commute
TRANSPORTATION CONSULTANTS

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Mr R Scott
Scott Wilkinson Planning
PO Box 37-359, Parnell 1151
Auckland

15 June 2022

Copy via email: **robert@scottwilkinson.co.nz**

Dear Robert

301-303 BUCKLAND ROAD- CLAUSE 23 RESPONSE

Further to your recent instructions, we have reviewed the evaluation of additional transport information from Auckland Council (via Arrive) and have responded. The items below only relate to the items noted as requiring additional information.

1 ITEM T1: INTENSIVE SCENARIO

The ITA scenario over-represented low-intensity activities such as vehicle sales and warehouse activities at 16% floor area ratio.

The new scenario has additional moderate-intensity LFR activity at 33% coverage, taking the average floor area ratio to around 25% coverage, but still has a considerable proportion of low-intensity vehicle sales and warehousing.

Drive-through restaurants and other food and beverage activities are permitted at any scale in the BGBZ. These activities can have high trip generation and are not accounted for in the assessment.

The information provides no corroborating information, such as information from similar BGBZ areas, to justify the proposed floor area ratio, development intensity or overall trip generation on a per-hectare basis. It has not been demonstrated that the assumed level of development is a good match for what the proposed zoning would enable.

There is still insufficient information to conclude that the two scenarios provided for analysis are sufficient.

Comment:

The likely estimates of the mix of likely activities and the traffic generation that results from the potential mix are highly subjective judgements. There are multiple factors in play given the range of activities that can be established in a BGBZ.

To summarise, the BGBZ enables a wide range of activities employment including office, LFR, all types of light industry, trade retail, commercial services, other forms of retail (including garden centres, marine retail motor vehicle sales and service stations). The mix of activities is subject to market forces and demand. The BGBZ is an employment focussed zone that is intentionally broad in the range employment activities enabled. On this basis, while it is possible that all the land would be developed as LFR, it is not considered realistic to assume that it would.

The transportation effects for the plan change approved recently for land adjoining Pukekohe Park (Plan Change 30) provided a similar methodology for land in the immediate proximity to the current PPC land to assessing the likely traffic demand split and this methodology was accepted by the

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Council. That same methodology has been updated and applied to the current site. We see no reason why the previous methodology (updated for this plan change) should not be adopted in this circumstance.

The applicant's economics expert has provided additional comment on the likely demand for the various activities should the requested BGBZ be confirmed on the site. His comments are as follows:

> *"I have reviewed the site size, dimensions, contour, location and surrounding uses. The site would be suitable for a range of activities enabled by the General Business zone, notably including large format retail, trade suppliers and industrial. It is not possible to accurately predict the mix of activities that eventuate on any site, as this would depend on the market at the time for different activities as well as the owner's preferences. There are also obscure activities that can occasionally use sites of this type. Within the context of these limitations, a potential outcome for the site would be one third large format retail (near the road), one third industrial (further back from the road) and one third other uses".*

We note that the site subject to this PPC has steeper terrain and that may have an impact on the viability of 100% or a very high percentage of LFR activity being established. In any case, we have undertaken an assessment of 100% LFR on the site as a possible (albeit highly unlikely) worst case scenario.

- 7.9ha total site
- 100% (7.9ha) of the site to be LFR
- LFR site coverage of 33% based on the Pukekohe Mega Centre on Manukau Road (previously consented). This equates to 26,000sqm GFA

Applying the 453 report rates yields a LFR trip generation of 1040 trips in the evening peak and 1560 trips on a Saturday. It is also noted that all the traffic (both PPC and PC30) have all been assumed to be new "Primary" trips. As such no reduction has been made for either multi-purpose / linked trips (those that may also visit other stores on the same Plan Change or other plan Change) or pass-by traffic (ie those vehicles already on the road network that deviate into the site). As such the assessment is considered conservative especially if the entire site is LFR.

The distribution has been based on the original Clause 23 response.

The results of this test (Appendix A) show:

- Both roundabouts operate at acceptable levels in the AM and PM peak weekday periods
- Both roundabouts experience pressure on a Saturday peak with the new PPC / PU-NS-2 Road roundabout just reaching typical capacity levels however the Kitchener Road / Manukau Road roundabout exceeding capacity.

While this analysis shows some traffic issues at peak flows on a Saturday (with all 100% LFR, no pass-by or multi-purpose reduction), the suggested roading layout will otherwise operate efficiently and safely. If, in the unlikely event that 100% LFR occupancy results, we are confident that there are additional traffic mitigation measures (such as Saturday peak spreading, multi-purpose trips, adding turning lanes) which will occur / can be implemented at the resource consent stage to address any additional traffic safety issues.

2 ITEM T4: DISTRIBUTION

The alternative splits provided for the assumed land uses are reasonable. Splits for other land uses are yet to be provided or reviewed.

Comment:

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We note the reviewer agrees that the alternative splits provided for the assumed land uses are reasonable. In terms of other land uses not being provided, the revised land uses provided represent a realistic scenario to be tested. When assessing Plan Changes the exact uses are never known. The scenarios modelled are considered to represent a realistic scenario for development.

