

Traffic Impact Assessment

Transpacific Diversification Project 05_0037 Mod 5



Traffic Impact Assessment

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1.0 Introduction

1.1 Background and Scope

Transpacific Refineries (TPR) currently operates a hydrogenation plant at Rutherford that refines recycled oil to base oil. The plant has been operating since 2006/7.

The TPR Product Diversification Project is proposing to install additional storage tanks to capitalise on its approved throughput capacity of 40,000 tonnes / annum. The additional storage tanks will allow the production of more grades of oil and allow further process flexibility.

TPR has commissioned AECOM to prepare a Traffic Impact Assessment (TIA) for the proposed Product Diversification Project (the Project). The TIA has been prepared to support the Environmental Assessment (EA) of the Project.

The TIA includes:

- A review of the existing road conditions, in particular at the New England Highway / Kyle Street / Mirage Road intersection, which provides access to the site from the strategic road network;
- An assessment of operational and construction traffic impacts during the AM and PM peak hour; and
- Consideration of measures to mitigate traffic impacts, if required.

The TIA has only assessed impacts on the road network in the AM and PM peak hour of a typical weekday as these generally represent the worst case for traffic impacts.

1.2 Structure of Report

The report has been structured as follows:

- **Section 1** provides an introduction to the Project;
- **Section 2** summarises the existing traffic conditions in the area surrounding the site;
- **Section 3** assesses the operational and construction traffic impact of the Project; and
- **Section 4** provides the study conclusions and any mitigation measures.

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2.0 Existing Conditions

2.1 Existing Site

The Transpacific site is located within the Rutherford area, in the city of Maitland within the Hunter Region of New South Wales. It is approximately 30 km north west of the Newcastle CBD, as shown in **Figure 1**. The site is situated within the Rutherford Industrial area which contains bulky goods retail, light industry and manufacturing plants.



Figure 1 Site context

2.2 Existing Traffic Conditions

2.2.1 Surrounding Road Network

The site is situated south of the New England Highway and accessed from Kyle Street as shown in **Figure 2**. The strategic road network surrounding the site includes the New England Highway, Cessnock Road and the Hunter Expressway which facilitates B-double routes to the site.



Figure 2 Site Location

New England Highway

The New England Highway at Rutherford is generally a two-lane undivided road. The New England Highway provides connectivity to the surrounding strategic road network, linking to the Hunter Expressway to the west and Cessnock Road to the east. It has a posted 80 km/h speed limit east and west side of the New England Highway / Kyle Street / Mirage Road intersection.

Average Annual Daily Traffic (AADT) data along the New England Highway, south of Anambah Road indicate traffic volumes fluctuated between 1995 and 2001, increasing between 1995 and 1998 then reducing between 1998 and 2001. A growth of approximately two per cent per annum has been experienced between 2001 and 2004.

Table 1 AADT on the New England Highway

Station ID	1995	1998	2001	2004
05.062 – South of Anambah Road	19,301	19,599	19,276	20,287

Source: Roads and Maritime Services, 2004

Kyle Street

Kyle Street is a local road providing access to the different land uses within the Rutherford Industrial Estate from New England Highway. It is a two-lane undivided road with a sign posted speed limit of 60 km/h.

2.2.2 Peak Hour Traffic Volumes

Intersection counts were undertaken at the intersection of New England Highway / Kyle Street / Mirage Road between 6am – 9am and 4pm – 7pm on 16 September 2015.

Analysis of the intersection counts showed the AM peak hour occurred between 7:45am – 8:45am and the PM peak hour occurred between 4:30pm – 5:30pm. A summary of turning movements at the roundabout intersection during the AM and PM peak hour is shown in **Figure 3**.

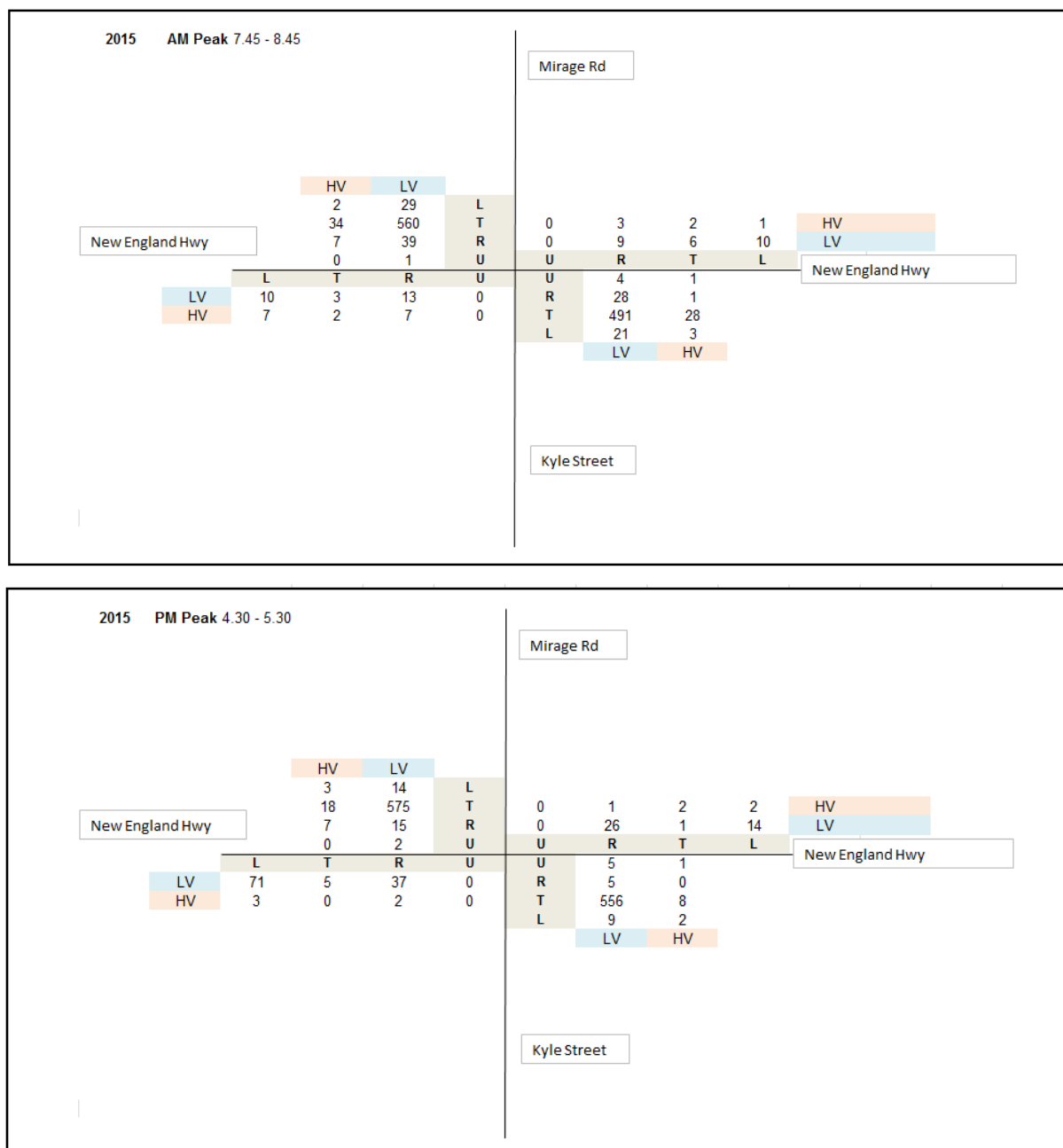


Figure 3 2015 Traffic Volumes at the New England / Kyle Street / Mirage Road Intersection

