Issue History

File Name	Prepared	Reviewed	Issued by	Date	Issued to
P4063.001T Turnock Street Extension Trigger Point Analysis Tech Memo	A. Payne	A. Eke	A. Eke	23/07/21	Gavin Johnson *gavin@johnsonpd.com.au*
P4063.002T Turnock Street Extension Trigger Point Analysis Tech Memo	A. Payne	L. Johnston	A. Payne	29/07/21	Gavin Johnson *gavin@johnsonpd.com.au*
P4063.003T Turnock Street Extension Trigger Point Analysis Tech Memo	A. Payne	L. Johnston	A. Payne	05/08/21	Gavin Johnson *gavin@johnsonpd.com.au*
P4063.004T Turnock Street Extension Trigger Point Analysis Tech Memo	A. Payne	A. Eke	A. Payne	11/08/21	Gavin Johnson *gavin@johnsonpd.com.au*
P4063.005T Turnock Street Extension Trigger Point Analysis Tech Memo	A. Payne	A. Eke	A. Payne	26/08/21	Gavin Johnson *gavin@johnsonpd.com.au*

Southern Link Road - Turnock Street Extension

Trigger Point Analysis

1. Introduction

1.1 Background

Bitzios Consulting has been engaged to identify trigger point(s) in which the proposed southern link road, also known as Turnock Street Extension, is warranted, based on forecast traffic and transport impacts to the surrounding road network by future traffic growth including the planned Tweed Valley Hospital (the Hospital) but without development of Gales land. Noting that the extension provides an additional east-west link, trigger points for this upgrade will be associated with the performance of Cudgen Road and its intersections within the vicinity of Turnock Street.

1.2 Scope

The scope of this technical memo is as follows:

- Review traffic context and existing transport planning relevant to the link road but without development of Gales land
- Identify trigger points that warrant the construction of the link road
- Undertake a daily traffic capacity analysis of Cudgen Road and forecast the approximate time period in which daily traffic capacity of Cudgen Road is exceeded and identify associated impacts
- Identify benefits to Cudgen Road and the surrounding road network associated with the link road
- Undertake design horizon intersection modelling of critical Cudgen Road intersections.

2. Context

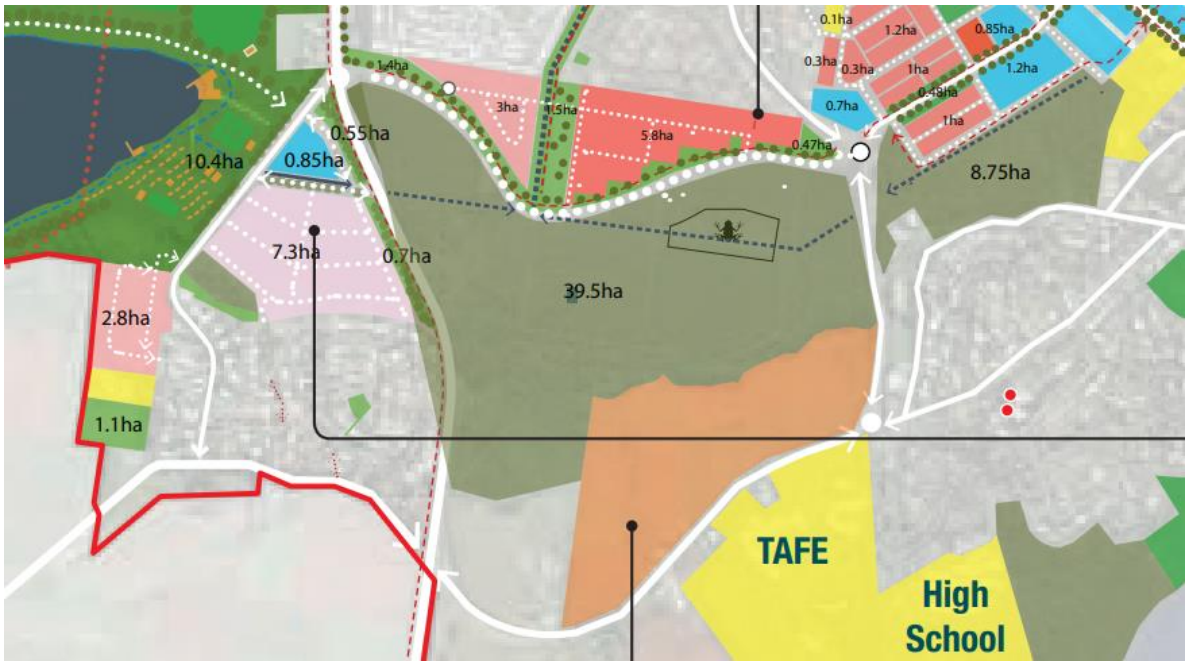
The proposed southern link road and the Tweed Coast Road / link road / Crescent Street intersection are identified in the Tweed Road Development Strategy (TRDS). As per the TRDS, the purpose of these works is to improve network connectivity and capacity by:

- Providing a new east-west link between southern Kingscliff and Tweed Coast Road
- Addressing traffic capacity issues at the Tweed Coast Road / Cudgen Road intersection
- Catering for future development in the area.

The proposed southern link road passes through Gales land and the TRDS identifies these works as being triggered by traffic growth primarily attributed to planned land releases in the area including but not limited to Gales land and Kings Forest. The TRDS was adopted in 2017, prior to the approval of the Hospital, and the TRDS did not consider the Hospital in its assessment. From a traffic perspective, these network upgrades may therefore be warranted earlier than previously envisaged based on future traffic growth including the Hospital, which is due to open in 2023, rather than development of Gales land directly, which has been the

assumption. This technical memo assesses the impact of background traffic including the Hospital without and irrespective of development over Gales land in the coming years.

The link road and roundabout upgrades are also identified in the Kingscliff Locality Plan (KLP) and Kingscliff Development Control Plan (DCP) as illustrated in Figure 2.1 of the KLP. It is critical to note that the Hospital (site illustrated in brown below) is currently under construction with an expected opening date of January 2023.



Source: Kingscliff Locality Plan

Figure 2.1: New Southern Link Road: Kingscliff Locality Plan

3. Daily Capacity Assessment

3.1 Strategic Modelling

Strategic modelling has been undertaken in the area using the Tweed Strategic Transport Model (TSTM). Figure 3.1 illustrates modelled 2041 daily traffic volumes on Cudgen Road, with and without the construction of the link road. Both of these models exclude all development of Gales but include other forecast development in the area including the Hospital and Kings Forest.

