (Total)	0.106 kg/h		
Carbon Monoxide (Total)	1.175 kg/h		
NOx (Total)	2.494 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 15.8% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,268,000 veh/y	62,400 ped/y	2,784,000 pers/y
Delay	30,089 veh-h/y	1,026 ped-h/y	37,132 pers-h/y
Effective Stops	1,800,775 veh/y	54,856 ped/y	2,215,786 pers/y
Travel Distance	1,724,074 veh-km/y	2,849 ped-km/y	2,071,737 pers-km/y
Travel Time	59,050 veh-h/y	1,686 ped-h/y	72,546 pers-h/y
Cost	1,821,223 \$/y	38,432 \$/y	1,859,655 \$/y
Fuel Consumption	229,362 L/y		
Carbon Dioxide	545,722 kg/y		
Hydrocarbons	51 kg/y		
Carbon Monoxide	564 kg/y		
NOx	1,197 kg/y		

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MOVEMENT SUMMARY

 Site: 1 [Base Year AM (Option 3)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	Aver. Vehicles veh	Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	195	3.6	0.654	41.3	LOS C	17.6	131.5	0.85	0.80	0.85	31.0
2	T1	1283	10.1	0.654	36.3	LOS C	17.8	135.2	0.85	0.77	0.85	32.4
3	R2	215	0.9	0.765	77.7	LOS F	7.4	52.0	0.99	0.84	1.08	23.1
Approach		1693	8.2	0.765	42.2	LOS C	17.8	135.2	0.87	0.78	0.88	30.5
East: North Rocks Road												
4	L2	34	5.9	0.358	67.6	LOS E	3.9	28.4	0.94	0.76	0.94	25.8
5	T1	173	2.3	0.358	61.3	LOS E	4.4	31.6	0.94	0.75	0.94	28.3
6	R2	168	1.2	0.805	81.6	LOS F	7.9	55.8	1.00	0.90	1.18	24.3
Approach		375	2.1	0.805	71.0	LOS F	7.9	55.8	0.97	0.82	1.05	26.1
North: Pennant Hills Road												
7	L2	130	6.9	0.103	10.5	LOS A	1.5	11.0	0.31	0.63	0.31	49.5
8	T1	1641	6.2	0.793	35.2	LOS C	25.2	185.4	0.86	0.77	0.86	33.1
9	R2	307	2.9	0.666	74.8	LOS F	6.8	48.5	1.00	0.82	1.02	23.4
Approach		2078	5.7	0.793	39.5	LOS C	25.2	185.4	0.85	0.77	0.85	31.8
West: North Rocks Road												
10	L2	52	7.7	0.768	84.5	LOS F	11.0	78.2	1.00	0.95	1.57	22.7
11	T1	201	0.5	0.768	78.8	LOS F	11.0	78.2	1.00	0.95	1.57	24.5
12	R2	326	1.5	0.739	77.8	LOS F	7.4	52.5	1.00	0.86	1.09	21.1
Approach		579	1.7	0.768	78.8	LOS F	11.0	78.2	1.00	0.90	1.30	22.5
All Vehicles		4725	5.8	0.805	47.8	LOS D	25.2	185.4	0.88	0.79	0.93	29.2

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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	50	69.3	LOS F	0.2	0.2	0.96	0.96
P2	East Full Crossing	6	30.7	LOS D	0.0	0.0	0.64	0.64
P3	North Full Crossing	44	69.2	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	30	33.4	LOS D	0.1	0.1	0.67	0.67
All Pedestrians		130	59.2	LOS E			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

 Site: 1 [Base Year PM (Option 3)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	30.5 km/h	1.6 km/h	30.1 km/h
Travel Distance (Total)	3512.2 veh-km/h	2.9 ped-km/h	4217.6 pers-km/h
Travel Time (Total)	115.3 veh-h/h	1.8 ped-h/h	140.2 pers-h/h
Demand Flows (Total)	4626 veh/h	61 ped/h	5612 pers/h
Percent Heavy Vehicles (Demand)	3.7 %		
Degree of Saturation	0.748	0.104	
Practical Spare Capacity	20.3 %		
Effective Intersection Capacity	6186 veh/h		
Control Delay (Total)	56.31 veh-h/h	1.14 ped-h/h	68.71 pers-h/h
Control Delay (Average)	43.8 sec	67.0 sec	44.1 sec
Control Delay (Worst Lane)	83.4 sec		
Control Delay (Worst Movement)	82.9 sec	69.3 sec	82.9 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	42.1 sec		
Idling Time (Average)	37.8 sec		
Intersection Level of Service (LOS)	LOS D	LOS F	
Aver. Back of Queue - Vehicles (Worst Lane)	23.2 veh		
Aver. Back of Queue - Distance (Worst Lane)	166.8 m		
Queue Storage Ratio (Worst Lane)	0.56		
Total Effective Stops	3579 veh/h	58 ped/h	4352 pers/h
Effective Stop Rate	0.77	0.94	0.78
Proportion Queued	0.86	0.94	0.86
Performance Index	364.3	2.1	366.4
Cost (Total)	3458.50 \$/h	41.32 \$/h	3499.83 \$/h
Fuel Consumption (Total)	422.3 L/h		
Carbon Dioxide (Total)	1000.5 kg/h		
Hydrocarbons (Total)	0.093 kg/h		
Carbon Monoxide (Total)	1.053 kg/h		
NOx (Total)	1.577 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 5.2 %

Number of Iterations: 6 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 13.9% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,220,480 veh/y	29,280 ped/y	2,693,856 pers/y
Delay	27,029 veh-h/y	545 ped-h/y	32,980 pers-h/y
Effective Stops	1,717,844 veh/y	27,624 ped/y	2,089,037 pers/y
Travel Distance	1,685,872 veh-km/y	1,403 ped-km/y	2,024,449 pers-km/y
Travel Time	55,349 veh-h/y	870 ped-h/y	67,288 pers-h/y
Cost	1,660,082 \$/y	19,835 \$/y	1,679,917 \$/y
Fuel Consumption	202,718 L/y		
Carbon Dioxide	480,219 kg/y		
Hydrocarbons	44 kg/y		
Carbon Monoxide	505 kg/y		
NOx	757 kg/y		