2.2.3 Existing Intersection Performance

The performance of the New England / Kyle Street / Mirage Road intersection has been evaluated using SIDRA Intersection 6.1, a computer-based modelling package designed for calculating isolated intersection performance.

The main performance indicators for SIDRA 6.1 include:

- Degree of Saturation (DoS) – measure of the ratio between traffic volumes and capacity of the intersection is used to measure the performance of isolated intersections. As DoS approaches 1.0, both queue length and delays increase rapidly. Satisfactory operations usually occur with a DoS of less than 0.9; and
- Average Delay – duration, in seconds, of the average vehicle waiting at an intersection, which corresponds to the Level of Service (LoS) – a measure of the overall performance of the intersection (this is explained further in **Table 2**).

Table 2 Performance Criteria for Intersections

Level of Service	Average Delay (secs/veh)	Traffic Signals, Roundabouts	Give Way and Stop Signs
A	Less than 14	Good Operation	Good Operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays	At capacity; requires other control mode
F	>70	Roundabouts require other control mode	At capacity; requires other control mode

Source: Guide to Traffic Generating Developments, RTA, 2002

The existing intersection has been modelled in SIDRA 6.1 as a roundabout. A schematic of the modelled current layout is illustrated in **Figure 4**.

Table 3 provides a summary of the intersection analysis for both AM and PM peak, while detailed outputs are provided in **Appendix A**.

Table 3 2015 Existing Traffic – Intersection Performance Summary

Approach	Volume (veh/h)	Level of Service	Degree of Saturation	Average Delay (s)	95% back of queue (m)
2015 AM Peak					
Kyle Street (S Leg)	43	A	0.028	8.6	1
New England Hwy (E Leg)	577	A	0.187	6.6	8
Mirage Road (N Leg)	32	A	0.022	7.9	1
New England Hwy (W Leg)	672	A	0.216	6.7	9
Total	1,324	A	0.216	6.7	9
2015 PM Peak					
Kyle Street (S Leg)	119	A	0.066	7.1	2
New England Hwy (E Leg)	586	A	0.184	6.3	8
Mirage Road (N Leg)	47	A	0.030	7.2	1
New England Hwy (W Leg)	634	A	0.201	6.4	9
Total	1,387	A	0.201	6.4	9

Source: AECOM

The SIDRA modelling indicates the intersection operates satisfactorily operating at Los A during the AM and PM peak hour periods with minimal queuing and delays experienced.

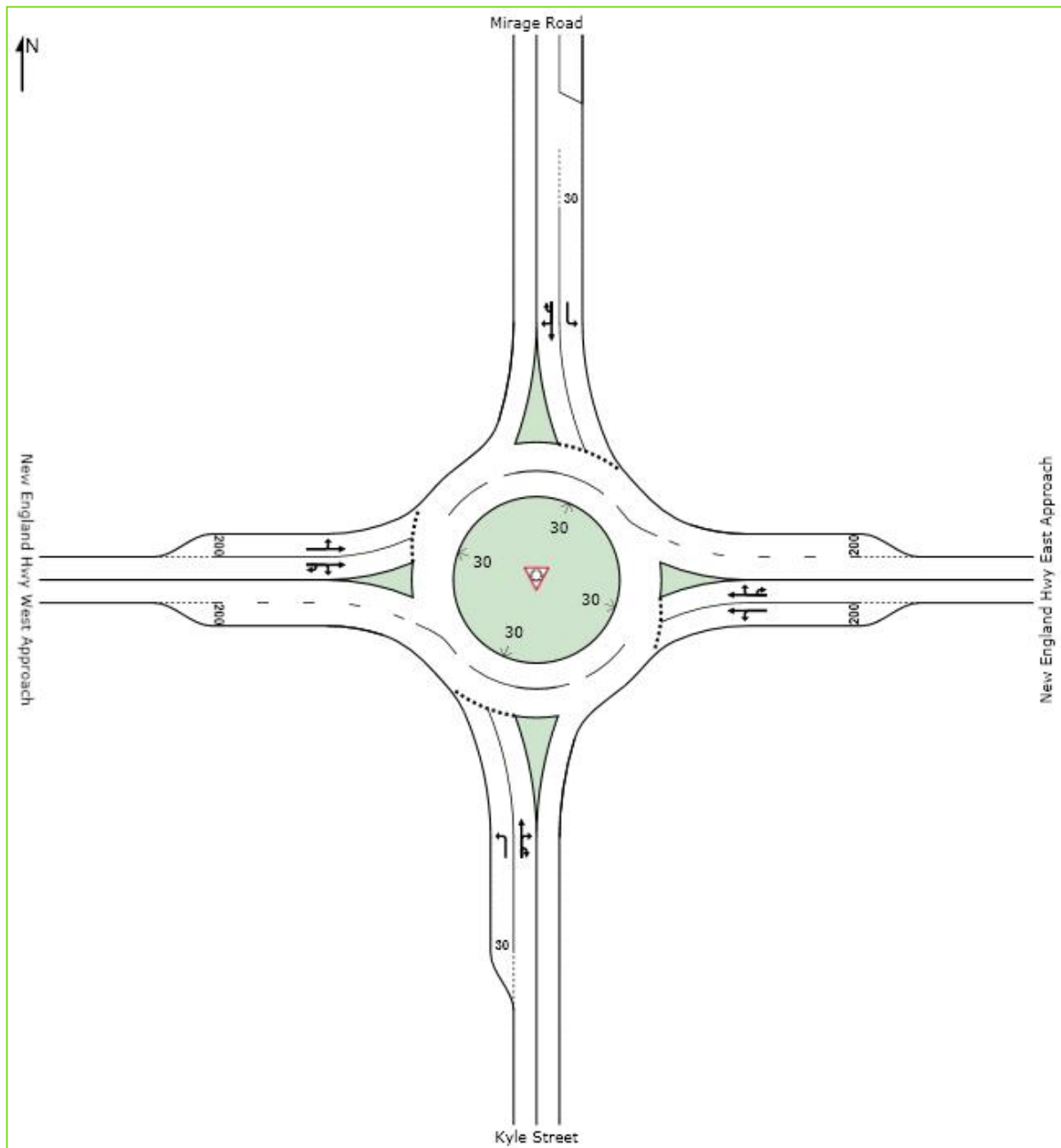


Figure 4 Existing layout of New England Highway / Kyle Street intersection

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3.0 Traffic Impact Assessment

3.1 Background Traffic

A growth rate of two per cent per annum (refer to **Section 2.2.1**) has been applied to capture background traffic growth for turning movements not associated with Kyle Street. Construction is expected to occur in 2016 and future operation to begin in 2017.