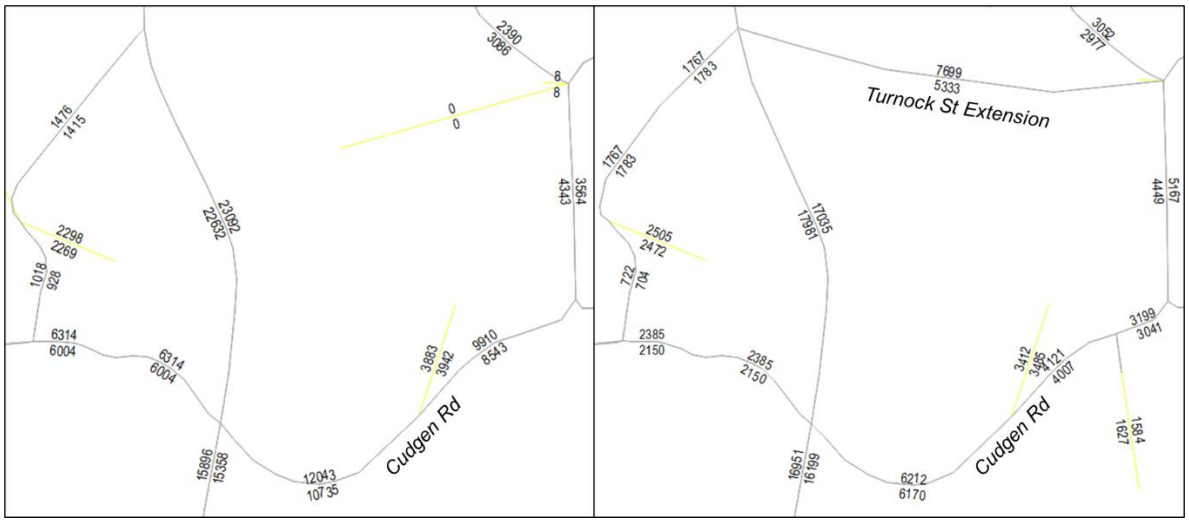


Figure 3.1: 2041 Strategic Model Daily Volume Comparison - Without Gales

By 2041, the new link road (shown as Turnock St Extension in the upper right part of Figure 3.1) provides an additional east-west link and is expected to re-route approximately half the daily traffic volumes from Cudgen Road.

Key outcomes from the strategic model are as follows:

- 2041 daily traffic volumes are distributed relatively evenly across Cudgen Road and the new road link with approximately 12,000 – 13,000 vpd expected on each
- The new link road is expected to result in the following reductions to 2041 daily traffic volumes on existing road links:
  - Cudgen Road east of the TAFE access: Reduced from approximately 18,500 to 6,200 vpd
  - Cudgen Road between Tweed Coast Road and the Hospital Access: Reduced from approximately 21,700 vpd to 12,400 vpd
  - Tweed Coast Road between Cudgen Road and the new link road: Reduced from approximately 45,700 vpd to 35,000 vpd.

The above indicates significant benefits to the surrounding road network and subsequently, greatly reduced congestion on Cudgen Road, particularly the eastern portion of Cudgen Road near the TAFE / High School area.

By balancing traffic volumes across the two east-west links, the new link road thereby maximises the capacity of each link and provides a major congestion reducing function with network permeability benefits for motorists in the Kingscliff area.

3.2 Capacity Analysis

Tweed Shire Council's (Council) Open Data Mapping identifies Cudgen Road as a Collector Road. As such, Cudgen Road is considered to have an environmental capacity of 7,000 vehicles per day (vpd). While exceeding this capacity does not represent a breakdown in traffic flow, it would be indicative of impacts to amenity for road users greater than intended for a road of this type.

A theoretical capacity of a two-lane road with uninterrupted traffic flow is 18,000vpd. This theoretical capacity is therefore identified as a threshold in which daily traffic volumes would result in significant congestion.

2016 and 2041 daily traffic volumes were sourced from the TSTM base scenarios (without Gales). Linear interpolation provided forecast daily traffic volumes in the interim years with a large increase expected in 2023 corresponding to the opening of the Hospital. Yearly daily traffic volume forecasts on Cudgen Road between Tweed Coast Road and the western Hospital access are illustrated in Figure 3.2.

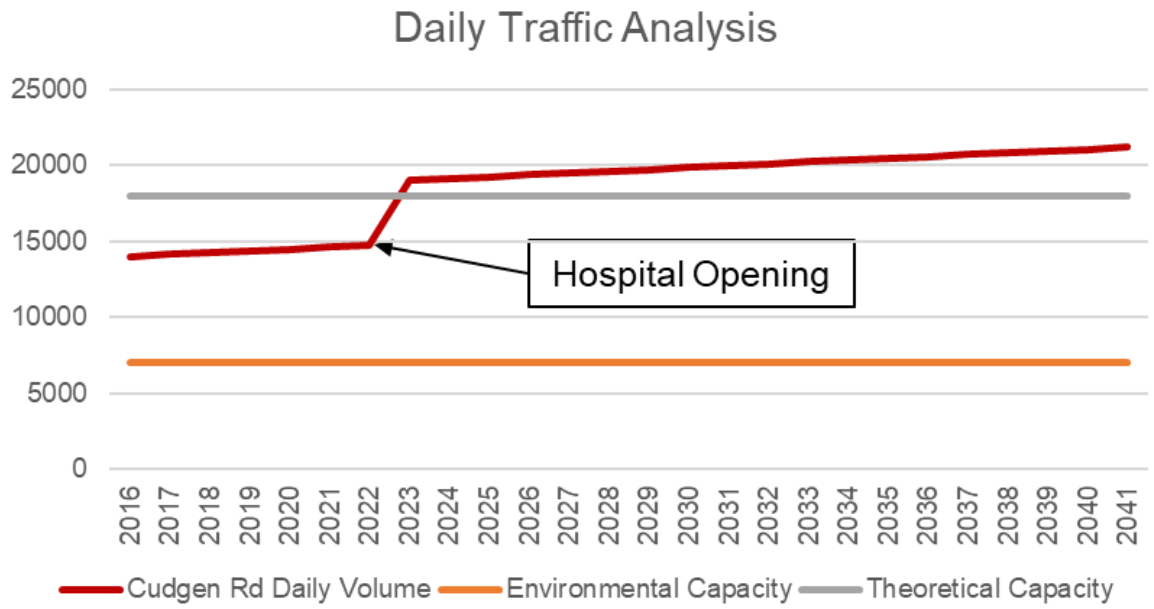


Figure 3.2: Cudgen Road Daily Traffic Analysis by Year

As shown, following the opening of the Hospital, without the link road, Cudgen Road is expected to carry over 18,000 vpd and exceed its theoretical capacity. For comparison, survey data from June 2020 indicated average weekday daily traffic volumes of 17,629 vpd on Tweed Coast Road north of Cudgen Road.

While it is acknowledged that Cudgen Road does currently have a greater through traffic carrying function than a typical collector road, it is not desirable for Cudgen Road to be carrying this level of daily traffic. The primary function of Cudgen Road is currently to provide a connection to Tweed Coast Road for residents / businesses within Kingscliff as well as servicing the TAFE and Kingscliff High School. The capacity analysis indicates that the introduction of the Hospital on Cudgen Road has expedited the need for the new link road by increasing traffic volumes along Cudgen Road. It is acknowledged that the Hospital will provide a series of intersection upgrades to address its direct traffic impacts, however the Hospital's traffic solution is predicated on the delivery of the new link road at some point in time after commencing operations and prior to the 10-year design horizon of 2033.

New transport infrastructure associated with the Hospital is also expected to significantly benefit alternate travel modes in the area with improvements to active transport and public transport connectivity. This will introduce new types of road users on Cudgen Road. While it is beneficial that the Hospital will likely encourage alternate transport modes, further increases in high traffic volumes on Cudgen Road without the new link road is expected to result in a less safe road environment for non-motorised road users including pedestrians, cyclists and in particular vulnerable users accessing the Hospital, school and TAFE.

The introduction of the link road will directly reduce traffic on Cudgen Road past the new Hospital. This outcome will therefore improve emergency vehicle access to the Hospital by reducing congestions and delays at surrounding intersections as well as the likelihood of incidents.

Based on the above, key benefits associated with the link road include the following:

- Improving network permeability to remove non essential through traffic off Cudgen Road past the Hospital, balance east-west traffic volumes and reduce congestion for the Kingscliff road network

- Significantly reducing traffic on Cudgen Road, improving safety and amenity for new public transport facilities fronting the Hospital as well as pedestrians, cyclists and vulnerable road users.
- Improve emergency vehicle access to the Hospital by reducing through traffic volumes and associated delays at Cudgen Road intersections
- Providing a critical and beneficial east-west link for Kingscliff residents and businesses, such as those around Marine Parade and Pearl Street, independent of Cudgen Road and impacts of external traffic associated with the Hospital.

