Subject: **Drury Centre Stage 2 (Fast Track)**
Response to Section 67 RFI dated 5 September 2025 Ref: 25001

Noted By: **Daryl Hughes** 19 September 2025

This memorandum responds to the key transport issues raised in the Section 67 Request for Information (RFI) from the EPA Panel dated 5 September 2025. Numbering follows the convention noted within the RFI.

5. Transport

REQUEST A

Following an initial review by the Panel's transportation expert, the following information is requested:

a) *Figures clearly showing external traffic movements to and from the site (entering and exiting) for both the previous and proposed scenarios, especially as between the 2,000vph and 3,800vph trigger levels. This is to determine if the change in mix in use (residential vs commercial) has any notable change in direction of traffic.*

Response

The plan change Saturn model was not rerun to test differences in trip direction resulting from the modifications to the activity mix, as it was anticipated that the changes would have minimal difference to the performance of the key intersection. The exercise merely ensured that the total trip generation thresholds were matched with those expected for each trigger point. Rerunning the Saturn model to change fundamental input variables and matrices could not be completed within the required timeframes, however, to respond to this question the proposed changes to activity mix were tested using a spreadsheet analysis to determine from first principles changes to inbound / outbound directionality.

Spreadsheet Analysis

A spreadsheet was created to approximate the changes in direction resulting from the proposed alterations to the activity mix for the 3,800vph trigger point (the 2,000vph trigger point is already consented, and in any case would produce less significant results than the larger yield at 3,800vph). Peak hour directional distributions were taken from the Institute of Transportation Engineers (ITE) Trip Generation Manual, as summarised below:

- Residential:

- AM Peak: 20% inbound / 80% outbound
  - PM Peak: 65% inbound / 35% outbound
- Retail:
  - AM Peak: 60% inbound / 40% outbound
  - PM Peak: 50% inbound / 50% outbound
- Commercial Offices:
  - AM Peak: 90% inbound / 10% outbound
  - PM Peak: 15% inbound / 85% outbound
- Community:
  - AM Peak: 55% inbound / 45% outbound
  - PM Peak: 45% inbound / 55% outbound

For the Plan Change activity mix, trip generation rates set by Supporting Growth Alliance (SGA) and adopted in the Plan Change modelling were used. For the proposed Stage 2 Fast Track activity mix (the subject application), the same trip generation rates were used, but adjustments were made to the residential trips rates to account for working from home (WFH), as set out in the 21 July 2025 WFH Memo. **Table 1** below summarises the activity mix; inbound / outbound traffic generation between the Plan Change and Stage 2 Fast Track activity mixes; and shows the difference between the two. It should be noted that this is a relatively blunt comparison method, as pass-by and diverted trips, internalisation, and traffic distribution throughout the local street network have not been taken into consideration. The outputs merely provide an indication of the inbound / outbound directionality trend.

Table 1: Changes to Inbound / Outbound Direction for 3,800vph Trigger Threshold

			Residential	Retail	Commercial	Community	Total	
Plan Change	Area / No		3,300hh	56,000sqm	17,900sqm	2,000sqm		
	AM	IN	289	305	290	11	895	
		OUT	1158	203	32	9	1402	
	PM	IN	941	1015	43	8	2007	
		OUT	506	1015	246	7	1775	
Fast Track	Area / No		2,660hh	7,000sqm	0	0		Diff
	AM	IN	245	388	0	0	633	- 262
		OUT	979	259	0	0	1237	- 164
	PM	IN	795	1293	0	0	2088	81
		OUT	428	1293	0	0	1721	- 54

As seen in the table, the AM peak hour sees a reduction in trips in both directions between the Plan Change and Stage 2 Fast Track trigger tables. This is because the greater proportion of retail activities proposed has a lower traffic generation in the AM peak hour than the other activities included in that development mix. Accordingly, the Stage 2 Fast Track proposal will bring relief to the AM peak hour network performance that was anticipated by Plan Change modelling.

The PM peak trips are broadly similar, with 81 more inbound trips and 54 fewer outbound trips, producing a negligible increase of 27 movements (+0.7%) overall under the Stage 2 Fast Track scenario. In terms of the directional distribution of trips:

- Inbound trips increase by 81 movements (+4%);
- outbound trips decrease by 54 movements (-3%); and
- the directional balance shifts from 53% inbound / 47% outbound under the Plan Change scenario to 55% inbound / 45% outbound under the Stage 2 Fast Track scenario.

In practical terms, the Stage 2 Fast Track scenario results in a slightly higher level of evening arrivals and fewer departures, reflecting a redistribution rather than an increase in demand. The overall effect is considered minor, as the marginal swing towards inbound traffic in the PM peak causes no material change in network loading or capacity requirements. It is reiterated that pass-by, diverted, trip internalisation and wider network distribution have not been taken into consideration in this comparative analysis. These factors will only further reduce the negligible effect of the proposed changes to activity mix

Response Summary

In summary, the spreadsheet exercise has demonstrated that the changes to directionality as a result of the proposed changes to the development mix are negligible and unlikely to make a significant difference to network performance.

REQUEST B

b) *The SATURN modelling in the 26 August 2025 response (page 12) appears to show a new road connecting Bremner Road to Waihoehoe Road (essentially replacing Norrie Road which has an existing single-lane bridge). This route is being used as an alternative traffic route should the SH1DC link not be included. Please comment on the appropriateness of this road being included (as while it has been designated, it is not understood to be funded).*

Response

The route represents AT Designation 1840[1] (Jesmond Road to Waihoehoe Road West FTN Upgrade), which enables a future upgrade to the Bremner Road / Norrie Road corridor, including the widening of the existing single-lane bridge on Norrie Road. The upgrade appears to have been included in the Plan Change Saturn model for 2028, presumably on the assumption that the works would be carried out concurrently with the Waihoehoe Road East Upgrade, as per Designation 1838. The route appears in the list of Drury Infrastructure Funding and Financing (DIFF) upgrades[2], and therefore should be constructed at some stage using Drury Development Contributions.

[1] https://at.govt.nz/media/zqbptv4p/1840_jesmond_to_waihoehoe_west_ftn_upgrade__.pdf?utm_source=chatgpt.com

[2] Auckland Council, Governing Body 27 April 2023, "Attachment A – Drury project list (Updated Drury investment programme)". Available via Council's Infocouncil document "Attachments of Governing Body – 27 April 2023

The Kiwi Property proposal is for the incremental development of a zoned Metropolitan Centre over a 15-year lapse period. My understanding is that Designation 1838 has been initiated and is intended to be constructed in recognition of the long-standing plans for urbanisation at Drury, the recognition at both national and regional government level of the strategic importance of Drury, the existing urban zoning of the Drury land and the need to provide a road network that facilitates urban development of both the Centre and the broader Drury urban area. In my opinion a failure to take account of the designation would have disregarded the strategic approach to roading and development embodied in the AUP.

REQUEST C

c) *Further to (b) above, should this road not be constructed (and the Norrie Road one-lane bridge be retained), can please assess / provide traffic volume diagrams as to where this traffic would be deviated to, given the one-lane bridge constraint (e.g., would it be to Great South Road).*

Response

In my opinion it is inconceivable that Auckland Council and Auckland Transport would consider it appropriate to retain into the future a single-lane bridge on a key urban zoned route providing access to the Metropolitan Centre from the existing and proposed residential development in Drury West. For that reason this seems to me to be a request that addresses a largely theoretical circumstance.

That said, the traffic model's use of Norrie Road as a convenient route to / from Drury East is not representative of the existing convoluted configuration – and the presence of the single-lane bridge – along its length. Accordingly, to assess the effect of downgrading the attraction of that route, further sensitivity testing was undertaken in Sidra. The testing was done for the PM peak hour only, as that is the most critical peak hour for the GSR / Waihoehoe Road intersection. In the interests of simplicity, we have carried out a single, extremely conservative sensitivity test which prevents any additional trips between the With and Without SH1DC scenarios from using the Firth Street / Norrie Road diversion.

The Saturn PM flow difference diagram (showing the difference in traffic flows in the PM peak with and without the SH1DC – already presented on page 12 of the Transport Response dated 16 August 2025) is shown below as **Figure 1**:

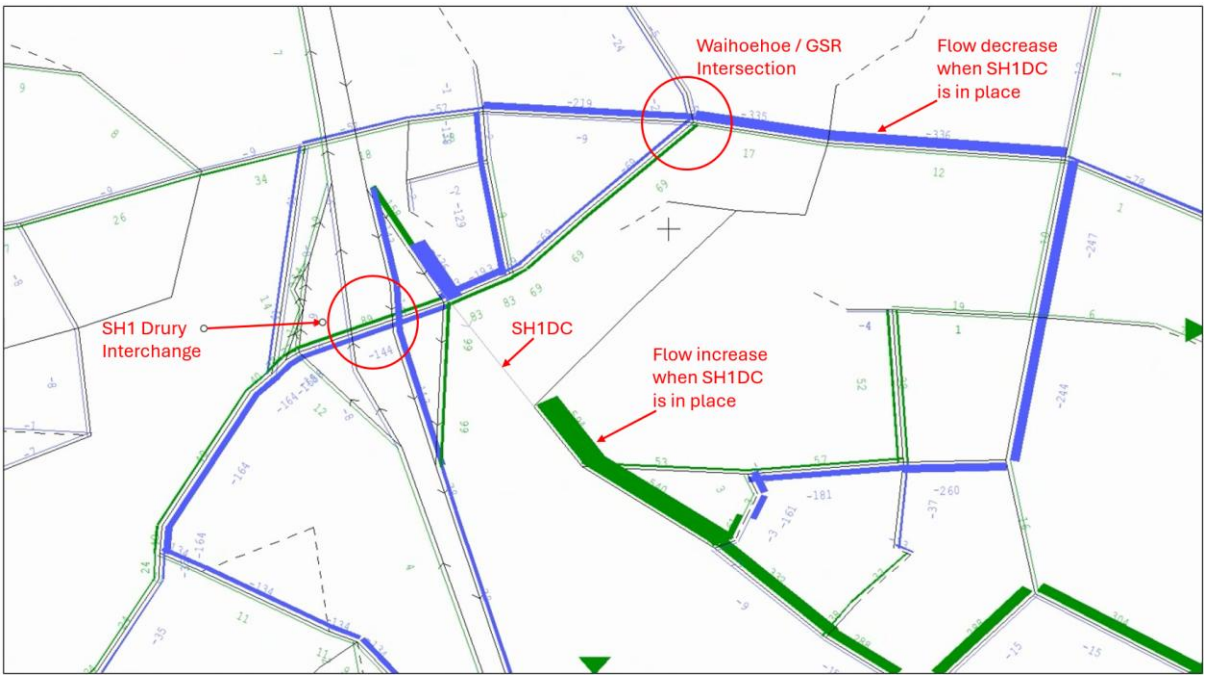


Figure 1: Difference in PM Flows when SH1DC is added (green=increase; blue=decrease)

