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Memo

To Waikato District Council and Ohinewai Rezoning parties
CC David Gaze; John Olliver, BBO; Stuart Penfold, BBO
From Cameron Inder / Rhulani Baloyi
Date 7 August 2020
Job No. 145860.16
Job name Proposed Ohinewai Rezoning and Structure Plan
Subject **Transportation-related implications of removing the Discount Factory Outlet (DFO) from the Ohinewai Structure Plan area**

1 Introduction

Subsequent to the completion of the expert conferencing in June 2020, Ambury Properties Ltd (APL) has decided to remove the Discount Factory Outlet (DFO) from the project and replace it with additional land for industrial purposes. The area allocated to the DFO was 5.5ha, so that 5.5ha will be allocated to industrial use with an Industrial zoning. To accommodate this change, the following amendments have been made to the illustrative Masterplan, the two Structure Plans and Zoning Plan (the amended plans are provided in Appendix A, while the two Structure Plans are shown in Figure No. 1 and Figure No. 2):

- The neighbourhood centre has been relocated slightly so that it straddles the main road (“Road Type 3”) with shops now provided on both sides of the street. This maximises the active frontages and allows the backs of the southern shops to back onto industrial land. The location of the neighbourhood centre at the interface between the residential and industrial areas means it provides a land use transition between the two and is also centrally located to both the residential and employment catchments. There is no change to the GFA cap of 2,500m².
- The east-west road connecting the neighbourhood centre to the service station / public transport centre will remain as an important pedestrian/cycle connection, albeit through a light industrial area. The road cross-section will include off-street cycling via shared walking and cycling paths on both sides of the road. The alternative pedestrian/cycle connection through the open space and along Tahuna Road to connect to the path through Ohinewai Reserve and onwards to the school will remain.
- The north-south road immediately to the east of the new industrial area is now reclassified as Type 2 instead of Type 3 as it will be an industrial access road instead of commercial.

This memorandum outlines the traffic and transportation related implications of the change.

Summary Conclusion of this Assessment:

By removing the DFO and replacing it with Industrial Zoning, this assessment finds that the existing road network can readily accommodate the additional traffic associated with the whole APL’s rezoning proposal. That is, no capacity-related upgrades at the Ohinewai Interchange and the Tahuna Road/ Lumsden Road intersection are likely to be required to accommodate APL rezoning traffic through to the assessment horizon year, 2041. This finding is attributed to the reduced trip generation during the peak periods, and particularly the PM peak, resulting from the removal of the DFO retail activities. Further sensitivity testing confirms that



the existing intersection layouts can accommodate higher trip rate figures (10-20% higher) than estimated by the Waikato Regional Transportation Model's (WRTM) assessment for the Ohinewai rezoning, but that capacity related upgrades may likely be triggered at the Tahuna Road/ Lumsden Road roundabout should the trip rates assessed by the WRTM be significantly higher (i.e. greater than 20%) than published surveyed trip rates.

