Planning | Surveying | Engineering | Environmental

Seven Oaks
c/o Sarah Hunt
Cheal Consultants Ltd

Ref: B22049
9 February 2024

Subject: **Seven Oaks Subdivision, Control Gates Bridge Impact – Section 92 Response**
Issued via: **sarahh@cheal.co.nz**

Dear Sarah

Background

This letter addresses the potential impacts to the Taupo Control Gates Bridge (CGB) by way of increased vehicle generation as part of a Section 92 (s92) Further Information request from Taupo District Council (TDC).

An excerpt of the s92 is shown below.

Transportation & Commercial Lots
In terms of the additional number of lots proposed and the potential impacts on the Control Gates Bridge, please provide further explanation around the potential impacts of additional vehicle trips generated by the proposed subdivision.

In addition to the integrated transport assessment (ITA) prepared for the Seven Oaks development by CKL dated March 2023, this S92 assessment utilises information from various reference documents including ITA's prepared by:

- Opus as part of the Nukuhua Plan Change prepared in October 2020 to establish existing peak hour turning demands at the Norman Smith Street / Spa Road roundabout; and
- Stantec prepared in March 2022 for the Lochviews Estate Subdivision for the most up to date expected vehicle volumes which also references the Nukukau developments.

Analysis

The Opus ITA, uses modelled data to predict the morning peak hour turning movements through the Norman Smith Street / Wairakei Drive intersection and the Tongariro Street / Spa Road roundabout.

As the CGB contains no traffic control measures of its own, in order to provide a thorough assessment of the effects of the Seven Oaks development on the CGB, the intersections of Wairakei Drive / Norman Smith Street and Tongariro Street / Spa Road have been incorporated into the analysis as they act as controls / proxies for the flow of traffic across the CGB.

The Wairakei Drive / Norman Smith Street intersection is noted to have undergone an upgrade in 2019 to include signals has the benefit of 'metering' the traffic flow over the CGB, reducing the overall impact, particularly in the southbound direction, to both the CGB and the Tongariro Street / Spa Road roundabout allowing for more freely flowing traffic.

It has been established from the Stantec ITA, that the theoretical CGB bridge capacity is 1,620 vehicles per hour (vph) and the overserved peak hour traffic volumes across the CGB inclusive of the Lochviews development traffic are 1,711 vehicles per hour (vph) and 1,777vph for the morning and evening peak hours. This indicates that the road network capacity including the Lochviews Estate already exceeds the previously calculated theoretical capacities.

The Seven Oaks development comprises some 92 residential lots and is predicted to add an additional 52vph through the road network from the Pohipi Drive / Wairakei Drive intersection. In addition, it is known that there are an additional 228 committed dwellings within the Kinloch area which are predicted to add an additional 135vph to the network at the same intersection. As the order of construction is not known and to provide a robust analysis of the network, the effects of all lots are to be considered, across two separate scenarios as outlined below.

- Scenario 1 – Baseline, Baseline plus Seven Oaks, Baseline plus Seven Oaks and Committed Developments
- Scenario 2 – Baseline, Baseline plus Committed Developments, Baseline plus Committed Developments and Seven Oaks

This analysis has been undertaken using SIDRA v9.1 during the busier AM peak as this is the busiest and most critical time period for CGB. The results are summarised in below and attached as Appendix A. Numbers in brackets for Sage 1 are the difference to the base scenarios with bracketed numbers in Stage 2 a comparison to Stage 1.

Table 1: Scenario 1 – North Approach

				Development Order					
				Stage 1			Stage 2		
	Pre Development (1,750vph)			Seven Oaks (+52vph)			Future Committed Developments (+135vph)		
Intersection	LOS	Delay (s)	Queue (m)	LOS	Delay (s)	Queue (m)	LOS	Delay (s)	Queue (m)
Wairakei / Norman	F	86	286.1	F	99.6 (+13.6)	317.5 (+31.4)	F	141.4 (+41.8)	401.8 (+84.3)
Spa Rd RAB	A	4.8	53.1	A	4.8	56.8 (+3.7)	A	4.9 (+0.1)	67.9 (+11.1)