The image shows that without SH1DC in place, approx. 130 vehicles use Firth Street to access Norrie Road, which then proceed through the intersection to reach Waihoehoe Road and Drury East. The Sidra Vehicle Movement Performance (VMP) for the 3,800vph trigger threshold without any adjustments is shown in **Figure 2** below as a base for the analysis (this VMP output was previously presented on page 14 of the Transport Response dated 26 August 2021). The Norrie Road and Great South Road south arrival movements to are circled in red for ease of reference, and the average queue length on Waihoehoe Road (which constitutes a pass condition) is circled in green.

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Great South Rd															
1	L2	All MCs	23	9.1	23	9.1	0.21	44.6	LOS D	3	22.5	0.81	0.67	0.81	30.2
2	T1	All MCs	276	8.2	276	8.2	0.34	36.2	LOS D	5.3	40.1	0.83	0.69	0.83	33.6
3	R2	All MCs	185	9.5	185	9.5	* 1.024	116.7	LOS F	9.6	72.7	1	1.29	1.77	19.2
Approach			484	8.7	484	8.7	1.024	67.3	LOS E	9.6	72.7	0.89	0.91	1.19	26
East: Waihoehoe Rd															
4	L2	All MCs	504	4.3	504	4.3	0.704	38.1	LOS D	15.2	110.4	0.91	0.85	0.91	32.3
5	T1	All MCs	362	6	362	6	0.797	50.3	LOS D	12.9	95.2	1	0.93	1.09	27.1
6	R2	All MCs	737	5.7	737	5.7	* 1.082	119.3	LOS F	27.7	203.3	0.98	1.19	1.53	19.6
Approach			1603	5.3	1603	5.3	1.082	78.2	LOS E	27.7	203.3	0.96	1.03	1.23	23.5
North: Great South Rd															
7	L2	All MCs	638	5.5	638	5.5	0.725	27.5	LOS C	11.5	84.5	0.86	0.95	0.86	38.8
8	T1	All MCs	515	7.8	515	7.8	* 1.093	162.7	LOS F	32.3	241.4	1	1.73	1.93	16.2
9	R2	All MCs	146	7.7	146	7.7	0.803	75.4	LOS E	5.6	42	1	0.94	1.21	23.1
Approach			1300	6.7	1300	6.7	1.093	86.5	LOS F	32.3	241.4	0.93	1.26	1.32	22.5
West: Norrie Rd															
10	L2	All MCs	311	4.6	311	4.6	0.743	44.6	LOS D	5.8	42	0.99	0.9	1.03	32.3
11	T1	All MCs	295	4.2	295	4.2	* 1.085	167.3	LOS F	17.9	130	1	1.59	1.97	13.9
12	R2	All MCs	21	0	21	0	0.061	61	LOS E	0.6	4.3	0.86	0.69	0.86	27
Approach			627	4.3	627	4.3	1.085	102.9	LOS F	17.9	130	0.99	1.22	1.47	18.2
All Vehicles			4013	6	4013	6	1.093	83.4	LOS F	32.3	241.4	0.95	1.12	1.29	22.6

Figure 2: Sidra Output at 3,800vph "pass" Without SH1DC (no adjustments)

Figure 2 shows that 295vph use the Norrie Road through route to access Drury East, whereas only 185vph use GSR south, and turn right into Waihoehoe Road. To remove the effect of the additional traffic diverting via Firth Street and Norrie Road when the SH1DC is not constructed, the following adjustments were made:

- GSR south right turns increased from 185 to 378 (added 193 vph).
- Norrie Road through trips reduced from 295 to 136 (removed 161vph).

Figure 3 below shows the results of the sensitivity test.

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Great South Rd															
1	L2	All MCs	23	9.1	23	9.1	0.598	53.4	LOS D	9.3	70.0	0.92	0.79	0.92	29.0
2	T1	All MCs	276	8.2	276	8.2	0.598	43.2	LOS D	9.3	70.0	0.92	0.79	0.92	32.1
3	R2	All MCs	378	4.6	378	4.6	*1.111	147.2	LOS F	17.6	128.2	0.99	1.30	1.78	16.7
Approach			677	6.2	677	6.2	1.111	101.6	LOS F	17.6	128.2	0.96	1.07	1.40	21.1
East: Waihoehoe Rd															
4	L2	All MCs	504	4.3	504	4.3	0.661	35.4	LOS D	14.6	105.7	0.87	0.84	0.87	33.1
5	T1	All MCs	362	6.0	362	6.0	0.827	53.0	LOS D	13.4	98.3	1.00	0.97	1.12	26.4
6	R2	All MCs	737	5.7	737	5.7	*1.112	135.8	LOS F	29.7	218.0	0.99	1.24	1.63	18.1
Approach			1603	5.3	1603	5.3	1.112	85.6	LOS F	29.7	218.0	0.95	1.05	1.28	22.9
North: Great South Rd															
7	L2	All MCs	638	5.5	638	5.5	0.766	38.7	LOS D	11.3	82.6	0.90	0.94	0.90	38.4
8	T1	All MCs	515	7.8	515	7.8	*1.127	190.6	LOS F	34.5	257.9	1.00	1.85	2.08	14.5
9	R2	All MCs	146	7.7	146	7.7	0.602	68.2	LOS E	5.1	38.1	0.99	0.80	0.99	24.8
Approach			1300	6.7	1300	6.7	1.127	102.3	LOS F	34.5	257.9	0.95	1.28	1.38	22.3
West: Norrie Rd															
10	L2	All MCs	311	4.6	311	4.6	*0.668	27.5	LOS C	5.3	38.2	0.95	0.83	0.95	33.4
11	T1	All MCs	136	9.1	136	9.1	0.428	49.1	LOS D	4.5	33.6	0.94	0.76	0.94	27.4
12	R2	All MCs	21	0.0	21	0.0	0.064	49.9	LOS D	0.6	4.4	0.87	0.69	0.87	26.8
Approach			468	5.7	468	5.7	0.668	34.8	LOS C	5.3	38.2	0.95	0.80	0.95	31.1
All Vehicles			4048	6.0	4048	6.0	1.127	87.7	LOS F	34.5	257.9	0.95	1.10	1.29	22.9

Figure 3: Sidra Output at 3,800vph "pass" Without SH1DC (Norrie flow change diverted to GSR)

Figure 3 establishes that by transferring the traffic diverting via Firth Street / Norrie Road to GSR, the intersection performance marginally degrades (average delay increases from 83.4sec to 87.7sec), and Waihoehoe Road average queue length increases from 203m to 218m. However, the test remains a pass, with Waihoehoe Road average queue less than the 250m threshold. In my opinion this is the worst-case scenario and transfers traffic largely to GSR.

REQUEST D

d) *The Sidra outputs (page 11 of the transportation response) show LOS F operation with over 5 minutes delay for a number of movements. This is not typically considered acceptable; however, it appears this is based on the previous network performance "criteria" of the original Plan Change 48 relating to average queue lengths. As such:*
   i. *Please comment further on how this intersection / surrounding area will operate safely with this level of delay; and*
   ii. *Please provide the same SIDRA output with 95%ile queues shown, rather than average queues.*

Response:

Given the sensitivity testing provided within the previous response, the remaining modelling questions may no longer be relevant, however, these have been addressed for completeness.

i) As stated previously, the levels of congestion are based upon the Network Capacity Criteria (NCC) that was initially suggested by Council's traffic expert and subsequently agreed by all other transport specialists prior to the Plan Change traffic modelling being carried out. Those specialists included representatives of Auckland Council, Auckland Transport, NZTA, SGA and the applicant. The philosophy behind the NCC was suggested as a sensible new approach to assessing performance around the new metropolitan centre: to enable such a level of congestion as to act as a deterrent to peak hour car drivers and an incentive to use other modes such as public transport or active modes. As such, as part of the NCC, average queues were considered and peak hour LOS F was tolerated, so long as interpeak LOS provided an opportunity to travel off-peak without significant delays and public transport was not unduly delayed. The resulting Plan Change trigger tables were the product of those assumptions.

   At the time that those discussions were taking place, the specialists also discussed the safety implications of the NCC. It was agreed that as long as the design of the roads and intersections were satisfactory, that the lower speeds evident in the expected congestion would prevent road safety problems from arising. It is acknowledged that uncontrolled (give way) intersections can suffer safety implications of congestion – as drivers can become impatient and take unsafe risks – but all of the key intersections in the Drury East area are traffic signal controlled, which will prevent such behaviour. Enforcement can be taken in any areas that see red light running. Overall, it is considered that the road safety effect of the congestion would either be negligible or would be positive due to relative slower speeds and journey times.

ii) Although average queue lengths formed the basis of the Plan Change modelling and resulting thresholds, the 95th percentile queues have been extracted to respond to this request.

