WAKA KOTAHI
NZ TRANSPORT AGENCY

RESOURCE MANAGEMENT ACT 1991

Further Submission on Plan Change 30 – Rezoning Residential 6, Residential 6a and Business 2 Zones to Business 1 and Business 2 Zones within Ravenswood at North Woodend and provide for a Key Activity Centre (KAC)

By Ravenswood Developments Limited

To: Waimakariri District Council
Private Bag 1005
Rangiora 7440

Pursuant to Clause 8 of the First Schedule of the Resource Management Act 1991 (RMA), **Waka Kotahi NZ Transport Agency** (Waka Kotahi) hereby makes this further submission on Plan Change 30 to the Waimakariri District Plan. Waka Kotahi NZ Transport Agency has an interest in the proposed plan change greater than that of the general public and has a legal obligation to contribute to an effective, efficient and safe land transport in the interest of the general public.

Following the original submission period, Waka Kotahi has been working with the applicant to better understand the potential effects the proposed rezoning will have on the state highway and the wider transport network. During the submission phase Waka Kotahi raised the following concerns:

- Reliance on the proposed Woodend Bypass to demonstrate that the potential effects on the state highway were acceptable;
- The traffic generation rates used to determine the effects on the state highway;
- Pedestrian and cyclist safety and facilities; and
- Timing of the development – so that Waka Kotahi is confident the state highway network can accommodate the increase in development.

The applicant has provided the following information which Waka Kotahi have reviewed and is provided in Appendix A:

- *Memo (File 310204044),* Stantec. Dated: 15/02/2021

The applicant has undertaken additional analysis at the request of Waka Kotahi (Appendix A) to show the potential effects on the state highway in the future, without the Woodend Bypass in place. There is no certainty regarding the possible timing of the bypass, given that there is no detailed design and no funding has been allocated for the project. The technical note provided by the applicant has tested the potential traffic effects in the short (2028) and medium-long term (2028-2038) without the Woodend Bypass in place and with a reduced capacity layout at the roundabout (which is a concept plan provided by Waka Kotahi and which reflects possible changes to the roundabout). The additional analysis has shown that the modified roundabout layout will operate efficiently with a good level of service. Waka Kotahi is satisfied with the additional analysis that has been completed (Appendix A). The applicant has now carried out AM and PM peak analysis for the short and medium-long term development scenarios to show the future traffic forecasts. Following receipt of the additional assessment undertaken by Stantec on behalf of the applicant, Waka Kotahi is confident that the potential effects on the state highway will be adequately managed.

The applicant has confirmed (and detailed in their original ITA) that crossings for pedestrians and cyclists will be provided at the roundabout. The applicant has also stated that additional midblock pedestrian crossing points may be considered in the future. Several other submitters have raised safety concerns for pedestrians crossing the state highway. Waka Kotahi agrees that the potential safety effects on active transport users should be adequately considered so that the development is well connected to the surrounding area for active transport users.

Waka Kotahi NZ Transport Agency's further submission points are included in Table 1 below.

Waka Kotahi NZ Transport Agency does not wish to be heard in support of this submission.

Dated at Christchurch this 22nd day of February 2021.

Richard Shaw
TEAM LEADER – CONSENTS AND APPROVALS

Pursuant to authority delegated
by Waka Kotahi NZ Transport Agency

Address for Service:
Waka Kotahi NZ Transport Agency
PO Box 1479
CHRISTCHURCH 8011

Attention: Gemma Kean
Phone: [redacted]
Email: [redacted]

TABLE 1: FURTHER SUBMISSION BY WAKA KOTAHI NZ TRANSPORT AGENCY

Submission Reference	Submitter	Summary of submission/relief sought by the submitter	Support or oppose the submission	Reasons for support or opposition	Decision sought
1	CP Holdings 2018 Limited	The submitter seeks to extend the Business 1 and Business 2 zoning to include all the land fronting Bob Robertson Drive. The submitter states that access directly from the state highway could be obtained.	Oppose	The land identified by the submitter is designated for the future Woodend Bypass (D058A), therefore, Waka Kotahi request that this land is not included in the proposed plan change. Furthermore, State Highway 1 at this location is a Limited Access Road and Waka Kotahi would not support new access directly to the State Highway.	That no additional land is included in the proposed plan change.
30	Waimakariri District Council	The submitter supports the establishment of a Key Activity Centre (KAC) at this location, however, an assessment of the size of the proposed KAC is requested. The submitter requests that the Outline Development Plan (ODP) be amended to include an accessible and integrated transport interchange.	Support	Waka Kotahi agree that an integrated transport interchange at this location would improve the confidence of the KAC being more inclusive and accessible. The inclusion of an integrated transport interchange at this location, in conjunction with a well connected cycling and walking network with bike shed facilities would ensure this KAC strongly aligns with the *Regional Mode Shift Plan – Greater Christchurch* and *Keeping Cities Moving* the national mode shift plan. Waka Kotahi agree with the submitter and consider that the developer should encourage residents of Pegasus and Woodend to use active and public transport modes to access the KAC.	N/A
32	Canterbury Regional Council	The submitter supports the proposed plan change in part and notes that the location of the KAC is consistent with the CRPS, however, the scale is inconsistent and the effects on Rangiora and Kaiapoi commercial centres should be properly considered. The submitter acknowledges that the proposed	Support	Waka Kotahi supports the proposed KAC at this location and acknowledges that good transport outcomes should be provided for through the proposed plan change process.	N/A

		KAC has been identified in the Waimakariri Development Strategy to ensure good transport outcomes.			
47	Donald Smith	The submitter supports the proposed plan change, however, requests that changes to the Pegasus roundabout to improve safety are made and suggests reducing the speed or signalising the intersection.	Oppose	The ITA prepared by the applicant mentions the need for additional midblock pedestrian crossing points at the roundabout. Waka Kotahi considers that these are appropriate to improve safety for pedestrians and cyclists crossing the roundabout in its current arrangement and the developer be required to provide for these crossing points. Waka Kotahi have recently undertaken a speed review for the section of State Highway 1 at Pegasus roundabout and the 70 km/hr speed limit has been retained.	That midblock pedestrian crossing points are included at the roundabout as per the applicant's ITA to provide a safe route for pedestrians and cyclists.
53	Rhonda Mather	The submitter supports the proposed plan change and suggests that Waimakariri District Council take the opportunity for the developer to contribute to road safety improvements on State Highway 1 – particularly the Pegasus roundabout and the safety of pedestrians and cyclists.	Neutral	The ITA prepared by the applicant mentions the need for additional midblock pedestrian crossing points at the roundabout. Waka Kotahi considers that these are appropriate to improve safety for pedestrians and cyclists crossing the roundabout in its current arrangement. Waka Kotahi have also investigated the feasibility of providing additional safety interventions at the Woodend township to enhance the experience of pedestrian and cyclists crossing the state highway. The signalled pedestrian crossing outside Woodend Primary School has recently been installed and is operational. Further enhancement of the network will be provided in due course.	That midblock pedestrian crossing points are included at the roundabout as per the applicant's ITA to provide a safe route for pedestrians and cyclists.
56	Pegasus Residents Group Incorporated	The submitter supports the proposed plan change but is concerned on the potential effects on safety of State Highway 1 traffic.	Neutral	The ITA prepared by the applicant mentions the need for additional midblock pedestrian crossing points at the roundabout. Waka Kotahi considers that these are appropriate to improve safety for pedestrians and cyclists crossing the roundabout in its current	That midblock pedestrian crossing points are included at the roundabout as per the

