APPENDIX A

Existing traffic flows on SH1

Estimated SH1 Waipu Holiday Peak Hour Traffic Volume

Summer holiday peak hour traffic data is not available for SH1 in the vicinity of Waipu. It is therefore necessary to estimate holiday peak hour traffic volumes from the average traffic volumes at this location, and the relationship between AADT and summer holiday peak hour traffic volumes for a comparable site. To assist with this assessment, WK-NZTA provided hourly directional traffic count data for the year 2019 (the last whole year pre-covid not affected by closures of SH1 at the Bryndewyns) from the two nearest continuous count stations on SH1:

- SH1 near Te Hana (Telemetry Site 17, ID: 01N00336) which is about 35km south of the site. 358 days counted.

- SH1 south of Whangarei (Nth of Maungakaramea Rd Puwera, Continuous site ID: 01N00274) which is about 29km north of the site. 202 days counted.

From the data provided, plots were generated of the average hourly two-way traffic volume for both sites by time of day and day of work. The graph for SH1 near Te Hana is shown as **Figure 1** and that for SH1 Maungakaramea as **Figure 2**.

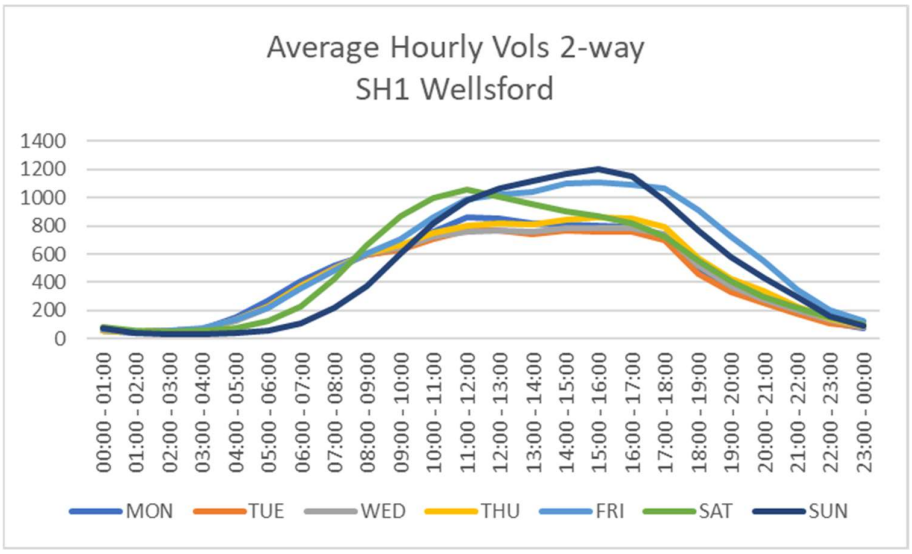


Figure 1 – Hourly two-way traffic volume by day of week/time of day on SH1 Te Hana.

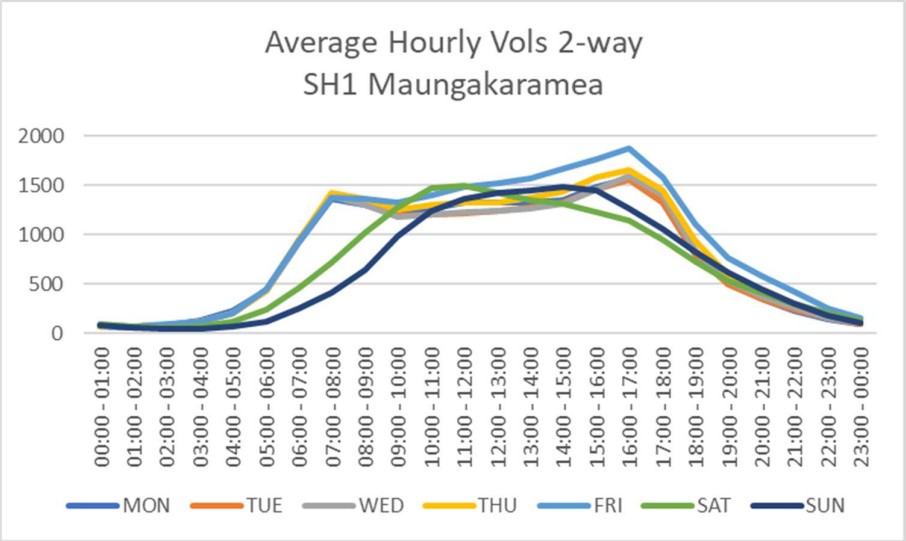


Figure 2 – Hourly two-way traffic volume by day of week/time of day on SH1 Maungakaramea.

The corresponding graph for SH1 near Waipu was provided by NZTA and is shown in **Figure 3**.

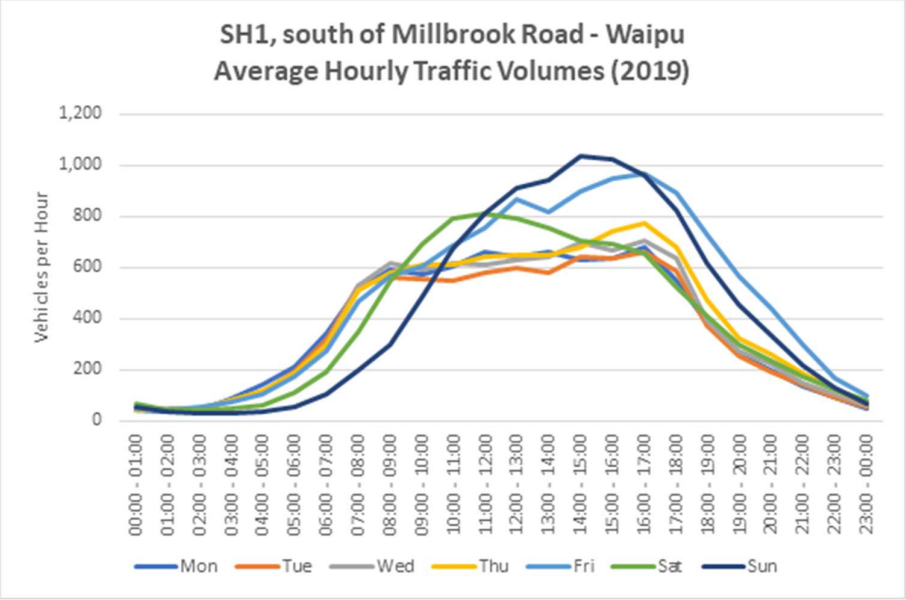


Figure 3 – Hourly two-way traffic volume by day of week/time of day on SH1 Waipu.

It is evident from **Figure 2** that on weekdays SH1 Maungakaramea has noticeable volume peaks in the morning and afternoon commuter peak periods. On weekends there are high levels of traffic between but excluding the AM and PM peak periods, and generally, the weekend traffic is lower than the weekday traffic. This suggests that SH1 Maungakaramea has a significant commuter traffic function.

A different pattern is evident for both the SH1 Te Hana profile in **Figure 1** and the SH1 Waipu profile in **Figure 3**. Both profiles show high levels of traffic between the AM and PM peak periods on weekdays. Weekend traffic is higher than weekday traffic, peaking mid-afternoon.

On this basis the 2019 annual hourly traffic data for SH1 Te Hana has been chosen to be the most applicable to estimate the holiday peak hour traffic volumes for SH1 at Waipu.

The NZTA also provided the 2019 average hourly two-way traffic volumes by time of day and day of week for SH1 south of Millbrook Road as shown in **Table 1** below. This data was based on 35 days' worth of count data and was considered to be "a reasonably good over view of traffic volumes".

Table 1: SH1 Waipu 2019 Two-way hourly traffic volumes

	00:00 - 01:00	01:00 - 02:00	02:00 - 03:00	03:00 - 04:00	04:00 - 05:00	05:00 - 06:00	06:00 - 07:00	07:00 - 08:00	08:00 - 09:00	09:00 - 10:00	10:00 - 11:00	11:00 - 12:00	12:00 - 13:00	13:00 - 14:00	14:00 - 15:00	15:00 - 16:00	16:00 - 17:00	17:00 - 18:00	18:00 - 19:00	19:00 - 20:00	20:00 - 21:00	21:00 - 22:00	22:00 - 23:00	23:00 - 00:00	Total
Mon	44	37	40	87	142	212	340	517	592	575	602	660	644	659	627	633	679	550	386	260	197	134	92	51	8,758
Tue	47	40	42	78	108	191	315	530	559	556	548	582	600	577	644	636	663	582	371	253	193	144	90	55	8,403
Wed	43	45	48	79	107	184	300	531	619	590	618	613	628	641	697	664	706	633	389	271	222	145	101	63	8,935
Thu	44	41	47	76	117	185	299	508	580	613	612	641	647	651	681	744	771	678	473	323	260	185	122	68	9,365
Fri	47	42	52	72	101	170	272	467	566	604	684	755	867	819	896	949	968	893	727	564	443	298	168	97	11,522
Sat	65	40	43	48	63	108	193	350	549	694	793	813	794	756	707	689	656	525	409	297	234	175	124	78	9,202
Sun	55	38	27	30	38	51	102	195	301	486	674	812	908	941	1,035	1,026	962	824	615	457	337	220	131	68	10,333
Average	49	40	43	67	97	157	260	443	538	588	647	697	727	720	755	763	772	669	481	346	269	186	118	68	9,503
Max	65	45	52	87	142	212	340	531	619	694	793	813	908	941	1,035	1,026	968	893	727	564	443	298	168	97	11,522

This data indicates that the average two-way traffic volume from noon to 1pm on Wednesdays in 2019 on SH1 south of Waipu was 628 vehicles per hour.

At SH1 Te Hana, the average two-way traffic volume from noon to 1pm on Wednesdays in 2019 was 765 vehicles per hour, while the day in 2019 with the 95th percentile (18th highest) two-way peak hour traffic volume was Sunday 21st April 2019 with a two-way peak traffic volume of 1,419 vehicles per hour occurring from 2pm to 3pm. This was chosen as the holiday peak hour on SH1 at Te Hana. The factor to convert the average two-way traffic volume from noon to 1pm on Wednesdays to the holiday peak hour two-way traffic volume is thus 1.85.

Assuming that the traffic patterns on SH1 at Waipu are similar to the traffic patterns at SH1 at Te Hana, it is estimated that the 95th percentile holiday peak hour traffic volume on SH1 at Waipu in 2019 was 1.85 times the average two-way traffic volume from noon to 1pm on Wednesdays, i.e. 1,165 vehicles per hour.

Estimated SH1 Waipu Daily Average Peak Hour Traffic Volume

The average two-way peak hour traffic volume on SH1 south of Waipu for each day of the week in 2019 can be extracted from the count data in **Table 2** as follows:

Table 2: SH1 Waipu Average Peak Hour Volume by Day of Week

Day of Week	Average Peak Hour Two-Way Traffic Volume
Monday	679
Tuesday	663
Wednesday	706
Thursday	771
Friday	968
Saturday	813
Sunday	1035
AVERAGE	805

Averaging the average peak hour traffic volume for each day of the week indicates the overall daily average peak hour traffic volume on SH1 Waipu in 2019 was 805 vehicles per hour.