   [Nb: I note that the Sidra VMP figure on page 11 of the 26 August Response Memo relates to a different intersection layout to that used in all other Sidra testing. Throughout the Plan Change and consenting process it has been recognised by all parties that the Waihoehoe / GSR intersection needs upgrading. The ultimate form of that upgrade has been the subject of consideration over time. The plan change modelling was based on an assumed indicative form of upgrade that, while not perfect, was considered to represent a sound and realistic intersection.
   Since then, AT has developed another layout for the intersection which was subsequently adopted for the updated modelling of the 2,000vph scenario (which represents the now granted Drury Centre Precinct Stage 1 consent). While that design did not cause major issues for the 2,000vph trigger point, it is in my opinion a compromised design which is significantly inferior to the version used in the plan change modelling. I raised my concerns in relation to the shortcomings of the new AT design in November 2024 as part of the AT design team stakeholder feedback process, but my recommended changes were not adopted. I maintain that the revised AT design has obvious shortcomings that can readily be resolved through relatively simple modifications using existing designations and avoiding encroachment into any third-

party land. As such, I expect that the AT design is likely to be modified and improved either prior to construction or shortly thereafter.]

Accordingly, and for completeness, it is appropriate that the modelling results for the 2,000vph trigger point be updated to reflect the anticipated Plan Change intersection design to enable sensible comparison with other modelling results. Accordingly, **Figure 7** shows the Sidra VMP for the 2,000vph threshold in the PM peak hour (without SH1DC) using the Plan Change intersection layout:

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Great South Rd															
1	L2	All MCs	23	9.1	23	9.1	0.335	54.9	LOS D	3.8	28.7	0.91	0.74	0.91	27.5
2	T1	All MCs	310	10.6	310	10.6	0.540	45.9	LOS D	6.9	52.6	0.93	0.77	0.93	30.8
3	R2	All MCs	122	11.0	122	11.0	*1.022	116.4	LOS F	6.3	47.9	1.00	1.24	1.83	19.3
Approach			455	10.7	455	10.7	1.022	65.2	LOS E	6.9	52.6	0.95	0.89	1.17	26.4
East: Waihoehoe Rd															
4	L2	All MCs	294	6.7	294	6.7	0.519	41.4	LOS D	8.7	64.2	0.88	0.81	0.88	31.4
5	T1	All MCs	234	1.8	234	1.8	0.485	42.2	LOS D	7.2	51.4	0.91	0.76	0.91	29.2
6	R2	All MCs	400	4.9	400	4.9	*1.076	117.7	LOS F	14.7	107.3	1.00	1.18	1.60	19.2
Approach			928	4.7	928	4.7	1.076	74.5	LOS E	14.7	107.3	0.94	0.96	1.20	24.0
North: Great South Rd															
7	L2	All MCs	458	5.4	458	5.4	0.436	33.5	LOS C	9.3	68.1	0.62	0.75	0.62	38.3
8	T1	All MCs	736	6.4	736	6.4	*1.084	152.3	LOS F	45.7	337.3	1.00	1.65	1.83	17.4
9	R2	All MCs	192	6.5	192	6.5	0.417	48.7	LOS D	3.6	27.0	0.88	0.78	0.88	33.9
Approach			1386	6.1	1386	6.1	1.084	98.7	LOS F	45.7	337.3	0.86	1.23	1.30	22.8
West: Norrie Rd															
10	L2	All MCs	337	4.9	337	4.9	0.435	38.2	LOS D	4.7	34.0	0.76	0.92	0.76	37.2
11	T1	All MCs	272	1.9	272	1.9	*1.034	128.2	LOS F	14.8	105.1	1.00	1.48	1.76	16.7
12	R2	All MCs	22	0.0	22	0.0	0.225	75.0	LOS E	0.8	5.5	0.99	0.70	0.99	23.2
Approach			631	3.4	631	3.4	1.034	78.3	LOS E	14.8	105.1	0.87	1.16	1.20	24.0
All Vehicles			3399	5.8	3399	5.8	1.084	83.8	LOS F	45.7	337.3	0.89	1.10	1.24	23.8

Figure 7: Updated PM Sidra VMP for the 2,000vph Trigger (Plan Change intersection Layout)

It can be seen that the performance of the intersection has improved compared to the previous 2,000vph threshold Sidra output on page 16 of the 26 August 2025 Transport Response. Importantly, the queue at Waihoehoe Road is improved at this trigger point using the Plan Change intersection layout, with the average queue being 107m.

Figure 8 shows the average and 95th percentile queue lengths per lane:

Lane Queues (Distance)														
Lane Number	Contin. Lane	Deg. Satn	Prog. Factor (Queue)	Overflow Queue (m)	Back of Queue (m)		Queue at Start of Green (m)		Cycle-Average Queue (m)		Queue Storage Ratio		Prob. Block.	Prob. SL Ov.	Ov. Lane No.
		v/c			Av.	95%	Av.	95%	Av.	95%	Av.	95%	%	%	
South: Great South Rd															
Lane 1		0.335	1.000	0.0	28.7	46.8	26.8	43.8	11.6	24.2	0.48	0.78	NA	0.0	2
Lane 2		0.540	1.000	0.0	52.6	85.9	46.7	76.2	20.8	43.5	0.11	0.17	0.0	NA	NA
Lane 3		1.022	1.000	11.6	47.9	78.2	45.0	73.4	28.9	60.5	0.38	0.63	NA	0.0	2
Approach		1.022			52.6	85.9	46.7	76.2	28.9	60.5	0.11	0.17			
East: Waihoehoe Rd															
Lane 1		0.519	1.000	0.0	64.2	104.8	54.0	88.1	22.2	46.4	0.51	0.84	NA	0.0	2
Lane 2		0.485	1.000	0.0	51.4	83.9	45.4	74.1	19.5	40.8	0.10	0.17	0.0	NA	NA
Lane 3		0.645	1.000	0.2	38.8	63.3	35.6	58.1	17.0	35.5	0.39	0.63	NA	56.6	2
Lane 4		1.076	1.000	40.9	107.3	175.0	100.4	163.8	74.5	155.6	1.07	1.75	NA	56.6	3
Approach		1.076			107.3	175.0	100.4	163.8	74.5	155.6	0.10	0.17			
North: Great South Rd															
Lane 1		0.436	1.000	0.0	68.1	111.1	51.3	83.7	14.8	30.8	0.68	1.11	NA	14.5	2
Lane 2		1.084	1.000	141.7	337.3	550.5	249.7	407.5	210.4	439.6	0.67	1.10	13.7	NA	NA
Lane 3		0.417	1.000	0.0	27.0	44.0	24.1	39.4	8.7	18.2	0.27	0.44	NA	0.0	2
Approach		1.084			337.3	550.5	249.7	407.5	210.4	439.6	0.67	1.10			
West: Norrie Rd															
Lane 1		0.435	1.000	0.0	34.0	55.4	27.8	45.4	9.4	19.5	0.11	0.18	0.0	NA	NA
Lane 2		1.034	1.000	31.9	105.1	171.5	91.0	148.5	63.6	132.8	2.10	3.43	NA	100.0	1
Lane 3		0.225	1.000	0.0	5.5	9.1	5.5	8.9	2.6	5.5	0.11	0.18	NA	0.0	2
Approach		1.034			105.1	171.5	91.0	148.5	63.6	132.8	0.11	0.18			
Intersection		1.084			337.3	550.5	249.7	407.5	210.4	439.6	0.67	1.10			

Figure 8: Sidra Output for 2,000vph Trigger Threshold, Showing Average and 95th %ile PM Queues

Figure 8 shows that the 107m queue on the critical Waihoehoe Road arm increases to 156m at its 95th percentile worst case. The worst queue is the GSR north approach, which increases from a 337m average to a 550m 95th percentile queue. The queueing remains within the pass criteria.

For consistency with the rest of the Plan Change modelling and trigger thresholds, the 3,800vph trigger point was always modelled using the intersection design adopted for the plan change.

Figure 9 below shows the average and 95th percentile Sidra queuing output for the 3,800vph trigger threshold (without any of the sensitivity test adjustments discussed earlier in this memo).

Lane Queues (Distance)														
Lane Number	Contin. Lane	Deg. Satn	Prog. Factor (Queue)	Overflow Queue (m)	Back of Queue (m)		Queue at Start of Green (m)		Cycle-Average Queue (m)		Queue Storage Ratio		Prob. Block.	Prob. SL Ov.	Ov. Lane No.
		v/c			Av.	95%	Av.	95%	Av.	95%	Av.	95%	%	%	
South: Great South Rd															
Lane 1		0.210	1.000	0.0	22.5	36.7	21.2	34.6	8.2	17.0	0.37	0.61	NA	0.0	2
Lane 2		0.340	1.000	0.0	40.1	65.4	36.1	58.9	14.2	29.6	0.08	0.13	0.0	NA	NA
Lane 3		1.024	1.000	18.8	72.7	118.7	66.1	107.9	43.5	91.0	0.58	0.95	NA	0.4	2
Approach		1.024			72.7	118.7	66.1	107.9	43.5	91.0	0.08	0.13			
East: Waihoehoe Rd															
Lane 1		0.704	1.000	0.0	110.4	180.2	80.6	131.6	34.0	71.1	0.88	1.44	NA	38.4	2
Lane 2		0.797	1.000	2.7	95.2	155.3	76.6	125.1	37.2	77.7	0.19	0.31	0.0	NA	NA
Lane 3		0.649	1.000	0.0	67.3	109.8	57.1	93.2	25.8	53.9	0.67	1.10	NA	100.0	2
Lane 4		1.082	1.000	82.2	203.3	331.9	175.9	287.0	137.3	286.9	2.03	3.32	NA	100.0	3
Approach		1.082			203.3	331.9	175.9	287.0	137.3	286.9	0.19	0.31			
North: Great South Rd															
Lane 1		0.725	1.000	0.0	84.5	137.9	55.4	90.4	18.9	39.6	0.85	1.38	NA	34.3	2
Lane 2		1.093	1.000	104.5	241.4	393.9	202.7	330.8	165.2	345.1	0.48	0.79	0.0	NA	NA
Lane 3		0.803	1.000	1.3	42.0	68.5	38.2	62.4	19.2	40.1	0.42	0.69	NA	0.0	2
Approach		1.093			241.4	393.9	202.7	330.8	165.2	345.1	0.48	0.79			
West: Norrie Rd															
Lane 1		0.743	1.000	1.1	42.0	68.6	34.6	56.5	16.2	33.9	0.14	0.23	0.0	NA	NA
Lane 2		1.085	1.000	53.5	130.0	212.1	118.0	192.5	91.2	190.6	2.60	4.24	NA	100.0	1
Lane 3		0.061	1.000	0.0	4.3	7.0	4.3	7.0	1.8	3.7	0.09	0.14	NA	0.0	2
Approach		1.085			130.0	212.1	118.0	192.5	91.2	190.6	0.14	0.23			
Intersection		1.093			241.4	393.9	202.7	330.8	165.2	345.1	0.48	0.79			