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MOVEMENT SUMMARY

 Site: 1 [Base Year PM (Option 3)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	Aver. Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	301	3.0	0.748	41.5	LOS C	22.9	164.6	0.89	0.84	0.89	30.7
2	T1	1574	3.3	0.748	36.8	LOS C	23.2	166.8	0.90	0.82	0.90	32.2
3	R2	49	2.0	0.373	82.9	LOS F	1.7	11.9	1.00	0.72	1.00	22.2
Approach		1924	3.2	0.748	38.7	LOS C	23.2	166.8	0.90	0.82	0.90	31.5
East: North Rocks Road												
4	L2	34	2.9	0.470	68.7	LOS E	5.4	38.7	0.96	0.78	0.96	25.7
5	T1	243	1.2	0.470	62.6	LOS E	6.0	42.3	0.96	0.78	0.96	28.0
6	R2	146	2.1	0.748	79.9	LOS F	6.7	47.8	1.00	0.86	1.11	24.6
Approach		423	1.7	0.748	69.0	LOS E	6.7	47.8	0.97	0.81	1.01	26.5
North: Pennant Hills Road												
7	L2	130	3.8	0.091	7.3	LOS A	0.8	5.9	0.20	0.60	0.20	52.2
8	T1	1255	6.6	0.528	27.9	LOS B	14.5	107.5	0.73	0.64	0.73	36.5
9	R2	311	1.0	0.744	78.8	LOS F	7.1	50.1	1.00	0.85	1.10	22.7
Approach		1696	5.4	0.744	35.7	LOS C	14.5	107.5	0.74	0.68	0.76	33.4
West: North Rocks Road												
10	L2	144	1.4	0.701	66.0	LOS E	11.4	81.0	0.98	0.94	1.44	26.1
11	T1	157	1.3	0.701	60.4	LOS E	11.4	81.0	0.98	0.94	1.44	28.0
12	R2	282	1.8	0.501	69.1	LOS E	5.9	41.8	0.97	0.80	0.97	22.8
Approach		583	1.5	0.701	66.0	LOS E	11.4	81.0	0.97	0.87	1.21	25.0
All Vehicles		4626	3.7	0.748	43.8	LOS D	23.2	166.8	0.86	0.77	0.90	30.5

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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	50	69.3	LOS F	0.2	0.2	0.96	0.96
P2	East Full Crossing	2	27.6	LOS C	0.0	0.0	0.61	0.61
P3	North Full Crossing	8	67.2	LOS F	0.0	0.0	0.95	0.95
P4	West Full Crossing	1	32.7	LOS D	0.0	0.0	0.66	0.66
All Pedestrians		61	67.0	LOS F			0.94	0.94

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

Site: 1 [Future Year AM (Do Nothing)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Phase Times)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	11.1 km/h	1.8 km/h	11.0 km/h
Travel Distance (Total)	5666.4 veh-km/h	3.3 ped-km/h	6803.0 pers-km/h
Travel Time (Total)	512.6 veh-h/h	1.8 ped-h/h	616.9 pers-h/h
Demand Flows (Total)	5554 veh/h	80 ped/h	6745 pers/h
Percent Heavy Vehicles (Demand)	5.9 %		
Degree of Saturation	1.286	0.092	
Practical Spare Capacity	-30.0 %		
Effective Intersection Capacity	4318 veh/h		
Control Delay (Total)	392.65 veh-h/h	1.09 ped-h/h	472.27 pers-h/h
Control Delay (Average)	254.5 sec	48.9 sec	252.1 sec
Control Delay (Worst Lane)	594.1 sec		
Control Delay (Worst Movement)	594.5 sec	69.2 sec	594.5 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	252.8 sec		
Idling Time (Average)	254.8 sec		
Intersection Level of Service (LOS)	LOS F	LOS E	
Aver. Back of Queue - Vehicles (Worst Lane)	102.6 veh		
Aver. Back of Queue - Distance (Worst Lane)	756.8 m		
Queue Storage Ratio (Worst Lane)	1.51		
Total Effective Stops	9025 veh/h	63 ped/h	10893 pers/h
Effective Stop Rate	1.62	0.78	1.61
Proportion Queued	0.96	0.78	0.95
Performance Index	1572.4	2.1	1574.6
Cost (Total)	15692.56 \$/h	40.74 \$/h	15733.29 \$/h
Fuel Consumption (Total)	1175.0 L/h		
Carbon Dioxide (Total)	2789.3 kg/h		
Hydrocarbons (Total)	0.317 kg/h		
Carbon Monoxide (Total)	2.656 kg/h		
NOx (Total)	4.987 kg/h		

Site Level of Service (LOS) Method: Delay (SIDRA). 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 2 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 2.9% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,665,920 veh/y	38,400 ped/y	3,237,505 pers/y
Delay	188,474 veh-h/y	522 ped-h/y	226,691 pers-h/y
Effective Stops	4,331,931 veh/y	30,115 ped/y	5,228,433 pers/y
Travel Distance	2,719,888 veh-km/y	1,570 ped-km/y	3,265,435 pers-km/y
Travel Time	246,060 veh-h/y	858 ped-h/y	296,129 pers-h/y
Cost	7,532,427 \$/y	19,553 \$/y	7,551,980 \$/y
Fuel Consumption	563,985 L/y		
Carbon Dioxide	1,338,876 kg/y		
Hydrocarbons	152 kg/y		
Carbon Monoxide	1,275 kg/y		
NOx	2,394 kg/y		

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MOVEMENT SUMMARY

Site: 1 [Future Year AM (Do Nothing)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Pennant Hills Road												
1	L2	228	3.5	0.205	14.7	LOS B	3.5	25.3	0.47	0.70	0.47	47.2
2	T1	1503	10.1	1.078	148.1	LOS F	90.0	684.7	0.92	1.41	1.63	17.4
3	R2	252	0.8	1.155	286.7	LOS F	21.7	152.7	0.99	1.44	2.48	10.3
Approach		1983	8.2	1.155	150.4	LOS F	90.0	684.7	0.88	1.33	1.61	17.1
East: North Rocks Road												
4	L2	36	5.6	0.098	57.1	LOS E	1.3	9.5	0.84	0.72	0.84	30.5
5	T1	183	2.2	1.286	589.2	LOS F	30.8	217.6	1.00	2.24	4.01	5.5
6	R2	178	1.1	1.286	594.5	LOS F	30.8	217.6	1.00	2.23	3.99	5.5
Approach		397	2.0	1.286	543.3	LOS F	30.8	217.6	0.99	2.10	3.71	5.9
North: Pennant Hills Road												
7	L2	156	7.1	1.085	219.5	LOS F	102.6	756.8	1.00	1.67	2.19	12.2
8	T1	1974	6.1	1.085	223.0	LOS F	102.6	756.8	1.00	1.79	2.20	12.3
9	R2	369	3.0	1.015	111.3	LOS F	10.1	72.8	1.00	1.11	1.99	16.2
Approach		2499	5.7	1.085	206.3	LOS F	102.6	756.8	1.00	1.68	2.17	12.8
West: North Rocks Road												
10	L2	61	8.2	1.284	552.6	LOS F	53.4	379.9	1.00	1.79	3.92	5.4
11	T1	234	0.4	1.284	547.0	LOS F	53.4	379.9	1.00	1.79	3.92	5.4
12	R2	380	1.6	1.284	585.4	LOS F	53.5	379.4	1.00	2.17	3.92	5.5
Approach		675	1.8	1.284	569.1	LOS F	53.5	379.9	1.00	2.00	3.92	5.5
All Vehicles		5554	5.9	1.286	254.5	LOS F	102.6	756.8	0.96	1.62	2.29	11.1

Site Level of Service (LOS) Method: Delay (SIDRA). 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.