3.2 Construction Traffic Impact

Construction traffic during the construction phase as part of the installation of the additional storage tanks and oil polish system components includes light vehicles and heavy vehicles accessing the site. During the peak period of construction, it is anticipated that 20 light vehicles and five heavy vehicles (trucks) would be generated per day.

As part of the assessment it has been assumed the daily construction traffic generated occurs in both the AM and PM peak hour, presenting a worst case scenario.

The following trip distribution and assignment assumptions have been made:

- Light vehicles – 90 per cent inbound and 10 per cent outbound during the AM peak and reverse in the PM peak;
- Heavy vehicles – move in and out of the site within each peak hour; and
- 30 per cent of vehicle trips travel to / from the west and 70 per cent to / from the east along the New England Highway.

The trips generated during construction were added onto the forecasted 2016 traffic volumes at the intersection as shown in **Figure 5**. The performance summary of the intersection is shown in **Table 4**, with detailed outputs provided in **Appendix B**.

Table 4 2016 Construction Traffic – Intersection Performance Summary

Approach	Volume (veh/h)	Level of Service	Degree of Saturation	Average Delay (s)	95% back of queue (m)
2016 AM Peak with construction					
Kyle Street (S Leg)	51	A	0.035	8.9	1
New England Hwy (E Leg)	606	A	0.198	6.7	8
Mirage Road (N Leg)	32	A	0.022	6.4	1
New England Hwy (W Leg)	692	A	0.225	6.8	10
Total	1,381	A	0.225	6.8	10
2016 PM Peak with construction					
Kyle Street (S Leg)	143	A	0.074	7.5	2
New England Hwy (E Leg)	602	A	0.190	6.3	8
Mirage Road (N Leg)	48	A	0.031	7.3	1
New England Hwy (W Leg)	649	A	0.210	6.5	9
Total	1,443	A	0.210	6.6	9

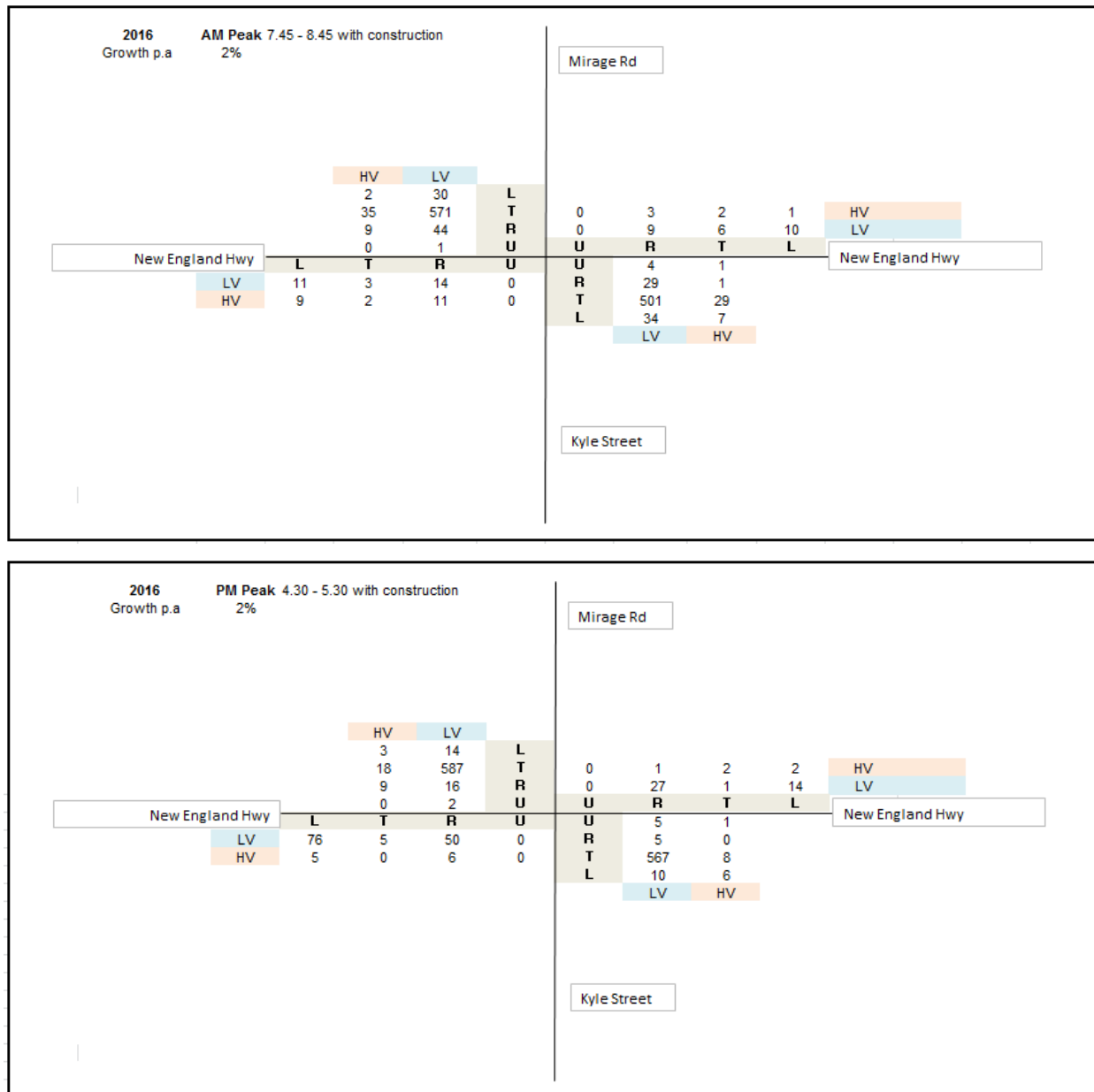


Figure 5 2016 Construction Traffic Volumes at New England Highway / Kyle Street / Mirage Road

SIDRA modelling indicates the intersection continues to perform at LoS A during the AM and PM peak hour with a significant amount of spare capacity at the intersection. The performance of the intersection is comparable with existing conditions.