Figure 8: Sidra Output for 3,800vph Trigger Threshold, Showing Average and 95th %ile PM Queues

Figure 8 shows that the 203m average queue on Waihoehoe Road would increase to a 95th percentile maximum of 330m during the PM peak hour. This indicates that the queue would occasionally reach beyond the Kath Henry Lane intersection some 250m away.

It is reiterated that the philosophy of the Plan Change and subsequent modelling always anticipated occasional blocking back to adjacent intersections, but it was decided these could be tolerated as long as the queues on average did not. As such, the 95th percentile queues shown above align with the NCC and overall transport philosophy.

REQUEST E

e) *The Sidra output on page 11 and Sidra output on page 14 show modelling of the same intersection, with increased traffic due to a step in the Precinct upgrade table (i.e., 2,000vph to 3,800vph). It is noted that the intersection appears to operate better with increased traffic, which is unusual. Please comment further on why this occurs and in particular:*
   i. *Have the same inputs been used in both the SIDRA analysis including cycle time; and*
   ii. *Has anything other than traffic volumes been altered in the SIDRA analysis*.

Response

As discussed above, the main reason for the unusual metrics between the 2,000vph and the 3,800vph Sidra outputs provided within the 26 August Transport Response was that the 2,000vph

trigger was modelled using the updated AT design, whereas the 3,800vph was consistent with all other Plan Change and subsequent consent modelling as it used the Plan Change intersection design.

It is confirmed that the phasing and cycle times are identical between the two scenarios, and both use the Plan Change intersection design. The comparisons in performance between the updated 2,000vph and unadjusted 3,800vph Sidra outputs (both without SH1DC) are summarised in **Table 2** below:

Table 2: Comparison of 2,000vph and 3,800vph Sidra Metrics

Metric	Result (diff)	
Trigger Threshold	2,000vph	3,800vph
LOS	F	F
Total Traffic Flow (vph)	3,399	4,013 (+704)
Waihoehoe Road Approach Flow (vph)	928	1,603 (+675)
GSR North and South Through Flow (vph)	1,046	791 (-255)
Intersection Degree of Saturation	1.084	1.093 (+0.009)
Intersection Average Delay (s)	83.8	83.4 (-0.4)

Table 2 shows that with a lower total traffic flow, the 2,000vph threshold key metrics are similar to the 3,800vph metrics (intersection degree of saturation and average delay), now that they are modelled using the same intersection design. As the intersection design, phasing and cycle time are the same, the performance comparison is explained as follows:

- The most significant increase in traffic flows are at the Waihoehoe Road approach, with an additional 1,603vph. However, with four lanes on that approach arm, the traffic signals can readily accommodate that additional traffic.
- The GSR through traffic movements are significant. At the 2,000vph threshold the SH1 six-laning upgrade is not yet constructed, resulting in significant additional traffic preferring to use GSR as an alternative north/south route to SH1. At the 3,800vph threshold, however, the SH1 six-laning upgrade will have been constructed. Those additional through trips that are present in the 2,000 vph analysis directly conflict with the Waihoehoe Road major traffic lows, and as a result degrades the intersection performance.

REQUEST F

f) For the existing (base), 2,000vph and 3,800vph trigger levels, please provide:
   i. SATURN turning volume plots at the SH1 interchange and at the Waihoehoe Road / Great South Road intersection;
   ii. Sidra movement summaries for the two intersections detailed above; and
   iii. The above (i and ii) with and without the SH1DC link.

Response

i. The Saturn turning plots with and without the SH1DC link are provided in Attachment 1. As explained earlier, there is only one set of Saturn volumes, as the two trigger thresholds were derived by iteratively adding or subtracting traffic flows through Sidra testing to establish the respective pass / fail points.
ii. Sidra movement summaries at GSR / Waihoehoe Road are provided in Attachment 2. However, the SH1 / GSR intersection was not tested in Sidra so can't be provided.
iii. With and without SH1DC results are provided wherever available.

REQUEST G

g) Please provide a review of the Flanagan Road / Road 3 Proposed Roundabout in relation to pedestrian provision. In particular, please comment in respect of the southern leg (Road 3) and if changes are required, do they change the bus tracking?

Response

The pedestrian desire lines and crossing locations have been reviewed. There is a pedestrian crossing location proposed on the southern leg of the roundabout that provides connection to Lot F. There is also a signalised intersection some 40m to the south of the Flanagan Road roundabout that also provides pedestrian connections to the western side of Road 3. Pedestrian crossings on the northern leg of the roundabout and western leg are not considered necessary as this land to the northwest of Flanagan Road is yet to be developed.

To enhance pedestrian safety, a pedestrian refuge island has been added to the flush median between the crossing point showing tactile paving, and bus tracking has been rerun. The updated drawing is provided in **Figure 10** below.