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.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue		Prop. Queued	Effective Stop Rate	
		ped/h	sec		Pedestrian ped	Distance m			
P2	East Full Crossing	6	21.3	LOS C	0.0	0.0	0.53	0.53	
P3	North Full Crossing	44	69.2	LOS F	0.2	0.2	0.96	0.96	
P4	West Full Crossing	30	24.7	LOS C	0.1	0.1	0.57	0.57	
All Pedestrians		80	48.9	LOS E			0.78	0.78	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

Site: 1 [Future Year PM (Do Nothing)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Phase Times)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	10.0 km/h	1.7 km/h	10.0 km/h
Travel Distance (Total)	5672.8 veh-km/h	0.5 ped-km/h	6807.9 pers-km/h
Travel Time (Total)	568.8 veh-h/h	0.3 ped-h/h	682.8 pers-h/h
Demand Flows (Total)	5559 veh/h	11 ped/h	6682 pers/h
Percent Heavy Vehicles (Demand)	3.7 %		
Degree of Saturation	1.410	0.017	
Practical Spare Capacity	-36.2 %		
Effective Intersection Capacity	3943 veh/h		
Control Delay (Total)	459.85 veh-h/h	0.18 ped-h/h	552.00 pers-h/h
Control Delay (Average)	297.8 sec	57.7 sec	297.4 sec
Control Delay (Worst Lane)	810.2 sec		
Control Delay (Worst Movement)	811.5 sec	69.1 sec	811.5 sec
Geometric Delay (Average)	1.8 sec		
Stop-Line Delay (Average)	296.0 sec		
Idling Time (Average)	289.3 sec		
Intersection Level of Service (LOS)	LOS F	LOS E	
Aver. Back of Queue - Vehicles (Worst Lane)	175.6 veh		
Aver. Back of Queue - Distance (Worst Lane)	1264.3 m		
Queue Storage Ratio (Worst Lane)	2.53		
Total Effective Stops	9821 veh/h	9 ped/h	11795 pers/h
Effective Stop Rate	1.77	0.86	1.77
Proportion Queued	0.95	0.86	0.95
Performance Index	1635.8	0.3	1636.2
Cost (Total)	17252.33 \$/h	6.32 \$/h	17258.65 \$/h
Fuel Consumption (Total)	1186.2 L/h		
Carbon Dioxide (Total)	2804.8 kg/h		
Hydrocarbons (Total)	0.313 kg/h		
Carbon Monoxide (Total)	2.530 kg/h		
NOx (Total)	3.389 kg/h		

Site Level of Service (LOS) Method: Delay (SIDRA). 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 0.2% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,668,320 veh/y	5,280 ped/y	3,207,264 pers/y
Delay	220,728 veh-h/y	85 ped-h/y	264,958 pers-h/y
Effective Stops	4,714,075 veh/y	4,552 ped/y	5,661,442 pers/y
Travel Distance	2,722,964 veh-km/y	227 ped-km/y	3,267,784 pers-km/y
Travel Time	273,004 veh-h/y	133 ped-h/y	327,738 pers-h/y
Cost	8,281,117 \$/y	3,034 \$/y	8,284,151 \$/y
Fuel Consumption	569,394 L/y		
Carbon Dioxide	1,346,321 kg/y		
Hydrocarbons	150 kg/y		
Carbon Monoxide	1,214 kg/y		
NOx	1,627 kg/y		

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MOVEMENT SUMMARY

Site: 1 [Future Year PM (Do Nothing)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	Aver. Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	324	3.1	0.304	17.0	LOS B	5.8	41.6	0.54	0.73	0.54	45.9
2	T1	1697	3.3	1.270	369.9	LOS F	175.6	1264.3	0.95	2.29	2.73	8.4
3	R2	53	1.9	0.271	77.2	LOS E	1.7	12.3	0.97	0.73	0.97	26.2
Approach		2074	3.2	1.270	307.3	LOS F	175.6	1264.3	0.89	2.01	2.35	9.8
East: North Rocks Road												
4	L2	54	3.7	0.162	52.3	LOS D	1.9	13.4	0.81	0.73	0.81	31.8
5	T1	382	1.3	1.410	805.7	LOS F	60.6	429.3	1.00	3.00	4.72	4.2
6	R2	230	2.2	1.410	811.5	LOS F	59.2	421.6	1.00	2.84	4.72	4.1
Approach		666	1.8	1.410	746.6	LOS F	60.6	429.3	0.98	2.76	4.40	4.5
North: Pennant Hills Road												
7	L2	158	3.8	0.965	84.4	LOS F	52.8	388.8	1.00	1.16	1.49	25.7
8	T1	1536	6.6	0.965	78.1	LOS E	52.8	388.8	0.97	1.14	1.38	26.3
9	R2	381	1.0	0.969	102.3	LOS F	9.0	63.9	1.00	1.18	1.99	22.2
Approach		2075	5.4	0.969	83.0	LOS F	52.8	388.8	0.98	1.15	1.50	25.4
West: North Rocks Road												
10	L2	184	1.6	1.226	452.2	LOS F	50.4	357.4	1.00	1.82	3.49	6.5
11	T1	200	1.5	1.226	446.5	LOS F	50.4	357.4	1.00	1.82	3.49	6.5
12	R2	360	1.9	1.226	489.3	LOS F	51.9	369.4	1.00	2.03	3.50	6.5
Approach		744	1.7	1.226	468.6	LOS F	51.9	369.4	1.00	1.92	3.50	6.5
All Vehicles		5559	3.7	1.410	297.8	LOS F	175.6	1264.3	0.95	1.77	2.43	10.0

Site Level of Service (LOS) Method: Delay (SIDRA). 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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P2	East Full Crossing	2	25.8	LOS C	0.0	0.0	0.59	0.59
P3	North Full Crossing	8	69.1	LOS F	0.0	0.0	0.96	0.96
P4	West Full Crossing	1	29.5	LOS C	0.0	0.0	0.63	0.63
All Pedestrians		11	57.7	LOS E			0.86	0.86