3.3 Future Operation Traffic Impact

The existing TPR facility at Rutherford currently generates up to 46 heavy vehicle movements per day for a throughput of approximately 24ML per year. As the Project is expected to result in an increase of throughput to approximately 26ML per year, heavy vehicle movements are expected to increase to approximately 70 heavy vehicle movements per day.

With the additional 24 heavy vehicle movements expected to be generated per day (not including current movements), it has been assumed that 75 per cent of the traffic would occur during the peak operational period of 7am - 6pm. Assuming a consistent profile, this results in two heavy vehicles per hour (or four heavy vehicle movements per hour).

The following trip distribution and assignment assumptions have been made:

- Heavy vehicles – move in and out of the site within each peak hour; and
- 30 per cent of vehicle trips travel to / from the west and 70 per cent to / from the east along the New England Highway.

The growth rate of two per cent per annum has been applied to other turning movements at the intersection to forecast the 2017 traffic volumes at the intersection.

The forecasted 2017 traffic volumes at the intersection are shown in **Figure 6**. The performance summary of the intersection is shown in **Table 5**, with detailed outputs provided in **Appendix C**.

Table 5 2017 Operational Traffic – Intersection Performance Summary

Approach	Volume (veh/h)	Level of Service	Degree of Saturation	Average Delay (s)	95% back of queue (m)
2017 AM Peak with construction					
Kyle Street (S Leg)	45	A	0.030	8.7	1
New England Hwy (E Leg)	600	A	0.195	6.6	8
Mirage Road (N Leg)	32	A	0.022	6.4	1
New England Hwy (W Leg)	702	A	0.227	6.7	10
Total	1,379	A	0.227	6.7	10
2017 PM Peak with construction					
Kyle Street (S Leg)	121	A	0.068	7.2	2
New England Hwy (E Leg)	609	A	0.192	6.3	8
Mirage Road (N Leg)	49	A	0.031	7.2	1
New England Hwy (W Leg)	660	A	0.210	6.4	9
Total	1,440	A	0.210	6.5	9

Source: AECOM, 2015

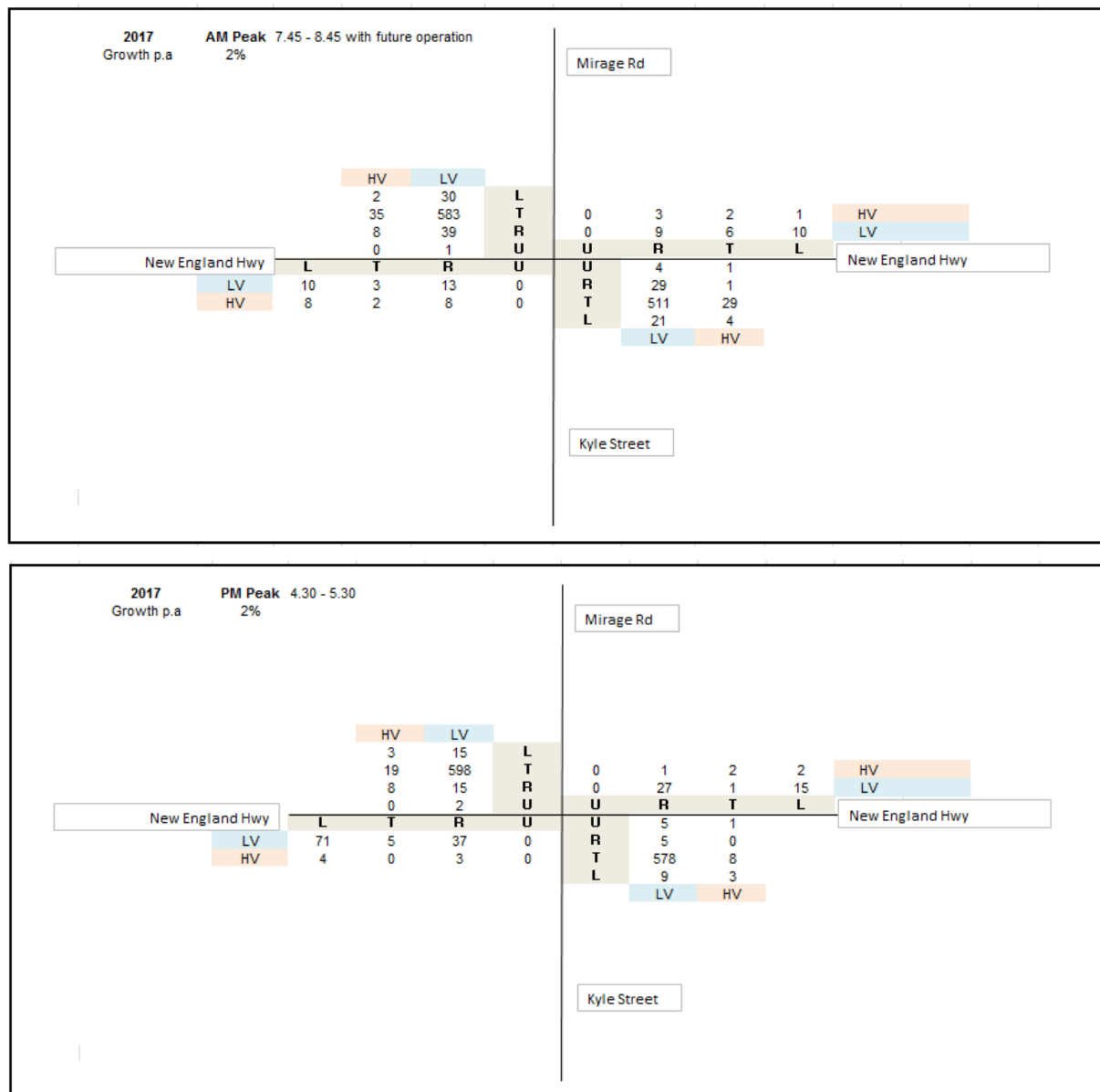


Figure 6 2017 Future Operation Traffic Volumes at New England Highway / Kyle Street / Mirage Road

SIDRA modelling indicates the intersection continues to perform at LoS A during the AM and PM peak hour with a significant amount of spare capacity at the intersection. The performance of the intersection is comparable with existing conditions.

3.4 Future Operation Impact (+ 10 years)

In accordance with Roads and Maritime Services requirements, a 10 year after opening scenario has been tested. The same annual growth rate of two per cent has been applied to generate background traffic at the intersection of New England Highway / Kyle Street / Mirage Road in 2027.

The forecasted 2027 traffic volumes at the intersection are shown in **Figure 7**. The performance summary of the intersection is shown in **Table 6**, with detailed outputs provided in **Appendix D**.