Figure No. 1: Proposed Revised Ohinewai Structure Plan

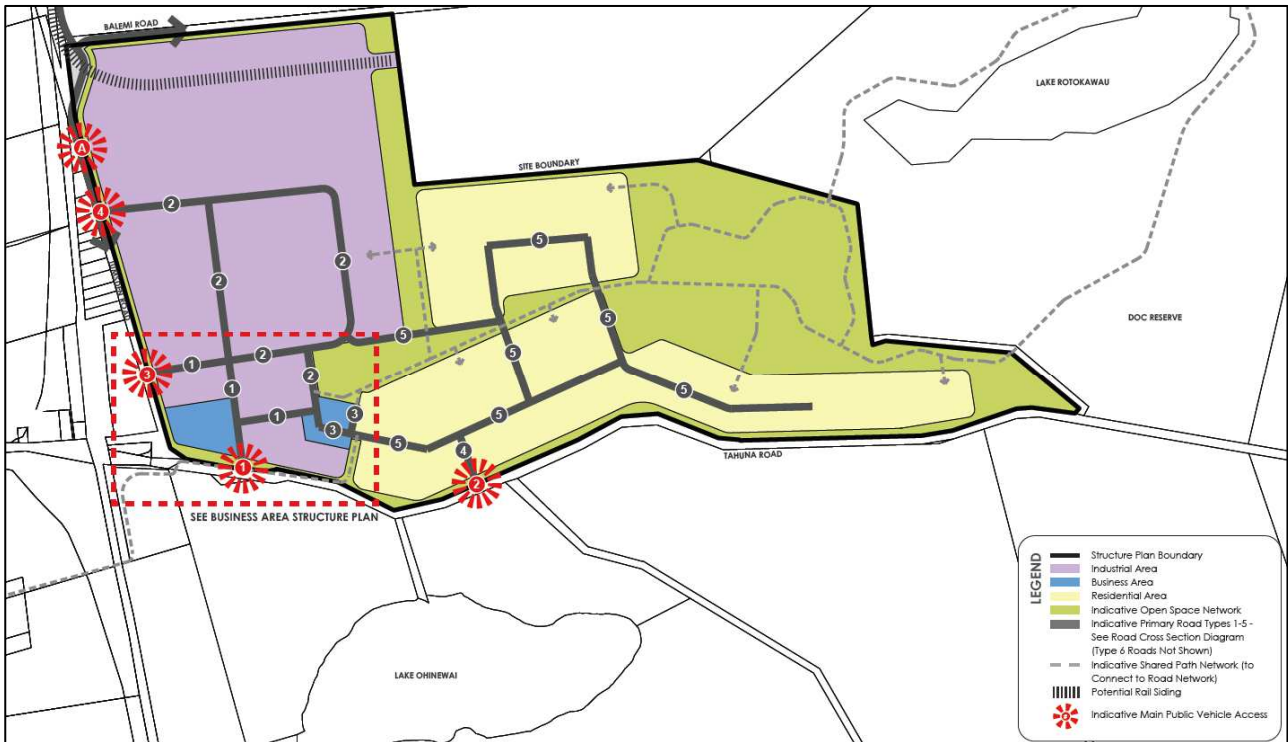


Figure No. 2: Proposed Business Area Structure Plan



2 Proposed Land Use Zoning – without the DFO

A summary of the indicative development areas within the amended Structure Plan (as illustrated in Figure No. 1 and Figure No. 2) is provided in Table No. 1.

Table No. 1

Proposed Sleepyhead Estate Zone Areas (without the DFO)						
APL Structure Plan Area	Masterplan Area	Gross Structure Plan Area ¹ (ha)	Net Masterplan Area ² (ha)	Share of Net Masterplan Area (%)	Net Developable Area (ha)	Share of Net Developable Area (%)
Industrial	TCG Factory	66.5 ha	22.4 ha	14%	62.0 ha	63%
	Rail Siding/ Freight Storage Area		7.6 ha	5%		
	General Industrial		32.0 ha	20%		
Business/ Commercial	Service Centre	4.5 ha	2.2 ha	1%	3.1 ha	3%
	Neighbourhood Centre		0.8 ha	1%		
	Corner Shop		0.1 ha	0%		
Residential	General Density	52 ha	15.9 ha	10%	32.7 ha	33%
	Medium Density		16.8 ha	11%		
Open Space	Public Open Space	55 ha	59.8 ha ³	38%	-	-
Total		178 ha	157.6ha	100%	97.8 ha	100%

As shown in Table No. 1, with the removal of the DFO within the business/ commercial area, the net developable area for business/commercial is 3% (3.1 ha), down from 9% (8.6 ha) previously. The industrial area increases from 58% (56.5 ha) to 63% (62 ha) of the net developable area.

The resulting development yield (in terms of GFA, dwelling units and number of jobs) is provided in Table No. 2. This shows:

- The removal of the DFO removes approximately 318 business/commercial activity jobs. While the replacement industrial activity is anticipated to provide approximately 149 additional jobs. Therefore, the net reduction is approximately 169 jobs with this change to the OSP.
- The remaining business/commercial activities are anticipated to employ approximately 64 workers at full development of the OSP area.

¹ Inclusive of road reserves.

² Excludes 20.8ha of road reserve areas (between 15% and 20% of the structure plan area has been allocated for road reserves and related infrastructure).

³ Includes private pocket parks within the residential and business areas.



Table No. 2

Estimated Development Yield					
Structure Plan Area	Masterplan Area	Net Developable (ha)	Estimated GFA ⁴ / dwelling units	Estimated Employment Yield	
				Employment Density	Jobs (no. of workers)
Industrial	TCG Factory	22.4 ha	100,000m ² GFA	67 workers/ha	1,500
	General Industrial ⁵	32.0 ha	160,150m ² GFA	27 workers/ha	865
Business/ Commercial	Service Centre	2.2 ha	Up to 1,500m ² GFA	58 workers/ha	10 ⁶
	Neighbourhood Centre	0.8 ha	Up to 2,500m ² GFA		48
	Corner Shop	0.1 ha	Up to 500m ² GFA		6
Residential	General Density	15.9 ha	419 dwellings	-	-
	Medium Density	16.8 ha	673 dwellings	-	-

3 Predicted Trip Generation – without the DFO

3.1 Trip Generation

The predicted trip generation for the Ohinewai rezoning has been revised to reflect the changes to the net developable area within the OSP area (refer to Table No. 2).

For ease of reference, Table No. 3 provides a summary of the WRTM’s predicted trip generation rates for APL’s rezoning proposal; given that the WRTM is an employment-based model, the predicted trip generation was based on the anticipated number of workers that are typically employed within industrial and commercial areas.

