

Appendix F – Integrated Transportation Assessment



Waikato Racing Club Incorporated

**Plan Change 13: Te Rapa Racecourse Medium
Density Residential Plan Change**

Integrated Transport Assessment




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1. Executive Summary

Bloxam Burnett & Olliver (BBO) has been commissioned by Waikato Racing Club Incorporated (WRCI) to prepare an Integrated Transport Assessment (ITA) to support a Plan Change application to Hamilton City Council to enable the rezoning of approximately 6.48 hectares (ha) of the Te Rapa Racecourse site from Major Facilities Zone to Residential Zone.

The development concept plan envisages approximately 200 residential dwellings to be developed based on a mix of single dwellings, townhouses and apartments. While these dwellings are located close to the racecourse and may have a degree of interaction with it, most of the dwellings are likely to have no direct integration with the Te Rapa Racecourse.

When completed, the proposed residential development is expected to generate approximately 1,500 vehicle trips per day and 160 trips per peak hour.

Access to the subject site is proposed via the existing access to the racecourse at Ken Browne Drive and a new access intersection at Sir Tristram Avenue approximately 90 m southwest of the Te Rapa Road / Sir Tristram Avenue intersection.

Overall, this ITA finds that the transportation effects on the adjoining road network enabled by the proposed rezoning can be managed and mitigated to an acceptable level subject to appropriate mitigation measures being adopted.

On that basis, the following transportation infrastructure and triggers are recommended for mitigating the future transport effects of the proposed rezoning:

Access Road Upgrades

- A no-parking restriction is introduced along the southwest side (northbound lane) of the Ken Browne Drive.
- The existing footpath on the north-eastern side of Ken Browne Drive be extended 75 m to the proposed access to the Plan Change area and be connected to the residential development footpaths.
- The existing footpath on the northern side of Sir Tristram Avenue should be extended for approximately 115 m running alongside Fairview Motors property to provide a connection to public transport on Te Rapa Road.
- Provide a walking and cycling shared path on the southern side of Sir Tristram Avenue between the proposed residential access intersection and the service lane, and along the Te Rapa service lane to a zebra crossing on a raised safety platform (RSP) across the service lane.
- Connect the shared path to a new mid-block RSP staggered signalised crossing across Te Rapa Road. (The introduction / implementation of a RSP at this location will be subject to a Road Safety Audit and Council's decision)
- Kerb let-downs (pram crossings) are required on Sir Tristram Avenue where pedestrians will cross between the footpaths on each side of the road.
- A landscape plan should be submitted to Council for approval as part of the design for subdivision consent, to identify the trees to be removed to accommodate the new access intersection on Sir Tristram Avenue.
- The existing racecourse site access at Mainstreet Place should be permanently closed.



Intersection Upgrades

- Te Rapa Road / Sir Tristram Avenue intersection to be upgraded to ban the right turn movements out onto Te Rapa Road. A conceptual design of the proposed Te Rapa Road / Sir Tristram Avenue intersection is presented in Figure 43.
- The movements at the intersection will be limited to left-in, left-out and right-in movements only.

Table No: 1

Staging of Transportation Infrastructure Improvements		
No.	Proposed Upgrade	Development Stage Trigger
1	Upgrading of Te Rapa Road / Sir Tristram Avenue intersection (Refer to Figure 43)	When access to Sir Tristram Avenue is provided. <i>OR</i> After 70 trips per peak hour is generated by the proposed development through Te Rapa Road / Garnett Avenue / Vardon Road intersection (i.e. approximately 60 dwellings) *
2	Extension of existing footpath on the north-eastern side of Ken Browne Drive to connect to residential development	Before any residential traffic is generated by the Plan Change area.
3	Extension of existing footpath on the northern side of Sir Tristram Avenue to the existing bus stop located 110 m northwest of Te Rapa Road / Sir Tristram Avenue intersection	When access to Sir Tristram Avenue is provided.
4	Construction of new shared path on the southern side of Sir Tristram Avenue to the Te Rapa service lane; Provision of a raised safety platform pedestrian crossing (zebra) across the service lane. Provision of a raised safety platform staggered mid-block signalised crossing over Te Rapa Road (Refer to Figure 36)	When access to Sir Tristram Avenue is provided.

* This is based on the predicted trip distribution (Figure 26) to Te Rapa Road / Garnett Avenue / Vardon Road intersection and the assumption that Ken Browne Drive access will be provided from the outset.



2. Introduction

WRCI seek to rezone approximately 6.48 hectares (ha) of the Te Rapa Racecourse site in Hamilton from Major Facilities Zone to Residential Zone for subsequent medium density residential development.

This Integrated Transport Assessment (ITA) supports a Plan Change application by WRCI to Hamilton City Council (the Council) to enable the proposed rezoning and is in general accordance with Table 15-2b in Appendix 15 of the Council's Operative District Plan (District Plan). The report provides an assessment of the traffic and transport aspects of the proposed rezoning, which include:

- The local transport environment surrounding the subject site;
- An estimation of the predicted trip generation;
- The effects of the Plan Change proposal on the wider road network; and
- The proposal's alignment with the District Plan's transportation related rules and provisions.

2.1 Background

The WRCI is the owner and operator of the Te Rapa Racecourse. The racecourse is the only horse racing events venue in Hamilton and an important resource for the City and the Waikato Region. The WRCI has been in existence since 1924 and currently hosts approximately 18 race days a year.

WRCI have identified that there is a surplus of land at the Te Rapa Racecourse site which is currently not being efficiently utilised. WRCI wishes to make provision for part of that land to be developed for medium density residential uses which will be complementary to its core business activities at the Te Rapa Racecourse site. The racecourse intends to continue to operate at its current location, hosting a number of racing events throughout the year.

Initial work on the plan change was undertaken in 2018. A draft ITA prepared by BBO was submitted to the Council back in May 2018 and it was peer reviewed by Gray Matter. An updated ITA (dated July 2019) was prepared in response to the peer review addressing the issues raised by Gray Matter. However, this was not submitted to Council as the project was put on-hold.

This assessment which is an update of the earlier ITA details the changes to the Plan Change proposal and addresses the traffic and transportation effects due to the current proposal. The comments previously received via the peer review have also been taken into consideration in this ITA. The main change since the original ITA is the industrial component of the proposal has been removed from this application and the concept plan has been updated. To address the peer review comments, an assessment of the proposed cross-sections for Sir Tristram Ave and Sir Ken Browne Drive, and additional information on the Te Rapa Road / Sir Tristram Avenue intersection has been included in this report.



3. Existing Transportation Environment

3.1 Site Location

The proposed Plan Change area (“subject site”) is located to the west of Te Rapa Road and is bounded to the north and west by Sir Tristram Avenue and Te Rapa Racecourse respectively. The site is approximately 6.48 ha in size and is currently accessed via Ken Browne Drive.

The locality of the subject site is shown in Figure 1.



Figure 1: Site Locality

3.2 Existing Land Use

The subject site is zoned Major Facilities in the District Plan in which residential developments are not permitted activities.

Properties to the north and east of the racecourse are predominantly occupied by a range of small to medium sized light industrial and commercial activities. One of the commercial premises which is along Te Rapa Road adjacent to the racecourse is owned by the WRCI through its subsidiary company Mainstreet Place LP. That site is currently occupied by Signature Homes.

The properties which immediately adjoin the racecourse to the south-east are located off Ken Browne Drive. Properties on the eastern side of Ken Browne Drive include commercial offices and the property on the western side of Ken Browne contains the Forest Lake Gardens Retirement Village, which includes apartments and villa units fronting onto the racetrack. The Bupa Foxbridge Retirement Village is located south of the racecourse (i.e. further west along Minogue Drive).



3.2.1 Consented Activity

A resource consent was recently granted to WRCI for the establishment of a childcare facility at #4-6 Sir Tristram Avenue. The site is consented for a childcare business, a small office, a workshop area and a 45-space car park. The childcare facility is consented to accommodate 120 children and 24 employees. The facility is now constructed and operational.

The childcare consent application ITA by Stantec identifies that the development is expected to generate between 90 to 176 vehicles per hour (vph) for any given peak hour. The ITA recommended safety improvement works to the Te Rapa Road / Sir Tristram Avenue intersection to mitigate the potential effects of the development. The approved changes are further discussed in 7.7.1.

As outlined in more detail in the AEE, the land is currently zoned Major Facilities and the District Plan permits major events and activities associated with the racecourse as of right. There is no limitation on the frequency or number of those events. They could generate significantly more traffic than the proposed plan change. This creates a 'permitted baseline' against which traffic effects may be assessed. However, given there is uncertainty over the nature of those events, they have not been specifically considered in this assessment. The current zoning does however mean that this assessment is conservative.

3.3 Existing Road Network

The existing network of roads surrounding the subject site that could potentially be affected by the proposed Plan Change are described in this section.

3.3.1 Roads

Te Rapa Road is considered a strategically important road corridor through the area. It is identified as part of Council's Strategic and Sensitive Transport Network and is classified as a Major Arterial Transport Corridor in the District Plan road hierarchy. The estimated AADT volumes along the section of the road between Garnett Avenue and Sir Tristram Avenue are 15,600 vpd (northbound) and 13,200 vpd (southbound) based on Mobile Road website. This section of Te Rapa Road has a posted speed limit of 60 km/h.

Ken Browne Drive is a two-way road that provides access to Te Rapa Racecourse. It is classified as a Local Transport Corridor in the District Plan road hierarchy with a posted speed limit of 50 km/h. The estimated AADT volume along Ken Browne Drive is 272 vpd based on Mobile Road website. The road has a sealed width of approximately 7.5 m and there is no painted centreline. In addition to providing access to Te Rapa Racecourse, Ken Browne Drive provides access to a number of commercial premises which are located on the north-eastern side of the road. A footpath connects these premises to Garnett Avenue and the north-eastern side of the road has a no-parking restriction. The south-western side of Ken Browne Drive generally is observed with continuous parked vehicles during weekday work hours, most likely associated with the commercial premises on the northeast side of Ken Browne Drive.

Sir Tristram Avenue is a tree-lined, local two-way road which connects Te Rapa Road to Te Rapa Racecourse. The road has gated access at its western terminus and primarily services the racecourse. Sir Tristram Avenue is identified as a Local Transport Corridor in the District Plan road hierarchy with a posted speed limit of 50 km/h. The estimated Annual Average Daily Traffic (AADT) volume along this road is 388 vehicles per day (vpd) based on information obtained from Mobile Road website. The road has an approximately 7.4 m sealed carriageway but no centreline markings. On the southern side of the road there is a 5.8 m wide grass berm which is planted with mature trees. On the northern side of the road, a 1.5 m wide footpath that begins 6.5 m west of the vehicle access to 2 Sir Tristram Avenue / 471 Te Rapa Road and terminates outside the western boundary for 8 Sir Tristram Avenue.



Garnett Avenue is a two-way, two-lane road with approximately 3.3 m lane widths and 1.3 m sealed shoulders. It is classified as a Local Transport Corridor in the District Plan road hierarchy with a posted speed limit of 50 km/h. Garnett Avenue (the south-western arm of the Te Rapa Road / Garnett Avenue / Vardon Road signalised intersection) has an estimated AADT volume of 5,600 vpd based on Mobile Road website.

3.3.2 Intersections

The Te Rapa Road / Garnett Avenue / Vardon Road intersection is a signalised intersection with all approaches having two or more lanes. Pedestrian crossing is permitted on all approaches except on the north-western Te Rapa Road approach. Figure 2 illustrates the existing intersection layout.

The Te Rapa Road / Sir Tristram Avenue intersection is a large give way controlled 'T' intersection with Te Rapa Road being the main road and Sir Tristram Avenue being the minor side road. The intersection is complicated by the presence of Northbound service lanes on the west side of Te Rapa Road. The terminology used in Figure 2, Figure 3 and Figure 4 will be consistent throughout this report.

The intersection of Ken Browne Drive with Garnett Avenue and Minogue Drive is controlled by a roundabout. The roundabout is four-legged and has one circulating lane. Each leg has a single approach lane and a single departure lane. The intersection is illustrated in Figure 4.



Figure 2: Te Rapa Road / Garnett Avenue / Vardon Road Signalised Intersection





Figure 3: Te Rapa Road / Sir Tristram Avenue Intersection



Figure 4: Ken Browne Drive / Garnett Avenue / Minogue Drive Roundabout



3.3.3 Accesses

There are currently three accesses to Te Rapa Racecourse via Ken Browne Drive, Sir Tristram Avenue and Mainstreet Place.

Ken Browne Drive is the southern access to the subject site and the primary access for non- racing club visitors to enter the site. The existing access into the racecourse site from Ken Browne Drive is sealed, initially to a width of 7.5 m before narrowing to approximately 5.5 m. Figure 5 shows the existing Ken Browne Drive access.



Figure 5: Existing Ken Browne Drive Access

The racecourse site can also be accessed via Sir Tristram Avenue, with an access gate located at the western terminus of the road. Horse floats and members enter from Sir Tristram Avenue. The site access is sealed to a variable width of between 8.0 m and 8.5 m. Vehicle access via Sir Tristram Avenue is usually gated except during race days. Figure 6 illustrates the existing Sir Tristram Avenue access.





Figure 6: Existing Sir Tristram Avenue Access

The racecourse site has approximately 120 m frontage to Mainstreet Place which is set aside as ‘road to vest’ (in the Council). The road to vest has been formed and sealed to a 7 m wide standard with kerb and channel edges. The road to vest is a continuation of Mainstreet Place, extending from the southern part of the cul-de-sac. This access is proposed to be closed as part of the proposed Plan Change. Figure 7 shows the existing Mainstreet Place access.



Figure 7: Existing Mainstreet Place Access



3.4 Existing Transport Modes

3.4.1 Public Transport

The locality is well served by public transport (PT) with bus stops being located on Garnett Avenue outside the Te Rapa shops and along Te Rapa Road (nearer to Sir Tristram Avenue intersection). Access to public transport is recommended to be within 600 m of walking distance as per the *Waikato Regional Public Transport Plan 2018 – 2028*. The approximate existing walking distances from the subject site to the nearest bus stops are presented in the figure below and they are all within the maximum requirement.



Figure 8: Approximate Existing Walking Distances to Nearest Bus Stops

The Garnett Avenue pair of bus stops are currently served by a single public service, 18 Te Rapa. This service travels between the Hamilton Transport Centre and The Base. It operates at 30-minute intervals during weekday commuter peaks.



There is an existing footpath on the eastern side of Ken Browne Drive which begins from the access to 11 Ken Browne Drive and continues through Garnett Avenue to provide connection to the bus stops.

The pair of bus stops on Te Rapa, closest to the subject site, are located opposite the Te Rapa Road / Sir Tristram Avenue intersection on the eastern side of Te Rapa Road, and approximately 20 m north of Fairview Motors' access on the western side of Te Rapa Road. These bus stops are currently served by the Comet route and the 21 Northern Connector.

Bus stops along the Comet route are served every 15 minutes between the Hospital and The Base via the Hamilton Transport Centre between 6.30 a.m. to 7.00 p.m. during weekday commuter peaks and half hourly on evenings and weekends. Comet buses also service the Mahoe and Glenview areas. The 21 Northern Connector is a regional service that provides service from the Hamilton Transport Centre to Huntly, Te Kauwhata and Pukekohe via The Base. The weekday services are provided every 35 minutes outside of the two-weekday commuter peak periods. More frequent services are provided during the weekday commuter peak periods.

There are no footpaths connecting to these bus stops, with passengers being required to walk north along the service lane to access the bus stop near Fairview Motors. To access the bus stop on the opposite side of Te Rapa Road, passengers must walk south along the service lane to the signalised crossing at Te Rapa Road / Home Straight intersection, to cross the road and walk north again along the footpath to the bus stop.

3.4.2 Walking and Cycling

Ken Browne Drive includes a 2 m wide pedestrian footpath for approximately 125 m from Garnett Ave, set back from the north-eastern boundary of the carriageway. There is no footpath on the southwest side of the road. There are no cycle lanes on Ken Browne Drive, but it is a low-speed local road environment, so cyclists safely share the road space with vehicles.

The Garnett Avenue connector to Te Rapa Road has pedestrian footpaths on both sides of the road. This section of Garnett Avenue also has approximately 1.3 m wide cycle lanes in addition to roadside parking bays on the outer edges of the carriageway.

The Garnett Avenue connector to Dalgliesh Avenue also has pedestrian footpaths and cycle lanes on both sides of the road. Roadside parking is variously provided throughout this section, either as part of the formed carriageway, or as recessed parking bays.

Minogue Drive has a 1.8 m wide pedestrian footpath on the northern side of the road providing connections to the retirement villages. There are no cyclist facilities on Minogue Drive.

Sir Tristram Avenue has a 1.5 m wide pedestrian footpath set back from the northern boundary of the road but has no footpath on the southern side of the carriageway. No cycling lanes are present along Sir Tristram Avenue.

Te Rapa Road, the section between Garnett Avenue and Sir Tristram Avenue, has a pedestrian footpath on the eastern side of Te Rapa Road and 1.2 m to 1.5 m wide on-road cycle lanes on both sides of the road.

3.5 Existing Traffic Volumes

The traffic volumes that were incorporated in the ITA that was initially submitted (May 2018) to Council were based on intersection count surveys undertaken in October 2017. Therefore, for the purpose of this



assessment, intersection count surveys were undertaken again to ensure traffic volumes are adequately up-to-date and can sufficiently support the analysis carried out in this report.

3.5.1 Intersection Volumes

SCATS count information was obtained from Council for the month of May 2021 to determine the peak hour traffic volumes at the Te Rapa Road / Garnett Avenue / Vardon Road signalised intersection. Figure 9 and Figure 10 provide a summary of the average approach and exit hourly flows at the intersection for the weekday AM and weekday PM peak periods respectively.

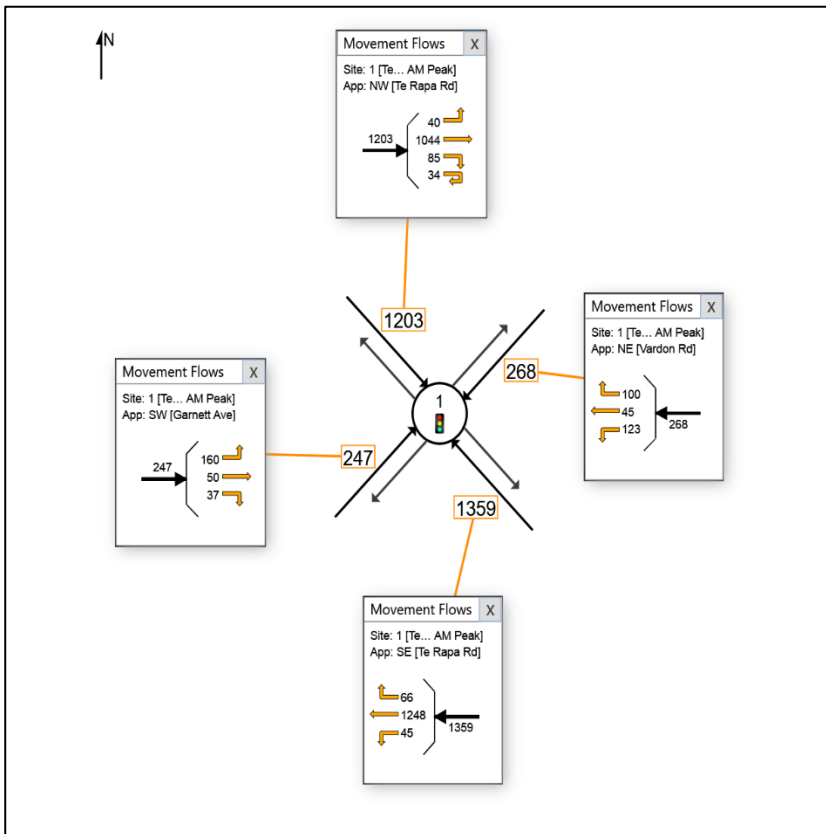


Figure 9: Existing Weekday AM Peak Hour Volumes at Te Rapa Road / Garnett Avenue / Vardon Road Intersection



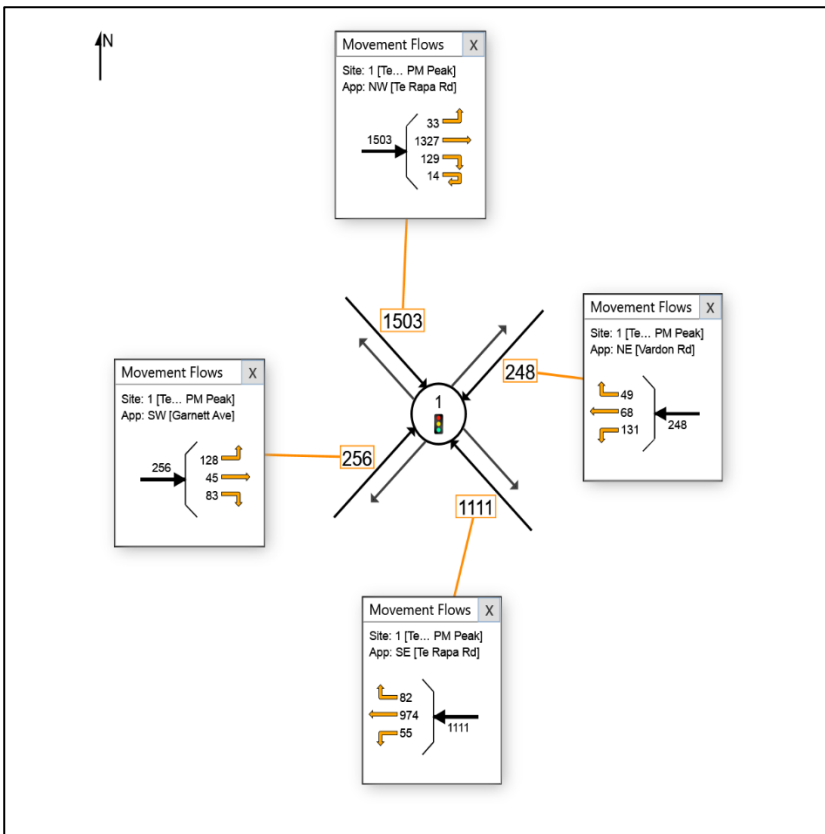


Figure 10: Existing Weekday PM Peak Hour Volumes at Te Rapa Road / Garnett Avenue / Vardon Road Intersection

Intersection count surveys were undertaken on the 7th and 8th of July 2021 to determine the peak hour traffic volumes at the Ken Browne Drive / Garnett Avenue / Minogue Drive roundabout and the Te Rapa Road / Sir Tristram Avenue intersection. Figure 11 to Figure 14 provide a summary of the 2021 turning movement counts at these intersections for the weekday AM and PM peak periods.



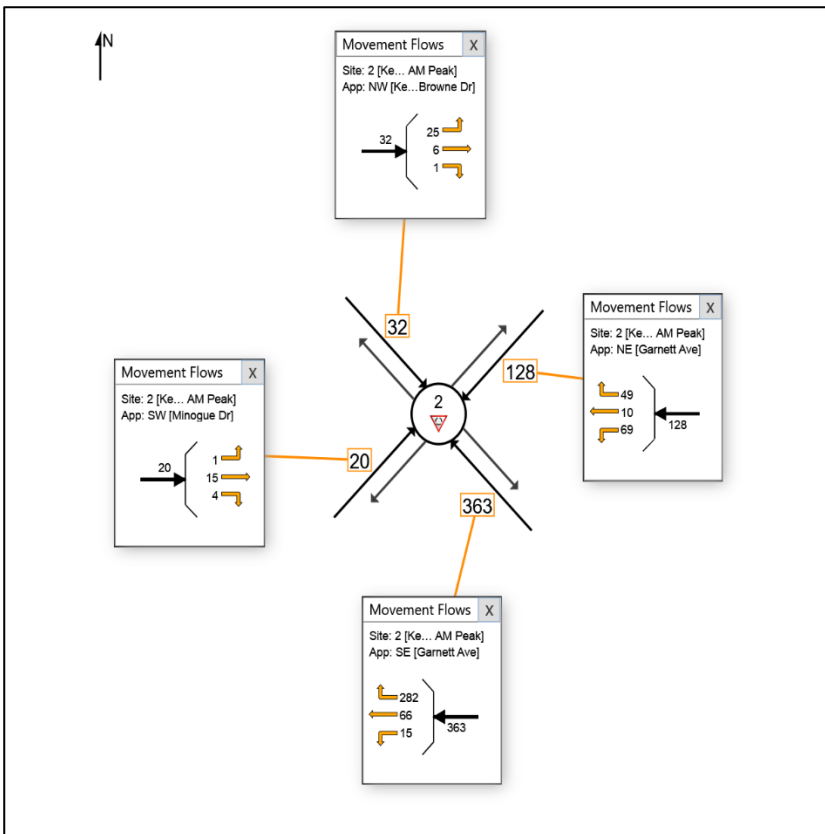


Figure 11: Existing Weekday AM Peak Hour Volumes at Ken Browne Drive / Garnett Avenue / Minogue Drive Roundabout

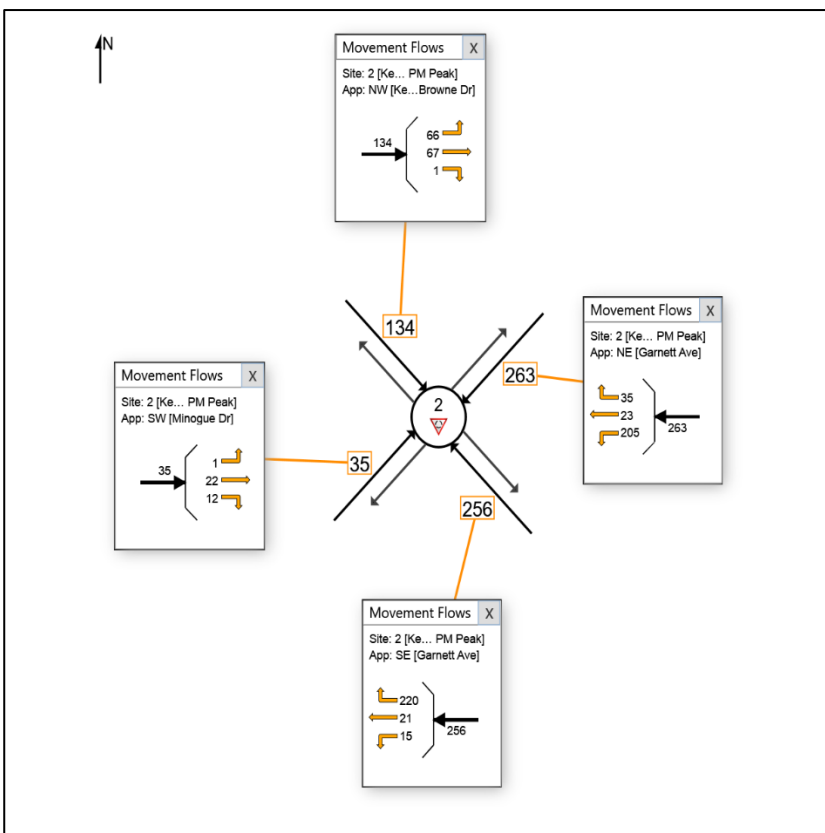


Figure 12: Existing Weekday PM Peak Hour Volumes at Ken Browne Drive / Garnett Avenue / Minogue Drive Roundabout



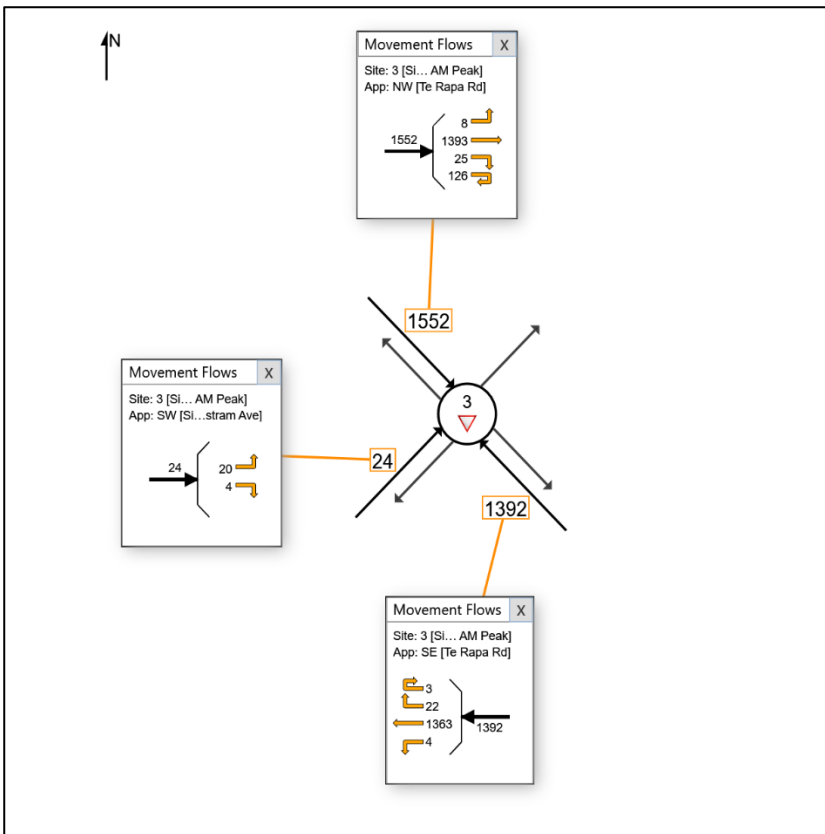


Figure 13: Existing Weekday AM Peak Hour Volumes at Te Rapa Road / Sir Tristram Avenue Intersection

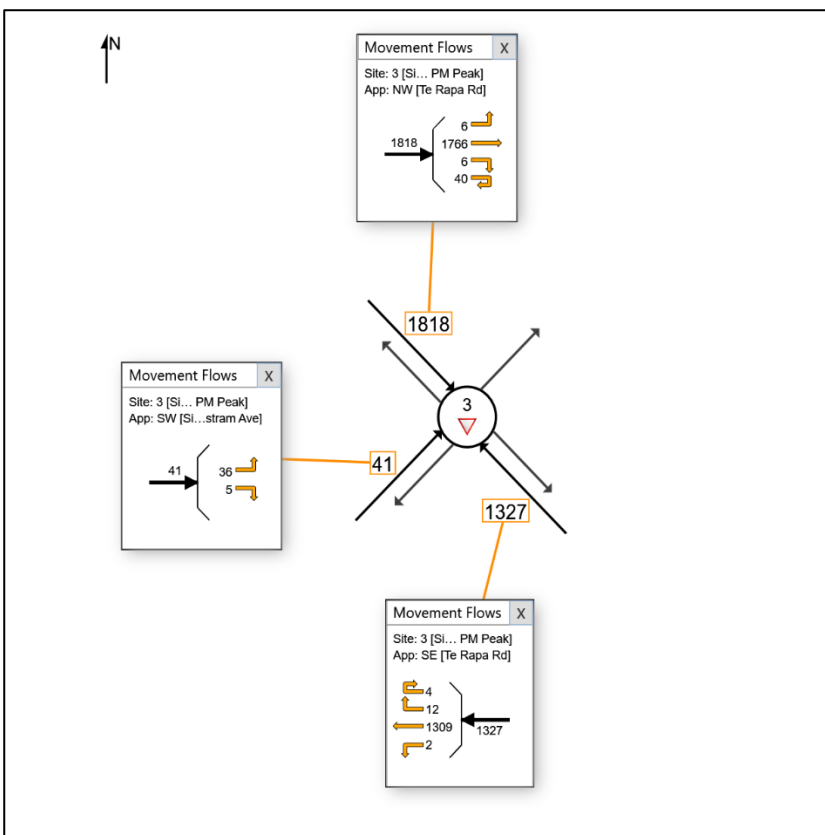


Figure 14: Existing Weekday PM Peak Hour Volumes at Te Rapa Road / Sir Tristram Avenue Intersection



3.5.2 Observed Traffic Patterns

The following observations were made from the SCATS and intersection count survey data related to traffic characteristics of the three intersections:

- The busiest flows at the Te Rapa Road / Garnett Avenue / Vardon Road intersection are along Te Rapa Road with a large volume of vehicles travelling north during the AM peak period and in the opposite direction during the PM peak period.
- The heaviest flows at the Ken Browne Drive / Garnett Avenue / Minogue Drive roundabout are between the two Garnett Avenue legs with a larger percentage of vehicles travelling from the south-eastern approach to the north-eastern approach.
- The busiest flows at the Te Rapa Road / Sir Tristram Avenue intersection are along Te Rapa Road with the southbound traffic flows heavier than the northbound. A popular traffic movement at this intersection is the U-turning vehicles travelling southbound on Te Rapa Road. These vehicles initially appear to be turning right into Sir Tristram Avenue but instead end up either U-turning onto Te Rapa Road or U turning across the front of Sir Tristram Avenue and into the Service Lane past Fairview Motors. However, it is noted that the southbound U-turning movement on Te Rapa Road is currently banned as per *The Hamilton Traffic Bylaw 2015*.

3.5.3 Race Day Volumes

It is also important to analyse the effects on the Ken Browne Drive / Garnett Avenue / Minogue Drive roundabout and Te Rapa Road / Sir Tristram Avenue intersection during a race day to understand the increase in traffic volumes as well as the directional split of vehicles visiting the racecourse.

Intersection count surveys were undertaken on the 14th of August 2021 between 11.30 a.m. to 1.00 p.m. and 4.30 p.m. to 6.00 p.m. to determine the mid-day and evening peak hour traffic volumes at the identified intersections. Figure 15 to Figure 18 provide a summary of the 2021 race day turning movement counts during peak periods.



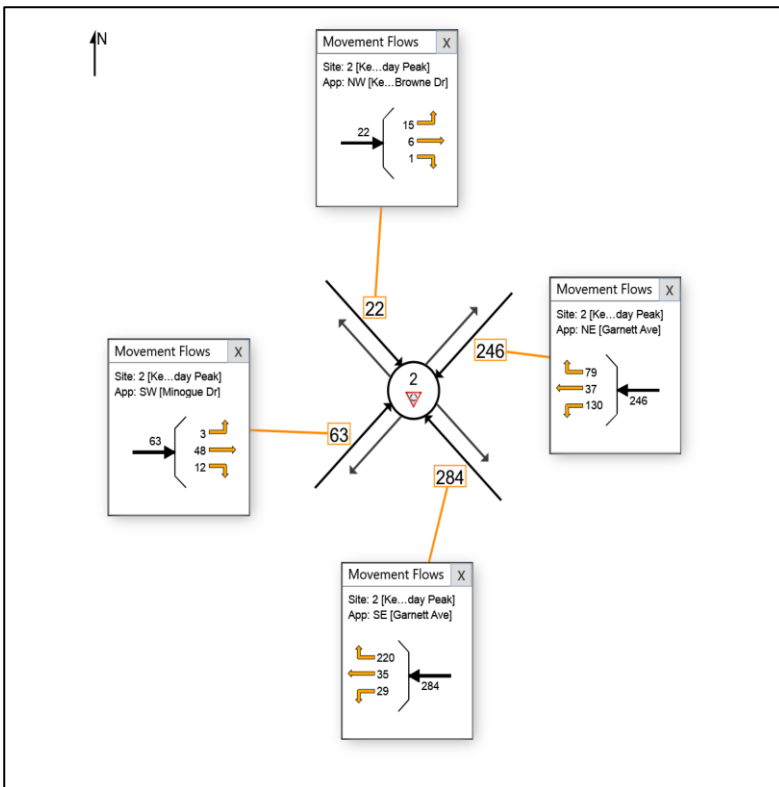


Figure 15: Race Day Midday Peak Hour Volumes at Ken Browne Drive / Garnett Avenue / Minogue Drive Roundabout

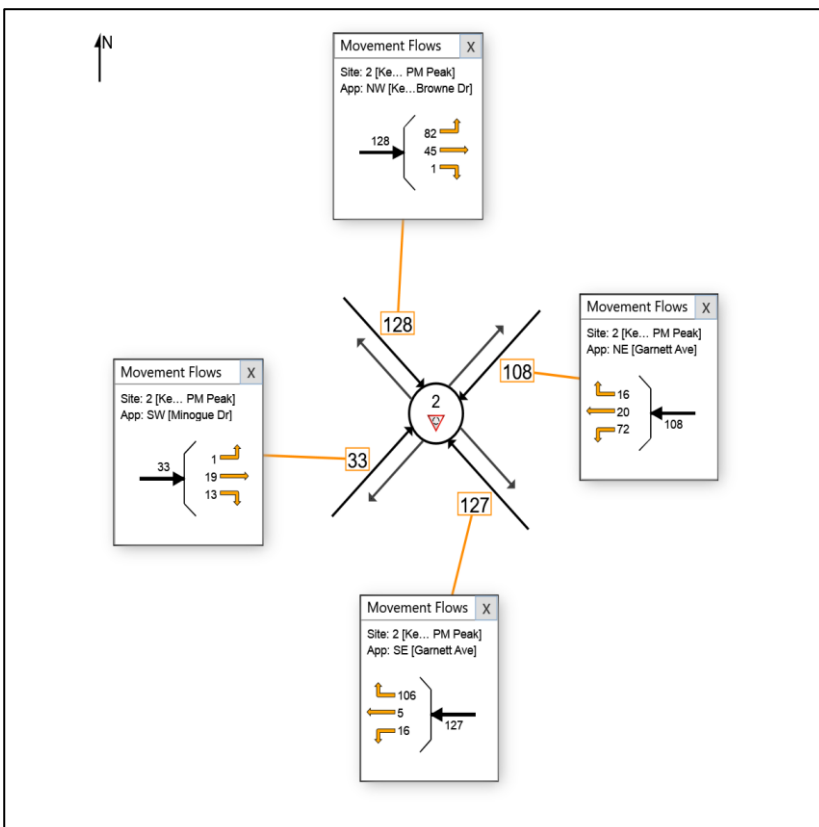


Figure 16: Existing Race Day PM Peak Hour Volumes at Ken Browne Drive / Garnett Avenue / Minogue Drive Roundabout



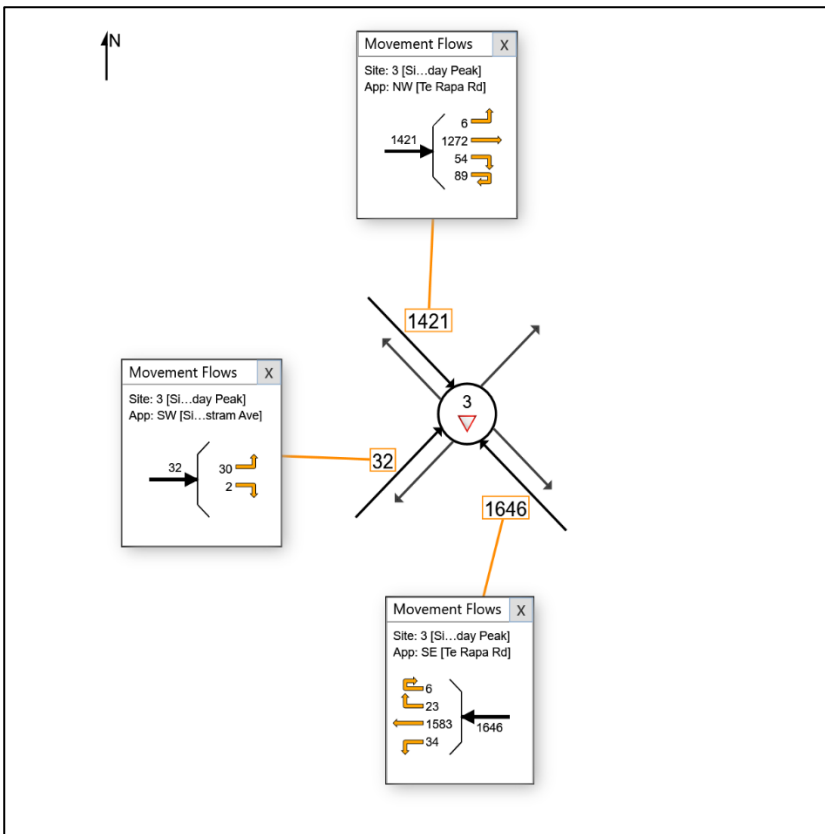


Figure 17: Existing Race Day Midday Peak Hour Volumes at Te Rapa Road / Sir Tristram Avenue Intersection

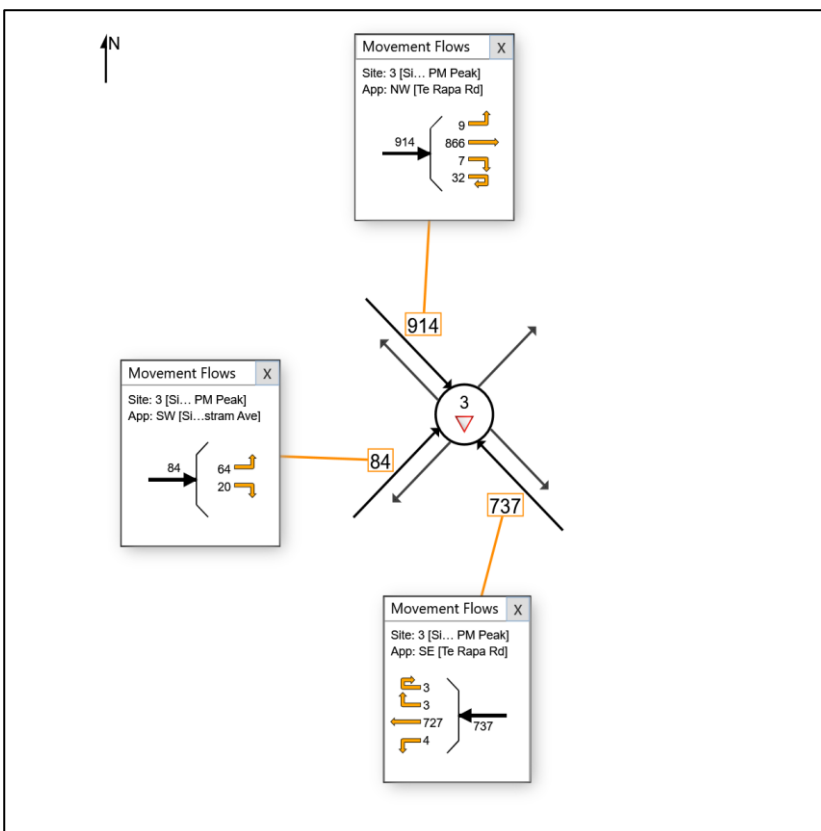


Figure 18: Existing Race Day PM Peak Hour Volumes at Te Rapa Road / Sir Tristram Avenue Intersection



3.6 Crash History

Crash data was sourced from the Waka Kotahi NZ Transport Agency’s Crash Analysis System (CAS) over a five-year period from 2017 to 2021, including available data for 2022. The study area includes all crashes along Ken Browne Drive and Sir Tristram Avenue, and the key intersections identified in the preceding sections.