Another approach to derive this figure is calculating the relationship between the average daily peak hour volume on SH1 Waipu and the AADT, and assuming the same relationship applies at SH1 Waipu.

The nearest SH1 count station to the proposed site in Waipu is count station ID: 01N00309 which is located about 400 metres south of Glenmohr Road and 650 metres north of Schultz Rd and is some 5 kilometres south of the site. The estimated AADT in 2019 was 10,225 vehicles per day.

In 2019 at SH1 Te Hana, the average two-way daily peak hour volume was 987 vehicles per hour, while the AADT was 12,429 vehicles per day. Thus, the average two-way daily peak hour volume was 7.9% of the AADT.

Assuming that the traffic patterns on SH1 at Waipu are similar to the traffic patterns at SH1 at Te Hana, it can be estimated that the average two-way daily peak hour traffic volume on SH1 at Waipu in 2019 was 7.9% of the AADT, i.e. 812 vehicles per hour.

The two methods give a very similar estimate of the 2019 average two-way daily peak hour traffic volume on SH1 at Waipu. For the purposes of this assessment, the higher of the two estimates was used, i.e. 812 vehicles per hour.

APPENDIX B

Waka Kotahi safety records: 2017-2022

CODED CRASH ID	Crash road	Distance	Direction	Side road	ID	Date	Day of week	Time	Description of events	Crash factors	Surface condition	Natural light	Weather	Junction	Control	Casualty count fatal	Casualty count serious	Casualty count minor
1211849	01N-0303	1160	N	FINLAYSON BROOK ROAD	201976588	3/08/2019	Sat	10:27	Car/Wagon1 SDB on SH 1, WAIPU, WHANGAREI lost control; went off road to right	CAR/WAGON1, alcohol test below limit, too far right	Dry	Bright sun	Fine	Nil (Default	Unknown	0	0	0
1212899	01N-0303	1103	N	FINLAYSON BROOK ROAD	201977575	12/08/2019	Mon	7:26	Car/Wagon1 NDB on SH 1 lost control turning right; went off road to left, Car/Wagon1 hit ditch	CAR/WAGON1, alcohol test below limit, driver dazzled, ENV: dazzling sun	Wet	Bright sun	Fine	Nil (Default	Unknown	0	0	0
1229100	SH 1	1039	N	FINLAYSON BROOK ROAD	2020143012	20/01/2020	Mon	9:28	Truck1 NDB on SH 1, WAIPU, WHANGAREI lost control; went off road to left, Truck1 hit fence	TRUCK1, alcohol test below limit, other fatigue, too far left	Dry	Bright sun	Fine	Nil (Default	Nil	0	0	0
1248284	SH 1	286	S	MILLBROOK ROAD	2020171171	21/11/2020	Sat	8:52	Motorcycle1 SDB on SH 1 hit rear end of Motorcycle2 stopped/moving slowly	MOTORCYCLE1, alcohol test below limit, following too closely MOTORCYCLE3, alcohol test below limit, suddenly braked MOTORCYCLE2, alcohol test below limit	Dry	Bright sun	Fine	Nil (Default	Nil	0	2	1
1274050	SH 1	713	S	MILLBROOK ROAD	2021179434	13/02/2021	Sat	11:55	Car/Wagon1 SDB on SH 1 changing lanes to left hit Car/Wagon2, Car/Wagon1 hit fence	CAR/WAGON2, alcohol test below limit CAR/WAGON1, alcohol test below limit, swerved to avoid vehicle	Dry	Bright sun	Fine	Nil (Default	Nil	0	0	0
1316504	THE BRAIGH	330	W	CABER LANE	2022230323	25/07/2022	Mon	16:30	SUV1 WDB on The Braigh lost control; went off road to right, SUV1 hit traffic sign, ditch, fence,	SUV1, alcohol suspected, drugs suspected, lost control under acceleration, too far right	Wet	Overcast	Heavy rain	Nil (Default	Unknown	0	0	1
1190246	THE BRAIGH	580	S	SH 1	201899900	20/11/2018	Tue	20:30	Car/Wagon1 WDB on The braigh hit Truck2 merging from the right	TRUCK2, failed to give way entering roadway from driveway	Wet	Dark	Light rain	Driveway	Nil	0	0	0
1249891	SHOEMAKER ROAD		I	WAIPU BYPASS	2020173711	21/12/2020	Mon	17:12	Car/Wagon1 NDB on SHOEMAKER ROAD hit Ute2 crossing at right angle from right	UTE2, alcohol test below limit, failed to give way at priority traffic control	Dry	Overcast	Fine	Crossroads	Give way	0	0	3
1192568	WAIPU BYPASS		I	SHOEMAKER ROAD	2018101359	11/12/2018	Tue	14:02	Car/Wagon1 SDB on WAIPU BYPASS hit Car/Wagon2 turning right onto AXROAD from the left	CAR/WAGON1, alcohol test below limit CAR/WAGON2, alcohol test below limit, did not check/notice another party from other dirn, failed to give way at priority traffic control	Dry	Overcast	Fine	Crossroads	Stop	0	0	0
1195366	WAIPU BYPASS		I	SHOEMAKER ROAD	201960496	1/03/2019	Fri	15:00	Car/Wagon1 SDB on WAIPU BYPASS hit Ute2 turning right onto AXROAD from the left	CAR/WAGON1, alcohol test below limit UTE2, alcohol test below limit, did not check/notice another party from other dirn, failed to give way at priority traffic control	Dry	Bright sun	Fine	T Junction	Stop	0	0	0
1212428	WAIPU BYPASS		I	SHOEMAKER ROAD	201977145	14/12/2019	Sat	9:30	Car/Wagon1 SDB on WAIPU BYPASS hit turning Ute2	UTE2, alcohol test below limit, did not check/notice another party from other dirn, failed to give way at priority traffic control CAR/WAGON1, alcohol test below limit	Dry	Overcast	Fine	Crossroads	Stop	0	0	2
1227909	WAIPU BYPASS	333	S	SHOEMAKER ROAD	2020141264	2/01/2020	Thu	16:40	Car/Wagon1 SDB on WAIPU BYPASS hit rear end of Van2 stopped/moving slowly	CAR/WAGON1, alcohol test below limit, following too closely, other attention diverted	Dry	Bright sun	Fine	Nil (Default	Nil	0	0	0
1292551	WAIPU BYPASS	300	S	SHOEMAKER ROAD	2021194901	17/07/2021	Sat	13:49	Car/Wagon1 SDB on WAIPU BYPASS hit Van2 headon on straight	CAR/WAGON1, alcohol test below limit, other fatigue, too far right	Wet	Overcast	Heavy rain	Nil (Default	Nil	0	0	0
1144650	WAIPU BYPASS	190	N	THE BRAIGH	201800167	20/06/2018	Wed	8:55	SUV1 NDB on WAIPU BYPASS hit Truck2 headon on straight, SUV1 hit non specific fence, Truck2 hit non specific ditch	SUV1, alcohol test below limit, too far right TRUCK2, alcohol test below limit	Wet	Overcast	Heavy rain	Nil (Default	Unknown	1	0	0
1174903	SH 1N	240	N	THE BRAIGH	201849213	30/09/2018	Sun	6:30	Car/Wagon1 SDB on Sh1 lost control; went off road to left, Car/Wagon1 hit non specific fence, non specific traffic sign	CAR/WAGON1, alcohol test below limit, fatigue due to lack of sleep	Dry	Overcast	Fine	Nil (Default	Unknown	0	0	0

APPENDIX C

Predicted 2032 traffic flows

Traffic Growth on SH1

Figure 1 below plots the two-way AADT volumes for SH1 Waipu (count station ID: 01N00309) from 2010. It is evident that the AADT generally follows a linear trend between 2010 and 2019, apart from a low volume recorded in 2015. Since 2019 the volumes have fluctuated widely.

The drop in traffic in 2020 corresponds to New Zealand's borders being closed in March 2020 because of the Covid pandemic, and the restrictions on travel within, to and from Auckland from 7 October 2020 to 14 February 2021. After February 2021 travel to/from Auckland was permitted but international travel was still prohibited, and the increase in AADT for 2021 may reflect an increase in local travel to compensate for the earlier local travel restrictions and the ongoing restriction on international travel. Despite New Zealand reopening its borders on 1 August 2022, the 2022 AADT is again well below the long-term trend.

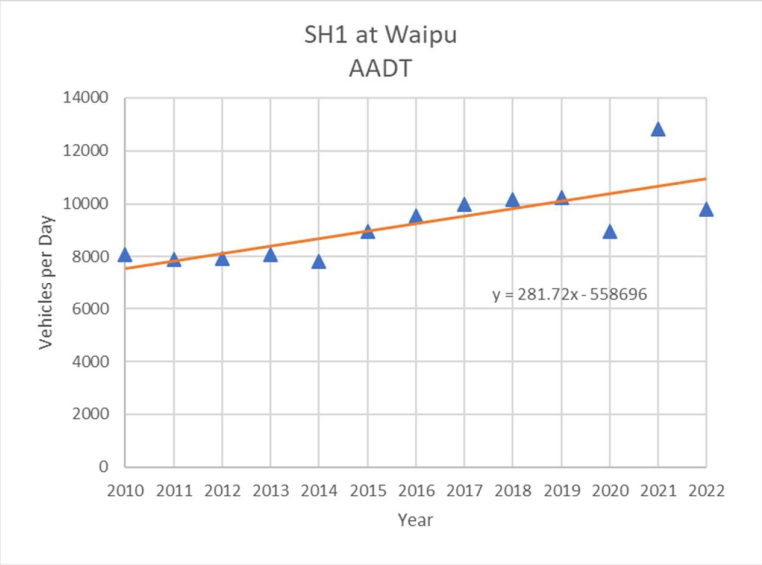


Figure 1 – Two-way AADT on SH1 Waipu

As at 25 July 2024, no AADT data for SH1 at Waipu has been published by NZTA for 2023. However, given the disruptions in travel to/from Northland since February 2023 arising from slips and road closures associated with cyclone Gabrielle and a subsequent flooding event, the 2023 AADT can again be expected to be low.

For the purposes of this assessment, it is assumed that overall traffic growth will continue along the historic linear trend. Linear regression indicates that between 2010 and 2019, the AADT increase on average was 309 vpd per year, which represents 3% of the 2019 AADT.

Forecasts of future traffic growth should take into account future expectations of fuel prices and demographics. The "Transport Demand Forecasts Summary" report produced by NZIER for the Ministry of Transport (December 2013) has taken these factors into account to estimate that the net growth in light vehicle traffic in Northland will equate to less than 2% per annum.

Nevertheless, for the SIDRA analysis an AADT increase of 309 vpd per year has been used on SH1 (which represents 3% of the 2019 AADT).

The NZTA Planning Policy Manual indicates that for assessing development proposals, it is important to consider predicted traffic levels in the future – generally 10 years. For the purposes of this assessment traffic growth of 3% per year over 13 years from 2019 to 2032 (a 39% increase) has been applied to the estimated 2019 holiday peak hour and daily average peak hour traffic volumes to estimate the corresponding 2032 volumes.