It is also noted any future activity would be also subject to E27 E27.6.1. "Trip generation" rule of the Unitary Plan. This rule if triggered (which is generally over 100 movements so will likely be triggered) requires a further assessment of transport, traffic or trip-generation effects for the activity. At this time (Resource Consent) the exact land-use will be known and thus a re-assessment will need to be undertaken.

3 ITEM T5: 90% TO THE NORTH

Most population growth is expected to the north of the site, so the north is likely to represent an increasing proportion of trips in future.

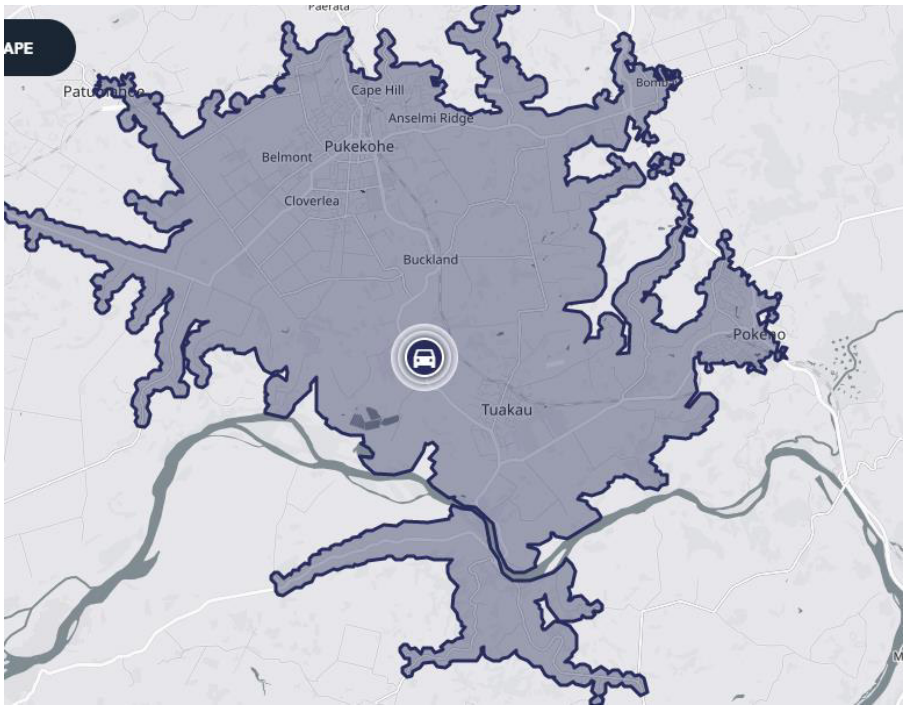
Insufficient information has been provided to support the assumed north/ south splits.

Comment:

A distribution of 90% to the north (as suggested by the reviewer) is not considered to be realistic given the existing distribution of traffic at the intersection of Buckland Road with Kitchener Road. As per the original response "*The volumes recorded at the Kitchener Road / Buckland Road intersection shows the direction of traffic along Buckland Road to be around 50/50 on a Saturday, and 60/40 on a weekday*". This is due to a significant amount of population being south of Pukekohe (esp Buckland, Tuakau and also Pokeno which the shortest time to the site is via the south). We have however tested (in the response) a revised scenario of having 70% to / from the north.

We note the comment that the north is likely to represent an increasing proportion of trips in future. In this regard we have reviewed the existing and future population in the wider area. In this regard the map below shows the site and the estimated 15-minute travel time from the site.

Figure 1: 15 minute travel time



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Of note within 15 minutes travel time is Pukekohe, Tuakau and Pokeno.

Current populations of these towns are:

- Pokeno 5,545 (Statistics 2021)
- Pukekohe 26,900 (2021)
- Tuakau 5,090 (2021)

As such Tuakau and Pokeno currently represents 28% of total population in 15 driving distance of the site. The distribution of 30% from the south is reasonable.

In terms of future population projections

- Pokeno 9,791 (Retail and Office Space Projections for Centres: 'Huntly' and 'Pokeno' Town Centres - 2060)
- Pukekohe 40,000 (2040) – 65,883 over entire Pakekohe – Paerata Structure plan area
- Tuakau 11,108 (2046 - Tuakau Structure Plan)

As such Tuakau and Pokeno is proposed to represent 34% of total population in 15 minute driving time of the site. The distribution of 30% from the south is still considered reasonable.

ITEM T6: 2036 SCENARIO

Please provide analysis of the proposal against a future development environment such as 2036.

Large-scale ITA's such as PPSP are broader in scope and explicitly state subsequent smaller-scale ITA's such as this one need to provide more detail.

While there may be spare capacity at current traffic volumes, the impact of the proposal on the future environment or the capacity of the proposed intersections in the future have not been demonstrated, regardless of how much employment may be provided, particularly as the proposed zoning differs from that assumed in the PPSP ITA.

Comment:

We have reviewed the 'background" 2036 traffic volumes from the PPSP ITA. This contains no specific / detailed information in future traffic volumes on Buckland Road. It does provide some 2048+ (Figure 8-6) daily flows indicating a future flow of between 0-5,000 vehicle per day in each direction. This compares to 8,350 vpd in 2017 (both directions). The site (and the approved Plan Change across the road) is considered to in itself be traffic growth in the area especially to 2036.