				arrangement and the developer be required to provide for these crossing points.	applicant's ITA to provide a safe route for pedestrians and cyclists.
57	Andrew Huntly	The submitter suggests that the plan change should only proceed if the Woodend Bypass project is completed.	Oppose	The timing for the future Woodend Bypass is unknown at this stage as stated in the original submission made by Waka Kotahi. The future Woodend Bypass does not have sufficient priority to attract funding for the next 10 years. Waka Kotahi will continue to work with Waimakariri District Council and the community to manage State Highway 1 safely and efficiently without the bypass in place. Waka Kotahi has been working with the applicant to demonstrate that the potential effects on State Highway 1 without the bypass in place are acceptable with the proposed plan change increase in Business zoning. Further comments on the additional information and modelling provided by the applicant are provided above and attached in the appendices.	That the plan change be considered without the proposed Woodend Bypass in place.
61	Debbie Bell	The submitter stated that the existing roading infrastructure is inadequate and has requested that the plan change be declined. The submitter has also identified the reliance on the Woodend Bypass by the applicant and has safety concerns in terms of pedestrians and cyclists on the surrounding roads.	Neutral	Waka Kotahi consider that the applicant has provided sufficient information to demonstrate that the potential effects on the transport network are acceptable without the Woodend Bypass in place.	N/A
64	Matt Newby	The submitter has questioned the reliability of the traffic modelling and the data from 2018 being used. The submitter has also identified that the modelling provided by the	Neutral	The developer has provided sufficient information to address the reliability of the traffic modelling and data used – see Appendix A and has assessed the effects on the state highway network (without the bypass in place).	N/A

		applicant assumes that the Woodend Bypass will be in place to suitably manage traffic. The submitter seeks safety improvements and for traffic from the development to be adequately managed (particularly onto Main North Road (State Highway 1) so that an efficient state highway network is maintained.		The information provided shows that the state highway will continue to operate at an acceptable level.	
67	Anna McHugh	The submitter requests a safe or controlled pedestrian crossing across State Highway 1.	Neutral	The ITA prepared by the applicant mentions the need for additional midblock pedestrian crossing points at the roundabout. Waka Kotahi considers that these are appropriate to improve safety for pedestrians and cyclists crossing the roundabout in its current arrangement and the developer be required to provide for these crossing points.	That midblock pedestrian crossing points are included at the roundabout as per the applicant's ITA to provide a safe route for pedestrians and cyclists.
68	Linda Crawford	The submitter requests a safe or controlled pedestrian crossing across State Highway 1.	Neutral	The ITA prepared by the applicant mentions the need for additional midblock pedestrian crossing points at the roundabout. Waka Kotahi considers that these are appropriate to improve safety for pedestrians and cyclists crossing the roundabout in its current arrangement and the developer be required to provide for these crossing points.	That midblock pedestrian crossing points are included at the roundabout as per the applicant's ITA to provide a safe route for pedestrians and cyclists.
69	Vera Setz Deuchars	The submitter requests a safe or controlled pedestrian crossing across State Highway 1 and requests	Oppose	The ITA prepared by the applicant mentions the need for additional midblock pedestrian crossing points at the roundabout. Waka Kotahi considers that these are	That midblock pedestrian crossing points

		that the speed limit be reduced from 70 km/hr to 30 km/hr at the Pegasus roundabout.		appropriate to improve safety for pedestrians and cyclists crossing the roundabout in its current arrangement and the developer be required to provide for these crossing points. Waka Kotahi have recently undertaken a speed review for the section of State Highway 1 at Pegasus roundabout and the 70 km/hr speed limit has been retained.	are included at the roundabout as per the applicant's ITA to provide a safe route for pedestrians and cyclists.
70	Kylie Schaare	The submitter requests a safe or controlled pedestrian crossing (under or overpass) over State Highway 1 and proposes that Waimakariri District Council and Waka Kotahi provide a safe crossing. The submitter requests a Traffic Management Plan (TMP) to manage pedestrian and cyclist movements to and from the area subject to the plan change.	Neutral	The ITA prepared by the applicant mentions the need for additional midblock pedestrian crossing points at the roundabout. Waka Kotahi considers that these are appropriate to improve safety for pedestrians and cyclists crossing the roundabout in its current arrangement and the developer be required to provide for these crossing points. A TMP is not the appropriate measure to manage potential traffic effects from the proposed plan change	That midblock pedestrian crossing points are included at the roundabout as per the applicant's ITA to provide a safe route for pedestrians and cyclists.
71	Christine Johnson	The submitter requests a safe or controlled pedestrian crossing across State Highway 1.	Support	The ITA prepared by the applicant mentions the need for additional midblock pedestrian crossing points at the roundabout. Waka Kotahi considers that these are appropriate to improve safety for pedestrians and cyclists crossing the roundabout in its current arrangement.	That midblock pedestrian crossing points are included at the roundabout as per the applicant's ITA to provide a safe route for pedestrians and cyclists.
72	Alissa Kuch	The submitter requests a safe or controlled pedestrian crossing across State Highway 1.	Support	The ITA prepared by the applicant mentions the need for additional midblock pedestrian crossing points at the roundabout. Waka Kotahi considers that these are appropriate to improve safety for pedestrians and	That midblock pedestrian crossing points are included at

				cyclists crossing the roundabout in its current arrangement.	the roundabout as per the applicant's ITA to provide a safe route for pedestrians and cyclists.