Table No. 3

WRTM Based Trip Rates							
Structure Plan Area	Masterplan Area	AM Peak Hour (trips per job/dwelling unit)			PM Peak Hour (trips per job/dwelling unit)		
		In	Out	Total	In	Out	Total
Industrial	TCG Factory	0.19	0.05	0.24	0.11	0.26	0.38
	General Industrial	0.39	0.11	0.49	0.24	0.54	0.77
Business	Service Centre	1.88	0.30	2.19	1.14	3.75	4.89
	Discount Factory Outlets	0.71	0.22	0.93	0.63	1.44	2.07
	Neighbourhood Centre	1.88	0.30	2.19	1.14	3.75	4.89
	Corner Shop	1.88	0.30	2.19	1.14	3.75	4.89
Residential	General Density	0.16	0.51	0.67	0.51	0.16	0.67
	Medium Density	0.11	0.40	0.51	0.42	0.13	0.54

⁴ To estimate GFA, a conservative figure of 50% was applied for building coverage across the industrial and business zone.

⁵ Excludes rail siding cargo/ freight storage area.

⁶ Based on a developable area of 0.2ha (excluding truck stop and other parking).



Table No. 4 provides a summary of the revised predicted trip generation associated with APL's rezoning proposal. The table provides the overall predicted trip generation for all three zone areas, as well as the anticipated number of internal⁷ and external trips.

Table No. 4

Revised Predicted Trip Generation								
Masterplan Area/ Land Use Activity	Estimated GFA/ Dwelling units	Estimated Yield (Jobs/ Dwelling Units)	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Industrial Area								
TCG Factory	100,000m ² GFA	1,500	284	79	363	172	394	565
General Industrial	160,150m ² GFA	865	333	93	427	205	466	671
Total Trip Generation (vph)			617	172	790	377	860	1,236
Internal trips (vph)			123	34	158	93	175	268
External trips (vph)			494	138	632	283	685	968
Business/ Commercial Area								
Service Centre	Up to 1,500m ² GFA	10	19	3	22	11	38	49
Neighbourhood Centre	Up to 2,500m ² GFA	48	91	15	106	55	181	236
Corner Shop	Up to 500m ² GFA	6	11	2	13	7	23	29
Total Trip Generation (vph)			121	20	141	73	241	314
Internal trips (vph)			24	4	28	16	53	69
External trips (vph)			97	16	112	57	188	245
Residential Area								
General Density	419 dwellings	419 dwellings	66	215	282	212	68	280
Medium Density	673 dwellings	673 dwellings	72	269	341	281	85	367
Total Trip Generation - Residential (vph)			138	484	622	493	153	647
Internal trips (vph)			42	106	148	102	31	133
External trips (vph)			97	378	474	391	122	514
Total for APL Development								
Total Trip Generation (vph)			877	676	1,553	943	1,254	2,197
Internal trips (vph)			189	145	334	211	259	470
External trips (vph)			688	531	1,219	732	995	1,727

⁷ As explained in Section 7 of the May 2020 ITA report, the WRTM estimates that between 20% and 25% of all trips generated by the land use activities within the OSP area will be internal trips (i.e. these trips will remain within the OSP area).



Table No. 4 demonstrates that the proposed development is anticipated to generate approximately 1,555 and 2,200 vehicle trips during the AM and PM peak hours respectively.

Previously, with the DFO, the overall trip generation per peak hour was 1,775 vph and 2,740 vph for the AM and PM peak periods respectively.

Replacing the DFO with industrial is therefore expected to reduce AM and PM peak hour trips by approximately 220 and 540 trips respectively. This equates to a 12.5% and 20% reduction in trips during the AM and PM peak hour trips respectively.

As discussed in the May 2020 ITA report, the WRTM predicts that only about 20-25% of these trips will be internal trips, resulting in an external volume of approximately 1,220 and 1,730 vehicle trips during the AM and PM peak hours respectively (this is reduced from 1,400 and 2,150 vehicle trips during the AM and PM peak hours respectively with the inclusion of the DFO).

3.2 External Trip Distribution

For ease of reference, Table No. 5 provides a summary from the May 2020 ITA report of the WRTM’s predicted trip distribution and assignment with the proposed APL development.

Table No. 5

WRTM - Predicted Trip Distribution for the proposed APL Development			
Direction		Trip Distribution	
		AM Peak	PM Peak
Inbound (%)	North (Te Kauwhata, Rangiriri, etc.)	29%	39%
	South (Huntly, Hamilton, etc.)	62%	53%
	East (Waihi, Tauranga, Rotorua)	9%	8%
Outbound (%)	North (Te Kauwhata, Rangiriri, etc.)	28%	32%
	South (Huntly, Hamilton, etc.)	65%	65%
	East (Waihi, Tauranga, Rotorua)	7%	3%

The predicted 2031 and 2041 external road traffic volumes (combined baseline and APL), derived using the percentages in Table No. 5 are attached for reference in Appendix B.

4 Revised Intersection Effects Assessment – without the DFO

This section of the memo outlines the revised traffic effects assessment for the proposed Ohinewai rezoning. The reduction in peak hour trips is expected to primarily affect the previously assessed performance of the following key intersections:

- SH1 Ohinewai interchange western ramp intersection (single-lane roundabout);
- SH1 Ohinewai interchange eastern ramp intersection (stop-controlled intersection), and
- Tahuna Road and Lumsden Road intersection (single-lane roundabout).