1. 2032 Summer Holiday Peak Hour Traffic Volumes Without Development

The forecast 2032 holiday peak hour volumes on SH1 at Waipu are determined by adding the forecast 39% traffic growth to the estimated 2019 holiday peak hour volumes. The results are shown in **Table 1** below:

Table 1: Estimated 2032 Holiday Peak Hour Traffic Volume SH1 Waipu

Component	Southbound	Northbound	Total
2019 Holiday Peak Hour Traffic Volume	590	575	1165
Traffic Growth 2019 to 2032	230	224	454
TOTAL	820	799	1619
Percentage	51%	49%	100%

The estimated 2032 summer holiday peak hour volumes on SH1 are 1.39 times the estimated 2019 holiday peak hour volumes. The same growth factor has been applied to holiday peak hour traffic volumes on Millbrook Road and The Braigh.

On this basis, the expected 2032 holiday peak hour turning movements on SH1 at the intersections with Millbrook Road and The Braigh with no development of the Service Centre site are shown in **Figure 2**.

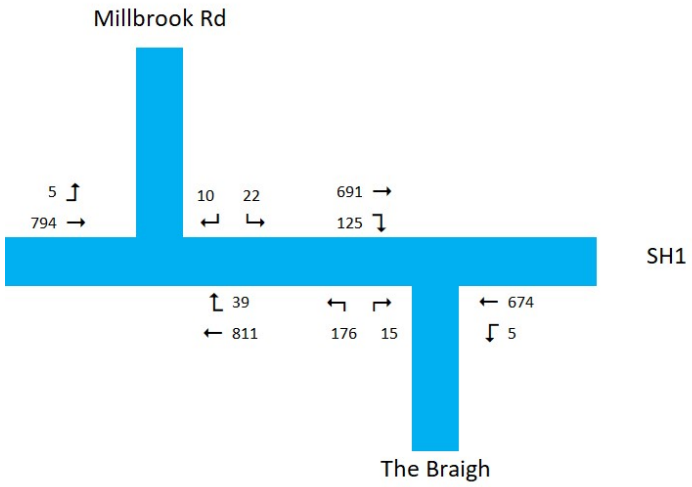


Figure 2 – Forecast 2032 Holiday Peak Hour Turning Movements at SH1 Waipu

2. 2032 Average Holiday Peak Hour Traffic Volumes Without Development

As with the summer holiday peak hour, the 2032 estimated average peak hour traffic volumes on SH1 are 1.39 times the estimated 2019 average peak hour volumes. The same growth factor has been applied to holiday peak hour traffic volumes on Millbrook Road and The Braigh.

On this basis, the expected 2032 average peak hour turning movements on SH1 at the intersections with Millbrook Road and The Braigh with no development of the Service Centre site are shown in **Figure 3**.

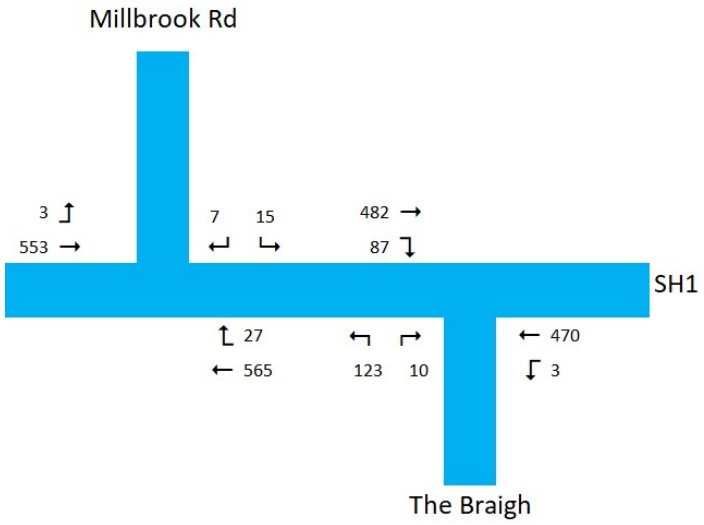


Figure 3 – Forecast 2032 Average Peak Hour Turning Movements at SH1 Waipu

APPENDIX D

Millbrook Road and The Braigh intersections
SIDRA-9 model results – 2032 holiday and average peak hour flows

MOVEMENT SUMMARY

Site: 101 [SH1/Millbrook Road - base holiday 2032 (Site Folder: 2032 Holiday Peak Base)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

New Site
Site Category: (None)
Stop (Two-Way)

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
NorthEast: SH1 North															
25	T1	All MCs	854	12.9	854	12.9	0.474	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	99.6
26	R2	All MCs	41	12.9	41	12.9	0.087	14.8	LOS B	0.3	2.3	0.72	0.91	0.72	61.1
Approach			895	12.9	895	12.9	0.474	0.7	NA	0.3	2.3	0.03	0.04	0.03	96.8
NorthWest: Millbrook Road															
27	L2	All MCs	23	12.9	23	12.9	0.656	37.8	LOS E	1.5	11.5	0.97	1.05	1.24	32.7
29	R2	All MCs	11	12.9	11	12.9	0.656	138.8	LOS F	1.5	11.5	0.97	1.05	1.24	32.7
Approach			34	12.9	34	12.9	0.656	69.3	LOS F	1.5	11.5	0.97	1.05	1.24	32.7
SouthWest: SH1 south															
30	L2	All MCs	5	12.9	5	12.9	0.468	8.2	LOS A	0.0	0.0	0.00	0.00	0.00	80.9
31	T1	All MCs	836	12.9	836	12.9	0.468	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	99.5
Approach			841	12.9	841	12.9	0.468	0.1	NA	0.0	0.0	0.00	0.00	0.00	99.4
All Vehicles			1769	12.9	1769	12.9	0.656	1.8	NA	1.5	11.5	0.04	0.04	0.04	94.4

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control 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 [SH1/The Braigh - base holiday 2032 (Site Folder: 2032 Holiday Peak Base)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

New Site
Site Category: (None)
Stop (Two-Way)

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
SouthEast: The Braigh															
21	L2	All MCs	185	12.9	185	12.9	0.896	39.6	LOS E	5.9	46.0	0.97	1.72	3.06	30.0
23	R2	All MCs	16	12.9	16	12.9	0.896	158.3	LOS F	5.9	46.0	0.97	1.72	3.06	29.9
Approach			201	12.9	201	12.9	0.896	48.9	LOS E	5.9	46.0	0.97	1.72	3.06	30.0
NorthEast: SH1 north															
24	L2	All MCs	5	12.9	5	12.9	0.397	8.2	LOS A	0.0	0.0	0.00	0.01	0.00	80.5
25	T1	All MCs	709	12.9	709	12.9	0.397	0.1	LOS A	0.0	0.0	0.00	0.01	0.00	98.8
Approach			715	12.9	715	12.9	0.397	0.1	NA	0.0	0.0	0.00	0.01	0.00	98.7
SouthWest: SH1 south															
31	T1	All MCs	727	12.9	727	12.9	0.404	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	99.7
32	R2	All MCs	132	12.9	132	12.9	0.210	10.0	LOS B	0.8	6.3	0.67	0.86	0.68	42.7
Approach			859	12.9	859	12.9	0.404	1.6	NA	0.8	6.3	0.10	0.13	0.10	82.8
All Vehicles			1775	12.9	1775	12.9	0.896	6.4	NA	5.9	46.0	0.16	0.26	0.40	72.9

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control 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 [SH1/Millbrook Road - base avg 2032 (Site Folder: 2032 Average Peak Base)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

New Site
Site Category: (None)
Stop (Two-Way)

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
NorthEast: SH1 North															
25	T1	All MCs	595	12.9	595	12.9	0.331	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.8
26	R2	All MCs	28	12.9	28	12.9	0.036	11.0	LOS B	0.1	1.1	0.57	0.76	0.57	65.3
Approach			623	12.9	623	12.9	0.331	0.5	NA	0.1	1.1	0.03	0.03	0.03	97.4
NorthWest: Millbrook Road															
27	L2	All MCs	16	12.9	16	12.9	0.104	14.7	LOS B	0.3	2.3	0.76	1.00	0.76	53.8
29	R2	All MCs	7	12.9	7	12.9	0.104	47.9	LOS E	0.3	2.3	0.76	1.00	0.76	53.7
Approach			23	12.9	23	12.9	0.104	25.2	LOS D	0.3	2.3	0.76	1.00	0.76	53.8
SouthWest: SH1 south															
30	L2	All MCs	3	12.9	3	12.9	0.325	8.2	LOS A	0.0	0.0	0.00	0.00	0.00	80.9
31	T1	All MCs	582	12.9	582	12.9	0.325	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.7
Approach			585	12.9	585	12.9	0.325	0.1	NA	0.0	0.0	0.00	0.00	0.00	99.6
All Vehicles			1232	12.9	1232	12.9	0.331	0.8	NA	0.3	2.3	0.03	0.04	0.03	96.9

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control 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 [SH1/The Braigh - base avg 2032 (Site Folder: 2032 Average Peak Base)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

New Site
Site Category: (None)
Stop (Two-Way)

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
SouthEast: The Braigh															
21	L2	All MCs	129	12.9	129	12.9	0.266	12.2	LOS B	1.1	8.2	0.64	1.01	0.71	41.7
23	R2	All MCs	11	12.9	11	12.9	0.266	39.3	LOS E	1.1	8.2	0.64	1.01	0.71	41.5
Approach			140	12.9	140	12.9	0.266	14.2	LOS B	1.1	8.2	0.64	1.01	0.71	41.7
NorthEast: SH1 north															
24	L2	All MCs	3	12.9	3	12.9	0.277	8.2	LOS A	0.0	0.0	0.00	0.00	0.00	80.7
25	T1	All MCs	495	12.9	495	12.9	0.277	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.1
Approach			498	12.9	498	12.9	0.277	0.1	NA	0.0	0.0	0.00	0.00	0.00	98.9
SouthWest: SH1 south															
31	T1	All MCs	507	12.9	507	12.9	0.282	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.8
32	R2	All MCs	92	12.9	92	12.9	0.100	7.4	LOS A	0.4	3.2	0.54	0.71	0.54	44.1
Approach			599	12.9	599	12.9	0.282	1.2	NA	0.4	3.2	0.08	0.11	0.08	83.6
All Vehicles			1237	12.9	1237	12.9	0.282	2.2	NA	1.1	8.2	0.11	0.17	0.12	79.5

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control 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.