Table No: 2

Crash History 2017 - 2021						
Location	Total Crashes	Crash Severity				Comments
		Death	Serious	Minor	Non-injury	
Ken Browne Dr	0	0	0	0	0	No crashes reported.
Sir Tristram Ave	0	0	0	0	0	No crashes reported
Te Rapa Rd / Garnett Ave / Vardon Rd intersection	14	0	0	1	13	Rear-end collisions were the most common crash type with drivers failing to stop or slow down for signals. This is a common type of crash at signalised intersections. The minor injury crash involved a turning vehicle onto Te Rapa Road failing to give way to a through moving vehicle.
Ken Browne Dr / Garnett Ave / Minogue Dr roundabout	1	0	0	0	1	Involved a driver intentionally crashing into another vehicle for unknown reason.
Te Rapa Rd / Sir Tristram Ave intersection	3	0	0	1	2	The minor injury involved a rear-end collision when a vehicle travelling northbound on Te Rapa Rd failed to stop or slow down for the queue ahead.

As shown in Table 2, the access roads (i.e. Ken Browne Drive and Sir Tristram Avenue) to the subject site do not appear to have any underlying road safety concerns. As for the Te Rapa Road / Garnett Avenue / Vardon Road intersection, the crash pattern observed is typical for a signalised intersection. Moreover, the crashes are attributed mostly to drivers’ negligence.



4. Proposed Plan Change

4.1 Proposal Overview

The proposed Te Rapa Medium Density Residential Zone provides the opportunity to develop a residential development adjacent to the Te Rapa Racecourse. The site location is convenient for accessing the Hamilton Central Business District, The Base shopping centre, other commercial services in Te Rapa and local amenities such as Minogue Park and the Waterworld swimming pool complex, either by car, public transport and walking or cycling.

The proposed residential development area is approximately 6.48 ha. The concept master plan (the concept plan) indicates that the likely yield is approximately 200 residential dwellings based on a mix of single dwellings, townhouses and apartments. While these dwellings are located close to the racecourse and may have a degree of interaction with it, the future occupiers may not have any direct connection to, or affiliation with the Te Rapa Racecourse.

The concept development plan for the site is illustrated in Figure 19 and also attached as Appendix A.

The proposed residential block and internal road layout generally provide active street frontages (i.e. public roads) and private rear-lanes. Active street frontages facilitate passive surveillance of public spaces and streets. As higher density housing is being sought within the plan change site, rear-lanes have been incorporated into the design. These rear-lanes help to avoid vehicle crossings, driveways and garages visually dominating streets and otherwise creating hazards for pedestrians and cyclists.

From a transportation perspective, the critical elements of the proposed rezoning are the roading connections proposed to the north and south of the subject site. The internal road will connect to Sir Tristram Avenue to the north and the southern access aligns with Ken Browne Drive. The transportation and traffic effects of this proposal are considered and discussed in the following sections of this report.





Figure 19: Proposed Concept Plan

4.2 Accesses

Access to the Plan Change area has been proposed via the existing access to the racecourse at Ken Browne Drive and a new access intersection at Sir Tristram Avenue approximately 90 m southwest of the Te Rapa Road / Sir Tristram Avenue intersection.

The daily and peak hour traffic volume using Ken Browne Drive and Sir Tristram Avenue will increase from present levels with the introduction of the proposed residential development. The effects of this increase on these local transport corridors and the intersection connections to the wider network are assessed in Section 7.5 of this report.

Although no staging plan exists for development of the area, for the purposes of this assessment, it is assumed that the Ken Browne Drive access will be the primary access (i.e. to be provided from the initial development stage) while the Sir Tristram Avenue access is a secondary access that may or may not be created at the same time as the Ken Browne Drive access. The location of Sir Tristram Avenue access is indicative at this stage and will be confirmed during detailed design, ensuring that there is minimal impact on “Notable Trees”.

4.3 Internal Road Cross- Section

The internal road network is expected to be developed in such a way that the design will reflect a low volume and low speed environment. This is intended to also discourage rat-running traffic from utilising the development’s internal road network to connect from Garnett Avenue to Te Rapa Road while avoiding the Te Rapa Road / Garnett Avenue / Vardon Road signalised intersection. General design principles that could be applied to support a safe and attractive environment for all road users include:



- Intersections within the local road network should provide a smaller radius to support a low-speed environment.
- Narrowing carriageways at certain sections and side friction from the on-street parking and residential vehicle crossings will encourage drivers to slow down.
- Mini or compact roundabouts at crossroads intersection to both reduce vehicle speeds and reduce the number of conflict points.
- Shared spaces force all road users to share the street, increasing awareness and reducing vehicle speeds.
- Ensuring that Crime Prevention Through Environmental Design (CPTED) principles are developed to increase safety for all road users.

4.3.1 Local Road

As a low trafficked roading connection that primarily provides an access function between the proposed residential development and the arterial road network (i.e. Te Rapa Road), the internal roading network would best align with the District Plan’s definition of a ‘local road’. The District Plan Appendix 15 Table 15-6a(ii) requires a Local Transport Corridor to have minimum road reserve width of 20.0 m with a 6.0 m carriageway width. The road reserve should also comprise of 2.0 m wide recessed parking bays and 1.5 m wide footpaths on both sides of the carriageway.

The proposed internal roads will be designed and constructed to a minimum road reserve width of 16.0 m with a carriageway width of 6.0 m as shown in Figure 20 and Figure 21. The roads will have at least 1.8 m wide footpaths on both sides of the carriageway. Recessed parking bays will not be provided along the entire length of the internal road. However, pockets of recessed parallel parking bays will be provided at certain sections of the road to accommodate visitor parking. The reduced road reserve width is considered acceptable in this case, as:

- The proposed development has strong walking and cycling connections to the adjoining road network.
- Occupiers’ vehicles will be parked within their respective lots.

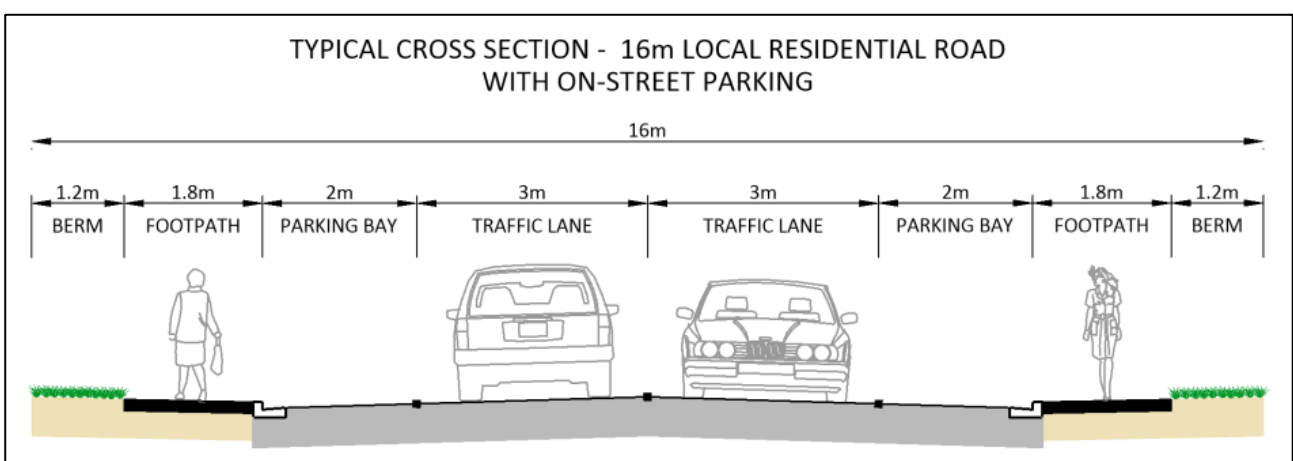


Figure 20: Typical Cross Section – 16 m Local Road with On-street Parking



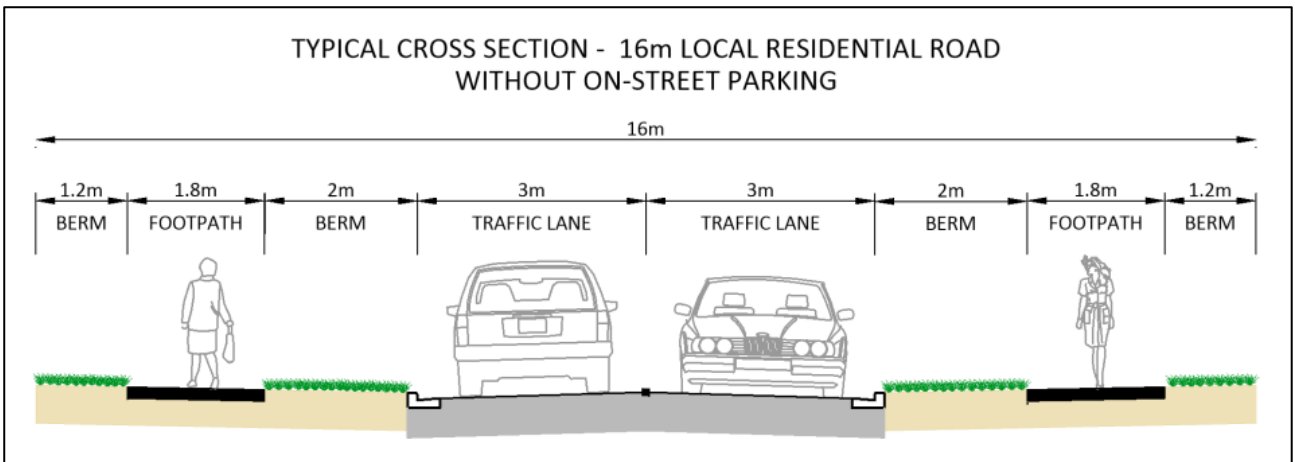


Figure 21: Typical Cross Section – 16 m Local Road without On-street Parking

4.3.2 Private Rear-Lanes

The 8 m wide roads shown in the concept plan are private rear-lanes with a minimum carriageway width of 5.5 m as shown in Figure 22. These service lanes mainly provide access to parking or garages. As illustrated in the concept plan, these rear-lanes create crossroads intersection with the local roads. This increases the number of conflict points and hence increases the risk of crashes. This assessment recommends that a median barrier with pedestrian and bicycle through route could be installed as shown in Figure 23. This would eliminate the right turns into and out from the service lanes, hence reducing the turning movement volumes (and conflict points) at the intersection.

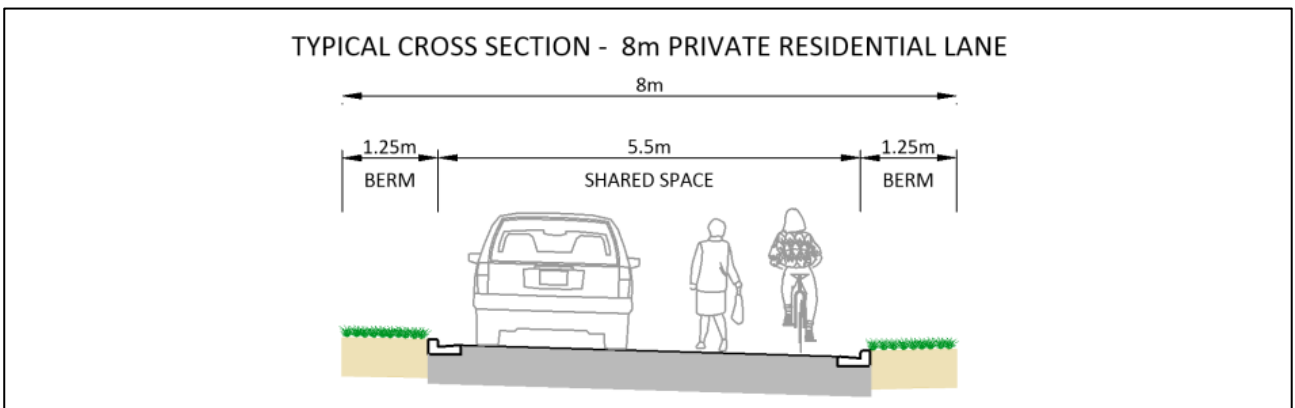


Figure 22: Typical Cross Section – 8 m Private Lane



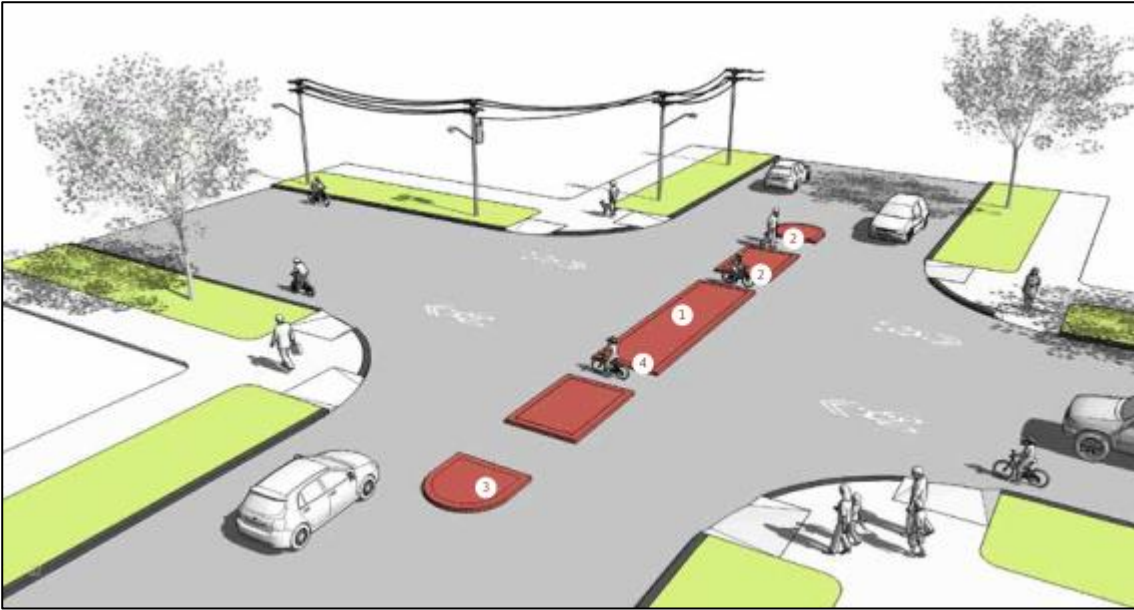


Figure 23: Median Barrier with Pedestrian and Bicycle Through Route

Detailed design of internal roads and other such transport infrastructure within the subject site will be carried out at subsequent consent application stages of the development project.

4.4 Walking and Cycling Provision

The attractiveness of walking and cycling for local trips is reliant on the accessibility of safe and convenient connections in and between the existing and proposed urban networks.

Pedestrian routes via footpaths alongside all new internal roads will be created through the subject site and connect to Ken Browne Drive and Sir Tristram Avenue. The subject site is already well served by bus routes that stop on Te Rapa Road and Garnett Avenue. Strong pedestrian connection to the bus stops on Te Rapa Road has also been proposed as part of the rezoning proposal. These connections are discussed in Section 7.5.

No cycle paths are proposed on Ken Browne Drive, Sir Tristram Avenue, or the proposed internal roads. In accordance with the District Plan guidance for Local Transport Corridors, cyclists can be safely accommodated sharing the road space with vehicles. The low-speed environment (30 - 40 km/h) that is proposed within the subject site allows vehicles and cyclists to safely share the lanes. The combination of traffic calming measures and side friction from on-street parking will reinforce the low-speed environment as is appropriate for residential streets.



5. Trip Generation

5.1 Baseline

As stated earlier, the consented childcare facility on Sir Tristram Avenue forms part of the permitted baseline along with any effects mitigation requirements of that consent. The trip generation predicted for the consented childcare facility was obtained from the ITA prepared by Stantec. The ITA predicted a total trip generation of 176 trips per peak hour for the childcare development.

5.2 Proposed Plan Change

The proposed rezoning is anticipated to yield a residential development with capacity for approximately 200 units, comprising a combination of apartments, townhouses and detached dwellings.

Trip generation data has been sourced from the *NZTA Research Report 453 – Trips and parking related to land use* (Report 453) and the *RTA Guide to Traffic Generating Developments* (RTA Guide). Report 453 states that the 50th percentile trip generation rate for an “inner suburban” residential dwelling is 9.5 trips per day per dwelling and approximately 1.1 trips per peak hour per dwelling. The RTA Guide indicates that the trip generation rate for smaller apartment units (i.e. up to two bedrooms) is approximately 0.5 trips per peak hour per unit while the trip generation rate for larger apartment units / townhouses (i.e. three or more bedrooms) is approximately 0.65 trips per peak hour per unit.

On that basis, the following trip rates were adopted for this assessment considering the assumptions about the mix of units:

Table No: 3

Trip Generation Rates						
Type of Residential Unit	Quantity (units)	Source	Trips per day per unit	Total trips per day	Trips per peak hour per unit	Total trips per peak hour
Apartment (up to two bedrooms)	55	RTA Guide	5	275	0.5	28
Townhouse (three or more bedrooms)	55	RTA Guide	6.5	358	0.65	36
Detached dwelling	90	Report 453	9.5	855	1.1	99
Total	200		-	1,488	-	163

It is anticipated that the proposed residential development will generate approximately 1,500 trips per day and 160 trips per peak hour.

It is to be noted that the predicted trip generation is based on a mix of residential dwelling types (i.e. detached dwelling, apartment units and townhouses). Therefore, it is recommended that if the proposed residential yield is increased to more than 90 detached dwellings during subdivision consent stages, then the trip generation assessment will have to be undertaken again to understand the changes to the total trip generation of the proposed development and the effects on the adjoining road network in the form of a simple ITA.



6. Trip Distribution

Access to the proposed Plan Change area is from locations to the south via Ken Browne Drive and from the north via Sir Tristram Avenue. Therefore, trips with an origin or destination in the city centre or south, east and west of the site are likely to do so via either the Te Rapa Road / Garnett Avenue / Vardon Road intersection, or via the Te Rapa Road / Storey Avenue intersection and then the roundabout at Ken Browne Drive. Trips north of the site, particularly Te Rapa Industrial area and The Base or the northeast of Hamilton (Rototuna area) can access via the Te Rapa Road / Sir Tristram Avenue intersection.

With reference to the ITE publication and RTA guide, it is reasonable to assume for the AM peak period that 25% of generated trips are attracted to the proposed residential development while the remaining 75% depart the site. During the PM peak period, around 65% of the trips generated are inbound to the site while the remaining 35% are departing.

For the purposes of this assessment, the peak hour directional split for the proposed development trips has been based on the turning movement percentages of traffic from Vardon Road. The area surrounding Vardon Road is residential and therefore provides a reasonable proxy to anticipate the direction of future movements from the proposed residential development.

On this basis, it is expected during the AM peak hour that:

- Approximately 34% of the traffic generated by the proposed residential development exiting the site will turn left from Ken Browne Drive to Garnett Avenue and subsequently turn right at Te Rapa Road to head towards the city centre.
- Approximately 13% of the additional traffic will proceed straight through from Ken Browne Drive to Garnett Avenue to access the Forest Lake and Maeroa suburbs en route to the city centre or Hamilton West.
- 28% of the imposed traffic will exit via Sir Tristram Avenue and then make a left turn towards Te Rapa Road (North).

During the PM peak hour, the survey data suggests that:

- About 33% of the traffic generated by the proposed residential development entering the site will turn left from Te Rapa Road (South) onto Garnett Avenue and then make a right turn onto Ken Browne Drive to return home after work hours.
- 18% of the additional traffic will drive straight through to Ken Browne Drive from Garnett Avenue.
- Approximately 14% of the imposed traffic will turn right from Te Rapa Road (North) to Sir Tristram Avenue and eventually turn left into the new local access road.

Figure 24 and Figure 25 illustrate the trip distribution patterns in percentages during the peak periods. Figure 26 and Figure 27 demonstrate the proposed residential development's assumed peak hour volume split.



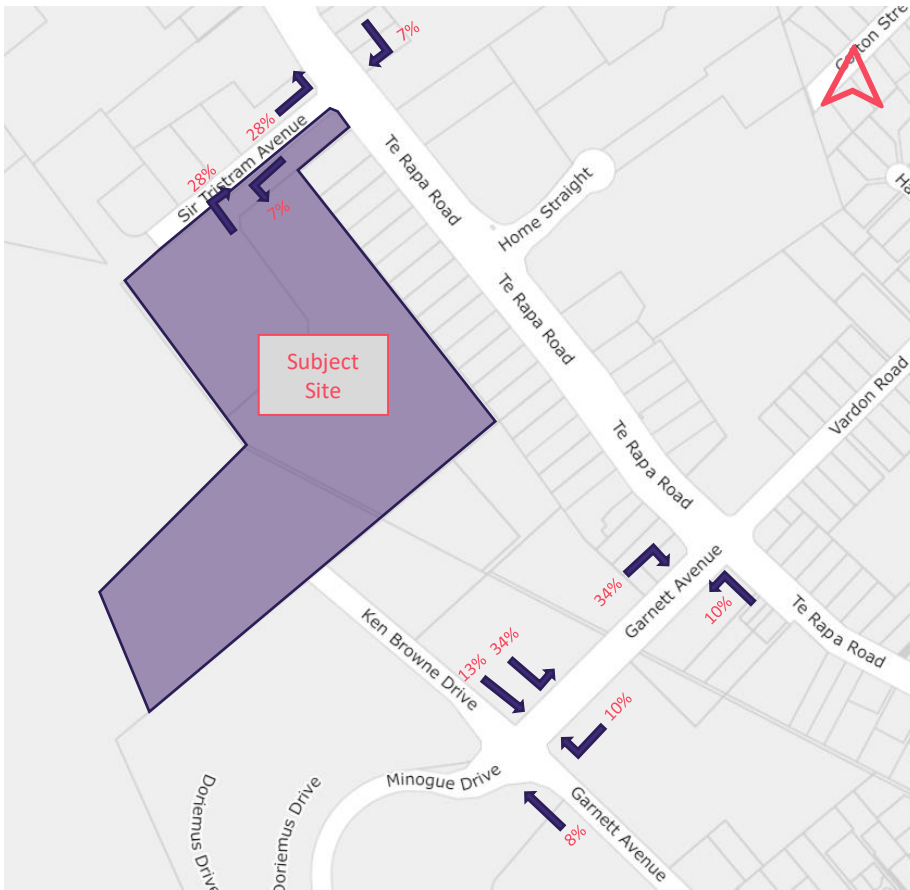


Figure 24: Weekday AM Peak Hour Trip Distribution (%)

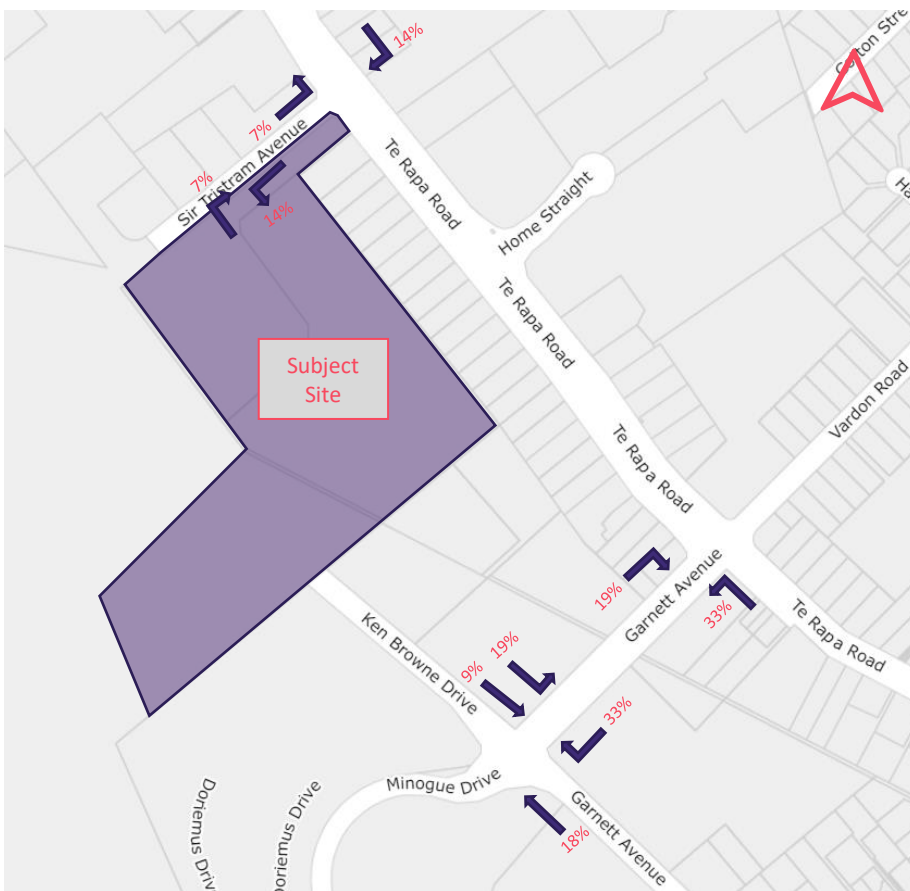


Figure 25: Weekday PM Peak Hour Trip Distribution (%)



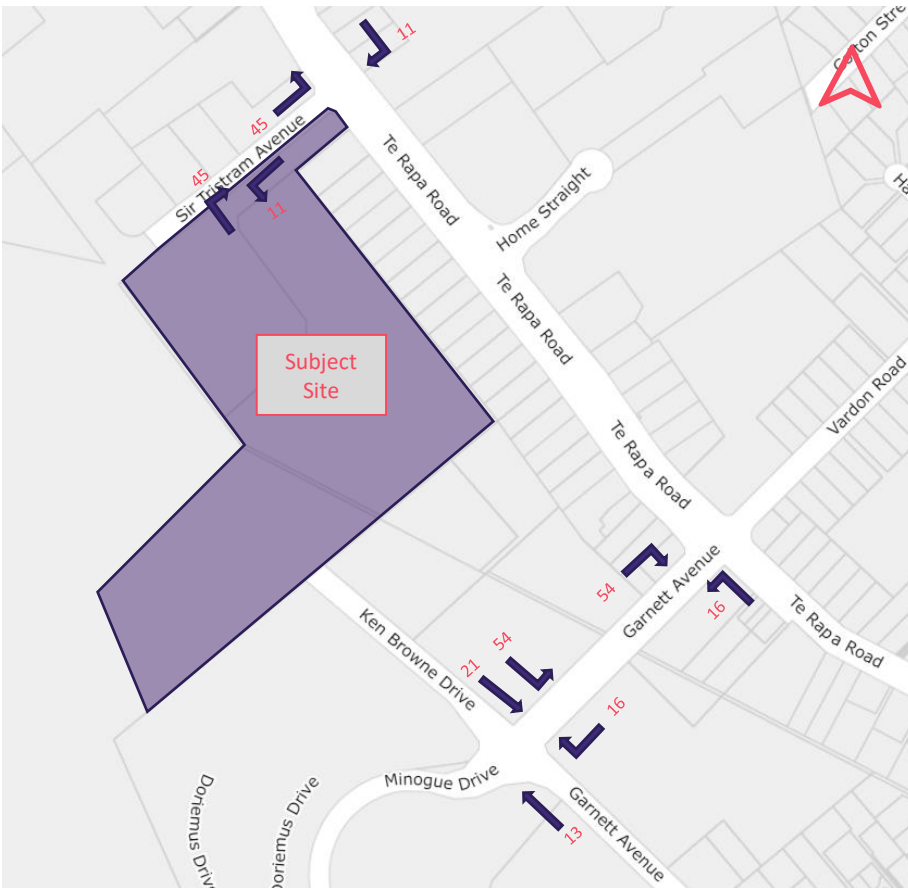


Figure 26: Weekday AM Peak Hour Trip Distribution (vph)

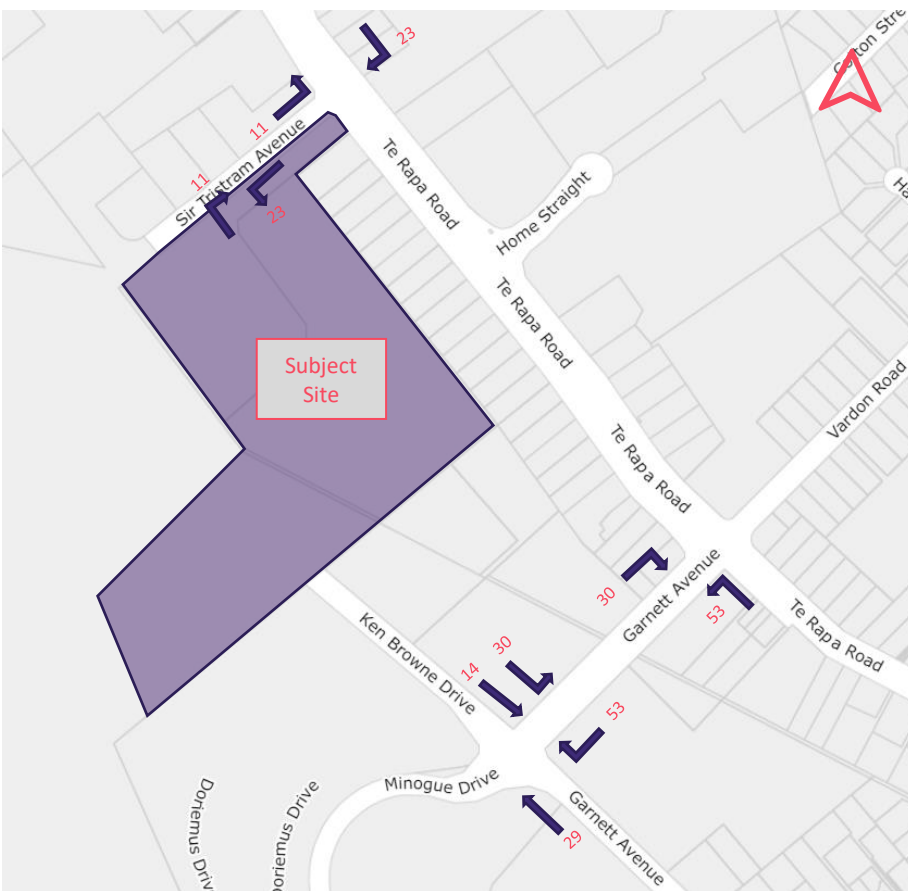


Figure 27: Weekday PM Peak Hour Trip Distribution (vph)



6.1 Racecourse Race Days

The Vardon Road traffic flows for Saturday at the Te Rapa Road signalised intersection are again deemed to be a reasonable proxy for residential traffic volume patterns at the site while racing events are being held at the adjacent racecourse. On this basis, during a typical race day approximately 70% of the trips generated by the proposed residential development during the mid-day peak hour will enter the site while 30% will depart. During the evening peak period, approximately 40% of the trips generated by the proposed residential development will head out of the site and the remaining 60% will be entering the site.

From the SCATS information obtained from Council, the mid-day peak hour turning movement percentages at Te Rapa Road are likely to be:

- Approximately 15% of development generated traffic exiting the site will turn left from Ken Browne Drive to Garnett Avenue and subsequently turn right at Te Rapa Road to head towards the city centre.
- Approximately 6% will proceed straight through from Ken Browne Drive to Garnett Avenue to access the Forest Lake and Maeroa suburbs en route to the city centre or Hamilton West.
- 9% of the imposed traffic will exit via Sir Tristram Avenue and then make a left turn towards Te Rapa Road (North).

During the PM peak hour, the SCATS data suggests that:

- About 31% of the traffic generated by the proposed residential development entering the site will turn left from Te Rapa Road (South) onto Garnett Avenue and then make a right turn onto Ken Browne Drive to return home after office hours.
- 19% of the additional traffic will drive straight through to Ken Browne Drive from Garnett Avenue.
- Approximately 10% of the imposed traffic will turn right from Te Rapa Road (North) to Sir Tristram Avenue and eventually turn left into the new local access road.

Figure 28 and Figure 29 illustrate the trip distribution patterns in percentages during race day peak periods. Figure 30 and Figure 31 demonstrate the proposed residential development's assumed peak hour volume split.

The above-mentioned trip distribution patterns on a Saturday are relatively conservative and illustrate the worst-case scenario, considering that there will be a good percentage of residents who choose to stay in at home or even proceed to the Racecourse (i.e. no external trips) on a Saturday.



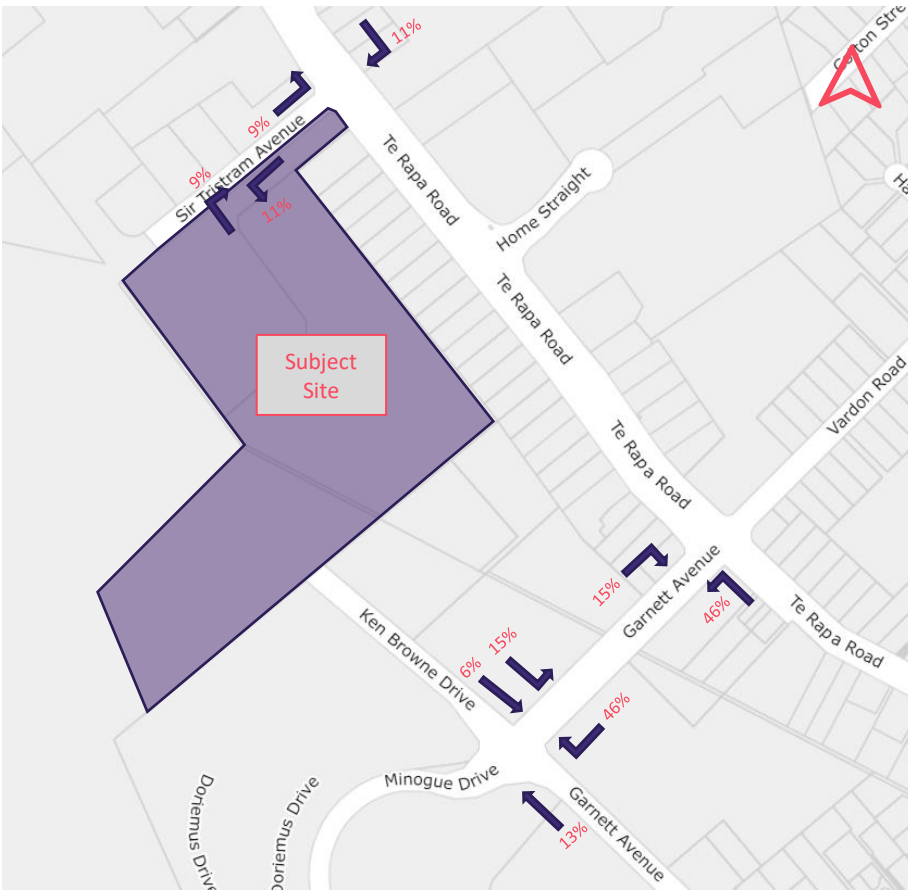


Figure 28: Race Day Mid-day Peak Hour Trip Distribution (%)

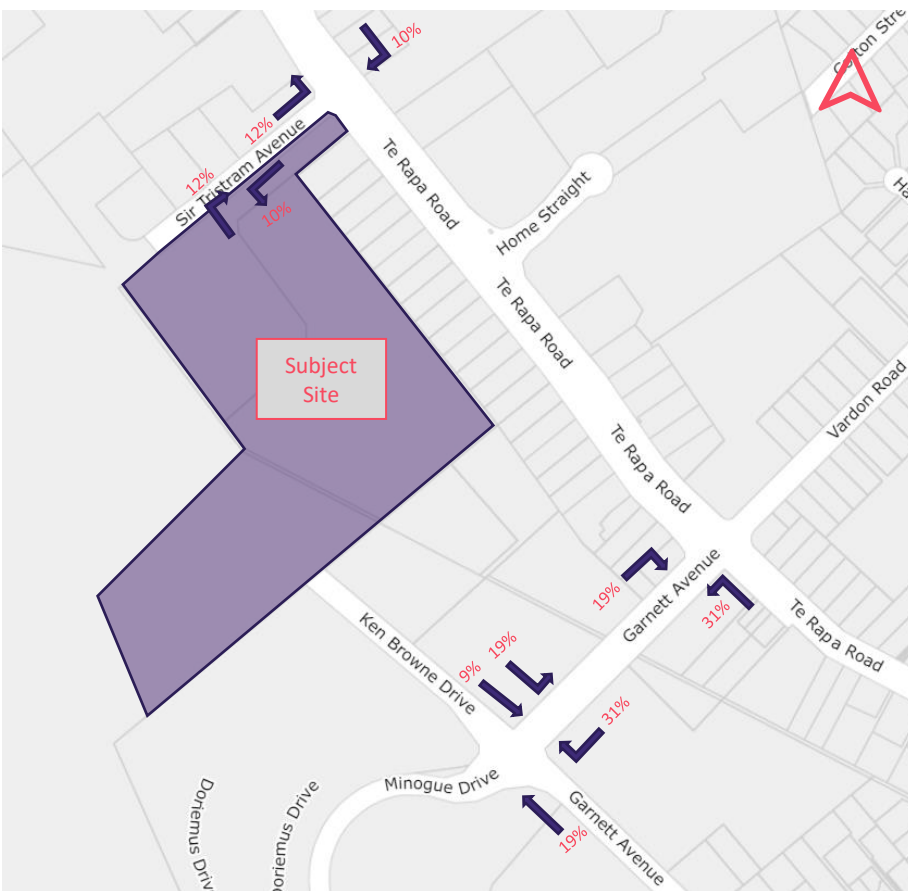


Figure 29: Race Day PM Peak Hour Trip Distribution (%)



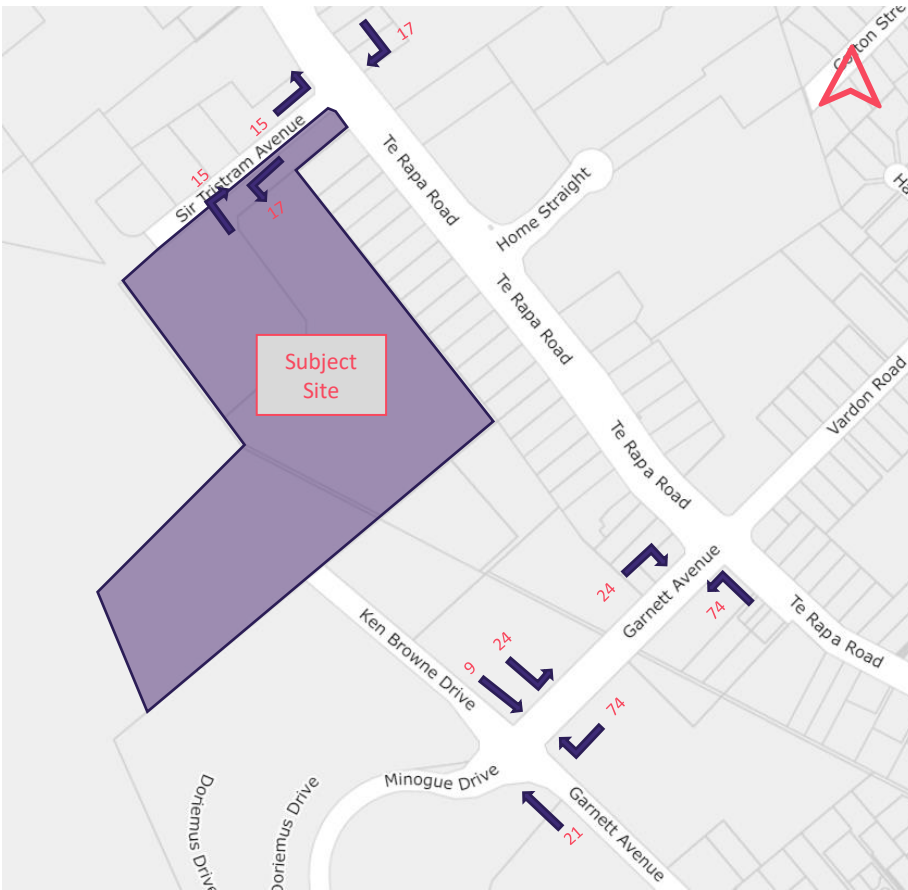


Figure 30: Race Day Mid-day Peak Hour Trip Distribution (vph)

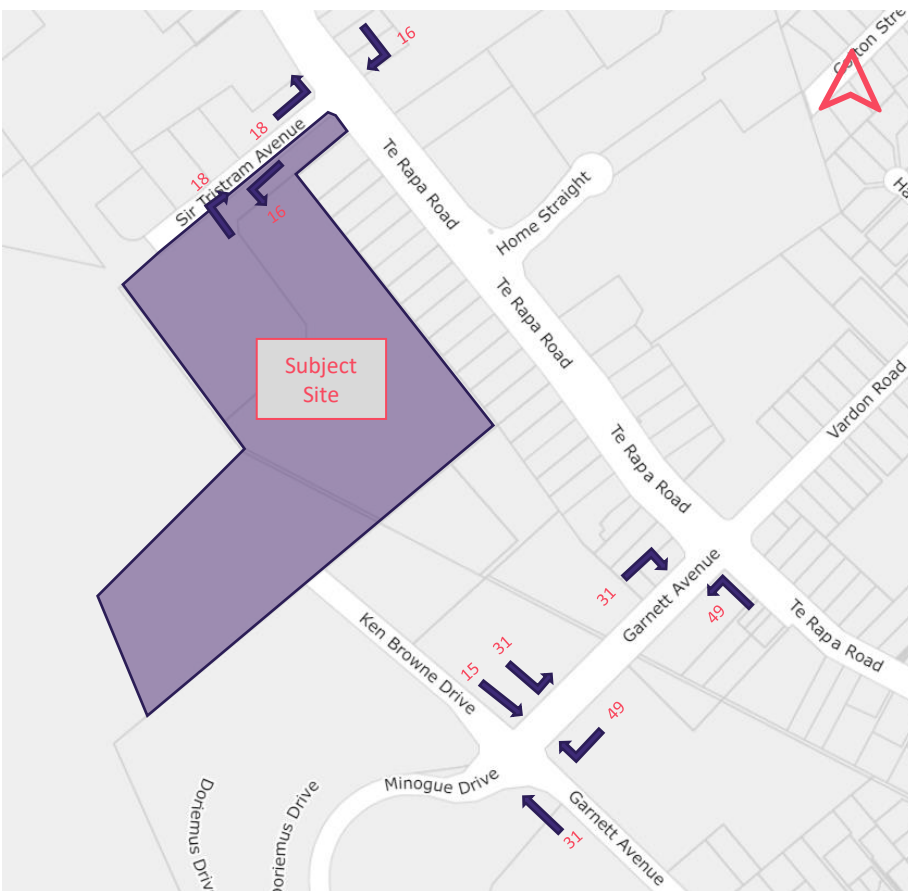


Figure 31: Race Day PM Peak Hour Trip Distribution (vph)



7. Assessment of Transportation Effects

7.1 Separation Distance

The District Plan Rule 25.14.4.1 (a)(i) requires a minimum separation of less than 2 m or more than 7.5 m between vehicle crossings on the same side of the road on a 50 km/h posted speed limit transport corridor. Access to individual allotments will be provided via the rear-lanes which do fulfil the minimum requirement. However, if the access arrangement to individual allotments were to change as part of future resource consents, the proposed development is expected to comply with the rule.