Table 2: Scenario 2 – North Approach

				Development Order					
				Stage 1			Stage 2		
	Pre Development (1,750vph)			Future Committed Developments (+135vph)			Seven Oaks (+52vph)		
Intersection	LOS	Delay (s)	Queue (m)	LOS	Delay (s)	Queue (m)	LOS	Delay (s)	Queue (m)
Wairakei / Norman	F	86	286.1	F	165.7 (+79.7)	426.4 (+140.3)	F	141.4 (-24.3)	401.8 (-24.6)
Spa Rd RAB	A	4.8	53.1	A	4.8	63.4 (+10.3)	A	4.9 (+0.1)	67.9 (+4.5)

The Wairakei Drive / Norman Smith Street intersection is shown in the baseline models of Table 1 and Table 2 to already be experiencing traffic volumes in excess of its capacity without any development.

It is evident between Table 1 and Table 2 however that the staging of the developments can factor significantly into the effect experienced to the network.

In scenario one, the Seven Oaks development is delivered first and results in:

- increase in delay by up to 14 seconds; and
- queue lengths of an additional 31m, equivalent to approximately 5 car lengths.

In scenario two, the Seven Oaks development is delivered last and the impact of this to the network results in

- decrease in delay by up to 24 seconds; and
- queue lengths decreased by 25m, approximately 4 car lengths.

It is noted that there is a delay in delay and queuing for the Wairakei Drive / Norman Smith Street intersection. This is attributable to a change in phase times to optimise overall intersection delay. The increase in demand from the north warrants an increase in green time which has therefore resulted in an overall reduction in delay and queuing. It is note that there is still significant queuing and congestion on this approach and that differences of this magnitude are unlikely to change travel behaviour in the area.

The signalised Wairakei Drive / Norman Smith Street intersection therefore has the effect of successfully managing the traffic flows across the CGB to an acceptable degree as demonstrated by the level of service (LOS) A achieved at the Tongariro Street / Spa Road roundabout intersection in each scenario.

As shown both Table 1 and Table 2, the roundabout at the Tongariro Street / Spa Road intersection performs well and experiences no change to its level of service with only minor changes to delay times and queue lengths, equivalent of up to 2 vehicles.

Summary

The network and CGB are already operating over capacity prior to any development in Kinloch however due to the introduction of the traffic lights at the Norman Smith Street / Wairakei Drive intersection, and roundabout intersection at Tongariro Street / Spa Road, the effect of the Seven Oaks development to the CGB has largely been negated. The upgrade to include signals at this intersection has had a positive effect to both the CGB and the Tongariro Street / Spa Road roundabout as the level of service remains constant despite the level of development north of the bridge.

The overall effect of the Seven Oaks development is therefore negligible to the CGB with a maximum impact to the network of adding 14 seconds delay time or 31m queuing length, equivalent to 5 car lengths.

We trust this meets your requirements. Please do not hesitate to contact us if you have any questions or require any additional information.

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CKL

Appendix A: SIDRA Analysis

MOVEMENT SUMMARY

Site: 101 [Baseline AM (Site Folder: Stantec Wairakei - Norman Intersection (AM))]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site Optimum Cycle Time - Minimum Delay)

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	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tongariro St															
1	L2	All MCs	411	2.0	411	2.0	0.224	4.5	LOS A	0.0	0.0	0.00	0.47	0.00	46.4
2	T1	All MCs	315	2.0	315	2.0	0.481	28.1	LOS C	12.1	86.4	0.84	0.72	0.84	36.1
Approach			725	2.0	725	2.0	0.481	14.7	LOS B	12.1	86.4	0.36	0.58	0.36	41.3
North: Wairakei Dr															
8	T1	All MCs	728	2.0	728	2.0	* 0.996	86.0	LOS F	40.2	286.1	0.94	1.21	1.38	26.1
Approach			728	2.0	728	2.0	0.996	86.0	LOS F	40.2	286.1	0.94	1.21	1.38	26.1
West: Norman Smith St															
10	L2	All MCs	4	2.0	4	2.0	0.297	37.5	LOS D	7.0	50.0	0.58	0.72	0.58	39.4
12	R2	All MCs	1114	2.0	1114	2.0	* 1.040	103.2	LOS F	70.9	505.0	0.90	1.19	1.45	23.3
Approach			1118	2.0	1118	2.0	1.040	102.9	LOS F	70.9	505.0	0.90	1.19	1.44	23.3
All Vehicles			2572	2.0	2572	2.0	1.040	73.3	LOS E	70.9	505.0	0.76	1.02	1.12	27.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options 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 (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* 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	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
North: Wairakei Dr												
P3	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	198.1	200.0	1.01
West: Norman Smith St												
P4	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	198.1	200.0	1.01
All Pedestrians		100	105	44.3	LOS E	0.1	0.1	0.94	0.94	198.1	200.0	1.01