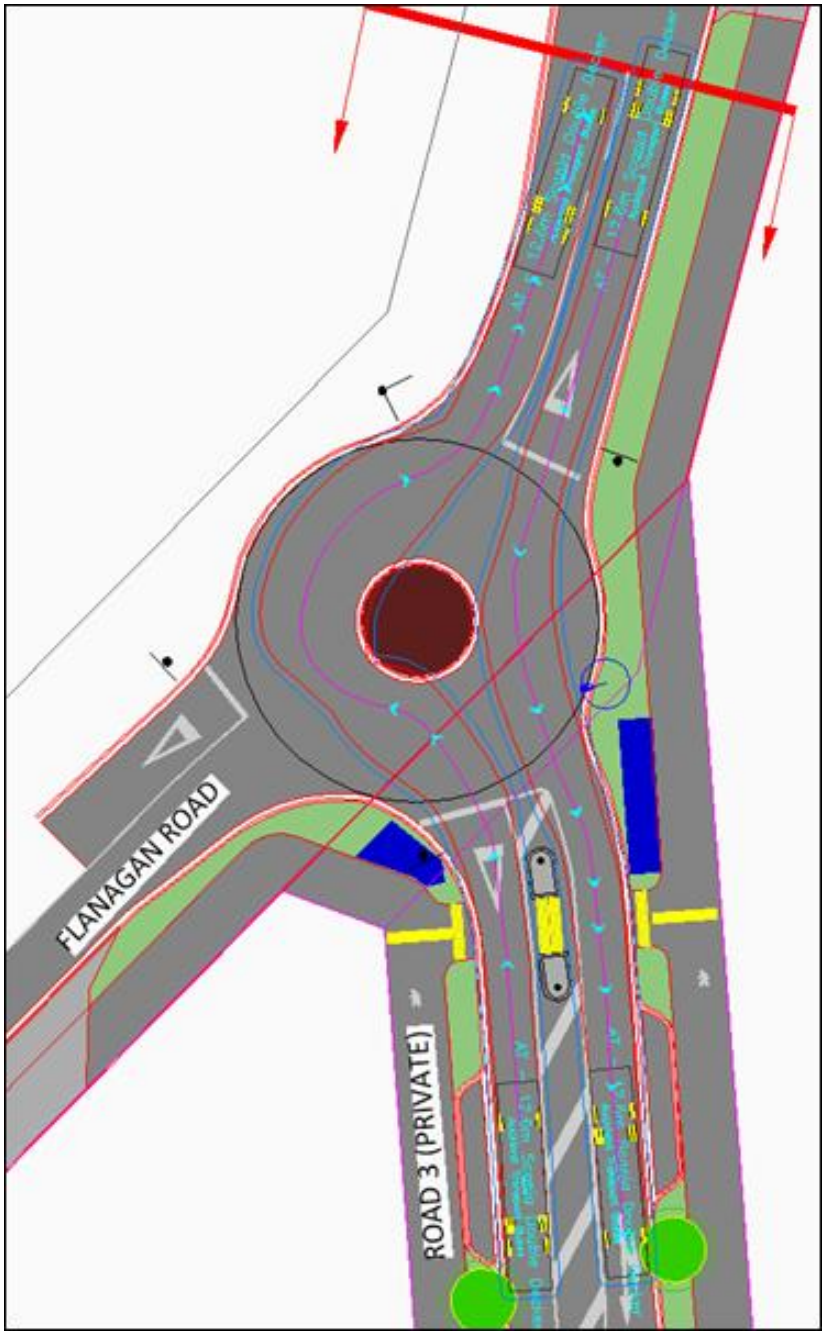


Figure 10: Added Pedestrian Refuge with Amended Bus Tracking Curves

Daryl Hughes
Hughes Traffic & Transportation

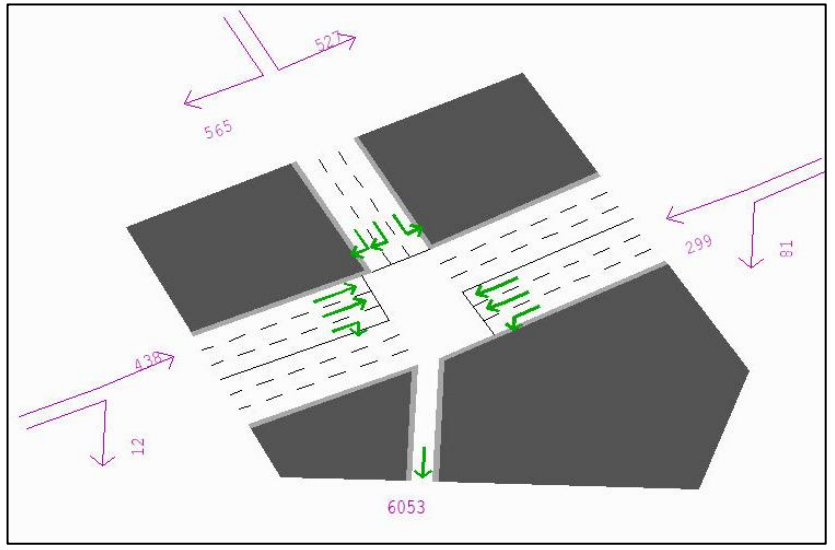
Attachments:

Attachment 1: Saturn turning plots at SH1 Drury Interchange and GSR / Waihoehoe Road with and without the SH1DC.
Attachment 2: Sidra movement summaries at GSR / Waihoehoe Road, with and without SH1DC.

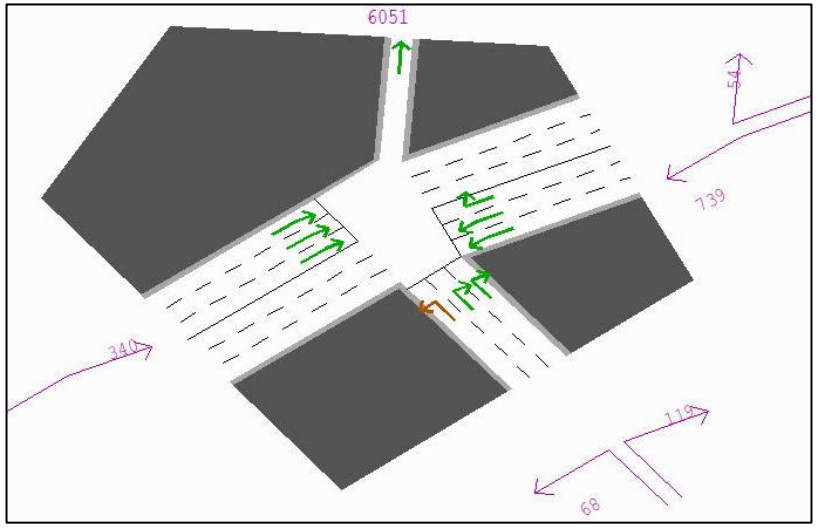
Attachment 1:

Saturn turning plots at SH1 Drury Interchange and GSR / Waihoehoe Road with and without SH1DC

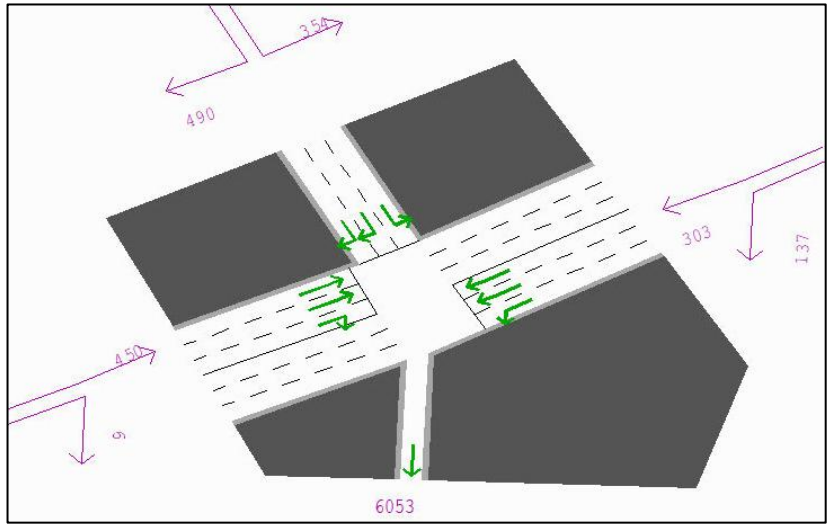
Interchange NB On: AM Without SH1DC



Interchange SB Off: AM Without SH1DC

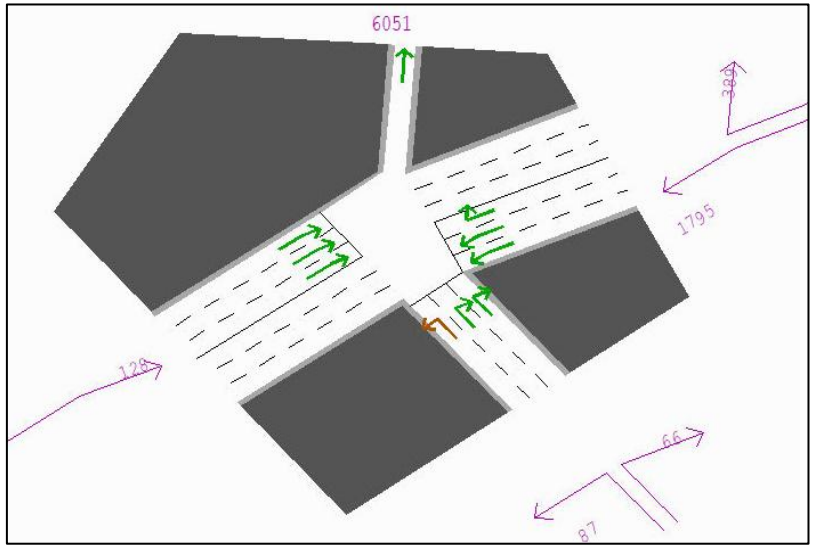


Interchange NB On: AM With SH1DC

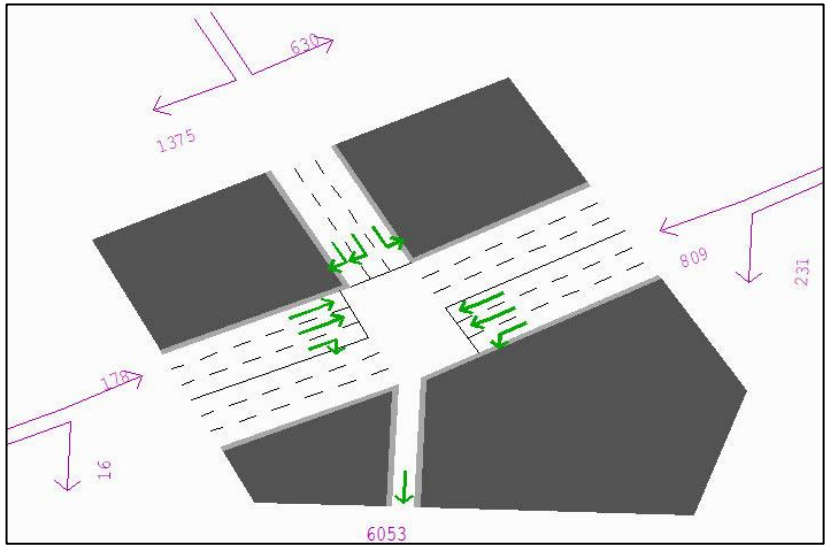


Interchange SB Off: AM With SH1DC

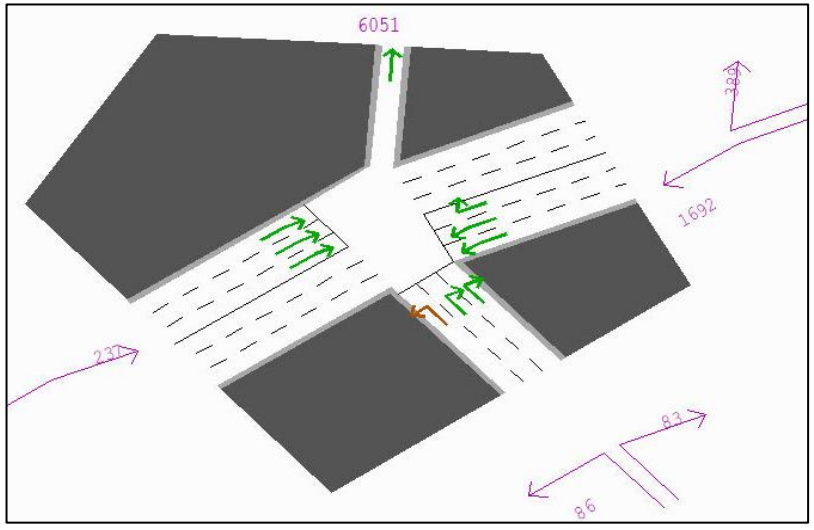
Saturn Outputs AM SH1 Drury Interchange: With / Without SH1DC



