

Our Ref: 82018194:IP
Contact: Ivo Pais / Peter Moy

17 September 2019

Lendlease
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Attention: Sarah Kelly

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Dear Sarah,

CALDERWOOD MOD 4 APPLICATION DEVELOPMENT TRIGGER

Cardno, Lendlease and RMS representatives met on Thursday 15th August 2019 to discuss the Calderwood Urban Development modification application (Mod 4). As part of this discussion, RMS requested information regarding the development trigger for the Broughton Avenue / Illawarra Highway / Tripoli Way extension for the proposed signalisation.

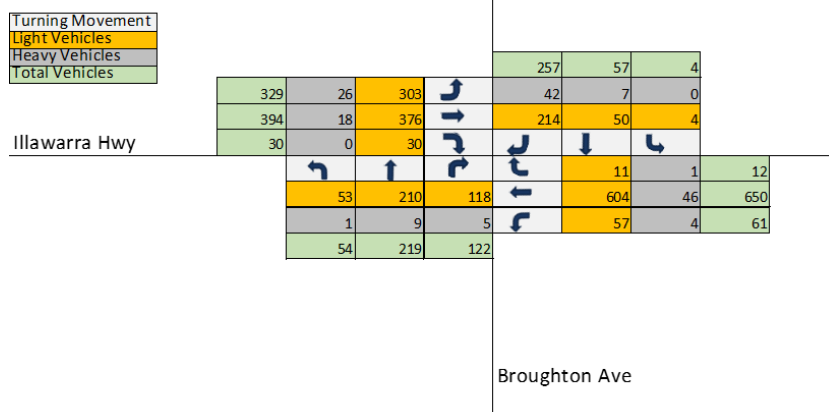
For context, the microsimulation traffic modelling (Aimsun) prepared for the modification application assessed the ultimate year scenario (2036) only, consistent with the 210 TMAP. There are no interim year analysis (microsimulation) that would otherwise identify trigger points through the life of the project.

Cardno has undertaken a high level assessment of the potential development trigger for the intersection of Broughton Avenue / Illawarra Highway / Tripoli Way extension through the following method:

- Undertake intersection modelling with the use of SIDRA v8.
- Import the 2036 traffic volumes outputted from the 2036 Aimsun model (6,000 Lot development) into SIDRA.
- Assess the intersection as a single lane roundabout, with four approaches (to reflect a pre-upgrade scenario).
- Utilise SIDRA's growth rate and design life function by applying a nominal -1% growth factor and target LoS C. This allows SIDRA to reduce the traffic volume on all approaches (due to the negative growth) until the intersection performs at LoS C. The growth rate is arbitrary and is used just to decrease the 2036 volumes.
- Compare the total volumes from the LoS C performing single lane roundabout to the ultimate 2036 traffic volumes.
- The ratio obtained above is then applied to the 6,000 Lots to obtain a Lot number, to inform the trigger point.

The 2036 volumes, as per the Aimsun modelling, are shown in **Figure 1-1**.

2036 AM Peak



2036 PM Peak

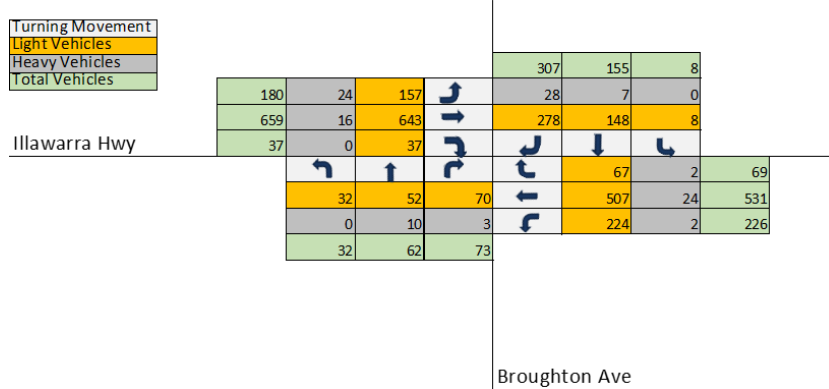


Figure 1-1 2036 Traffic Volumes

The single lane roundabout (SIDRA model) is depicted in **Figure 1-2**.