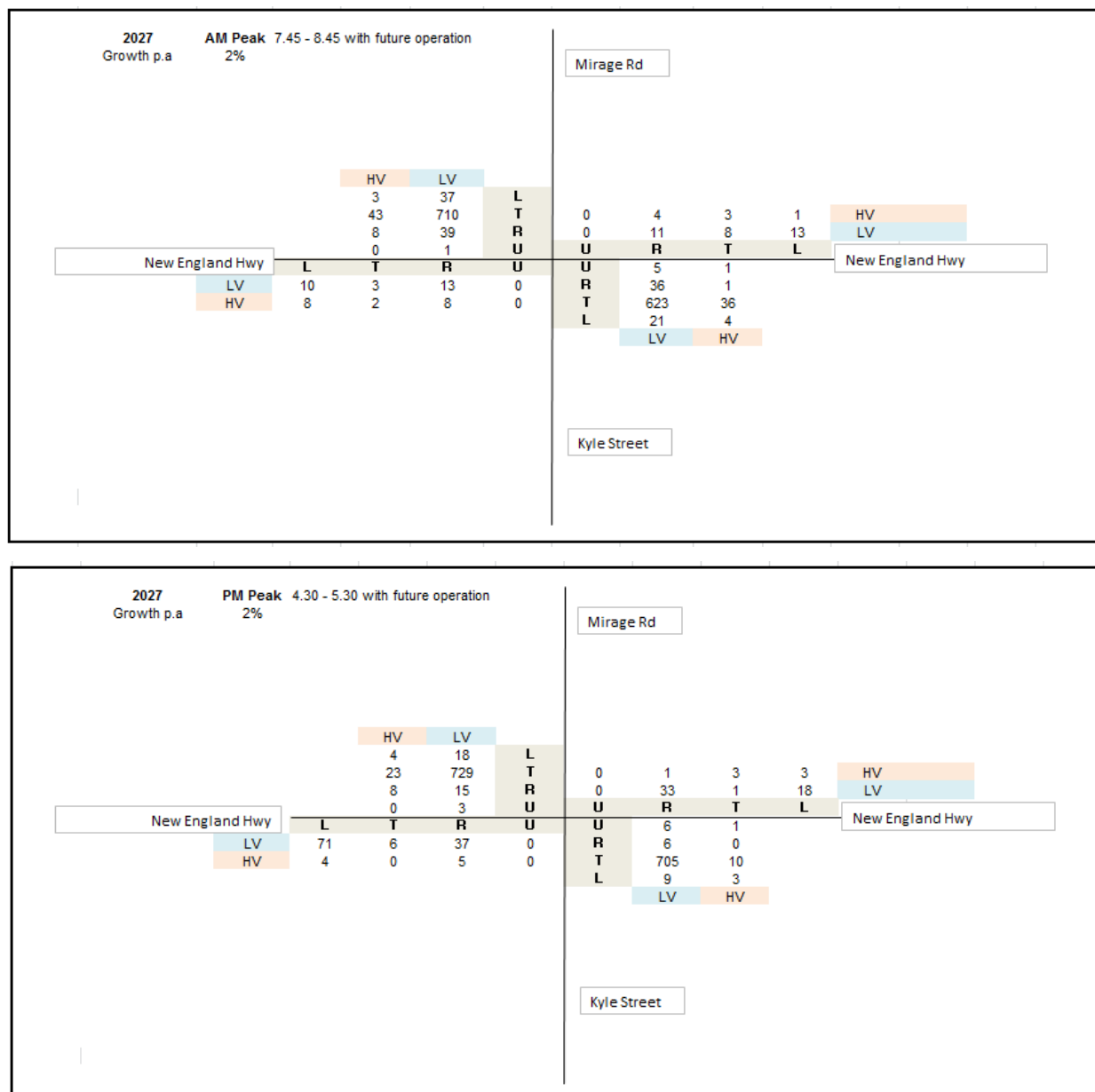


Figure 7 2027 Future Operation Traffic Volumes at New England Highway / Kyle Street / Mirage Road

Table 6 2027 Operational Traffic – Intersection Performance Summary

Approach	Volume (veh/h)	Level of Service	Degree of Saturation	Average Delay (s)	95% back of queue (m)
2027 AM Peak with construction					
Kyle Street (S Leg)	45	A	0.031	9.1	1
New England Hwy (E Leg)	727	A	0.237	6.7	10
Mirage Road (N Leg)	41	A	0.030	6.5	1
New England Hwy (W Leg)	841	A	0.273	6.7	12
Total	1,654	A	0.273	6.7	12
2027 PM Peak with construction					
Kyle Street (S Leg)	122	A	0.071	7.4	2
New England Hwy (E Leg)	740	A	0.234	6.4	10
Mirage Road (N Leg)	60	A	0.039	7.5	1
New England Hwy (W Leg)	800	A	0.255	6.4	12
Total	1,723	A	0.255	6.5	12

SIDRA modelling indicates that 10 years after commencement of the Project, the intersection continues to perform at LoS A during the AM and PM peak hour. The performance of the intersection is comparable with existing conditions and 2017 future operation with a marginal increase in DoS and queue lengths along New England Highway.

4.0 Conclusion

The analysis shows that proposed construction traffic and future operation of the site is likely to have a minor impact on the operation of the intersection of New England Highway / Kyle Street / Mirage Road, the main intersection from the strategic road network to the TPR at Rutherford. Results show the intersection continues to operate at LoS A and has a comparable performance to the existing condition.

Table 7 Summary of SIDRA Results for New England Highway / Kyle Street / Mirage Road

Scenario	Volume (veh/h)	Level of Service	Degree of Saturation	Average Delay (s)	95% back of queue (m)
2015 – existing condition					
AM peak	1,324	A	0.216	6.7	9
PM peak	1,387	A	0.201	6.4	9
2016 – construction impact					
AM peak	1,381	A	0.225	6.8	10
PM peak	1,443	A	0.210	6.6	9
2017 – future operation					
AM peak	1,379	A	0.227	6.7	10
PM peak	1,440	A	0.210	6.5	9
2027 – future operation (+10 years)					
AM peak	1,654	A	0.273	6.7	12
PM peak	1,723	A	0.255	6.5	12

To mitigate potential impacts during construction, a detailed Construction Environmental Management Plan (CEMP) should be prepared by the chosen contractor and include construction specific traffic management measures. This should be developed in consultation with Roads and Maritime Services and Maitland City Council and submitted to Department of Planning and Environment prior to the commencement of construction. The CEMP would cover all temporary warning, guidance and information signage, as well as appropriate traffic control devices.

The ongoing operation of the facilities existing traffic management practises are considered suitable to continue managing operational traffic following the implementation of the proposed Project.

The Project has the potential to conservatively generate up to 24 additional heavy vehicle movements per day which equates to two heavy vehicles in each of the AM and PM peak hours. SIDRA modelling shows the Project has a negligible impact on the future operation of the intersection, performing similarly to existing conditions as shown in **Table 7**. As a result no intersection upgrades have been identified for the New England Highway / Kyle Street / Mirage Road intersection.