Stantec

Memo

To:	Jerome O'Sullivan	From:	Andrew Leckie & Andrew Metherell
	Infinity Investment Group Holdings		Stantec Christchurch
File:	310204044	Date:	February 15, 2021

At our recent meeting with Waka Kotahi NZ Transport Agency (Waka Kotahi) to discuss their submission on Proposed Plan Change 30 (Plan Change), we were requested by Waka Kotahi to provide further assessment of the potential effects of traffic that could be generated by the proposed Ravenswood Plan Change if no Woodend Bypass is provided.

Whilst transport planning of new development and the transport network to date has envisaged the construction of the designated Woodend Bypass, Waka Kotahi advised they can provide no certainty that the Woodend Bypass would be constructed within the timeframe aligned to the Plan Change (i.e. within the next ten years). In that respect the following further information was requested:

- Short term 2028 assessment for weekday AM and PM peaks, without bypass, and allowing for extent of development assumptions;
- Medium-long term sensitivity assessment for weekday AM and PM peaks, without bypass, and allowing for extent of development assumptions;

It was requested that the further analysis test the future performance of a potential revised layout for the SH1 / Bob Robertson Drive / Pegasus Boulevard roundabout that Waka Kotahi is investigating for improved pedestrian and cyclist safety.

1. Future Traffic Forecasts

2018 and 2028, AM and PM peak traffic forecasts for the SH1 / Pegasus roundabout have been provided by Waka Kotahi, which we understand are mostly aligned with the current version of the CAST model and are forming the basis of their local area investigations. For this assessment, adjustments have been made to increase the left turn from Pegasus in both periods, and slightly decrease the through movement from the south in the PM peak to reflect CAST volumes previously assessed. The 2018 and 2028 traffic forecasts adopted for this assessment are summarised in Table 1.

The Ravenswood leg of the roundabout was not included in the 2018 traffic model. The table includes the increases in forecast volumes from 2018 to 2028 where applicable.

Table 1: Peak Period Traffic Forecasts without Bypass

Period	Approach	Movement	2018 No Bypass	2028 No Bypass	Increase 2018-2028
AM	SH1 South	Left	-	27	27
		Through	378	424	46
		Right	192	130	-62
		Approach	*570*	*581*	*11*
	Pegasus	Left	287	277	-10
		Through	-	121	121
		Right	21	32	11
		Approach	*308*	*430*	*122*
	SH1 North	Left	35	55	20
		Through	421	489	68
		Right	-	17	17
		Approach	*456*	*561*	*105*
	Ravenswood	Left	-	18	18
		Through	-	101	101
		Right	-	74	74
		Approach	*0*	*193*	*193*
	Intersection Total		1,334	1,765	431

Period	Approach	Movement	2018	2028	Increase 2018-2028
PM	SH1 South	Left	-	98	98
		Through	650	732	82
		Right	331	221	-110
		Approach	*981*	*1,051*	*70*
	Pegasus	Left	248	147	-101
		Through	-	162	162
		Right	26	42	16
		Approach	*274*	*351*	*77*
	SH1 North	Left	22	34	12
		Through	*460*	504	44
		Right	-	27	27
		Approach	*482*	*565*	*83*
	Ravenswood	Left	-	27	27
		Through	-	119	119
		Right	-	45	45
		Approach	-	*191*	*191*
	Intersection Total		1,737	2,158	421

It can be seen that from 2018 to 2028 there is a redistribution of traffic between Pegasus and the south as the Ravenswood road network is utilised as a more direct link for travel to and from Rangiora. The addition of Ravenswood also enables some trips that would have been to and from the south to now be between Ravenswood and Pegasus (e.g. shopping and work trips).

The change in volume at the intersection associated with through movements on SH1 contributes approximately 114vph of the 431vph increase in the AM peak, and 126vph of the 421vph increase in the PM peak.

In order to test a medium-long term scenario, SH1 through volumes (indicative of a further 10 years' growth) have been estimated by applying the same increase forecast between 2018 and 2028, to the 2028 volumes. A nominal 25% increase in 2028 traffic volumes turning to and from Pegasus is allowed for (assuming Pegasus is approximately 80% developed at 2028, and becomes fully developed in the medium-long term). A 50% increase in volumes from Ravenswood is allowed for (generally assuming Ravenswood residential and commercial activity as zoned is 66% developed at 2028, and would be fully developed in the medium-long term as currently zoned).

Table 2: Peak Hour Traffic Forecasts without Plan Change, without Bypass

Period	Approach	Movement	2028 No Bypass	Medium-Long Term No Bypass (~2038)	Increase
AM	SH1 South	Left	27	41	14
		Through	424	470	46
		Right	130	163	33
		Approach	*581*	*673*	*92*
	Pegasus	Left	277	346	69
		Through	121	182	61
		Right	32	40	8
		Approach	*430*	*568*	*138*
	SH1 North	Left	55	69	14
		Through	489	557	68
		Right	17	26	9
		Approach	*561*	*651*	*90*
	Ravenswood	Left	18	27	9
		Through	101	152	51
		Right	74	111	37
		Approach	*193*	*290*	*97*
	Intersection Total		1,765	2,182	417
PM	SH1 South	Left	98	147	49
		Through	732	814	82
		Right	221	276	55
		Approach	*1,051*	*1,237*	*186*
	Pegasus	Left	147	184	37
		Through	162	243	81
		Right	42	53	11
		Approach	*351*	*479*	*128*
	SH1 North	Left	34	43	9
		Through	504	548	44
		Right	27	41	14
		Approach	*565*	*631*	*66*
	Ravenswood	Left	27	41	14
		Through	119	179	60
		Right	45	68	23
		Approach	*191*	*287*	*96*
	Intersection Total		2,158	2,634	476

2. Ravenswood Plan Change Traffic Generation

The 27 August 2020 memo outlined the Plan Change traffic generation calculations which were based on expected Business zone floor area increases and allowed for internal movements within Ravenswood and pass-by traffic. The following figure is a modified version of that presented in our memo dated 27 August 2020. It outlines the weekday PM peak forecast external traffic generation increases resulting from the Plan Change when fully developed, without the Woodend Bypass. For simplicity, the previously forecast Woodend (Garlick Street) and Woodend Bypass external traffic movements have been combined on SH1 South.