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 [Baseline+Dev AM (Site Folder: Stantec Wairakei - Norman Intersection (AM))]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site Optimum Cycle Time - Minimum Delay)

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	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tongariro St															
1	L2	All MCs	411	2.0	411	2.0	0.224	4.5	LOS A	0.0	0.0	0.00	0.47	0.00	46.4
2	T1	All MCs	315	2.0	315	2.0	0.481	28.1	LOS C	12.1	86.4	0.84	0.72	0.84	36.1
Approach			725	2.0	725	2.0	0.481	14.7	LOS B	12.1	86.4	0.36	0.58	0.36	41.3
North: Wairakei Dr															
8	T1	All MCs	751	2.0	751	2.0	* 1.027	99.6	LOS F	44.6	317.5	0.94	1.31	1.49	23.9
Approach			751	2.0	751	2.0	1.027	99.6	LOS F	44.6	317.5	0.94	1.31	1.49	23.9
West: Norman Smith St															
10	L2	All MCs	4	2.0	4	2.0	0.305	37.8	LOS D	7.2	51.2	0.58	0.72	0.58	39.4
12	R2	All MCs	1146	2.0	1146	2.0	* 1.068	117.9	LOS F	78.1	556.3	0.90	1.25	1.57	21.3
Approach			1151	2.0	1151	2.0	1.068	117.6	LOS F	78.1	556.3	0.90	1.25	1.56	21.4
All Vehicles			2626	2.0	2626	2.0	1.068	84.0	LOS F	78.1	556.3	0.76	1.08	1.21	25.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options 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 (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* 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	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
North: Wairakei Dr												
P3	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	198.1	200.0	1.01
West: Norman Smith St												
P4	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	198.1	200.0	1.01
All Pedestrians		100	105	44.3	LOS E	0.1	0.1	0.94	0.94	198.1	200.0	1.01

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 [Baseline+Future AM (Site Folder: Stantec Wairakei - Norman Intersection (AM))]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site Optimum Cycle Time - Minimum Delay)

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	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tongariro St															
1	L2	All MCs	411	2.0	411	2.0	0.224	4.5	LOS A	0.0	0.0	0.00	0.47	0.00	46.4
2	T1	All MCs	315	2.0	315	2.0	0.526	27.7	LOS C	11.5	81.8	0.88	0.75	0.88	36.2
Approach			725	2.0	725	2.0	0.526	14.6	LOS B	11.5	81.8	0.38	0.59	0.38	41.4
North: Wairakei Dr															
8	T1	All MCs	784	2.0	784	2.0	* 1.150	165.7	LOS F	59.9	426.4	0.95	1.81	2.13	16.6
Approach			784	2.0	784	2.0	1.150	165.7	LOS F	59.9	426.4	0.95	1.81	2.13	16.6
West: Norman Smith St															
10	L2	All MCs	4	2.0	4	2.0	0.311	33.0	LOS C	6.8	48.1	0.56	0.71	0.56	40.2
12	R2	All MCs	1200	2.0	1200	2.0	* 1.091	124.5	LOS F	81.8	582.1	0.90	1.33	1.74	20.2
Approach			1204	2.0	1204	2.0	1.091	124.2	LOS F	81.8	582.1	0.89	1.33	1.74	20.2
All Vehicles			2714	2.0	2714	2.0	1.150	106.9	LOS F	81.8	582.1	0.77	1.27	1.49	21.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options 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 (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* 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	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
North: Wairakei Dr												
P3	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04
West: Norman Smith St												
P4	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04
All Pedestrians		100	105	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04