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

Site: 1 [Future Year AM (Option 1)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Phase Times)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	8.5 km/h	1.8 km/h	8.5 km/h
Travel Distance (Total)	4210.8 veh-km/h	3.3 ped-km/h	5056.3 pers-km/h
Travel Time (Total)	494.2 veh-h/h	1.8 ped-h/h	594.9 pers-h/h
Demand Flows (Total)	5554 veh/h	80 ped/h	6745 pers/h
Percent Heavy Vehicles (Demand)	5.9 %		
Degree of Saturation	1.317	0.092	
Practical Spare Capacity	-31.7 %		
Effective Intersection Capacity	4216 veh/h		
Control Delay (Total)	411.30 veh-h/h	1.09 ped-h/h	494.65 pers-h/h
Control Delay (Average)	266.6 sec	49.1 sec	264.0 sec
Control Delay (Worst Lane)	648.7 sec		
Control Delay (Worst Movement)	648.7 sec	69.2 sec	648.7 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	264.9 sec		
Idling Time (Average)	258.0 sec		
Intersection Level of Service (LOS)	LOS F	LOS E	
95% Back of Queue - Vehicles (Worst Lane)	217.2 veh		
95% Back of Queue - Distance (Worst Lane)	1600.0 m		
Queue Storage Ratio (Worst Lane)	2.45		
Total Effective Stops	9281 veh/h	63 ped/h	11200 pers/h
Effective Stop Rate	1.67	0.79	1.66
Proportion Queued	0.92	0.79	0.91
Performance Index	1277.0	2.2	1279.1
Cost (Total)	15349.59 \$/h	42.13 \$/h	15391.71 \$/h
Fuel Consumption (Total)	1076.8 L/h		
Carbon Dioxide (Total)	2553.2 kg/h		
Hydrocarbons (Total)	0.299 kg/h		
Carbon Monoxide (Total)	2.364 kg/h		
NOx (Total)	4.405 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 0.0% 0.3% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,665,920 veh/y	38,400 ped/y	3,237,505 pers/y
Delay	197,424 veh-h/y	523 ped-h/y	237,432 pers-h/y
Effective Stops	4,454,897 veh/y	30,173 ped/y	5,376,048 pers/y
Travel Distance	2,021,202 veh-km/y	1,570 ped-km/y	2,427,013 pers-km/y
Travel Time	237,213 veh-h/y	887 ped-h/y	285,543 pers-h/y
Cost	7,367,801 \$/y	20,220 \$/y	7,388,021 \$/y
Fuel Consumption	516,845 L/y		
Carbon Dioxide	1,225,554 kg/y		
Hydrocarbons	144 kg/y		
Carbon Monoxide	1,135 kg/y		
NOx	2,114 kg/y		

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MOVEMENT SUMMARY

Site: 1 [Future Year AM (Option 1)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	228	3.5	0.787	32.8	LOS C	27.4	203.6	0.75	0.74	0.76	34.4
2	T1	1503	10.1	0.787	29.3	LOS C	37.4	284.8	0.80	0.73	0.80	35.5
3	R2	252	0.8	1.308	478.4	LOS F	50.0	352.2	1.00	1.77	3.27	5.4
Approach		1983	8.2	1.308	86.8	LOS F	50.0	352.2	0.82	0.87	1.11	19.8
East: North Rocks Road												
4	L2	36	5.6	0.755	83.7	LOS F	8.6	61.9	1.00	0.87	1.15	22.6
5	T1	183	2.2	0.755	78.5	LOS F	8.6	61.9	1.00	0.86	1.16	24.6
6	R2	178	1.1	1.317	648.7	LOS F	49.6	350.7	1.00	2.32	4.20	4.6
Approach		397	2.0	1.317	334.6	LOS F	49.6	350.7	1.00	1.52	2.52	8.2
North: Pennant Hills Road												
7	L2	156	7.1	0.123	10.7	LOS A	2.9	21.8	0.33	0.64	0.33	49.4
8	T1	1974	6.1	1.179	391.7	LOS F	217.2	1600.0	1.00	2.53	3.02	5.9
9	R2	369	3.0	1.171	395.5	LOS F	37.6	270.1	1.00	1.75	3.17	6.4
Approach		2499	5.7	1.179	368.5	LOS F	217.2	1600.0	0.96	2.30	2.88	6.4
West: North Rocks Road												
10	L2	61	8.2	1.170	365.9	LOS F	60.6	431.4	1.00	1.77	3.08	6.4
11	T1	234	0.4	1.170	360.2	LOS F	60.6	431.4	1.00	1.77	3.08	7.1
12	R2	380	1.6	1.170	390.2	LOS F	67.7	480.4	1.00	1.83	3.09	5.7
Approach		675	1.8	1.170	377.6	LOS F	67.7	480.4	1.00	1.80	3.09	6.3
All Vehicles		5554	5.9	1.317	266.6	LOS F	217.2	1600.0	0.92	1.67	2.24	8.5

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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Queue Distance m	Prop. Queued	Effective Stop Rate
P2	East Full Crossing	6	25.8	LOS C	0.0	0.0	0.59	0.59
P3	North Full Crossing	44	69.2	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	30	24.1	LOS C	0.1	0.1	0.57	0.57
All Pedestrians		80	49.1	LOS E			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