APPENDIX E

Proposed service centre layout

STAGE-1 LEGEND:

1 BP SERVICE STATION BLDG
2 BP FORECOURT CANOPY
3 BP TRUCK STOP
4 BP TRUCK PARKS
5 BP EV CAR PARKS
6 BP EV TRUCK PARKS
7 COACH PARK
8 BP AIR PARK
9 BP U/GRND TANKS & CAMPER PARKS
10 QSR - 1 DRIVE THROUGH
11 QSR - 1 BLDG 260m2
12 BLDG 148m2
21 QSR - 2 DRIVE THRU
22 QSR - 2 BLDG 260m2
23 BLDG 148m2

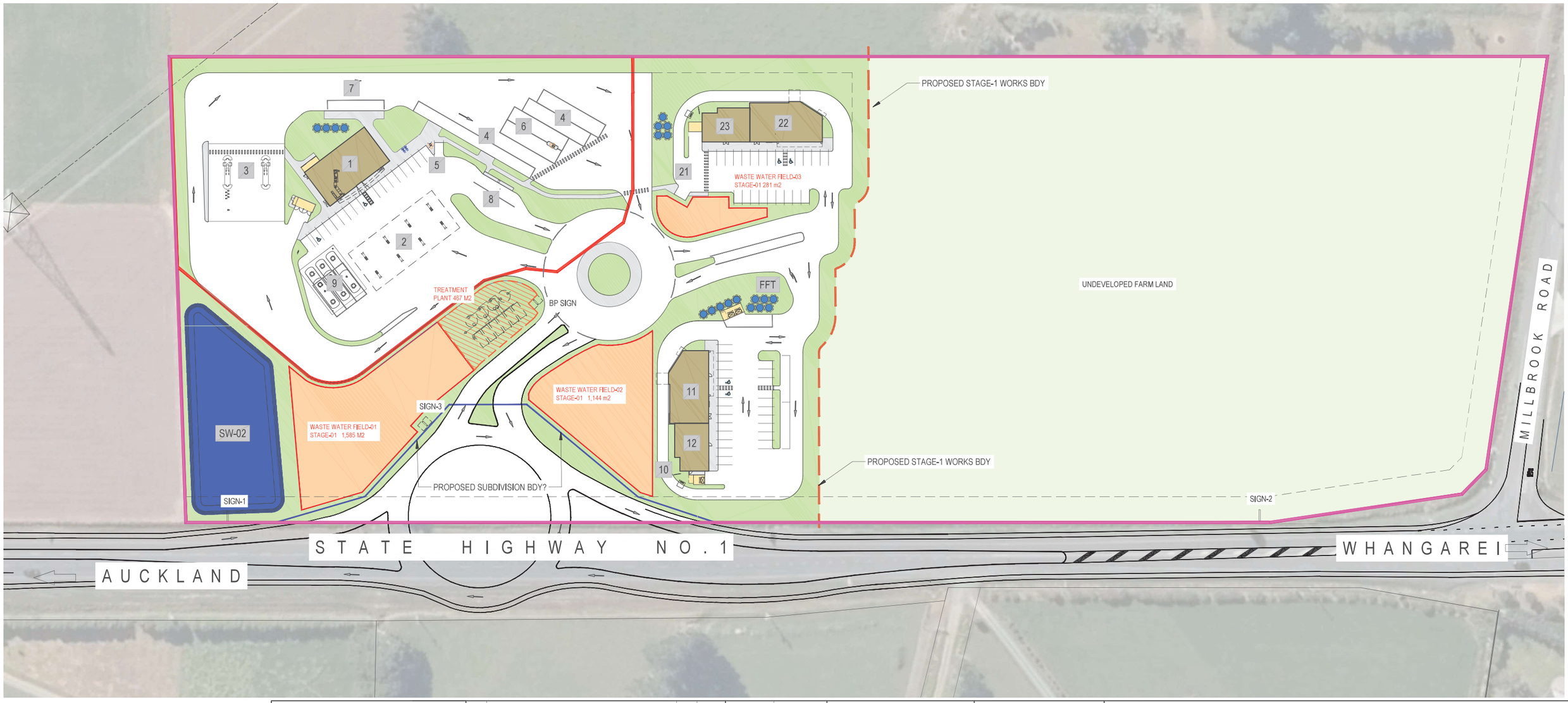
OVERALL SITE AREA - 59,162 m2
BP LEASE AREA - 11,055 m2
STAGE 1 EXTENT
SW — STORM WATER PONDS - REFER TO CKL DOCS
WW — WASTE WATER FIELDS - REFER TO CKL DOCS
WATER TANKS
FFT — WATER TANKS - FIRE FIGHTING (FIRE ENGINEER TO CONFIRM REQUIREMENTS)

STAGE-1 CAR PARK ASSESSMENT:

BLDG:	USE:	AREA:		CAR PARKS PROVIDED
01	BP	305m2	=	17 + 1 AIR + 2 EV + 3 CAMPER PARKS 4 TRUCK PARKS 2 TRUCK EV 1 COACH PARK
11	QSR-1	260m2	=	15 + 2 GRILL PARKS
12	CAFE / GENERAL FOOD-1	148m2	=	9
22	QSR-2	260m2	=	15 + 2 GRILL PARKS
23	CAFE / GENERAL FOOD-1	148m2	=	8
NOT OTHERWISE ACCOUNTED IN STAGE 1			=	2 CAMPER PARKS
STAGE-1 TOTALS			=	**64 CAR PARKS 4 GRILL PARKS 5 CAMPER PARKS 2 EV PARKS 1 AIR PARK 4 TRUCK PARKS 2 TRUCK EV PARKS 1 COACH PARK**

STAGE-1 COVERAGE TABLE:

TOTAL SITE AREA	=	59,162 m2
PERMITTED BUILDING COVERAGE 59,16 2m2 x .2	=	20% NET SITE 11,832 m2
PROPOSED STAGE-1 BUILDING COVERAGE	=	1,670 m2 (incl canopies)
PROPOSED LANDSCAPE AREA INCL PONDS	=	11,834 m2
FARMLAND (UNDEVELOPED STAGE-2)	=	29,571m2



TECHNITRADES ARCHITECTURE
12 Ben Lomond Crescent, Pakuranga, Auckland 2010
Phone (09) 5767166 | design@technitrades.co.nz

REV.	DESCRIPTION	BY	DATE
A	STAGES REDEFINED - DWG NO.s REVISED	MK	25-07-24

A1 Scale.	1:600
A3 Scale.	1:1200
Designed.	L.MEIKLEJOHN
Drawn.	B.MILLWARD
A1 Plot Scale.	1 : 1
A3 Plot Scale.	1 : 2

NOTES.
DO NOT SCALE.
DIMENSIONS IN MILLIMETERS UNLESS NOTED OTHERWISE.
IF IN DOUBT ON ANY ISSUE SEEK VERIFICATION PRIOR TO PROCEEDING.
READ THESE DRAWINGS IN CONJUNCTION WITH ALL OTHER CONSULTANTS DRAWINGS AND SPECIFICATIONS.

Client Reference No.
.

Project Title.
VACO INVESTMENTS LIMITED
WAIPU GATEWAY SERVICE CENTRE
47 Millbrook Road, Waipu, Whangārei District

Drawing Title.
Stage-1 Proposed Site Plan

3096-H-S1-01

Rev. A

STAGE-2 (OPTION-2) LEGEND:

13	BLDG 408m2 (4 x 102m2 TENANCIES INDICATED)
14	BLDG 113m2
15	EV PARKS (x 4)
16	BLDG 1,000m2 + 170m2 MEZZ UP TO 3 TENANCIES, SIZES SUBJECT TO TENANT NEEDS
17	LOADING AREA
18	BLDG 296m2
19	BLDG - 90m2
19A	BLDG - 90m2
20	BLDG - 114m2
20A	BLDG - 135m2
21	QSR - 2 DRIVE THRU
24	BLDG - 294m2 (3 x 98m2 TENANCIES INDICATED)
25	FARMING & AGRI SUPPLIES - 500m2 + 72m2 MEZZ
26	OUTDOOR DISPLAY & STORAGE 191m2
27	CAR PARKS
28	BLDG 2,082m2 + 148m2 MEZZ
28A	LOADING
29	BLDG 930m2
29A	OUTDOOR DISPLAY 342m2
30	MARINE & VEHICLE SALES & SERVICES, BLDG 1,157m2 + 184m2 MEZZ
30A	LOADING
	OVERALL SITE AREA - 59,162 m2
	STAGE 2 EXTENT
SW	STORM WATER PONDS - REFER TO CKL DOCS
	WATER TANKS
FFT	WATER TANKS - FIRE FIGHTING (FIRE ENGINEER TO CONFIRM REQUIREMENTS)

CAR PARK ASSESSMENT - STAGE 1 (AS PER 3096-S1-01):

STAGE-1 TOTALS	=	**64 CAR PARKS** **4 GRILL PARKS** **5 CAMPER PARKS** **2 EV PARKS** **1 AIR PARK** **4 TRUCK PARKS** **2 TRUCK EV PARKS** **1 COACH PARK**

STAGE 2 (OPTION-2) CAR PARK ASSESSMENT:

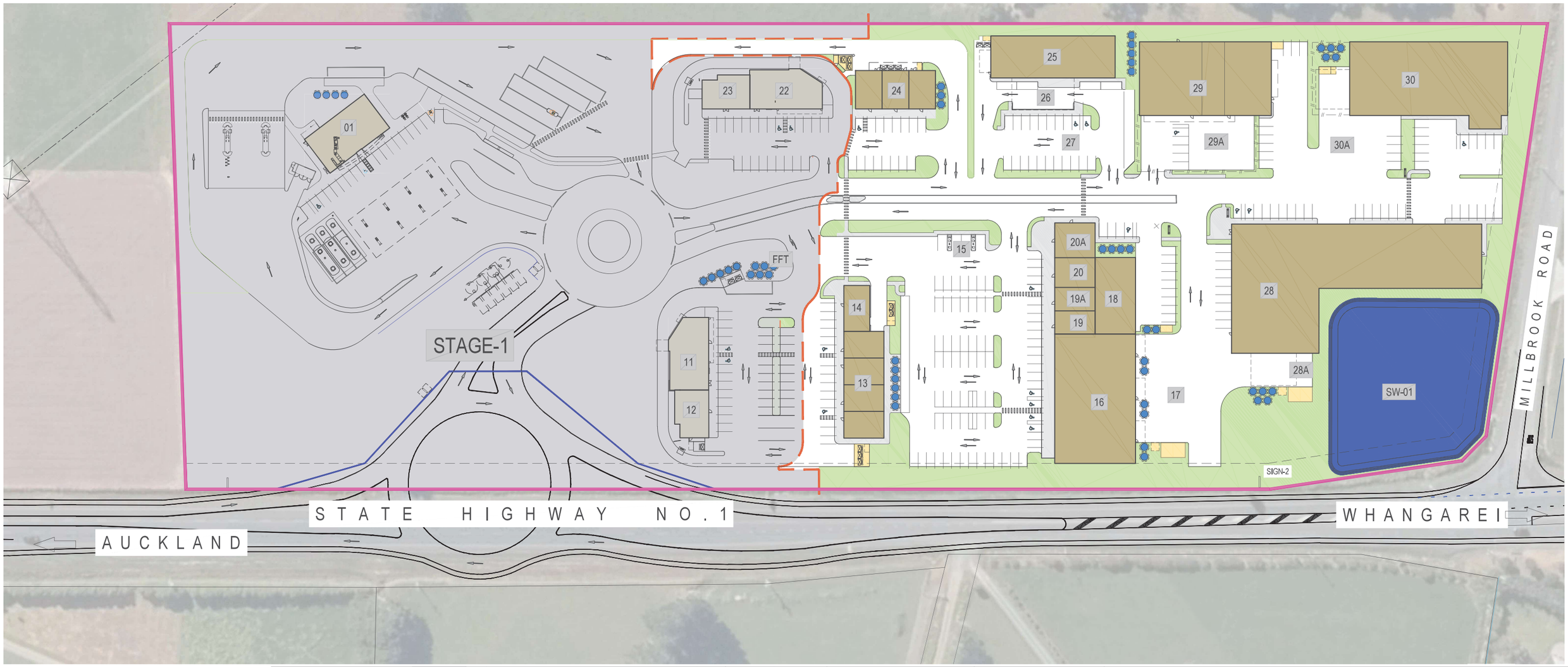
BLDG:	USE:	AREA:		CAR PARKS PROVIDED
RURAL/HOME SUPPLIES, WAREHOUSING, MARINE OR VEHICLE SALES & SERVICE BUILDINGS 13,14,16,18,19-20a,21,22,23,25,28				
13	AS ABOVE	408m2	=	20
14	AS ABOVE	113m2	=	6
16	AS ABOVE	1,170m2	=	53 + 2 CAMPER PARKS
18	AS ABOVE	296m2	=	13
19-20	AS ABOVE	439m2	=	24
24	AS ABOVE	294m2	=	16