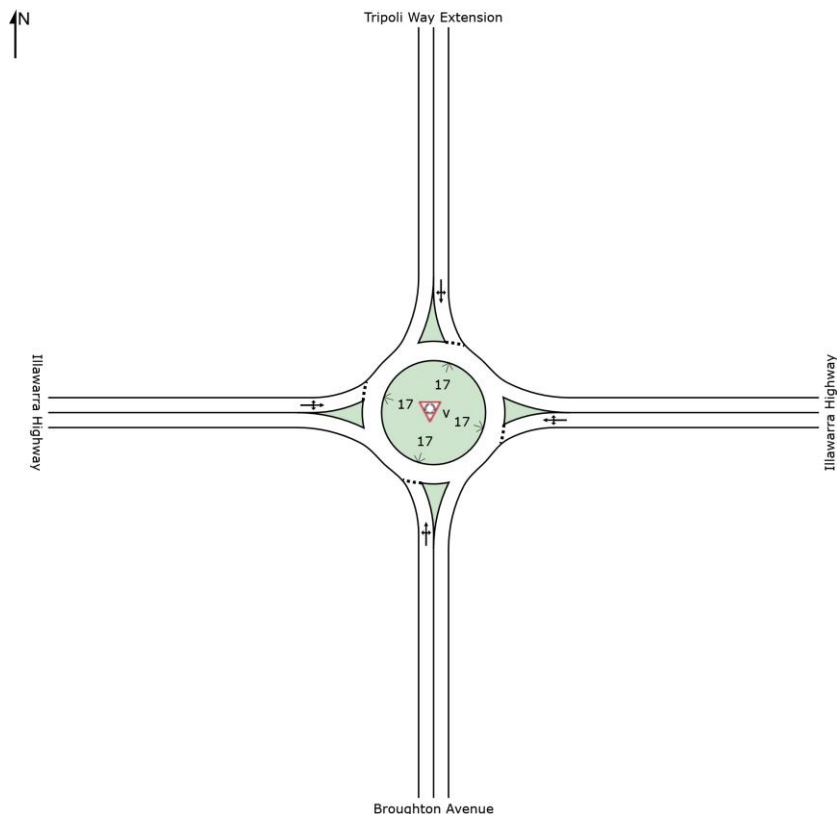


Figure 1-2 Single Lane Roundabout

The results of the trigger assessment are shown in **Table 1-1**.

Table 1-1 Development Trigger Summary

Period	2036 Volumes	Reduced Volumes	Ratio	Lots
AM	2200	2024	0.92	5520
PM	2344	2063	0.88	5280

Based on the methodology described above, the single lane roundabout would likely perform at LoS C up to 5,280 Lots. Thereafter, it would be expected that the LoS would deteriorate and require the signalised intersection upgrade.

In conclusion, the expected development trigger would be equivalent to the 5,281st Lot requiring the upgrade of Broughton Avenue / Illawarra Highway / Tripoli Way extension.

Yours sincerely,



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APPENDIX

A

SIDRA MOVEMENT SUMMARY

MOVEMENT SUMMARY



Site: v [Broughton Avenue/ Illawarra Highway 2036 AM - All ped phases - Trigger]

Broughton Ave/ Illawarra Hwy

Roundabout

Design Life Analysis (Level of Service Target (Worst Vehicle Movement)): Results for 8 years