Noting the above, the new link road is considered to be a critical east-west link for the local area irrespective of any development within Gales and will result in significant transport benefits for all road users on Cudgen Road, particularly following the completion of the Hospital expected in 2023. Noting the time required for approval and construction of the new road link, it is recommended that the opening of this road link should be planned as soon as practicable.

4. Intersection Modelling

4.1 Traffic Volumes

The SIDRA Intersection layouts and turn volumes were sourced from the Hospital traffic assessment. As per that assessment, a base year of 2023 was adopted assuming full development of the Hospital and no development of Gales, with traffic volumes provided at **Attachment A** (Sheet 1).

2033 traffic volumes were also sourced from the Hospital assessment and are provided at **Attachment A** (Sheet 4). A comparison of the 2023 and 2033 'with hospital' traffic volumes was undertaken to determine linear traffic growth rates for each turn movement as outlined in **Attachment A** (Sheet 2). These linear growth rates facilitate a design life analysis of the assessed intersection to forecast the year in which traffic volumes are expected to exceed the capacity of the intersection.

4.2 SIDRA Assessment

4.2.1 Methodology

To determine a trigger point for the link road based on intersection capacity SIDRA Intersection 9 was used to assess the following intersections:

- Tweed Coast Road / Cudgen Road
- Cudgen Road / Hospital Access.

The layouts of the above intersections were assessed as per the Hospital traffic assessment with all relevant upgrades. Assessments were undertaken during the morning peak hour (MVT), evening peak hour (EVT) and peak development vehicle hour (PVT).

A degree of saturation of 0.9 was identified as the intersection failure threshold as per RMS theoretical capacity requirements for signalised intersections.

4.2.2 Tweed Coast Road / Cudgen Road Intersection – 2 Lane

The Tweed Coast Road / Cudgen Road SIDRA Intersection layout, with relevant upgrades associated with the Hospital development, is illustrated in Figure 4.1.

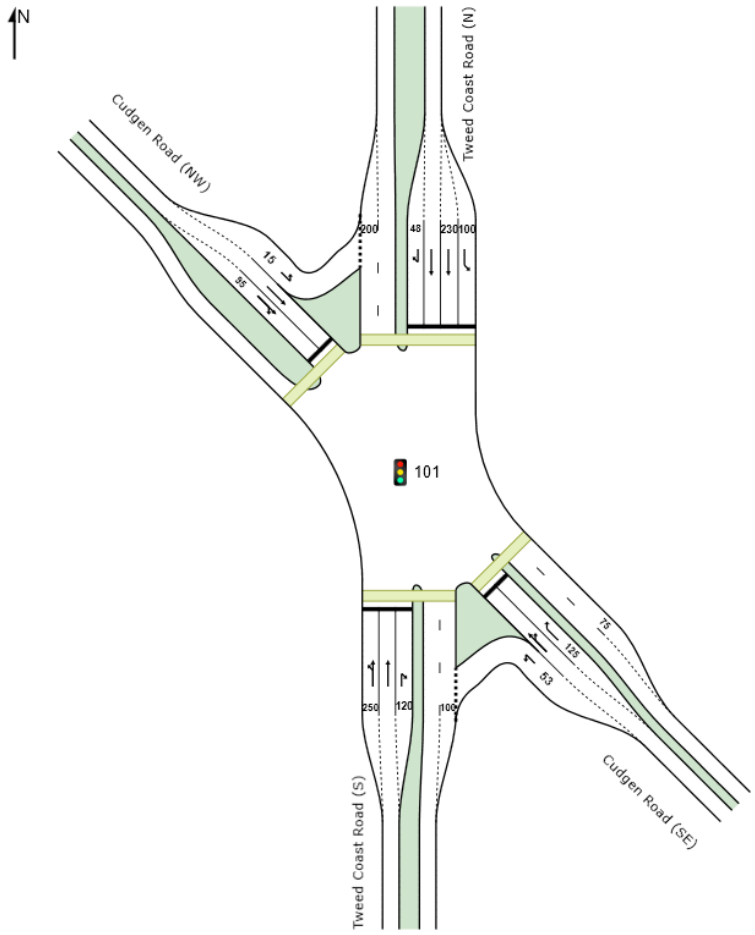


Figure 4.1: Tweed Coast Road / Cudgen Road SIDRA Intersection Layout (2-Lane)

2023 SIDRA analysis results indicated that the morning peak hour (MVT) was the critical time period for this intersection. SIDRA design life analysis indicated that, without further traffic growth and / or the new link road associated with the Gales development, the Tweed Coast Road (2 lane) / Cudgen Road intersection can cater for MVT traffic growth until the year 2027. Detailed SIDRA outputs are provided at **Attachment B** with intersection results summarised in Table 4.1.

Table 4.1: Tweed Coast Road / Cudgen Road (2-Lane) SIDRA Results Summary

Peak Period	SIDRA Intersection Results				
	Volume (vph)	DOS (v/c)	Delay (seconds)	LOS	Queue (m)
2023					
MVT	2,690	0.90	35	C	136
EVT	2,900	0.88	35	C	165
PVT	2,954	0.86	33	C	137
2027					
MVT	2,854	0.89	42	C	178

4.2.3 Tweed Coast Road / Cudgen Road Intersection – 4 Lane

It is noted that, as a part of the TRDS, Tweed Coast Road is to be upgraded to a four-lane cross-section. As a result, SIDRA modelling was also undertaken accordingly with the four-lane intersection layout shown in Figure 4.2.

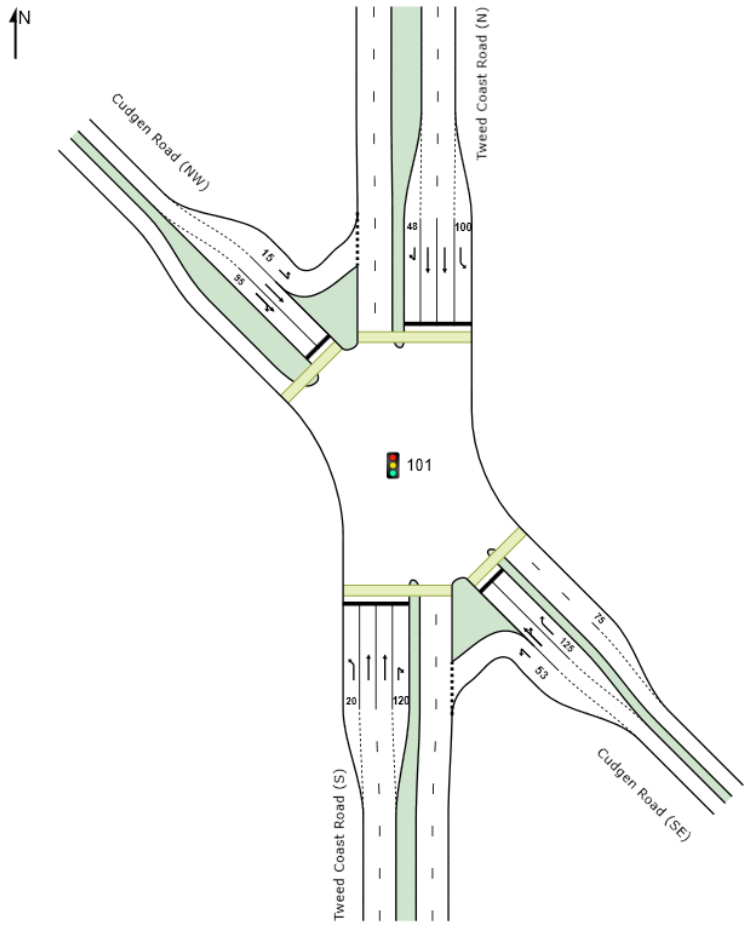


Figure 4.2: Tweed Coast Road / Cudgen Road SIDRA Intersection Layout (4-lane)

Detailed SIDRA results for the four-lane intersection arrangement are provided at **Attachment B** with results summarised in Table 4.2.