STAGE-2 (OPTION-2) CAR PARK :

BLDG:	USE:	AREA:		CAR PARKS PROVIDED
25	FARMING & AGRICULTURAL SUPPLIES OUTDOOR DISPLAY	500m2 191m2	=	25 + 1 TRAILER
28	AS DETAILED OVER	1,500 + 148 MEZZ	=	31
29	AS DETAILED OVER BLDG 930m2 + O/SIDE DISPLAY	342m2	=	14
30	MARINE & VEHICLE SALES & SERVICE	1,157 + 184 MEZZ	=	15
NOT OTHERWISE ACCOUNTED IN STAGE 2			=	4 EV PARKS
STAGE-2 (OPTION-2) TOTALS			=	**217 CAR PARKS** **2 CAMPER PARKS** **1 TRAILER PARK** **4 EV PARKS**
OVERALL TOTALS (STAGE-1 + STAGE-2 (OPTION-2)			=	**281 CAR PARKS** **4 GRILL PARKS** **7 CAMPER PARKS** **1 TRAILER PARK** **6 EV PARKS** **1 AIR PARK** **4 TRUCK PARKS** **2 TRUCK EV PARKS** **1 COACH PARK**

STAGE-2 (OPTION-2) COVERAGE TABLE:

TOTAL SITE AREA	=	59,162 m2
PERMITTED BUILDING COVERAGE 59,16 2m2 x .2	= =	20% NET SITE 11,832 m2
PROPOSED BUILDING COVERAGE		
STAGE-1	=	1,670 m2 (incl canopies)
+ STAGE-2 (OPTION-2)	=	8,147 m2 (incl canopies)
	=	**9,817 m2 (incl canopies)**
PROPOSED LANDSCAPE AREA INCL PONDS FOR STAGE 1 + SATGE 2 (OPTION-1)	= =	19,200m2 32 % NET SITE AREA



TECHNITRADES ARCHITECTURE
12 Ben Lomond Crescent, Pakuranga, Auckland 2010
Phone (09) 5767166 | design@technitrades.co.nz

REV.	DESCRIPTION	BY	DATE
A	STAGES REDEFINED	MK	25-07-24

A1 Scale.	1:600
A3 Scale.	1:1200
Designed.	L.MEIKLEJOHN
Drawn.	B.MILLWARD
A1 Plot Scale.	1 : 1
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Client Reference No.
.

Project Title.
VACO INVESTMENTS LIMITED
WAIPU GATEWAY SERVICE CENTRE
47 Millbrook Road, Waipu, Whangārei District

Drawing Title.
Stage-2 Option-2 Proposed Site Plan

3096-H-S2-2-01

Rev. A

APPENDIX F

Typical tracking paths for a 23m HPMV truck and trailer

Rev	Revisions	By	Date

TPC TRAFFIC PLANNING CONSULTANTS LTD
Level 1, 400 Titirangi Rd, Titirangi, P.O Box 60-255, Auckland 0604
Phone: 09 817-2500 www.trafficplanning.co.nz

Project Title
BP Waipu Bypass Service Station
47 Millbrook Road, Waipu, Whangarie

Sheet Title
Vehicle Tracking - 23.0m Truck and Trailer (500mm clearance)

Designed	JB	Drawn	AM	Project No - (Sheet No)	Scales 1:750 (A3)
Checked	JB	Approved	JB	21803 - VTC - (1)	Date 12.02.23

D:\Users\Ally\Traffic Planning Dropbox\AUTOCAD Files\2021 Projects\21803 - BP Waipu Bypass Service Station\Vehicle Tracking\VTC\21803 - VTC.dwg

APPENDIX G

Trip generation and distribution predictions

Stand-Alone Peak Hour Traffic Generation of Waipu Gateway Activities

In undertaking a traffic assessment, it is common to apply published traffic generation rates to each of the separate activities on a site, and then add them to estimate the total traffic generation of the site. For another site, WK-NZTA have suggested using 85% percentile trip generation rates from NZTA Research Report 453 "Trips and Parking Related to Land Use".

On this basis, the peak hour vehicle trip generation of the full Option 2 development of the proposed Waipu Gateway service centre is shown in **Table 1**.

Table 1: Peak Hour Vehicle Trip Generation of Proposed Waipu Gateway Service Centre

Plan No.	Activity	GFA (m^2)	NZRR453 85th percentile trip generation rate	predicted peak vehicle movements/hour
1-9	Service station/truck stop, including EV car and truck charging stations	20 bays	20.4	408
10-11	QSR + drive-through	260	52/100m^2	135
12	Food outlet	148	16.7/100m^2	25
13	Rural/home supplies, warehousing, marine or vehicles sales &service	408	17.1/100m^2	23
14	Rural/home supplies, warehousing, marine or vehicles sales &service	113	5.6/100m^2	6
15	EV charging stations			
16-17	Rural/home supplies, warehousing, marine or vehicles sales &service	1,170	5.6/100m^2	66
18	Rural/home supplies, warehousing, marine or vehicles sales &service	296	5.6/100m^2	17
19-20	Rural/home supplies, warehousing, marine or vehicles sales &service	439	5.6/100m^2	25
21-22	QSR + drive-through	260	52/100m^2	135
23	Food store	148	16.7/100m^2	25
24	Rural/home supplies, warehousing, marine or vehicles sales &service	294	5.6/100m^2	16
25-27	Farming/agricultural supplies	500	5.6/100m^2	28
28	Rural/home supplies, warehousing, marine or vehicles sales &service	2,228	5.6/100m^2	125
29	Rural/home supplies, warehousing, marine or vehicles sales &service	930	5.6/100m^2	52
30	Marine/vehicles sales/service	1,341	5.6/100m^2	75
TOTAL				1,160

Stage 1 will comprise the service station (buildings 1-9), two fast food outlets (buildings 10-11 and 21-22) and two food outlets (buildings 12 and 23) with the GFAs as set out In **Table 1**. The stand-alone peak hour traffic generation of Stage 1 would be the sum of the traffic generations of each component of Stage 1, i.e. 728 vehicle movements per hour.

Accounting for Service Centre Pass-by Trips

Pass-by trips refer to motorists who turn into and out from the site when they were already passing the site.

Data on pass-by trip rates have been sourced from the *ITE Trip Generation Handbook – 3rd Edition*, *Austroads Guide to Traffic Management (AGTM) Part 12: Traffic Impact of Developments*, and survey data on trip generation for fast food outlets undertaken for Roads

and Maritime Services NSW by Bitzios Consulting. The results for relevant types of land-use are shown in **Table 2** below:

Table 2: Published Pass-by Trip Rates

Activity	Pass-by Trips (%)	Source
McDonalds	51%	Survey of 10 restaurants in NSW undertaken for Road and Maritime Services in NSW in 2016
Fast Food Outlets	35%	Undiverted drop-in: Table C8.1 of AGTM Part 12
Fast food restaurant with drive through	50%	ITE Trip Generation Handbook - 3rd Edition
Convenience Market with GAS	66%	ITE Trip Generation Handbook - 3rd Edition
Gas/service station with convenience market	56%	ITE Trip Generation Handbook - 3rd Edition
AVERAGE	52%	

As suggested by the consultant engaged by NZTA to review the transport assessment, an intercept survey was undertaken at The Grange, Warkworth, on Friday 16 June 2023 from 4:30pm to 6:30pm. Of 31 observations, 18 (58%) were pass-by trips. The survey was undertaken on the day the Warkworth bypass opened. Prior to the bypass opening, the proportion of pass-by trips would have been higher.

These pass-by rates generally apply to urban sites, where trip distances are limited and it is not onerous to make a special (primary) trip to such activities. However, in the case of Waipu, there is a limited local population and trip distances will tend to be longer. It is thus more onerous to make a special trip to such activities, and the pass-by rate would be higher.

On this basis, a pass-by trip rate of 66% would appear reasonable to apply to the proposed Waipu Gateway service centre.

However, acknowledging that the published pass-by trip rates, and the activities at The Grange have no farming and agriculture supplies, rural home supplies and marine sales components, this assessment applies no pass-by trips for these components of the development, reducing the proportion of trips external to the proposed Waipu Gateway service centre site that are pass-by trips to 30%.

Accounting for Service Centre Linked Trips

Service centres comprise a number of complementary services – for example the proposed service centre will comprise a service station, fast food outlets, food outlets and rural service activities. In undertaking a traffic assessment, it is common to apply published traffic generation rates to each of the separate activities on a site, and then add them to estimate the total traffic generation of the site.

However, it would not be unusual for customers who are on the site to make use of more than one service, for example to have a meal or buy takeaways while they are on the site to

refuel their vehicle, and thus the total estimated traffic generation of the site should be reduced to account for this. There is, however, no published information that we could source on linked trips for service centres.

An indication of the effect of linked trips can be derived by looking at the difference between peak hour vehicle movements derived by adding the traffic generation predicted for each of the separate activities on a site with the actual measured peak hour vehicle movements.

Such a comparison was made for the BP Service Centre on SH1, Bombay. The traffic generation predicted for each of the separate activities on the site were estimated by applying the 85th percentile trip generation rates suggested by NZTA Research Report 453 to the scale of activities at the BP Bombay Service Centre. The GFAs were estimated from Auckland Council Geo Maps aerial photography and Google Maps Street View. As no counts for café seating were available, the numbers of seats in cafés in the Bombay Service Centre were estimated by assuming 50% of the GFA of cafés would be set aside for diner seating, and that (based on RTA surveys) the mean eating gross floor area per seat is 1.5m^2.