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Appendix A

2015 Existing Conditions SIDRA Results

Appendix A 2015 Existing Conditions SIDRA Results

MOVEMENT SUMMARY

 **Site: 2015 AM**

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Kyle Street											
1	L2	17	41.2	0.023	6.3	LOS A	0.1	0.8	0.47	0.59	51.0
2	T1	5	40.0	0.028	5.5	LOS A	0.1	0.9	0.45	0.65	49.6
3	R2	20	35.0	0.028	11.2	LOS A	0.1	0.9	0.45	0.65	50.1
3u	U	1	0.0	0.028	12.8	LOS A	0.1	0.9	0.45	0.65	54.8
Approach		43	37.2	0.028	8.6	LOS A	0.1	0.9	0.46	0.63	50.5
East: New England Hwy East Approach											
4	L2	24	12.5	0.187	6.0	LOS A	1.0	7.6	0.21	0.46	60.3
5	T1	519	5.4	0.187	6.2	LOS A	1.0	7.6	0.21	0.48	67.2
6	R2	29	3.4	0.187	12.1	LOS A	1.0	7.5	0.22	0.50	58.3
6u	U	5	20.0	0.187	15.2	LOS B	1.0	7.5	0.22	0.50	63.5
Approach		577	5.7	0.187	6.6	LOS A	1.0	7.6	0.21	0.48	66.4
North: Mirage Road											
7	L2	11	9.1	0.014	4.6	LOS A	0.0	0.4	0.48	0.53	53.3
8	T1	8	25.0	0.022	3.8	LOS A	0.1	0.7	0.47	0.59	49.8
9	R2	12	25.0	0.022	9.3	LOS A	0.1	0.7	0.47	0.59	49.2
9u	U	1	0.0	0.022	10.8	LOS A	0.1	0.7	0.47	0.59	49.0
Approach		32	18.7	0.022	6.4	LOS A	0.1	0.7	0.47	0.57	50.6
West: New England Hwy West Approach											
10	L2	31	6.5	0.216	5.8	LOS A	1.3	9.3	0.20	0.46	56.1
11	T1	594	5.7	0.216	6.3	LOS A	1.3	9.3	0.21	0.48	67.2
12	R2	46	15.2	0.216	12.3	LOS A	1.2	9.2	0.22	0.50	61.9
12u	U	1	0.0	0.216	14.9	LOS B	1.2	9.2	0.22	0.50	64.5
Approach		672	6.4	0.216	6.7	LOS A	1.3	9.3	0.21	0.48	66.2
All Vehicles		1324	7.4	0.216	6.7	LOS A	1.3	9.3	0.23	0.48	65.1

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

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

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY



Site: 2015 PM

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Kyle Street											
1	L2	74	4.1	0.066	5.0	LOS A	0.2	1.8	0.44	0.58	58.9
2	T1	5	0.0	0.050	5.3	LOS A	0.2	1.3	0.46	0.70	49.5
3	R2	39	5.1	0.050	11.1	LOS A	0.2	1.3	0.46	0.70	55.8
3u	U	1	0.0	0.050	13.3	LOS A	0.2	1.3	0.46	0.70	54.5
Approach		119	4.2	0.066	7.1	LOS A	0.2	1.8	0.45	0.63	57.3
East: New England Hwy East Approach											
4	L2	11	18.2	0.184	6.0	LOS A	1.1	7.5	0.19	0.45	60.3
5	T1	564	1.4	0.184	6.1	LOS A	1.1	7.5	0.19	0.46	68.7
6	R2	5	0.0	0.184	12.0	LOS A	1.0	7.4	0.20	0.47	58.8
6u	U	6	16.7	0.184	15.1	LOS B	1.0	7.4	0.20	0.47	64.2
Approach		586	1.9	0.184	6.3	LOS A	1.1	7.5	0.19	0.46	68.4
North: Mirage Road											
7	L2	16	12.5	0.020	4.7	LOS A	0.1	0.5	0.48	0.55	52.6
8	T1	3	66.7	0.030	4.6	LOS A	0.1	0.8	0.45	0.65	48.3
9	R2	27	3.7	0.030	8.9	LOS A	0.1	0.8	0.45	0.65	51.9
9u	U	1	0.0	0.030	10.8	LOS A	0.1	0.8	0.45	0.65	48.0
Approach		47	10.6	0.030	7.2	LOS A	0.1	0.8	0.46	0.61	51.8
West: New England Hwy West Approach											
10	L2	17	17.6	0.201	6.0	LOS A	1.2	8.8	0.20	0.45	56.0
11	T1	593	3.0	0.201	6.2	LOS A	1.2	8.8	0.20	0.46	68.2
12	R2	22	31.8	0.201	12.6	LOS A	1.2	8.7	0.21	0.48	61.5
12u	U	2	0.0	0.201	14.8	LOS B	1.2	8.7	0.21	0.48	64.9
Approach		634	4.4	0.201	6.4	LOS A	1.2	8.8	0.20	0.46	67.5
All Vehicles		1387	3.5	0.201	6.4	LOS A	1.2	8.8	0.23	0.48	66.2

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

Appendix B

2016 Construction SIDRA Results

Appendix B 2016 Construction SIDRA Results

MOVEMENT SUMMARY

 **Site: 2016 AM - Construction**

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Kyle Street											
1	L2	20	45.0	0.028	6.4	LOS A	0.1	1.0	0.48	0.61	50.3
2	T1	5	40.0	0.035	5.5	LOS A	0.1	1.2	0.46	0.67	49.5
3	R2	25	44.0	0.035	11.4	LOS A	0.1	1.2	0.46	0.67	48.5
3u	U	1	0.0	0.035	12.8	LOS A	0.1	1.2	0.46	0.67	54.7
Approach		51	43.1	0.035	8.9	LOS A	0.1	1.2	0.47	0.64	49.4
East: New England Hwy East Approach											
4	L2	41	17.1	0.198	6.1	LOS A	1.1	8.3	0.22	0.47	60.1
5	T1	530	5.5	0.198	6.3	LOS A	1.1	8.3	0.23	0.48	67.1
6	R2	30	3.3	0.198	12.2	LOS A	1.1	8.1	0.24	0.50	58.2
6u	U	5	20.0	0.198	15.3	LOS B	1.1	8.1	0.24	0.50	63.4
Approach		606	6.3	0.198	6.7	LOS A	1.1	8.3	0.23	0.48	66.0
North: Mirage Road											
7	L2	11	9.1	0.014	4.7	LOS A	0.0	0.4	0.49	0.54	53.2
8	T1	8	25.0	0.022	3.8	LOS A	0.1	0.7	0.48	0.59	49.8
9	R2	12	25.0	0.022	9.4	LOS A	0.1	0.7	0.48	0.59	49.1
9u	U	1	0.0	0.022	10.9	LOS A	0.1	0.7	0.48	0.59	49.0
Approach		32	18.7	0.022	6.4	LOS A	0.1	0.7	0.48	0.57	50.6
West: New England Hwy West Approach											
10	L2	32	6.3	0.225	5.9	LOS A	1.3	9.8	0.22	0.46	56.0
11	T1	606	5.8	0.225	6.3	LOS A	1.3	9.8	0.23	0.48	67.0
12	R2	53	17.0	0.225	12.4	LOS A	1.3	9.8	0.24	0.51	61.6
12u	U	1	0.0	0.225	14.9	LOS B	1.3	9.8	0.24	0.51	64.3
Approach		692	6.6	0.225	6.8	LOS A	1.3	9.8	0.23	0.48	66.0
All Vehicles		1381	8.1	0.225	6.8	LOS A	1.3	9.8	0.24	0.49	64.7