Site: 1 [Future Year PM (Option 1)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	10.1 km/h	1.7 km/h	10.1 km/h
Travel Distance (Total)	4252.0 veh-km/h	0.5 ped-km/h	5102.8 pers-km/h
Travel Time (Total)	422.8 veh-h/h	0.3 ped-h/h	507.7 pers-h/h
Demand Flows (Total)	5559 veh/h	11 ped/h	6682 pers/h
Percent Heavy Vehicles (Demand)	3.7 %		
Degree of Saturation	1.113	0.010	
Practical Spare Capacity	-19.1 %		
Effective Intersection Capacity	4996 veh/h		
Control Delay (Total)	340.43 veh-h/h	0.17 ped-h/h	408.69 pers-h/h
Control Delay (Average)	220.5 sec	56.4 sec	220.2 sec
Control Delay (Worst Lane)	293.8 sec		
Control Delay (Worst Movement)	293.8 sec	65.4 sec	293.8 sec
Geometric Delay (Average)	1.8 sec		
Stop-Line Delay (Average)	218.7 sec		
Idling Time (Average)	216.3 sec		
Intersection Level of Service (LOS)	LOS F	LOS E	
95% Back of Queue - Vehicles (Worst Lane)	140.2 veh		
95% Back of Queue - Distance (Worst Lane)	1037.4 m		
Queue Storage Ratio (Worst Lane)	1.87		
Total Effective Stops	9330 veh/h	9 ped/h	11205 pers/h
Effective Stop Rate	1.68	0.86	1.68
Proportion Queued	0.98	0.86	0.98
Performance Index	1190.1	0.3	1190.4
Cost (Total)	13368.05 \$/h	6.43 \$/h	13374.48 \$/h
Fuel Consumption (Total)	964.4 L/h		
Carbon Dioxide (Total)	2281.5 kg/h		
Hydrocarbons (Total)	0.264 kg/h		
Carbon Monoxide (Total)	2.140 kg/h		
NOx (Total)	3.309 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 6.9% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,668,320 veh/y	5,280 ped/y	3,207,264 pers/y
Delay	163,408 veh-h/y	83 ped-h/y	196,172 pers-h/y
Effective Stops	4,478,381 veh/y	4,536 ped/y	5,378,593 pers/y
Travel Distance	2,040,941 veh-km/y	227 ped-km/y	2,449,356 pers-km/y
Travel Time	202,951 veh-h/y	135 ped-h/y	243,677 pers-h/y
Cost	6,416,665 \$/y	3,086 \$/y	6,419,751 \$/y
Fuel Consumption	462,889 L/y		
Carbon Dioxide	1,095,116 kg/y		
Hydrocarbons	127 kg/y		
Carbon Monoxide	1,027 kg/y		
NOx	1,588 kg/y		

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\SIDRA_PennantHills-NorthRocks\Pennant Hills_North Rocks_v4.sip8

MOVEMENT SUMMARY

Site: 1 [Future Year PM (Option 1)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	324	3.1	1.065	221.7	LOS F	94.1	676.4	1.00	1.58	2.15	9.6
2	T1	1697	3.3	1.065	211.2	LOS F	127.0	913.9	1.00	1.75	2.11	10.1
3	R2	53	1.9	0.232	74.6	LOS F	2.8	19.6	0.96	0.73	0.96	23.5
Approach		2074	3.2	1.065	209.3	LOS F	127.0	913.9	1.00	1.70	2.09	10.1
East: North Rocks Road												
4	L2	54	3.7	0.985	126.9	LOS F	22.5	160.2	1.00	1.28	1.76	17.1
5	T1	382	1.3	0.985	120.9	LOS F	22.5	160.2	1.00	1.28	1.76	18.7
6	R2	230	2.2	1.110	293.8	LOS F	38.9	277.7	1.00	1.62	2.67	9.3
Approach		666	1.8	1.110	181.1	LOS F	38.9	277.7	1.00	1.39	2.08	13.8
North: Pennant Hills Road												
7	L2	158	3.8	0.115	8.1	LOS A	2.0	14.6	0.24	0.62	0.24	51.5
8	T1	1536	6.6	1.113	285.1	LOS F	140.2	1037.4	1.00	2.11	2.50	7.8
9	R2	381	1.0	1.107	289.7	LOS F	31.8	224.7	1.00	1.54	2.68	8.4
Approach		2075	5.4	1.113	264.9	LOS F	140.2	1037.4	0.94	1.89	2.36	8.6
West: North Rocks Road												
10	L2	184	1.6	1.040	143.3	LOS F	42.6	302.0	1.00	1.24	2.02	12.0
11	T1	200	1.5	1.040	137.7	LOS F	42.6	302.0	1.00	1.24	2.02	13.2
12	R2	360	1.9	1.040	186.9	LOS F	46.9	333.8	1.00	1.35	2.04	11.0
Approach		744	1.7	1.040	162.9	LOS F	46.9	333.8	1.00	1.29	2.03	11.9
All Vehicles		5559	3.7	1.113	220.5	LOS F	140.2	1037.4	0.98	1.68	2.18	10.1

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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Queue Distance m	Prop. Queued	Effective Stop Rate
P2	East Full Crossing	2	33.3	LOS D	0.0	0.0	0.67	0.67
P3	North Full Crossing	8	65.4	LOS F	0.0	0.0	0.93	0.93
P4	West Full Crossing	1	31.4	LOS D	0.0	0.0	0.65	0.65
All Pedestrians		11	56.4	LOS E			0.86	0.86

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

Site: 1 [Future Year AM (Option 2)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	19.2 km/h	1.7 km/h	18.9 km/h
Travel Distance (Total)	4213.4 veh-km/h	5.8 ped-km/h	5061.9 pers-km/h
Travel Time (Total)	219.7 veh-h/h	3.5 ped-h/h	267.2 pers-h/h
Demand Flows (Total)	5554 veh/h	130 ped/h	6795 pers/h
Percent Heavy Vehicles (Demand)	5.9 %		
Degree of Saturation	1.015	0.104	
Practical Spare Capacity	-11.3 %		
Effective Intersection Capacity	5474 veh/h		
Control Delay (Total)	144.26 veh-h/h	2.16 ped-h/h	175.27 pers-h/h
Control Delay (Average)	93.5 sec	59.8 sec	92.9 sec
Control Delay (Worst Lane)	155.7 sec		
Control Delay (Worst Movement)	155.7 sec	69.3 sec	155.7 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	91.8 sec		
Idling Time (Average)	88.5 sec		
Intersection Level of Service (LOS)	LOS F	LOS E	
Aver. Back of Queue - Vehicles (Worst Lane)	51.4 veh		
Aver. Back of Queue - Distance (Worst Lane)	378.6 m		
Queue Storage Ratio (Worst Lane)	0.95		
Total Effective Stops	6211 veh/h	115 ped/h	7569 pers/h
Effective Stop Rate	1.12	0.88	1.11
Proportion Queued	0.97	0.88	0.97
Performance Index	630.0	4.1	634.2
Cost (Total)	6963.40 \$/h	80.03 \$/h	7043.43 \$/h
Fuel Consumption (Total)	698.2 L/h		
Carbon Dioxide (Total)	1659.5 kg/h		
Hydrocarbons (Total)	0.170 kg/h		
Carbon Monoxide (Total)	1.659 kg/h		
NOx (Total)	3.528 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 2 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 2.8% 30.2% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,665,920 veh/y	62,400 ped/y	3,261,505 pers/y
Delay	69,244 veh-h/y	1,036 ped-h/y	84,130 pers-h/y
Effective Stops	2,981,498 veh/y	55,221 ped/y	3,633,019 pers/y
Travel Distance	2,022,444 veh-km/y	2,802 ped-km/y	2,429,734 pers-km/y
Travel Time	105,464 veh-h/y	1,685 ped-h/y	128,242 pers-h/y
Cost	3,342,431 \$/y	38,414 \$/y	3,380,845 \$/y
Fuel Consumption	335,145 L/y		
Carbon Dioxide	796,547 kg/y		
Hydrocarbons	82 kg/y		
Carbon Monoxide	796 kg/y		
NOx	1,694 kg/y		