On this basis, the peak hour vehicle trip generation of the proposed activities at the BP Bombay service centre using the 85% design generation rates from NZTA Research Report 453 are shown in **Table 3**.

Table 3: Peak Hour Trip Generation of Activities at BP Bombay Service Centre

Activity	Size	Peak Hour Vehicle Trip Rate (85%)	Estimated Peak Hour Vehicle Trips
McDonalds	600m^2 GFA	52.2 veh/hr per 100m^2 GFA	313
Restaurants/cafés	384 seats	0.5 veh/hr per seat	192
Convenience Store	250m^2 GFA	18.9 veh/hr per 100m^2 GFA	47
Service Station (fuelling)	16 fuel dispensers	20.4 per bay	326
TOTAL			878

By comparison, the actual turning movements counted at this service centre in August 2016 were as shown in **Table 4**.

Table 4: Surveyed Vehicle Turning Movements at BP Bombay Service Centre

Peak Hour	Turning Movements
Weekday AM Peak Hour	456
Weekday PM Peak Hour	414
Saturday MD Peak Hour	632

By comparing the difference between the peak hour vehicle movements derived by adding the traffic generation predicted for each of the separate activities on a site with the actual measured peak hour vehicle movements, it appears that the proportion of linked trips was

48% in the AM peak hour, 53% in the PM peak hour and 28% in the midday Saturday peak hour.

As suggested by the consultant engaged by NZTA to review the transport assessment, an intercept survey was undertaken at The Grange, Warkworth, on Friday 16 June 2023 from 4:30pm to 6:30pm. Of 31 observations, 13 trips to the service station included a trip to another activity that was located within the same site (The Grange), meaning 42% were linked trips.

For the purposes of this assessment, it is assumed that 50% of trips to the proposed Waipu Gateway service centre will be linked trips. However, acknowledging that the activities at the BP Service Centre on SH1, Bombay and The Grange, Warkworth have no farming and agriculture supplies, rural home supplies and marine sales activities, this assessment assumes no linked trips for these components of the Waipu Gateway Service Centre development, reducing the proportion of total trips to the proposed Waipu Gateway service centre that are linked trips to 31%.

Pass-by Trip Turning Movements

Accounting for linked trips, the predicted holiday peak hour trip generation of the service centre external to the site is 796 vehicle movements per hour. As indicated above, 66% of vehicle movements are expected to be associated with pass-by trips (excepting farming and agriculture supplies, rural home supplies and marine sales), meaning pass-by trips in the holiday peak hour are expected to account for 240 vehicle movements per hour. It is assumed that the direction of pass-by trips will be in proportion to the holiday peak hour traffic volume by direction, i.e., 51% southbound and 49% northbound. Thus 122 vehicle movements per hour will be associated with southbound pass-by trips and 118 vehicle movements per hour will be associated with northbound pass-by trips. Finally, it is assumed that the pass-by vehicle movements will be equally split between vehicles entering the service centre and vehicles leaving the service centre. On this basis, the expected holiday peak hour pass-by vehicle movements associated with the proposed service centre are shown in **Table 5**.

Table 5: Predicted Holiday Peak Hour Pass-By Vehicle Movements

Direction	Northbound	Southbound
In	59	61
Out	59	61
TOTAL	118	122

These vehicle movements are not additional traffic, and so the volume of through traffic on SH1 needs to be reduced by the corresponding amount, i.e., 59 vehicles per hour northbound and 61 vehicles per hour southbound.

Primary Trip Vehicle Movements

Primary trips are special trips made solely for the purpose of visiting the service centre, i.e. trips that are not linked trips or pass-by trips. It is predicted that 70% of the predicted holiday peak hour trip generation of the service centre external to the site will be associated with primary trips, i.e., 556 vehicle movements in the holiday peak hour.

It is assumed that primary trips will originate equally between origins to the north of Waipu, origins to the south of Waipu, and origins within Waipu, i.e., 185 vehicle movements associated with each of these origins. It is once again expected that primary vehicle movements will be equally split between vehicles entering and leaving the service centre.

Customers from areas to the south will approach the site northbound on SH1 and leave the site southbound on SH1, customers from areas to the north will approach the site southbound on SH1 and leave the site northbound on SH1, and customers from Waipu will access the site via The Braigh and return the same way.

On this basis, the expected holiday peak hour primary vehicle movements generated by the proposed service centre are shown in **Figure 1**.

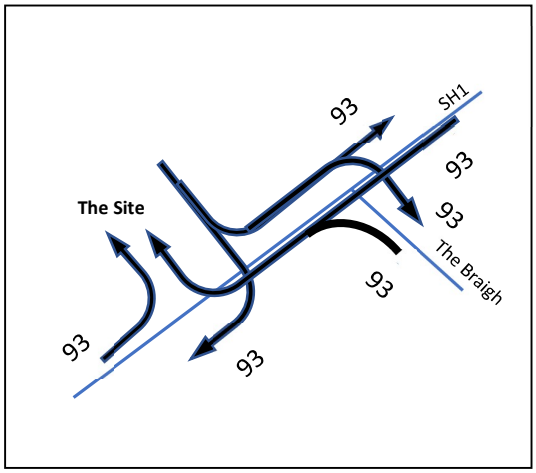


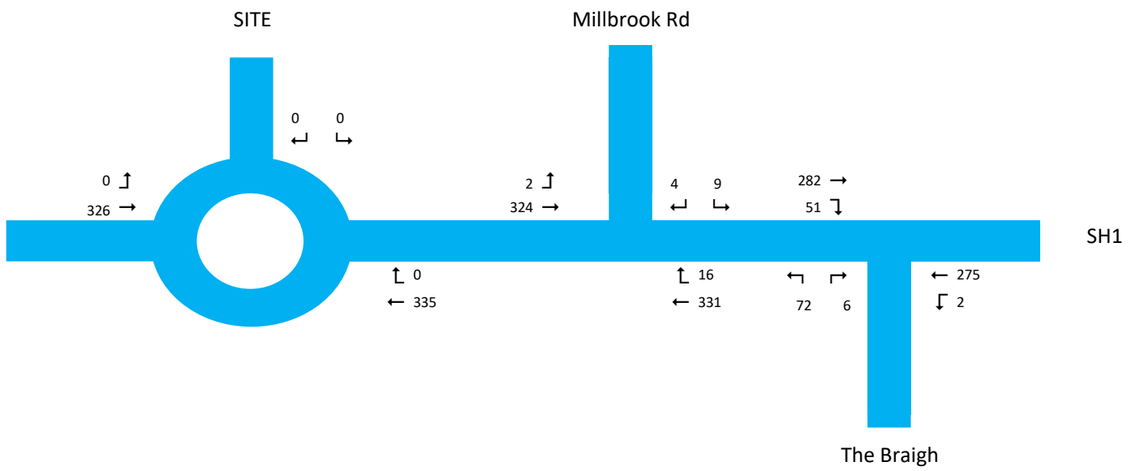
Figure 1 – Holiday Peak Hour Service Centre Primary Turning Movements

These turning movements are additional traffic movements and need to be added to the 2032 holiday peak hour turning movement volumes.

It has been conservatively assumed that the average peak hour traffic generation of the Waipu Service Centre will be the same as the holiday peak hour traffic generation.

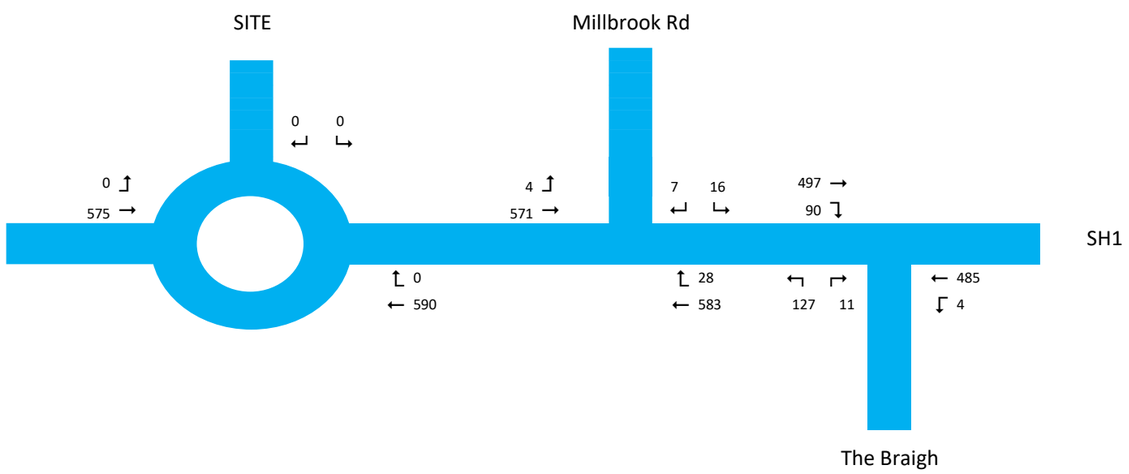
Waipu Gateway

COUNTED TURNING MOVEMENTS 12NOON TO 1PM, WED 9TH FEB 2022



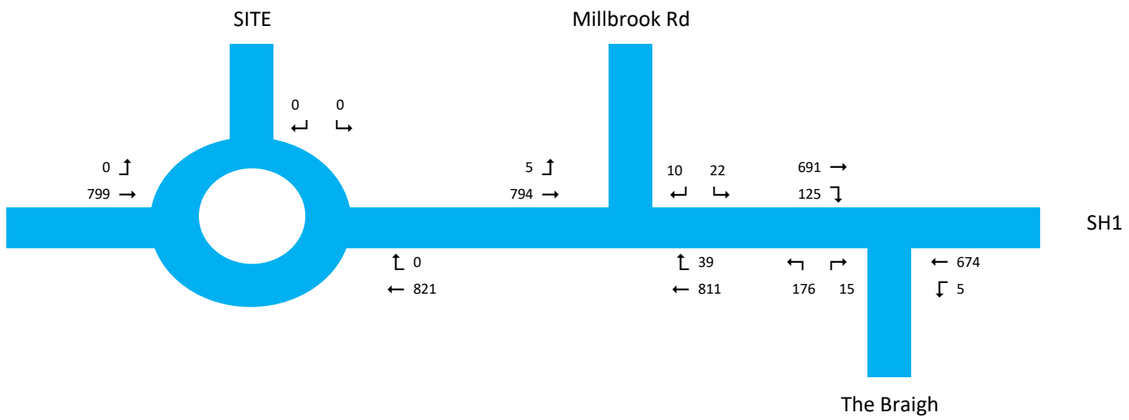
	NBD	SBD	TOTAL
SH1 TE HANA 2019 AVERAGE WED 12-1 VOLUME			765
SH1 TE HANA 2019 HOLIDAY (95%) PEAK HOUR VOLUME			1419
SH1 TE HANA AVERAGE WED 12-1 → HOLIDAY PEAK HOUR FACTOR			1.85
SH1 WAIPU COUNTED 2022 WED 12-1 VOLUME	326	335	661
PERCENT	49%	51%	100%
SH1 WAIPU AVERAGE 2019 WED 12-1 VOLUME			628
SH1 WAIPU 2022 COUNTED → 2019 AVERAGE WED 12-1 FACTOR			0.95
SH1 WAIPU COUNTED 2022 WED 12-1 → 2019 HOLIDAY PEAK HOUR FACTOR			1.76