The District Plan Rule 25.14.4.1 (c) specifies a minimum separation distance of 15 m from a proposed vehicle crossing to the nearest intersection. The nearest third-party access on Ken Browne Drive (i.e. 15 Ken Browne Drive) is located approximately 75 m south-east of the proposed access intersection to the plan change area. The nearest vehicle crossing to the proposed access intersection at Sir Tristram Avenue would be that of the consented childcare facility at 4 – 6 Sir Tristram Avenue which is approximately 36 m away.

The Regional Infrastructure Technical Specification (RITS) specifies a minimum intersection spacing of 30 m on local roads. This is readily achieved by the separation distances of approximately 195 m to the Ken Browne Drive / Garnett Avenue / Minogue Drive roundabout and approximately 90 m to the Te Rapa Road / Sir Tristram Avenue intersection. Intersections within the proposed development is also expected to comply with this requirement.

7.2 Sight Distances

The District Plan Rule 25.14.4.1 (e) specifies a minimum sight distance of 60 m from vehicle crossings on a 50 km/h posted speed limit transport corridor. As a new residential development this can be achieved through the design. The Applicant should ensure that minimum sight distance required by the District Plan is complied with for the proposed rear-lanes with no physical structures (e.g. trees, services infrastructure or embankments) obstructing the required sight lines.

Austroads Guide to Road Design Part 4A – Unsignalised and Signalised Intersections requires the minimum safe intersection sight distance (SISD) to be approximately 97 m for a design speed of 50 km/h. The proposed access intersection on Sir Tristram Avenue will comply with the minimum SISD towards the Te Rapa Road / Sir Tristram Avenue intersection.

7.3 Rear-Lane Vehicle Crossings

This assessment recommends that all rear-lane vehicle crossings be formed in accordance with the RITS Section 3.3.19.3 and Drawing D3.3.1 residential standard crossing.

7.4 Parking Generation

The *National Policy Statement on Urban Development 2020* required the removal of minimum on-site parking requirements from the District Plan, with the exception to accessible car park spaces, loading and bicycle parking. It did not restrict on-site car park spaces being provided as a choice by the developer. The number of parking spaces to be provided will be determined at the detailed design stage of the development.

However, approximately 14 cycle spaces will have to be provided as per District Plan requirement for apartment units.



As for the racecourse, a parking area has been identified to the west of the proposed stormwater wetland. This area is relatively larger than the parking area that is currently available on-site. Hence, the proposed rezoning and the residential development will not affect the parking capacity of the racecourse. The land to the north of the racetrack has been identified as a location for horse truck parking in the concept plan. This land will also be used for overflow public parking on race days.

7.5 Access Road Cross-Section

Access to the plan change site has been proposed via the existing access to the racecourse at Ken Browne Drive and a new access at Sir Tristram Avenue approximately 90 m southwest of the Te Rapa Road / Sir Tristram Avenue intersection. Development of the site will inevitably increase traffic flows on both these roads. The District Plan requires local roads serving residential land use to have a minimum carriageway width of 6.0 m. It also requires the roads to have recessed parallel parking bays and 1.5 m wide footpaths on both sides of the carriageway.

7.5.1 Ken Browne Drive Access

Ken Browne Drive is currently sealed to a width of approximately 7.5 m. To accommodate the increased traffic volume on Ken Browne Drive due to the proposed Plan Change, it is recommended that a no-parking restriction is introduced along the southwest side (northbound lane) of the road.

Currently, the north-eastern side of the road has a no-parking restriction, and this should be replicated on the south-western side. The parked demand appears to be associated with workers from the commercial premises that have access from Ken Browne Drive despite the substantial amount of off-street parking that is provided on those sites. The long line of parked vehicles reduces the effective carriageway width, and although this does not cause problems at present as the Racecourse is not generating much traffic on weekdays, it may cause safety issues in future with the proposed increase in traffic from the proposed residential development.

As sufficient off-street parking is provided at the commercial premises, this assessment considers that widening the road to introduce recessed parallel parking bays on either side of the carriageway is not desirable.

A footpath currently connects the commercial premises to Garnett Avenue on the north-eastern side of Ken Browne Drive. A recommendation of this report is that the footpath be extended 75 m to the proposed access to the Plan Change area and be connected to the residential development footpaths. Initial investigations indicate that the footpath can be aligned and designed in such a manner that no tree removal is required. The berm width narrows towards the northern end of Ken Browne Drive with a steep slope towards the east. However, a 1.5 m wide footpath can still be accommodated between the kerb and tree as shown in Figure 32. Due to the presence of tree roots, it is recommended that the footpath be constructed as a boardwalk similar to that installed along Te Rapa Road (northbound) adjacent to The Base (refer to Figure 33). This assessment finds that footpath on the south-western side of the carriageway is of little benefit as there are no direct property accesses on this side of the road.





Figure 32: Proposed Footpath Extension on Ken Browne Drive



Figure 33: Existing Boardwalk adjacent to The Base



7.5.2 Sir Tristram Avenue Access

Sir Tristram Avenue has an approximately 7.4 m sealed carriageway with a pedestrian footpath set back from the northern boundary of the road but has no footpath on the southern side of the carriageway. The existing footpath on the northern side of the carriageway is recommended to be extended for approximately 115 m running alongside Fairview Motors property and leading to the existing bus stop located 110 m northwest of Te Rapa Road / Sir Tristram Avenue intersection. There is sufficient within the existing road reserve to accommodate the changes proposed as shown in Figure 34.

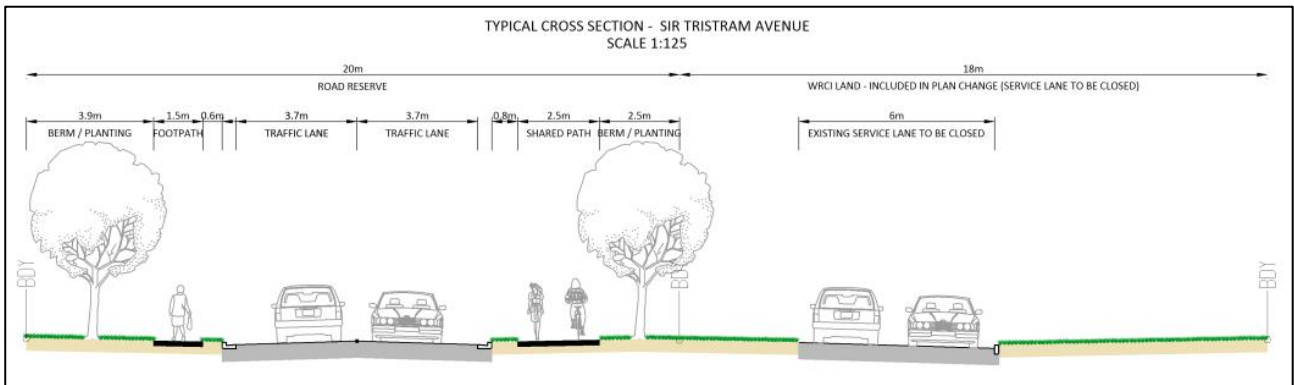


Figure 34: Typical Sir Tristram Avenue Cross Section with Proposed Changes

However, there is a pinch point along this proposed footpath route (i.e. the south eastern boundary of Fairview Motors) at which the existing berm narrows to approximately 2.5 m as shown in Figure 35. Therefore, at this location the 1.5 m wide new footpath is recommended to abut the back of kerb. This ensures that the Fairview Motors flood light pole is not in the middle of the proposed footpath and hence need not be relocated. The existing posted speed limit sign, give way sign, street name sign and street light pole will have to be relocated such that they are not positioned in the middle of the proposed footpath. Indicative locations of these signs and street light poles are shown in Drawing 144720-00-0007 (Appendix B), however the locations can be confirmed during detailed design stage.





Figure 35: Signs and Light Poles to be Relocated to Accommodate Footpath

Moreover, a 2.5 m wide shared path is proposed on the southern side of Sir Tristram Avenue from the new residential access towards the service lane and leading towards the proposed signalised mid-block crossing on Te Rapa Road which will be further discussed in the following section. This provides for a continuous and direct path for residents to the bus stop on the opposite side of Te Rapa Road (i.e. 474 Te Rapa Road).

Access to the site on the southern side of Sir Tristram Avenue will require existing trees in the existing median to be removed as shown in the Te Rapa Road / Sir Tristram Avenue intersection concept design in Figure 43 and Appendix B. A landscape plan will be prepared during detailed design stage to identify any trees to be removed to accommodate the new access, and any replacement planting required.

Recessed parallel parking bays are not recommended in this case as the only vehicles illegally parked on the northern side of the road or on the berms appeared to be associated with Fairview Motors which has a considerable amount of parking spaces within its site. The street parking is believed to be a way to advertise for sales beyond their boundary.

7.6 Walking and Cycling

Bus stops are located on Te Rapa Road, within walking distance from the site, but not connected to the site by footpaths. Appropriate pedestrian connections to bus stops and neighbouring businesses, where residents may walk from or to, are recommended to support the proposed Plan Change application.

Sections 7.5.1 and 7.5.2 elaborate on the recommended connections on Ken Browne Drive and Sir Tristram Avenue. In addition to these connections, the new shared path on the southern side of Sir Tristram Avenue is proposed to be extended along the service lane within WRCI owned land which is currently occupied by



Signature Homes. This shared path will lead pedestrians / cyclists to a pedestrian crossing (zebra) on a raised safety platform to cross the service lane and connect pedestrians safely from the new path to a new signalised mid-block crossing on Te Rapa Road which proceeds to connect to the existing 3 m wide path on the eastern side of Te Rapa Road as illustrated in Figure 36 (Drawing 144720-00-0015).

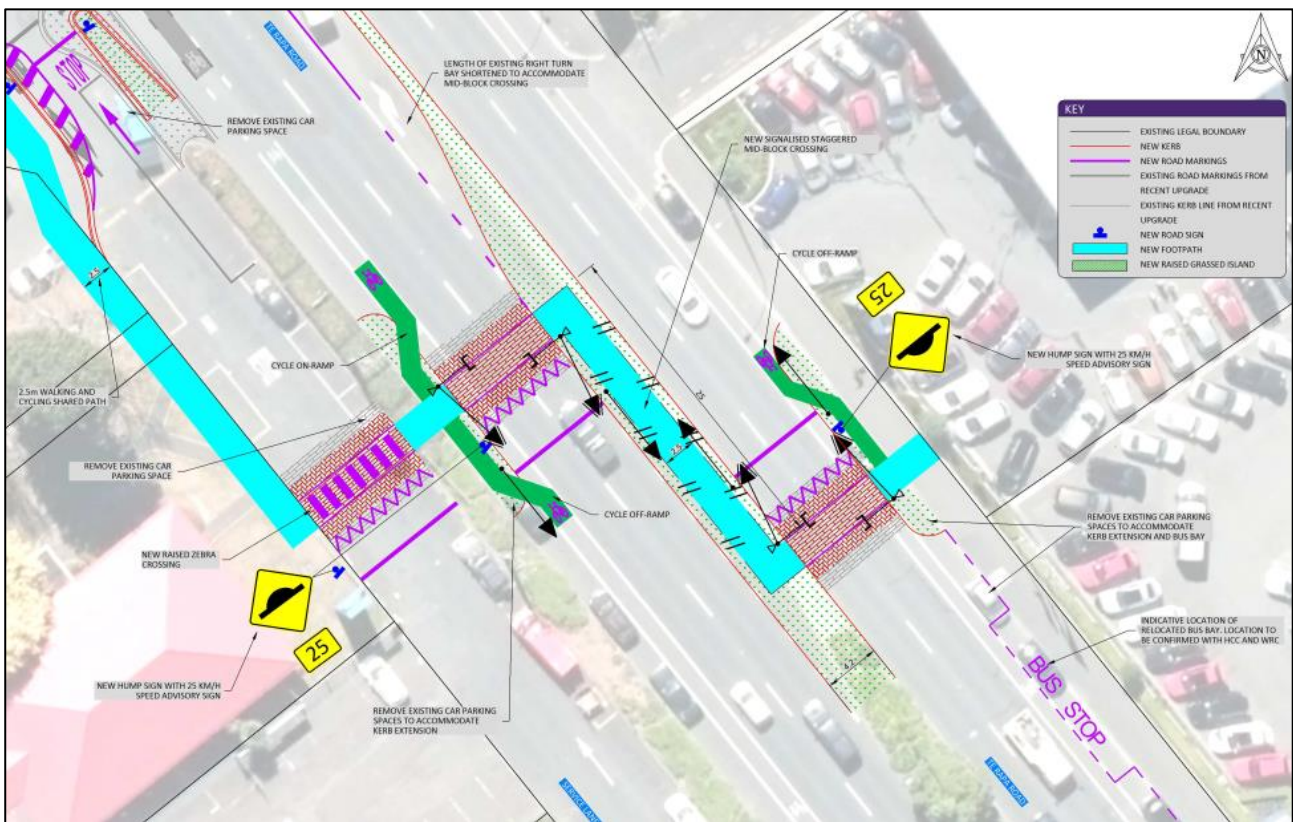


Figure 36: Proposed Mid-Block Crossing on Te Rapa Road

The mid-block crossing is proposed as a two-stage signalised crossing on raised safety platforms (RSP). The two-stage crossing is necessary due to the number of existing vehicle crossings on the eastern side of Te Rapa Road which does not allow for a typical one-stage crossing across Te Rapa Road. The RSP at the crossings increase the crossing conspicuity, reduce operating speeds of vehicles on the approaches, and allow for seamless (no level change) travel for mobility impaired pedestrians. Kerb extensions are also proposed to reduce the crossing distance and increase the visibility for both pedestrians / cyclists and drivers. Cycle on and off-ramps are indicated in the concept design above for cyclists to join the on-road cycle lanes (refer to Drawings 144720-00-0006 and 144720-00-0015). The introduction of RSP at this location will be subject to a Road Safety Audit and Council’s decision.

In summary, the proposed mid-block crossing:

- Allows pedestrians and cyclists to cross multiple vehicle lanes safely.
- Helps to direct pedestrians and cyclists to safe crossing locations.

As part of this proposal, the southbound bus stop on Te Rapa Road is also recommended to be relocated to reduce the walking distance from the signalised mid-block crossing. Based on consultation with Waikato Regional Council (WRC) and Hamilton City Council, it was understood that the existing bus stops at 475 and 474 Te Rapa Road are under utilised with no safe crossing point between them and that Council is generally supportive of relocating the bus stops. The southbound bus stop is proposed to be relocated approximately 70 m south from its existing location.



Overall, with the improvements recommended to pedestrian connections which also provide for improved access to public transport, the subject site is considered to achieve reasonable connectivity and accessibility for alternative transport modes. The establishment of these connections and traffic calming measures within the proposed residential development will ensure that a high standard of pedestrian safety and amenity is provided.

7.6.1 Signalisation of Te Rapa Road / Sir Tristram Avenue Intersection

The possibility of signalising Te Rapa Road / Sir Tristram Avenue was also considered as an alternative to the provision of a mid-block signalised pedestrian crossing. It was raised by HCC during pre-application consultation. This alternative could potentially provide some capacity relief at the Te Rapa Road / Garnett Avenue / Vardon Road intersection for right turning traffic from Garnett Avenue to Te Rapa Road (further discussed in Section 7.8.2), whilst also providing a safe pedestrian crossing solution over Te Rapa Road to the bus stop opposite Sir Tristram Ave.

However, given further review, BBO does not consider that signalising Te Rapa Road / Sir Tristram Avenue intersection would be beneficial overall, for the following reasons:

- Signalisation would provide more capacity and therefore encourage more vehicle-based trips to and from Sir Tristram Ave following the Plan Change and residential development (by accommodating the right turn movement) as opposed to the proposed safety upgrades that physically prevent the right turn movements out of Sir Tristram Avenue as discussed in Section 7.7.3. Restricting access through Sir Tristram Ave as proposed will help encourage future residents of the Plan Change area to use Public Transport and walking and cycling rather than private vehicle transport. Promoting infrastructure solutions that increase safety and accessibility for alternative modes of transport is the key to limiting further vehicle-based transport effects on the adjoining road network and environment. Signalising the whole intersection would be counterproductive in this regard.
- Integration of the existing service lane with the signalised intersection will be challenging.
 - The service lane could potentially be terminated south of the signalised intersection and a new exit onto Te Rapa Road will have to be created as illustrated in Figure 37 (figure does not show signalised intersection). The new exit could potentially create weaving issues with vehicles exiting the service lane cutting across two traffic lanes and a bicycle lane to get to the right turning lane over a short distance. With vehicles travelling northbound on Te Rapa Road at approximately 60 km/h, any rear-end, or side impact collisions will result in serious and fatal injuries; OR



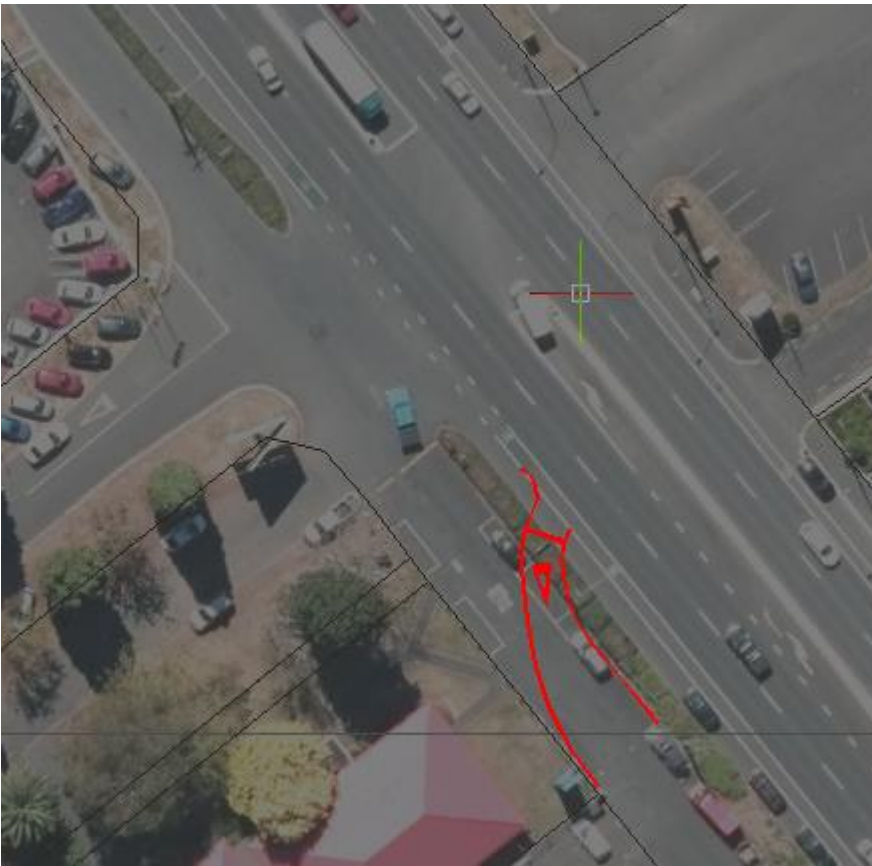


Figure 37: Indicative Service Lane Exit if Sir Tristram Avenue Intersection is Signalised (Sketch)

- The service lane could be designed to connect to Sir Tristram Avenue approach as shown in Figure 38, which is relatively close to the intersection. This might raise safety concerns with vehicles exiting the service lane cutting across two traffic lanes to get to the left turning lane onto Te Rapa Road. Drivers exiting the service lane will have to be aware of traffic arriving from the east (left / right turning vehicles from Te Rapa Road) and west (through / right turning vehicles as well as left turning vehicles from Sir Tristram Avenue) which is relatively similar to the existing intersection configuration (with the exception of the U-turning movement from Te Rapa Road).



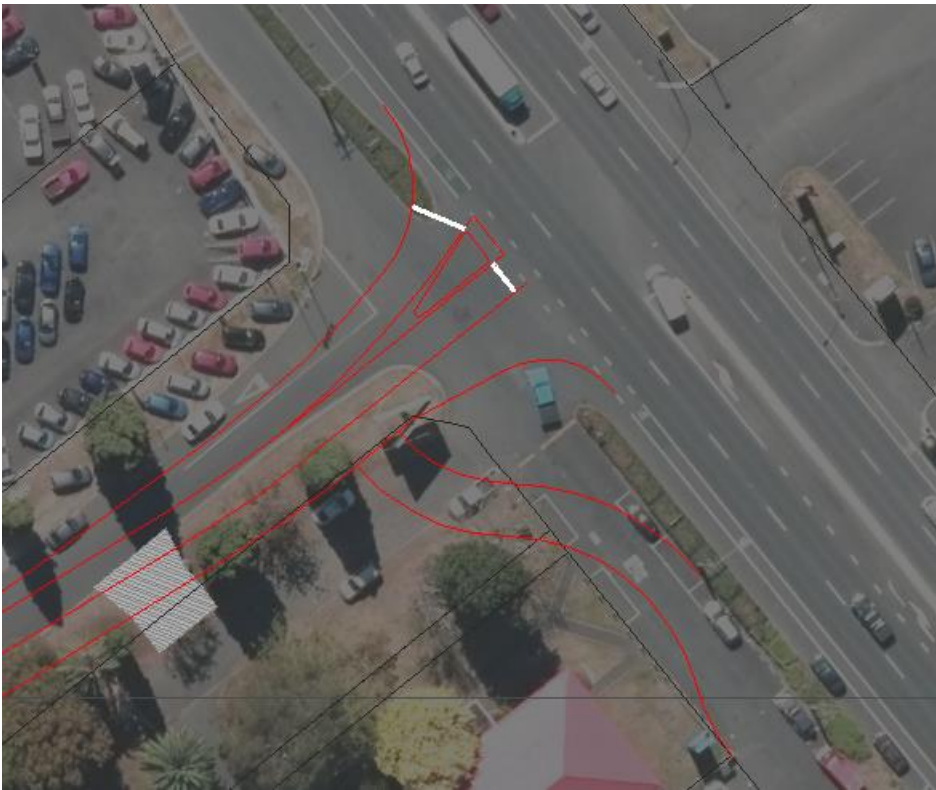


Figure 38: Indicative Connection of Service Lane to Sir Tristram Avenue (Sketch)

- The intersection will need to be a crossroads intersection if signalised due to the existing car park access on the opposite side of Te Rapa Road. The width of the car park access is approximately 13.5 m. Signalising the intersection might result in realignment of Sir Tristram Avenue to align with the car park access. With a crossroads intersection, the phasing is expected to increase delays, which may or may not affect the adjoining network operation considering there would be three signalised intersections in a row within 500 m.
- Section 4.5 of the *Austrroads AP-R556-17 Research Report "Understanding and Improving Safe System Intersection Performance"* discusses the assessment undertaken for Urban Signalised Intersection Retrofit Combination Treatment which is considered to be an innovative design concept that is more closely aligned with Safe System objectives. The report states that:

"Conventionally, signals are installed at existing intersections to provide access for new traffic, where there are operational issues, or to rectify an existing safety problem. Issues relating to pedestrians and cyclists may also influence the decision to signalise an intersection (Austrroads 2013b). Existing signalised intersections are often retrofitted with additional safety treatments when the use of the intersection exceeded its original design (e.g. higher AADT, more pedestrians, or cyclists), which resulted in increased crash history. Common treatments include phasing changes, red light/speed cameras, mast arms and fully controlled right turns (FCRT), or pedestrian fencing. These conventional treatments need to be recognised for providing a supporting contribution towards the Safe System".

However, the report does highlight eliminating right turn movements from all approaches as a design improvement (among other suggestions that include but not limited to signalised zebra crossings, queue detectors, safety platforms, dedicated bike lanes / head start boxes and removing slip lanes to reduce turning speeds) to the retrofitted combined treatment with the intention to improve the level of Safe System alignment.

Banning right turn movements, with support from physical road design changes show a significant reduction in opposing-turning crashes in the post-period (60% to 90% cited in Austrroads 2012). Therefore, it is our conclusion that banning right turn movement out of Sir Tristram Avenue coupled



with the proposed signalised mid-block crossing (safe crossing location away from intersection) is a safer, more beneficial option overall for promoting alternative transport than a retrofitted crossroads signalised intersection.

7.7 Road Safety at Te Rapa Road / Sir Tristram Avenue Intersection

7.7.1 Consented Re-design of Intersection

The Te Rapa Road / Sir Tristram Avenue intersection has been re-designed and upgraded recently as part of the consented childcare activity at 4 – 6 Sir Tristram Avenue. The changes to the intersection are illustrated in Figure 39 and Figure 40 below.

The upgrade included additional kerb buildouts and pavement markings to narrow the service lane to the south of the intersection and separate movements to / from the adjacent driveway to the south and Sir Tristram Avenue. A kerb-side island was constructed at the north end of the service lane where it merges with Te Rapa Road, to reduce the area of potential conflict and providing separation to Fairview Motors access to the north. The service lane was realigned to encourage vehicles to approach the merge area closer to a right angle. Give way sign and markings were installed at the end of the service lane to make it clear that vehicles exiting the service lane are to yield to traffic on Te Rapa Road.



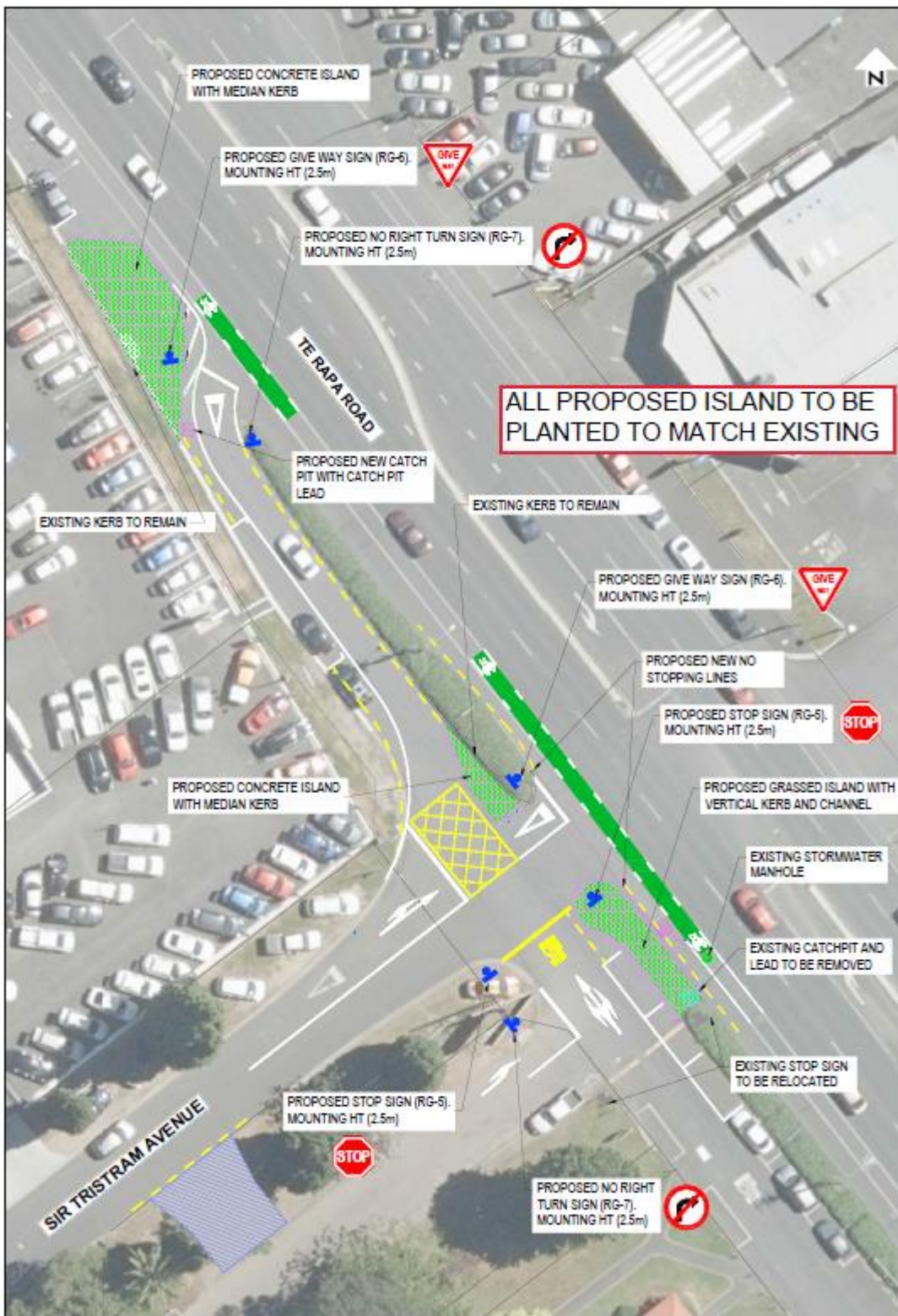


Figure 39: Approved Te Rapa Road / Sir Tristram Avenue Intersection Design as part of Consented Childcare Development





Figure 40: Te Rapa Road / Sir Tristram Avenue Intersection Layout after Construction

7.7.2 Safety Concerns

This assessment finds that the intersection upgrade has addressed several safety issues with the original intersection layout, however, there remains safety issues for road users in the new layout. This section describes those safety issues.

Sir Tristram Avenue currently has very low volumes of traffic, which is primarily associated with Fairview Motors and / or race days, and now the consented childcare facility. Vehicles accessing Sir Tristram Avenue from Te Rapa Road are currently able to make left and right turns to Sir Tristram Avenue, the latter benefitting from a right turn bay for southbound traffic on Te Rapa Road.

The service lane parallel to Te Rapa Road adds to the travel distance for right turning traffic into Sir Tristram Avenue (i.e. three live lanes, two northbound lanes on Te Rapa Road and the service lane). Moreover, site observation shows that despite the ban introduced by the Council, there are still substantial numbers of southbound drivers making U-turns. The U-turn movements reduces the opportunity for traffic exiting Sir Tristram Avenue to turn right onto Te Rapa Road as the traffic volume in the inside southbound lane is relatively high. Figure 3 illustrates the intersection.

To achieve adequate visibility, right turning vehicles exiting Sir Tristram Avenue are required to cross the service lane and sit at the Te Rapa Road boundary whilst awaiting opportunity to merge with southbound traffic. This has now been addressed by the intersection upgrade where a formally marked refuge area has been introduced for right turning vehicles waiting to undertake this manoeuvre. A 'Keep Clear' area has also been marked at the Sir Tristram Avenue / service lane intersection.



Although there is no recent crash history associated with vehicles right turning out from Sir Tristram Avenue, this movement is expected to become less practical (and more dangerous) as traffic volumes increase on Sir Tristram Avenue. Moreover, formalising (i.e. marking out) a refuge area will also increase the risk of collision between Te Rapa Road southbound U-turning vehicles and vehicles waiting to turn right from Sir Tristram Avenue onto Te Rapa Road. The southbound U-turn movement onto Te Rapa Road is currently banned as per *The Hamilton Traffic Bylaw 2015*, however, the surveyed traffic counts indicate that approximately 40 to 130 vehicles complete this movement during peak periods which is relatively high for a U-turn movement.

With the Access Lane being parallel to Sir Tristram Avenue, it is not immediately clear or intuitive as to which road leads to the Racing Club when entering from Te Rapa Road. Figure 41 illustrates this.

The intersection upgrade has addressed this issue by extending the traffic island between Te Rapa Road and the service lane on the southwest approach. Extending the traffic island means that vehicles will no longer be permitted to turn right directly from Te Rapa Road into the Access Lane. This lane currently provides access for horse trucks to the stables at the rear of the racecourse, and to Signature Homes' rear car park. While access to the Access Lane can still be gained by a left turn from the service lane, another vehicle crossing will also be constructed off Sir Tristram Avenue to retain access to Signature Homes' car park as per Stantec's re-design.

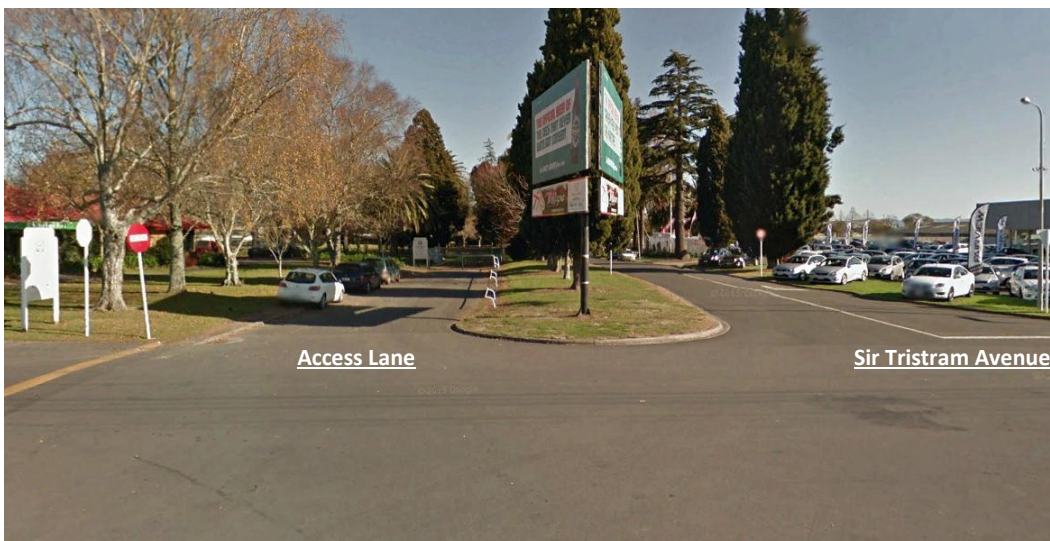


Figure 41: Access Lane Parallel to Sir Tristram Avenue

From site observations, car transporters servicing Fairview Motors arrive from the south and park along the areas identified in the figure below to unload vehicles. These areas are undesignated unloading areas. The kerb side island to be introduced at the north end of the service lane where it merges with Te Rapa Road, prevents these car transporters from waiting along the service lane. Moreover, if a car transporter was to wait along the road shoulder of Te Rapa Road, the Safe Intersection Sight Distance (SISD) of vehicles exiting the service lane based on the realignment of the service lane will be affected as shown in Figure 42 which raises safety concerns.





Figure 42: Car Transporters Waiting Area

7.7.3 Proposed Modifications to Te Rapa Road / Sir Tristram Avenue Intersection

For the above reasons relating to safety, it is recommended as part of the proposed rezoning to limit the movements at Sir Tristram Avenue intersection to left-in, left-out and right-in movements only. This would mean that the right turn movements out onto Te Rapa Road will be banned. Motorists affected by this movement ban (mostly related to racecourse race days) will be required to use the Te Rapa Road / Sunshine Avenue roundabout to perform a U-turn and return southbound on Te Rapa Road which equates to an extra travel distance of approximately 1 km.

The recommendation would increase the travel distance and time for motorists wishing to head south, however it is considered a minor inconvenience to achieve the safety improvements by reducing the range of conflict points and the potential for driver confusion.

To accommodate car transporters safely at the intersection and to mitigate sight line concerns for vehicles exiting the service lane onto Te Rapa Road, this assessment recommends relocating the left turn exit approximately 30 m southeast from its current location. The kerb buildout along Fairview Motors will be reconstructed to allow safe merging of vehicles exiting the service lane onto Te Rapa Road as well as to allow car transporters to safely exit Te Rapa Road and unload vehicles away from the existing bicycle lane.

A conceptual design of the proposed Te Rapa Road / Sir Tristram Avenue intersection is presented in Figure 43. The plan is also attached in Appendix B for reference. Vehicle tracking analysis has been undertaken for a 99th percentile car and a large rigid truck to ensure the concept design can cater for the required vehicles. As shown in Appendix B, these vehicles can safely navigate the intersection with no manoeuvring issues. Vehicle tracking for a semi-trailer has not been undertaken as it is not considered to be an appropriate design



vehicle for this environment with Sir Tristram Avenue as a minor secondary access to the proposed residential development, and the gateway to the Te Rapa racecourse.

However, in the future, if any industrial activity is consented to obtain access from Sir Tristram Avenue, the raised island separating the service lane and Te Rapa Road (to the south of Sir Tristram Avenue) will have to be modified to include mountable kerbs such that semi-trailers could track over as shown in Figure 44.

Given the above improvements proposed which reduce the number of conflicting vehicle movements at the intersection, it is considered that any adverse traffic effects are appropriately mitigated.