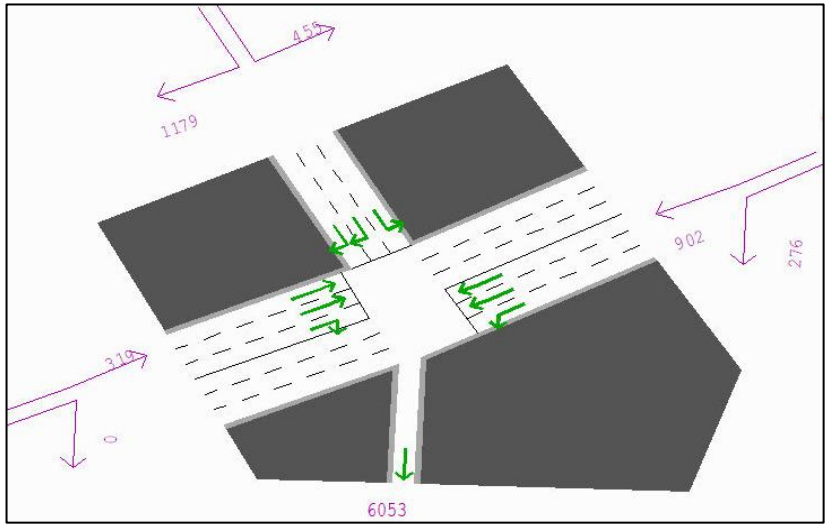
Interchange NB On: PM Without SH1DC



Interchange SB Off: PM Without SH1DC

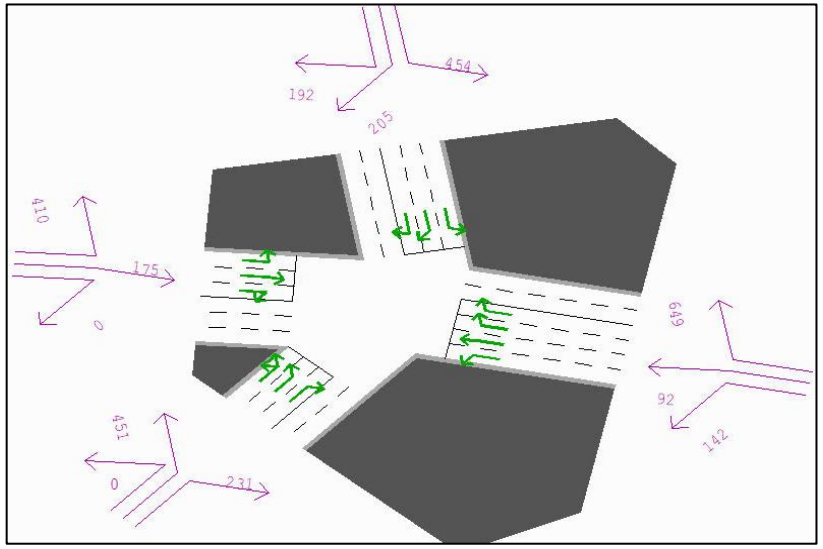


Interchange NB On: PM With SH1DC

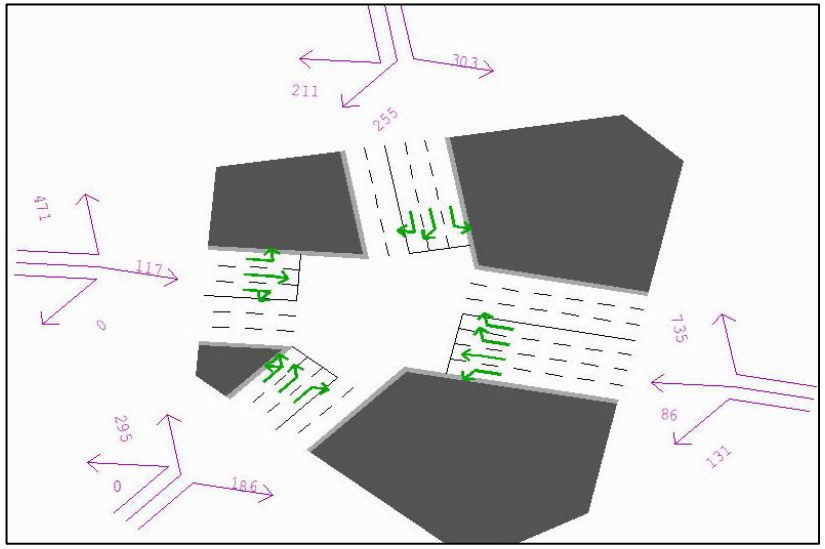


Interchange SB Off: PM With SH1DC

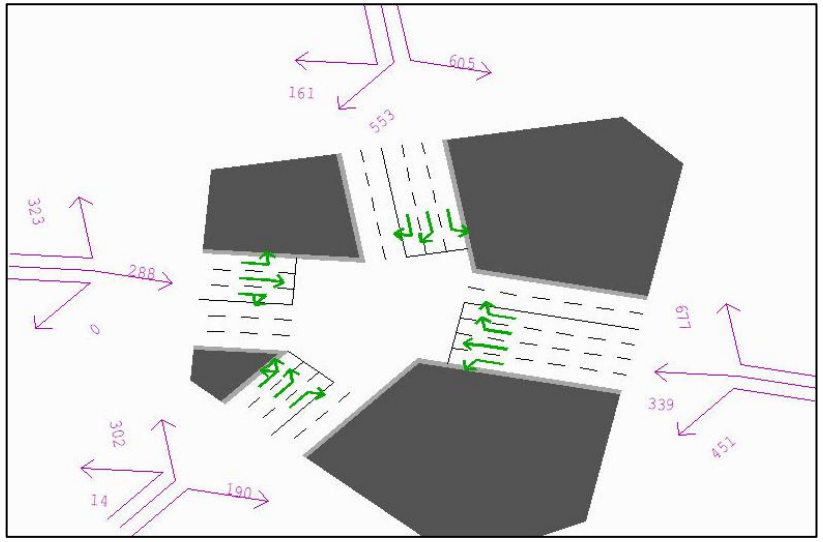
Saturn Outputs PM SH1 Drury Interchange: With / Without SH1DC