Table 4.2: Tweed Coast Road / Cudgen Road (four-lane) SIDRA Results Summary

Peak Period	2033 SIDRA Intersection Results				
	Volume (vph)	DOS (v/c)	Delay (seconds)	LOS	Queue (m)
MVT	3,102	0.89	49	D	272
EVT	3,329	0.88	38	C	224
PVT	3,390	0.88	45	D	246

As shown, the intersection is expected to operate within acceptable performance limits by 2033 with the upgrade to Tweed Coast Road, consistent with modelling undertaken for the Hospital. However, further analysis shows that this intersection is at capacity and cannot cater for further growth in traffic volumes beyond 2033.

4.2.4 Cudgen Road / Hospital Access Intersection

The Cudgen Road / Hospital Access signalised SIDRA Intersection layout is illustrated in Figure 4.3.

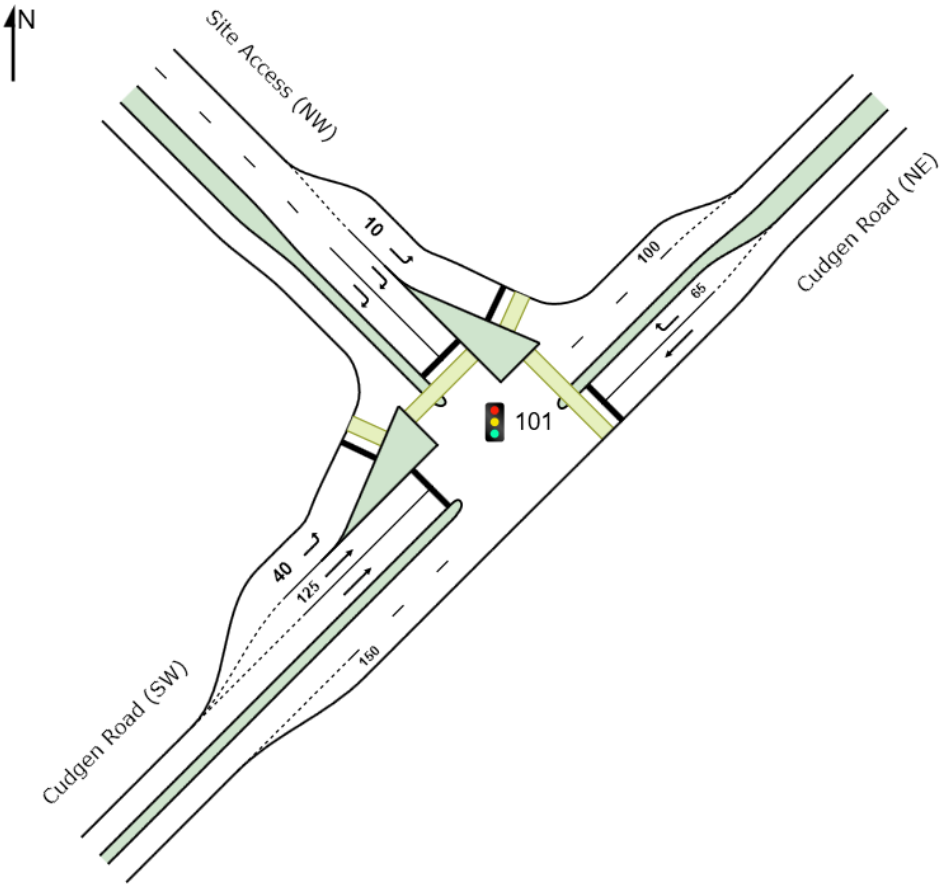


Figure 4.3: Cudgen Road / Hospital Access SIDRA Intersection Layout

Detailed SIDRA results for the intersection arrangement are provided at **Attachment B** with results summarised in Table 4.3.

Table 4.3: Cudgen Road / Hospital Access SIDRA Results Summary

Peak Period	2033 SIDRA Intersection Results				
	Volume (vph)	DOS (v/c)	Delay (seconds)	LOS	Queue (m)
MVT	1,986	0.66	9	A	141
EVT	2,070	0.76	10	A	169
PVT	2,046	0.73	9	A	151

As shown, the Cudgen Road / Hospital Access operates well within acceptable performance limits at the year 2033. As such, this intersection is not considered a limiting factor in determining thresholds for the provision of the new link road.

4.3 Intersection Thresholds

The timing for when the link road is warranted, based on the above SIDRA assessment and considering intersection capacity only, as follows:

- At 2027 based only on Tweed Coast Road / Cudgen Road intersection performance, without the four-lane upgrade of the Tweed Coast Road cross-section
- At 2033 based only on Tweed Coast Road / Cudgen Road intersection performance, with the four-lane upgrade of the Tweed Coast Road cross-section
- Not triggered earlier based on Tweed Coast Road / Hospital Access intersection performance.

5. Conclusion

In summary, the key external benefit of the proposed link road would be the reduction of traffic volumes on Cudgen Road. The link road would greatly reduce traffic capacity issues on Cudgen Road, which will occur irrespective of the Gales development and be exacerbated by the opening of the Hospital in 2023. The proposed link road, widening Tweed Coast Road to four lanes, and intersection upgrades are all required to ameliorate future capacity issues associated with anticipated growth within Kingscliff including the Hospital.

The western end of Cudgen Road and associated intersections at Tweed Coast Road are planned for upgrade as part of the Hospital approvals. However, congestion at the eastern end of Cudgen Road, in the vicinity of the TAFE and the Cudgen Road / Turnock Street intersection and Kingscliff High School, will only be reduced by the new link road.

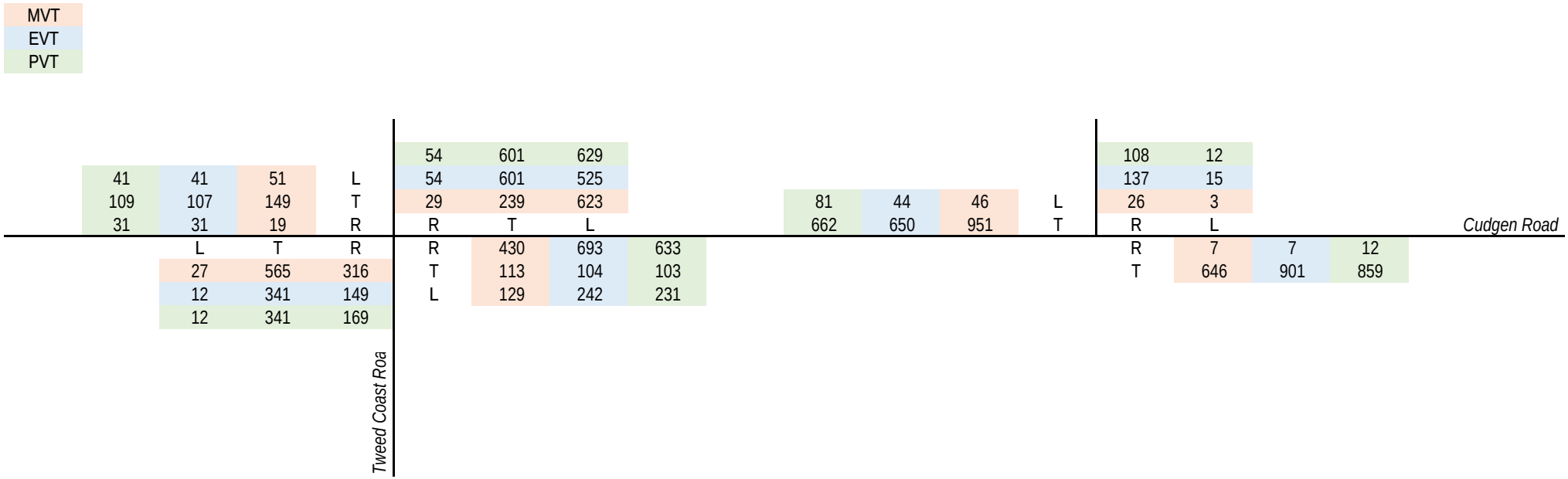
The introduction of the link road will directly reduce traffic on Cudgen Road past the new Hospital. This outcome will therefore improve emergency vehicle access to the Hospital by reducing congestions and delays at surrounding intersections as well as the likelihood of incidents.