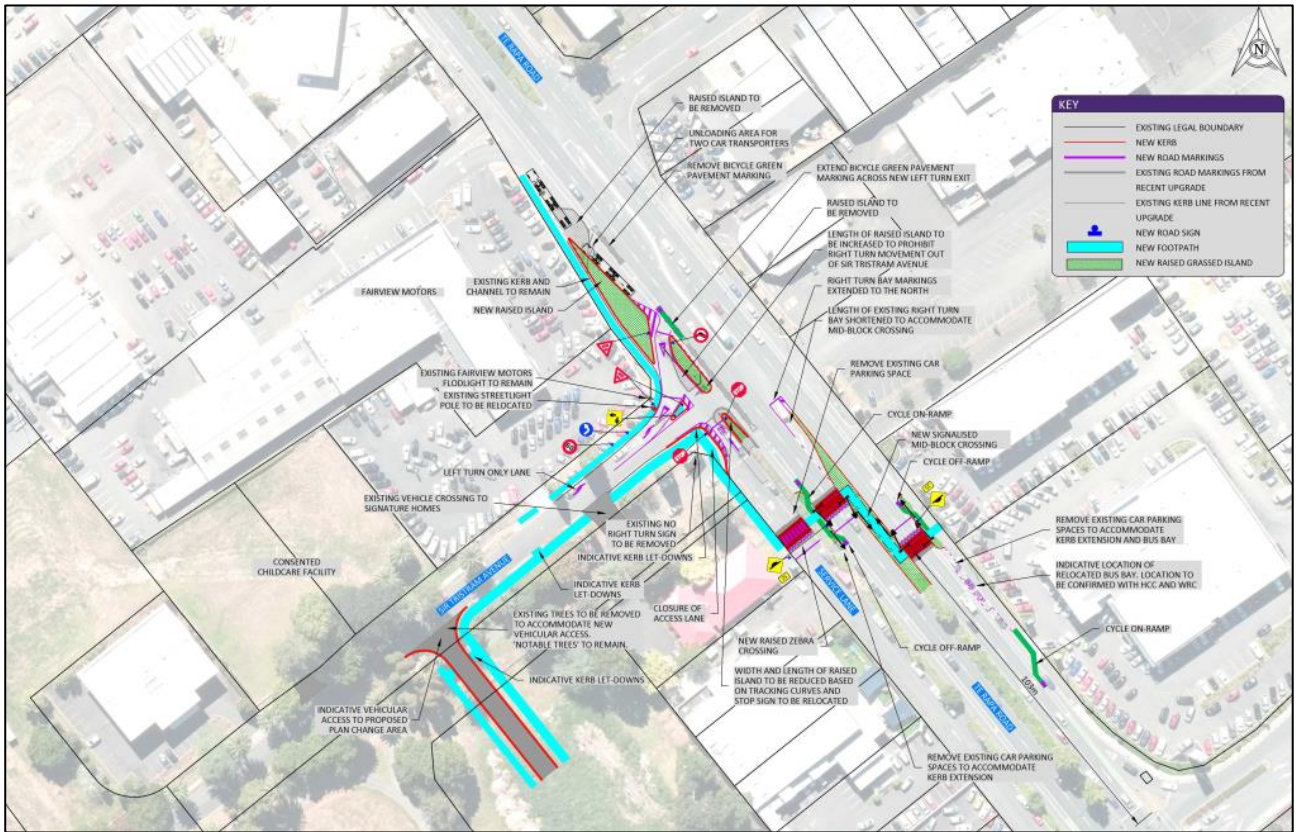


Figure 43: Te Rapa Road / Sir Tristram Avenue Intersection Concept Design



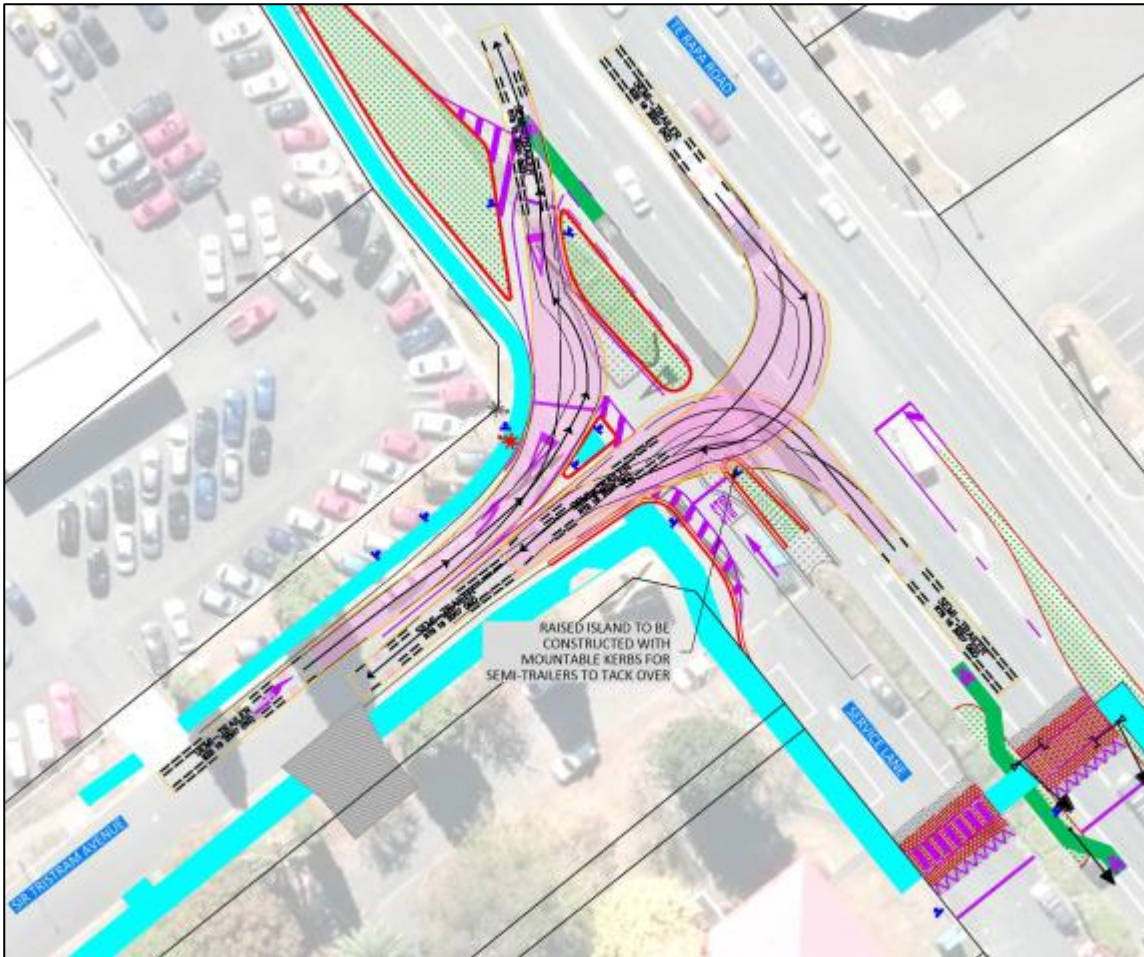


Figure 44: Tracking Curves of a Semi-Trailer

The proposed improvements have been modelled by SIDRA and the results of this are discussed in Section 7.8.

7.8 Intersection Capacity and Performance

The intersections have been modelled using the industry-recognised SIDRA Intersection 9 to assess the effects of traffic associated with the proposed Plan Change on the intersections identified in Section 3.3.2.

The capacity assessment results are summarised in the following sub-sections in terms of Level of Service (LOS) with full SIDRA outputs provided in Appendix C. LOS is a standard measure for intersection performance and is based on the average delay experienced by drivers in each lane, by arm. In general, LOS levels A to C are considered acceptable, LOS D to E are considered permissible where reasonable improvements cannot be made. LOS F is generally considered to be an unsatisfactory level of service. Delay thresholds in seconds of delay for LOS A to F are given in Table 4 below.



Table No. 4

SIDRA Level of Service Definitions	
Level of Service	Average Delay per Vehicle for Signalised Intersections (seconds)
A	≤ 10
B	10 - 20
C	20 – 35
D	35 – 55
E	55 – 80
F	> 80

7.8.1 Modelling Scenarios

1. 2021 Baseline

The 2021 baseline represents the performance of the existing intersections with current peak hour traffic flows and the consented peak period traffic volumes from the childcare facility as identified in Section 3.2.1. Although changes have been introduced to the Te Rapa Road / Sir Tristram Avenue intersection as part of the childcare facility consent application, the changes which are based on safety improvements have no implications on the permitted movements at the intersection. Hence, the intersection layout remains the same as per existing when modelled via SIDRA.

Baseline models were built using the surveyed traffic volumes and calibrated against the observed queue lengths such that the models reflected the current situation as accurately as possible.

2. 2021 Baseline + Development

This scenario considers the effects caused by the proposed residential development by adding approximately 160 trips per peak hour to the baseline 2021 models.

The Te Rapa Road / Sir Tristram Avenue intersection has been modelled based on the proposed improvements recommended in Section 7.7.3 and illustrated in Figure 43 (i.e. right turn movement out of Sir Tristram Avenue banned).

3. 2031 Baseline

The proposed Plan Change is expected to be fully developed within 10 years. Therefore, the effects assessment was conducted on the basis of a 10-year assessment period. To estimate the future baseline traffic of the 2031 horizon year, the following average background annual traffic growth rates were adopted:

- Te Rapa Road (Northbound) = 1%
- Te Rapa Road (Southbound) = 2%
- Vardon Road = 1%
- Garnett Avenue = 0%
- Ken Browne Drive, Sir Tristram Avenue and Minogue Drive = 0%

The background growth rates for Te Rapa Road, Vardon Road and Garnett Avenue were calculated based on the AADT volumes obtained from Council’s “2018 Traffic Counting Data”. The background



growth rates for Ken Browne Drive, Sir Tristram Avenue and Minogue Drive were assumed to be 0% to avoid double counting as the growth on these local roads are dependent on developments that have been or will be consented to obtain access from these roads.

4. 2031 Baseline + Development

Additional traffic (i.e. 160 trips per peak hour) associated with the proposed residential development was added to the baseline 2031 model to understand the effects on the intersections for a future year scenario.

The Te Rapa Road / Sir Tristram Avenue intersection has been modelled based on the proposed improvements recommended in Section 7.7.3 and illustrated in Figure 43 (i.e. right turn movement out of Sir Tristram Avenue banned).

7.8.2 Te Rapa Road / Garnett Avenue / Vardon Road Signalised Intersection

The signalised intersection layout is shown in Figure 24. Table 5 presents the SIDRA analysis results for all four scenarios at this intersection during the peak periods.

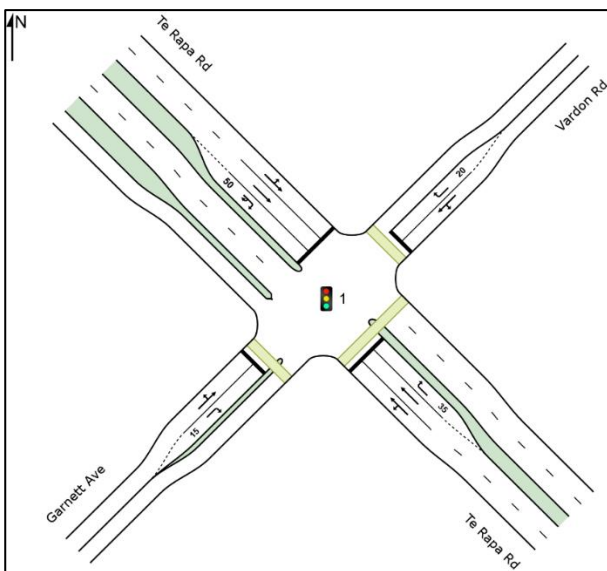


Figure 45: Existing Te Rapa Road / Garnett Avenue / Vardon Road Intersection Layout



Table No. 5

Te Rapa Rd / Garnett Ave / Vardon Rd Intersection Performance									
Scenario	Peak	Intersection Average			Worst Movements (in terms of delay)				
		V/C	Delay (s)	LOS	Movement	Delay (s)	Queue (m)	LOS	
1	Baseline 2021	AM	0.91	36	D	LT from Garnett Avenue	55	94	E
		PM	0.89	37	D	RT from Garnett Avenue	54	33	D
2	Baseline 2021 + Development	AM	0.92	40	D	LT from Garnett Avenue	65	105	E
		PM	0.94	42	D	RT from Garnett Avenue	81	58	F
3	Baseline 2031	AM	0.95	47	D	LT from Garnett Avenue	84	135	F
		PM	0.97	51	D	RT from Garnett Avenue	103	53	F
4	Baseline 2031 + Development	AM	0.96	56	E	LT from Garnett Avenue	99	157	F
		PM	1.02	74	E	RT from Garnett Avenue	169	101	F

Analysis of the modelling results identified the following performance issues:

- Garnett Avenue appears to be the worst performing approach in all scenarios.
- There are minimal changes in the performance of the intersection when trips generated by the proposed residential development is added to the baseline (year 2021) with the average delay at the intersection increasing by approximately 4 to 5 seconds during peak periods. However, the right turning movement from Garnett Avenue drops to LOS F during the AM Peak.
- In the baseline 10-year scenario (year 2031), the intersection continues to perform at LOS D. However, Garnet Avenue will perform unsatisfactorily with the average delay of the right turning movement from Garnett Avenue reaching 103 seconds. By adding the proposed residential development, the level of service for the intersection reduces to E with the average delay increasing by approximately 9 to 23 seconds during peak periods.
- A fundamental issue is that there is no easy solution to increase the intersection capacity without creating additional lanes. The performance of the left turn movement from Garnett Avenue into Te Rapa Road justifies this movement being exclusive without the through traffic to Vardon Road added. However, incorporating additional lanes will require significant re-design and upgrade of the intersection considering the proximity of the northbound service lane on Te Rapa Road. Figure 46 illustrates the boundary lines at this intersection.



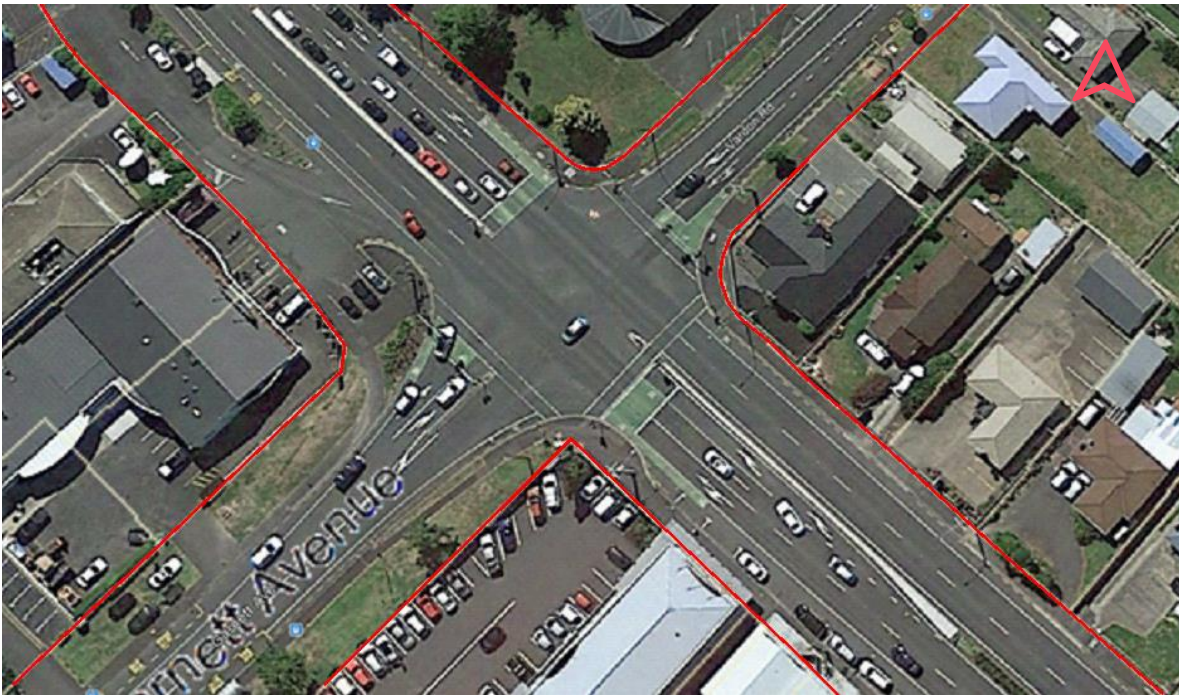


Figure 46: Road Boundary at Te Rapa Road / Garnett Avenue / Vardon Road Intersection

7.8.3 Ken Browne Drive / Garnett Avenue / Minogue Drive Roundabout

The roundabout layout is shown in Figure 47. Table 6 presents the SIDRA results for all four scenarios at this intersection during the peak periods.

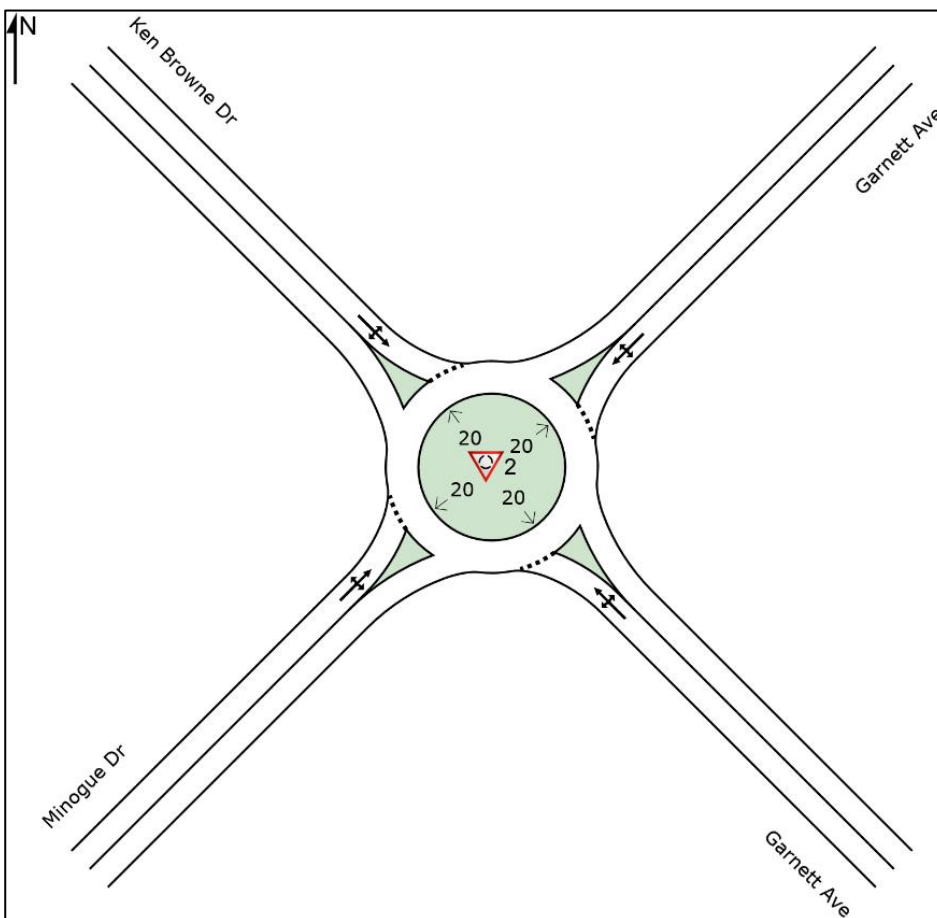


Figure 47: Existing Ken Browne Drive / Garnett Avenue / Minogue Drive Roundabout Layout



Table No. 6

Ken Browne Dr / Garnett Ave / Minogue Dr Roundabout Performance									
Scenario	Peak	Intersection Average			Worst Movements (in terms of delay)				
		V/C	Delay (s)	LOS	Approach	Delay (s)	Queue (m)	LOS	
1	Baseline 2021 & Baseline 2031	AM	0.31	5	A	Ken Browne Dr Approach	10	2	A
		PM	0.30	8	A	Ken Browne Dr Approach	13	10	B
2	Baseline 2021 + Development & Baseline 2031 + Development	AM	0.33	6	A	Ken Browne Dr Approach	13	8	B
		PM	0.40	9	A	Ken Browne Dr Approach	15	15	B

Analysis of the modelling results identified the following performance issues:

- The results for the with and without development scenarios for each assessment year are similar as the background growth rates for Ken Browne Drive, Sir Tristram Avenue, Minogue Drive and Garnett Avenue have been assumed to be 0% as discussed in Section 7.8.1.
- The roundabout performs satisfactorily at LOS A in all scenarios and will have plenty of capacity to accommodate the additional traffic imposed by the proposed residential development.

7.8.4 Te Rapa Road / Sir Tristram Avenue Intersection

Figure 48 illustrates the layout that was modelled to represent the existing condition and Figure 49 presents the layout that was modelled to represent the changes to be introduced with the proposed Plan Change (i.e. right turn movement out of Sir Tristram Avenue to be banned). With reference to the figures below, due to the limitations of SIDRA, the left turning volume from Te Rapa Road (southeast approach) could not be assigned to the left most lane. Instead, the volume was incorporated with the service lane traffic. Since the left-turning volume is very low, the impact due to this limitation is considered negligible.

This assessment acknowledges that the southbound U-turning movement onto Te Rapa Road is banned. However, drivers currently still do undertake this movement. Therefore, the modelling has considered the U-turn as a permitted movement to understand its impact on the performance of the intersection. Table 7 presents the SIDRA analysis results for all four scenarios at this intersection during the peak periods.



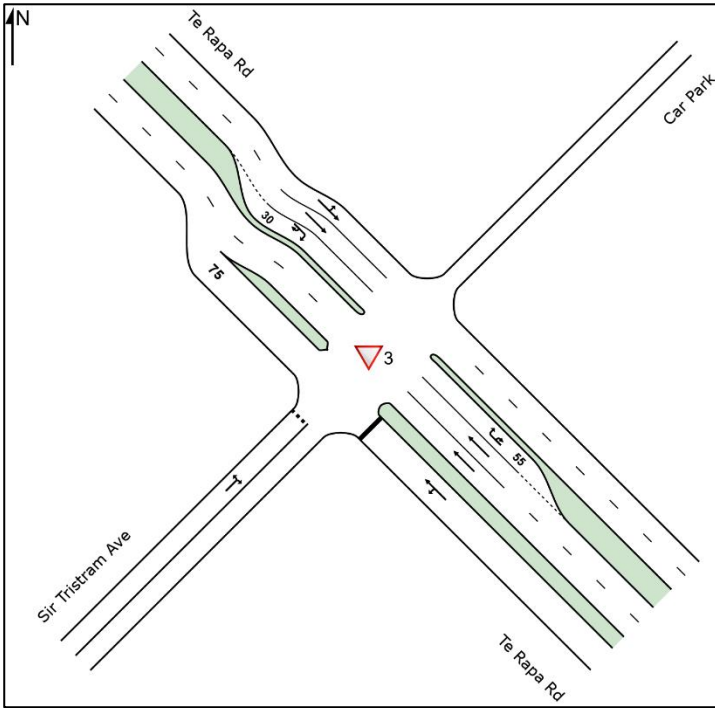


Figure 48: Existing Te Rapa Road / Sir Tristram Avenue Intersection Layout

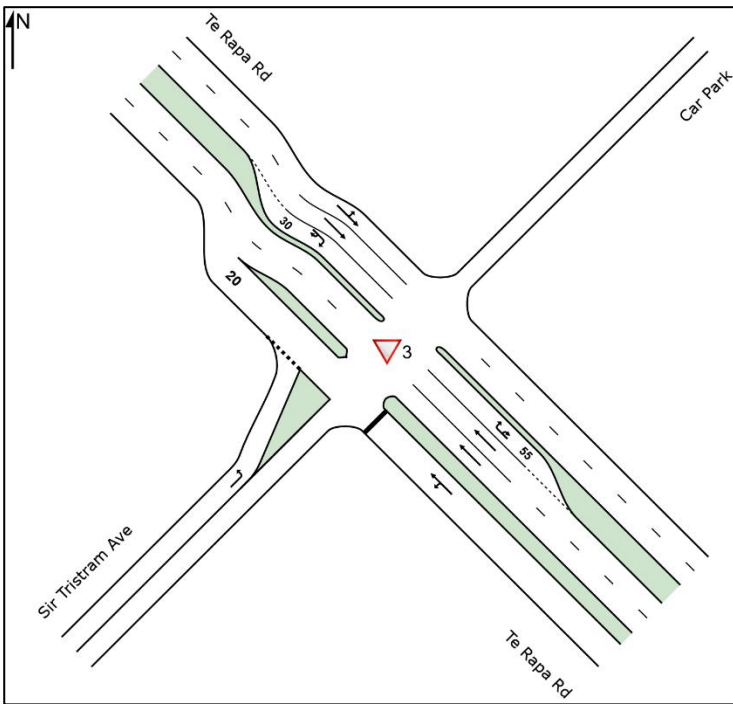


Figure 49: Proposed Te Rapa Road / Sir Tristram Avenue Intersection Layout



Table No. 7

Te Rapa Rd / Sir Tristram Avenue Intersection Performance									
Scenario	Peak	Intersection Average			Worst Movements (in terms of delay)				
		V/C	Delay (s)	LOS	Movement	Delay (s)	Queue (m)	LOS	
1	Baseline 2021	AM	0.68	5	N/A	RT from Sir Tristram Avenue	82	25	F
		PM	1.44	39	N/A	RT from Sir Tristram Avenue	1,015	477	F
2	Baseline 2021 + Development	AM	0.51	4	N/A	LT from Sir Tristram Avenue	5	3	A
		PM	0.50	3	N/A	LT from Sir Tristram Avenue	5	3	A
3	Baseline 2031	AM	1.03	12	N/A	RT from Sir Tristram Avenue	345	113	F
		PM	2.37	88	N/A	RT from Sir Tristram Avenue	2,632	810	F
4	Baseline 2031 + Development	AM	0.51	3	N/A	LT from Sir Tristram Avenue	6	3	A
		PM	0.61	3	N/A	LT from Sir Tristram Avenue	5	3	A

Analysis of the modelling results identified the following performance issues:

- The baseline 2021 model results indicate that with the additional traffic imposed by the consented childcare development, the right turning movement out of Sir Tristram Avenue fails with an average delay of approximately 17 minutes during the PM peak hour. The intersection's degree of saturation is also recorded to be above 1. The performance of the intersection only gets worse for the baseline 2031 model with the consented intersection layout.
- When the right turning movement out of Sir Tristram Avenue is prohibited, the intersection performs satisfactorily with all movements performing at LOS A (i.e. both in 2021 and 2031). This remains consistent when trips generated by the proposed residential development is added onto the adjoining road network.
- The results indicate that the proposed layout (Figure 43) can adequately accommodate the consented plus development traffic volumes and hence is recommended as the intersection upgrade option to mitigate any safety and efficiency concerns arising associated with the consented intersection layout.

7.8.5 Race Day Intersection Performances

Based on the trip distribution assumptions highlighted in Section 6.1, Tables 8 to 10 summarise SIDRA results for all four scenarios at the three identified intersections during race day peak periods.



Table No. 8

Te Rapa Rd / Garnett Ave / Vardon Rd Intersection Performance									
Scenario	Peak	Intersection Average			Worst Movements (in terms of delay)				
		V/C	Delay (s)	LOS	Movement	Delay (s)	Queue (m)	LOS	
1	Race Day Baseline 2021	Mid-day	1.08	118	F	LT from Garnett Avenue	249	330	F
		PM	0.76	27	C	LT from Garnett Avenue	38	41	D
2	Race Day Baseline 2021 + Development	Mid-day	1.10	133	F	LT from Garnett Avenue	273	351	F
		PM	0.81	27	C	LT from Garnett Avenue	39	42	D
3	Race Day Baseline 2031	Mid-day	1.19	213	F	LT from Garnett Avenue	420	454	F
		PM	0.80	28	C	LT from Garnett Avenue	42	46	D
4	Race Day Baseline 2031 + Development	Mid-day	1.21	238	F	LT from Garnett Avenue	459	480	F
		PM	0.81	28	C	LT from Garnett Avenue	42	46	D

Table No. 9

Ken Browne Dr / Garnett Ave / Minogue Dr Roundabout Performance									
Scenario	Peak	Intersection Average			Worst Movements (in terms of delay)				
		V/C	Delay (s)	LOS	Approach	Delay (s)	Queue (m)	LOS	
1	Race Day Baseline 2021 & Race Day Baseline 2031	Mid-day	0.26	5	A	Minogue Dr Approach	11	5	B
		PM	0.24	6	A	Ken Browne Dr Approach	9	7	A
2	Race Day Baseline 2021 + Development & Race Day Baseline 2031 + Development	Mid-day	0.31	6	A	Minogue Dr Approach	13	6	B
		PM	0.32	8	A	Ken Browne Dr Approach	11	11	B



Table No. 10

Te Rapa Rd / Sir Tristram Avenue Intersection Performance									
Scenario	Peak	Intersection Average			Worst Movements (in terms of delay)				
		V/C	Delay (s)	LOS	Movement	Delay (s)	Queue (m)	LOS	
1 Race Day Baseline 2021	Mid-day	0.43	4	N/A	RT from Sir Tristram Avenue	48	1	E	
	PM	0.25	3	N/A	RT from Sir Tristram Avenue	21	4	C	
2 Race Day Baseline 2021 + Development	Mid-day	0.43	4	N/A	LT from Sir Tristram Avenue	5	1	A	
	PM	0.25	3	N/A	LT from Sir Tristram Avenue	5	2	A	
3 Race Day Baseline 2031	Mid-day	0.48	4	N/A	RT from Sir Tristram Avenue	62	1	F	
	PM	0.30	3	N/A	RT from Sir Tristram Avenue	27	4	D	
4 Race Day Baseline 2031 + Development	Mid-day	0.49	4	N/A	LT from Sir Tristram Avenue	6	1	A	
	PM	0.30	3	N/A	LT from Sir Tristram Avenue	5	2	A	

Analysis of the modelling results identified the following performance issues:

- The Te Rapa Road / Garnett Avenue / Vardon Road signalized intersection is currently performing unsatisfactorily during a mid-day peak period on a race day, with the average delay on the left turning movement from Garnett Avenue reaching approximately 4 minutes. There are minimal changes in the performance of the intersection when trips generated by the proposed residential development is added to the baseline (year 2021) with the average delay at the intersection increasing by approximately 15 seconds during mid-day peak hour. This conclusion applies to the future year (year 2031) scenarios as well.
- The Ken Browne Drive / Garnett Avenue / Minogue Drive roundabout performs satisfactorily at LOS A in all scenarios and will have plenty of capacity to accommodate the additional traffic imposed by the proposed residential development during race days.
- The results indicate that the proposed changes to the Te Rapa Road / Sir Tristram Avenue layout (Figure 43) can adequately accommodate the additional development traffic volumes during race days.

7.8.6 Modelling Outcome Summary

The preceding sections and tables show that despite the increased vehicle trips associated with the proposed Plan Change, the existing Ken Browne Drive / Garnett Avenue / Minogue Drive roundabout and the Te Rapa Road / Sir Tristram Avenue intersection with the proposed upgrades will continue to operate at an adequate level of service in the current and future year scenarios, including race days. In fact, the performance of the



Te Rapa Road/Sir Tristram Avenue intersection is significantly improved by the upgrade proposed through the plan change.

The Te Rapa Road / Garnett Avenue/ Vardon Road intersection is already performing unsatisfactorily in 2031 without the development. With the proposed residential development, the right turning movement from Garnett Avenue worsens. The added delays observed at the Garnett Avenue approach, especially in the future year 2031, with and without the proposed development site trips are not unexpected. However, these delays are mainly due to the existing high volume of vehicles on Te Rapa Road and the ongoing growth over time (as Hamilton's population increases) which will inevitably demand more green time allocation to the Te Rapa Road approaches.

As mentioned, there is no easy solution to increase the capacity of the Te Rapa Road / Garnett Avenue/ Vardon Road intersection without substantial work to create additional lanes. However, providing infrastructure to promote and increase the use of alternative modes of transport is the key alternative to limit impacts on the performance of the intersection. There will be a percentage of trips that utilize the PT network that is readily available in the vicinity and also the cycling network surrounding the site. The 2018 Census data for the neighbouring Saint Andrews West statistical area identifies that approximately 3% and 2% of home to work and work to home trips are made using public buses and cycling respectively. With the strong pedestrian connections to existing bus stops that are proposed as part of the rezoning application (Section 7.5) as well as the slow speed environment proposed within the development that supports safe cycling, it can be expected that private vehicle trips generated by the residential development would be approximately 95% of all peak period trips (i.e. 10 vehicle trips per peak hour are made by PT and cycling). This is effectively the baseline mode-share scenario that can be assumed for the rezoned site. Since a reduction of 10 trips per hour to the traffic volumes will make little difference to the intersection performance assessments, we have assumed a worst-case scenario of 100% of development related trips will be private vehicle trips.

Given the performance of the Te Rapa Road / Garnett Avenue/ Vardon Road intersection is already generally poor with existing and future traffic growth from population and employment increase in Hamilton, any upgrade to the capacity or improvements for walking and cycling and PT should be led by the Council and potentially the costs shared equitably between all key stakeholders that benefit from the improvements.

7.9 Waikato Regional Transport Model (WRTM)

The WRTM is currently based on 2013 census data (although is in the process of being updated to 2018 base year) and contains 2500 zones. Forecast year models include 2021, 2031, 2041 and 2051 and are based on National Institute of Demographic and Economic Analysis (NIDEA) "low" growth projections.

To ensure the consistency in the assessment, the 2031 traffic volumes used in the SIDRA models in this report that were based on assumed background growth rates were compared to the 2031 traffic volume in the WRTM model version released in 2017. This comparison was conducted to determine if the estimated 2031 volumes (excluding consented childcare facility and proposed residential development) were reliable or should the WRTM future volume predictions be used instead for this assessment.



Table No: 11

Traffic Volume Comparison				
Section	AM Peak Two-way Traffic Volumes (vph)		PM Peak Two-way Traffic Volumes (vph)	
	Estimated 2031 (used in this report)	Forecast 2031 (used in WRTM)	Estimated 2031 (used in this report)	Forecast 2031 (used in WRTM)
Te Rapa Rd (Southeast)	3,477	1,162	3,318	1,436
Te Rapa Rd (Northwest)	3,660	1,197	3,332	1,495
Garnett Ave	536	193	617	295
Vardon Rd	550	50	520	81
Ken Browne Dr	153	480	199	926
Sir Tristram Ave	62	480	53	926

As shown in the table above, the WRTM forecast 2031 traffic volumes are much less than the estimated 2031 traffic volumes used in the SIDRA modelling in this assessment except for Ken Browne Drive and Sir Tristram Avenue (discussed below). This is attributed to the fact that the current WRTM is based on 2013 census data. As a result, the consensus amongst traffic engineering practitioners using the WRTM is that future forecast projections are generally under-estimating.

However, the volumes indicated in the WRTM for Ken Browne Drive and Sir Tristram Avenue are higher than that used in this assessment. In the 2031 WRTM road network, there is a through road connecting Sir Tristram Avenue to Ken Browne Drive which in return attracts rat-running traffic from Te Rapa Road. There is no residential development included on the subject site, so the traffic volumes indicated on these roads in the WRTM are solely rat-running traffic avoiding the signalized intersections on Te Rapa Road.

On this basis, it is reasonable to conclude that the estimated 2031 traffic volumes based on 2021 turning count surveys and the assumed background growth rates are a more reliable and conservative future forecast for this specific site than the WRTM.

7.10 Staging of Transportation Infrastructure Improvements

This section of the report provides a summary of the staging, and associated triggers for the recommended transportation infrastructure improvements. The recommended improvements are based on the findings from the transportation effects assessments that were undertaken in the preceding sections.

The triggers associated with each improvement are related to capacity and safety improvements associated with the advancement of the proposed development stages of the Plan Change. These improvements relate to the associated number of trips that are expected to be generated and distributed on the local road network as the site is successively developed.

Table 12 below provides a summary of the staging of the proposed transportation infrastructure upgrades associated with this rezoning submission.



Table No: 12

Staging of Transportation Infrastructure Improvements		
No.	Proposed Upgrade	Development Stage Trigger
1	Upgrading of Te Rapa Road / Sir Tristram Avenue intersection (Refer to Figure 43)	When access to Sir Tristram Avenue is provided. OR After 70 trips per peak hour is generated by the proposed development through Te Rapa Road / Garnett Avenue / Vardon Road intersection (i.e. approximately 60 dwellings) *
2	Extension of existing footpath on the north-eastern side of Ken Browne Drive to connect to residential development	Before any residential traffic is generated by the Plan Change area.
3	Extension of existing footpath on the northern side of Sir Tristram Avenue to the existing bus stop located 110 m northwest of Te Rapa Road / Sir Tristram Avenue intersection	When access to Sir Tristram Avenue is provided.
4	Construction of new shared path on the southern side of Sir Tristram Avenue to the Te Rapa service lane; Provision of a raised safety platform pedestrian crossing (zebra) across the service lane. Provision of a raised safety platform staggered mid-block signalised crossing over Te Rapa Road (Refer to Figure 36)	When access to Sir Tristram Avenue is provided.

* This is based on the predicted trip distribution (Figure 26) to Te Rapa Road / Garnett Avenue / Vardon Road intersection and the assumption that Ken Browne Drive access will be provided from the outset.



8. Transport Strategies and Policies

8.1 Government Policy Statement on Land Transport 2021 / 22 – 2030 / 31

The Government Policy Statement (GPS2021) outlines this Government’s priorities for expenditure from the National Land Transport Fund over the next 10 years. It also provides guidance to decision-makers about where the Government will focus resources, consistent with the purpose of the Land Transport Management Act, which is:

“To contribute to an effective, efficient, and safe land transport system in the public interest”.

The key strategic priorities of the GPS2021 are defined as Safety, Better Travel Options, Improving Freight Connections and Climate Change. These are defined further as follows:

- *Safety: Developing a transport system where no-one is killed or seriously injured;*
- *Better Travel Options: Providing people with better transport options to access social and economic opportunities;*
- *Improving Freight Connections: Improving freight connections for economic development; and*
- *Climate Change: Developing a low carbon transport system that supports emissions reductions, while improving safety and inclusive access.*

8.2 Waikato Regional Land Transport Plan 2021 - 2051

The Waikato Regional Land Transport Plan 2021 – 2051 sets out the strategic direction for land transport in the Waikato region over the next thirty years. The Plan is built around the region’s three key transport problems, namely:

- *Protecting the function of our strategic corridors in the context of growth pressures in and around Hamilton, the North Waikato and in the upper North Island.*
- *Tackling our complex road safety problem and the disproportionate number of death and serious injuries in the region.*
- *Providing better, more equitable transport options to access social, health, economic and cultural opportunities.*

The Plan sets out seven priorities for land transport in the Waikato region. The priorities relevant in this instance are as follows.

- *Strategic Corridors: Improving network resilience, route reliability and safety on key strategic corridors.*
- *Managing Growth: Providing multi-modal transport solutions to support housing and growth in high growth areas.*
- *Road Safety: Implementing priorities in Road to Zero for the Waikato 2020 road safety strategy.*
- *Access and Mobility: Growing public transport and active mode share in urban and high growth areas.*
- *Maintaining what we have: Maximising efficiencies and optimisation across the transport system.*



8.3 Access Hamilton Strategy

Access Hamilton guides the city's development, transport infrastructure, and planning over the next 30 years. It aims to support Hamilton's economic and social environment, support sustainable development and land use, manage incremental change in transport, and position infrastructure and land development to meet the city's long-term needs.

8.4 Road to Zero Road Safety Strategy 2020 – 2030

This strategy sets out the vision for New Zealand where no one is killed or seriously injured in road crashes. The following seven principles are included in the strategy to guide how we design the network and make road safety decisions:

- *Promote good choices but plan for mistakes*
- *Design for human vulnerability*
- *Strengthen all parts of the road transport system*
- *Shared responsibility for improving road safety*
- *Our actions are grounded in evidence and evaluated*
- *Road safety actions support health, wellbeing, and liveable places*
- *Make safety a critical decision-making priority*

8.5 Policy Alignment of the Proposed Plan Change

The proposed Plan Change is consistent with the GPS and directions set out in the Waikato Regional Land Transport Plan and Access Hamilton Strategy because:

- The 'Safety' priority set out in the GPS signals a focus on improving the safety of local roads across the network and includes increased investment in footpaths to support access to and uptake of active travel modes. The proposed rezoning will result in additional vehicle movements on Te Rapa Road, which is identified as a regionally significant corridor in the Waikato Regional Policy Statement. Upgrades will be made to the Te Rapa Road / Sir Tristram Avenue intersection to ensure that unsafe movements are reduced and to allow safe access to the site.
- The proposed rezoning will establish residential dwellings in close proximity to places of employment (Te Rapa Industrial Zone), places of recreation (i.e. The Base, Waterworld and Minogue Park) and education (St Peter Chanel Catholic School, Vardon School, Forest Lake Primary) reducing the need for future residents to rely on private motor vehicles. As part of the development, walking and cycling connections to the wider network will be improved.
- Te Rapa Racecourse is identified in Access Hamilton as one of several 'generation and destination nodes' in the Te Rapa locality. The proposed Plan Change is considered well aligned with Access Hamilton insofar as the rezoning outcomes will contribute towards the economic, social, environmental and cultural wellbeing of the city. The racecourse is an important social and cultural hub which makes a tangible contribution to the economic wellbeing of the racing industry. The proposed rezoning also supports sustainability and economic development objectives for a compact city with consolidation and intensification around a key node.
- The proposed rezoning is consistent with the Road to Zero Road Strategy as it provides for safe and secure public environments that encourage walking and the use of public transport.