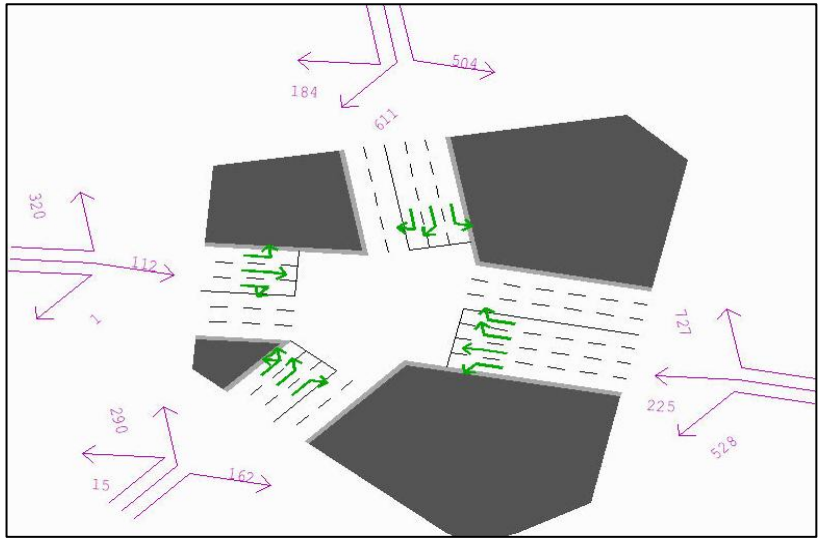
GSR / Waihoehoe AM Without SH1DC



GSR / Waihoehoe AM With SH1DC



GSR / Waihoehoe PM Without SH1DC

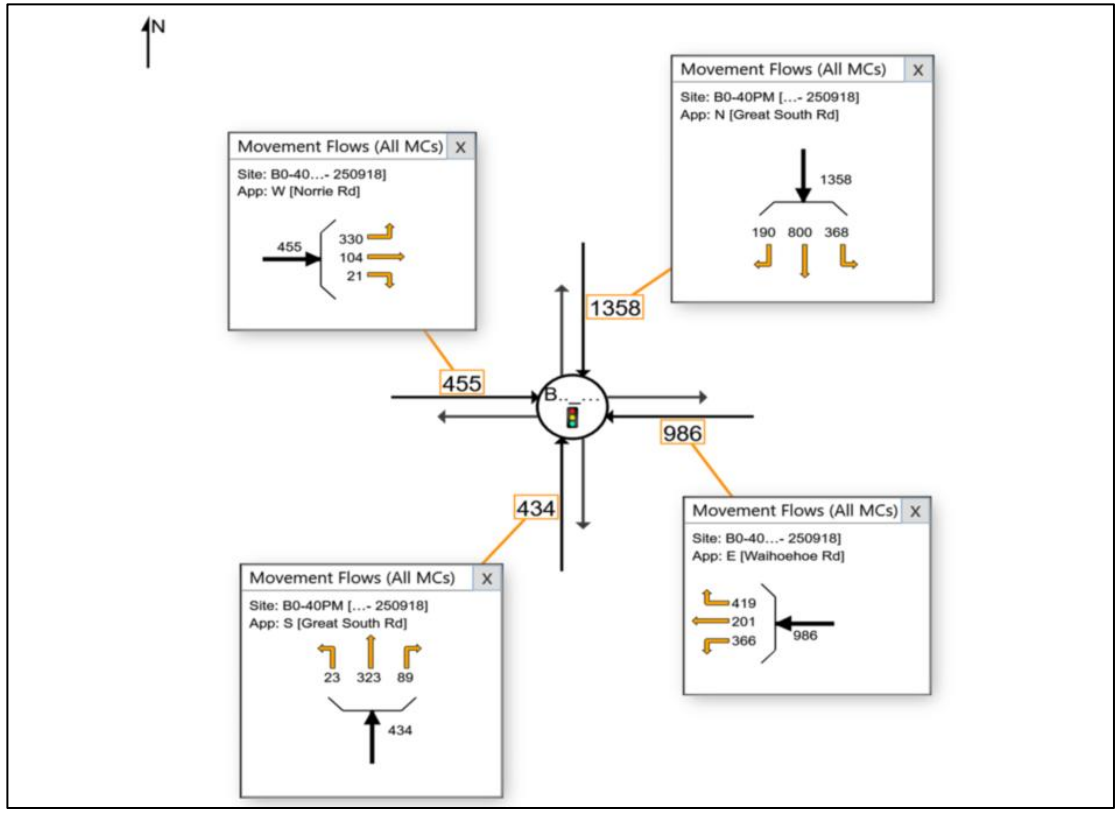


GSR / Waihoehoe PM With SH1DC

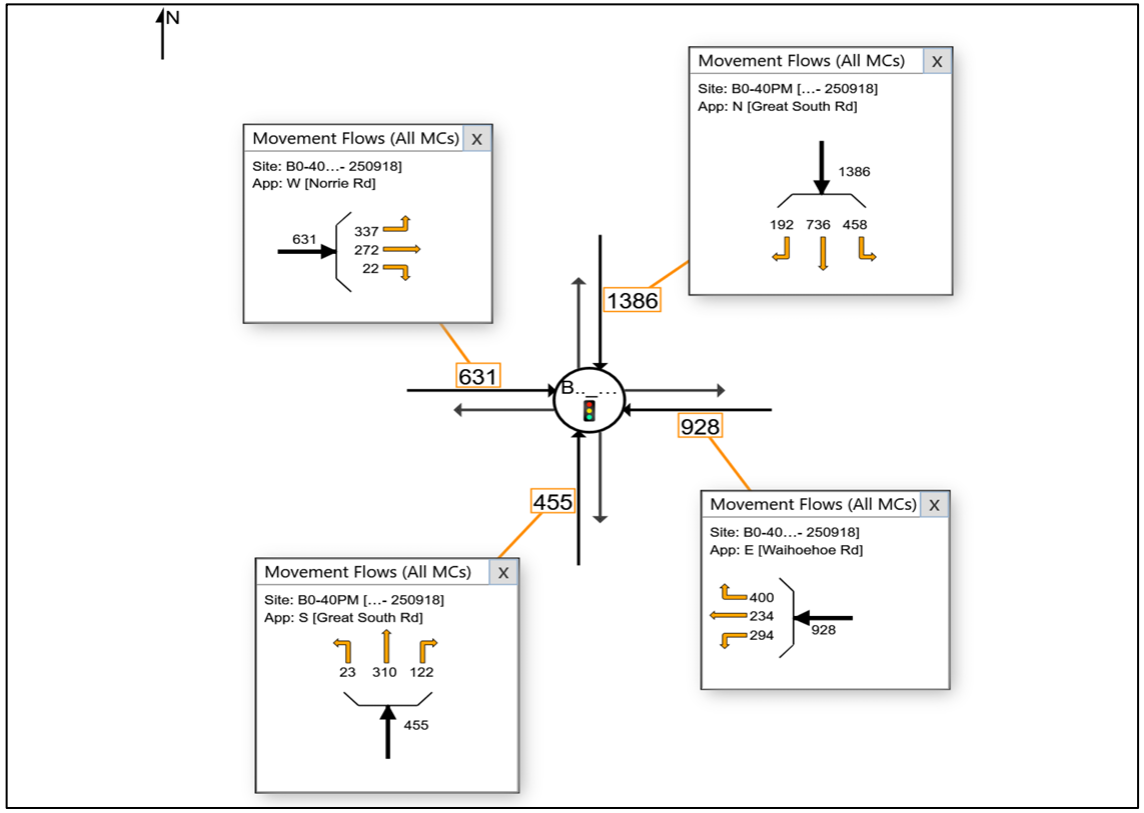
Saturn Outputs AM & PM GSR / Waihoehoe: With / Without SH1DC

Attachment 2:

Sidra movement summaries at GSR / Waihoehoe Road, with and without SH1DC



2,000vpd GSR / Waihoehoe PM With SH1DC



2,000vpd GSR / Waihoehoe PM Without SH1DC YES

Sidra Input Flows PM GSR / Waihoehoe: With / Without SH1DC 2,000vpd

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Great South Rd															
1	L2	All MCs	23	9.1	23	9.1	0.322	52.2	LOS D	3.8	29.3	0.89	0.73	0.89	28.2
2	T1	All MCs	323	11.5	323	11.5	0.520	43.9	LOS D	7.0	53.7	0.92	0.76	0.92	31.3
3	R2	All MCs	89	9.3	89	9.3	0.982	96.0	LOS F	4.1	31.3	1.00	1.12	1.73	21.6
Approach			434	10.9	434	10.9	0.982	55.0	LOS D	7.0	53.7	0.93	0.83	1.08	28.5
East: Waihoehoe Rd															
4	L2	All MCs	366	5.9	366	5.9	0.679	45.2	LOS D	11.6	85.6	0.94	0.85	0.94	30.4
5	T1	All MCs	201	2.6	201	2.6	0.418	41.4	LOS D	6.1	43.7	0.89	0.74	0.89	29.5
6	R2	All MCs	419	4.9	419	4.9	*1.055	107.8	LOS F	14.7	107.3	1.00	1.15	1.53	20.2
Approach			986	4.8	986	4.8	1.055	71.0	LOS E	14.7	107.3	0.96	0.95	1.18	24.7
North: Great South Rd															
7	L2	All MCs	368	5.3	368	5.3	0.340	33.4	LOS C	6.7	49.3	0.56	0.72	0.56	39.1
8	T1	All MCs	800	6.2	800	6.2	*1.108	171.1	LOS F	51.9	382.8	1.00	1.73	1.93	16.1
9	R2	All MCs	190	6.5	190	6.5	*0.458	59.1	LOS E	3.7	27.6	0.91	0.79	0.91	33.0
Approach			1358	6.0	1358	6.0	1.108	118.1	LOS F	51.9	382.8	0.87	1.33	1.42	20.7
West: Norrie Rd															
10	L2	All MCs	330	4.1	330	4.1	0.450	19.7	LOS B	4.8	34.6	0.79	0.78	0.79	36.7
11	T1	All MCs	104	4.0	104	4.0	*0.317	48.1	LOS D	3.3	24.1	0.92	0.73	0.92	27.7
12	R2	All MCs	21	0.0	21	0.0	0.184	65.4	LOS E	0.7	5.2	0.98	0.70	0.98	23.5
Approach			455	3.9	455	3.9	0.450	28.2	LOS C	4.8	34.6	0.83	0.77	0.83	33.3
All Vehicles			3232	6.0	3232	6.0	1.108	82.6	LOS F	51.9	382.8	0.90	1.07	1.22	23.9