The timing for delivery of the new link road, Tweed Coast Road / Cudgen Road intersection and widening of Tweed Coast Road should therefore be expedited given that:

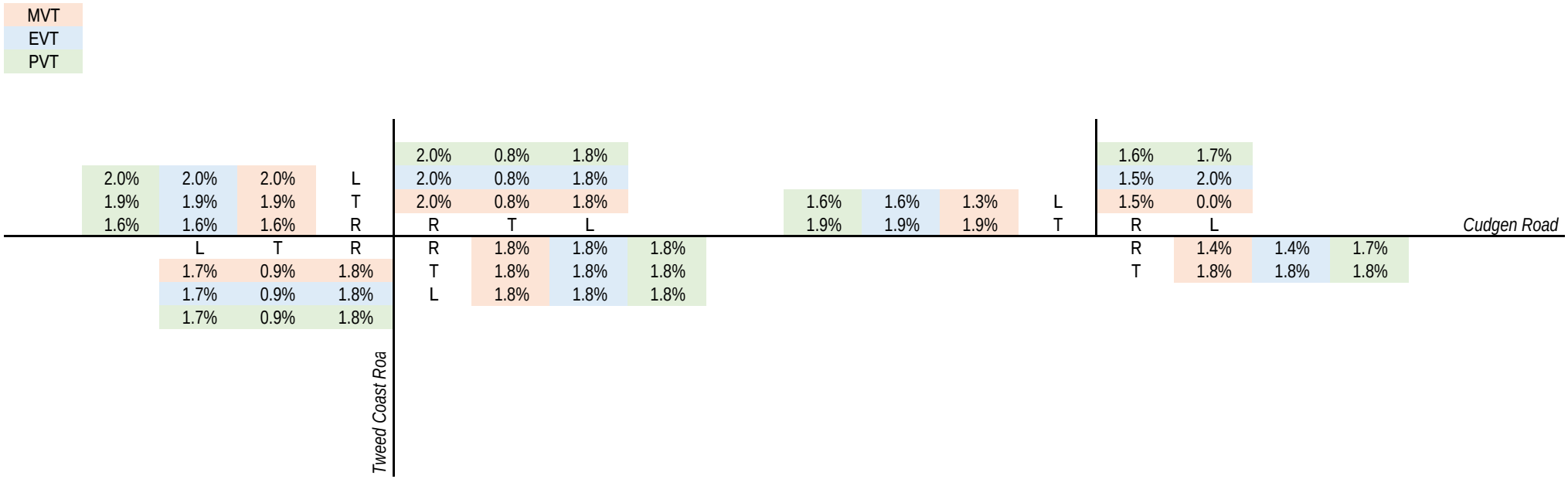
- By 2023 following the opening of the Hospital, Cudgen Road is expected to reach its theoretical capacity as the only road connection for traffic between Tweed Coast Road and Kingscliff
- By 2027 Tweed Coast Road / Cudgen Road intersection will reach capacity without the widening of Tweed Coast Road to four-lanes
- By 2033 Tweed Coast Road / Cudgen Road intersection will reach capacity even with the widening of Tweed Coast Road to a four-lanes.

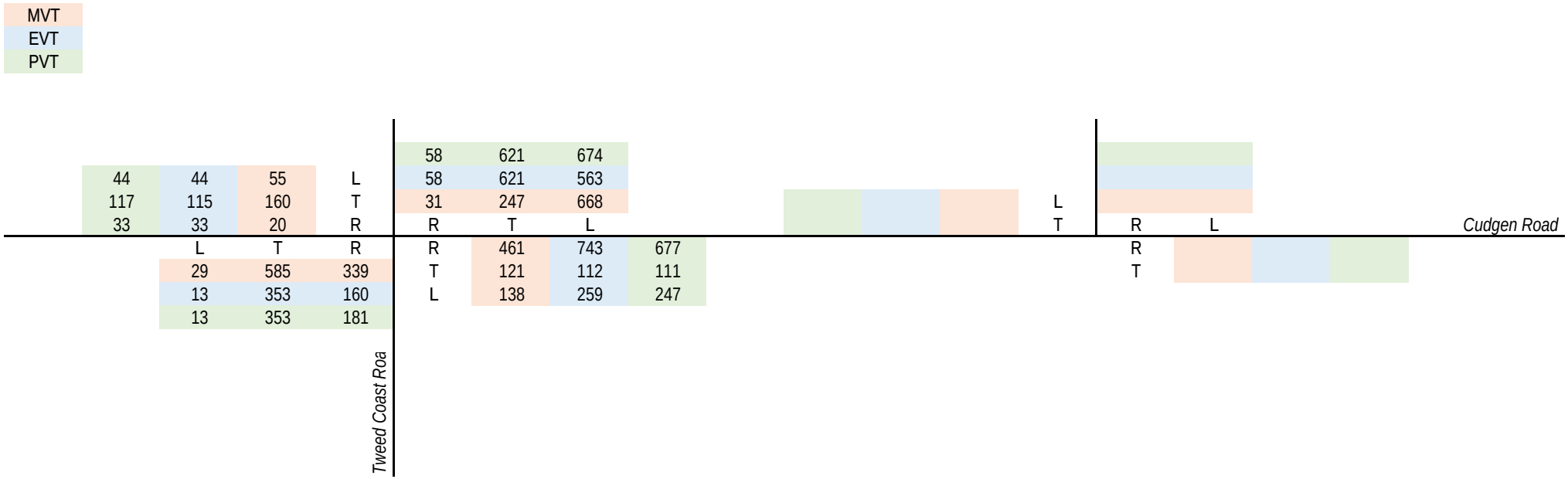
The early construction of the link road would provide significant immediate benefits to local road capacity, reduce congestion and ameliorate safety and amenity impacts associated with significant ongoing traffic growth forecast for the surrounding road network. This will subsequently greatly improve access to residences and businesses in Kingscliff Village with consequent commercial / employment benefits.