We have also undertaken sensitivity testing as noted previously with a highly unlikely scenario of retail area.

4 ITEM T8: PUKEKOHE PARK

While the events are infrequent, they have the potential to generate significant adverse effects. The impact of the proposal on the ability to implement appropriate Traffic Management Plans for events and potentially change the impact of the events remains unknown.

The ability of activities on the site to operate safely and efficiently while events are occurring also remains unknown.

Comment:

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The large events at Pukekohe Park are considered to be infrequent events and are required to be under control of Traffic Management Plans. The events enabled are also highly variable in terms of numbers, intensity and hours of operation. On this basis there remains a high degree of uncertainty as to magnitude or frequency of events. Given this uncertainty, additional assessment is not considered appropriate or helpful as it would be based on highly variable assumptions. It is noted that the BGBZ has been selected for this land in part recognition of the nature of Pukekohe Park (including its reverse sensitivity effects) and the effects it generates on the immediate locality including large events.

It should also be noted that the Pukekohe Paerata Structure Plan has identified this area as an area for employment growth to support residential development in Pukekohe and this location is seen as an ideal place to establish employment related activities.

5 ITEM T10: MANUKAU / KITCHENER / BUCKLAND/ PUKEKOHE PARK GATE 2 INTERSECTION #1 - EVENTS

Please provide an assessment of how this intersection would operate during events at Pukekohe Park in the future.

Comment:

See Item T8.

6 ITEM T11: MANUKAU / KITCHENER / BUCKLAND/ PUKEKOHE PARK GATE 2 INTERSECTION #2 – TRAFFIC LIGHTS

Insufficient information provided on relative merits of traffic signals and roundabouts on matters such as efficiency, safety, and pedestrian and cyclist safety and amenity, particularly considering future urbanised environment. No information assessing intersection choice considering safe system assessment framework.

Comment:

This intersection has previously been assessed and approved (by Auckland Transport) as a roundabout as part of PC30. Further in previous discussions with Auckland Transport, a roundabout is preferred in this location due to them lowering speeds especially in areas which transition from rural and urban. It is also noted that in Pukekohe all other intersections are roundabouts.

We have however undertaken an assessment of roundabout vs signals using Safe System Assessment Framework (SSAF) in **Appendix B**. Of note the analysis only reviews the Buckland Road / Kitchener Road intersection as the Buckland Road / PU-NS-2 road will have essentially the same results. The results show similar results between the two options with the roundabout obtaining a lower score (and therefore consider safer especially for more venerable users).

7 ITEM T13: MODELLING DIAGRAMS

Please provide diagrams from the modelling software to confirm the layout(s) modelled.

Comment:

See **Attachment B** for the detailed diagrams / summary.

8 ITEM T18: BUCKLAND / PU-NS-2 INTERSECTION

Please provide an assessment of how this intersection would operate during events at Pukekohe Park in the future.

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Comment:

See Item T8.

9 ITEM T19: BUCKLAND / PU-NS-2 INTERSECTION (SIGNALS)

Please provide an assessment of how this intersection would operate under traffic signal control.

Comment:

In previous discussions with Auckland Transport, roundabouts in locations such as the one proposed are preferred due to them lowering speeds especially in areas which transition from rural and urban. It is also noted that in Pukekohe all other intersections are roundabouts.

We have however undertaken an assessment of roundabout vs signals using Safe System Assessment Framework (SSAF) in **Appendix B**. The results show similar results between the two options with the roundabout obtaining a lower score (and therefore consider safer).

10 ITEM T21: BUCKLAND / PU-NS-2 INTERSECTION (SIDRA)

Please provide diagrams from the modelling software to confirm the layout(s) modelled.

Comment:

See **Attachment C** for the detailed diagrams / summary.

11 ITEM T22: PEDESTRIANS/ CYCLISTS

Please provide information around selection of appropriate pedestrian (and cyclist) crossing facilities, particularly across Buckland Road, and how proposed provisions respond to the need for crossing facilities.

Comment:

We agree with the comment that the site will likely attract walking and cycling trips, potentially including trips from Pukekohe Park. It should however be stressed that the application is for a Plan Change rather than Resource Consent and as such the details of any such crossing facility would typically be considered at a later stage. However, in terms of the Plan Change crossing facilities:

- Both roundabouts will feature pedestrian crossing facilities on all approaches. The detail of these would be undertaken at detailed design stage however we note Auckland Transport recent preference for roundabouts over signals due to lower speeds and thus resulting lower impacts. This is reflected in Auckland Transport's Urban Streets and Roads Design Guide pg 187 "*Roundabouts are the preferred safe intersection type. This is because they reduce the number of potential conflicts between road users, and lower the driving speed*."
- As per the initial 11 April 2022 response (Appendix A), the concept layouts of Buckland Road includes a painted flush median along the entire frontage. This coupled with the two roundabouts then enables:
    - Informal crossing points using the median (potential with islands)
    - Potential of a signalised crossing located somewhere near the mid-point between roundabout
    - Potential of a raised zebra crossing located somewhere near the mid-point between roundabout

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The exact location can only be determined at future stages when lot / building layouts are known and thus pedestrian desire lines are able to be determined.