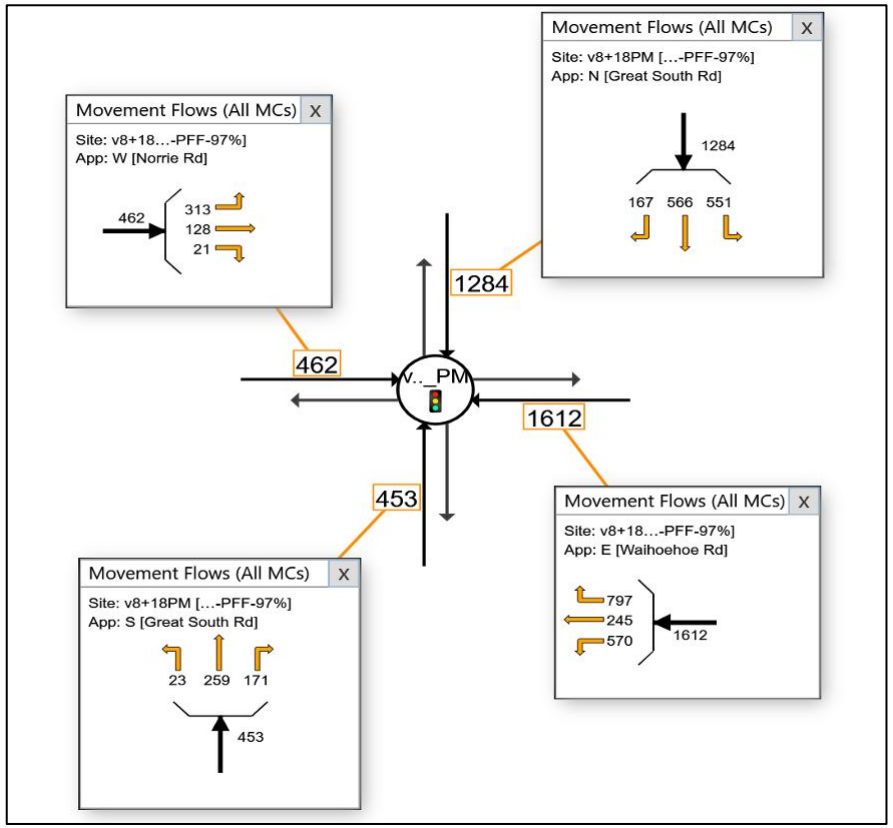
GSR / Waihoehoe PM With SH1DC

Vehicle Movement Performance

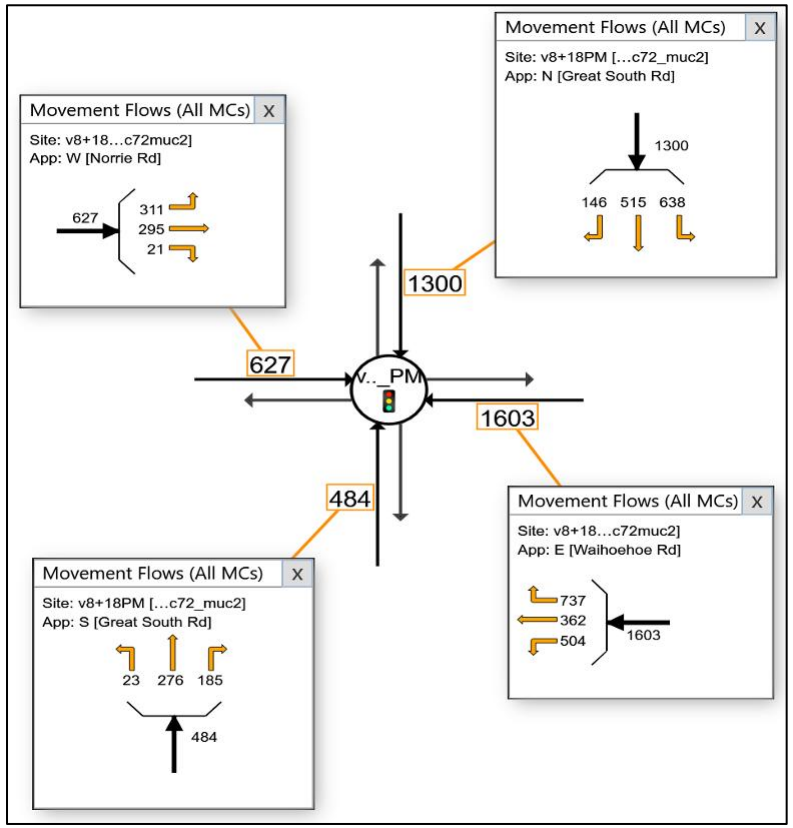
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Great South Rd															
1	L2	All MCs	23	9.1	23	9.1	0.335	54.9	LOS D	3.8	28.7	0.91	0.74	0.91	27.5
2	T1	All MCs	310	10.6	310	10.6	0.540	45.9	LOS D	6.9	52.6	0.93	0.77	0.93	30.8
3	R2	All MCs	122	11.0	122	11.0	*1.022	116.4	LOS F	6.3	47.9	1.00	1.24	1.83	19.3
Approach			455	10.7	455	10.7	1.022	65.2	LOS E	6.9	52.6	0.95	0.89	1.17	26.4
East: Waihoehoe Rd															
4	L2	All MCs	294	6.7	294	6.7	0.519	41.4	LOS D	8.7	64.2	0.88	0.81	0.88	31.4
5	T1	All MCs	234	1.8	234	1.8	0.485	42.2	LOS D	7.2	51.4	0.91	0.76	0.91	29.2
6	R2	All MCs	400	4.9	400	4.9	*1.076	117.7	LOS F	14.7	107.3	1.00	1.18	1.60	19.2
Approach			928	4.7	928	4.7	1.076	74.5	LOS E	14.7	107.3	0.94	0.96	1.20	24.0
North: Great South Rd															
7	L2	All MCs	458	5.4	458	5.4	0.436	33.5	LOS C	9.3	68.1	0.62	0.75	0.62	38.3
8	T1	All MCs	736	6.4	736	6.4	*1.084	152.3	LOS F	45.7	337.3	1.00	1.65	1.83	17.4
9	R2	All MCs	192	6.5	192	6.5	0.417	48.7	LOS D	3.6	27.0	0.88	0.78	0.88	33.9
Approach			1386	6.1	1386	6.1	1.084	98.7	LOS F	45.7	337.3	0.86	1.23	1.30	22.8
West: Norrie Rd															
10	L2	All MCs	337	4.9	337	4.9	0.435	38.2	LOS D	4.7	34.0	0.76	0.92	0.76	37.2
11	T1	All MCs	272	1.9	272	1.9	*1.034	128.2	LOS F	14.8	105.1	1.00	1.48	1.76	16.7
12	R2	All MCs	22	0.0	22	0.0	0.225	75.0	LOS E	0.8	5.5	0.99	0.70	0.99	23.2
Approach			631	3.4	631	3.4	1.034	78.3	LOS E	14.8	105.1	0.87	1.16	1.20	24.0
All Vehicles			3399	5.8	3399	5.8	1.084	83.8	LOS F	45.7	337.3	0.89	1.10	1.24	23.8

GSR / Waihoehoe PM Without SH1DC

Sidra Outputs PM GSR / Waihoehoe: With / Without SH1DC 2,000vpd



3,800vpd GSR / Waihoehoe PM With SH1DC



3,800vpd GSR / Waihoehoe PM Without SH1DC

Sidra Input Flows PM GSR / Waihoehoe: With / Without SH1DC 3,800vpd

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	Demand Flows HV] %	Arrival Flows [Total veh/h	Arrival Flows HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Aver. Back Of Queue Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Great South Rd															
1	L2	All MCs	23	9.1	23	9.1	0.19	42.6	LOS D	2.8	21	0.79	0.66	0.79	30.8
2	T1	All MCs	259	10.8	259	10.8	0.307	34.4	LOS C	4.9	37.3	0.8	0.67	0.8	34.2
3	R2	All MCs	171	8.4	171	8.4	* 1.131	197.6	LOS F	11.3	85.2	1	1.51	2.23	13.5
Approach			453	9.8	453	9.8	1.131	96.5	LOS F	11.3	85.2	0.88	0.99	1.34	21.5
East: Waihoehoe Rd															
4	L2	All MCs	570	4	570	4	0.812	43.5	LOS D	19.2	138.7	0.97	0.9	1.01	30.8
5	T1	All MCs	245	3.8	245	3.8	0.515	42.6	LOS D	7.7	55.4	0.92	0.77	0.92	29.1
6	R2	All MCs	797	5.3	797	5.3	* 1.135	147.6	LOS F	33.3	243.9	0.99	1.28	1.68	17.3
Approach			1612	4.6	1612	4.6	1.135	94.9	LOS F	33.3	243.9	0.97	1.07	1.33	21.3
North: Great South Rd															
7	L2	All MCs	551	5.4	551	5.4	0.594	28.9	LOS C	9	65.9	0.76	0.8	0.76	39.7
8	T1	All MCs	566	8.9	566	8.9	* 1.147	208.1	LOS F	39.6	298.2	1	1.88	2.17	13.7
9	R2	All MCs	167	6.8	167	6.8	1.092	177.1	LOS F	10.1	75	1	1.42	2.07	13.1
Approach			1284	7.1	1284	7.1	1.147	127.2	LOS F	39.6	298.2	0.9	1.36	1.55	17.9
West: Norrie Rd															
10	L2	All MCs	313	4.6	313	4.6	* 0.841	37.5	LOS D	6.8	49.3	1	0.92	1.16	30.1
11	T1	All MCs	128	4	128	4	0.389	48.7	LOS D	4.1	30	0.94	0.75	0.94	27.5
12	R2	All MCs	21	0	21	0	0.064	49.9	LOS D	0.6	4.4	0.87	0.69	0.87	26.8
Approach			462	4.2	462	4.2	0.841	41.1	LOS D	6.8	49.3	0.98	0.86	1.09	29.2
All Vehicles			3810	6	3810	6	1.147	99.4	LOS F	39.6	298.2	0.94	1.13	1.38	20.6

Sidra output at 3,800vph “pass” WITH SH1DC

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	Demand Flows HV] %	Arrival Flows [Total veh/h	Arrival Flows HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Aver. Back Of Queue Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Great South Rd															
1	L2	All MCs	23	9.1	23	9.1	0.21	44.6	LOS D	3	22.5	0.81	0.67	0.81	30.2
2	T1	All MCs	276	8.2	276	8.2	0.34	36.2	LOS D	5.3	40.1	0.83	0.69	0.83	33.6
3	R2	All MCs	185	9.5	185	9.5	* 1.024	116.7	LOS F	9.6	72.7	1	1.29	1.77	19.2
Approach			484	8.7	484	8.7	1.024	67.3	LOS E	9.6	72.7	0.89	0.91	1.19	26
East: Waihoehoe Rd															
4	L2	All MCs	504	4.3	504	4.3	0.704	38.1	LOS D	15.2	110.4	0.91	0.85	0.91	32.3
5	T1	All MCs	362	6	362	6	0.797	50.3	LOS D	12.9	95.2	1	0.93	1.09	27.1
6	R2	All MCs	737	5.7	737	5.7	* 1.082	119.3	LOS F	27.7	203.3	0.98	1.19	1.53	19.6
Approach			1603	5.3	1603	5.3	1.082	78.2	LOS E	27.7	203.3	0.96	1.03	1.23	23.5
North: Great South Rd															
7	L2	All MCs	638	5.5	638	5.5	0.725	27.5	LOS C	11.5	84.5	0.86	0.95	0.86	38.8
8	T1	All MCs	515	7.8	515	7.8	* 1.093	162.7	LOS F	32.3	241.4	1	1.73	1.93	16.2
9	R2	All MCs	146	7.7	146	7.7	0.803	75.4	LOS E	5.6	42	1	0.94	1.21	23.1
Approach			1300	6.7	1300	6.7	1.093	86.5	LOS F	32.3	241.4	0.93	1.26	1.32	22.5
West: Norrie Rd															
10	L2	All MCs	311	4.6	311	4.6	0.743	44.6	LOS D	5.8	42	0.99	0.9	1.03	32.3
11	T1	All MCs	295	4.2	295	4.2	* 1.085	167.3	LOS F	17.9	130	1	1.59	1.97	13.9
12	R2	All MCs	21	0	21	0	0.061	61	LOS E	0.6	4.3	0.86	0.69	0.86	27
Approach			627	4.3	627	4.3	1.085	102.9	LOS F	17.9	130	0.99	1.22	1.47	18.2
All Vehicles			4013	6	4013	6	1.093	83.4	LOS F	32.3	241.4	0.95	1.12	1.29	22.6

Sidra output at 3,800vph “pass” WITHOUT SH1DC

Sidra Output Flows PM GSR / Waihoehoe: With / Without SH1DC 2,000vpd