Attachment A: Intersection Turn Volumes



Design Year 2023


MVT
EVT
PVT
2.0% 0.8% 1.8%
2.0% 2.0% 2.0% L 2.0% 0.8% 1.8%
1.9% 1.9% 1.9% T 2.0% 0.8% 1.8%
1.6% 1.6% 1.6% R R T L
1.6% 1.6% 1.3% L
1.9% 1.9% 1.9% T
1.6% 1.7%
1.5% 2.0%
1.5% 0.0%
R L
Cudgen Road
L T R R 1.8% 1.8% 1.8%
1.7% 0.9% 1.8% T 1.8% 1.8% 1.8%
1.7% 0.9% 1.8% L 1.8% 1.8% 1.8%
1.7% 0.9% 1.8%
R 1.4% 1.4% 1.7%
T 1.8% 1.8% 1.8%
Tweed Coast Roa



Design Year 2027

MVT																				
EVT																				
PVT																				
					65	651	739								125	14				
	49	49	61	L	65	651	620								158	18				
	129	127	177	T	35	259	735			94	51	52	L		30	3				
	36	36	22	R	R	T	L			785	771	1128	T		R	L				*Cudgen Road*
		L	T	R	R	508	813	744							R	8	8	14		
		32	612	374	T	134	123	122							T	765	1064	1014		
		14	370	176	L	153	285	272												
		14	370	199																
				Tweed Coast Roa																

Design Year 2033

Attachment B: Detailed SIDRA Outputs

MOVEMENT SUMMARY

Site: 101 [2033 Design MVT - 4-Lane (Site Folder: General)]

Tweed Coast Road - Cudgen Road
2023 AM Peak
Design Traffic
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road (S)														
1a	L1	32	4.0	34	4.0	0.031	18.2	LOS B	1.0	7.3	0.44	0.64	0.44	45.0
2	T1	612	3.0	644	3.0	0.378	27.1	LOS B	15.5	111.3	0.69	0.60	0.69	41.5
3b	R3	374	4.0	394	4.0	* 0.892	76.7	LOS F	31.9	231.2	1.00	0.96	1.20	26.3
Approach		1018	3.4	1072	3.4	0.892	45.1	LOS D	31.9	231.2	0.79	0.73	0.87	34.3
SouthEast: Cudgen Road (SE)														
21b	L3	153	5.0	161	5.0	0.114	7.8	LOS A	1.4	10.3	0.16	0.63	0.16	53.0
22	T1	134	3.0	141	3.0	* 0.864	67.1	LOS E	22.4	160.4	0.97	0.97	1.16	28.1
23a	R1	508	2.0	535	2.0	0.864	71.8	LOS F	29.0	206.3	0.99	0.96	1.15	27.8
Approach		795	2.7	837	2.7	0.864	58.7	LOS E	29.0	206.3	0.83	0.90	0.96	30.7
North: Tweed Coast Road (N)														
7a	L1	735	2.0	774	2.0	* 0.873	34.7	LOS C	38.1	271.5	0.95	0.91	1.00	38.9
8	T1	259	5.0	273	5.0	0.294	49.1	LOS D	8.1	59.1	0.86	0.70	0.86	33.2
9b	R3	35	7.0	37	7.0	0.399	84.0	LOS F	2.8	20.4	1.00	0.74	1.00	25.0
Approach		1029	2.9	1083	2.9	0.873	40.0	LOS C	38.1	271.5	0.93	0.85	0.97	36.6
NorthWest: Cudgen Road (NW)														
27b	L3	61	6.0	64	6.0	0.088	16.3	LOS B	1.6	12.1	0.42	0.68	0.42	47.3
28	T1	177	5.0	186	5.0	* 0.869	79.9	LOS F	12.1	88.6	0.99	0.90	1.20	26.1
29a	R1	22	6.0	23	6.0	0.869	87.0	LOS F	12.1	88.6	1.00	0.97	1.30	25.3
Approach		260	5.3	274	5.3	0.869	65.6	LOS E	12.1	88.6	0.86	0.85	1.02	29.1
All Vehicles		3102	3.2	3265	3.2	0.892	48.6	LOS D	38.1	271.5	0.85	0.82	0.94	33.5

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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tweed Coast Road (S)												
P1	Full	1	1	57.2	LOS E	0.0	0.0	0.87	0.87	90.0	42.6	0.47
SouthEast: Cudgen Road (SE)												
P5	Full	1	1	51.3	LOS E	0.0	0.0	0.83	0.83	78.9	36.0	0.46

North: Tweed Coast Road (N)											
P3	Full	5	5	69.1	LOS F	0.0	0.0	0.96	0.96	102.7	43.6	0.42
NorthWest: Cudgen Road (NW)											
P7	Full	1	1	27.6	LOS C	0.0	0.0	0.61	0.61	55.8	36.6	0.66
All Pedestrians		8	8	60.2	LOS F	0.0	0.0	0.89	0.89	92.3	41.7	0.45

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.

MOVEMENT SUMMARY

Site: 101 [2033 Design EVT - 4-Lane (Site Folder: General)]

Tweed Coast Road - Cudgen Road
2023 PM Peak
Design Traffic
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road (S)														
1a	L1	14	0.0	15	0.0	0.021	27.5	LOS B	0.5	3.4	0.65	0.66	0.65	40.4
2	T1	370	4.0	389	4.0	0.463	39.9	LOS C	9.3	67.2	0.91	0.75	0.91	36.3
3b	R3	176	7.0	185	7.0	* 0.879	69.3	LOS E	11.5	85.2	1.00	0.98	1.39	27.8
Approach		560	4.8	589	4.8	0.879	48.8	LOS D	11.5	85.2	0.93	0.82	1.05	33.2
SouthEast: Cudgen Road (SE)														
21b	L3	285	6.0	300	6.0	0.247	11.4	LOS A	5.1	37.2	0.36	0.68	0.36	50.4
22	T1	123	7.0	129	7.0	* 0.855	42.0	LOS C	22.1	159.1	0.89	0.93	1.08	34.6
23a	R1	813	2.0	856	2.0	0.855	46.5	LOS D	31.5	224.0	0.96	0.95	1.11	34.2
Approach		1221	3.4	1285	3.4	0.855	37.9	LOS C	31.5	224.0	0.81	0.89	0.93	37.1
North: Tweed Coast Road (N)														
7a	L1	620	3.0	653	3.0	0.599	13.8	LOS A	13.5	96.8	0.69	0.78	0.69	48.5
8	T1	651	2.0	685	2.0	* 0.823	48.9	LOS D	20.1	142.8	1.00	0.95	1.15	33.3
9b	R3	65	6.0	68	6.0	0.324	54.4	LOS D	3.4	25.3	0.94	0.77	0.94	31.4
Approach		1336	2.7	1406	2.7	0.823	32.9	LOS C	20.1	142.8	0.85	0.86	0.93	38.8
NorthWest: Cudgen Road (NW)														
27b	L3	49	8.0	52	8.0	0.067	16.3	LOS B	1.1	8.3	0.49	0.68	0.49	47.2
28	T1	127	3.0	134	3.0	* 0.715	55.4	LOS D	6.6	49.6	0.99	0.80	1.07	31.4
29a	R1	36	18.0	38	18.0	0.715	61.0	LOS E	6.6	49.6	1.00	0.85	1.14	30.6
Approach		212	6.7	223	6.7	0.715	47.3	LOS D	6.6	49.6	0.87	0.78	0.95	33.9
All Vehicles		3329	3.6	3504	3.6	0.879	38.3	LOS C	31.5	224.0	0.85	0.86	0.95	36.8

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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tweed Coast Road (S)												
P1	Full	5	5	34.4	LOS D	0.0	0.0	0.79	0.79	67.2	42.6	0.63
SouthEast: Cudgen Road (SE)												
P5	Full	5	5	41.9	LOS E	0.0	0.0	0.87	0.87	69.6	36.0	0.52

North: Tweed Coast Road (N)											
P3	Full	5	5	49.2	LOS E	0.0	0.0	0.95	0.95	82.7	43.6	0.53
NorthWest: Cudgen Road (NW)											
P7	Full	5	5	41.9	LOS E	0.0	0.0	0.87	0.87	70.1	36.6	0.52
All Pedestrians		20	21	41.8	LOS E	0.0	0.0	0.87	0.87	72.4	39.7	0.55

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.