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	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Broughton Avenue											
1	L2	51	1.8	0.803	35.9	LOS C	11.7	84.8	1.00	1.37	36.9
2	T1	201	4.1	0.803	36.3	LOS C	11.7	84.8	1.00	1.37	37.4
3	R2	112	4.1	0.803	40.6	LOS C	11.7	84.8	1.00	1.37	37.3
Approach		363	3.8	0.803	37.6	LOS C	11.7	84.8	1.00	1.37	37.3
East: Illawarra Highway											
4	L2	57	8.1	0.752	12.8	LOS A	11.5	85.3	0.99	0.98	48.6
5	T1	599	6.9	0.752	13.0	LOS A	11.5	85.3	0.99	0.98	49.6
6	R2	12	15.4	0.752	17.7	LOS B	11.5	85.3	0.99	0.98	49.1
Approach		668	7.2	0.752	13.1	LOS A	11.5	85.3	0.99	0.98	49.5
North: Tripoli Way Extension											
7	L2	4	0.0	0.442	9.0	LOS A	3.5	27.7	0.86	0.88	48.7
8	T1	53	12.1	0.442	9.8	LOS A	3.5	27.7	0.86	0.88	49.4
9	R2	236	17.1	0.442	14.4	LOS A	3.5	27.7	0.86	0.88	48.9
Approach		293	16.0	0.442	13.5	LOS A	3.5	27.7	0.86	0.88	49.0
West: Illawarra Highway											
10	L2	306	7.8	0.781	13.6	LOS A	13.1	96.2	1.00	0.99	48.1
11	T1	365	4.5	0.781	13.7	LOS A	13.1	96.2	1.00	0.99	49.1
12	R2	28	0.0	0.781	17.7	LOS B	13.1	96.2	1.00	0.99	49.1
Approach		699	5.8	0.781	13.8	LOS A	13.1	96.2	1.00	0.99	48.6
All Vehicles		2024	7.4	0.803	17.8	LOS B	13.1	96.2	0.98	1.04	46.4

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.

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.

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MOVEMENT SUMMARY

 **Site: v [Broughton Avenue/ Illawarra Highway 2036 PM - All ped phases - Trigger]**

Broughton Ave/ Illawarra Hwy

Roundabout

Design Life Analysis (Level of Service Target (Worst Vehicle Movement)): Results for 12 years

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	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Broughton Avenue											
1	L2	29	3.0	0.308	11.8	LOS A	2.2	16.6	0.92	0.92	47.9
2	T1	56	17.2	0.308	13.1	LOS A	2.2	16.6	0.92	0.92	48.5
3	R2	64	4.1	0.308	16.4	LOS B	2.2	16.6	0.92	0.92	48.7
Approach		150	8.8	0.308	14.3	LOS A	2.2	16.6	0.92	0.92	48.5
East: Illawarra Highway											
4	L2	199	0.9	0.940	35.3	LOS C	27.8	200.4	1.00	1.56	37.4
5	T1	469	4.5	0.940	35.9	LOS C	27.8	200.4	1.00	1.56	37.9
6	R2	61	2.9	0.940	40.0	LOS C	27.8	200.4	1.00	1.56	37.8
Approach		729	3.4	0.940	36.1	LOS C	27.8	200.4	1.00	1.56	37.7
North: Tripoli Way Extension											
7	L2	8	11.1	0.717	20.8	LOS B	9.0	67.7	1.00	1.22	42.7
8	T1	136	5.2	0.717	20.7	LOS B	9.0	67.7	1.00	1.22	43.6
9	R2	269	9.5	0.717	25.3	LOS B	9.0	67.7	1.00	1.22	43.3
Approach		414	8.1	0.717	23.7	LOS B	9.0	67.7	1.00	1.22	43.4
West: Illawarra Highway											
10	L2	159	13.3	0.682	6.8	LOS A	8.0	58.4	0.79	0.64	51.5
11	T1	578	2.4	0.682	6.7	LOS A	8.0	58.4	0.79	0.64	52.9
12	R2	33	0.0	0.682	10.9	LOS A	8.0	58.4	0.79	0.64	52.8
Approach		771	4.6	0.682	6.9	LOS A	8.0	58.4	0.79	0.64	52.6
All Vehicles		2063	5.2	0.940	21.1	LOS B	27.8	200.4	0.92	1.10	44.3

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.

Roundabout Capacity Model: SIDRA Standard.

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

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

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