ESTIMATED 2019 HOLIDAY PEAK HOUR TURNING MOVEMENTS



ANNUAL GROWTH RATE	3.0%
MODEL YEAR	2032
TOTAL GROWTH FACTOR 2019 TO 2032	1.39

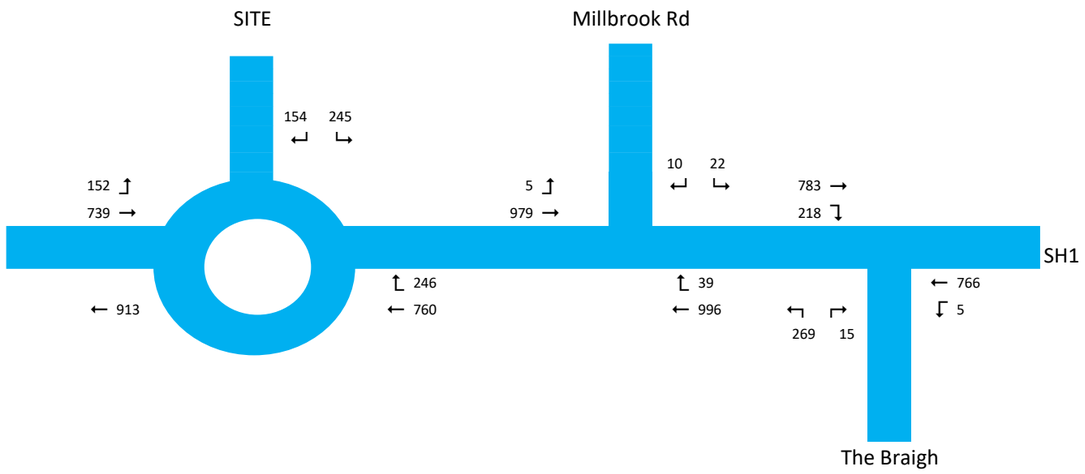
ESTIMATED 2032 HOLIDAY PEAK HOUR TURNING MOVEMENTS (EXCL DEVELOPMENT TRAFFIC)



	NBD	SBD	TOTAL
WAIPU GATEWAY EXTERNAL PEAK HOUR TRIP GEN			796
PERCENT PASS-BY TRIPS			30%
TOTAL PASS-BY VEH MOVEMENTS			240
PERCENT PASS-BY BY DIRECTION	49%	51%	
PASS-BY MOVEMENTS BY DIRECTION	118	122	
%IN	50%	50%	
PASS-BY IN MOVEMENTS BY DIRECTION	59	61	
PASS-BY OUT MOVEMENTS BY DIRECTION	59	61	
PERCENT PRIMARY TRIPS			70%
TOTAL PRIMARY VEH MOVEMENTS			556
SPLIT BETWEEN SH1 NBD, SH1 SBD AND WAIPU			33%
NUMBER OF PRIMARY MOVEMENTS PER ORIGIN			185
%IN			50%
PRIMARY IN MOVEMENTS PER ORIGIN			93
PRIMARY OUT MOVEMENTS PER ORIGIN			93

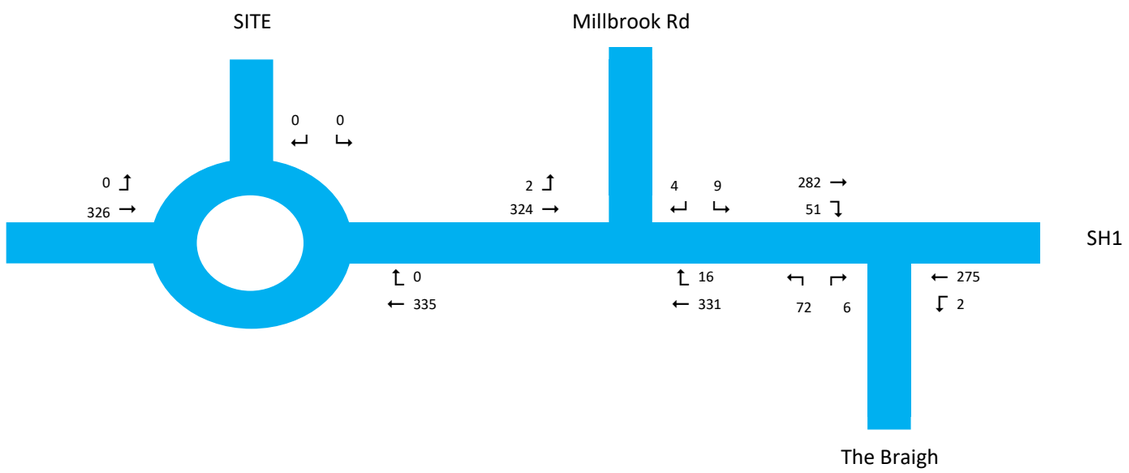
FULL SITE DEVELOPMENT 5/7/2024

ESTIMATED 2032 HOLIDAY PEAK HOUR TURNING MOVEMENTS (INCL DEVELOPMENT TRAFFIC)
FULL SITE DEVELOPMENT 5/7/2024



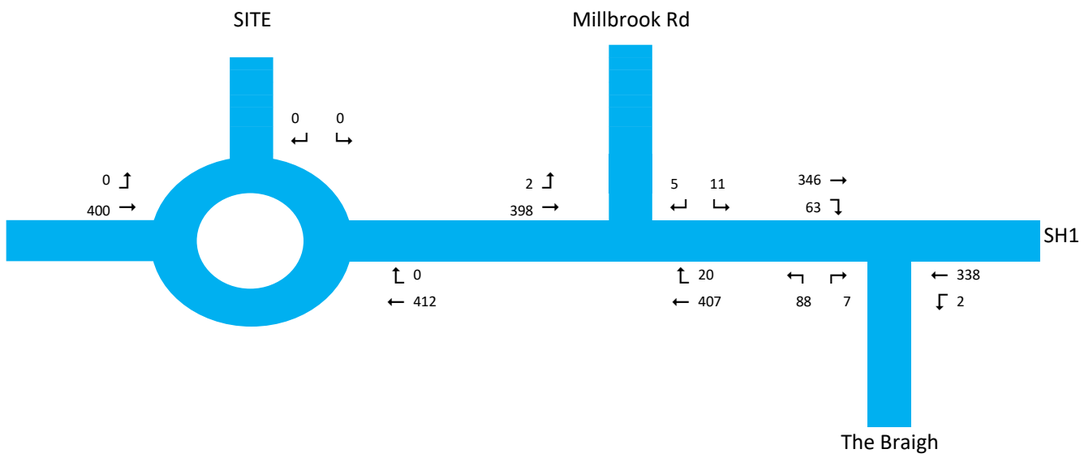
BP Waipu

COUNTED TURNING MOVEMENTS 12NOON TO 1PM, WED 9TH FEB 2022



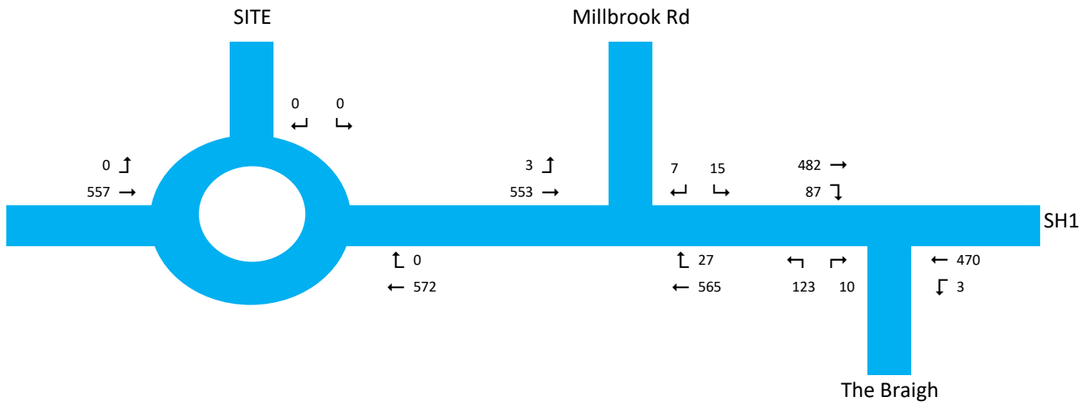
	NBD	SBD	TOTAL
SH1 TE HANA 2019 AADT			12,429
SH1 TE HANA 2019 ANNUAL DAILY AVERAGE PEAK HOUR VOLUME			987
AVERAGE PEAK HOUR % of AADT			7.9%
SH1 WAIPU 2019 AADT			10,225
ESTIMATED SH1 WAIPU 2019 ANNUAL DAILY AVG PEAK HOUR VOLUME			812
SH1 WAIPU COUNTED 2022 WED 12-1 VOLUME	326	335	661
PERCENT	49%	51%	100%
COUNTED NOON WED 2022 → 2019 ANNUAL AVG PEAK FACTOR			1.23

ESTIMATED 2019 ANNUAL AVERAGE DAILY PEAK HOUR TURNING MOVEMENTS



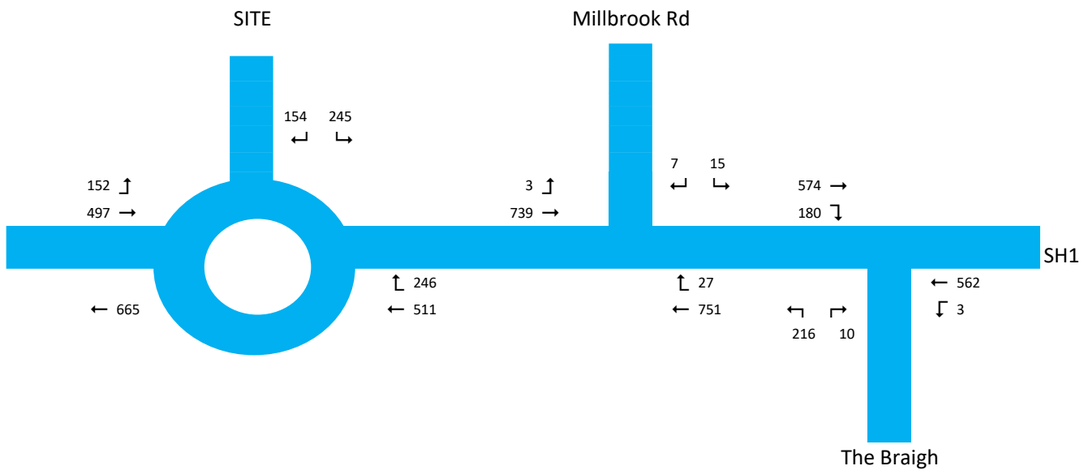
ANNUAL GROWTH RATE	3.0%
MODEL YEAR	2032
TOTAL GROWTH FACTOR 2019 TO 2032	1.39

ESTIMATED 2032 AVERAGE PEAK HOUR TURNING MOVEMENTS (EXCL DEVELOPMENT TRAFFIC)