MOVEMENT SUMMARY

Site: 101 [2033 Design PVT - 4-Lane (Site Folder: General)]

Tweed Coast Road - Cudgen Road
2023 PM Peak - Development Peak
Design Traffic
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road (S)														
1a	L1	14	0.0	15	0.0	0.021	35.6	LOS C	0.7	4.6	0.66	0.66	0.66	37.1
2	T1	370	4.0	389	4.0	0.429	50.9	LOS D	12.2	88.5	0.89	0.74	0.89	32.7
3b	R3	199	7.0	209	7.0	* 0.884	87.3	LOS F	17.2	127.5	1.00	0.95	1.29	24.5
Approach		583	4.9	614	4.9	0.884	63.0	LOS E	17.2	127.5	0.92	0.81	1.02	29.4
SouthEast: Cudgen Road (SE)														
21b	L3	272	6.0	286	6.0	0.234	12.4	LOS A	6.2	45.5	0.34	0.68	0.34	49.7
22	T1	122	7.0	128	7.0	* 0.822	46.7	LOS D	24.8	178.8	0.86	0.85	0.95	33.2
23a	R1	744	2.0	783	2.0	0.822	51.5	LOS D	34.6	246.2	0.92	0.88	0.98	32.7
Approach		1138	3.5	1198	3.5	0.822	41.6	LOS C	34.6	246.2	0.77	0.83	0.82	35.7
North: Tweed Coast Road (N)														
7a	L1	739	3.0	778	3.0	* 0.677	16.8	LOS B	22.9	164.3	0.71	0.80	0.71	47.0
8	T1	651	2.0	685	2.0	0.777	57.9	LOS E	25.3	179.8	0.98	0.88	1.03	30.8
9b	R3	65	6.0	68	6.0	0.288	68.0	LOS E	4.5	33.2	0.93	0.77	0.93	28.1
Approach		1455	2.7	1532	2.7	0.777	37.5	LOS C	25.3	179.8	0.84	0.83	0.86	37.1
NorthWest: Cudgen Road (NW)														
27b	L3	49	8.0	52	8.0	0.066	17.6	LOS B	1.4	10.4	0.44	0.68	0.44	46.4
28	T1	129	3.0	136	3.0	* 0.760	75.6	LOS F	9.2	68.4	0.99	0.82	1.08	26.8
29a	R1	36	18.0	38	18.0	0.760	81.7	LOS F	9.2	68.4	1.00	0.87	1.15	26.1
Approach		214	6.7	225	6.7	0.760	63.3	LOS E	9.2	68.4	0.87	0.80	0.95	29.6
All Vehicles		3390	3.6	3568	3.6	0.884	44.9	LOS D	34.6	246.2	0.83	0.82	0.88	34.5

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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tweed Coast Road (S)												
P1	Full	5	5	41.1	LOS E	0.0	0.0	0.74	0.74	73.8	42.6	0.58
SouthEast: Cudgen Road (SE)												
P5	Full	5	5	51.3	LOS E	0.0	0.0	0.83	0.83	79.0	36.0	0.46

North: Tweed Coast Road (N)											
P3	Full	5	5	69.1	LOS F	0.0	0.0	0.96	0.96	102.7	43.6	0.42
NorthWest: Cudgen Road (NW)											
P7	Full	5	5	51.3	LOS E	0.0	0.0	0.83	0.83	79.4	36.6	0.46
All Pedestrians		20	21	53.2	LOS E	0.0	0.0	0.84	0.84	83.7	39.7	0.47

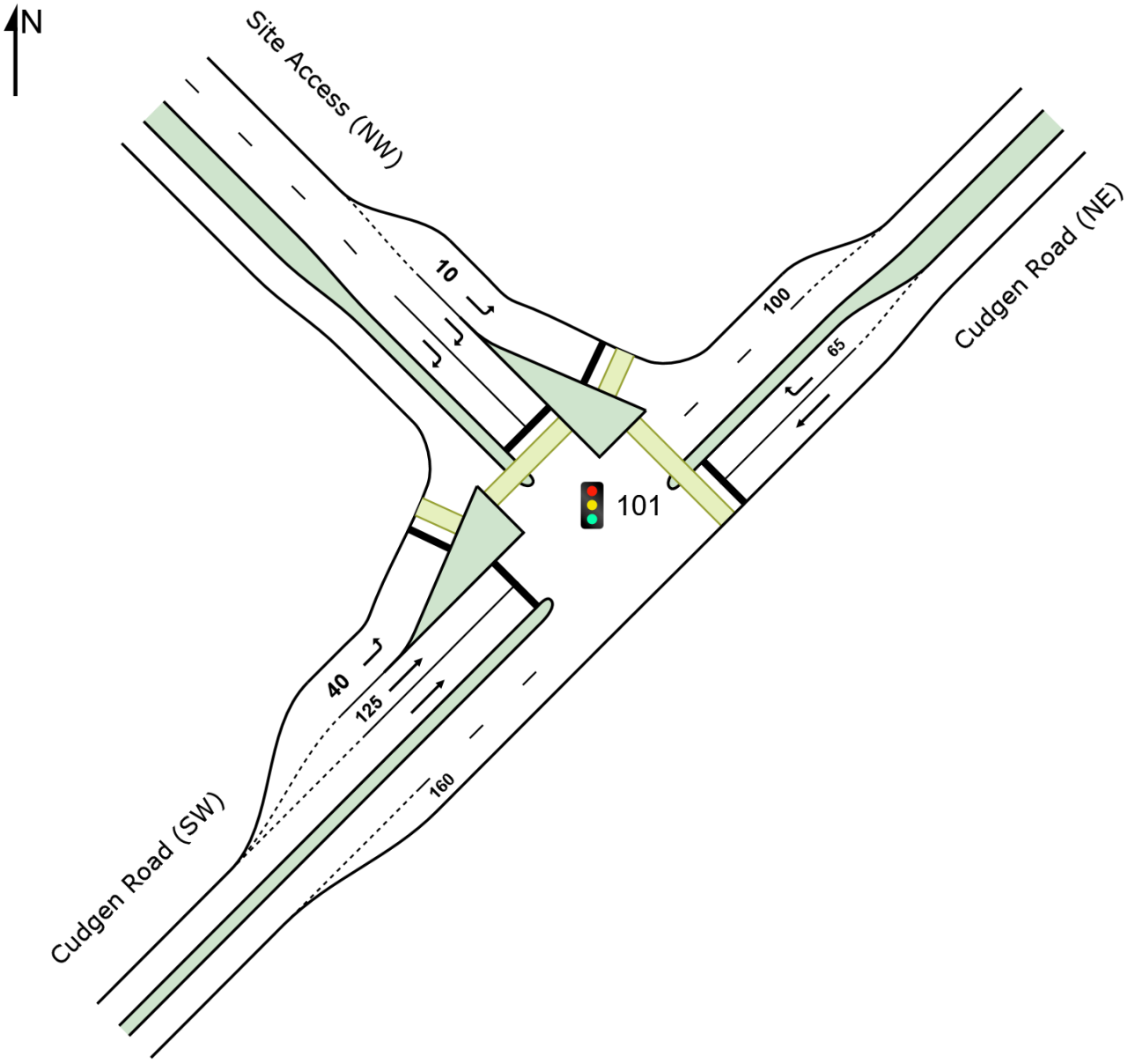
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: 101 [2033 Design MVT - Signalised Slip (Site Folder: Signalised Slip)]