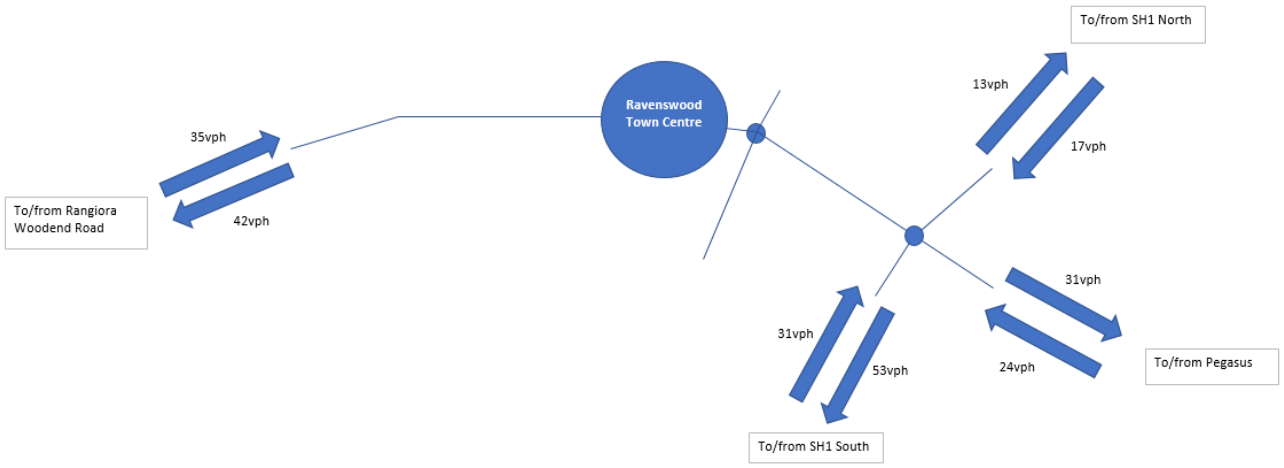

Figure 1: Weekday Evening Peak External Traffic Volume Increases Forecast Resulting from Proposed Plan Change, without Woodend Bypass (Modified Version of Figure Presented in 27 August 2020 Memo)

For simplicity in assessing morning peak periods, the external traffic generation outlined above has been flipped by direction and factored by 50%, as indicated in Figure 2. This is because the traffic generation of the town centre would be expected to be much lower during the morning peak period than during the evening peak period, particularly for the town centre retail component which may be at approximately 30-40% of the PM peak traffic generation. The morning peak directionality of non-retail commercial trip generation is generally the reverse of that in the evening peak.

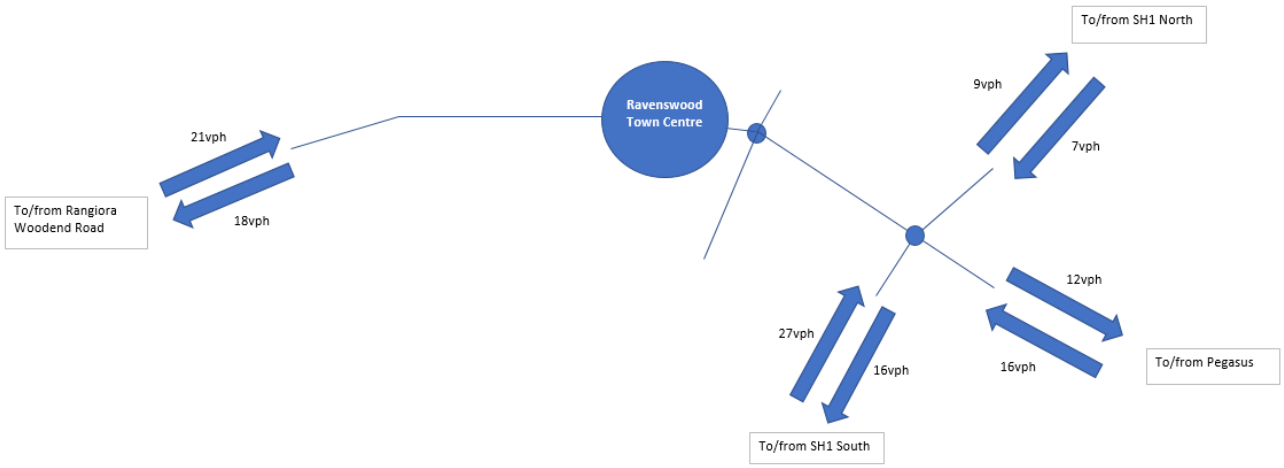

Figure 2: Weekday Morning Peak External Traffic Volume Increases Forecast Resulting from Fully Developed Proposed Plan Change, without Bypass

The following table combines the future traffic forecasts (without the Plan Change) presented earlier with these forecast traffic volume increases resulting from the Plan Change.

Table 3: Peak Hour Traffic Forecasts with Plan Change, No Bypass

Period	Approach	Movement	2028 with Plan Change, no Bypass	Medium-Long Term (~2038) with Plan Change, no Bypass
AM	SH1 South	Left	54	67
		Through	424	470
		Right	130	163
		Approach	*608*	*700*
	Pegasus	Left	277	346
		Through	137	197
		Right	32	40
		Approach	*446*	*583*
	SH1 North	Left	55	69
		Through	489	557
		Right	24	32
		Approach	*568*	*658*
	Ravenswood	Left	27	36
		Through	113	164
		Right	90	127
		Approach	*229*	*326*
	Intersection Total		1,850	2,266
PM	SH1 South	Left	129	178
		Through	732	814
		Right	221	276
		Approach	*1,082*	*1268*
	Pegasus	Left	147	184
		Through	186	267
		Right	42	53
		Approach	*375*	*503*
	SH1 North	Left	34	43
		Through	504	548
		Right	44	58
		Approach	*582*	*648*
	Ravenswood	Left	40	54
		Through	150	210
		Right	98	121
		Approach	*288*	*384*
	Intersection Total		2,327	2,803

3. SH1 Roundabout Traffic Analysis without Woodend Bypass

The performance of the SH1 roundabout has been analysed for morning and evening peak periods in 2028 and the medium-long term (~2038) without the Woodend Bypass, without and with the additional traffic outlined above.

Extracts from SIDRA Intersection 8 are presented below for the four assessment periods without and with the extra traffic that could be generated by the proposed Plan Change.

As a worst case from a capacity perspective, the roundabout used in the analysis includes the lane layout alterations that Waka Kotahi is planning at the SH1 / Pegasus Boulevard / Bob Robertson Drive intersection. The existing layout and the indicative concept layout being investigated by Waka Kotahi are shown below. The roundabout amendments by Waka Kotahi will reduce capacity with single approach lanes on the minor legs and single through lanes on the highway.