9. Conclusion

The overall transportation effects on the adjoining road network with the introduction of the proposed rezoning are expected to be minor to moderate if no transport mitigation measures are implemented.

However, with the recommended mitigation measures, the transportation effects from rezoning the site for residential purposes can be sufficiently mitigated to an acceptable and appropriate level, which is generally no more than minor. The following conclusions are made based on the assessments detailed in this report:

- The proposal consists of rezoning approximately 6.48 ha of the Te Rapa Racecourse site from Major Facilities Zone to Residential Zone for subsequent medium density residential development.
- When completed, the proposed residential development is expected to generate approximately 1,500 trips per day and 160 trips per peak hour.
- Access to the subject site is proposed via the existing access to the racecourse at Ken Browne Drive and a new access intersection at Sir Tristram Avenue approximately 90 m southwest of the Te Rapa Road / Sir Tristram Avenue intersection.
- A network of internal roads has been proposed to service the residential development. The internal road network is expected to be developed in such a way that the design will reflect a low volume and low speed environment. This could be achieved via various traffic calming strategies. This would also discourage rat-running traffic from utilising the proposed internal road network.
- At detailed design stage the proposed development is expected to comply with all District Plan requirements with regards to separation distances between accesses and to intersections, sight distances and cycle parking generation.
- The Te Rapa Road / Sir Tristram Avenue intersection is reasonably complex due to a combination of factors including the wide carriageway on Te Rapa Road, the one-way service lane parallel to Te Rapa Road, the Access Lane to Signature Homes car park which is parallel to Sir Tristram Avenue and the provision for car transporters at the intersection.
- For the safety reasons highlighted in this ITA, it is recommended to limit the movements at Te Rapa Road / Sir Tristram Avenue intersection to left-in, left-out and right-in movements only. This would mean that the right turns out to Te Rapa Road are banned and made as physically difficult to perform as practicable. A conceptual design of these proposed changes to Te Rapa Road / Sir Tristram Avenue intersection is presented in Figure 43. Traffic affected by this movement ban (mostly related to racecourse race days) can use the Te Rapa Road / Sunshine Avenue roundabout to perform a u-turn and return southbound on Te Rapa Road which equates to an extra travel distance of approximately 1 km.
- With the intersection upgrades recommended, the Te Rapa Road / Sir Tristram Avenue intersection is also expected to perform satisfactorily in the current and future year scenarios, including race days. Its safety and capacity will be significantly improved.
- Traffic modelling shows that, despite the increased vehicle trips associated with the proposed residential development, the existing Ken Browne Drive / Garnett Avenue / Minogue Drive roundabout will continue to operate at an adequate level of service in the current and future year scenarios, including race days.
- With the proposed residential development, the right turning movement from Garnett Avenue at the Te Rapa Road / Garnett Avenue / Vardon Road intersection performs unsatisfactorily. A fundamental issue is that there is no easy solution to increase the intersection capacity without creating additional lanes. The performance of the left turn movement from Garnett Avenue into Te Rapa Road justifies this movement being exclusive without the through traffic to Vardon Road added.



However, incorporating additional lanes will require significant re-design and upgrade of the intersection considering the proximity of the northbound service lane on Te Rapa Road.

- With the strong pedestrian connections proposed for connection to the existing bus stops as well as the slow speed environment design for internal roads within the development, it can be expected that a minimum 5% of peak hour trips generated by the site will be by PT and walking and cycling modes. This is likely to increase as the wider public transport and cycling networks improve and become more attractive for use over time. Therefore, providing infrastructure to enable efficient and safe connection to these alternative modes of transport will help to limit the impact on existing delays and queues at the Te Rapa Road / Garnett Avenue / Vardon Road intersection.
- The estimated 2031 traffic volumes derived from 2021 turning count survey data and background traffic growth rates are considered to be a more reliable and conservative future forecast than the 2031 WRTM future forecasts.
- The proposal aligns with the relevant policies and strategies at both national and local levels.



10. Recommendations

Based on the conclusions of this report, there are no traffic or transportation effects related reasons why the rezoning proposal should not be approved, provided the following recommended effects mitigation measures are implemented through the Medium Density Residential zone rules applying to subsequent resource consents or building consents, or through other measures.

Access Road Upgrades

- A no-parking restriction is introduced along the southwest side (northbound lane) of the Ken Browne Drive.
- The existing footpath on the north-eastern side of Ken Browne Drive be extended 75 m to the proposed access to the Plan Change area and be connected to the residential development footpaths.
- The existing footpath on the northern side of Sir Tristram Avenue should be extended for approximately 115 m running alongside Fairview Motors property to provide a connection to public transport on Te Rapa Road.
- Provide a walking and cycling shared path on the southern side of Sir Tristram Avenue between the proposed residential access intersection and the service lane, and along the Te Rapa service lane to a zebra crossing on a raised safety platform (RSP) across the service lane.
- Connect the shared path to a new mid-block RSP staggered signalised crossing across Te Rapa Road. (The introduction / implementation of a RSP at this location will be subject to a Road Safety Audit and Council's decision)
- Kerb let-downs (pram crossings) are required on Sir Tristram Avenue where pedestrians will cross between the footpaths on each side of the road.
- A landscape plan should be submitted to Council for approval as part of the design for subdivision consent, to identify the trees to be removed to accommodate the new access intersection on Sir Tristram Avenue.
- The existing racecourse site access at Mainstreet Place should be permanently closed.

Intersection Upgrades

- Te Rapa Road / Sir Tristram Avenue intersection to be upgraded to ban the right turn movements out onto Te Rapa Road. A conceptual design of the proposed Te Rapa Road / Sir Tristram Avenue intersection is presented in Figure 43.
- The movements at the intersection will be limited to left-in, left-out and right-in movements only.

Infrastructure Upgrade Timing

The above-mentioned infrastructure upgrades and the timing for delivery of each is summarised in Table 12 in Section 7.10

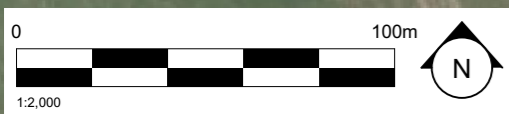


Appendix A – Proposed Concept Plan





- LEGEND**
- OPEN SPACE
 - RESIDENTIAL USE
 - NOISE SENSITIVE AREA
 - TYPICAL STREET
 - MINOR STREET
 - REAR LANEWAY
 - EXISTING NEIGHBOURING VET CARPARK
 - PROPOSED WETLAND
 - PROPOSED WETLAND EXTENSION
 - FOOTPATH
 - REAR LANEWAY MEDIUM BARRIER
 - VIEWSHAFTS
 - POSSIBLE CONNECTION TO NEIGHBOURING DEVELOPMENT
 - ACCESS POINT



notes:
do not scale from drawings. all data to be verified on site prior to commencement of work.
copyright:
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original scale

rev	issue	date
B	Landscape Layout Update	18/07/2022

project consultant list:

structural	mechanical
#Structural Engineer	#Mechanical Engineer

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WAIKATO RACING CLUB

PROPOSED SITE CONCEPT PLAN
MARCH 2022

design ChowHill scale 1:2000@A3
drawn ChowHill
check approved

CONCEPT DESIGN		
project no.	sheet	revision
16704	L80.09	2
date printed 18/07/2022		

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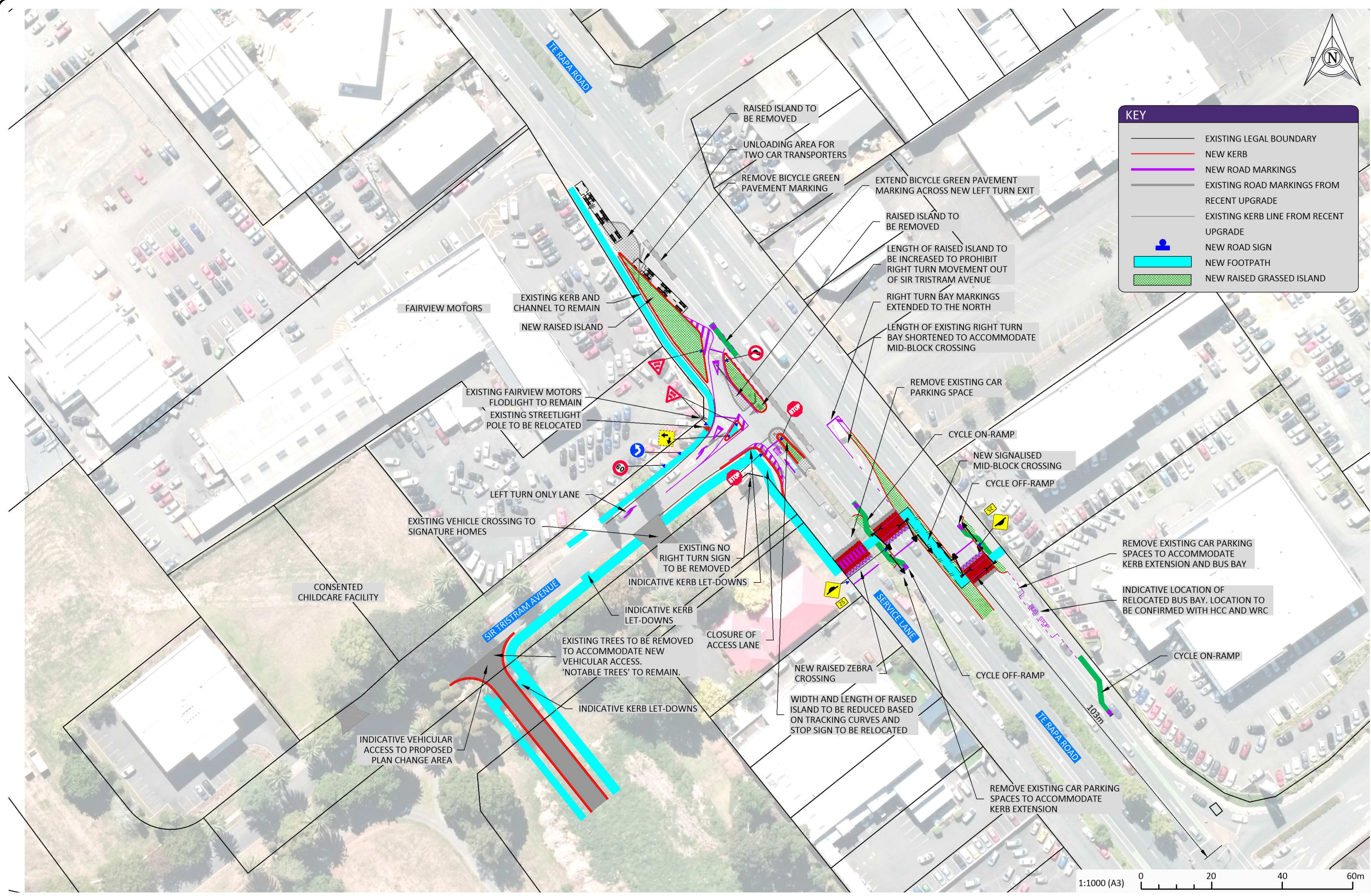
Appendix B – Te Rapa Road / Sir Tristram Avenue Intersection Concept Design



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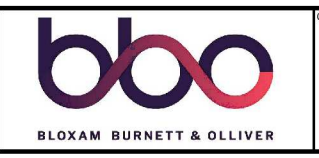


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D	08.06.2022	ADDED INDICATIVE KERB LET-DOWN LOCATIONS	SKB	CI	CI
C	23.03.2022	ADDED FOOTPATH ALONG SERVICE LANE	SKB	CI	CI
B	04.10.2021	FOR RESOURCE CONSENT APPLICATION	SKB	CI	CI
A	12.08.2021	FOR RESOURCE CONSENT APPLICATION	SKB	CI	CI

DESIGNED	CHECKED
SKB	CI
DRAWN	APPROVED
SKB	CI



CLIENT
TE RAPA RESIDENTIAL PLAN CHANGE

DRAWING
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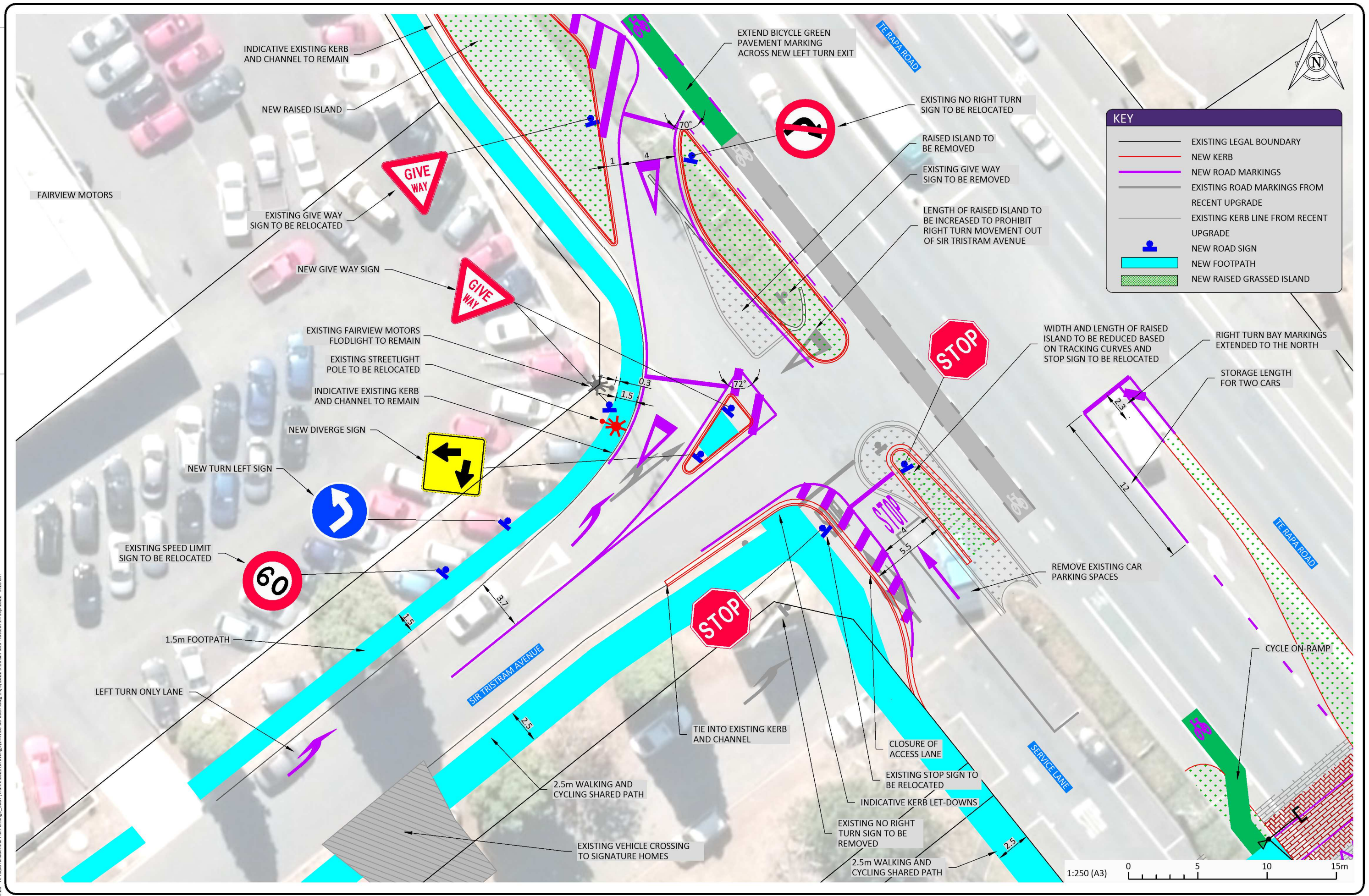
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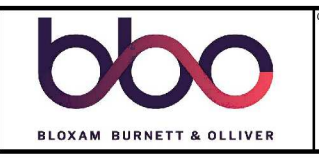
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C	23.03.2022	ADDED FOOTPATH ALONG SERVICE LANE	SKB	CI	CI
B	04.10.2021	FOR RESOURCE CONSENT APPLICATION	SKB	CI	CI
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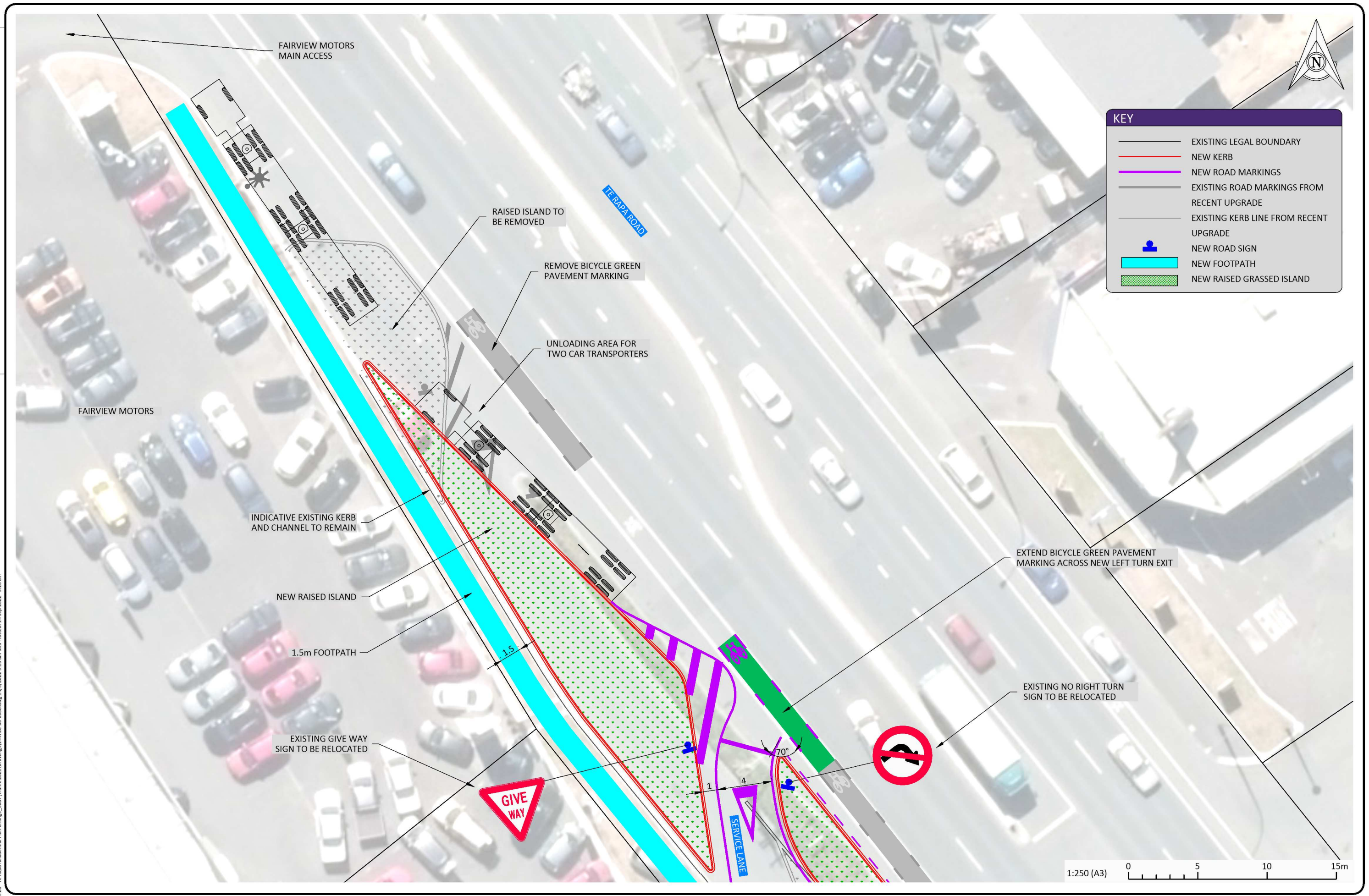


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 Version 4.0 - March 2020



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DRAWN	APPROVED
SB	CI


BLOXAM BURNETT & OLLIVER

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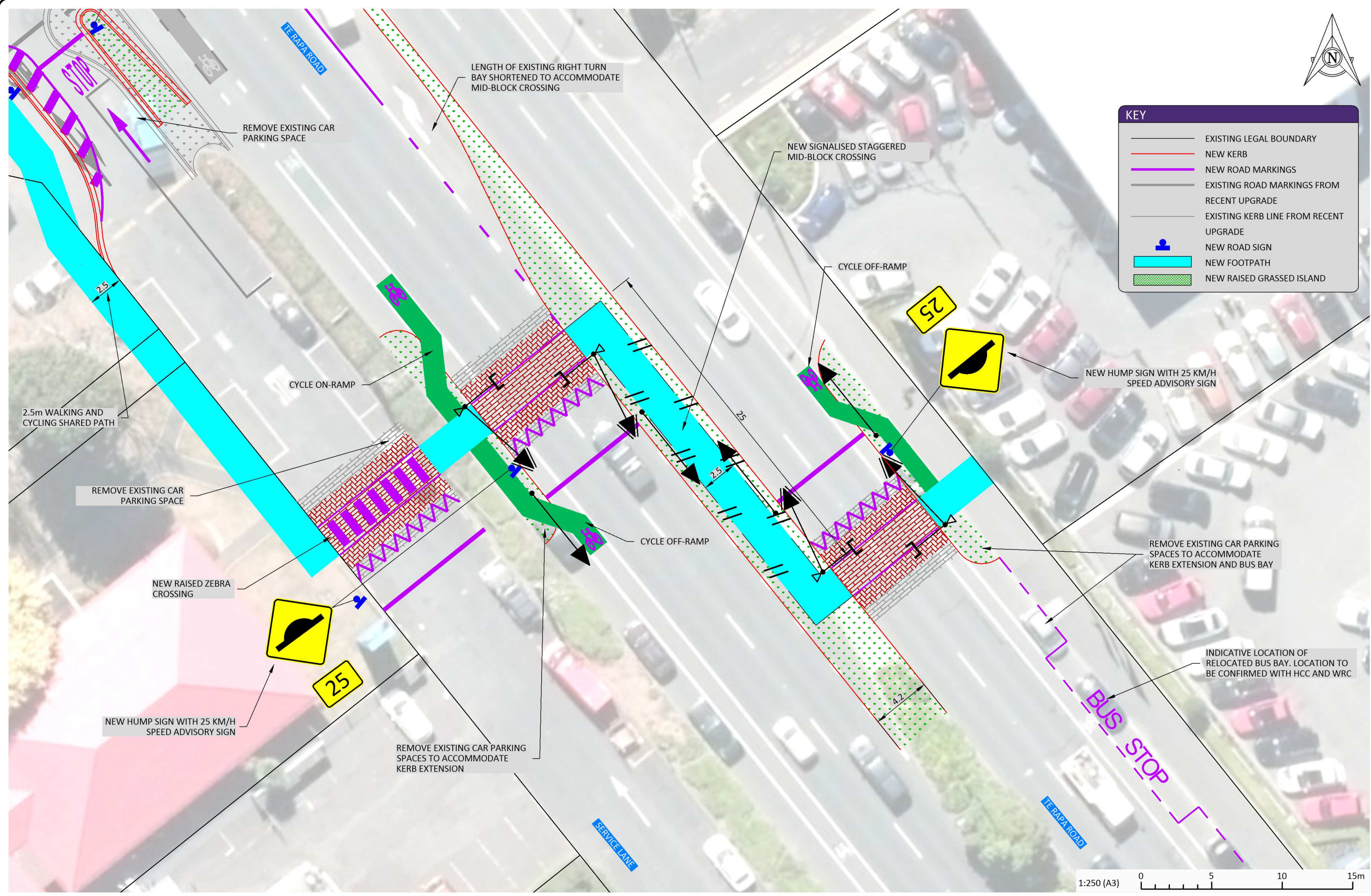
Te Rapa
 Waikato Racing Club

PROJECT
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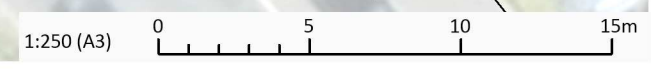
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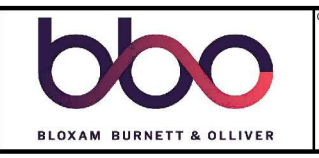


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Te Rapa
Waikato Racing Club

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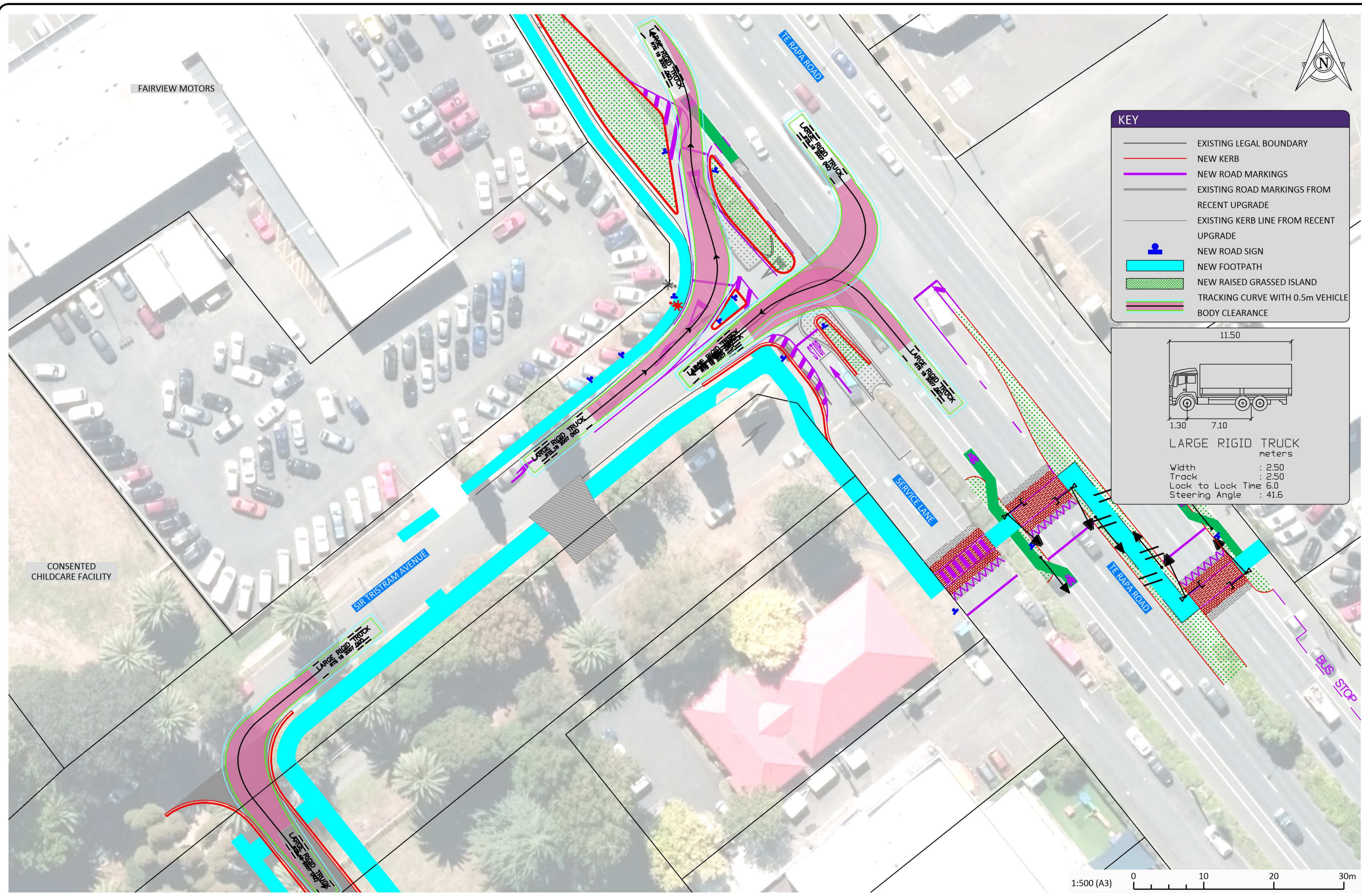
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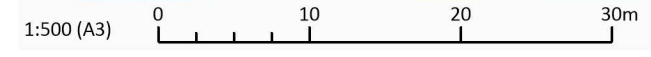
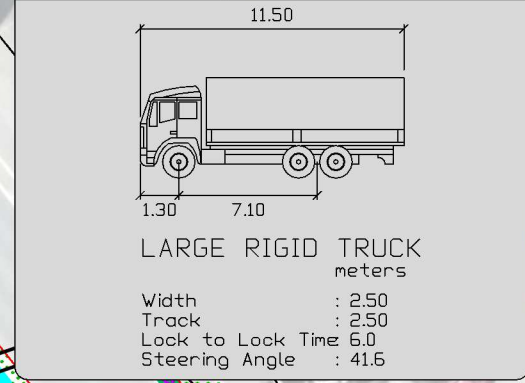
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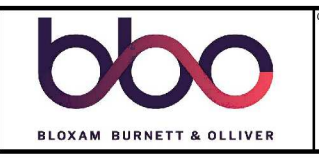


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23.03.2022	ADDED FOOTPATH ALONG SERVICE LANE	SKB	CI	CI
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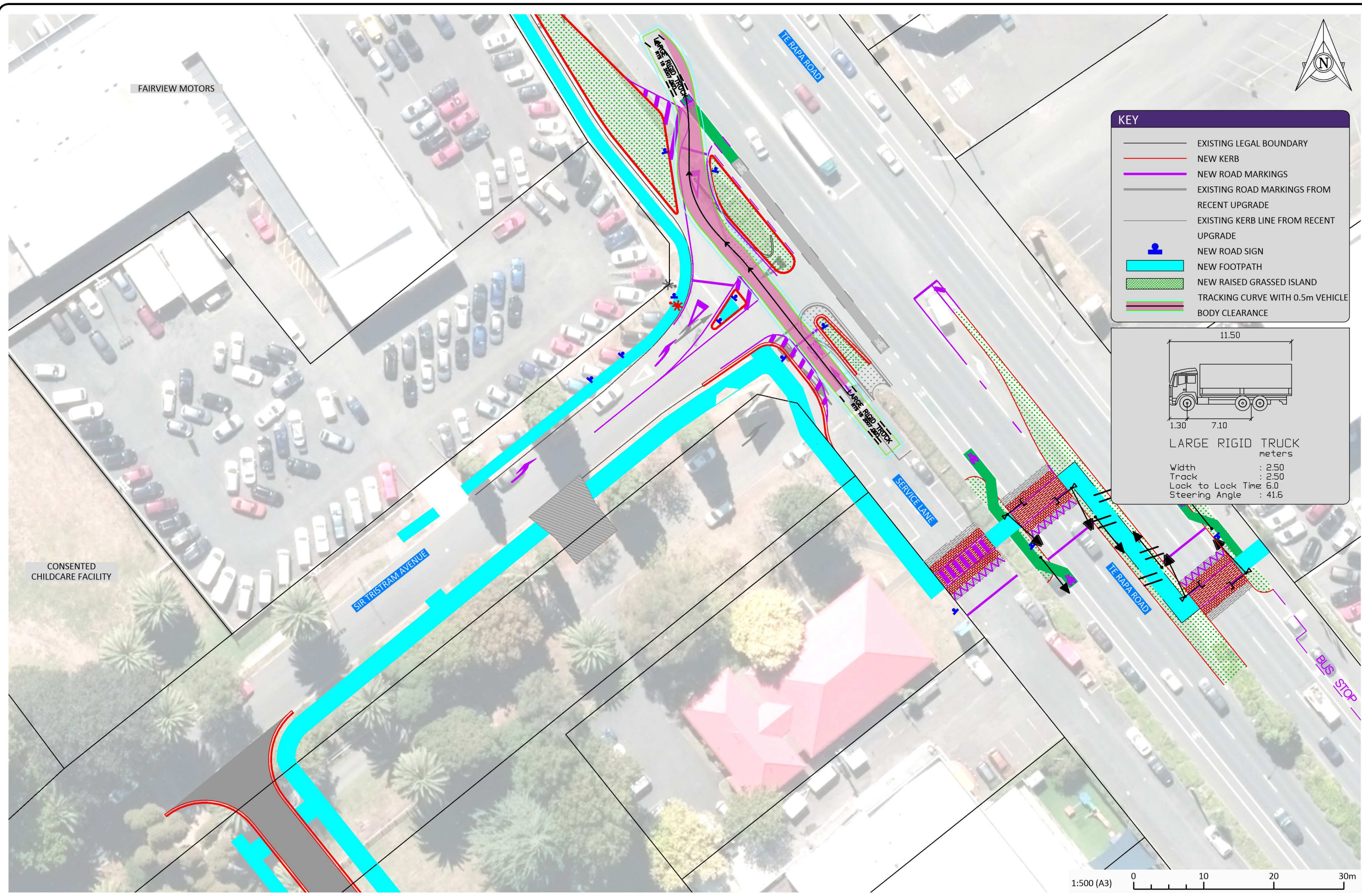
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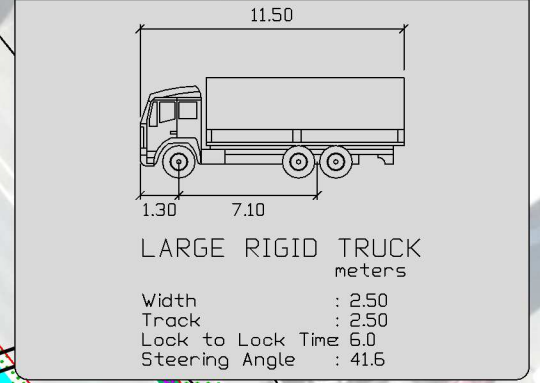
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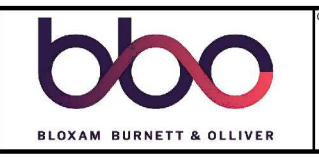
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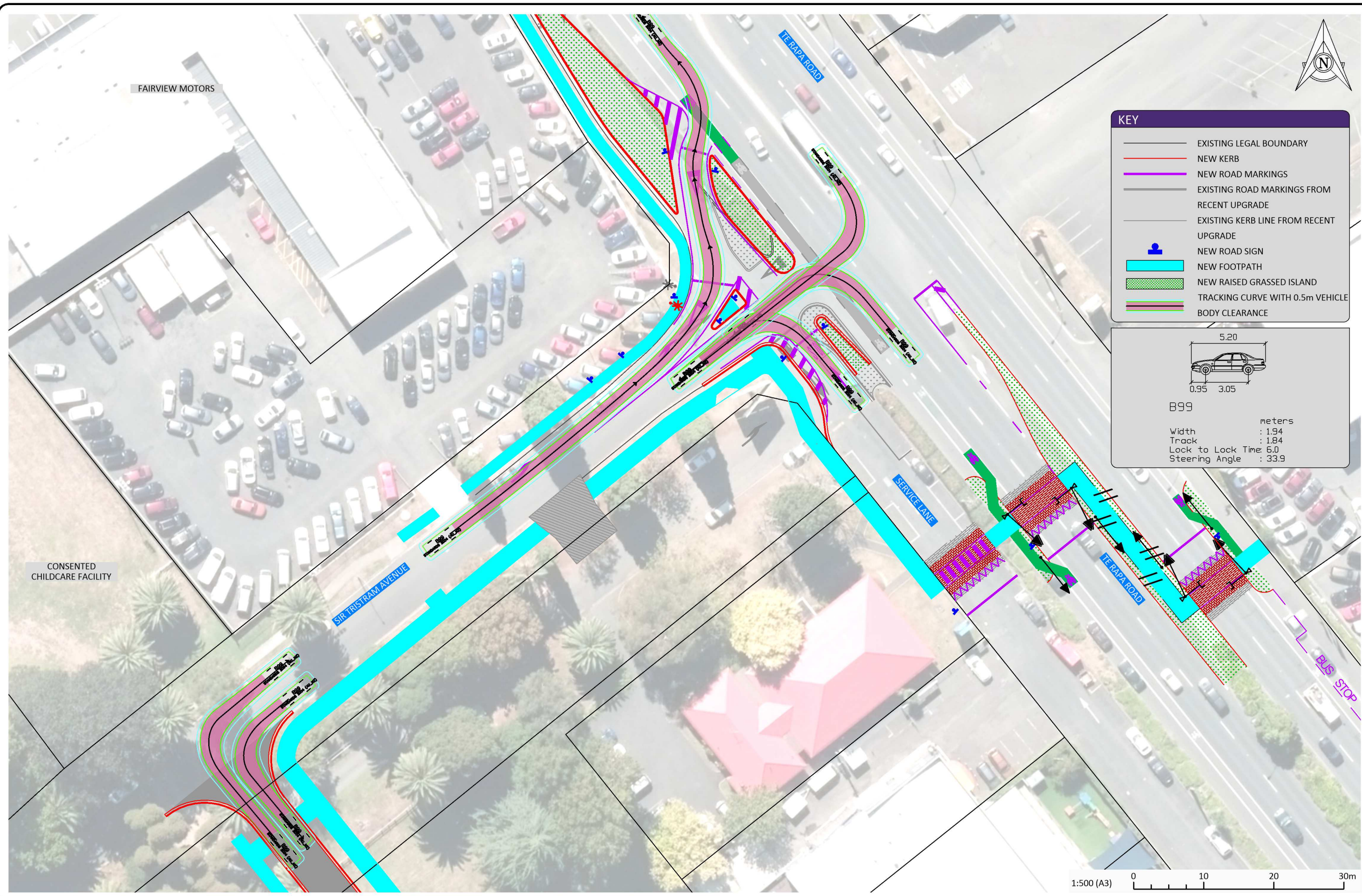
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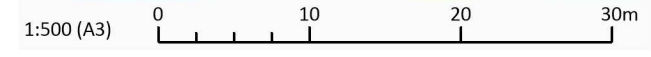
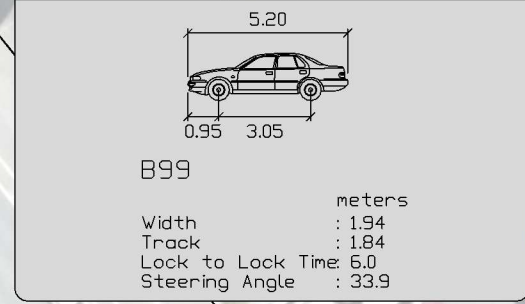
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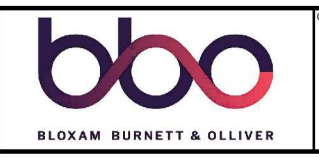


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23.03.2022	ADDED FOOTPATH ALONG SERVICE LANE	SKB	CI	CI
04.10.2021	FOR RESOURCE CONSENT APPLICATION	SKB	CI	CI
12.08.2021	FOR RESOURCE CONSENT APPLICATION	SKB	CI	CI