Cudgen Road - Site Access
2033 AM Peak
Design Traffic
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [2033 Design MVT - Signalised Slip (Site Folder: Signalised Slip)]

Cudgen Road - Site Access
2033 AM Peak
Design Traffic
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Cudgen Road (NE)														
25	T1	765	5.0	805	5.0	0.550	3.8	LOS A	12.2	89.0	0.43	0.39	0.43	56.6
26	R2	8	2.0	8	2.0	0.053	43.7	LOS D	0.3	2.2	0.94	0.66	0.94	22.3
Approach		773	5.0	814	5.0	0.550	4.2	LOS A	12.2	89.0	0.43	0.39	0.43	56.2
NorthWest: Site Access (NW)														
27	L2	3	2.0	3	2.0	0.007	28.0	LOS B	0.1	0.7	0.78	0.50	0.78	27.7
29	R2	30	2.0	32	2.0	* 0.123	39.5	LOS C	0.7	4.6	0.96	0.67	0.96	27.0
Approach		33	2.0	35	2.0	0.123	38.4	LOS C	0.7	4.6	0.95	0.65	0.95	27.1
SouthWest: Cudgen Road (SW)														
30	L2	52	2.0	55	2.0	0.036	9.0	LOS A	0.5	3.6	0.26	0.66	0.26	44.6
31	T1	1128	6.0	1187	6.0	* 0.660	11.1	LOS A	19.2	141.4	0.64	0.58	0.64	51.8
Approach		1180	5.8	1242	5.8	0.660	11.0	LOS A	19.2	141.4	0.63	0.58	0.63	51.5
All Vehicles		1986	5.4	2091	5.4	0.660	8.8	LOS A	19.2	141.4	0.56	0.51	0.56	52.7

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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
NorthEast: Cudgen Road (NE)												
P6	Full	100	105	34.4	LOS D	0.2	0.2	0.93	0.93	62.4	36.4	0.58
NorthWest: Site Access (NW)												
P7	Full	100	105	10.0	LOS B	0.1	0.1	0.50	0.50	35.7	33.4	0.93
P7S	Slip/ Bypass	100	105	6.8	LOS A	0.1	0.1	0.41	0.41	26.8	26.0	0.97
SouthWest: Cudgen Road (SW)												
P8S	Slip/ Bypass	100	105	34.4	LOS D	0.2	0.2	0.93	0.93	54.4	26.0	0.48
All Pedestrians		400	421	21.4	LOS C	0.2	0.2	0.69	0.69	44.8	30.5	0.68

MOVEMENT SUMMARY

Site: 101 [2033 Design EVT - Signalised Slip (Site Folder: Signalised Slip)]

Cudgen Road - Site Access
2033 PM Peak
Design Traffic
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Cudgen Road (NE)														
25	T1	1064	3.0	1120	3.0	*0.760	5.7	LOS A	23.5	168.8	0.59	0.55	0.59	55.4
26	R2	8	2.0	8	2.0	0.053	43.7	LOS D	0.3	2.2	0.94	0.66	0.94	22.3
Approach		1072	3.0	1128	3.0	0.760	5.9	LOS A	23.5	168.8	0.59	0.55	0.59	55.1
NorthWest: Site Access (NW)														
27	L2	18	2.0	19	2.0	0.040	26.6	LOS B	0.6	4.1	0.80	0.57	0.80	27.5
29	R2	158	2.0	166	2.0	*0.656	42.6	LOS D	3.8	26.9	1.00	0.86	1.11	26.2
Approach		176	2.0	185	2.0	0.656	41.0	LOS C	3.8	26.9	0.98	0.83	1.08	26.3
SouthWest: Cudgen Road (SW)														
30	L2	51	2.0	54	2.0	0.035	9.0	LOS A	0.5	3.5	0.26	0.66	0.26	44.6
31	T1	771	6.0	812	6.0	0.451	8.9	LOS A	10.8	79.3	0.54	0.48	0.54	52.9
Approach		822	5.8	865	5.8	0.451	8.9	LOS A	10.8	79.3	0.53	0.49	0.53	52.5
All Vehicles		2070	4.0	2179	4.0	0.760	10.1	LOS A	23.5	168.8	0.60	0.55	0.61	51.0

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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
NorthEast: Cudgen Road (NE)												
P6	Full	100	105	34.4	LOS D	0.2	0.2	0.93	0.93	62.4	36.4	0.58
NorthWest: Site Access (NW)												
P7	Full	100	105	10.0	LOS B	0.1	0.1	0.50	0.50	35.7	33.4	0.93
P7S	Slip/ Bypass	100	105	6.8	LOS A	0.1	0.1	0.41	0.41	26.8	26.0	0.97
SouthWest: Cudgen Road (SW)												
P8S	Slip/ Bypass	100	105	34.4	LOS D	0.2	0.2	0.93	0.93	54.4	26.0	0.48
All Pedestrians		400	421	21.4	LOS C	0.2	0.2	0.69	0.69	44.8	30.5	0.68

MOVEMENT SUMMARY

Site: 101 [2033 Design PVT - Signalised Slip (Site Folder: Signalised Slip)]

Cudgen Road - Site Access
2033 PM Peak - Development Peak
Design Traffic
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Cudgen Road (NE)														
25	T1	1014	3.0	1067	3.0	* 0.728	5.2	LOS A	21.0	150.8	0.55	0.52	0.55	55.6
26	R2	14	2.0	15	2.0	0.093	44.1	LOS D	0.6	4.0	0.95	0.69	0.95	22.2
Approach		1028	3.0	1082	3.0	0.728	5.7	LOS A	21.0	150.8	0.56	0.52	0.56	55.1
NorthWest: Site Access (NW)														
27	L2	14	2.0	15	2.0	0.031	26.6	LOS B	0.4	3.1	0.79	0.56	0.79	27.5
29	R2	125	2.0	132	2.0	* 0.511	41.5	LOS C	2.9	20.3	1.00	0.76	1.00	26.5
Approach		139	2.0	146	2.0	0.511	40.0	LOS C	2.9	20.3	0.98	0.74	0.98	26.5
SouthWest: Cudgen Road (SW)														
30	L2	94	2.0	99	2.0	0.065	9.0	LOS A	0.9	6.7	0.26	0.67	0.26	44.5
31	T1	785	6.0	826	6.0	0.460	9.0	LOS A	11.1	81.4	0.55	0.48	0.55	52.8
Approach		879	5.6	925	5.6	0.460	9.0	LOS A	11.1	81.4	0.52	0.50	0.52	52.1
All Vehicles		2046	4.0	2154	4.0	0.728	9.4	LOS A	21.0	150.8	0.57	0.53	0.57	51.4

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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
NorthEast: Cudgen Road (NE)												
P6	Full	100	105	34.4	LOS D	0.2	0.2	0.93	0.93	62.4	36.4	0.58
NorthWest: Site Access (NW)												
P7	Full	100	105	10.0	LOS B	0.1	0.1	0.50	0.50	35.7	33.4	0.93
P7S	Slip/ Bypass	100	105	6.8	LOS A	0.1	0.1	0.41	0.41	26.8	26.0	0.97
SouthWest: Cudgen Road (SW)												
P8S	Slip/ Bypass	100	105	34.4	LOS D	0.2	0.2	0.93	0.93	54.4	26.0	0.48
All Pedestrians		400	421	21.4	LOS C	0.2	0.2	0.69	0.69	44.8	30.5	0.68