	NBD	SBD	TOTAL	
WAIPU GATEWAY EXTERNAL PEAK HOUR TRIP GEN			796	FULL SITE DEVELOPMENT OPTION 2 - 5/7/2024
PERCENT PASS-BY TRIPS			30%	
TOTAL PASS-BY VEH MOVEMENTS			240	
PERCENT PASS-BY BY DIRECTION	49%	51%		
PASS-BY MOVEMENTS BY DIRECTION	118	122		
%IN	50%	50%		
PASS-BY IN MOVEMENTS BY DIRECTION	59	61		
PASS-BY OUT MOVEMENTS BY DIRECTION	59	61		
PERCENT PRIMARY TRIPS			70%	
TOTAL PRIMARY VEH MOVEMENTS			556	
SPLIT BETWEEN SH1 NBD, SH1 SBD AND WAIPU			33%	
NUMBER OF PRIMARY MOVEMENTS PER ORIGIN			185	
%IN			50%	
PRIMARY IN MOVEMENTS PER ORIGIN			93	
PRIMARY OUT MOVEMENTS PER ORIGIN			93	

ESTIMATED 2032 AVERAGE PEAK HOUR TURNING MOVEMENTS (INCL DEVELOPMENT TRAFFIC)
FULL SITE DEVELOPMENT OPTION 2 - 5/7/2024



APPENDIX H

SIDRA-9 model results – 2032 holiday and average peak with Service Centre

- *Service Centre roundabout*
- *Millbrook Road/The Braigh intersections*

MOVEMENT SUMMARY

Site: 101 [Service Centre roundabout - full dev holiday 2032 (Site Folder: 2032 Holiday Peak Full Dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

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
NorthEast: SH1 north															
25	T1	All MCs	800	12.9	800	12.9	0.798	9.5	LOS A	12.2	95.2	0.86	0.61	0.88	66.1
26	R2	All MCs	259	12.9	259	12.9	0.798	16.9	LOS B	12.2	95.2	0.86	0.61	0.88	48.2
Approach			1059	12.9	1059	12.9	0.798	11.3	LOS B	12.2	95.2	0.86	0.61	0.88	60.6
NorthWest: site access															
27	L2	All MCs	258	12.9	258	12.9	0.699	14.0	LOS B	8.4	65.7	1.00	1.11	1.44	41.9
29	R2	All MCs	162	12.9	162	12.9	0.699	18.5	LOS B	8.4	65.7	1.00	1.11	1.44	41.5
Approach			420	12.9	420	12.9	0.699	15.7	LOS B	8.4	65.7	1.00	1.11	1.44	41.7
SouthWest: SH1 south															
30	L2	All MCs	160	12.9	160	12.9	0.783	11.4	LOS B	12.0	93.5	0.91	0.71	1.05	48.7
31	T1	All MCs	778	12.9	778	12.9	0.783	11.8	LOS B	12.0	93.5	0.91	0.71	1.05	66.9
Approach			938	12.9	938	12.9	0.783	11.7	LOS B	12.0	93.5	0.91	0.71	1.05	62.9
All Vehicles			2417	12.9	2417	12.9	0.798	12.2	LOS B	12.2	95.2	0.90	0.74	1.04	57.0

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.

MOVEMENT SUMMARY

Site: 101 [SH1/Millbrook Road - full dev holiday 2032 (Site Folder: 2032 Holiday Peak Full Dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

New Site
Site Category: (None)
Stop (Two-Way)

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
NorthEast: SH1 North															
25	T1	All MCs	1048	12.9	1048	12.9	0.583	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	99.4
26	R2	All MCs	41	12.9	41	12.9	0.149	21.0	LOS C	0.4	3.5	0.84	0.95	0.84	55.3
Approach			1089	12.9	1089	12.9	0.583	0.9	NA	0.4	3.5	0.03	0.04	0.03	96.5
NorthWest: Millbrook Road															
27	L2	All MCs	23	12.9	23	12.9	1.498	566.8	LOS F	10.2	79.4	1.00	1.32	2.99	5.2
29	R2	All MCs	11	12.9	11	12.9	1.498	868.8	LOS F	10.2	79.4	1.00	1.32	2.99	5.2
Approach			34	12.9	34	12.9	1.498	661.2	LOS F	10.2	79.4	1.00	1.32	2.99	5.2
SouthWest: SH1 south															
30	L2	All MCs	5	12.9	5	12.9	0.576	8.3	LOS A	0.0	0.0	0.00	0.00	0.00	80.8
31	T1	All MCs	1031	12.9	1031	12.9	0.576	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	99.3
Approach			1036	12.9	1036	12.9	0.576	0.1	NA	0.0	0.0	0.00	0.00	0.00	99.2
All Vehicles			2159	12.9	2159	12.9	1.498	10.8	NA	10.2	79.4	0.03	0.04	0.06	76.4

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control 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 [SH1/The Braigh - full dev holiday 2032 (Site Folder: 2032 Holiday Peak Full Dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

New Site
Site Category: (None)
Stop (Two-Way)

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
SouthEast: The Braigh															
21	L2	All MCs	312	12.9	312	12.9	1.849	786.9	LOS F	96.9	753.5	1.00	7.49	20.76	4.2
23	R2	All MCs	16	12.9	16	12.9	1.849	931.8	LOS F	96.9	753.5	1.00	7.49	20.76	4.2
Approach			327	12.9	327	12.9	1.849	793.9	LOS F	96.9	753.5	1.00	7.49	20.76	4.2
NorthEast: SH1 north															
24	L2	All MCs	5	12.9	5	12.9	0.451	8.2	LOS A	0.0	0.0	0.00	0.00	0.00	80.6
25	T1	All MCs	806	12.9	806	12.9	0.451	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	98.9
Approach			812	12.9	812	12.9	0.451	0.1	NA	0.0	0.0	0.00	0.00	0.00	98.7
SouthWest: SH1 south															
31	T1	All MCs	824	12.9	824	12.9	0.458	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	99.6
32	R2	All MCs	229	12.9	229	12.9	0.451	14.4	LOS B	2.2	17.1	0.79	1.03	1.15	40.6
Approach			1054	12.9	1054	12.9	0.458	3.2	NA	2.2	17.1	0.17	0.23	0.25	75.7
All Vehicles			2193	12.9	2193	12.9	1.849	120.1	NA	96.9	753.5	0.23	1.23	3.22	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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control 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 [Service Centre roundabout - full dev average 2032 (Site Folder: 2032 Average Peak full dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

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
NorthEast: SH1 north															
25	T1	All MCs	538	12.9	538	12.9	0.599	8.4	LOS A	6.0	46.7	0.61	0.58	0.61	67.5
26	R2	All MCs	259	12.9	259	12.9	0.599	15.8	LOS B	6.0	46.7	0.61	0.58	0.61	49.0
Approach			797	12.9	797	12.9	0.599	10.8	LOS B	6.0	46.7	0.61	0.58	0.61	60.1
NorthWest: site access															
27	L2	All MCs	258	12.9	258	12.9	0.473	4.3	LOS A	3.8	29.3	0.81	0.67	0.85	47.0
29	R2	All MCs	162	12.9	162	12.9	0.473	8.8	LOS A	3.8	29.3	0.81	0.67	0.85	46.4
Approach			420	12.9	420	12.9	0.473	6.0	LOS A	3.8	29.3	0.81	0.67	0.85	46.8
SouthWest: SH1 south															
30	L2	All MCs	160	12.9	160	12.9	0.564	8.7	LOS A	4.9	38.0	0.67	0.60	0.67	49.7
31	T1	All MCs	523	12.9	523	12.9	0.564	9.0	LOS A	4.9	38.0	0.67	0.60	0.67	68.9
Approach			683	12.9	683	12.9	0.564	8.9	LOS A	4.9	38.0	0.67	0.60	0.67	63.2
All Vehicles			1900	12.9	1900	12.9	0.599	9.1	LOS A	6.0	46.7	0.68	0.60	0.68	57.5

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 [SH1/Millbrook Road - full dev average 2032 (Site Folder: 2032 Average Peak full dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

New Site
Site Category: (None)
Stop (Two-Way)

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
NorthEast: SH1 North															
25	T1	All MCs	791	12.9	791	12.9	0.439	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	99.7
26	R2	All MCs	28	12.9	28	12.9	0.052	13.6	LOS B	0.2	1.4	0.67	0.87	0.67	62.4
Approach			819	12.9	819	12.9	0.439	0.5	NA	0.2	1.4	0.02	0.03	0.02	97.7
NorthWest: Millbrook Road															
27	L2	All MCs	16	12.9	16	12.9	0.321	22.3	LOS C	0.7	5.4	0.93	1.02	1.04	39.4
29	R2	All MCs	7	12.9	7	12.9	0.321	110.7	LOS F	0.7	5.4	0.93	1.02	1.04	39.3
Approach			23	12.9	23	12.9	0.321	50.5	LOS F	0.7	5.4	0.93	1.02	1.04	39.3
SouthWest: SH1 south															
30	L2	All MCs	3	12.9	3	12.9	0.434	8.2	LOS A	0.0	0.0	0.00	0.00	0.00	80.9
31	T1	All MCs	778	12.9	778	12.9	0.434	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	99.6
Approach			781	12.9	781	12.9	0.434	0.1	NA	0.0	0.0	0.00	0.00	0.00	99.5
All Vehicles			1623	12.9	1623	12.9	0.439	1.0	NA	0.7	5.4	0.02	0.03	0.03	96.5

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control 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 [SH1/The Braigh - full dev average 2032 (Site Folder: 2032 Average Peak full dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

New Site
Site Category: (None)
Stop (Two-Way)

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
SouthEast: The Braigh															
21	L2	All MCs	227	12.9	227	12.9	0.561	17.0	LOS C	2.9	22.9	0.78	1.21	1.33	39.2
23	R2	All MCs	11	12.9	11	12.9	0.561	87.6	LOS F	2.9	22.9	0.78	1.21	1.33	39.0
Approach			238	12.9	238	12.9	0.561	20.2	LOS C	2.9	22.9	0.78	1.21	1.33	39.2
NorthEast: SH1 north															
24	L2	All MCs	3	12.9	3	12.9	0.331	8.2	LOS A	0.0	0.0	0.00	0.00	0.00	80.7
25	T1	All MCs	592	12.9	592	12.9	0.331	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.2
Approach			595	12.9	595	12.9	0.331	0.1	NA	0.0	0.0	0.00	0.00	0.00	99.0
SouthWest: SH1 south															
31	T1	All MCs	604	12.9	604	12.9	0.336	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.8
32	R2	All MCs	189	12.9	189	12.9	0.241	8.7	LOS A	1.0	8.0	0.62	0.81	0.64	43.4
Approach			794	12.9	794	12.9	0.336	2.1	NA	1.0	8.0	0.15	0.19	0.15	76.1
All Vehicles			1626	12.9	1626	12.9	0.561	4.0	NA	2.9	22.9	0.19	0.27	0.27	72.2

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.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control 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.