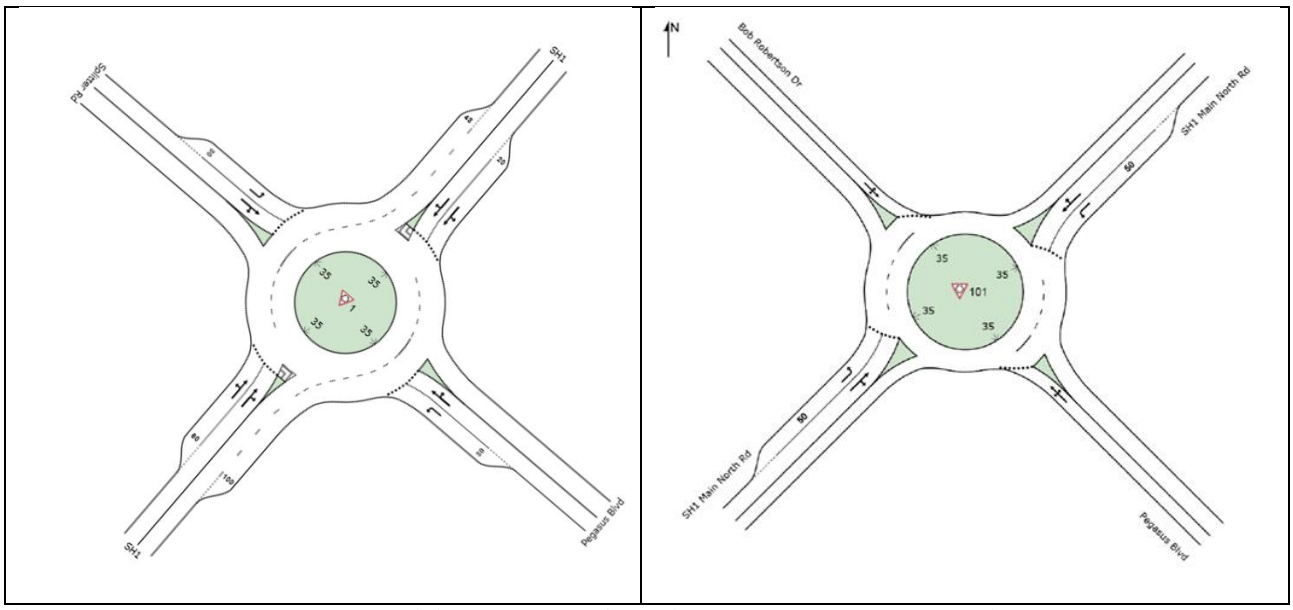

Figure 3: SH1 Roundabout Modelled (Existing Layout on Left, Possible NZTA Concept Layout on Right)

3.1 2028 AM Peak with No Bypass and Modified Roundabout

During the 2028 AM peak period, the modified SH1 roundabout is forecast to operate efficiently with low delays consistent with levels of service A and B on all movements. The extra traffic that could be generated by the Plan Change would have a minimal impact on the performance of the intersection.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
1	L2	28	2.5	0.024	6.0	LOS A	0.1	0.7	0.30	0.52	0.30	59.6
2	T1	446	4.3	0.354	6.2	LOS A	2.2	16.3	0.36	0.55	0.36	66.2
3	R2	137	2.5	0.354	12.6	LOS B	2.2	16.3	0.36	0.55	0.36	55.9
Approach		612	3.8	0.354	7.6	LOS A	2.2	16.3	0.36	0.54	0.36	64.3
East: Pegasus Blvd												
4	L2	292	1.7	0.484	5.1	LOS A	3.1	22.3	0.68	0.76	0.75	58.2
5	T1	127	0.0	0.484	4.8	LOS A	3.1	22.3	0.68	0.76	0.75	17.8
6	R2	34	2.2	0.484	10.3	LOS B	3.1	22.3	0.68	0.76	0.75	61.1
Approach		453	1.3	0.484	5.4	LOS A	3.1	22.3	0.68	0.76	0.75	49.2
North: SH1												
7	L2	58	0.0	0.050	6.4	LOS A	0.2	1.5	0.38	0.57	0.38	58.9
8	T1	515	11.7	0.356	6.8	LOS A	2.1	16.2	0.46	0.54	0.46	64.6
9	R2	18	2.5	0.356	13.0	LOS B	2.1	16.2	0.46	0.54	0.46	41.1
Approach		591	10.3	0.356	7.0	LOS A	2.1	16.2	0.45	0.54	0.45	63.6
West: Ravenswood												
10	L2	19	2.5	0.209	3.9	LOS A	1.0	7.2	0.55	0.62	0.55	56.6
11	T1	106	2.5	0.209	3.5	LOS A	1.0	7.2	0.55	0.62	0.55	19.4
12	R2	78	2.5	0.209	9.1	LOS A	1.0	7.2	0.55	0.62	0.55	59.4
Approach		203	2.5	0.209	5.7	LOS A	1.0	7.2	0.55	0.62	0.55	40.5
All Vehicles		1858	5.1	0.484	6.7	LOS A	3.1	22.3	0.49	0.60	0.50	59.5

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
1	L2	57	2.5	0.048	6.1	LOS A	0.2	1.5	0.33	0.54	0.33	59.3
2	T1	446	4.3	0.359	6.2	LOS A	2.3	16.7	0.39	0.55	0.39	66.0
3	R2	137	2.5	0.359	12.6	LOS B	2.3	16.7	0.39	0.55	0.39	55.7
Approach		640	3.8	0.359	7.6	LOS A	2.3	16.7	0.38	0.55	0.38	64.0
East: Pegasus Blvd												
4	L2	292	1.7	0.513	5.6	LOS A	3.6	25.3	0.72	0.81	0.81	57.6
5	T1	144	0.0	0.513	5.3	LOS A	3.6	25.3	0.72	0.81	0.81	17.5
6	R2	34	2.2	0.513	10.8	LOS B	3.6	25.3	0.72	0.81	0.81	60.4
Approach		469	1.2	0.513	5.9	LOS A	3.6	25.3	0.72	0.81	0.81	47.7
North: SH1												
7	L2	58	0.0	0.051	6.5	LOS A	0.2	1.6	0.40	0.58	0.40	58.7
8	T1	515	11.7	0.367	6.9	LOS A	2.2	17.2	0.49	0.55	0.49	64.3
9	R2	25	2.5	0.367	13.1	LOS B	2.2	17.2	0.49	0.55	0.49	40.9
Approach		598	10.2	0.367	7.2	LOS A	2.2	17.2	0.48	0.56	0.48	63.0
West: Ravenswood												
10	L2	28	2.5	0.250	3.9	LOS A	1.2	8.9	0.57	0.64	0.57	56.5
11	T1	119	2.5	0.250	3.6	LOS A	1.2	8.9	0.57	0.64	0.57	19.3
12	R2	95	2.5	0.250	9.1	LOS A	1.2	8.9	0.57	0.64	0.57	59.2
Approach		242	2.5	0.250	5.8	LOS A	1.2	8.9	0.57	0.64	0.57	41.5
All Vehicles		1949	5.0	0.513	6.8	LOS A	3.6	25.3	0.52	0.62	0.54	58.8