DESIGNED	CHECKED
SKB	CI
DRAWN	APPROVED
SKB	CI



CLIENT
TE RAPA RESIDENTIAL PLAN CHANGE

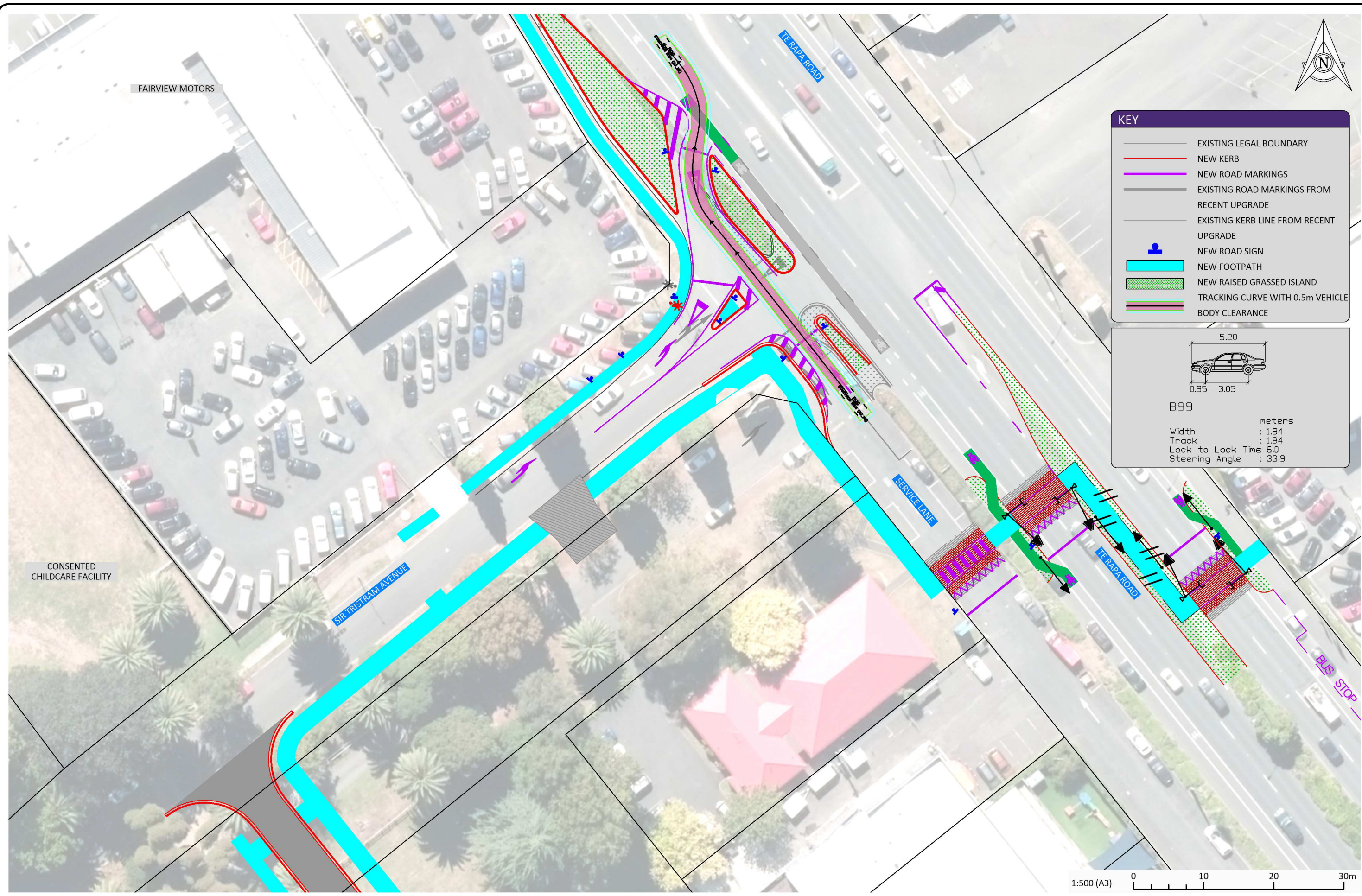
DRAWING
TE RAPA ROAD / SIR TRISTRAM AVENUE INTERSECTION CONCEPT DESIGN 99 PERCENTILE CAR TRACKING CURVES FROM / TO SIR TRISTRAM AVENUE

STATUS	
PRELIMINARY	
DATE	SCALE (ORIGINAL SIZE A3)
12.08.2021	1:500
DRAWING NUMBER	REVISION
144720-00-0011	D

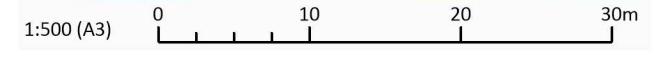
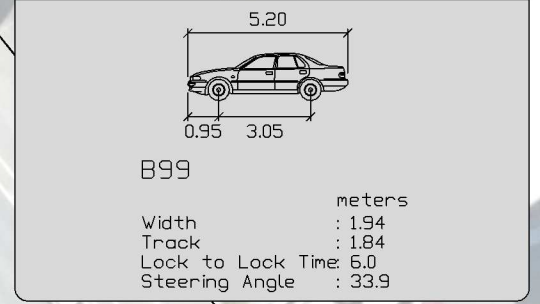
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SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY

C:\Users\k107120\OneDrive\Documents\Te Rapa Residential Plan Change - 9687\Traffic 2021\Drawing\144720-00-0012.dwg 14/9/2022 9:20 am sva Plotted: 14 Sep 2022 9:20 am

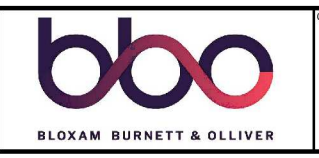


KEY	
	EXISTING LEGAL BOUNDARY
	NEW KERB
	NEW ROAD MARKINGS
	EXISTING ROAD MARKINGS FROM RECENT UPGRADE
	EXISTING KERB LINE FROM RECENT UPGRADE
	NEW ROAD SIGN
	NEW FOOTPATH
	NEW RAISED GRASSED ISLAND
	TRACKING CURVE WITH 0.5m VEHICLE BODY CLEARANCE



DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR	
D	18.08.2022	ADDED MID-BLOCK CROSSING ON TE RAPA ROAD	SKB	CI	CI
C	23.03.2022	ADDED FOOTPATH ALONG SERVICE LANE	SKB	CI	CI
B	04.10.2021	FOR RESOURCE CONSENT APPLICATION	SKB	CI	CI
A	12.08.2021	FOR RESOURCE CONSENT APPLICATION	SKB	CI	CI

DESIGNED	CHECKED
SKB	CI
DRAWN	APPROVED
SKB	CI



CLIENT
TE RAPA RESIDENTIAL PLAN CHANGE

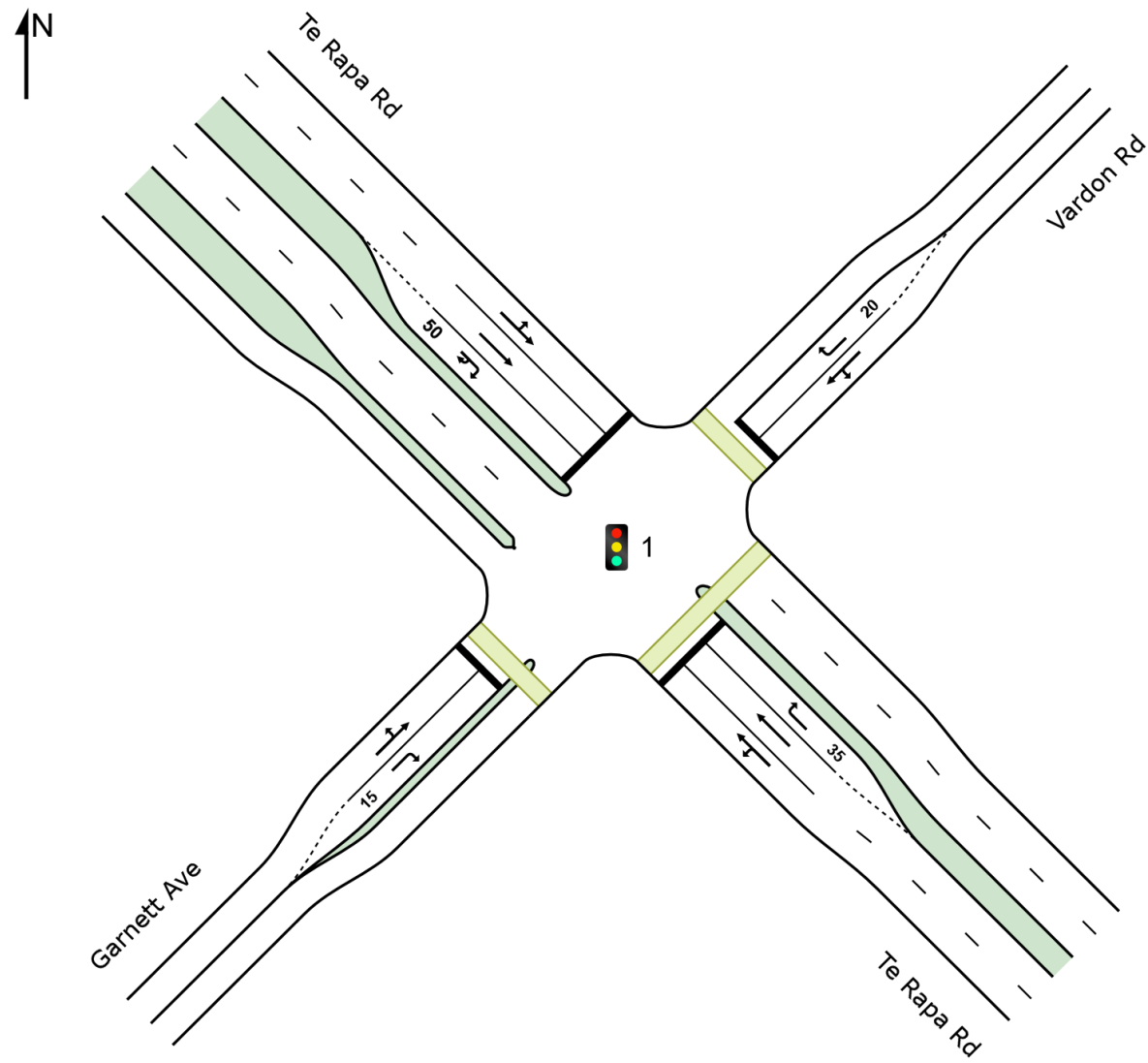
DRAWING
TE RAPA ROAD / SIR TRISTRAM AVENUE INTERSECTION CONCEPT DESIGN 99 PERCENTILE CAR TRACKING CURVES FROM SERVICE LANE

STATUS	
PRELIMINARY	
DATE	SCALE (ORIGINAL SIZE A3)
12.08.2021	1:500
DRAWING NUMBER	REVISION
144720-00-0012	D

Appendix C – SIDRA Outputs



SIDRA Results – Te Rapa Road / Garnett Avenue / Vardon Road Signalised Intersection



2021 Baseline (Existing Traffic Volumes + Consented / Permitted Traffic Volumes)

Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2021 - AM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	56	8.0	56	8.0	0.736	32.3	LOS C	31.6	225.8	0.96	0.85	0.96	34.7
2	T1	1611	2.0	1611	2.0	0.736	27.3	LOS C	31.6	225.8	0.95	0.83	0.95	37.9
3	R2	94	2.0	94	2.0	0.365	46.0	LOS D	3.8	27.1	0.99	0.75	0.99	30.5
Approach		1761	2.2	1761	2.2	0.736	28.4	LOS C	31.6	225.8	0.95	0.83	0.95	37.2
NorthEast: Vardon Rd														
4	L2	137	1.0	137	1.0	0.489	32.5	LOS C	6.4	45.5	0.87	0.76	0.87	34.8
5	T1	50	3.0	50	3.0	0.489	27.9	LOS C	6.4	45.5	0.87	0.76	0.87	31.4
6	R2	114	2.0	114	2.0	* 0.885	57.2	LOS E	5.6	39.5	1.00	1.07	1.68	24.8
Approach		301	1.7	301	1.7	0.885	41.1	LOS D	6.4	45.5	0.92	0.88	1.18	30.2
NorthWest: Te Rapa Rd														
7	L2	44	2.0	44	2.0	0.873	41.7	LOS D	30.2	218.5	1.00	1.04	1.20	30.9
8	T1	1214	4.0	1214	4.0	* 0.873	37.0	LOS D	30.2	218.5	0.98	1.03	1.20	33.5
9	R2	100	4.0	100	4.0	* 0.906	58.0	LOS E	6.9	49.2	1.00	1.11	1.72	19.2
9u	U	40	0.0	40	0.0	0.906	59.4	LOS E	6.9	49.2	1.00	1.11	1.72	20.5
Approach		1398	3.8	1398	3.8	0.906	39.3	LOS D	30.2	218.5	0.99	1.03	1.25	31.9
SouthWest: Garnett Ave														
10	L2	193	2.0	193	2.0	0.894	55.0	LOS E	13.1	93.7	0.99	1.16	1.55	20.0
11	T1	60	5.0	60	5.0	* 0.894	50.5	LOS D	13.1	93.7	0.99	1.16	1.55	24.7
12	R2	45	2.0	45	2.0	0.538	50.3	LOS D	2.0	14.3	1.00	0.78	1.08	25.4
Approach		298	2.6	298	2.6	0.894	53.4	LOS D	13.1	93.7	0.99	1.10	1.48	21.9
All Vehicles		3758	2.8	3758	2.8	0.906	35.5	LOS D	31.6	225.8	0.96	0.93	1.12	33.1



Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2021 - PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Te Rapa Rd														
1	L2	59	2.0	59	2.0	0.516	32.7	LOS C	23.0	166.4	0.87	0.76	0.87	34.4
2	T1	1090	4.0	1090	4.0	0.516	27.8	LOS C	23.0	166.4	0.86	0.74	0.86	37.5
3	R2	101	2.0	101	2.0	* 0.444	52.4	LOS D	4.7	33.3	1.00	0.75	1.00	29.0
Approach		1250	3.7	1250	3.7	0.516	30.0	LOS C	23.0	166.4	0.87	0.75	0.87	36.3
NorthEast: Vardon Rd														
4	L2	149	1.0	149	1.0	0.845	53.6	LOS D	11.5	81.8	1.00	1.02	1.33	29.1
5	T1	77	5.0	77	5.0	0.845	49.0	LOS D	11.5	81.8	1.00	1.02	1.33	25.2
6	R2	56	2.0	56	2.0	* 0.492	54.6	LOS D	2.7	19.3	1.00	0.75	1.00	25.4
Approach		282	2.3	282	2.3	0.845	52.5	LOS D	11.5	81.8	1.00	0.96	1.26	27.4
NorthWest: Te Rapa Rd														
7	L2	37	0.0	37	0.0	0.857	38.5	LOS D	38.4	270.9	0.99	0.97	1.09	32.1
8	T1	1497	1.0	1497	1.0	* 0.857	33.7	LOS C	38.4	270.9	0.96	0.94	1.07	35.0
9	R2	142	3.0	142	3.0	0.541	47.8	LOS D	7.0	50.4	0.98	0.79	0.98	21.6
9u	U	15	0.0	15	0.0	0.541	49.2	LOS D	7.0	50.4	0.98	0.79	0.98	22.9
Approach		1691	1.1	1691	1.1	0.857	35.1	LOS D	38.4	270.9	0.96	0.93	1.06	33.6
SouthWest: Garnett Ave														
10	L2	149	1.0	149	1.0	0.885	59.1	LOS E	11.2	79.4	0.96	1.12	1.51	19.2
11	T1	52	5.0	52	5.0	* 0.885	54.5	LOS D	11.2	79.4	0.96	1.12	1.51	23.8
12	R2	93	2.0	93	2.0	0.781	54.1	LOS D	4.7	33.2	0.98	0.95	1.35	24.5
Approach		294	2.0	294	2.0	0.885	56.7	LOS E	11.2	79.4	0.97	1.07	1.46	21.9
All Vehicles		3517	2.2	3517	2.2	0.885	36.5	LOS D	38.4	270.9	0.93	0.88	1.04	32.7



Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2021 – Race Day Mid-Day Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Te Rapa Rd														
1	L2	58	8.0	58	8.0	0.729	43.3	LOS D	51.3	366.1	0.94	0.85	0.94	30.3
2	T1	1599	2.0	1599	2.0	0.729	37.2	LOS D	51.3	366.1	0.91	0.80	0.91	33.4
3	R2	311	2.0	311	2.0	* 1.059	201.9	LOS F	40.0	284.6	1.00	1.48	2.41	13.1
Approach		1968	2.2	1968	2.2	1.059	63.4	LOS E	51.3	366.1	0.92	0.91	1.15	25.6
NorthEast: Vardon Rd														
4	L2	86	1.0	86	1.0	0.796	71.6	LOS E	7.7	54.8	1.00	0.92	1.25	25.4
5	T1	31	3.0	31	3.0	0.796	67.1	LOS E	7.7	54.8	1.00	0.92	1.25	21.4
6	R2	57	2.0	57	2.0	* 0.675	75.3	LOS E	3.8	27.3	1.00	0.81	1.15	21.5
Approach		174	1.7	174	1.7	0.796	72.0	LOS E	7.7	54.8	1.00	0.89	1.22	23.5
NorthWest: Te Rapa Rd														
7	L2	52	2.0	52	2.0	1.055	185.9	LOS F	99.5	719.3	1.00	1.78	2.14	11.9
8	T1	1358	4.0	1358	4.0	* 1.055	183.5	LOS F	99.5	719.3	1.00	1.81	2.17	12.1
9	R2	140	4.0	140	4.0	0.720	65.0	LOS E	12.2	87.4	1.00	0.85	1.07	17.9
9u	U	55	0.0	55	0.0	0.720	66.5	LOS E	12.2	87.4	1.00	0.85	1.07	19.1
Approach		1605	3.8	1605	3.8	1.055	169.3	LOS F	99.5	719.3	1.00	1.69	2.03	12.5
SouthWest: Garnett Ave														
10	L2	229	2.0	229	2.0	1.081	248.6	LOS F	46.0	329.7	1.00	1.79	2.68	6.3
11	T1	71	5.0	71	5.0	* 1.081	244.0	LOS F	46.0	329.7	1.00	1.79	2.68	8.7
12	R2	111	2.0	111	2.0	0.819	62.3	LOS E	6.9	49.4	0.87	0.95	1.25	22.8
Approach		411	2.5	411	2.5	1.081	197.5	LOS F	46.0	329.7	0.97	1.56	2.29	8.9
All Vehicles		4158	2.8	4158	2.8	1.081	117.9	LOS F	99.5	719.3	0.96	1.28	1.60	16.6



Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2021 – Race Day PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	35	2.0	35	2.0	0.322	25.9	LOS C	8.9	64.7	0.84	0.70	0.84	37.7
2	T1	630	4.0	630	4.0	0.322	21.2	LOS C	8.9	64.7	0.84	0.70	0.84	41.1
3	R2	69	2.0	69	2.0	0.220	37.1	LOS D	2.2	15.9	0.97	0.73	0.97	32.9
Approach		734	3.7	734	3.7	0.322	23.0	LOS C	8.9	64.7	0.85	0.70	0.85	39.8
NorthEast: Vardon Rd														
4	L2	43	1.0	43	1.0	0.415	39.3	LOS D	2.3	16.3	0.99	0.75	0.99	32.8
5	T1	23	5.0	23	5.0	0.415	34.7	LOS C	2.3	16.3	0.99	0.75	0.99	29.2
6	R2	26	2.0	26	2.0	* 0.166	38.2	LOS D	0.9	6.2	0.96	0.71	0.96	29.8
Approach		92	2.3	92	2.3	0.415	37.8	LOS D	2.3	16.3	0.98	0.74	0.98	31.2
NorthWest: Te Rapa Rd														
7	L2	25	0.0	25	0.0	0.718	29.9	LOS C	15.8	111.4	0.96	0.85	1.00	35.6
8	T1	939	1.0	939	1.0	* 0.718	25.1	LOS C	15.8	111.4	0.95	0.84	0.99	39.1
9	R2	84	3.0	84	3.0	* 0.466	39.0	LOS D	3.2	22.8	0.99	0.76	0.99	24.1
9u	U	9	0.0	9	0.0	0.466	40.4	LOS D	3.2	22.8	0.99	0.76	0.99	25.4
Approach		1057	1.1	1057	1.1	0.718	26.5	LOS C	15.8	111.4	0.96	0.84	0.99	37.6
SouthWest: Garnett Ave														
10	L2	119	1.0	119	1.0	0.760	37.5	LOS D	5.8	41.2	0.97	0.95	1.26	24.8
11	T1	42	5.0	42	5.0	* 0.760	33.0	LOS C	5.8	41.2	0.97	0.95	1.26	29.6
12	R2	97	2.0	97	2.0	0.408	32.0	LOS C	3.0	21.5	0.91	0.77	0.91	30.9
Approach		258	2.0	258	2.0	0.760	34.7	LOS C	5.8	41.2	0.95	0.88	1.13	28.1
All Vehicles		2141	2.2	2141	2.2	0.760	26.8	LOS C	15.8	111.4	0.92	0.79	0.96	36.7



2021 Baseline + Development (Existing Traffic Volumes + Consented Traffic Volumes + Development Traffic Volumes)

Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2021 + Development - AM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	72	8.0	72	8.0	0.800	36.0	LOS D	34.8	248.6	0.99	0.89	1.01	33.0
2	T1	1611	2.0	1611	2.0	0.800	31.1	LOS C	34.8	248.6	0.98	0.88	1.01	36.0
3	R2	94	2.0	94	2.0	* 0.378	47.7	LOS D	3.9	28.1	0.99	0.75	0.99	30.1
Approach		1777	2.2	1777	2.2	0.800	32.2	LOS C	34.8	248.6	0.98	0.87	1.01	35.4
NorthEast: Vardon Rd														
4	L2	137	1.0	137	1.0	0.661	40.1	LOS D	7.5	52.9	0.95	0.83	1.01	32.4
5	T1	50	3.0	50	3.0	0.661	35.6	LOS D	7.5	52.9	0.95	0.83	1.01	28.8
6	R2	114	2.0	114	2.0	* 0.917	62.7	LOS E	6.0	42.5	1.00	1.14	1.84	23.7
Approach		301	1.7	301	1.7	0.917	47.9	LOS D	7.5	52.9	0.97	0.94	1.32	28.4
NorthWest: Te Rapa Rd														
7	L2	44	2.0	44	2.0	0.905	48.1	LOS D	33.6	242.9	1.00	1.10	1.29	28.9
8	T1	1214	4.0	1214	4.0	* 0.905	43.6	LOS D	33.6	242.9	0.99	1.10	1.30	31.1
9	R2	100	4.0	100	4.0	0.804	52.7	LOS D	6.5	46.8	1.00	0.94	1.32	20.3
9u	U	40	0.0	40	0.0	0.804	54.1	LOS D	6.5	46.8	1.00	0.94	1.32	21.6
Approach		1398	3.8	1398	3.8	0.905	44.7	LOS D	33.6	242.9	0.99	1.08	1.30	30.0
SouthWest: Garnett Ave														
10	L2	193	2.0	193	2.0	0.924	65.0	LOS E	14.6	104.8	0.96	1.24	1.69	18.0
11	T1	60	5.0	60	5.0	* 0.924	60.4	LOS E	14.6	104.8	0.96	1.24	1.69	22.6
12	R2	99	2.0	99	2.0	0.651	44.3	LOS D	4.2	30.0	0.96	0.85	1.09	27.0
Approach		352	2.5	352	2.5	0.924	58.4	LOS E	14.6	104.8	0.96	1.13	1.52	21.3
All Vehicles		3828	2.8	3828	2.8	0.924	40.4	LOS D	34.8	248.6	0.98	0.98	1.18	31.2



Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2021 + Development - PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	112	2.0	112	2.0	0.562	35.3	LOS D	25.7	185.3	0.90	0.79	0.90	32.9
2	T1	1090	4.0	1090	4.0	0.562	30.3	LOS C	25.7	185.3	0.88	0.77	0.88	36.2
3	R2	101	2.0	101	2.0	* 0.462	54.7	LOS D	4.9	34.8	1.00	0.75	1.00	28.4
Approach		1303	3.7	1303	3.7	0.562	32.6	LOS C	25.7	185.3	0.89	0.77	0.89	35.0
NorthEast: Vardon Rd														
4	L2	149	1.0	149	1.0	0.934	71.5	LOS E	14.0	99.8	1.00	1.23	1.70	25.5
5	T1	77	5.0	77	5.0	* 0.934	66.9	LOS E	14.0	99.8	1.00	1.23	1.70	21.5
6	R2	56	2.0	56	2.0	0.513	57.0	LOS E	2.8	20.2	1.00	0.75	1.01	24.9
Approach		282	2.3	282	2.3	0.934	67.4	LOS E	14.0	99.8	1.00	1.14	1.56	24.4
NorthWest: Te Rapa Rd														
7	L2	37	0.0	37	0.0	0.893	45.5	LOS D	43.4	306.3	1.00	1.03	1.17	29.8
8	T1	1497	1.0	1497	1.0	* 0.893	40.8	LOS D	43.4	306.3	0.98	1.02	1.16	32.1
9	R2	142	3.0	142	3.0	0.564	50.1	LOS D	7.4	52.9	0.99	0.80	0.99	21.0
9u	U	15	0.0	15	0.0	0.564	51.6	LOS D	7.4	52.9	0.99	0.80	0.99	22.3
Approach		1691	1.1	1691	1.1	0.893	41.8	LOS D	43.4	306.3	0.98	1.00	1.14	31.1
SouthWest: Garnett Ave														
10	L2	149	1.0	149	1.0	0.841	51.5	LOS D	10.4	74.3	0.92	1.01	1.29	20.9
11	T1	52	5.0	52	5.0	0.841	46.9	LOS D	10.4	74.3	0.92	1.01	1.29	25.6
12	R2	123	2.0	123	2.0	* 0.937	81.1	LOS F	8.1	57.8	0.96	1.25	1.96	19.6
Approach		324	2.0	324	2.0	0.937	62.0	LOS E	10.4	74.3	0.94	1.10	1.54	21.0
All Vehicles		3600	2.2	3600	2.2	0.937	42.3	LOS D	43.4	306.3	0.95	0.93	1.12	30.5



Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2021 + Development - Race Day Mid-Day Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	132	8.0	132	8.0	0.757	44.2	LOS D	54.7	391.9	0.96	0.86	0.96	29.8
2	T1	1599	2.0	1599	2.0	0.757	37.9	LOS D	54.7	391.9	0.92	0.81	0.92	33.0
3	R2	311	2.0	311	2.0	* 1.096	260.0	LOS F	47.0	334.6	1.00	1.63	2.73	10.8
Approach		2042	2.4	2042	2.4	1.096	72.2	LOS E	54.7	391.9	0.93	0.94	1.19	23.7
NorthEast: Vardon Rd														
4	L2	86	1.0	86	1.0	0.974	107.1	LOS F	10.0	70.6	1.00	1.26	1.96	20.4
5	T1	31	3.0	31	3.0	0.974	102.5	LOS F	10.0	70.6	1.00	1.26	1.96	16.6
6	R2	57	2.0	57	2.0	* 0.685	76.6	LOS E	3.9	27.7	1.00	0.82	1.16	21.2
Approach		174	1.7	174	1.7	0.974	96.3	LOS F	10.0	70.6	1.00	1.12	1.70	19.9
NorthWest: Te Rapa Rd														
7	L2	52	2.0	52	2.0	1.071	212.2	LOS F	107.8	779.7	1.00	1.90	2.29	10.7
8	T1	1358	4.0	1358	4.0	* 1.071	209.7	LOS F	107.8	779.7	1.00	1.92	2.31	10.9
9	R2	140	4.0	140	4.0	0.780	69.0	LOS E	12.8	91.5	1.00	0.88	1.14	17.2
9u	U	55	0.0	55	0.0	0.780	70.4	LOS E	12.8	91.5	1.00	0.88	1.14	18.5
Approach		1605	3.8	1605	3.8	1.071	192.7	LOS F	107.8	779.7	1.00	1.79	2.17	11.2
SouthWest: Garnett Ave														
10	L2	229	2.0	229	2.0	1.096	273.0	LOS F	49.1	351.4	1.00	1.85	2.79	5.8
11	T1	71	5.0	71	5.0	* 1.096	268.4	LOS F	49.1	351.4	1.00	1.85	2.79	8.0
12	R2	135	2.0	135	2.0	0.914	86.0	LOS F	10.4	73.7	0.86	1.11	1.56	18.9
Approach		435	2.5	435	2.5	1.096	214.2	LOS F	49.1	351.4	0.96	1.62	2.41	8.4
All Vehicles		4256	2.9	4256	2.9	1.096	133.1	LOS F	107.8	779.7	0.96	1.34	1.71	15.2



Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2021 + Development - Race Day PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	84	2.0	84	2.0	0.374	26.2	LOS C	9.6	69.3	0.87	0.74	0.87	36.8
2	T1	630	4.0	630	4.0	0.374	21.6	LOS C	9.6	69.3	0.87	0.72	0.87	40.5
3	R2	69	2.0	69	2.0	0.211	35.4	LOS D	2.1	15.1	0.96	0.73	0.96	33.4
Approach		783	3.6	783	3.6	0.374	23.3	LOS C	9.6	69.3	0.88	0.73	0.88	39.2
NorthEast: Vardon Rd														
4	L2	43	1.0	43	1.0	0.397	37.5	LOS D	2.2	15.5	0.98	0.75	0.98	33.3
5	T1	23	5.0	23	5.0	0.397	32.9	LOS C	2.2	15.5	0.98	0.75	0.98	29.7
6	R2	26	2.0	26	2.0	* 0.159	36.4	LOS D	0.8	5.9	0.95	0.70	0.95	30.3
Approach		92	2.3	92	2.3	0.397	36.1	LOS D	2.2	15.5	0.97	0.73	0.97	31.7
NorthWest: Te Rapa Rd														
7	L2	25	0.0	25	0.0	0.761	31.1	LOS C	15.8	111.6	0.98	0.90	1.07	35.1
8	T1	939	1.0	939	1.0	* 0.761	26.4	LOS C	15.8	111.6	0.98	0.90	1.07	38.4
9	R2	84	3.0	84	3.0	* 0.446	37.2	LOS D	3.0	21.7	0.99	0.76	0.99	24.6
9u	U	9	0.0	9	0.0	0.446	38.6	LOS D	3.0	21.7	0.99	0.76	0.99	25.9
Approach		1057	1.1	1057	1.1	0.761	27.5	LOS C	15.8	111.6	0.98	0.88	1.06	37.1
SouthWest: Garnett Ave														
10	L2	119	1.0	119	1.0	0.808	39.0	LOS D	5.8	41.5	0.97	1.01	1.41	24.3
11	T1	42	5.0	42	5.0	* 0.808	34.5	LOS C	5.8	41.5	0.97	1.01	1.41	29.1
12	R2	128	2.0	128	2.0	0.558	32.3	LOS C	4.0	28.6	0.95	0.81	0.97	30.7
Approach		289	2.0	289	2.0	0.808	35.4	LOS D	5.8	41.5	0.96	0.92	1.21	28.0
All Vehicles		2221	2.2	2221	2.2	0.808	27.4	LOS C	15.8	111.6	0.94	0.83	1.01	36.3



2031 Baseline

Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2031 – AM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	62	8.0	62	8.0	0.798	40.5	LOS D	45.6	325.4	0.98	0.88	0.98	31.3
2	T1	1772	2.0	1772	2.0	0.798	35.2	LOS D	45.6	325.4	0.97	0.86	0.97	34.2
3	R2	104	2.0	104	2.0	* 0.519	59.9	LOS E	5.5	39.3	1.00	0.75	1.00	27.3
Approach		1938	2.2	1938	2.2	0.798	36.7	LOS D	45.6	325.4	0.97	0.85	0.97	33.6
NorthEast: Vardon Rd														
4	L2	151	1.0	151	1.0	0.599	41.8	LOS D	9.3	65.7	0.89	0.78	0.89	32.0
5	T1	55	3.0	55	3.0	0.599	37.2	LOS D	9.3	65.7	0.89	0.78	0.89	28.3
6	R2	126	2.0	126	2.0	* 0.937	79.5	LOS E	8.3	59.3	1.00	1.20	1.85	20.8
Approach		332	1.7	332	1.7	0.937	55.3	LOS E	9.3	65.7	0.93	0.94	1.26	26.6
NorthWest: Te Rapa Rd														
7	L2	54	2.0	54	2.0	0.921	54.7	LOS D	50.9	368.0	1.00	1.08	1.23	27.1
8	T1	1468	4.0	1468	4.0	* 0.921	50.3	LOS D	50.9	368.0	0.98	1.07	1.23	29.0
9	R2	122	4.0	122	4.0	0.776	60.1	LOS E	9.5	68.0	1.00	0.89	1.18	18.8
9u	U	49	0.0	49	0.0	0.776	61.5	LOS E	9.5	68.0	1.00	0.89	1.18	20.1
Approach		1693	3.8	1693	3.8	0.921	51.4	LOS D	50.9	368.0	0.98	1.05	1.22	27.9
SouthWest: Garnett Ave														
10	L2	193	2.0	193	2.0	0.945	84.4	LOS F	18.8	134.6	1.00	1.25	1.73	15.1
11	T1	60	5.0	60	5.0	* 0.945	79.8	LOS E	18.8	134.6	1.00	1.25	1.73	19.4
12	R2	45	2.0	45	2.0	0.346	55.4	LOS E	2.3	16.6	0.96	0.75	0.96	24.2
Approach		298	2.6	298	2.6	0.945	79.1	LOS E	18.8	134.6	0.99	1.18	1.61	17.3
All Vehicles		4261	2.8	4261	2.8	0.945	47.0	LOS D	50.9	368.0	0.97	0.96	1.14	29.2



Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2031 – PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	65	2.0	65	2.0	0.545	36.8	LOS D	31.8	229.5	0.87	0.77	0.87	32.7
2	T1	1258	4.0	1258	4.0	0.545	31.7	LOS C	31.8	229.5	0.85	0.75	0.85	35.7
3	R2	112	2.0	112	2.0	* 0.601	64.7	LOS E	6.4	45.8	1.00	0.77	1.02	26.4
Approach		1435	3.8	1435	3.8	0.601	34.5	LOS C	31.8	229.5	0.86	0.75	0.86	34.4
NorthEast: Vardon Rd														
4	L2	165	1.0	165	1.0	0.973	99.3	LOS F	20.2	144.6	1.00	1.32	1.84	21.3
5	T1	85	5.0	85	5.0	* 0.973	94.8	LOS F	20.2	144.6	1.00	1.32	1.84	17.5
6	R2	62	2.0	62	2.0	0.665	68.3	LOS E	3.8	26.8	1.00	0.81	1.14	22.6
Approach		312	2.3	312	2.3	0.973	91.9	LOS F	20.2	144.6	1.00	1.22	1.70	20.5
NorthWest: Te Rapa Rd														
7	L2	45	0.0	45	0.0	0.940	56.2	LOS E	70.9	500.4	1.00	1.08	1.21	26.8
8	T1	1895	1.0	1895	1.0	* 0.940	52.1	LOS D	70.9	500.4	0.97	1.07	1.21	28.5
9	R2	173	3.0	173	3.0	0.567	55.0	LOS E	10.2	73.3	0.98	0.81	0.98	19.9
9u	U	18	0.0	18	0.0	0.567	56.4	LOS E	10.2	73.3	0.98	0.81	0.98	21.2
Approach		2131	1.1	2131	1.1	0.940	52.5	LOS D	70.9	500.4	0.97	1.05	1.19	27.7
SouthWest: Garnett Ave														
10	L2	149	1.0	149	1.0	0.879	66.0	LOS E	13.0	92.5	0.95	1.06	1.39	17.9
11	T1	52	5.0	52	5.0	0.879	61.4	LOS E	13.0	92.5	0.95	1.06	1.39	22.4
12	R2	93	2.0	93	2.0	* 0.961	103.4	LOS F	7.5	53.1	0.98	1.27	2.10	16.8
Approach		294	2.0	294	2.0	0.961	77.0	LOS E	13.0	92.5	0.96	1.13	1.62	18.2
All Vehicles		4172	2.2	4172	2.2	0.973	51.0	LOS D	70.9	500.4	0.93	0.96	1.14	28.0



Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2031 – Race Day Mid-Day Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	64	8.0	64	8.0	0.842	47.1	LOS D	61.3	438.0	1.00	0.90	1.00	29.1
2	T1	1766	2.0	1766	2.0	0.842	41.5	LOS D	61.3	438.0	0.96	0.86	0.97	31.8
3	R2	344	2.0	344	2.0	* 1.186	409.7	LOS F	69.6	495.7	1.00	2.01	3.53	7.4
Approach		2174	2.2	2174	2.2	1.186	99.9	LOS F	69.6	495.7	0.96	1.05	1.38	19.4
NorthEast: Vardon Rd														
4	L2	95	1.0	95	1.0	0.922	86.5	LOS F	9.7	68.8	1.00	1.13	1.64	23.0
5	T1	34	3.0	34	3.0	0.922	81.9	LOS F	9.7	68.8	1.00	1.13	1.64	19.1
6	R2	63	2.0	63	2.0	* 0.757	78.0	LOS E	4.4	31.1	1.00	0.86	1.26	21.0
Approach		192	1.7	192	1.7	0.922	82.9	LOS F	9.7	68.8	1.00	1.04	1.52	21.8
NorthWest: Te Rapa Rd														
7	L2	63	2.0	63	2.0	1.159	356.6	LOS F	182.0	1316.3	1.00	2.57	3.13	6.9
8	T1	1655	4.0	1655	4.0	* 1.159	353.7	LOS F	182.0	1316.3	1.00	2.59	3.15	7.0
9	R2	171	4.0	171	4.0	0.996	125.5	LOS F	22.7	162.9	0.99	1.27	1.93	11.3
9u	U	67	0.0	67	0.0	0.996	126.9	LOS F	22.7	162.9	0.99	1.27	1.93	12.2
Approach		1956	3.8	1956	3.8	1.159	326.0	LOS F	182.0	1316.3	1.00	2.43	3.00	7.2
SouthWest: Garnett Ave														
10	L2	229	2.0	229	2.0	1.186	420.0	LOS F	63.4	454.4	1.00	2.30	3.60	3.9
11	T1	71	5.0	71	5.0	* 1.186	415.4	LOS F	63.4	454.4	1.00	2.30	3.60	5.5
12	R2	111	2.0	111	2.0	0.958	112.4	LOS F	9.8	70.1	0.91	1.25	1.90	15.9
Approach		411	2.5	411	2.5	1.186	336.2	LOS F	63.4	454.4	0.97	2.01	3.14	5.7
All Vehicles		4733	2.9	4733	2.9	1.186	213.2	LOS F	182.0	1316.3	0.98	1.70	2.21	10.5



Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2031 – Race Day PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	39	2.0	39	2.0	0.315	25.1	LOS C	10.4	75.4	0.80	0.68	0.80	38.2
2	T1	696	4.0	696	4.0	0.315	20.4	LOS C	10.4	75.4	0.80	0.67	0.80	41.6
3	R2	76	2.0	76	2.0	0.264	40.6	LOS D	2.7	19.2	0.98	0.73	0.98	31.9
Approach		811	3.7	811	3.7	0.315	22.5	LOS C	10.4	75.4	0.82	0.68	0.82	40.0
NorthEast: Vardon Rd														
4	L2	47	1.0	47	1.0	0.421	41.6	LOS D	2.7	19.0	0.98	0.75	0.98	32.1
5	T1	25	5.0	25	5.0	0.421	37.0	LOS D	2.7	19.0	0.98	0.75	0.98	28.4
6	R2	29	2.0	29	2.0	* 0.201	41.8	LOS D	1.1	7.6	0.97	0.71	0.97	28.7
Approach		101	2.3	101	2.3	0.421	40.5	LOS D	2.7	19.0	0.98	0.74	0.98	30.4
NorthWest: Te Rapa Rd														
7	L2	30	0.0	30	0.0	0.763	30.7	LOS C	21.3	150.1	0.96	0.88	1.01	35.2
8	T1	1145	1.0	1145	1.0	* 0.763	25.9	LOS C	21.3	150.1	0.95	0.87	1.00	38.7
9	R2	102	3.0	102	3.0	* 0.615	43.4	LOS D	4.3	30.9	1.00	0.81	1.07	22.7
9u	U	11	0.0	11	0.0	0.615	44.8	LOS D	4.3	30.9	1.00	0.81	1.07	24.1
Approach		1288	1.1	1288	1.1	0.763	27.5	LOS C	21.3	150.1	0.95	0.86	1.01	37.1
SouthWest: Garnett Ave														
10	L2	119	1.0	119	1.0	0.800	42.3	LOS D	6.5	46.0	0.97	0.99	1.34	23.3
11	T1	42	5.0	42	5.0	* 0.800	37.7	LOS D	6.5	46.0	0.97	0.99	1.34	28.1
12	R2	97	2.0	97	2.0	0.444	35.6	LOS D	3.4	23.9	0.93	0.78	0.93	29.6
Approach		258	2.0	258	2.0	0.800	39.0	LOS D	6.5	46.0	0.96	0.91	1.19	26.7
All Vehicles		2458	2.1	2458	2.1	0.800	27.6	LOS C	21.3	150.1	0.91	0.80	0.96	36.4