The intersections have been modelled in a consistent manner to that in the December 2019 and May 2020 ITA reports, using Sidra Intersection 8.0 and the same input parameters except traffic volumes.

The 2031 and 2041 AM and PM “with APL” traffic scenarios have been remodelled for this assessment to determine whether any previously recommended capacity improvement measures are still warranted with the removal of the DFO traffic. Note: Both the 2031 and 2041 scenarios assume full development of the OSP area. The only difference is the amount of background traffic growth on the network.



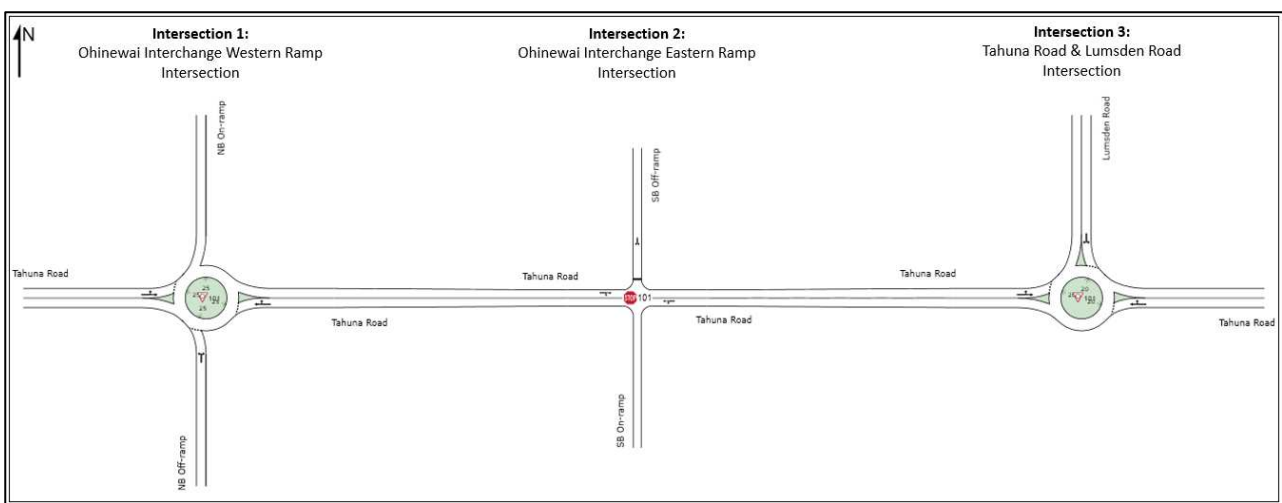
In addition, we have checked the expected change in the maximum queue length on the southbound off-ramp of the Ohinewai Interchange as this was a critical performance and safety consideration raised by Mr Swears during expert witness conferencing.

The length of the southbound off-ramp is 312 m from the stop line at the top to the nose of the gore area at the start of the ramp. The required deceleration distance (comfortable rate of deceleration) from 110 km/h to a stop is 185 m (as per Table 5.2 in the Austroads Guide to Road Design Manual Part 4A). On this basis, as identified by BBO at the conferencing, the 95th percentile queue length on the southbound off-ramp should not exceed 127 m.

4.1 Capacity Analysis - 2031 Baseline with the APL Rezoning (Scenario 1)

This performance assessment is based on the existing (2020) road network configuration as illustrated by Figure No. 3. The Sidra Intersection movement summaries for this scenario are provided in Appendix C.

Figure No. 3: Local road network - existing (2020) intersection configuration



The capacity assessment results for Scenario 1 (2031 with APL traffic) are summarised in Table No. 6.

Table No. 6

Scenario 1 (2031 Baseline + APL Traffic) – Movement Summary							
Intersection	Approach	AM Peak Hour			PM Peak Hour		
		Ave Delay (sec)	95 th Queue (m)	LOS	Ave Delay (sec)	95 th Queue (m)	LOS
Intersection 1: Ohinewai Interchange Western Ramp Intersection (Roundabout)	South: Off-ramp	8.6	19.5	A	10.4	21.8	B
	East: Tahuna Rd	6.9	0.0	A	6.9	0.0	A
	West: Tahuna Rd	5.8	2.6	A	7.3	2.8	A
	Intersection	7.9	19.5	A	8.6	21.8	A
Intersection 2: Ohinewai Interchange Eastern Ramp Intersection (Stop Control)	East: Tahuna Rd	3.9	0.0	-	3.7	0.0	-
	North: Off-ramp	12.4	13.1	B	12.9	20.2	B
	West: Tahuna Rd	1.1	3.7	-	1.8	5.1	-
	Intersection	4.5	13.1	-	5.0	20.2	-
Intersection 3: Tahuna Road and Lumsden Road (Roundabout)	East: Tahuna Rd	4.7	19.3	A	11.1	26.3	B
	North: Lumsden Rd	8.1	7.6	A	22.8	145.3	C
	West: Tahuna Rd	3.2	30.1	A	3.0	37.8	A
	Intersection	4.5	30.1	A	13.1	145.3	B