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

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

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 **Site: 2016 PM - Construction**

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Kyle Street											
1	L2	81	6.2	0.074	5.1	LOS A	0.3	2.0	0.45	0.59	58.4
2	T1	5	0.0	0.069	5.2	LOS A	0.3	1.9	0.47	0.72	49.4
3	R2	56	10.7	0.069	11.2	LOS A	0.3	1.9	0.47	0.72	54.4
3u	U	1	0.0	0.069	13.3	LOS A	0.3	1.9	0.47	0.72	54.3
Approach		143	7.7	0.074	7.5	LOS A	0.3	2.0	0.46	0.65	56.3
East: New England Hwy East Approach											
4	L2	16	37.5	0.190	6.3	LOS A	1.1	7.9	0.20	0.46	59.6
5	T1	575	1.4	0.190	6.2	LOS A	1.1	7.9	0.20	0.46	68.7
6	R2	5	0.0	0.190	12.0	LOS A	1.1	7.6	0.21	0.47	58.7
6u	U	6	16.7	0.190	15.1	LOS B	1.1	7.6	0.21	0.47	64.1
Approach		602	2.5	0.190	6.3	LOS A	1.1	7.9	0.20	0.46	68.2
North: Mirage Road											
7	L2	16	12.5	0.021	4.8	LOS A	0.1	0.6	0.50	0.56	52.6
8	T1	3	66.7	0.031	4.7	LOS A	0.1	0.9	0.47	0.65	48.2
9	R2	28	3.6	0.031	8.9	LOS A	0.1	0.9	0.47	0.65	51.9
9u	U	1	0.0	0.031	10.9	LOS A	0.1	0.9	0.47	0.65	48.0
Approach		48	10.4	0.031	7.3	LOS A	0.1	0.9	0.48	0.62	51.8
West: New England Hwy West Approach											
10	L2	17	17.6	0.210	6.1	LOS A	1.3	9.4	0.23	0.46	55.8
11	T1	605	3.0	0.210	6.3	LOS A	1.3	9.4	0.24	0.47	67.9
12	R2	25	36.0	0.210	12.8	LOS A	1.3	9.3	0.25	0.48	61.1
12u	U	2	0.0	0.210	14.9	LOS B	1.3	9.3	0.25	0.48	64.7
Approach		649	4.6	0.210	6.5	LOS A	1.3	9.4	0.24	0.47	67.2
All Vehicles		1443	4.2	0.210	6.6	LOS A	1.3	9.4	0.26	0.49	65.7

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

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

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix C

2017 Future Operation SIDRA Results

Appendix C 2017 Future Operation SIDRA Results

MOVEMENT SUMMARY



Site: 2017 AM - Future Operation

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Kyle Street											
1	L2	18	44.4	0.025	6.4	LOS A	0.1	0.9	0.48	0.60	50.4
2	T1	5	40.0	0.030	5.5	LOS A	0.1	1.0	0.46	0.66	49.6
3	R2	21	38.1	0.030	11.3	LOS A	0.1	1.0	0.46	0.66	49.5
3u	U	1	0.0	0.030	12.8	LOS A	0.1	1.0	0.46	0.66	54.7
Approach		45	40.0	0.030	8.7	LOS A	0.1	1.0	0.47	0.64	50.0
East: New England Hwy East Approach											
4	L2	25	16.0	0.195	6.0	LOS A	1.1	8.0	0.21	0.46	60.2
5	T1	540	5.4	0.195	6.3	LOS A	1.1	8.0	0.22	0.48	67.2
6	R2	30	3.3	0.195	12.1	LOS A	1.1	7.9	0.23	0.50	58.3
6u	U	5	20.0	0.195	15.3	LOS B	1.1	7.9	0.23	0.50	63.4
Approach		600	5.8	0.195	6.6	LOS A	1.1	8.0	0.22	0.48	66.3
North: Mirage Road											
7	L2	11	9.1	0.014	4.7	LOS A	0.0	0.4	0.49	0.54	53.2
8	T1	8	25.0	0.022	3.8	LOS A	0.1	0.7	0.47	0.59	49.8
9	R2	12	25.0	0.022	9.4	LOS A	0.1	0.7	0.47	0.59	49.1
9u	U	1	0.0	0.022	10.9	LOS A	0.1	0.7	0.47	0.59	49.0
Approach		32	18.7	0.022	6.4	LOS A	0.1	0.7	0.48	0.57	50.6
West: New England Hwy West Approach											
10	L2	32	6.3	0.227	5.8	LOS A	1.3	9.9	0.21	0.46	56.0
11	T1	622	6.3	0.227	6.3	LOS A	1.3	9.9	0.22	0.48	67.0
12	R2	47	17.0	0.227	12.4	LOS A	1.3	9.9	0.23	0.50	61.8
12u	U	1	0.0	0.227	14.9	LOS B	1.3	9.9	0.23	0.50	64.5
Approach		702	7.0	0.227	6.7	LOS A	1.3	9.9	0.22	0.48	66.0
All Vehicles		1379	7.8	0.227	6.7	LOS A	1.3	9.9	0.23	0.49	65.0