2031 Baseline + Development

Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2031 + Development – AM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	81	8.0	81	8.0	0.821	47.1	LOS D	54.1	387.0	1.00	0.89	1.00	29.0
2	T1	1772	2.0	1772	2.0	0.821	41.8	LOS D	54.1	387.0	0.98	0.87	0.98	31.7
3	R2	104	2.0	104	2.0	* 0.606	70.3	LOS E	6.5	46.3	1.00	0.76	1.02	25.4
Approach		1957	2.2	1957	2.2	0.821	43.5	LOS D	54.1	387.0	0.98	0.87	0.98	31.1
NorthEast: Vardon Rd														
4	L2	151	1.0	151	1.0	0.781	58.6	LOS E	12.3	87.3	0.96	0.89	1.11	27.9
5	T1	55	3.0	55	3.0	0.781	54.1	LOS D	12.3	87.3	0.96	0.89	1.11	23.9
6	R2	126	2.0	126	2.0	* 0.949	94.4	LOS F	9.8	70.1	0.99	1.20	1.83	18.8
Approach		332	1.7	332	1.7	0.949	71.4	LOS E	12.3	87.3	0.97	1.01	1.38	23.5
NorthWest: Te Rapa Rd														
7	L2	54	2.0	54	2.0	0.936	64.6	LOS E	60.4	436.9	1.00	1.08	1.23	24.8
8	T1	1468	4.0	1468	4.0	* 0.936	60.4	LOS E	60.4	436.9	0.98	1.08	1.24	26.3
9	R2	122	4.0	122	4.0	0.830	71.6	LOS E	11.3	80.9	1.00	0.92	1.25	16.8
9u	U	49	0.0	49	0.0	0.830	73.0	LOS E	11.3	80.9	1.00	0.92	1.25	18.0
Approach		1693	3.8	1693	3.8	0.936	61.7	LOS E	60.4	436.9	0.98	1.06	1.24	25.3
SouthWest: Garnett Ave														
10	L2	193	2.0	193	2.0	0.956	99.2	LOS F	21.9	157.0	0.96	1.23	1.68	13.5
11	T1	60	5.0	60	5.0	* 0.956	94.7	LOS F	21.9	157.0	0.96	1.23	1.68	17.5
12	R2	99	2.0	99	2.0	0.796	62.4	LOS E	6.1	43.5	0.91	0.94	1.25	22.8
Approach		352	2.5	352	2.5	0.956	88.1	LOS F	21.9	157.0	0.95	1.15	1.56	16.5
All Vehicles		4334	2.8	4334	2.8	0.956	56.4	LOS E	60.4	436.9	0.98	0.98	1.16	26.5



Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2031 + Development – PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	118	2.0	118	2.0	0.595	40.6	LOS D	35.8	258.6	0.90	0.80	0.90	30.9
2	T1	1258	4.0	1258	4.0	0.595	35.4	LOS D	35.8	258.6	0.88	0.77	0.88	34.0
3	R2	112	2.0	112	2.0	* 0.632	68.3	LOS E	6.8	48.4	1.00	0.77	1.04	25.7
Approach		1488	3.7	1488	3.7	0.632	38.3	LOS D	35.8	258.6	0.89	0.78	0.89	32.7
NorthEast: Vardon Rd														
4	L2	165	1.0	165	1.0	1.023	152.8	LOS F	26.8	191.4	1.00	1.54	2.20	16.2
5	T1	85	5.0	85	5.0	* 1.023	148.3	LOS F	26.8	191.4	1.00	1.54	2.20	12.9
6	R2	62	2.0	62	2.0	0.699	72.3	LOS E	4.0	28.4	1.00	0.83	1.18	22.0
Approach		312	2.3	312	2.3	1.023	135.6	LOS F	26.8	191.4	1.00	1.40	2.00	16.0
NorthWest: Te Rapa Rd														
7	L2	45	0.0	45	0.0	0.989	91.8	LOS F	93.8	661.8	1.00	1.29	1.48	20.0
8	T1	1895	1.0	1895	1.0	* 0.989	88.1	LOS F	93.8	661.8	0.98	1.30	1.49	20.9
9	R2	173	3.0	173	3.0	0.597	58.5	LOS E	10.9	77.8	0.99	0.81	0.99	19.1
9u	U	18	0.0	18	0.0	0.597	59.9	LOS E	10.9	77.8	0.99	0.81	0.99	20.4
Approach		2131	1.1	2131	1.1	0.989	85.6	LOS F	93.8	661.8	0.99	1.25	1.45	20.8
SouthWest: Garnett Ave														
10	L2	149	1.0	149	1.0	0.826	56.5	LOS E	12.1	86.0	0.91	0.95	1.17	19.7
11	T1	52	5.0	52	5.0	0.826	51.9	LOS D	12.1	86.0	0.91	0.95	1.17	24.4
12	R2	123	2.0	123	2.0	* 1.022	169.3	LOS F	14.1	100.6	1.00	1.51	2.47	11.8
Approach		324	2.0	324	2.0	1.022	98.5	LOS F	14.1	100.6	0.94	1.16	1.67	15.6
All Vehicles		4255	2.2	4255	2.2	1.023	73.7	LOS E	93.8	661.8	0.95	1.09	1.31	22.7



Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2031 + Development – Race Day Mid-Day Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
1	L2	138	8.0	138	8.0	0.896	51.9	LOS D	68.2	488.4	1.00	0.94	1.04	27.4
2	T1	1766	2.0	1766	2.0	0.896	47.2	LOS D	68.2	488.4	0.96	0.92	1.04	29.8
3	R2	344	2.0	344	2.0	* 1.208	447.3	LOS F	73.7	524.7	1.00	2.10	3.72	6.9
Approach		2248	2.4	2248	2.4	1.208	108.7	LOS F	73.7	524.7	0.97	1.10	1.45	18.2
NorthEast: Vardon Rd														
4	L2	95	1.0	95	1.0	0.996	124.9	LOS F	12.1	85.5	1.00	1.35	2.09	18.5
5	T1	34	3.0	34	3.0	0.996	120.3	LOS F	12.1	85.5	1.00	1.35	2.09	14.9
6	R2	63	2.0	63	2.0	* 0.757	78.0	LOS E	4.4	31.1	1.00	0.86	1.26	21.0
Approach		192	1.7	192	1.7	0.996	108.7	LOS F	12.1	85.5	1.00	1.19	1.82	18.5
NorthWest: Te Rapa Rd														
7	L2	63	2.0	63	2.0	1.186	402.6	LOS F	195.8	1416.3	1.00	2.77	3.38	6.2
8	T1	1655	4.0	1655	4.0	* 1.186	399.5	LOS F	195.8	1416.3	1.00	2.79	3.40	6.2
9	R2	171	4.0	171	4.0	0.996	125.7	LOS F	22.7	163.1	0.99	1.27	1.93	11.2
9u	U	67	0.0	67	0.0	0.996	127.1	LOS F	22.7	163.1	0.99	1.27	1.93	12.2
Approach		1956	3.8	1956	3.8	1.186	366.3	LOS F	195.8	1416.3	1.00	2.60	3.22	6.5
SouthWest: Garnett Ave														
10	L2	229	2.0	229	2.0	1.209	458.5	LOS F	67.1	480.4	1.00	2.40	3.79	3.6
11	T1	71	5.0	71	5.0	* 1.209	453.9	LOS F	67.1	480.4	1.00	2.40	3.79	5.1
12	R2	135	2.0	135	2.0	1.048	213.9	LOS F	18.6	132.7	1.00	1.58	2.61	9.8
Approach		435	2.5	435	2.5	1.209	381.8	LOS F	67.1	480.4	1.00	2.15	3.42	5.1
All Vehicles		4831	2.9	4831	2.9	1.209	237.6	LOS F	195.8	1416.3	0.99	1.81	2.36	9.6

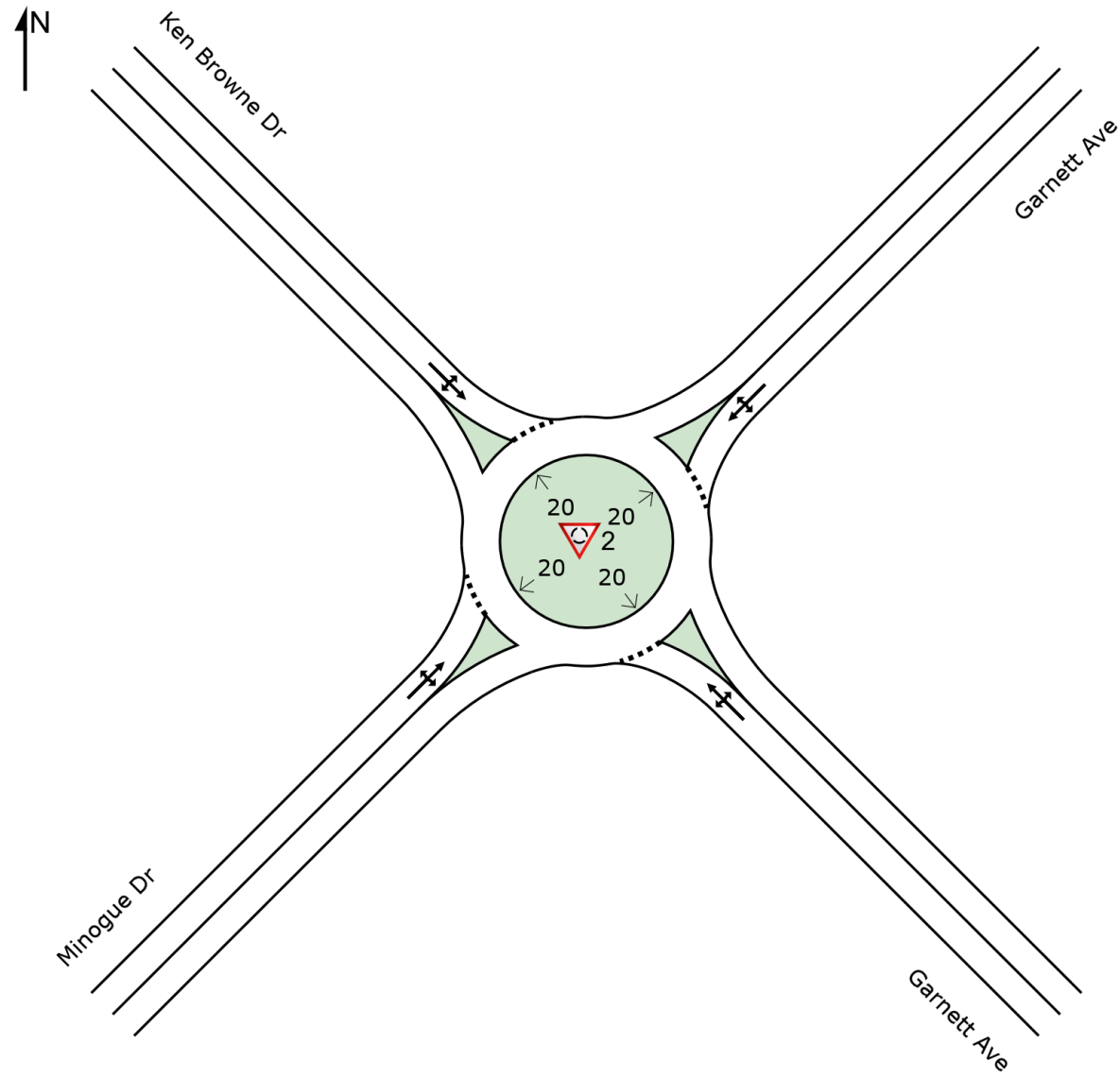


Site: 1 [Te Rapa Rd / Garnett Ave / Vardon Rd – Baseline 2031 + Development – Race Day PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Te Rapa Rd														
1	L2	88	2.0	88	2.0	0.342	25.8	LOS C	11.5	82.7	0.81	0.71	0.81	37.1
2	T1	696	4.0	696	4.0	0.342	21.1	LOS C	11.5	82.7	0.81	0.69	0.81	40.8
3	R2	76	2.0	76	2.0	0.267	41.2	LOS D	2.7	19.5	0.98	0.74	0.98	31.8
Approach		860	3.6	860	3.6	0.342	23.4	LOS C	11.5	82.7	0.83	0.69	0.83	39.2
NorthEast: Vardon Rd														
4	L2	47	1.0	47	1.0	0.498	43.7	LOS D	2.8	19.8	1.00	0.76	1.00	31.5
5	T1	25	5.0	25	5.0	0.498	39.1	LOS D	2.8	19.8	1.00	0.76	1.00	27.8
6	R2	29	2.0	29	2.0	* 0.204	42.3	LOS D	1.1	7.7	0.97	0.71	0.97	28.5
Approach		101	2.3	101	2.3	0.498	42.2	LOS D	2.8	19.8	0.99	0.74	0.99	29.9
NorthWest: Te Rapa Rd														
7	L2	30	0.0	30	0.0	0.773	31.6	LOS C	21.8	154.0	0.97	0.89	1.03	34.8
8	T1	1145	1.0	1145	1.0	* 0.773	26.8	LOS C	21.8	154.0	0.95	0.88	1.02	38.2
9	R2	102	3.0	102	3.0	* 0.624	44.0	LOS D	4.4	31.4	1.00	0.81	1.08	22.6
9u	U	11	0.0	11	0.0	0.624	45.4	LOS D	4.4	31.4	1.00	0.81	1.08	23.9
Approach		1288	1.1	1288	1.1	0.773	28.4	LOS C	21.8	154.0	0.96	0.87	1.02	36.6
SouthWest: Garnett Ave														
10	L2	119	1.0	119	1.0	0.805	42.4	LOS D	6.5	46.3	0.96	0.99	1.34	23.3
11	T1	42	5.0	42	5.0	* 0.805	37.8	LOS D	6.5	46.3	0.96	0.99	1.34	28.1
12	R2	128	2.0	128	2.0	0.605	35.5	LOS D	4.5	32.3	0.93	0.82	0.99	29.6
Approach		289	2.0	289	2.0	0.805	38.7	LOS D	6.5	46.3	0.95	0.92	1.19	27.0
All Vehicles		2538	2.1	2538	2.1	0.805	28.4	LOS C	21.8	154.0	0.91	0.81	0.97	35.9



SIDRA Results – Ken Browne Drive / Garnett Avenue / Minogue Drive Roundabout



2021 Baseline

Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2021 - AM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Garnett Ave														
1	L2	15	0.0	16	0.0	0.305	5.4	LOS A	2.0	16.2	0.27	0.12	0.27	43.1
2	T1	66	20.0	69	20.0	0.305	5.7	LOS A	2.0	16.2	0.27	0.12	0.27	40.9
3	R2	282	17.0	297	17.0	0.305	5.6	LOS A	2.0	16.2	0.27	0.12	0.27	42.3
Approach		363	16.8	382	16.8	0.305	5.6	LOS A	2.0	16.2	0.27	0.12	0.27	42.1
NorthEast: Garnett Ave														
4	L2	69	3.0	73	3.0	0.050	1.6	LOS A	0.3	2.2	0.06	0.01	0.06	44.3
5	T1	10	0.0	11	0.0	0.050	1.6	LOS A	0.3	2.2	0.06	0.01	0.06	46.9
6	R2	49	5.0	52	5.0	0.050	1.7	LOS A	0.3	2.2	0.06	0.01	0.06	46.6
Approach		128	3.5	135	3.5	0.050	1.6	LOS A	0.3	2.2	0.06	0.01	0.06	45.3
NorthWest: Ken Browne Dr														
7	L2	25	11.0	26	11.0	0.079	9.5	LOS A	0.3	2.3	0.52	0.44	0.52	35.7
8	T1	6	0.0	6	0.0	0.079	9.5	LOS A	0.3	2.3	0.52	0.44	0.52	38.6
9	R2	1	0.0	1	0.0	0.079	9.5	LOS A	0.3	2.3	0.52	0.44	0.52	42.1
Approach		32	8.6	34	8.6	0.079	9.5	LOS A	0.3	2.3	0.52	0.44	0.52	36.6
SouthWest: Minogue Dr														
10	L2	1	0.0	1	0.0	0.058	10.8	LOS B	0.2	1.6	0.58	0.51	0.58	39.3
11	T1	15	0.0	16	0.0	0.058	10.8	LOS B	0.2	1.6	0.58	0.51	0.58	40.3
12	R2	4	0.0	4	0.0	0.058	10.8	LOS B	0.2	1.6	0.58	0.51	0.58	41.8
Approach		20	0.0	21	0.0	0.058	10.8	LOS B	0.2	1.6	0.58	0.51	0.58	40.6
All Vehicles		543	12.6	572	12.6	0.305	5.1	LOS A	2.0	16.2	0.24	0.13	0.24	42.4



Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2021 - PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Garnett Ave														
1	L2	15	0.0	16	0.0	0.265	5.9	LOS A	1.8	14.1	0.30	0.14	0.30	42.7
2	T1	21	18.0	22	18.0	0.265	6.2	LOS A	1.8	14.1	0.30	0.14	0.30	40.6
3	R2	220	16.0	232	16.0	0.265	6.2	LOS A	1.8	14.1	0.30	0.14	0.30	41.8
Approach		256	15.2	269	15.2	0.265	6.2	LOS A	1.8	14.1	0.30	0.14	0.30	41.8
NorthEast: Garnett Ave														
4	L2	205	1.0	216	1.0	0.292	6.8	LOS A	2.0	14.2	0.37	0.20	0.37	39.9
5	T1	23	0.0	24	0.0	0.292	6.8	LOS A	2.0	14.2	0.37	0.20	0.37	43.2
6	R2	35	0.0	37	0.0	0.292	6.8	LOS A	2.0	14.2	0.37	0.20	0.37	40.9
Approach		263	0.8	277	0.8	0.292	6.8	LOS A	2.0	14.2	0.37	0.20	0.37	40.4
NorthWest: Ken Browne Dr														
7	L2	66	3.0	69	3.0	0.303	12.6	LOS B	1.4	10.0	0.56	0.52	0.56	33.5
8	T1	67	6.0	71	6.0	0.303	12.6	LOS B	1.4	10.0	0.56	0.52	0.56	36.2
9	R2	1	0.0	1	0.0	0.303	12.6	LOS B	1.4	10.0	0.56	0.52	0.56	40.1
Approach		134	4.5	141	4.5	0.303	12.6	LOS B	1.4	10.0	0.56	0.52	0.56	35.0
SouthWest: Minogue Dr														
10	L2	1	0.0	1	0.0	0.082	9.2	LOS A	0.3	2.2	0.50	0.41	0.50	40.3
11	T1	22	0.0	23	0.0	0.082	9.2	LOS A	0.3	2.2	0.50	0.41	0.50	41.2
12	R2	12	0.0	13	0.0	0.082	9.2	LOS A	0.3	2.2	0.50	0.41	0.50	42.7
Approach		35	0.0	37	0.0	0.082	9.2	LOS A	0.3	2.2	0.50	0.41	0.50	41.7
All Vehicles		688	6.8	724	6.8	0.303	7.8	LOS A	2.0	14.2	0.39	0.25	0.39	39.9



Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2021 – Race Day Mid-Day Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Garnett Ave														
1	L2	31	0.0	31	0.0	0.259	5.3	LOS A	1.6	12.2	0.36	0.20	0.36	43.2
2	T1	37	10.0	37	10.0	0.259	5.5	LOS A	1.6	12.2	0.36	0.20	0.36	41.2
3	R2	232	10.0	232	10.0	0.259	5.5	LOS A	1.6	12.2	0.36	0.20	0.36	42.6
Approach		300	9.0	300	9.0	0.259	5.5	LOS A	1.6	12.2	0.36	0.20	0.36	42.5
NorthEast: Garnett Ave														
4	L2	137	3.0	137	3.0	0.096	1.9	LOS A	0.6	4.5	0.09	0.02	0.09	44.0
5	T1	39	0.0	39	0.0	0.096	1.9	LOS A	0.6	4.5	0.09	0.02	0.09	46.6
6	R2	83	5.0	83	5.0	0.096	2.0	LOS A	0.6	4.5	0.09	0.02	0.09	46.2
Approach		259	3.2	259	3.2	0.096	2.0	LOS A	0.6	4.5	0.09	0.02	0.09	45.1
NorthWest: Ken Browne Dr														
7	L2	16	10.0	16	10.0	0.051	8.7	LOS A	0.2	1.5	0.49	0.39	0.49	36.4
8	T1	6	0.0	6	0.0	0.051	8.7	LOS A	0.2	1.5	0.49	0.39	0.49	39.2
9	R2	1	0.0	1	0.0	0.051	8.7	LOS A	0.2	1.5	0.49	0.39	0.49	42.7
Approach		23	7.0	23	7.0	0.051	8.7	LOS A	0.2	1.5	0.49	0.39	0.49	37.5
SouthWest: Minogue Dr														
10	L2	3	0.0	3	0.0	0.163	11.3	LOS B	0.7	4.7	0.56	0.53	0.56	39.0
11	T1	51	0.0	51	0.0	0.163	11.3	LOS B	0.7	4.7	0.56	0.53	0.56	40.0
12	R2	13	0.0	13	0.0	0.163	11.3	LOS B	0.7	4.7	0.56	0.53	0.56	41.5
Approach		67	0.0	67	0.0	0.163	11.3	LOS B	0.7	4.7	0.56	0.53	0.56	40.3
All Vehicles		649	5.7	649	5.7	0.259	4.8	LOS A	1.6	12.2	0.28	0.17	0.28	42.9



Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2021 – Race Day PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Garnett Ave														
1	L2	17	0.0	17	0.0	0.126	4.4	LOS A	0.7	5.5	0.19	0.07	0.19	43.8
2	T1	5	10.0	5	10.0	0.126	4.5	LOS A	0.7	5.5	0.19	0.07	0.19	42.1
3	R2	112	10.0	112	10.0	0.126	4.5	LOS A	0.7	5.5	0.19	0.07	0.19	43.5
Approach		134	8.7	134	8.7	0.126	4.5	LOS A	0.7	5.5	0.19	0.07	0.19	43.5
NorthEast: Garnett Ave														
4	L2	76	1.0	76	1.0	0.122	5.0	LOS A	0.7	4.9	0.27	0.12	0.27	41.4
5	T1	21	0.0	21	0.0	0.122	5.0	LOS A	0.7	4.9	0.27	0.12	0.27	44.5
6	R2	17	0.0	17	0.0	0.122	5.0	LOS A	0.7	4.9	0.27	0.12	0.27	42.9
Approach		114	0.7	114	0.7	0.122	5.0	LOS A	0.7	4.9	0.27	0.12	0.27	42.3
NorthWest: Ken Browne Dr														
7	L2	86	3.0	86	3.0	0.235	9.4	LOS A	1.0	7.3	0.39	0.29	0.39	36.0
8	T1	47	6.0	47	6.0	0.235	9.4	LOS A	1.0	7.3	0.39	0.29	0.39	38.7
9	R2	1	0.0	1	0.0	0.235	9.4	LOS A	1.0	7.3	0.39	0.29	0.39	42.2
Approach		134	4.0	134	4.0	0.235	9.4	LOS A	1.0	7.3	0.39	0.29	0.39	37.1
SouthWest: Minogue Dr														
10	L2	1	0.0	1	0.0	0.060	6.9	LOS A	0.2	1.6	0.33	0.21	0.33	41.7
11	T1	20	0.0	20	0.0	0.060	6.9	LOS A	0.2	1.6	0.33	0.21	0.33	42.7
12	R2	14	0.0	14	0.0	0.060	6.9	LOS A	0.2	1.6	0.33	0.21	0.33	44.1
Approach		35	0.0	35	0.0	0.060	6.9	LOS A	0.2	1.6	0.33	0.21	0.33	43.3
All Vehicles		417	4.3	417	4.3	0.235	6.4	LOS A	1.0	7.3	0.29	0.17	0.29	41.2



2021 Baseline + Development

Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2021 + Development - AM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Garnett Ave														
1	L2	16	0.0	16	0.0	0.325	5.8	LOS A	2.2	17.9	0.32	0.15	0.32	42.9
2	T1	82	20.0	82	20.0	0.325	6.1	LOS A	2.2	17.9	0.32	0.15	0.32	40.6
3	R2	297	17.0	297	17.0	0.325	6.0	LOS A	2.2	17.9	0.32	0.15	0.32	42.0
Approach		395	16.9	395	16.9	0.325	6.0	LOS A	2.2	17.9	0.32	0.15	0.32	41.8
NorthEast: Garnett Ave														
4	L2	73	3.0	73	3.0	0.057	1.7	LOS A	0.4	2.7	0.12	0.03	0.12	44.2
5	T1	11	0.0	11	0.0	0.057	1.7	LOS A	0.4	2.7	0.12	0.03	0.12	46.7
6	R2	68	5.0	68	5.0	0.057	1.7	LOS A	0.4	2.7	0.12	0.03	0.12	46.4
Approach		152	3.7	152	3.7	0.057	1.7	LOS A	0.4	2.7	0.12	0.03	0.12	45.3
NorthWest: Ken Browne Dr														
7	L2	80	11.0	80	11.0	0.253	12.6	LOS B	1.1	8.3	0.58	0.55	0.58	33.4
8	T1	27	0.0	27	0.0	0.253	12.6	LOS B	1.1	8.3	0.58	0.55	0.58	36.3
9	R2	1	0.0	1	0.0	0.253	12.6	LOS B	1.1	8.3	0.58	0.55	0.58	40.1
Approach		108	8.1	108	8.1	0.253	12.6	LOS B	1.1	8.3	0.58	0.55	0.58	34.2
SouthWest: Minogue Dr														
10	L2	1	0.0	1	0.0	0.060	11.3	LOS B	0.2	1.7	0.60	0.54	0.60	39.0
11	T1	16	0.0	16	0.0	0.060	11.3	LOS B	0.2	1.7	0.60	0.54	0.60	40.0
12	R2	4	0.0	4	0.0	0.060	11.3	LOS B	0.2	1.7	0.60	0.54	0.60	41.5
Approach		21	0.0	21	0.0	0.060	11.3	LOS B	0.2	1.7	0.60	0.54	0.60	40.2
All Vehicles		676	12.0	676	12.0	0.325	6.3	LOS A	2.2	17.9	0.32	0.20	0.32	41.1



Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2021 + Development - PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Garnett Ave														
1	L2	16	0.0	16	0.0	0.333	7.3	LOS A	2.3	18.5	0.44	0.26	0.44	41.9
2	T1	51	18.0	51	18.0	0.333	7.7	LOS A	2.3	18.5	0.44	0.26	0.44	39.4
3	R2	232	16.0	232	16.0	0.333	7.7	LOS A	2.3	18.5	0.44	0.26	0.44	40.6
Approach		299	15.5	299	15.5	0.333	7.7	LOS A	2.3	18.5	0.44	0.26	0.44	40.5
NorthEast: Garnett Ave														
4	L2	216	1.0	216	1.0	0.355	7.8	LOS A	2.6	18.5	0.43	0.25	0.43	39.0
5	T1	24	0.0	24	0.0	0.355	7.8	LOS A	2.6	18.5	0.43	0.25	0.43	42.4
6	R2	90	0.0	90	0.0	0.355	7.8	LOS A	2.6	18.5	0.43	0.25	0.43	39.8
Approach		330	0.7	330	0.7	0.355	7.8	LOS A	2.6	18.5	0.43	0.25	0.43	39.5
NorthWest: Ken Browne Dr														
7	L2	99	3.0	99	3.0	0.402	15.0	LOS B	2.1	15.4	0.61	0.60	0.65	31.9
8	T1	85	6.0	85	6.0	0.402	15.0	LOS B	2.1	15.4	0.61	0.60	0.65	34.6
9	R2	1	0.0	1	0.0	0.402	15.0	LOS B	2.1	15.4	0.61	0.60	0.65	38.7
Approach		185	4.4	185	4.4	0.402	15.0	LOS B	2.1	15.4	0.61	0.60	0.65	33.2
SouthWest: Minogue Dr														
10	L2	1	0.0	1	0.0	0.094	10.6	LOS B	0.4	2.6	0.56	0.51	0.56	39.4
11	T1	23	0.0	23	0.0	0.094	10.6	LOS B	0.4	2.6	0.56	0.51	0.56	40.3
12	R2	13	0.0	13	0.0	0.094	10.6	LOS B	0.4	2.6	0.56	0.51	0.56	41.9
Approach		37	0.0	37	0.0	0.094	10.6	LOS B	0.4	2.6	0.56	0.51	0.56	40.9
All Vehicles		851	6.6	851	6.6	0.402	9.4	LOS A	2.6	18.5	0.48	0.34	0.49	38.5



Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2021 + Development – Race Day Mid-Day Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Garnett Ave														
1	L2	31	0.0	31	0.0	0.306	6.3	LOS A	2.0	14.8	0.47	0.31	0.47	42.6
2	T1	58	10.0	58	10.0	0.306	6.5	LOS A	2.0	14.8	0.47	0.31	0.47	40.4
3	R2	232	10.0	232	10.0	0.306	6.5	LOS A	2.0	14.8	0.47	0.31	0.47	41.7
Approach		321	9.0	321	9.0	0.306	6.5	LOS A	2.0	14.8	0.47	0.31	0.47	41.6
NorthEast: Garnett Ave														
4	L2	137	3.0	137	3.0	0.123	2.1	LOS A	0.8	5.6	0.11	0.02	0.11	43.7
5	T1	39	0.0	39	0.0	0.123	2.1	LOS A	0.8	5.6	0.11	0.02	0.11	46.3
6	R2	154	5.0	154	5.0	0.123	2.1	LOS A	0.8	5.6	0.11	0.02	0.11	45.7
Approach		330	3.6	330	3.6	0.123	2.1	LOS A	0.8	5.6	0.11	0.02	0.11	44.9
NorthWest: Ken Browne Dr														
7	L2	40	10.0	40	10.0	0.126	9.9	LOS A	0.5	3.8	0.52	0.45	0.52	35.5
8	T1	15	0.0	15	0.0	0.126	9.9	LOS A	0.5	3.8	0.52	0.45	0.52	38.3
9	R2	1	0.0	1	0.0	0.126	9.9	LOS A	0.5	3.8	0.52	0.45	0.52	41.9
Approach		56	7.1	56	7.1	0.126	9.9	LOS A	0.5	3.8	0.52	0.45	0.52	36.4
SouthWest: Minogue Dr														
10	L2	3	0.0	3	0.0	0.188	13.4	LOS B	0.8	5.5	0.63	0.63	0.63	37.8
11	T1	51	0.0	51	0.0	0.188	13.4	LOS B	0.8	5.5	0.63	0.63	0.63	38.8
12	R2	13	0.0	13	0.0	0.188	13.4	LOS B	0.8	5.5	0.63	0.63	0.63	40.3
Approach		67	0.0	67	0.0	0.188	13.4	LOS B	0.8	5.5	0.63	0.63	0.63	39.0
All Vehicles		774	5.8	774	5.8	0.306	5.5	LOS A	2.0	14.8	0.33	0.23	0.33	42.2



Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2021 + Development – Race Day PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Garnett Ave														
1	L2	17	0.0	17	0.0	0.176	5.4	LOS A	1.0	7.9	0.33	0.17	0.33	43.2
2	T1	36	10.0	36	10.0	0.176	5.6	LOS A	1.0	7.9	0.33	0.17	0.33	41.3
3	R2	112	10.0	112	10.0	0.176	5.6	LOS A	1.0	7.9	0.33	0.17	0.33	42.6
Approach		165	9.0	165	9.0	0.176	5.5	LOS A	1.0	7.9	0.33	0.17	0.33	42.4
NorthEast: Garnett Ave														
4	L2	76	1.0	76	1.0	0.177	5.6	LOS A	1.1	7.5	0.32	0.16	0.32	40.6
5	T1	21	0.0	21	0.0	0.177	5.6	LOS A	1.1	7.5	0.32	0.16	0.32	43.8
6	R2	66	0.0	66	0.0	0.177	5.6	LOS A	1.1	7.5	0.32	0.16	0.32	41.8
Approach		163	0.5	163	0.5	0.177	5.6	LOS A	1.1	7.5	0.32	0.16	0.32	41.6
NorthWest: Ken Browne Dr														
7	L2	117	3.0	117	3.0	0.317	10.8	LOS B	1.5	10.8	0.43	0.33	0.43	34.9
8	T1	62	6.0	62	6.0	0.317	10.8	LOS B	1.5	10.8	0.43	0.33	0.43	37.5
9	R2	1	0.0	1	0.0	0.317	10.8	LOS B	1.5	10.8	0.43	0.33	0.43	41.3
Approach		180	4.0	180	4.0	0.317	10.8	LOS B	1.5	10.8	0.43	0.33	0.43	35.9
SouthWest: Minogue Dr														
10	L2	1	0.0	1	0.0	0.068	7.9	LOS A	0.3	1.8	0.42	0.31	0.42	41.1
11	T1	20	0.0	20	0.0	0.068	7.9	LOS A	0.3	1.8	0.42	0.31	0.42	42.0
12	R2	14	0.0	14	0.0	0.068	7.9	LOS A	0.3	1.8	0.42	0.31	0.42	43.5
Approach		35	0.0	35	0.0	0.068	7.9	LOS A	0.3	1.8	0.42	0.31	0.42	42.6
All Vehicles		543	4.2	543	4.2	0.317	7.5	LOS A	1.5	10.8	0.36	0.23	0.36	40.1



2031 Baseline

Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2031 - AM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Garnett Ave														
1	L2	16	0.0	16	0.0	0.305	5.4	LOS A	2.0	16.2	0.27	0.12	0.27	43.1
2	T1	69	20.0	69	20.0	0.305	5.7	LOS A	2.0	16.2	0.27	0.12	0.27	40.9
3	R2	297	17.0	297	17.0	0.305	5.7	LOS A	2.0	16.2	0.27	0.12	0.27	42.3
Approach		382	16.8	382	16.8	0.305	5.7	LOS A	2.0	16.2	0.27	0.12	0.27	42.1
NorthEast: Garnett Ave														
4	L2	73	3.0	73	3.0	0.050	1.6	LOS A	0.3	2.2	0.06	0.01	0.06	44.3
5	T1	11	0.0	11	0.0	0.050	1.6	LOS A	0.3	2.2	0.06	0.01	0.06	46.9
6	R2	52	5.0	52	5.0	0.050	1.7	LOS A	0.3	2.2	0.06	0.01	0.06	46.6
Approach		136	3.5	136	3.5	0.050	1.6	LOS A	0.3	2.2	0.06	0.01	0.06	45.3
NorthWest: Ken Browne Dr														
7	L2	26	11.0	26	11.0	0.077	9.5	LOS A	0.3	2.3	0.52	0.44	0.52	35.8
8	T1	6	0.0	6	0.0	0.077	9.5	LOS A	0.3	2.3	0.52	0.44	0.52	38.6
9	R2	1	0.0	1	0.0	0.077	9.5	LOS A	0.3	2.3	0.52	0.44	0.52	42.2
Approach		33	8.7	33	8.7	0.077	9.5	LOS A	0.3	2.3	0.52	0.44	0.52	36.6
SouthWest: Minogue Dr														
10	L2	1	0.0	1	0.0	0.058	10.8	LOS B	0.2	1.6	0.58	0.51	0.58	39.3
11	T1	16	0.0	16	0.0	0.058	10.8	LOS B	0.2	1.6	0.58	0.51	0.58	40.3
12	R2	4	0.0	4	0.0	0.058	10.8	LOS B	0.2	1.6	0.58	0.51	0.58	41.8
Approach		21	0.0	21	0.0	0.058	10.8	LOS B	0.2	1.6	0.58	0.51	0.58	40.6
All Vehicles		572	12.6	572	12.6	0.305	5.1	LOS A	2.0	16.2	0.24	0.13	0.24	42.4



Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2031 - PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Garnett Ave														
1	L2	16	0.0	16	0.0	0.266	5.9	LOS A	1.8	14.2	0.30	0.14	0.30	42.7
2	T1	22	18.0	22	18.0	0.266	6.2	LOS A	1.8	14.2	0.30	0.14	0.30	40.5
3	R2	232	16.0	232	16.0	0.266	6.2	LOS A	1.8	14.2	0.30	0.14	0.30	41.8
Approach		270	15.2	270	15.2	0.266	6.2	LOS A	1.8	14.2	0.30	0.14	0.30	41.8
NorthEast: Garnett Ave														
4	L2	216	1.0	216	1.0	0.293	6.8	LOS A	2.0	14.3	0.37	0.20	0.37	39.8
5	T1	24	0.0	24	0.0	0.293	6.8	LOS A	2.0	14.3	0.37	0.20	0.37	43.2
6	R2	37	0.0	37	0.0	0.293	6.8	LOS A	2.0	14.3	0.37	0.20	0.37	40.9
Approach		277	0.8	277	0.8	0.293	6.8	LOS A	2.0	14.3	0.37	0.20	0.37	40.3
NorthWest: Ken Browne Dr														
7	L2	69	3.0	69	3.0	0.303	12.6	LOS B	1.4	10.0	0.56	0.52	0.56	33.5
8	T1	71	6.0	71	6.0	0.303	12.6	LOS B	1.4	10.0	0.56	0.52	0.56	36.2
9	R2	1	0.0	1	0.0	0.303	12.6	LOS B	1.4	10.0	0.56	0.52	0.56	40.1
Approach		141	4.5	141	4.5	0.303	12.6	LOS B	1.4	10.0	0.56	0.52	0.56	35.0
SouthWest: Minogue Dr														
10	L2	1	0.0	1	0.0	0.083	9.2	LOS A	0.3	2.3	0.50	0.42	0.50	40.3
11	T1	23	0.0	23	0.0	0.083	9.2	LOS A	0.3	2.3	0.50	0.42	0.50	41.2
12	R2	13	0.0	13	0.0	0.083	9.2	LOS A	0.3	2.3	0.50	0.42	0.50	42.7
Approach		37	0.0	37	0.0	0.083	9.2	LOS A	0.3	2.3	0.50	0.42	0.50	41.7
All Vehicles		725	6.8	725	6.8	0.303	7.8	LOS A	2.0	14.3	0.39	0.25	0.39	39.9



Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2031 – Race Day Mid-Day Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Garnett Ave														
1	L2	31	0.0	31	0.0	0.259	5.3	LOS A	1.6	12.2	0.36	0.20	0.36	43.2
2	T1	37	10.0	37	10.0	0.259	5.5	LOS A	1.6	12.2	0.36	0.20	0.36	41.2
3	R2	232	10.0	232	10.0	0.259	5.5	LOS A	1.6	12.2	0.36	0.20	0.36	42.6
Approach		300	9.0	300	9.0	0.259	5.5	LOS A	1.6	12.2	0.36	0.20	0.36	42.5
NorthEast: Garnett Ave														
4	L2	137	3.0	137	3.0	0.096	1.9	LOS A	0.6	4.5	0.09	0.02	0.09	44.0
5	T1	39	0.0	39	0.0	0.096	1.9	LOS A	0.6	4.5	0.09	0.02	0.09	46.6
6	R2	83	5.0	83	5.0	0.096	2.0	LOS A	0.6	4.5	0.09	0.02	0.09	46.2
Approach		259	3.2	259	3.2	0.096	2.0	LOS A	0.6	4.5	0.09	0.02	0.09	45.1
NorthWest: Ken Browne Dr														
7	L2	16	10.0	16	10.0	0.051	8.7	LOS A	0.2	1.5	0.49	0.39	0.49	36.4
8	T1	6	0.0	6	0.0	0.051	8.7	LOS A	0.2	1.5	0.49	0.39	0.49	39.2
9	R2	1	0.0	1	0.0	0.051	8.7	LOS A	0.2	1.5	0.49	0.39	0.49	42.7
Approach		23	7.0	23	7.0	0.051	8.7	LOS A	0.2	1.5	0.49	0.39	0.49	37.5
SouthWest: Minogue Dr														
10	L2	3	0.0	3	0.0	0.163	11.3	LOS B	0.7	4.7	0.56	0.53	0.56	39.0
11	T1	51	0.0	51	0.0	0.163	11.3	LOS B	0.7	4.7	0.56	0.53	0.56	40.0
12	R2	13	0.0	13	0.0	0.163	11.3	LOS B	0.7	4.7	0.56	0.53	0.56	41.5
Approach		67	0.0	67	0.0	0.163	11.3	LOS B	0.7	4.7	0.56	0.53	0.56	40.3
All Vehicles		649	5.7	649	5.7	0.259	4.8	LOS A	1.6	12.2	0.28	0.17	0.28	42.9



Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2031 – Race Day PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Garnett Ave														
1	L2	17	0.0	17	0.0	0.126	4.4	LOS A	0.7	5.5	0.19	0.07	0.19	43.8
2	T1	5	10.0	5	10.0	0.126	4.5	LOS A	0.7	5.5	0.19	0.07	0.19	42.1
3	R2	112	10.0	112	10.0	0.126	4.5	LOS A	0.7	5.5	0.19	0.07	0.19	43.5
Approach		134	8.7	134	8.7	0.126	4.5	LOS A	0.7	5.5	0.19	0.07	0.19	43.5
NorthEast: Garnett Ave														
4	L2	76	1.0	76	1.0	0.122	5.0	LOS A	0.7	4.9	0.27	0.12	0.27	41.4
5	T1	21	0.0	21	0.0	0.122	5.0	LOS A	0.7	4.9	0.27	0.12	0.27	44.5
6	R2	17	0.0	17	0.0	0.122	5.0	LOS A	0.7	4.9	0.27	0.12	0.27	42.9
Approach		114	0.7	114	0.7	0.122	5.0	LOS A	0.7	4.9	0.27	0.12	0.27	42.3
NorthWest: Ken Browne Dr														
7	L2	86	3.0	86	3.0	0.235	9.4	LOS A	1.0	7.3	0.39	0.29	0.39	36.0
8	T1	47	6.0	47	6.0	0.235	9.4	LOS A	1.0	7.3	0.39	0.29	0.39	38.7
9	R2	1	0.0	1	0.0	0.235	9.4	LOS A	1.0	7.3	0.39	0.29	0.39	42.2
Approach		134	4.0	134	4.0	0.235	9.4	LOS A	1.0	7.3	0.39	0.29	0.39	37.1
SouthWest: Minogue Dr														
10	L2	1	0.0	1	0.0	0.060	6.9	LOS A	0.2	1.6	0.33	0.21	0.33	41.7
11	T1	20	0.0	20	0.0	0.060	6.9	LOS A	0.2	1.6	0.33	0.21	0.33	42.7
12	R2	14	0.0	14	0.0	0.060	6.9	LOS A	0.2	1.6	0.33	0.21	0.33	44.1
Approach		35	0.0	35	0.0	0.060	6.9	LOS A	0.2	1.6	0.33	0.21	0.33	43.3
All Vehicles		417	4.3	417	4.3	0.235	6.4	LOS A	1.0	7.3	0.29	0.17	0.29	41.2