These results demonstrate the following:

- Both the eastern and western ramp intersections (i.e. Intersections 1 and 2) are expected to operate at acceptable levels of service (LOS B and better - including all interchange movements) during both the 2031 AM and PM peak periods with the addition of the APL rezoning traffic to the 2031 baseline. Furthermore, the 95th percentile queue on the southbound off-ramp is not expected to exceed 20 m during both peak hours. This confirms that no capacity upgrades are expected to be required by 2031 at the Ohinewai Interchange.
- The Tahuna Road/ Lumsden Road intersection (i.e. Intersection 3) lanes are expected to operate at level of service A during the 2031 AM peak hour and LOS B and C during the PM peak period with the addition of the APL traffic. It is worth noting that although the 95th percentile queue of 19 vehicles (or 145 m) is expected on the Lumsden Road approach of the intersection during the PM peak period, the average delay per vehicle on this approach is fairly low at 23 seconds. Furthermore, the 145 m queue is not anticipated to impact on the safety or operations at Access 3 to the site, which is located approximately 220 m from the roundabout on Lumsden Road. Based on these findings, the existing roundabout has sufficient capacity to operate at an efficient level if the DFO traffic is removed from the network. Therefore, it will not require upgrading to increase its capacity as concluded in the May 2020 ITA report.

Notwithstanding the above findings, there is still the need to provide a safe and convenient connection across Tahuna Road and the SH1 expressway for pedestrians and cyclists. As discussed in Section 8.6 of the May 2020 ITA report, the preferred solution option remains:

- The provision of a pedestrian and cyclist crossing facility on the eastern side of the Tahuna Road/ Lumsden Road roundabout as a raised platform zebra crossing with a two-stage crossing arrangement.
- The provision of a new purpose built shared walking and cycling path bridge spanning the North Island Main Truck railway line (NIMT) and the State Highway 1 Expressway south of the Interchange, together with shared path connections to Tahuna Road and Ohinewai South Road to connect the OSP site to the existing Ohinewai Village, school and ultimately through to Huntly.

4.2 Capacity Analysis - 2041 Baseline with the APL Rezoning (Scenario 2)

The performance results for the 2041 with APL traffic scenario are summarised in Table No. 7. The Sidra Intersection movement summaries for this scenario are provided in Appendix C. Similar to Scenario 1, this performance assessment was based on the existing road network configuration as illustrated by Figure No. 3.

Table No. 7

Scenario 2 (2041 Baseline + APL Traffic) – Movement Summary							
Intersection	Approach	AM Peak Hour			PM Peak Hour		
		Ave Delay (sec)	95 th Queue (m)	LOS	Ave Delay (sec)	95 th Queue (m)	LOS
Intersection 1: Ohinewai Interchange Western Ramp Intersection (Roundabout)	South: Off-ramp	10.1	19.1	B	12.5	24.1	B
	East: Tahuna Rd	8.4	0.0	A	8.5	0.0	A
	West: Tahuna Rd	7.1	2.5	A	9.3	3.0	A
	Intersection	9.4	19.1	A	10.4	24.1	B
Intersection 2: Ohinewai Interchange Eastern Ramp Intersection (Stop Control)	East: Tahuna Rd	4.0	0.0	-	3.5	0.0	-
	North: Off-ramp	13.8	18.2	B	14.8	26.7	B
	West: Tahuna Rd	0.3	0.9	-	2.1	5.9	-
	Intersection	4.8	18.2	-	5.3	26.7	-



Scenario 2 (2041 Baseline + APL Traffic) – Movement Summary							
Intersection	Approach	AM Peak Hour			PM Peak Hour		
		Ave Delay (sec)	95 th Queue (m)	LOS	Ave Delay (sec)	95 th Queue (m)	LOS
Intersection 3: Tahuna Road and Lumsden Road (Roundabout)	East: Tahuna Rd	4.6	18.6	A	12.7	33.8	B
	North: Lumsden Rd	8.2	8.1	A	23.5	148.1	C
	West: Tahuna Rd	3.2	31.8	A	3.0	38.9	A
	Intersection	4.5	31.8	A	13.5	148.1	B

As shown in Table No. 7, the 2041 AM and PM performance results for each of the three key intersections are only marginally worse than the 2031 AM and PM scenarios.

The 2041 results show that both the Ohinewai Interchange ramp intersections and the existing Tahuna Road/Lumsden Road roundabout all have sufficient capacity to continue operating efficiently, (LOS A and B, and only Lumsden Road at LOS C in the PM Peak), with the site fully developed but excluding DFO traffic.

Therefore, in contrast to the conclusions of the May 2020 ITA report, no capacity upgrades are proven to be required to accommodate the full APL development without the DFO.