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MOVEMENT SUMMARY

Site: 1 [Future Year AM (Option 2)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	Aver. Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	228	3.5	0.829	51.5	LOS D	24.4	181.9	0.97	0.90	1.00	27.6
2	T1	1503	10.1	0.829	46.6	LOS D	24.4	185.7	0.96	0.90	1.00	28.7
3	R2	252	0.8	0.913	88.4	LOS F	9.7	68.1	0.99	0.95	1.32	21.3
Approach		1983	8.2	0.913	52.5	LOS D	24.4	185.7	0.97	0.90	1.04	27.2
East: North Rocks Road												
4	L2	36	5.6	0.379	67.8	LOS E	4.2	30.1	0.94	0.76	0.94	25.7
5	T1	183	2.2	0.379	61.5	LOS E	4.7	33.5	0.94	0.76	0.94	28.2
6	R2	178	1.1	0.604	69.5	LOS E	7.5	53.1	0.98	0.82	0.98	26.6
Approach		397	2.0	0.604	65.7	LOS E	7.5	53.1	0.96	0.78	0.96	27.2
North: Pennant Hills Road												
7	L2	156	7.1	0.130	11.8	LOS A	2.0	14.8	0.36	0.65	0.36	48.6
8	T1	1974	6.1	1.002	125.8	LOS F	51.4	378.6	1.00	1.39	1.61	15.3
9	R2	369	3.0	1.015	155.7	LOS F	12.9	92.7	1.00	1.24	1.99	14.1
Approach		2499	5.7	1.015	123.1	LOS F	51.4	378.6	0.96	1.32	1.59	15.9
West: North Rocks Road												
10	L2	61	8.2	1.000	106.3	LOS F	17.1	121.5	1.00	1.19	1.75	14.8
11	T1	234	0.4	1.000	100.6	LOS F	17.1	121.5	1.00	1.19	1.75	16.2
12	R2	380	1.6	1.000	135.7	LOS F	22.6	160.0	1.00	1.21	1.76	13.9
Approach		675	1.8	1.000	120.9	LOS F	22.6	160.0	1.00	1.20	1.76	14.8
All Vehicles		5554	5.9	1.015	93.5	LOS F	51.4	378.6	0.97	1.12	1.37	19.2

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.

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.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	50	69.3	LOS F	0.2	0.2	0.96	0.96	
P2	East Full Crossing	6	36.8	LOS D	0.0	0.0	0.70	0.70	
P3	North Full Crossing	44	69.2	LOS F	0.2	0.2	0.96	0.96	
P4	West Full Crossing	30	34.7	LOS D	0.1	0.1	0.68	0.68	
All Pedestrians		130	59.8	LOS E			0.88	0.88	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

Site: 1 [Future Year PM (Option 2)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	22.8 km/h	1.6 km/h	22.7 km/h
Travel Distance (Total)	4254.8 veh-km/h	2.9 ped-km/h	5108.7 pers-km/h
Travel Time (Total)	186.4 veh-h/h	1.8 ped-h/h	225.5 pers-h/h
Demand Flows (Total)	5559 veh/h	61 ped/h	6732 pers/h
Percent Heavy Vehicles (Demand)	3.7 %		
Degree of Saturation	0.966	0.104	
Practical Spare Capacity	-6.8 %		
Effective Intersection Capacity	5757 veh/h		
Control Delay (Total)	114.89 veh-h/h	1.14 ped-h/h	139.00 pers-h/h
Control Delay (Average)	74.4 sec	67.3 sec	74.3 sec
Control Delay (Worst Lane)	93.6 sec		
Control Delay (Worst Movement)	95.2 sec	69.3 sec	95.2 sec
Geometric Delay (Average)	1.8 sec		
Stop-Line Delay (Average)	72.6 sec		
Idling Time (Average)	67.1 sec		
Intersection Level of Service (LOS)	LOS F	LOS F	
Aver. Back of Queue - Vehicles (Worst Lane)	40.8 veh		
Aver. Back of Queue - Distance (Worst Lane)	293.4 m		
Queue Storage Ratio (Worst Lane)	0.98		
Total Effective Stops	5695 veh/h	58 ped/h	6892 pers/h
Effective Stop Rate	1.02	0.95	1.02
Proportion Queued	0.97	0.95	0.97
Performance Index	618.1	2.1	620.3
Cost (Total)	5809.07 \$/h	41.41 \$/h	5850.48 \$/h
Fuel Consumption (Total)	602.7 L/h		
Carbon Dioxide (Total)	1427.0 kg/h		
Hydrocarbons (Total)	0.141 kg/h		
Carbon Monoxide (Total)	1.444 kg/h		
NOx (Total)	2.256 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 3 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 15.7% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,668,320 veh/y	29,280 ped/y	3,231,264 pers/y
Delay	55,146 veh-h/y	547 ped-h/y	66,722 pers-h/y
Effective Stops	2,733,791 veh/y	27,720 ped/y	3,308,269 pers/y
Travel Distance	2,042,292 veh-km/y	1,401 ped-km/y	2,452,152 pers-km/y
Travel Time	89,468 veh-h/y	872 ped-h/y	108,233 pers-h/y
Cost	2,788,354 \$/y	19,875 \$/y	2,808,229 \$/y
Fuel Consumption	289,289 L/y		
Carbon Dioxide	684,976 kg/y		
Hydrocarbons	68 kg/y		
Carbon Monoxide	693 kg/y		
NOx	1,083 kg/y		