Again, it is noted that all the above would be subject to further detailed design / Auckland Transport approval.

12 ITEM T23: ACCESS

No information provided to enable an assessment of the appropriateness of proposed direct property access to Buckland Road at other locations.

Comment:

Any direct access to Buckland Road requires a Resource Consent under E27.6.4.1 "Vehicle Access Restrictions" as Buckland Road is an arterial. As such, like all other arterials in Auckland, any land use that requests access directly to an arterial is protected and requires assessment. We do not consider there is anything special regarding this land-use or arterial road that requires any further assessment / protection above that already contained in the unitary Plan.

The main access is intended to be provided via the new internal road network linking to the new proposed roundabout.

13 ITEM T24: SPEED LIMIT

If safe access at any point is dependent on a change to the posted speed limit, please provide discussion on how safe access could be provided in the event a speed limit change is delayed or does not eventuate.

Comment:

See Item T23. The speed limit at the time of any Resource Consent application would be taken into account in the assessment criteria within E27.8.2(10) (relating to E27.6.4.1 "Vehicle Access Restrictions") which includes effects of the location and design of the access on the safe and efficient operation of the adjacent transport network having regard to visibility and safe sight distances (which would include operating speed). Should the speed limit not be reduced, and the resulting sight distance not be achieved, then the proposed access will unlikely be approved (until the speed is reduced).

Of note the inclusion of the roundabouts (over signals) has been partly chosen because they reduce speeds on roads.

Yours sincerely

Commute Transportation Consultants

Leo Hills

Director

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APPENDIX A: 100% LFR RESULTS

MOVEMENT SUMMARY

Site: 102v [Manukau Rd/ PPC Road intersection SAT - 100%]

New Site
Roundabout

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	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Buckland Rd (south)											
1	L2	246	5.0	1.038	82.7	LOS F	48.5	353.9	1.00	2.46	25.4
2	T1	459	5.0	1.038	83.0	LOS F	48.5	353.9	1.00	2.46	25.7
3	R2	11	5.0	1.038	87.7	LOS F	48.5	353.9	1.00	2.46	25.7
Approach		716	5.0	1.038	83.0	LOS F	48.5	353.9	1.00	2.46	25.6
East: Gate 3											
4	L2	11	5.0	0.122	20.4	LOS C	0.9	6.9	1.00	0.90	43.8
5	T1	11	5.0	0.122	20.7	LOS C	0.9	6.9	1.00	0.90	44.7
6	R2	11	5.0	0.122	25.4	LOS C	0.9	6.9	1.00	0.90	44.6
Approach		32	5.0	0.122	22.2	LOS C	0.9	6.9	1.00	0.90	44.4
North: Bucklend Rd (north)											
7	L2	11	5.0	0.937	21.4	LOS C	30.3	221.3	1.00	1.16	42.8
8	T1	423	5.0	0.937	21.7	LOS C	30.3	221.3	1.00	1.16	43.7
9	R2	575	5.0	0.937	26.4	LOS C	30.3	221.3	1.00	1.16	43.6
Approach		1008	5.0	0.937	24.4	LOS C	30.3	221.3	1.00	1.16	43.6
West: PPC Road											
10	L2	575	5.0	1.004	55.4	LOS E	43.5	317.7	1.00	2.02	31.0
11	T1	11	5.0	1.004	55.7	LOS E	43.5	317.7	1.00	2.02	31.5
12	R2	246	5.0	1.004	60.3	LOS E	43.5	317.7	1.00	2.02	31.4
Approach		832	5.0	1.004	56.8	LOS E	43.5	317.7	1.00	2.02	31.1
All Vehicles		2587	5.0	1.038	51.0	LOS E	48.5	353.9	1.00	1.80	33.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 102v [Manukau Rd/ PPC Road intersection PM - 100% lfr]

New Site
Roundabout

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	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Buckland Rd (south)											
1	L2	132	5.0	0.600	7.8	LOS A	6.3	45.7	0.83	0.77	51.8
2	T1	447	5.0	0.600	8.1	LOS A	6.3	45.7	0.83	0.77	53.1
3	R2	11	5.0	0.600	12.8	LOS B	6.3	45.7	0.83	0.77	53.0
Approach		589	5.0	0.600	8.2	LOS A	6.3	45.7	0.83	0.77	52.8
East: Gate 3											
4	L2	11	5.0	0.076	13.1	LOS B	0.5	4.0	0.94	0.82	47.9
5	T1	11	5.0	0.076	13.4	LOS B	0.5	4.0	0.94	0.82	49.0
6	R2	11	5.0	0.076	18.0	LOS B	0.5	4.0	0.94	0.82	48.9
Approach		32	5.0	0.076	14.8	LOS B	0.5	4.0	0.94	0.82	48.6
North: Bucklend Rd (north)											
7	L2	11	5.0	0.722	7.4	LOS A	9.9	72.5	0.87	0.72	50.8
8	T1	502	5.0	0.722	7.7	LOS A	9.9	72.5	0.87	0.72	52.0
9	R2	306	5.0	0.722	12.4	LOS B	9.9	72.5	0.87	0.72	51.9
Approach		819	5.0	0.722	9.4	LOS A	9.9	72.5	0.87	0.72	51.9
West: PPC Road											
10	L2	460	5.0	0.801	16.5	LOS B	13.4	97.5	1.00	1.14	46.0
11	T1	11	5.0	0.801	16.8	LOS B	13.4	97.5	1.00	1.14	47.0
12	R2	197	5.0	0.801	21.5	LOS C	13.4	97.5	1.00	1.14	46.9
Approach		667	5.0	0.801	18.0	LOS B	13.4	97.5	1.00	1.14	46.3
All Vehicles		2107	5.0	0.801	11.9	LOS B	13.4	97.5	0.90	0.87	50.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 102v [Manukau Rd/ PPC Road intersection AM - 100% lfr]