4.3 Sensitivity Testing

4.3.1 Sensitivity Test A - WRTM's Trip Generation Rates

Further sensitivity testing⁸ has been conducted for the 2041 baseline + APL traffic scenario (Scenario 2) as part of the revised intersection effects assessment in order to determine the effect of higher trip rates (higher than those estimated from the WRTM-based assessment for APL's rezoning proposal) for the general light industrial⁹, business and residential areas on the performance and efficiency of the existing intersection forms.

Table No. 8 provides a summary of the scenarios that were analysed, while Table No. 9 provides a summary of the key outputs¹⁰ for the evaluated scenarios.

Table No. 8

Sensitivity Testing - Higher Trip Generation Rate Figures	
Test No.	Description
Test A0	WRTM-based trip generation rates
Test A1	Trip rates for General Industrial and Business/ Commercial increased by 10%
Test A2	Trip rates for Residential increased by 10%
Test A3	Trip rates for General Industrial, Business/ Commercial and Residential increased by 10%
Test A4	Trip rates for General Industrial and Business/ Commercial increased by 20%
Test A5	Trip rates for Residential increased by 20%
Test A6	Trip rates for General Industrial, Business/ Commercial and Residential increased by 20%

⁸ One of the key concerns raised during expert conferencing by the Waikato District Council and Waka Kotahi NZ Transport Agency traffic experts was related to the appropriateness of the trip generation rates adopted in the May 2020 ITA from the WRTM. The experts considered that further sensitivity testing could reduce the uncertainty of the appropriateness of the proposed mitigation measures.

⁹ The assessment excluded sensitivity testing for the TCG manufacturing factory component given that the WDC traffic expert considers that "the trip generation for the TCG factory component is well understood by the ITA".

¹⁰ Results are provided for critical intersection movements only. The Sidra Intersection default gap acceptance parameters for large trucks were applied for heavy vehicles at the southbound off-ramp.

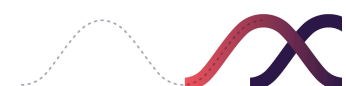


Table No. 9

Summary of Findings - Sensitivity Testing Higher Trip Generation Rate Figures										
Critical Movement				Test A0	Test A1	Test A2	Test A3	Test A4	Test A5	Test A6
Intersection	Approach	Movement	Sidra Output							
AM Peak Hour										
Intersection 2: Ohinewai Interchange Eastern Ramp Intersection	North: Southbound Off-ramp	Left Turn	Vol (vph)	266	275	268	278	284	272	289
			LOS	LOS B	LOS B	LOS B	LOS B	LOS B	LOS B	LOS C
			95th Q (m)	17.8	19.4	18.3	20.1	21.4	18.9	22.8
			Ave Delay (s)	13.5	14.0	13.7	14.2	14.7	13.9	15.1
		Right Turn	Vol (vph)	15	15	15	15	15	15	15
			LOS	LOS C	LOS C	LOS C	LOS C	LOS C	LOS C	LOS C
	95th Q (m)		17.8	19.4	18.3	20.1	21.7	18.9	22.8	
	West: Tahuna Road	Right Turn	Vol (vph)	7	7	7	7	7	7	7
			LOS	LOS A	LOS A	LOS A	LOS A	LOS A	LOS B	LOS B
			95th Q (m)	0.9	0.9	1.0	1.0	1.0	1.0	1.1
			Ave Delay (s)	9.5	9.6	9.9	10.1	9.8	10.4	10.8
	Intersection 3: Tahuna Road and Lumsden Road	North: Lumsden Road	Right Turn	Vol (vph)	205	213	205	213	220	205
LOS				LOS A	LOS A	LOS A	LOS A	LOS A	LOS A	LOS A
95th Q (m)				8.0	8.4	8.1	8.5	8.8	8.1	9.0
Ave Delay (s)				8.4	8.4	8.4	8.5	8.4	8.5	8.5
PM Peak Hour										
Intersection 2: Ohinewai Interchange Eastern Ramp Intersection	North: Southbound Off-ramp	Left Turn	Vol (vph)	342	349	359	365	357	375	388
			LOS	LOS B	LOS B	LOS C	LOS C	LOS C	LOS C	LOS C
			95th Q (m)	26	27.7	29.8	31.6	29.4	34.2	38.8
			Ave Delay (s)	14.5	14.9	15.4	15.8	15.3	16.5	17.6
		Right Turn	Vol (vph)	6	6	6	6	6	6	6
			LOS	LOS C	LOS C	LOS D	LOS D	LOS D	LOS D	LOS D
	95th Q (m)		26	27.7	29.8	31.6	29.4	34.2	38.8	
	West: Tahuna Road	Right Turn	Vol (vph)	15	15	15	15	15	15	15
			LOS	LOS C	LOS C	LOS C	LOS C	LOS C	LOS C	LOS C
			95th Q (m)	5.4	6.4	5.8	6.9	7.7	6.2	8.2
			Ave Delay (s)	18.2	20.2	18.9	21	22.4	19.6	23.2
	Intersection 3: Tahuna Road and Lumsden Road	North: Lumsden Road	Right Turn	Vol (vph)	795	838	795	838	880	795
LOS				LOS C	LOS C	LOS C	LOS C	LOS D	LOS C	LOS E
95th Q (m)				127	166	150	206	230	183	385
Ave Delay (s)				22.4	27.1	26.6	34.4	35.8	32.7	69.8