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 [Baseline+Dev+Future AM (Site Folder: Stantec Wairakei - Norman Intersection (AM))]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site Optimum Cycle Time - Minimum Delay)

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	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tongariro St															
1	L2	All MCs	411	2.0	411	2.0	0.224	4.5	LOS A	0.0	0.0	0.00	0.47	0.00	46.4
2	T1	All MCs	315	2.0	315	2.0	0.491	25.9	LOS C	11.1	78.9	0.85	0.72	0.85	36.9
Approach			725	2.0	725	2.0	0.491	13.8	LOS B	11.1	78.9	0.37	0.58	0.37	41.8
North: Wairakei Dr															
8	T1	All MCs	807	2.0	807	2.0	* 1.113	141.4	LOS F	56.4	401.8	0.95	1.67	1.94	18.6
Approach			807	2.0	807	2.0	1.113	141.4	LOS F	56.4	401.8	0.95	1.67	1.94	18.6
West: Norman Smith St															
10	L2	All MCs	4	2.0	4	2.0	0.330	35.4	LOS D	7.1	50.8	0.59	0.72	0.59	39.7
12	R2	All MCs	1232	2.0	1232	2.0	* 1.157	167.6	LOS F	98.4	700.8	0.90	1.50	2.09	16.4
Approach			1236	2.0	1236	2.0	1.157	167.1	LOS F	98.4	700.8	0.90	1.50	2.08	16.5
All Vehicles			2768	2.0	2768	2.0	1.157	119.5	LOS F	98.4	700.8	0.78	1.31	1.59	20.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options 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 (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* 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	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
North: Wairakei Dr												
P3	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04
West: Norman Smith St												
P4	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04
All Pedestrians		100	105	39.3	LOS D	0.1	0.1	0.94	0.94	193.1	200.0	1.04

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 [Baseline AM (Site Folder: Stantec Tongariro - Spa Roundbaout (AM))]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

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	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tongariro St South															
2	T1	All MCs	368	2.0	368	2.0	0.406	5.6	LOS A	2.6	18.8	0.61	0.61	0.61	45.0
3	R2	All MCs	86	2.0	86	2.0	0.406	8.7	LOS A	2.6	18.8	0.62	0.61	0.62	44.4
Approach			455	2.0	455	2.0	0.406	6.2	LOS A	2.6	18.8	0.61	0.61	0.61	44.9
East: Spa Rd															
4	L2	All MCs	60	2.0	60	2.0	0.143	12.4	LOS B	0.8	6.0	0.82	0.79	0.82	41.7
6	R2	All MCs	357	2.0	357	2.0	0.500	15.3	LOS B	4.6	32.9	0.96	0.86	1.12	40.5
Approach			417	2.0	417	2.0	0.500	14.9	LOS B	4.6	32.9	0.94	0.85	1.07	40.7
North: Tongariri St North															
7	L2	All MCs	958	2.0	958	2.0	0.621	5.0	LOS A	6.8	48.4	0.45	0.49	0.45	45.0
8	T1	All MCs	884	2.0	884	2.0	0.652	4.5	LOS A	7.5	53.1	0.50	0.44	0.50	45.5
Approach			1842	2.0	1842	2.0	0.652	4.8	LOS A	7.5	53.1	0.47	0.47	0.47	45.2
All Vehicles			2714	2.0	2714	2.0	0.652	6.6	LOS A	7.5	53.1	0.57	0.55	0.59	44.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Baseline+Dev AM (Site Folder: Stantec Tongariro - Spa Roundbaout (AM))]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