New Site
Roundabout

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	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Buckland Rd (south)											
1	L2	99	5.0	0.575	6.3	LOS A	5.2	38.0	0.70	0.64	52.3
2	T1	534	5.0	0.575	6.6	LOS A	5.2	38.0	0.70	0.64	53.6
3	R2	11	5.0	0.575	11.3	LOS B	5.2	38.0	0.70	0.64	53.5
Approach		643	5.0	0.575	6.7	LOS A	5.2	38.0	0.70	0.64	53.4
East: Gate 3											
4	L2	11	5.0	0.041	7.7	LOS A	0.2	1.8	0.68	0.66	51.4
5	T1	11	5.0	0.041	8.0	LOS A	0.2	1.8	0.68	0.66	52.7
6	R2	11	5.0	0.041	12.7	LOS B	0.2	1.8	0.68	0.66	52.5
Approach		32	5.0	0.041	9.5	LOS A	0.2	1.8	0.68	0.66	52.2
North: Bucklend Rd (north)											
7	L2	11	5.0	0.402	4.5	LOS A	3.6	26.2	0.39	0.52	52.6
8	T1	309	5.0	0.402	4.9	LOS A	3.6	26.2	0.39	0.52	53.9
9	R2	229	5.0	0.402	9.5	LOS A	3.6	26.2	0.39	0.52	53.8
Approach		549	5.0	0.402	6.8	LOS A	3.6	26.2	0.39	0.52	53.8
West: PPC Road											
10	L2	154	5.0	0.299	8.1	LOS A	2.2	15.7	0.79	0.79	51.4
11	T1	11	5.0	0.299	8.4	LOS A	2.2	15.7	0.79	0.79	52.7
12	R2	65	5.0	0.299	13.0	LOS B	2.2	15.7	0.79	0.79	52.6
Approach		229	5.0	0.299	9.5	LOS A	2.2	15.7	0.79	0.79	51.8
All Vehicles		1454	5.0	0.575	7.2	LOS A	5.2	38.0	0.60	0.62	53.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
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HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

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New Site
Roundabout

Movement Performance - Vehicles											
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South: Buckland Rd (south)											
1	L2	72	5.0	1.070	93.1	LOS F	76.7	559.8	1.00	2.93	24.0
2	T1	915	5.0	1.070	93.2	LOS F	76.7	559.8	1.00	2.93	24.3
3	R2	47	5.0	1.070	98.9	LOS F	76.7	559.8	1.00	2.93	24.4
Approach		1034	5.0	1.070	93.5	LOS F	76.7	559.8	1.00	2.93	24.3
East: Gate 2 (site main access)											
4	L2	31	5.0	0.829	50.5	LOS E	12.5	91.4	1.00	1.41	32.3
5	T1	69	5.0	0.829	50.6	LOS E	12.5	91.4	1.00	1.41	32.9
6	R2	196	5.0	0.829	56.3	LOS E	12.5	91.4	1.00	1.41	33.0
Approach		296	5.0	0.829	54.4	LOS E	12.5	91.4	1.00	1.41	32.9
North: Manukau Rd (north)											
7	L2	327	5.0	1.087	92.7	LOS F	113.0	825.0	1.00	2.41	24.0
8	T1	903	5.0	1.087	92.9	LOS F	113.0	825.0	1.00	2.41	24.3
9	R2	193	5.0	1.087	98.6	LOS F	113.0	825.0	1.00	2.41	24.4
Approach		1423	5.0	1.087	93.6	LOS F	113.0	825.0	1.00	2.41	24.2
West: Kitchener Rd (west)											
10	L2	291	5.0	1.212	251.2	LOS F	69.1	504.1	1.00	3.35	11.7
11	T1	93	5.0	1.212	251.3	LOS F	69.1	504.1	1.00	3.35	11.8
12	R2	64	5.0	1.212	257.0	LOS F	69.1	504.1	1.00	3.35	11.8
Approach		447	5.0	1.212	252.0	LOS F	69.1	504.1	1.00	3.35	11.8
All Vehicles		3200	5.0	1.212	112.1	LOS F	113.0	825.0	1.00	2.62	21.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 102v [Manukau Rd/ Kitchener Rd/ Buckland Rd intersection Proposed PM - 100% lfr]