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MOVEMENT SUMMARY

Site: 1 [Future Year PM (Option 2)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	Aver. Vehicles veh	Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	324	3.1	0.966	95.2	LOS F	40.8	293.4	1.00	1.14	1.37	18.7
2	T1	1697	3.3	0.966	89.7	LOS F	40.8	293.4	1.00	1.19	1.37	19.4
3	R2	53	1.9	0.190	71.1	LOS F	1.6	11.6	0.94	0.72	0.94	24.3
Approach		2074	3.2	0.966	90.1	LOS F	40.8	293.4	1.00	1.17	1.36	19.4
East: North Rocks Road												
4	L2	54	3.7	0.741	73.7	LOS F	9.2	65.4	1.00	0.87	1.07	24.6
5	T1	382	1.3	0.741	67.4	LOS E	10.1	71.6	1.00	0.87	1.06	26.9
6	R2	230	2.2	0.786	75.1	LOS F	10.4	74.5	1.00	0.89	1.11	25.5
Approach		666	1.8	0.786	70.6	LOS F	10.4	74.5	1.00	0.88	1.08	26.2
North: Pennant Hills Road												
7	L2	158	3.8	0.116	7.9	LOS A	1.2	8.5	0.23	0.62	0.23	51.7
8	T1	1536	6.6	0.859	53.7	LOS D	25.3	186.9	0.96	0.93	1.06	26.7
9	R2	381	1.0	0.912	93.6	LOS F	9.9	69.8	1.00	1.00	1.43	20.3
Approach		2075	5.4	0.912	57.5	LOS E	25.3	186.9	0.91	0.92	1.07	26.3
West: North Rocks Road												
10	L2	184	1.6	0.900	84.8	LOS F	18.5	131.0	1.00	1.12	1.71	22.3
11	T1	200	1.5	0.900	79.2	LOS F	18.5	131.0	1.00	1.12	1.71	24.1
12	R2	360	1.9	0.893	80.5	LOS F	18.0	128.0	1.00	0.98	1.24	20.7
Approach		744	1.7	0.900	81.2	LOS F	18.5	131.0	1.00	1.05	1.48	22.1
All Vehicles		5559	3.7	0.966	74.4	LOS F	40.8	293.4	0.97	1.02	1.23	22.8

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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	50	69.3	LOS F	0.2	0.2	0.96	0.96
P2	East Full Crossing	2	40.3	LOS E	0.0	0.0	0.73	0.73
P3	North Full Crossing	8	65.4	LOS F	0.0	0.0	0.93	0.93
P4	West Full Crossing	1	38.2	LOS D	0.0	0.0	0.71	0.71
All Pedestrians		61	67.3	LOS F			0.95	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

Site: 1 [Future Year AM (Option 3)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	26.1 km/h	1.7 km/h	25.7 km/h
Travel Distance (Total)	4214.3 veh-km/h	5.9 ped-km/h	5063.1 pers-km/h
Travel Time (Total)	161.5 veh-h/h	3.5 ped-h/h	197.3 pers-h/h
Demand Flows (Total)	5554 veh/h	130 ped/h	6795 pers/h
Percent Heavy Vehicles (Demand)	5.9 %		
Degree of Saturation	0.935	0.104	
Practical Spare Capacity	-3.8 %		
Effective Intersection Capacity	5937 veh/h		
Control Delay (Total)	90.69 veh-h/h	2.12 ped-h/h	110.96 pers-h/h
Control Delay (Average)	58.8 sec	58.8 sec	58.8 sec
Control Delay (Worst Lane)	107.4 sec		
Control Delay (Worst Movement)	111.9 sec	69.3 sec	111.9 sec
Geometric Delay (Average)	1.7 sec		
Stop-Line Delay (Average)	57.1 sec		
Idling Time (Average)	51.7 sec		
Intersection Level of Service (LOS)	LOS E	LOS E	
Aver. Back of Queue - Vehicles (Worst Lane)	42.1 veh		
Aver. Back of Queue - Distance (Worst Lane)	310.3 m		
Queue Storage Ratio (Worst Lane)	0.78		
Total Effective Stops	5071 veh/h	114 ped/h	6199 pers/h
Effective Stop Rate	0.91	0.88	0.91
Proportion Queued	0.92	0.88	0.92
Performance Index	496.3	4.1	500.4
Cost (Total)	5044.44 \$/h	79.77 \$/h	5124.21 \$/h
Fuel Consumption (Total)	597.0 L/h		
Carbon Dioxide (Total)	1420.1 kg/h		
Hydrocarbons (Total)	0.135 kg/h		
Carbon Monoxide (Total)	1.449 kg/h		
NOx (Total)	3.110 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 4 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 1.4% 0.0% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,665,920 veh/y	62,400 ped/y	3,261,505 pers/y
Delay	43,533 veh-h/y	1,020 ped-h/y	53,259 pers-h/y
Effective Stops	2,433,906 veh/y	54,626 ped/y	2,975,313 pers/y
Travel Distance	2,022,871 veh-km/y	2,849 ped-km/y	2,430,294 pers-km/y
Travel Time	77,513 veh-h/y	1,679 ped-h/y	94,695 pers-h/y
Cost	2,421,333 \$/y	38,288 \$/y	2,459,621 \$/y
Fuel Consumption	286,580 L/y		
Carbon Dioxide	681,634 kg/y		
Hydrocarbons	65 kg/y		
Carbon Monoxide	696 kg/y		
NOx	1,493 kg/y		

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MOVEMENT SUMMARY

Site: 1 [Future Year AM (Option 3)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	Aver. Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	228	3.5	0.753	44.2	LOS D	21.5	160.0	0.91	0.84	0.91	29.9
2	T1	1503	10.1	0.753	37.7	LOS C	22.2	169.2	0.90	0.81	0.90	31.8
3	R2	252	0.8	0.914	88.4	LOS F	9.7	68.1	0.99	0.95	1.32	21.3
Approach		1983	8.2	0.914	44.9	LOS D	22.2	169.2	0.91	0.83	0.95	29.5
East: North Rocks Road												
4	L2	36	5.6	0.379	67.8	LOS E	4.2	30.1	0.94	0.76	0.94	25.7
5	T1	183	2.2	0.379	61.5	LOS E	4.7	33.5	0.94	0.76	0.94	28.2
6	R2	178	1.1	0.906	92.9	LOS F	9.1	64.6	1.00	1.02	1.42	22.4
Approach		397	2.0	0.906	76.2	LOS F	9.1	64.6	0.97	0.88	1.16	25.1
North: Pennant Hills Road												
7	L2	156	7.1	0.129	12.2	LOS A	2.1	15.7	0.36	0.64	0.36	48.3
8	T1	1974	6.1	0.935	55.5	LOS D	42.1	310.3	0.92	0.97	1.08	26.3
9	R2	369	3.0	0.761	77.0	LOS F	8.4	60.2	1.00	0.87	1.10	23.0
Approach		2499	5.7	0.935	56.0	LOS D	42.1	310.3	0.90	0.93	1.04	26.6
West: North Rocks Road												
10	L2	61	8.2	0.931	111.9	LOS F	15.8	112.4	1.00	1.20	1.98	18.7
11	T1	234	0.4	0.931	106.2	LOS F	15.8	112.4	1.00	1.20	1.98	20.4
12	R2	380	1.6	0.913	93.9	LOS F	9.9	70.0	1.00	1.02	1.43	18.7
Approach		675	1.8	0.931	99.8	LOS F	15.8	112.4	1.00	1.10	1.67	19.3
All Vehicles		5554	5.9	0.935	58.8	LOS E	42.1	310.3	0.92	0.91	1.09	26.1