The following was concluded based on the results outlined in Table No. 9:

SH1 Ohinewai Interchange – Eastern Ramp Intersection:

All critical movements at the intersection are expected to operate at acceptable levels of service (LOS D and better) during the peak periods for Test A1 to A6 with minimal delays and queueing. The worst performing sensitivity test is Test A6 (where the WRTM-based trip rates were to all increase by 20%), causing a 95th percentile queue of approximately 40 m on the southbound off-ramp during the PM peak. There is ample reserve storage (87 m) to the back of the worst-case sensitivity test queue length.

Overall, it is expected that the existing intersection configuration (compulsory stop on the southbound off-ramp) will have sufficient capacity to accommodate the traffic associated with APL's rezoning proposal; the sensitivity assessment shows that no capacity upgrades will be triggered should the trip rates assessed by the WRTM for the general industrial, commercial, and residential trip rates increase by 10-20%.

Tahuna Road & Lumsden Road Roundabout:

The sensitivity testing indicates that, with the removal of the DFO, the existing intersection form (single circulating lane roundabout) will have sufficient capacity to accommodate the additional traffic associated with APL's rezoning proposal should the trip rates assessed by the WRTM for the general industrial, commercial, and residential trip rates increase by 10% (i.e. Test A1 to A3).

The worst performing test (Test A6) produces a 385 m 95th percentile queue southbound on Lumsden Road with average delays of approximately 70 seconds; this is due to over 880 vph giving way to approximately 520 vph travelling eastbound. These sensitivity test volumes are significant, and the resulting queue length on Lumsden Road is very large. This assessment considers that this volume of traffic is highly unlikely given it would require all of the trips rates to be significantly higher (more than 20%) than published surveyed trip rate figures indicate.

Notwithstanding the above, the sensitivity tests demonstrate that the existing intersection configuration is appropriate, but that capacity upgrades may likely be triggered should the trip rates assessed by the WRTM for the industrial, commercial, and residential activities be significantly higher than published surveyed trip rate figures (i.e. by 20% and more).

4.3.2 Sensitivity testing – Gap Acceptance

Additional sensitivity testing was carried out as part of this assessment to test the effect of higher gap acceptance factors (i.e. higher delay in turning factors for large trucks) within Sidra Intersection specifically for left turning heavy vehicles at the southbound off-ramp¹¹.

Table No. 10 provides a summary of the scenarios that were analysed, while Table No. 11 to follow provides a summary of the key outputs¹² for the evaluated scenarios.

¹¹ During expert conferencing, the Waka Kotahi NZ Transport Agency traffic expert questioned the effect on the Sidra Intersection modelling if turning high productivity motor vehicles (HPMV's) need to wait for both lanes to clear.

¹² Results are provided for critical intersection movements only. The Sidra Intersection default gap acceptance parameters for large trucks were applied for heavy vehicles at the southbound off-ramp.

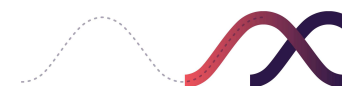


Table No. 10

Sensitivity Testing - Higher Gap Acceptance Figures	
Test No.	Description
Test B0	Gap acceptance and opposing vehicle factor of 1.5 (SIDRA default value for heavy vehicles) and a design vehicle length of 10 m.
Test B1	Gap acceptance and opposing vehicle factor of 2.5 (SIDRA default value for large trucks) and a design vehicle length of 19.5 m.
Test B2	Gap acceptance and opposing vehicle factor of 3.0 (Highway Capacity Manual (HCM) default value for large trucks) and a design vehicle length of 19.5 m.
Test B3	Gap acceptance and opposing vehicle factor of 4.0 and a design vehicle length of 19.5 m.