New Site
Roundabout

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	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Buckland Rd (south)											
1	L2	111	5.0	0.925	25.2	LOS C	26.8	195.9	1.00	1.40	42.6
2	T1	772	5.0	0.925	25.4	LOS C	26.8	195.9	1.00	1.40	43.6
3	R2	25	5.0	0.925	31.1	LOS C	26.8	195.9	1.00	1.40	43.8
Approach		907	5.0	0.925	25.5	LOS C	26.8	195.9	1.00	1.40	43.5
East: Gate 2 (site main access)											
4	L2	16	5.0	0.574	19.0	LOS B	5.9	43.4	1.00	1.12	43.9
5	T1	55	5.0	0.574	19.1	LOS B	5.9	43.4	1.00	1.12	45.0
6	R2	194	5.0	0.574	24.8	LOS C	5.9	43.4	1.00	1.12	45.2
Approach		264	5.0	0.574	23.3	LOS C	5.9	43.4	1.00	1.12	45.1
North: Manukau Rd (north)											
7	L2	180	5.0	0.808	6.5	LOS A	13.6	99.3	0.92	0.65	51.8
8	T1	689	5.0	0.808	6.6	LOS A	13.6	99.3	0.92	0.65	53.4
9	R2	177	5.0	0.808	12.3	LOS B	13.6	99.3	0.92	0.65	53.6
Approach		1046	5.0	0.808	7.6	LOS A	13.6	99.3	0.92	0.65	53.1
West: Kitchener Rd (west)											
10	L2	180	5.0	0.729	30.1	LOS C	9.5	69.3	1.00	1.27	39.7
11	T1	52	5.0	0.729	30.2	LOS C	9.5	69.3	1.00	1.27	40.6
12	R2	92	5.0	0.729	35.9	LOS D	9.5	69.3	1.00	1.27	40.7
Approach		323	5.0	0.729	31.8	LOS C	9.5	69.3	1.00	1.27	40.1
All Vehicles		2541	5.0	0.925	18.7	LOS B	26.8	195.9	0.97	1.05	46.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 102v [Manukau Rd/ Kitchener Rd/ Buckland Rd intersection Proposed AM - 100% lfr]

New Site
Roundabout

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	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Buckland Rd (south)											
1	L2	107	5.0	0.638	7.5	LOS A	7.1	51.9	0.83	0.76	52.3
2	T1	548	5.0	0.638	7.6	LOS A	7.1	51.9	0.83	0.76	53.9
3	R2	32	5.0	0.638	13.3	LOS B	7.1	51.9	0.83	0.76	54.2
Approach		687	5.0	0.638	7.9	LOS A	7.1	51.9	0.83	0.76	53.7
East: Gate 2 (site main access)											
4	L2	25	5.0	0.322	7.8	LOS A	2.4	17.3	0.81	0.81	50.3
5	T1	53	5.0	0.322	7.9	LOS A	2.4	17.3	0.81	0.81	51.8
6	R2	182	5.0	0.322	13.6	LOS B	2.4	17.3	0.81	0.81	52.0
Approach		260	5.0	0.322	11.9	LOS B	2.4	17.3	0.81	0.81	51.8
North: Manukau Rd (north)											
7	L2	202	5.0	0.566	4.9	LOS A	5.9	42.8	0.64	0.54	53.2
8	T1	429	5.0	0.566	5.1	LOS A	5.9	42.8	0.64	0.54	54.9
9	R2	93	5.0	0.566	10.7	LOS B	5.9	42.8	0.64	0.54	55.1
Approach		724	5.0	0.566	5.8	LOS A	5.9	42.8	0.64	0.54	54.4
West: Kitchener Rd (west)											
10	L2	164	5.0	0.456	10.7	LOS B	3.9	28.7	0.94	0.95	49.9
11	T1	54	5.0	0.456	10.9	LOS B	3.9	28.7	0.94	0.95	51.4
12	R2	84	5.0	0.456	16.6	LOS B	3.9	28.7	0.94	0.95	51.6
Approach		302	5.0	0.456	12.4	LOS B	3.9	28.7	0.94	0.95	50.7
All Vehicles		1974	5.0	0.638	8.3	LOS A	7.1	51.9	0.77	0.71	53.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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APPENDIX B: SAFE SYSTEM ASSESSMENT FRAMEWORK

14.1 GENERAL

The Safe System approach involves different elements of the system working together to help eliminate death and serious injury. It involves shared responsibility in reaching this objective, including road users and road managers each taking a role. A key objective is to ensure that when driver errors do occur, they do not result in high severity outcomes.

The framework published by Austroads (AP-R509-16) is used in assessing how closely road design and operation align with the Safe System objectives, and in clarifying which elements need to be modified to achieve closer alignment with Safe System objectives.

14.2 ASSESSMENT

The Safe System assessment framework as defined in Austroads (2016a) is completed by assigning a score of between zero and four to each cell in the matrix. A score of zero indicates that the system is fully aligned with the Safe System vision for that component of a given crash type. The higher the score, the further the project is from a Safe System condition. Scores are allocated considering the factors of interest shown in the matrix and the scoring system shown in Table B2 of the Austroads document (Appendix A of this document).

Once there is a score in each cell for the exposure, likelihood and severity rows, the product of each column is calculated and entered in the final row, labelled total. The purpose of this multiplicative approach is that if a score of zero has been given for any component of a crash type (i.e. exposure, likelihood or severity), that crash type receives a total of zero and is eliminated from the score (as it has reached a Safe System). The sum of the infrastructure total scores for each crash type is then added to the final cell on the right-hand side (with the bold border). This score is out of a possible 448 and represents the safer speeds, safer roads and roadsides pillars. The closer the score is to zero, the more the project in question is in alignment with Safe System principles.