Figure 4: 2028 AM SH1 Roundabout Performance, Without Plan Change (Top) and With Plan Change

3.2 2028 PM Peak with No Bypass and Modified Roundabout

The through volumes on SH1 are higher during the evening peak period and there are accordingly some slightly higher delays noticeable on the Ravenswood approach to the modified roundabout in particular. With the extra traffic that could be generated by the Plan Change, the delays on the Ravenswood approach increase by about four seconds and 95% queue lengths increase by about two vehicles. The performance of this approach remains acceptable while the performances of the other approaches remain at a good level of service and barely change with the extra traffic added.

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
1	L2	103	2.5	0.089	6.2	LOS A	0.4	2.9	0.36	0.56	0.36	59.0
2	T1	771	4.3	0.631	6.7	LOS A	5.5	39.5	0.56	0.58	0.56	64.9
3	R2	233	2.5	0.631	13.1	LOS B	5.5	39.5	0.56	0.58	0.56	54.3
Approach		1106	3.8	0.631	8.0	LOS A	5.5	39.5	0.54	0.58	0.54	62.9
East: Pegasus Blvd												
4	L2	155	1.7	0.404	4.4	LOS A	2.3	16.4	0.66	0.66	0.66	58.4
5	T1	171	0.0	0.404	4.1	LOS A	2.3	16.4	0.66	0.66	0.66	18.5
6	R2	44	2.2	0.404	9.6	LOS A	2.3	16.4	0.66	0.66	0.66	61.3
Approach		369	1.0	0.404	4.9	LOS A	2.3	16.4	0.66	0.66	0.66	43.0
North: SH1												
7	L2	36	0.0	0.032	6.7	LOS A	0.1	1.0	0.44	0.58	0.44	58.5
8	T1	531	11.7	0.393	7.2	LOS A	2.5	19.4	0.54	0.57	0.54	63.9
9	R2	28	2.5	0.393	13.4	LOS B	2.5	19.4	0.54	0.57	0.54	40.6
Approach		595	10.5	0.393	7.5	LOS A	2.5	19.4	0.54	0.57	0.54	62.6
West: Ravenswood												
10	L2	28	2.5	0.350	8.5	LOS A	2.4	17.0	0.89	0.91	0.89	52.1
11	T1	125	2.5	0.350	8.2	LOS A	2.4	17.0	0.89	0.91	0.89	17.0
12	R2	47	2.5	0.350	13.7	LOS B	2.4	17.0	0.89	0.91	0.89	54.5
Approach		201	2.5	0.350	9.6	LOS A	2.4	17.0	0.89	0.91	0.89	32.7
All Vehicles		2272	5.0	0.631	7.5	LOS A	5.5	39.5	0.59	0.62	0.59	58.7

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
1	L2	136	2.5	0.120	6.4	LOS A	0.6	4.2	0.41	0.58	0.41	58.7
2	T1	771	4.3	0.648	6.9	LOS A	5.8	41.6	0.62	0.60	0.62	64.6
3	R2	233	2.5	0.648	13.3	LOS B	5.8	41.6	0.62	0.60	0.62	53.8
Approach		1139	3.7	0.648	8.2	LOS A	5.8	41.6	0.60	0.60	0.60	62.4
East: Pegasus Blvd												
4	L2	155	1.7	0.466	5.5	LOS A	3.1	22.1	0.74	0.80	0.81	57.1
5	T1	196	0.0	0.466	5.2	LOS A	3.1	22.1	0.74	0.80	0.81	18.1
6	R2	44	2.2	0.466	10.7	LOS B	3.1	22.1	0.74	0.80	0.81	59.9
Approach		395	0.9	0.466	6.0	LOS A	3.1	22.1	0.74	0.80	0.81	40.6
North: SH1												
7	L2	36	0.0	0.034	7.0	LOS A	0.2	1.2	0.51	0.60	0.51	57.9
8	T1	531	11.7	0.434	7.6	LOS A	3.1	23.7	0.65	0.62	0.65	63.0
9	R2	46	2.5	0.434	13.8	LOS B	3.1	23.7	0.65	0.62	0.65	40.0
Approach		613	10.3	0.434	8.1	LOS A	3.1	23.7	0.64	0.62	0.64	61.2
West: Ravenswood												
10	L2	42	2.5	0.544	12.6	LOS B	4.8	34.1	0.96	1.09	1.23	46.9
11	T1	158	2.5	0.544	12.3	LOS B	4.8	34.1	0.96	1.09	1.23	15.1
12	R2	103	2.5	0.544	17.8	LOS B	4.8	34.1	0.96	1.09	1.23	48.8
Approach		303	2.5	0.544	14.2	LOS B	4.8	34.1	0.96	1.09	1.23	32.6
All Vehicles		2449	4.8	0.648	8.5	LOS A	5.8	41.6	0.68	0.69	0.72	56.6

Figure 5: 2028 PM SH1 Roundabout Performance, Without Plan Change (Top) and With Plan Change