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

MOVEMENT SUMMARY

 **Site: 2017 PM - Future Operation**

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Kyle Street											
1	L2	75	5.3	0.068	5.1	LOS A	0.3	1.9	0.45	0.59	58.5
2	T1	5	0.0	0.053	5.3	LOS A	0.2	1.4	0.47	0.71	49.5
3	R2	40	7.5	0.053	11.2	LOS A	0.2	1.4	0.47	0.71	55.2
3u	U	1	0.0	0.053	13.4	LOS A	0.2	1.4	0.47	0.71	54.4
Approach		121	5.8	0.068	7.2	LOS A	0.3	1.9	0.46	0.64	56.9
East: New England Hwy East Approach											
4	L2	12	25.0	0.192	6.1	LOS A	1.1	7.9	0.19	0.46	60.0
5	T1	586	1.4	0.192	6.1	LOS A	1.1	7.9	0.20	0.46	68.7
6	R2	5	0.0	0.192	12.0	LOS A	1.1	7.7	0.21	0.47	58.8
6u	U	6	16.7	0.192	15.1	LOS B	1.1	7.7	0.21	0.47	64.2
Approach		609	2.0	0.192	6.3	LOS A	1.1	7.9	0.20	0.46	68.4
North: Mirage Road											
7	L2	17	11.8	0.021	4.7	LOS A	0.1	0.6	0.49	0.55	52.7
8	T1	3	66.7	0.031	4.7	LOS A	0.1	0.8	0.46	0.65	48.2
9	R2	28	3.6	0.031	8.9	LOS A	0.1	0.8	0.46	0.65	51.9
9u	U	1	0.0	0.031	10.9	LOS A	0.1	0.8	0.46	0.65	48.0
Approach		49	10.2	0.031	7.2	LOS A	0.1	0.8	0.47	0.62	51.9
West: New England Hwy West Approach											
10	L2	18	16.7	0.210	6.0	LOS A	1.3	9.3	0.20	0.45	56.0
11	T1	617	3.1	0.210	6.2	LOS A	1.3	9.3	0.21	0.46	68.1
12	R2	23	34.8	0.210	12.6	LOS A	1.3	9.2	0.22	0.48	61.4
12u	U	2	0.0	0.210	14.8	LOS B	1.3	9.2	0.22	0.48	64.9
Approach		660	4.5	0.210	6.4	LOS A	1.3	9.3	0.21	0.46	67.5
All Vehicles		1440	3.8	0.210	6.5	LOS A	1.3	9.3	0.23	0.48	66.1

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

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

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix D

2027 Future Operation SIDRA Results

Appendix D 2027 Future Operation SIDRA Results

MOVEMENT SUMMARY



Site: 2027 AM - Future Operation

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: Kyle Street											
1	L2	18	44.4	0.027	6.9	LOS A	0.1	0.9	0.52	0.64	50.1
2	T1	5	40.0	0.031	5.8	LOS A	0.1	1.0	0.49	0.68	49.5
3	R2	21	38.1	0.031	11.6	LOS A	0.1	1.0	0.49	0.68	49.4
3u	U	1	0.0	0.031	13.0	LOS A	0.1	1.0	0.49	0.68	54.6
Approach		45	40.0	0.031	9.1	LOS A	0.1	1.0	0.50	0.67	49.8
East: New England Hwy East Approach											
4	L2	25	16.0	0.237	6.1	LOS A	1.4	10.3	0.23	0.46	60.0
5	T1	659	5.5	0.237	6.3	LOS A	1.4	10.3	0.24	0.48	67.0
6	R2	37	2.7	0.237	12.2	LOS A	1.4	10.1	0.25	0.50	58.1
6u	U	6	16.7	0.237	15.3	LOS B	1.4	10.1	0.25	0.50	63.4
Approach		727	5.8	0.237	6.7	LOS A	1.4	10.3	0.24	0.48	66.2
North: Mirage Road											
7	L2	14	7.1	0.018	5.0	LOS A	0.1	0.5	0.52	0.58	53.5
8	T1	12	33.3	0.030	4.3	LOS A	0.1	1.0	0.51	0.61	49.6
9	R2	14	21.4	0.030	9.6	LOS A	0.1	1.0	0.51	0.61	49.7
9u	U	1	0.0	0.030	11.1	LOS A	0.1	1.0	0.51	0.61	48.9
Approach		41	19.5	0.030	6.5	LOS A	0.1	1.0	0.52	0.60	50.8
West: New England Hwy West Approach											
10	L2	40	7.5	0.273	5.9	LOS A	1.7	12.4	0.23	0.46	55.9
11	T1	753	5.7	0.273	6.3	LOS A	1.7	12.4	0.24	0.48	67.0
12	R2	47	17.0	0.273	12.5	LOS A	1.7	12.3	0.25	0.50	61.7
12u	U	1	0.0	0.273	15.0	LOS B	1.7	12.3	0.25	0.50	64.4
Approach		841	6.4	0.273	6.7	LOS A	1.7	12.4	0.24	0.48	66.1
All Vehicles		1654	7.4	0.273	6.7	LOS A	1.7	12.4	0.26	0.49	65.1

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

MOVEMENT SUMMARY

 **Site: 2027 PM - Future Operation**

New Site
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Kyle Street											
1	L2	75	5.3	0.071	5.3	LOS A	0.3	2.0	0.49	0.63	58.4
2	T1	6	0.0	0.057	5.6	LOS A	0.2	1.5	0.51	0.74	49.4
3	R2	40	7.5	0.057	11.5	LOS A	0.2	1.5	0.51	0.74	55.2
3u	U	1	0.0	0.057	13.7	LOS A	0.2	1.5	0.51	0.74	54.4
Approach		122	5.7	0.071	7.4	LOS A	0.3	2.0	0.50	0.67	56.7
East: New England Hwy East Approach											
4	L2	12	25.0	0.234	6.2	LOS A	1.4	10.2	0.22	0.46	59.8
5	T1	715	1.4	0.234	6.2	LOS A	1.4	10.2	0.23	0.46	68.5
6	R2	6	0.0	0.234	12.1	LOS A	1.4	10.0	0.24	0.47	58.6
6u	U	7	14.3	0.234	15.1	LOS B	1.4	10.0	0.24	0.47	64.1
Approach		740	1.9	0.234	6.4	LOS A	1.4	10.2	0.23	0.46	68.2
North: Mirage Road											
7	L2	21	14.3	0.029	5.2	LOS A	0.1	0.8	0.52	0.60	52.0
8	T1	4	75.0	0.039	5.2	LOS A	0.1	1.1	0.50	0.68	48.0
9	R2	34	2.9	0.039	9.1	LOS A	0.1	1.1	0.50	0.68	51.9
9u	U	1	0.0	0.039	11.1	LOS A	0.1	1.1	0.50	0.68	47.9
Approach		60	11.7	0.039	7.5	LOS A	0.1	1.1	0.51	0.65	51.6
West: New England Hwy West Approach											
10	L2	22	18.2	0.255	6.0	LOS A	1.6	11.9	0.22	0.46	55.9
11	T1	752	3.1	0.255	6.2	LOS A	1.6	11.9	0.22	0.46	68.0
12	R2	23	34.8	0.255	12.7	LOS A	1.6	11.7	0.23	0.48	61.3
12u	U	3	0.0	0.255	14.9	LOS B	1.6	11.7	0.23	0.48	64.8
Approach		800	4.4	0.255	6.4	LOS A	1.6	11.9	0.22	0.46	67.4
All Vehicles		1723	3.7	0.255	6.5	LOS A	1.6	11.9	0.25	0.49	66.1

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