The assessment is based on the “safe system scoring matrix” shown below.

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Table 4.4: Safe System matrix scoring system

Road user exposure	Crash likelihood	Crash severity
0 = there is no exposure to a certain crash type. This might mean there is no side flow or intersecting roads, no cyclists, no pedestrians, or motorcyclists).	0 = there is only minimal chance that a given crash type can occur for an individual road user given the infrastructure in place. Only extreme behaviour or substantial vehicle failure could lead to a crash. This may mean, for example, that two traffic streams do not cross at grade, or that pedestrians do not cross the road.	0 = should a crash occur, there is only minimal chance that it will result in a fatality or serious injury to the relevant road user involved. This might mean that kinetic energies transferred during the crash are low enough not to cause a fatal or serious injury (FSI), or that excessive kinetic energies are effectively redirected/dissipated before being transferred to the road user. Users may refer to Safe System-critical impact speeds for different crash types, while considering impact angles, and types of roadside hazards/barriers present.
1 = volumes of vehicles that may be involved in a particular crash type are particularly low, and therefore exposure is low. For run-of-road, head-on, intersection and 'other' crash types, AADT is < 1 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are < 10 units per day.	1 = it is highly unlikely that a given crash type will occur.	1 = should a crash occur, it is highly unlikely that it will result in a fatality or serious injury to any road user involved. Kinetic energies must be fairly low during a crash, or the majority is effectively dissipated before reaching the road user.
2 = volumes of vehicles that may be involved in a particular crash type are moderate, and therefore exposure is moderate. For run-of-road, head-on, intersection and 'other' crash types, AADT is between 1 000 and 5 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are 10–50 units per day.	2 = it is unlikely that a given crash type will occur.	2 = should a crash occur, it is unlikely that it will result in a fatality or serious injury to any road user involved. Kinetic energies are moderate, and the majority of the time they are effectively dissipated before reaching the road user.
3 = volumes of vehicles that may be involved in a particular crash type are high, and therefore exposure is high. For run-of-road, head-on, intersection and 'other' crash types, AADT is between 5 000 and 10 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are 50–100 units per day.	3 = it is likely that a given crash type will occur.	3 = should a crash occur, it is likely that it will result in a fatality or serious injury to any road user involved. Kinetic energies are moderate, but are not effectively dissipated and therefore may or may not result in an FSI.
4 = volumes of vehicles that may be involved in a particular crash type are very high, or the road is very long, and therefore exposure is very high. For run-of-road, head-on, intersection and 'other' crash types, AADT is > 10 000 per day. For cyclist, pedestrian and motorcycle crash types, volumes are > 100 units per day.	4 = the likelihood of individual road user errors leading to a crash is high given the infrastructure in place (e.g. high approach speed to a sharp curve, priority movement control, filtering right turn across several opposing lanes, high speed).	4 = should a crash occur, it is highly likely that it will result in a fatality or serious injury to any road user involved. Kinetic energies are high enough to cause an FSI crash, and it is unlikely that the forces will be dissipated before reaching the road user.

14.3 ASSESSMENT (GENERAL)

The SSAF assessment for the proposed Buckland Road / Kitchener Road cross-roads intersection:

For the purpose of the following assessment, it is assumed that the area to the northwest of the intersection is developed, and thus pedestrian / cycle facilities are also established. As such, the pedestrian and cyclist numbers have been assessed as 100+ per day.

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Assuming the AADT volumes at the intersection are in the order of greater 10,000 vpd and pedestrian, cyclist and motorcycle numbers are between

14.4 BUCKLAND ROAD / KITCHENER ROAD (SIGNALS)

The SSAF assessment for a future signalised intersection is detailed in Table 1 below. The assessment assumes dedicated pedestrian and cycling crossing facilities on all approaches. For the purpose of this assessment, no filter right turns are proposed.

Table 1: Buckland Road / Kitchener Road intersection signals SSAF

	Run off road	Head on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
Exposure	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Likelihood	1/4	2/4	2/4	3/4	1/4	1/4	2/4
Severity	2/4	2/4	2/4	2/4	3/4	3/4	3/4
Product	**8 / 64**	**16 / 64**	**16 / 64**	**24 / 64**	**12 / 64**	**12 / 64**	**24 / 64**
						Total	**112/448**

As detailed above, the signals option i resulted in a total SSAF score of 112 / 448.

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14.5 BUCKLAND ROAD / KITCHENER ROAD (ROUNDABOUT)

The SSAF assessment for a new roundabout intersection is detailed in **Table 2** below. The roundabout design assessed assumed:

- Single lane roundabout
- No specific traffic calming on the approaches
- Pedestrian refuges and pram crossings on each approach

Table 2: Buckland Road / Kitchener intersection - roundabout SSAF

	Run off road	Head on	Intersection	Other	Pedestrian	Cyclist	Motorcyclist
Exposure	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Likelihood	1/4	1/4	2/4	3/4	2/4	2/4	2/4
Severity	2/4	1/4	1/4	1/4	2 ½ /4	2 ½ /4	3/4
Product	**8/ 64**	**4/ 64**	**8/ 64**	**12/ 64**	**20/ 64**	**20/ 64**	**24/ 64**
						Total	**96/448**

As detailed above, the roundabout option resulted in a total SSAF score of 96 / 448.