3.3 Medium-Long Term (~2038) AM Peak with No Bypass and Modified Roundabout

The medium-long term morning peak traffic volumes analysed are still at a level that the additional traffic that could be generated by the Plan Change would have a minimal impact on the modified roundabout performance.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
1	L2	43	2.5	0.038	6.2	LOS A	0.2	1.3	0.39	0.55	0.39	58.9
2	T1	495	4.3	0.430	6.5	LOS A	3.1	22.7	0.50	0.57	0.50	65.2
3	R2	172	2.5	0.430	12.9	LOS B	3.1	22.7	0.50	0.57	0.50	54.7
Approach		709	3.8	0.430	8.0	LOS A	3.1	22.7	0.49	0.57	0.49	63.0
East: Pegasus Blvd												
4	L2	364	1.7	0.733	10.5	LOS B	8.0	56.8	0.91	1.12	1.32	50.9
5	T1	192	0.0	0.733	10.2	LOS B	8.0	56.8	0.91	1.12	1.32	15.0
6	R2	42	2.2	0.733	15.7	LOS B	8.0	56.8	0.91	1.12	1.32	53.1
Approach		598	1.2	0.733	10.8	LOS B	8.0	56.8	0.91	1.12	1.32	41.3
North: SH1												
7	L2	73	0.0	0.067	6.9	LOS A	0.3	2.3	0.48	0.61	0.48	58.2
8	T1	586	11.7	0.444	7.5	LOS A	3.1	23.5	0.60	0.59	0.60	63.4
9	R2	27	2.5	0.444	13.6	LOS B	3.1	23.5	0.60	0.59	0.60	40.3
Approach		686	10.1	0.444	7.6	LOS A	3.1	23.5	0.59	0.60	0.59	62.2
West: Ravenswood												
10	L2	28	2.5	0.348	4.7	LOS A	2.0	14.3	0.68	0.72	0.68	55.5
11	T1	160	2.5	0.348	4.4	LOS A	2.0	14.3	0.68	0.72	0.68	18.9
12	R2	117	2.5	0.348	9.9	LOS A	2.0	14.3	0.68	0.72	0.68	58.1
Approach		305	2.5	0.348	6.6	LOS A	2.0	14.3	0.68	0.72	0.68	39.4
All Vehicles		2299	4.8	0.733	8.4	LOS A	8.0	56.8	0.66	0.74	0.76	55.9

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
1	L2	71	2.5	0.063	6.3	LOS A	0.3	2.2	0.41	0.57	0.41	58.7
2	T1	495	4.3	0.436	6.6	LOS A	3.2	23.4	0.53	0.58	0.53	65.0
3	R2	172	2.5	0.436	13.0	LOS B	3.2	23.4	0.53	0.58	0.53	54.5
Approach		737	3.7	0.436	8.0	LOS A	3.2	23.4	0.51	0.58	0.51	62.7
East: Pegasus Blvd												
4	L2	364	1.7	0.773	12.3	LOS B	9.4	66.2	0.95	1.20	1.47	48.8
5	T1	207	0.0	0.773	12.0	LOS B	9.4	66.2	0.95	1.20	1.47	14.2
6	R2	42	2.2	0.773	17.5	LOS B	9.4	66.2	0.95	1.20	1.47	50.8
Approach		614	1.2	0.773	12.6	LOS B	9.4	66.2	0.95	1.20	1.47	38.9
North: SH1												
7	L2	73	0.0	0.069	7.0	LOS A	0.3	2.4	0.50	0.62	0.50	58.0
8	T1	586	11.7	0.458	7.6	LOS A	3.3	25.0	0.64	0.61	0.64	63.2
9	R2	34	2.5	0.458	13.8	LOS B	3.3	25.0	0.64	0.61	0.64	40.1
Approach		693	10.0	0.458	7.9	LOS A	3.3	25.0	0.62	0.61	0.62	61.8
West: Ravenswood												
10	L2	38	2.5	0.395	4.9	LOS A	2.4	16.9	0.71	0.74	0.71	55.2
11	T1	173	2.5	0.395	4.5	LOS A	2.4	16.9	0.71	0.74	0.71	18.8
12	R2	134	2.5	0.395	10.1	LOS B	2.4	16.9	0.71	0.74	0.71	57.9
Approach		344	2.5	0.395	6.7	LOS A	2.4	16.9	0.71	0.74	0.71	40.1
All Vehicles		2387	4.7	0.773	9.0	LOS A	9.4	66.2	0.69	0.77	0.82	54.9

Figure 6: Medium-Long Term (~2038) AM SH1 Roundabout Performance, Without Plan Change (Top) and With Plan Change

3.4 Medium-Long Term PM Peak

The northbound through volumes on the highway in particular are high during the medium-long term evening peak period assessed. Accordingly there is delay forecast on the Ravenswood approach during this period, with a level of service D forecast without the Plan Change. The relatively low extra traffic volumes that could be generated by the Plan Change would add to this delay, with the performance of this approach deteriorating to a level of service F in this analysis. The Plan Change traffic would have a minimal impact on the performance of the other approaches including the SH1 approaches.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
1	L2	155	2.5	0.144	6.7	LOS A	0.7	5.3	0.48	0.62	0.48	58.1
2	T1	857	4.3	0.779	9.0	LOS A	10.6	76.4	0.81	0.77	0.92	63.0
3	R2	291	2.5	0.779	15.4	LOS B	10.6	76.4	0.81	0.77	0.92	52.0
Approach		1302	3.7	0.779	10.1	LOS B	10.6	76.4	0.77	0.75	0.87	60.7
East: Pegasus Blvd												
4	L2	194	1.7	0.619	7.5	LOS A	5.4	38.1	0.85	0.97	1.05	54.6
5	T1	256	0.0	0.619	7.2	LOS A	5.4	38.1	0.85	0.97	1.05	17.1
6	R2	56	2.2	0.619	12.7	LOS B	5.4	38.1	0.85	0.97	1.05	57.2
Approach		505	0.9	0.619	7.9	LOS A	5.4	38.1	0.85	0.97	1.05	38.2
North: SH1												
7	L2	45	0.0	0.045	7.3	LOS A	0.2	1.6	0.54	0.62	0.54	57.7
8	T1	577	11.7	0.482	8.0	LOS A	3.6	27.6	0.70	0.64	0.70	62.6
9	R2	43	2.5	0.482	14.2	LOS B	3.6	27.6	0.70	0.64	0.70	39.8
Approach		665	10.3	0.482	8.4	LOS A	3.6	27.6	0.69	0.64	0.69	61.0
West: Ravenswood												
10	L2	43	2.5	0.784	36.0	LOS D	10.0	71.5	1.00	1.38	1.90	31.5
11	T1	188	2.5	0.784	35.6	LOS D	10.0	71.5	1.00	1.38	1.90	9.2
12	R2	72	2.5	0.784	41.2	LOS D	10.0	71.5	1.00	1.38	1.90	32.3
Approach		303	2.5	0.784	37.0	LOS D	10.0	71.5	1.00	1.38	1.90	18.5
All Vehicles		2776	4.6	0.784	12.2	LOS B	10.6	76.4	0.79	0.83	0.97	52.5