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	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tongariro St South															
2	T1	All MCs	368	2.0	368	2.0	0.407	5.6	LOS A	2.7	18.9	0.61	0.61	0.61	45.0
3	R2	All MCs	86	2.0	86	2.0	0.407	8.7	LOS A	2.7	18.9	0.62	0.61	0.62	44.4
Approach			455	2.0	455	2.0	0.407	6.2	LOS A	2.7	18.9	0.61	0.61	0.61	44.9
East: Spa Rd															
4	L2	All MCs	60	2.0	60	2.0	0.148	12.9	LOS B	0.9	6.3	0.83	0.80	0.83	41.5
6	R2	All MCs	357	2.0	357	2.0	0.519	16.3	LOS B	5.0	35.4	0.98	0.88	1.17	40.1
Approach			417	2.0	417	2.0	0.519	15.8	LOS B	5.0	35.4	0.95	0.87	1.12	40.3
North: Tongariri St North															
7	L2	All MCs	986	2.0	986	2.0	0.638	5.1	LOS A	7.2	51.4	0.46	0.49	0.46	44.9
8	T1	All MCs	911	2.0	911	2.0	0.671	4.5	LOS A	8.0	56.8	0.52	0.44	0.52	45.4
Approach			1897	2.0	1897	2.0	0.671	4.8	LOS A	8.0	56.8	0.49	0.47	0.49	45.2
All Vehicles			2768	2.0	2768	2.0	0.671	6.7	LOS A	8.0	56.8	0.58	0.55	0.60	44.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Baseline+Future AM (Site Folder: Stantec Tongariro - Spa Roundbaout (AM))]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

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	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tongariro St South															
2	T1	All MCs	368	2.0	368	2.0	0.408	5.6	LOS A	2.7	19.1	0.61	0.61	0.61	45.0
3	R2	All MCs	86	2.0	86	2.0	0.408	8.7	LOS A	2.7	19.1	0.63	0.61	0.63	44.4
Approach			455	2.0	455	2.0	0.408	6.2	LOS A	2.7	19.1	0.61	0.61	0.61	44.9
East: Spa Rd															
4	L2	All MCs	60	2.0	60	2.0	0.159	13.6	LOS B	1.0	6.9	0.86	0.81	0.86	41.1
6	R2	All MCs	357	2.0	357	2.0	0.556	18.2	LOS B	5.7	40.5	1.00	0.93	1.27	39.3
Approach			417	2.0	417	2.0	0.556	17.6	LOS B	5.7	40.5	0.98	0.91	1.21	39.5
North: Tongariri St North															
7	L2	All MCs	1032	2.0	1032	2.0	0.667	5.1	LOS A	7.9	56.6	0.48	0.50	0.48	44.9
8	T1	All MCs	953	2.0	953	2.0	0.702	4.6	LOS A	8.9	63.4	0.55	0.44	0.55	45.3
Approach			1984	2.0	1984	2.0	0.702	4.8	LOS A	8.9	63.4	0.52	0.47	0.52	45.1
All Vehicles			2856	2.0	2856	2.0	0.702	6.9	LOS A	8.9	63.4	0.60	0.56	0.63	44.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Baseline+Dev+Future AM (Site Folder: Stantec Tongariro - Spa Roundbaout (AM))]

Output produced by SIDRA INTERSECTION Version: 9.1.1.200

New Site
Site Category: (None)
Roundabout

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	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tongariro St South															
2	T1	All MCs	368	2.0	368	2.0	0.408	5.6	LOS A	2.7	19.0	0.61	0.61	0.61	45.0
3	R2	All MCs	86	2.0	86	2.0	0.408	8.7	LOS A	2.7	19.0	0.63	0.61	0.63	44.4
Approach			455	2.0	455	2.0	0.408	6.2	LOS A	2.7	19.0	0.61	0.61	0.61	44.9
East: Spa Rd															
4	L2	All MCs	60	2.0	60	2.0	0.166	14.0	LOS B	1.0	7.3	0.87	0.82	0.87	40.9
6	R2	All MCs	357	2.0	357	2.0	0.581	19.8	LOS B	6.2	44.1	1.00	0.97	1.32	38.7
Approach			417	2.0	417	2.0	0.581	18.9	LOS B	6.2	44.1	0.98	0.95	1.26	39.0
North: Tongariri St North															
7	L2	All MCs	1060	2.0	1060	2.0	0.685	5.1	LOS A	8.4	60.1	0.50	0.50	0.50	44.9
8	T1	All MCs	979	2.0	979	2.0	0.721	4.6	LOS A	9.5	67.9	0.58	0.45	0.58	45.3
Approach			2039	2.0	2039	2.0	0.721	4.9	LOS A	9.5	67.9	0.54	0.47	0.54	45.1
All Vehicles			2911	2.0	2911	2.0	0.721	7.1	LOS A	9.5	67.9	0.61	0.56	0.65	44.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
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.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.