14.6 TRAFFIC CALMING MEASURES

It is noted that no additional speed calming measures have been assessed at the intersections outlined above. The changes to the SSAF scores above resulting from additional traffic calming would depend on the exact measures and frequency of the calming. In general, the implementation of traffic calming on each approach at the intersection would likely reduce the severity of most crashes by reducing vehicle speeds.

14.7 CONCLUSION

From the Safe System Framework Assessment (SSFA) assessment for a proposed intersection upgrade at Buckland Road / Kitchener Road, it is concluded:

- The roundabout option scores slightly lower than the signals option and as such is closer to the "*Safe System vision*";
- the difference in scores between the roundabout and the signals in this location is however not considered significant (96 vs. 112). Further, while the signals option is considered to have a lower score for pedestrian and cyclists (dedicated phases for pedestrians and cyclists), the roundabout option will have less severe pedestrian and cyclist crashes and will have a lower score for vehicle related crashes (reduced speeds); and

  The introduction of traffic calming (if provided) at either intersection form has the potential to reduce the severity of most crashes.

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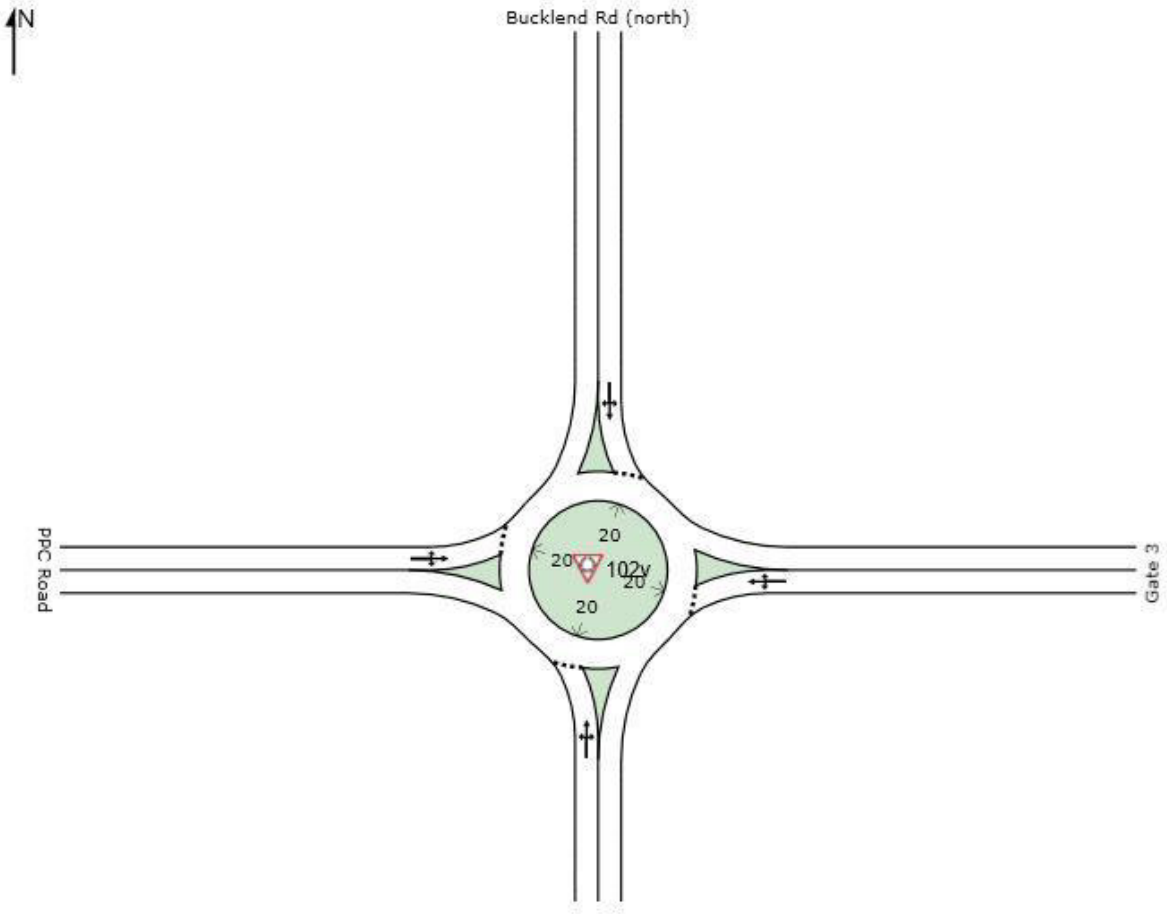
APPENDIX C: SIDRA LAYOUTS

SITE LAYOUT

Site: 102v [Manukau Rd/ PPC Road intersection AM]

New Site
Roundabout



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SITE LAYOUT

Site: 102v [Manukau Rd/ Kitchener Rd/ Buckland Rd intersection Proposed AM]

New Site
Roundabout