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1												
1	L2	187	2.5	0.178	6.9	LOS A	1.0	6.9	0.52	0.64	0.52	57.8
2	T1	857	4.3	0.798	9.7	LOS A	11.7	84.5	0.85	0.81	1.02	62.5
3	R2	291	2.5	0.798	16.1	LOS B	11.7	84.5	0.85	0.81	1.02	51.5
Approach		1335	3.7	0.798	10.7	LOS B	11.7	84.5	0.81	0.79	0.95	60.2
East: Pegasus Blvd												
4	L2	194	1.7	0.691	9.9	LOS A	6.9	49.0	0.92	1.09	1.26	51.5
5	T1	271	0.0	0.691	9.5	LOS A	6.9	49.0	0.92	1.09	1.26	15.8
6	R2	56	2.2	0.691	15.1	LOS B	6.9	49.0	0.92	1.09	1.26	53.8
Approach		520	0.9	0.691	10.3	LOS B	6.9	49.0	0.92	1.09	1.26	35.3
North: SH1												
7	L2	45	0.0	0.047	7.6	LOS A	0.3	1.8	0.59	0.64	0.59	57.3
8	T1	577	11.7	0.527	8.9	LOS A	4.5	34.4	0.78	0.73	0.83	62.0
9	R2	61	2.5	0.527	15.0	LOS B	4.5	34.4	0.78	0.73	0.83	39.3
Approach		683	10.1	0.527	9.3	LOS A	4.5	34.4	0.77	0.72	0.81	59.9
West: Ravenswood												
10	L2	57	2.5	1.084	143.9	LOS F	40.1	286.6	1.00	2.76	5.13	12.2
11	T1	221	2.5	1.084	143.6	LOS F	40.1	286.6	1.00	2.76	5.13	3.3
12	R2	127	2.5	1.084	149.1	LOS F	40.1	286.6	1.00	2.76	5.13	12.4
Approach		405	2.5	1.084	145.3	LOS F	40.1	286.6	1.00	2.76	5.13	7.5
All Vehicles		2943	4.5	1.084	28.8	LOS C	40.1	286.6	0.84	1.10	1.55	39.4

Figure 7: Medium-Long Term (~2038) PM SH1 Roundabout Performance, Without Plan Change (Top) and With Plan Change

It is important to note that this is a relatively long-term scenario and there are many variables at play as to how the roundabout will continue to perform.

The medium-long-term PM peak scenario (the worst-case scenario tested above) has been tested on the existing roundabout layout as a comparison. The table below shows that in the medium-long term and with the Plan Change, the existing roundabout would continue to operate with good levels of service A and B for all movements.

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: SH1											
1	L2	187	2.5	0.313	7.1	LOS A	1.8	12.8	0.54	0.63	57.1
2	T1	857	4.3	0.670	8.0	LOS A	6.7	48.7	0.67	0.70	54.9
3	R2	291	2.5	0.670	14.5	LOS B	6.7	48.7	0.70	0.72	52.7
Approach		1335	3.7	0.670	9.3	LOS A	6.7	48.7	0.66	0.69	54.7
East: Pegasus Blvd											
4	L2	194	1.7	0.217	3.7	LOS A	0.9	6.4	0.55	0.63	60.8
5	T1	281	0.0	0.295	2.8	LOS A	1.4	9.9	0.58	0.47	33.7
6	R2	56	2.2	0.295	8.4	LOS A	1.4	9.9	0.58	0.47	31.9
Approach		531	0.9	0.295	3.7	LOS A	1.4	9.9	0.57	0.53	48.1
North: SH1											
7	L2	45	0.0	0.266	5.3	LOS A	1.6	12.0	0.67	0.72	18.1
8	T1	577	11.7	0.364	5.9	LOS A	2.6	19.9	0.70	0.72	59.7
9	R2	61	2.5	0.364	11.3	LOS B	2.6	19.9	0.71	0.72	18.1
Approach		683	10.1	0.364	6.3	LOS A	2.6	19.9	0.70	0.72	54.2
West: Splitter Rd											
10	L2	57	2.5	0.098	6.3	LOS A	0.5	3.5	0.73	0.77	28.2
11	T1	221	2.5	0.432	6.2	LOS A	3.1	21.8	0.86	0.93	18.3
12	R2	127	2.5	0.432	11.7	LOS B	3.1	21.8	0.86	0.93	56.2
Approach		405	2.5	0.432	7.9	LOS A	3.1	21.8	0.84	0.91	33.6
All Vehicles		2954	4.5	0.670	7.4	LOS A	6.7	48.7	0.68	0.70	51.1

Figure 8: Medium-Long Term (~2038) PM SH1 Roundabout Performance, With Plan Change and Existing Roundabout Layout

When the modified roundabout design is being developed, it may be possible to retain two approach lanes on Bob Robertson Drive to provide better opportunity for traffic to exit Ravenswood, while still achieving the aim of making the highway easier to cross for pedestrians and cyclists. It is noted that there is likely to be a low demand for pedestrians to cross Bob Robertson Drive close to the roundabout and there will be opportunities to cross further into Ravenswood. Provisioning for the future performance of the roundabout in the concept modification design development would reduce the likelihood of Waka Kotahi needing to revisit the most appropriate intersection form in the longer term.

If the Woodend Bypass is constructed, there would be some re-distribution of traffic and a reduced use of the SH1 roundabout overall with travel between Woodend and Ravenswood not needing to use the roundabout.

4. Internal Roundabout Performance without Woodend Bypass

There was some discussion about the performance of the internal roundabout during the recent meeting. The possible concern would be that a queue extends back from the internal roundabout to the SH1 roundabout.

In the analysis reported on above, there are 503vph entering Bob Robertson Drive during the medium-long term evening peak period and there are 296vph during the medium-long term morning peak period. These volumes are very low compared to the 950vph analysed on the Bob Robertson Drive approach to the internal roundabout in the ITA. The internal roundabout was forecast to operate very efficiently into the long-term in the ITA. There was minimal queuing forecast for vehicles entering Ravenswood at the internal roundabout due to low opposing flows (the main movements were straight along Bob Robertson Drive and left into / right out of

Garlick Street). It is considered that the analysis of the performance of the internal roundabout presented in the ITA is very conservative and there is no concern with its performance affecting the operation of SH1.

5. Conclusion

We trust that this memo addresses the information gaps advised by Waka Kotahi regarding performance of the SH1 roundabout under a scenario that does not include the Woodend Bypass.

It is considered that the analysis continues to demonstrate that the Ravenswood centre can appropriately integrate with the transport network. In the medium long-term if the Bypass is not constructed, there will be some sensitivity to roundabout layout in the weekday PM peak period. Desirably, the current investigations by Waka Kotahi for modifying the roundabout will allow for the future capacity, or plan for efficient retrofitting to improve capacity again on key movements in the future, such as allowing two exit lanes from Ravenswood.

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