Table No. 11

Summary of Findings - Sensitivity Testing Higher Gap Acceptance Figures							
Critical Movement				Test B0	Test B2	Test B2	Test B3
Intersection	Approach	Movement	Sidra Output				
AM Peak Hour							
Intersection 2: Ohinewai Interchange Eastern Ramp Intersection	North: Southbound Off-ramp	Left Turn	Vol (vph)	266	266	266	266
			LOS	LOS B	LOS B	LOS B	LOS C
			95th Q (m)	14.3	17.8	19.7	24.1
			Ave Delay (s)	12.2	13.5	14.3	16.1
		Right Turn	Vol (vph)	15	15	15	15
			LOS	LOS C	LOS C	LOS C	LOS C
	95th Q (m)		14.3	17.8	19.7	24.1	
	West: Tahuna Road	Right Turn	Vol (vph)	7	7	7	7
			LOS	LOS A	LOS A	LOS A	LOS A
			95th Q (m)	0.9	0.9	0.9	0.9
			Ave Delay (s)	9.5	9.5	9.5	9.5
	PM Peak Hour						
Intersection 2: Ohinewai Interchange Eastern Ramp Intersection	North: Southbound Off-ramp	Left Turn	Vol (vph)	342	342	342	342
			LOS	LOS B	LOS B	LOS C	LOS C
			95th Q (m)	20.5	26.0	29.3	37.1
			Ave Delay (s)	12.9	14.5	15.5	18.1
		Right Turn	Vol (vph)	6	6	6	6
			LOS	LOS C	LOS C	LOS C	LOS D
	95th Q (m)		20.5	26.0	29.3	37.1	
	West: Tahuna Road	Right Turn	Vol (vph)	15	15	15	15
			LOS	LOS C	LOS C	LOS C	LOS C
			95th Q (m)	5.4	5.4	5.4	5.4
			Ave Delay (s)	18.2	18.2	18.2	18.2



As shown in Table No. 11, the worst performing sensitivity test is Test B3 (longest turning delay), causing a 95th percentile queue of 37 m (equivalent to 5 cars) on the southbound off-ramp. As previously mentioned, the required deceleration distance (comfortable deceleration) from 110 km/h to a stop is 185 m. On this basis, the 95th percentile queue length on the southbound off-ramp should not exceed 127 m. There is clearly ample reserve storage (90 m) to the back of the worst-case sensitivity test queue length.

The sensitivity testing confirms that the existing intersection form remains appropriate even when factoring in significantly higher delays for large trucks at the southbound off-ramp.

5 Conclusions

The following is concluded on the basis of removing the DFO from the OSP area, and the revised intersection performance assessments:

APL Rezoning Proposal – Revised Trip Generation with the removal of the DFO

Overall, the removal of the DFO removes approximately 318 business/commercial activity jobs. While the replacement industrial activity is anticipated to provide approximately 149 additional jobs. Therefore, the net reduction is approximately 169 jobs with this change to the OSP. The remaining business/commercial zone is anticipated to employ approximately 64 workers at full development of the OSP area.

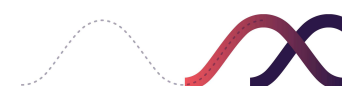
Previously, with the DFO, the overall trip generation per peak hour was 1,775 vph and 2,740 vph for the AM and PM peak periods respectively. The proposed development is now anticipated to generate approximately 1,555 and 2,200 vehicle trips during the AM and PM peak hours respectively. Replacing the DFO with industrial is therefore expected to reduce AM and PM peak hour trips by approximately 220 and 540 trips respectively. This equates to a 12.5% and 20% reduction in trips during the AM and PM peak hour trips respectively.

With the WRTM estimating that only about 20-25% of these trips will be internal trips, the APL rezoning proposal (without the DFO) is anticipated to generate approximately 1,220 and 1,730 external vehicle trips during the AM and PM peak hours, respectively.

Revised Intersection Performance Assessments

The intersection performance assessments were revised to reflect the changes to the net developable area within the OSP area.

- The effects of the proposed APL rezoning traffic on the local road network are considered to be no more than minor from a capacity perspective. The Ohinewai Interchange and the Tahuna Road/ Lumsden Road intersection are expected to operate at acceptable levels for service during both the AM and PM peak periods with the addition of the APL rezoning traffic to the 2031/ 2041 baselines.
- Sensitivity testing of higher trip rates figures (10-20% higher than published trip rate figures) demonstrate that:
 - Ohinewai Interchange: the existing interchange configuration (roundabout at the northbound on/off-ramp and a compulsory stop on the southbound off-ramp) is appropriate, robust and will have sufficient capacity to accommodate the traffic associated with APL's proposal should the trip rates assessed by the WRTM for the general industrial, commercial, and residential trip rates increase by 10-20%.
 - Tahuna Road/ Lumsden Road intersection: the existing intersection configuration (single circulating lane roundabout) is appropriate, but that capacity upgrades may likely be triggered should the trip rates assessed by the WRTM for the industrial, commercial, and residential activities be significantly higher than published surveyed trip rate.

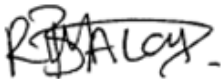


- Sensitivity testing higher gap acceptance factors for large trucks at the southbound off-ramp confirmed that the existing intersection form remains appropriate even when factoring in significantly higher delays for large trucks at the southbound off-ramp.

Notwithstanding the above, the effects of the proposed APL rezoning traffic are considered to be more than minor if no mitigation is provided in terms of safety and for walking and cycling trips. On this basis, the safety related infrastructure upgrades proposed in Table 31 of the May 2020 ITA remain valid.

Yours sincerely

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Appendix A – Revised Illustrative Masterplan, Structure Plans and Zoning Plan



Appendix B – 2031 and 2041 Traffic Volume Figures



Appendix C – Sidra Intersection Summaries