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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	50	69.3	LOS F	0.2	0.2	0.96	0.96
P2	East Full Crossing	6	29.5	LOS C	0.0	0.0	0.63	0.63
P3	North Full Crossing	44	69.2	LOS F	0.2	0.2	0.96	0.96
P4	West Full Crossing	30	32.1	LOS D	0.1	0.1	0.65	0.65
All Pedestrians		130	58.8	LOS E			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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INTERSECTION SUMMARY

Site: 1 [Future Year PM (Option 3)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Intersection Performance - Hourly Values			
Performance Measure	Vehicles	Pedestrians	Persons
Travel Speed (Average)	26.8 km/h	1.6 km/h	26.6 km/h
Travel Distance (Total)	4255.7 veh-km/h	2.9 ped-km/h	5109.8 pers-km/h
Travel Time (Total)	158.9 veh-h/h	1.8 ped-h/h	192.5 pers-h/h
Demand Flows (Total)	5559 veh/h	61 ped/h	6732 pers/h
Percent Heavy Vehicles (Demand)	3.7 %		
Degree of Saturation	0.912	0.078	
Practical Spare Capacity	-1.3 %		
Effective Intersection Capacity	6096 veh/h		
Control Delay (Total)	87.40 veh-h/h	1.11 ped-h/h	105.99 pers-h/h
Control Delay (Average)	56.6 sec	65.4 sec	56.7 sec
Control Delay (Worst Lane)	93.6 sec		
Control Delay (Worst Movement)	93.6 sec	67.4 sec	93.6 sec
Geometric Delay (Average)	1.8 sec		
Stop-Line Delay (Average)	54.8 sec		
Idling Time (Average)	49.8 sec		
Intersection Level of Service (LOS)	LOS E	LOS F	
Aver. Back of Queue - Vehicles (Worst Lane)	32.3 veh		
Aver. Back of Queue - Distance (Worst Lane)	232.4 m		
Queue Storage Ratio (Worst Lane)	0.77		
Total Effective Stops	5016 veh/h	57 ped/h	6076 pers/h
Effective Stop Rate	0.90	0.93	0.90
Proportion Queued	0.93	0.93	0.93
Performance Index	519.3	2.1	521.4
Cost (Total)	4880.43 \$/h	40.71 \$/h	4921.14 \$/h
Fuel Consumption (Total)	552.6 L/h		
Carbon Dioxide (Total)	1308.8 kg/h		
Hydrocarbons (Total)	0.125 kg/h		
Carbon Monoxide (Total)	1.351 kg/h		
NOx (Total)	2.075 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.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Site Model Variability Index (Iterations 3 to N): 0.0 %

Number of Iterations: 2 (Maximum: 10)

Largest change in Lane Degrees of Saturation for the last three Main (Timing-Capacity) Iterations: 4.8% 4.5% 0.0%

Intersection Performance - Annual Values			
Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows (Total)	2,668,320 veh/y	29,280 ped/y	3,231,264 pers/y
Delay	41,952 veh-h/y	532 ped-h/y	50,875 pers-h/y
Effective Stops	2,407,552 veh/y	27,319 ped/y	2,916,382 pers/y
Travel Distance	2,042,733 veh-km/y	1,403 ped-km/y	2,452,682 pers-km/y
Travel Time	76,269 veh-h/y	857 ped-h/y	92,379 pers-h/y
Cost	2,342,607 \$/y	19,540 \$/y	2,362,147 \$/y
Fuel Consumption	265,262 L/y		
Carbon Dioxide	628,218 kg/y		
Hydrocarbons	60 kg/y		
Carbon Monoxide	649 kg/y		
NOx	996 kg/y		

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MOVEMENT SUMMARY

Site: 1 [Future Year PM (Option 3)]

Pennant Hills Road / North Rocks Road

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	Aver. Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pennant Hills Road												
1	L2	324	3.1	0.901	62.5	LOS E	32.3	232.3	1.00	0.99	1.13	24.5
2	T1	1697	3.3	0.901	57.5	LOS E	32.3	232.3	1.00	1.01	1.13	25.6
3	R2	53	1.9	0.403	83.1	LOS F	1.8	12.8	1.00	0.72	1.00	22.1
Approach		2074	3.2	0.901	58.9	LOS E	32.3	232.4	1.00	1.00	1.13	25.3
East: North Rocks Road												
4	L2	54	3.7	0.588	65.3	LOS E	8.6	61.0	0.96	0.81	0.96	26.5
5	T1	382	1.3	0.588	59.1	LOS E	9.3	65.7	0.96	0.81	0.96	28.8
6	R2	230	2.2	0.898	88.9	LOS F	11.7	83.4	1.00	1.00	1.34	23.0
Approach		666	1.8	0.898	69.9	LOS E	11.7	83.4	0.98	0.87	1.09	26.3
North: Pennant Hills Road												
7	L2	158	3.8	0.114	8.0	LOS A	1.2	8.9	0.24	0.61	0.24	51.6
8	T1	1536	6.6	0.779	36.0	LOS C	23.9	176.8	0.86	0.77	0.86	32.7
9	R2	381	1.0	0.912	93.6	LOS F	9.9	69.8	1.00	1.01	1.43	20.3
Approach		2075	5.4	0.912	44.4	LOS D	23.9	176.8	0.84	0.80	0.92	30.1
West: North Rocks Road												
10	L2	184	1.6	0.847	78.5	LOS F	16.8	119.3	1.00	1.07	1.70	23.5
11	T1	200	1.5	0.847	72.8	LOS F	16.8	119.3	1.00	1.07	1.70	25.3
12	R2	360	1.9	0.590	68.5	LOS E	7.5	53.7	0.98	0.82	0.98	22.9
Approach		744	1.7	0.847	72.1	LOS F	16.8	119.3	0.99	0.95	1.35	23.7
All Vehicles		5559	3.7	0.912	56.6	LOS E	32.3	232.4	0.93	0.90	1.08	26.8

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.

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.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	50	67.4	LOS F	0.2	0.2	0.95	0.95
P2	East Full Crossing	2	32.0	LOS D	0.0	0.0	0.65	0.65
P3	North Full Crossing	8	65.4	LOS F	0.0	0.0	0.93	0.93
P4	West Full Crossing	1	37.5	LOS D	0.0	0.0	0.71	0.71
All Pedestrians		61	65.4	LOS F			0.93	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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