2031 Baseline + Development

Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2031 + Development - AM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Garnett Ave														
1	L2	16	0.0	16	0.0	0.325	5.8	LOS A	2.2	17.9	0.32	0.15	0.32	42.9
2	T1	82	20.0	82	20.0	0.325	6.1	LOS A	2.2	17.9	0.32	0.15	0.32	40.6
3	R2	297	17.0	297	17.0	0.325	6.0	LOS A	2.2	17.9	0.32	0.15	0.32	42.0
Approach		395	16.9	395	16.9	0.325	6.0	LOS A	2.2	17.9	0.32	0.15	0.32	41.8
NorthEast: Garnett Ave														
4	L2	73	3.0	73	3.0	0.057	1.7	LOS A	0.4	2.7	0.12	0.03	0.12	44.2
5	T1	11	0.0	11	0.0	0.057	1.7	LOS A	0.4	2.7	0.12	0.03	0.12	46.7
6	R2	68	5.0	68	5.0	0.057	1.7	LOS A	0.4	2.7	0.12	0.03	0.12	46.4
Approach		152	3.7	152	3.7	0.057	1.7	LOS A	0.4	2.7	0.12	0.03	0.12	45.3
NorthWest: Ken Browne Dr														
7	L2	80	11.0	80	11.0	0.253	12.6	LOS B	1.1	8.3	0.58	0.55	0.58	33.4
8	T1	27	0.0	27	0.0	0.253	12.6	LOS B	1.1	8.3	0.58	0.55	0.58	36.3
9	R2	1	0.0	1	0.0	0.253	12.6	LOS B	1.1	8.3	0.58	0.55	0.58	40.1
Approach		108	8.1	108	8.1	0.253	12.6	LOS B	1.1	8.3	0.58	0.55	0.58	34.2
SouthWest: Minogue Dr														
10	L2	1	0.0	1	0.0	0.060	11.3	LOS B	0.2	1.7	0.60	0.54	0.60	39.0
11	T1	16	0.0	16	0.0	0.060	11.3	LOS B	0.2	1.7	0.60	0.54	0.60	40.0
12	R2	4	0.0	4	0.0	0.060	11.3	LOS B	0.2	1.7	0.60	0.54	0.60	41.5
Approach		21	0.0	21	0.0	0.060	11.3	LOS B	0.2	1.7	0.60	0.54	0.60	40.2
All Vehicles		676	12.0	676	12.0	0.325	6.3	LOS A	2.2	17.9	0.32	0.20	0.32	41.1



Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2031 + Development - PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total	HV]	[Total	HV]				[Veh.	Dist]				
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Garnett Ave														
1	L2	16	0.0	16	0.0	0.333	7.3	LOS A	2.3	18.5	0.44	0.26	0.44	41.9
2	T1	51	18.0	51	18.0	0.333	7.7	LOS A	2.3	18.5	0.44	0.26	0.44	39.4
3	R2	232	16.0	232	16.0	0.333	7.7	LOS A	2.3	18.5	0.44	0.26	0.44	40.6
Approach		299	15.5	299	15.5	0.333	7.7	LOS A	2.3	18.5	0.44	0.26	0.44	40.5
NorthEast: Garnett Ave														
4	L2	216	1.0	216	1.0	0.355	7.8	LOS A	2.6	18.5	0.43	0.25	0.43	39.0
5	T1	24	0.0	24	0.0	0.355	7.8	LOS A	2.6	18.5	0.43	0.25	0.43	42.4
6	R2	90	0.0	90	0.0	0.355	7.8	LOS A	2.6	18.5	0.43	0.25	0.43	39.8
Approach		330	0.7	330	0.7	0.355	7.8	LOS A	2.6	18.5	0.43	0.25	0.43	39.5
NorthWest: Ken Browne Dr														
7	L2	99	3.0	99	3.0	0.402	15.0	LOS B	2.1	15.4	0.61	0.60	0.65	31.9
8	T1	85	6.0	85	6.0	0.402	15.0	LOS B	2.1	15.4	0.61	0.60	0.65	34.6
9	R2	1	0.0	1	0.0	0.402	15.0	LOS B	2.1	15.4	0.61	0.60	0.65	38.7
Approach		185	4.4	185	4.4	0.402	15.0	LOS B	2.1	15.4	0.61	0.60	0.65	33.2
SouthWest: Minogue Dr														
10	L2	1	0.0	1	0.0	0.094	10.6	LOS B	0.4	2.6	0.56	0.51	0.56	39.4
11	T1	23	0.0	23	0.0	0.094	10.6	LOS B	0.4	2.6	0.56	0.51	0.56	40.3
12	R2	13	0.0	13	0.0	0.094	10.6	LOS B	0.4	2.6	0.56	0.51	0.56	41.9
Approach		37	0.0	37	0.0	0.094	10.6	LOS B	0.4	2.6	0.56	0.51	0.56	40.9
All Vehicles		851	6.6	851	6.6	0.402	9.4	LOS A	2.6	18.5	0.48	0.34	0.49	38.5



Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2031 + Development – Race Day Mid-Day Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Garnett Ave														
1	L2	31	0.0	31	0.0	0.307	6.3	LOS A	2.0	14.8	0.48	0.32	0.48	42.6
2	T1	58	10.0	58	10.0	0.307	6.5	LOS A	2.0	14.8	0.48	0.32	0.48	40.4
3	R2	232	10.0	232	10.0	0.307	6.5	LOS A	2.0	14.8	0.48	0.32	0.48	41.7
Approach		321	9.0	321	9.0	0.307	6.5	LOS A	2.0	14.8	0.48	0.32	0.48	41.6
NorthEast: Garnett Ave														
4	L2	137	3.0	137	3.0	0.124	2.1	LOS A	0.8	5.7	0.11	0.02	0.11	43.7
5	T1	39	0.0	39	0.0	0.124	2.1	LOS A	0.8	5.7	0.11	0.02	0.11	46.3
6	R2	157	5.0	157	5.0	0.124	2.2	LOS A	0.8	5.7	0.11	0.02	0.11	45.7
Approach		333	3.6	333	3.6	0.124	2.1	LOS A	0.8	5.7	0.11	0.02	0.11	44.9
NorthWest: Ken Browne Dr														
7	L2	40	10.0	40	10.0	0.126	9.9	LOS A	0.5	3.8	0.52	0.45	0.52	35.5
8	T1	15	0.0	15	0.0	0.126	9.9	LOS A	0.5	3.8	0.52	0.45	0.52	38.3
9	R2	1	0.0	1	0.0	0.126	9.9	LOS A	0.5	3.8	0.52	0.45	0.52	41.9
Approach		56	7.1	56	7.1	0.126	9.9	LOS A	0.5	3.8	0.52	0.45	0.52	36.4
SouthWest: Minogue Dr														
10	L2	3	0.0	3	0.0	0.189	13.5	LOS B	0.8	5.6	0.63	0.63	0.63	37.8
11	T1	51	0.0	51	0.0	0.189	13.5	LOS B	0.8	5.6	0.63	0.63	0.63	38.7
12	R2	13	0.0	13	0.0	0.189	13.5	LOS B	0.8	5.6	0.63	0.63	0.63	40.3
Approach		67	0.0	67	0.0	0.189	13.5	LOS B	0.8	5.6	0.63	0.63	0.63	39.0
All Vehicles		777	5.8	777	5.8	0.307	5.5	LOS A	2.0	14.8	0.33	0.23	0.33	42.1



Site: 2 [Ken Browne Dr / Garnett Ave / Minogue Dr – Baseline 2031 + Development – Race Day PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Garnett Ave														
1	L2	17	0.0	17	0.0	0.176	5.4	LOS A	1.0	7.9	0.33	0.17	0.33	43.2
2	T1	36	10.0	36	10.0	0.176	5.6	LOS A	1.0	7.9	0.33	0.17	0.33	41.3
3	R2	112	10.0	112	10.0	0.176	5.6	LOS A	1.0	7.9	0.33	0.17	0.33	42.6
Approach		165	9.0	165	9.0	0.176	5.5	LOS A	1.0	7.9	0.33	0.17	0.33	42.4
NorthEast: Garnett Ave														
4	L2	76	1.0	76	1.0	0.177	5.6	LOS A	1.1	7.5	0.32	0.16	0.32	40.6
5	T1	21	0.0	21	0.0	0.177	5.6	LOS A	1.1	7.5	0.32	0.16	0.32	43.8
6	R2	66	0.0	66	0.0	0.177	5.6	LOS A	1.1	7.5	0.32	0.16	0.32	41.8
Approach		163	0.5	163	0.5	0.177	5.6	LOS A	1.1	7.5	0.32	0.16	0.32	41.6
NorthWest: Ken Browne Dr														
7	L2	117	3.0	117	3.0	0.317	10.8	LOS B	1.5	10.8	0.43	0.33	0.43	34.9
8	T1	62	6.0	62	6.0	0.317	10.8	LOS B	1.5	10.8	0.43	0.33	0.43	37.5
9	R2	1	0.0	1	0.0	0.317	10.8	LOS B	1.5	10.8	0.43	0.33	0.43	41.3
Approach		180	4.0	180	4.0	0.317	10.8	LOS B	1.5	10.8	0.43	0.33	0.43	35.9
SouthWest: Minogue Dr														
10	L2	1	0.0	1	0.0	0.068	7.9	LOS A	0.3	1.8	0.42	0.31	0.42	41.1
11	T1	20	0.0	20	0.0	0.068	7.9	LOS A	0.3	1.8	0.42	0.31	0.42	42.0
12	R2	14	0.0	14	0.0	0.068	7.9	LOS A	0.3	1.8	0.42	0.31	0.42	43.5
Approach		35	0.0	35	0.0	0.068	7.9	LOS A	0.3	1.8	0.42	0.31	0.42	42.6
All Vehicles		543	4.2	543	4.2	0.317	7.5	LOS A	1.5	10.8	0.36	0.23	0.36	40.1



SIDRA Results – Te Rapa Road / Sir Tristram Avenue Intersection

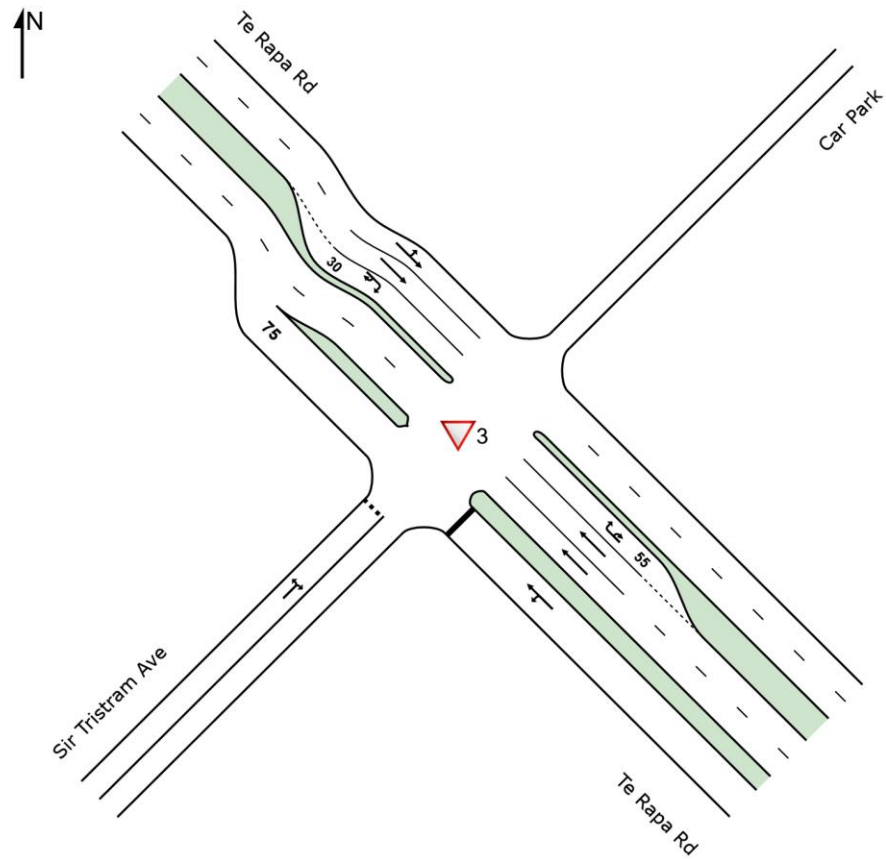


Figure 1: Existing Te Rapa Rd / Sir Tristram Ave Int (baseline scenarios)

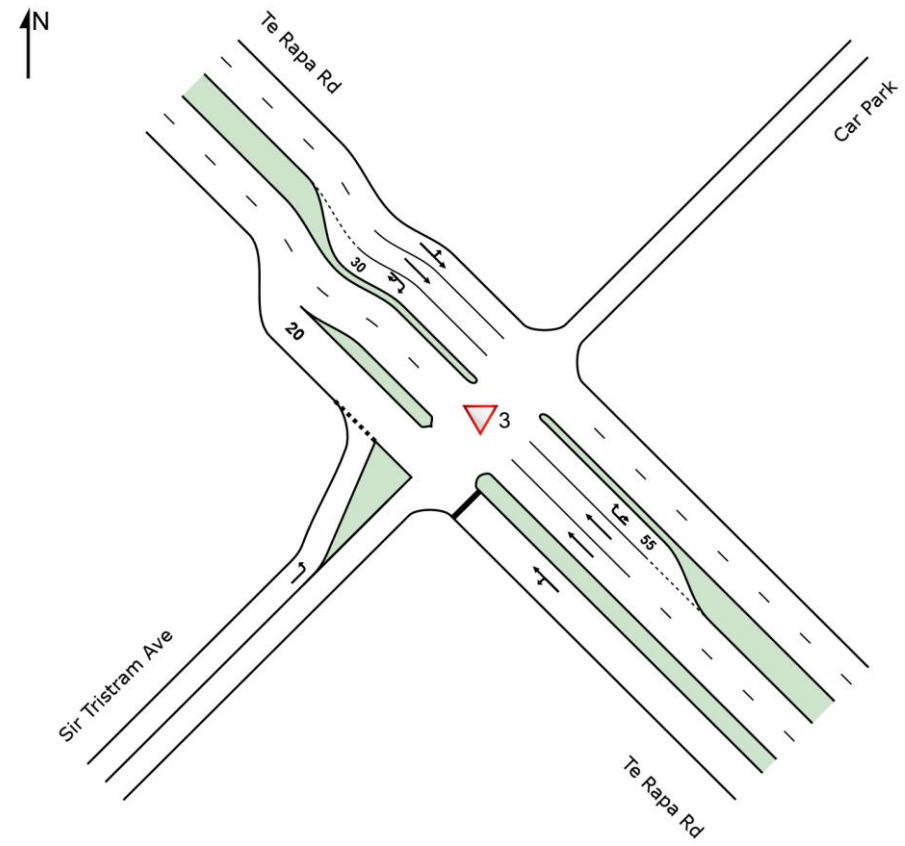


Figure 2: Proposed Te Rapa Rd / Sir Tristram Ave Int (Development scenarios)

2021 Baseline

Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2021 - AM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	74	6.0	74	6.0	0.502	7.9	LOS A	0.2	1.4	0.08	0.96	0.08	38.8
5	T1	1435	7.0	1435	7.0	0.381	5.1	LOS A	0.0	0.0	0.00	0.57	0.00	50.3
23	R2	23	0.0	23	0.0	0.015	4.6	LOS A	0.0	0.0	0.00	0.56	0.00	44.5
6u	U	3	0.0	3	0.0	0.015	5.8	LOS A	0.0	0.0	0.00	0.56	0.00	40.0
Approach		1535	6.8	1535	6.8	0.502	5.2	LOS A	0.2	1.4	0.00	0.58	0.00	49.7
NorthWest: Te Rapa Rd														
27	L2	8	0.0	8	0.0	0.395	5.6	LOS A	0.0	0.0	0.00	0.20	0.00	57.0
11	T1	1466	7.0	1466	7.0	0.395	1.2	LOS A	0.0	0.0	0.00	0.20	0.00	58.7
12	R2	49	6.0	49	6.0	0.127	4.6	LOS A	0.0	0.0	0.00	0.58	0.00	45.0
12u	U	133	6.0	133	6.0	0.127	6.5	LOS A	0.0	0.0	0.00	0.58	0.00	46.2
Approach		1656	6.9	1656	6.9	0.395	1.7	NA	0.0	0.0	0.00	0.24	0.00	56.3
SouthWest: Sir Tristram Ave														
1	L2	50	6.0	50	6.0	0.683	37.6	LOS E	3.3	24.6	0.50	0.80	0.96	22.8
3	R2	58	6.0	58	6.0	0.683	81.5	LOS F	3.3	24.6	0.50	0.80	0.96	16.2
Approach		108	6.0	108	6.0	0.683	61.2	LOS F	3.3	24.6	0.50	0.80	0.96	19.6
All Vehicles		3299	6.8	3299	6.8	0.683	5.3	NA	3.3	24.6	0.02	0.42	0.03	50.7



Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2021 - PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	56	6.0	56	6.0	0.165	7.8	LOS A	0.1	1.0	0.07	0.96	0.07	38.8
5	T1	1378	7.0	1378	7.0	0.366	5.0	LOS A	0.0	0.0	0.00	0.57	0.00	50.3
23	R2	13	0.0	13	0.0	0.010	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	44.4
6u	U	4	0.0	4	0.0	0.010	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	39.8
Approach		1451	6.9	1451	6.9	0.366	5.1	LOS A	0.1	1.0	0.00	0.58	0.00	49.9
NorthWest: Te Rapa Rd														
27	L2	6	0.0	6	0.0	0.500	5.7	LOS A	0.0	0.0	0.00	0.19	0.00	56.9
11	T1	1859	7.0	1859	7.0	0.500	1.3	LOS A	0.0	0.0	0.00	0.19	0.00	58.6
12	R2	35	6.0	35	6.0	0.051	4.6	LOS A	0.0	0.0	0.00	0.56	0.00	45.2
12u	U	42	6.0	42	6.0	0.051	6.4	LOS A	0.0	0.0	0.00	0.56	0.00	46.4
Approach		1942	6.9	1942	6.9	0.500	1.4	NA	0.0	0.0	0.00	0.21	0.00	57.7
SouthWest: Sir Tristram Ave														
1	L2	59	6.0	59	6.0	1.436	869.0	LOS F	64.7	476.2	1.00	2.64	6.29	2.5
3	R2	75	6.0	75	6.0	1.436	1014.8	LOS F	64.7	476.2	1.00	2.64	6.29	1.4
Approach		134	6.0	134	6.0	1.436	950.6	LOS F	64.7	476.2	1.00	2.64	6.29	1.9
All Vehicles		3527	6.9	3527	6.9	1.436	39.0	NA	64.7	476.2	0.04	0.45	0.24	28.8



Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2021 – Race Day Mid-Day Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	36	6.0	36	6.0	0.175	7.9	LOS A	0.3	2.1	0.12	1.00	0.12	39.5
5	T1	1666	7.0	1666	7.0	0.428	5.2	LOS A	0.3	2.1	0.00	0.58	0.00	50.1
23	R2	24	0.0	24	0.0	0.017	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	44.4
6u	U	6	0.0	6	0.0	0.017	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	39.9
Approach		1732	6.9	1732	6.9	0.428	5.2	LOS A	0.3	2.1	0.01	0.59	0.01	49.8
NorthWest: Te Rapa Rd														
27	L2	6	0.0	6	0.0	0.361	5.6	LOS A	0.0	0.0	0.00	0.20	0.00	57.0
11	T1	1339	7.0	1339	7.0	0.361	1.2	LOS A	0.0	0.0	0.00	0.20	0.00	58.7
12	R2	57	6.0	57	6.0	0.102	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	45.1
12u	U	94	6.0	94	6.0	0.102	6.6	LOS A	0.0	0.0	0.00	0.57	0.00	46.3
Approach		1496	6.9	1496	6.9	0.361	1.7	NA	0.0	0.0	0.00	0.23	0.00	56.6
SouthWest: Sir Tristram Ave														
1	L2	32	6.0	32	6.0	0.044	5.3	LOS A	0.2	1.1	0.14	0.50	0.14	43.2
3	R2	2	6.0	2	6.0	0.044	47.9	LOS E	0.2	1.1	0.14	0.50	0.14	39.9
Approach		34	6.0	34	6.0	0.044	7.8	LOS A	0.2	1.1	0.14	0.50	0.14	43.1
All Vehicles		3262	6.9	3262	6.9	0.428	3.6	NA	0.3	2.1	0.00	0.42	0.00	52.7



Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2021 – Race Day PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	4	6.0	4	6.0	0.082	7.7	LOS A	0.0	0.3	0.04	1.04	0.04	40.0
5	T1	765	7.0	765	7.0	0.201	5.1	LOS A	0.0	0.3	0.00	0.57	0.00	50.3
23	R2	3	0.0	3	0.0	0.004	4.6	LOS A	0.0	0.0	0.00	0.60	0.00	44.1
6u	U	3	0.0	3	0.0	0.004	5.8	LOS A	0.0	0.0	0.00	0.60	0.00	39.4
Approach		775	6.9	775	6.9	0.201	5.1	LOS A	0.0	0.3	0.00	0.57	0.00	50.2
NorthWest: Te Rapa Rd														
27	L2	9	0.0	9	0.0	0.247	5.6	LOS A	0.0	0.0	0.00	0.20	0.00	57.0
11	T1	912	7.0	912	7.0	0.247	1.1	LOS A	0.0	0.0	0.00	0.20	0.00	58.7
12	R2	7	6.0	7	6.0	0.029	4.6	LOS A	0.0	0.0	0.00	0.59	0.00	44.9
12u	U	34	6.0	34	6.0	0.029	6.3	LOS A	0.0	0.0	0.00	0.59	0.00	46.2
Approach		962	6.9	962	6.9	0.247	1.4	NA	0.0	0.0	0.00	0.22	0.00	57.7
SouthWest: Sir Tristram Ave														
1	L2	67	6.0	67	6.0	0.130	4.8	LOS A	0.5	3.5	0.06	0.51	0.06	42.4
3	R2	21	6.0	21	6.0	0.130	20.6	LOS C	0.5	3.5	0.06	0.51	0.06	38.7
Approach		88	6.0	88	6.0	0.130	8.5	LOS A	0.5	3.5	0.06	0.51	0.06	41.8
All Vehicles		1825	6.9	1825	6.9	0.247	3.3	NA	0.5	3.5	0.00	0.38	0.00	53.4



2021 Baseline + Development

Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2021 + Development - AM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	74	6.0	74	6.0	0.506	7.9	LOS A	0.2	1.4	0.09	0.96	0.09	38.8
5	T1	1435	7.0	1435	7.0	0.381	5.1	LOS A	0.0	0.0	0.00	0.57	0.00	50.3
23	R2	23	0.0	23	0.0	0.015	4.6	LOS A	0.0	0.0	0.00	0.56	0.00	44.5
6u	U	3	0.0	3	0.0	0.015	5.8	LOS A	0.0	0.0	0.00	0.56	0.00	40.0
Approach		1535	6.8	1535	6.8	0.506	5.2	LOS A	0.2	1.4	0.00	0.58	0.00	49.7
NorthWest: Te Rapa Rd														
27	L2	8	0.0	8	0.0	0.395	5.6	LOS A	0.0	0.0	0.00	0.20	0.00	57.0
11	T1	1466	7.0	1466	7.0	0.395	1.2	LOS A	0.0	0.0	0.00	0.20	0.00	58.7
12	R2	60	6.0	60	6.0	0.133	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	45.0
12u	U	133	6.0	133	6.0	0.133	6.6	LOS A	0.0	0.0	0.00	0.57	0.00	46.3
Approach		1667	6.9	1667	6.9	0.395	1.8	NA	0.0	0.0	0.00	0.24	0.00	56.2
SouthWest: Sir Tristram Ave														
1	L2	153	6.0	153	6.0	0.101	5.2	LOS A	0.4	3.2	0.16	0.47	0.16	45.5
Approach		153	6.0	153	6.0	0.101	5.2	LOS A	0.4	3.2	0.16	0.47	0.16	45.5
All Vehicles		3355	6.8	3355	6.8	0.506	3.5	NA	0.4	3.2	0.01	0.41	0.01	52.6



Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2021 + Development - PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	56	6.0	56	6.0	0.164	7.8	LOS A	0.1	1.0	0.06	0.97	0.06	38.8
5	T1	1378	7.0	1378	7.0	0.366	5.1	LOS A	0.0	0.0	0.00	0.57	0.00	50.3
23	R2	13	0.0	13	0.0	0.010	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	44.4
6u	U	4	0.0	4	0.0	0.010	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	39.8
Approach		1451	6.9	1451	6.9	0.366	5.2	LOS A	0.1	1.0	0.00	0.58	0.00	49.9
NorthWest: Te Rapa Rd														
27	L2	6	0.0	6	0.0	0.500	5.7	LOS A	0.0	0.0	0.00	0.19	0.00	56.9
11	T1	1859	7.0	1859	7.0	0.500	1.3	LOS A	0.0	0.0	0.00	0.19	0.00	58.6
12	R2	29	6.0	29	6.0	0.048	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	45.2
12u	U	42	6.0	42	6.0	0.048	6.5	LOS A	0.0	0.0	0.00	0.57	0.00	46.4
Approach		1936	6.9	1936	6.9	0.500	1.4	NA	0.0	0.0	0.00	0.21	0.00	57.8
SouthWest: Sir Tristram Ave														
1	L2	145	6.0	145	6.0	0.093	4.9	LOS A	0.4	2.9	0.08	0.47	0.08	45.8
Approach		145	6.0	145	6.0	0.093	4.9	LOS A	0.4	2.9	0.08	0.47	0.08	45.8
All Vehicles		3532	6.9	3532	6.9	0.500	3.1	NA	0.4	2.9	0.00	0.37	0.00	53.7



Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2021 + Development – Race Day Mid-Day Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	36	6.0	36	6.0	0.088	7.9	LOS A	0.1	1.0	0.11	0.97	0.11	39.1
5	T1	1666	7.0	1666	7.0	0.439	5.1	LOS A	0.1	1.0	0.00	0.57	0.00	50.2
23	R2	24	0.0	24	0.0	0.017	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	44.4
6u	U	6	0.0	6	0.0	0.017	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	39.9
Approach		1732	6.9	1732	6.9	0.439	5.1	LOS A	0.1	1.0	0.00	0.58	0.00	49.9
NorthWest: Te Rapa Rd														
27	L2	6	0.0	6	0.0	0.361	5.6	LOS A	0.0	0.0	0.00	0.20	0.00	57.0
11	T1	1339	7.0	1339	7.0	0.361	1.2	LOS A	0.0	0.0	0.00	0.20	0.00	58.7
12	R2	74	6.0	74	6.0	0.112	4.6	LOS A	0.0	0.0	0.00	0.56	0.00	45.2
12u	U	94	6.0	94	6.0	0.112	6.6	LOS A	0.0	0.0	0.00	0.56	0.00	46.4
Approach		1513	6.9	1513	6.9	0.361	1.7	NA	0.0	0.0	0.00	0.24	0.00	56.4
SouthWest: Sir Tristram Ave														
1	L2	49	6.0	49	6.0	0.032	5.3	LOS A	0.1	0.9	0.12	0.47	0.12	45.6
Approach		49	6.0	49	6.0	0.032	5.3	LOS A	0.1	0.9	0.12	0.47	0.12	45.6
All Vehicles		3294	6.8	3294	6.8	0.439	3.6	NA	0.1	1.0	0.00	0.42	0.00	52.7



Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2021 + Development – Race Day PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	4	6.0	4	6.0	0.041	7.7	LOS A	0.0	0.1	0.06	1.00	0.06	39.5
5	T1	765	7.0	765	7.0	0.202	5.0	LOS A	0.0	0.1	0.00	0.57	0.00	50.4
23	R2	3	0.0	3	0.0	0.004	4.6	LOS A	0.0	0.0	0.00	0.60	0.00	44.1
6u	U	3	0.0	3	0.0	0.004	5.8	LOS A	0.0	0.0	0.00	0.60	0.00	39.4
Approach		775	6.9	775	6.9	0.202	5.1	LOS A	0.0	0.1	0.00	0.57	0.00	50.3
NorthWest: Te Rapa Rd														
27	L2	9	0.0	9	0.0	0.247	5.6	LOS A	0.0	0.0	0.00	0.20	0.00	57.0
11	T1	912	7.0	912	7.0	0.247	1.1	LOS A	0.0	0.0	0.00	0.20	0.00	58.7
12	R2	23	6.0	23	6.0	0.038	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	45.2
12u	U	34	6.0	34	6.0	0.038	6.3	LOS A	0.0	0.0	0.00	0.57	0.00	46.4
Approach		978	6.9	978	6.9	0.247	1.4	NA	0.0	0.0	0.00	0.22	0.00	57.4
SouthWest: Sir Tristram Ave														
1	L2	106	6.0	106	6.0	0.068	4.7	LOS A	0.3	2.1	0.07	0.47	0.07	45.8
Approach		106	6.0	106	6.0	0.068	4.7	LOS A	0.3	2.1	0.07	0.47	0.07	45.8
All Vehicles		1859	6.9	1859	6.9	0.247	3.1	NA	0.3	2.1	0.00	0.38	0.00	53.5



2031 Baseline

Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2031 - AM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	74	6.0	74	6.0	0.504	7.9	LOS A	0.2	1.4	0.09	0.96	0.09	38.8
5	T1	1585	7.0	1585	7.0	0.421	5.1	LOS A	0.0	0.0	0.00	0.57	0.00	50.3
23	R2	25	0.0	25	0.0	0.016	4.6	LOS A	0.0	0.0	0.00	0.56	0.00	44.5
6u	U	3	0.0	3	0.0	0.016	5.8	LOS A	0.0	0.0	0.00	0.56	0.00	40.0
Approach		1687	6.8	1687	6.8	0.504	5.2	LOS A	0.2	1.4	0.00	0.58	0.00	49.8
NorthWest: Te Rapa Rd														
27	L2	10	0.0	10	0.0	0.482	5.7	LOS A	0.0	0.0	0.00	0.20	0.00	56.9
11	T1	1787	7.0	1787	7.0	0.482	1.2	LOS A	0.0	0.0	0.00	0.19	0.00	58.6
12	R2	55	6.0	55	6.0	0.152	4.6	LOS A	0.0	0.0	0.00	0.58	0.00	44.9
12u	U	162	6.0	162	6.0	0.152	6.6	LOS A	0.0	0.0	0.00	0.58	0.00	46.2
Approach		2014	6.9	2014	6.9	0.482	1.8	NA	0.0	0.0	0.00	0.24	0.00	56.3
SouthWest: Sir Tristram Ave														
1	L2	50	6.0	50	6.0	1.026	244.4	LOS F	15.4	113.1	1.00	1.94	4.13	7.4
3	R2	58	6.0	58	6.0	1.026	344.6	LOS F	15.4	113.1	1.00	1.94	4.13	4.4
Approach		108	6.0	108	6.0	1.026	298.2	LOS F	15.4	113.1	1.00	1.94	4.13	5.8
All Vehicles		3809	6.8	3809	6.8	1.026	11.7	NA	15.4	113.1	0.03	0.44	0.12	44.6



Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2031 - PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	56	6.0	56	6.0	0.165	7.8	LOS A	0.1	1.0	0.07	0.96	0.07	38.8
5	T1	1522	7.0	1522	7.0	0.404	5.0	LOS A	0.0	0.0	0.00	0.57	0.00	50.3
23	R2	14	0.0	14	0.0	0.010	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	44.4
6u	U	4	0.0	4	0.0	0.010	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	39.8
Approach		1596	6.9	1596	6.9	0.404	5.1	LOS A	0.1	1.0	0.00	0.58	0.00	49.9
NorthWest: Te Rapa Rd														
27	L2	7	0.0	7	0.0	0.609	5.8	LOS A	0.0	0.0	0.00	0.19	0.00	56.8
11	T1	2266	7.0	2266	7.0	0.609	1.3	LOS A	0.0	0.0	0.00	0.19	0.00	58.4
12	R2	36	6.0	36	6.0	0.058	4.6	LOS A	0.0	0.0	0.00	0.56	0.00	45.2
12u	U	51	6.0	51	6.0	0.058	6.5	LOS A	0.0	0.0	0.00	0.56	0.00	46.4
Approach		2360	6.9	2360	6.9	0.609	1.5	NA	0.0	0.0	0.00	0.20	0.00	57.6
SouthWest: Sir Tristram Ave														
1	L2	59	6.0	59	6.0	2.366	2535.9	LOS F	110.0	809.8	1.00	4.01	10.09	1.0
3	R2	75	6.0	75	6.0	2.366	2631.5	LOS F	110.0	809.8	1.00	4.01	10.09	0.5
Approach		134	6.0	134	6.0	2.366	2589.4	LOS F	110.0	809.8	1.00	4.01	10.09	0.7
All Vehicles		4090	6.9	4090	6.9	2.366	87.7	NA	110.0	809.8	0.03	0.48	0.33	17.8



Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2031 – Race Day Mid-Day Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	40	6.0	40	6.0	0.194	7.9	LOS A	0.3	2.3	0.14	0.99	0.14	39.3
5	T1	1846	7.0	1846	7.0	0.475	5.2	LOS A	0.3	2.3	0.00	0.58	0.00	50.1
23	R2	27	0.0	27	0.0	0.020	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	44.4
6u	U	7	0.0	7	0.0	0.020	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	39.8
Approach		1920	6.9	1920	6.9	0.475	5.3	LOS A	0.3	2.3	0.01	0.59	0.01	49.8
NorthWest: Te Rapa Rd														
27	L2	7	0.0	7	0.0	0.439	5.7	LOS A	0.0	0.0	0.00	0.20	0.00	57.0
11	T1	1632	7.0	1632	7.0	0.439	1.2	LOS A	0.0	0.0	0.00	0.20	0.00	58.6
12	R2	69	6.0	69	6.0	0.125	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	45.1
12u	U	115	6.0	115	6.0	0.125	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	46.3
Approach		1823	6.9	1823	6.9	0.439	1.7	NA	0.0	0.0	0.00	0.23	0.00	56.5
SouthWest: Sir Tristram Ave														
1	L2	32	6.0	32	6.0	0.052	5.6	LOS A	0.2	1.3	0.18	0.50	0.18	42.6
3	R2	2	6.0	2	6.0	0.052	61.6	LOS F	0.2	1.3	0.18	0.50	0.18	39.0
Approach		34	6.0	34	6.0	0.052	8.9	LOS A	0.2	1.3	0.18	0.50	0.18	42.5
All Vehicles		3777	6.9	3777	6.9	0.475	3.6	NA	0.3	2.3	0.01	0.42	0.01	52.8



Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2031 – Race Day PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	4	6.0	4	6.0	0.090	7.7	LOS A	0.0	0.3	0.04	1.04	0.04	40.1
5	T1	845	7.0	845	7.0	0.222	5.1	LOS A	0.0	0.3	0.00	0.57	0.00	50.3
23	R2	3	0.0	3	0.0	0.004	4.6	LOS A	0.0	0.0	0.00	0.60	0.00	44.1
6u	U	3	0.0	3	0.0	0.004	5.8	LOS A	0.0	0.0	0.00	0.60	0.00	39.4
Approach		855	6.9	855	6.9	0.222	5.1	LOS A	0.0	0.3	0.00	0.57	0.00	50.2
NorthWest: Te Rapa Rd														
27	L2	11	0.0	11	0.0	0.301	5.6	LOS A	0.0	0.0	0.00	0.20	0.00	56.9
11	T1	1112	7.0	1112	7.0	0.301	1.2	LOS A	0.0	0.0	0.00	0.20	0.00	58.7
12	R2	9	6.0	9	6.0	0.036	4.6	LOS A	0.0	0.0	0.00	0.59	0.00	44.9
12u	U	41	6.0	41	6.0	0.036	6.3	LOS A	0.0	0.0	0.00	0.59	0.00	46.2
Approach		1173	6.9	1173	6.9	0.301	1.4	NA	0.0	0.0	0.00	0.22	0.00	57.7
SouthWest: Sir Tristram Ave														
1	L2	67	6.0	67	6.0	0.161	4.8	LOS A	0.6	4.1	0.08	0.51	0.08	41.4
3	R2	21	6.0	21	6.0	0.161	26.7	LOS D	0.6	4.1	0.08	0.51	0.08	37.2
Approach		88	6.0	88	6.0	0.161	10.0	LOS B	0.6	4.1	0.08	0.51	0.08	40.7
All Vehicles		2116	6.9	2116	6.9	0.301	3.2	NA	0.6	4.1	0.00	0.37	0.00	53.6



2031 Baseline + Development

Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2031 + Development - AM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	74	6.0	74	6.0	0.509	7.9	LOS A	0.2	1.4	0.10	0.96	0.10	38.8
5	T1	1585	7.0	1585	7.0	0.421	5.1	LOS A	0.0	0.0	0.00	0.57	0.00	50.3
23	R2	25	0.0	25	0.0	0.016	4.6	LOS A	0.0	0.0	0.00	0.56	0.00	44.5
6u	U	3	0.0	3	0.0	0.016	5.8	LOS A	0.0	0.0	0.00	0.56	0.00	40.0
Approach		1687	6.8	1687	6.8	0.509	5.2	LOS A	0.2	1.4	0.00	0.58	0.00	49.7
NorthWest: Te Rapa Rd														
27	L2	10	0.0	10	0.0	0.482	5.7	LOS A	0.0	0.0	0.00	0.20	0.00	56.9
11	T1	1787	7.0	1787	7.0	0.482	1.2	LOS A	0.0	0.0	0.00	0.19	0.00	58.6
12	R2	66	6.0	66	6.0	0.158	4.6	LOS A	0.0	0.0	0.00	0.58	0.00	45.0
12u	U	162	6.0	162	6.0	0.158	6.7	LOS A	0.0	0.0	0.00	0.58	0.00	46.2
Approach		2025	6.9	2025	6.9	0.482	1.8	NA	0.0	0.0	0.00	0.24	0.00	56.2
SouthWest: Sir Tristram Ave														
1	L2	153	6.0	153	6.0	0.102	5.5	LOS A	0.4	3.2	0.18	0.48	0.18	45.4
Approach		153	6.0	153	6.0	0.102	5.5	LOS A	0.4	3.2	0.18	0.48	0.18	45.4
All Vehicles		3865	6.8	3865	6.8	0.509	3.4	NA	0.4	3.2	0.01	0.40	0.01	52.8



Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2031 + Development - PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	56	6.0	56	6.0	0.168	7.9	LOS A	0.1	1.0	0.09	0.95	0.09	38.8
5	T1	1522	7.0	1522	7.0	0.404	5.1	LOS A	0.0	0.0	0.00	0.57	0.00	50.3
23	R2	14	0.0	14	0.0	0.010	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	44.4
6u	U	4	0.0	4	0.0	0.010	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	39.8
Approach		1596	6.9	1596	6.9	0.404	5.2	LOS A	0.1	1.0	0.00	0.58	0.00	49.9
NorthWest: Te Rapa Rd														
27	L2	7	0.0	7	0.0	0.609	5.8	LOS A	0.0	0.0	0.00	0.19	0.00	56.8
11	T1	2266	7.0	2266	7.0	0.609	1.3	LOS A	0.0	0.0	0.00	0.19	0.00	58.4
12	R2	59	6.0	59	6.0	0.071	4.6	LOS A	0.0	0.0	0.00	0.55	0.00	45.3
12u	U	51	6.0	51	6.0	0.071	6.5	LOS A	0.0	0.0	0.00	0.55	0.00	46.5
Approach		2383	6.9	2383	6.9	0.609	1.5	NA	0.0	0.0	0.00	0.21	0.00	57.5
SouthWest: Sir Tristram Ave														
1	L2	145	6.0	145	6.0	0.093	5.1	LOS A	0.4	2.9	0.09	0.47	0.09	45.8
Approach		145	6.0	145	6.0	0.093	5.1	LOS A	0.4	2.9	0.09	0.47	0.09	45.8
All Vehicles		4124	6.9	4124	6.9	0.609	3.1	NA	0.4	2.9	0.00	0.36	0.00	53.8



Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2031 + Development – Race Day Mid-Day Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	40	6.0	40	6.0	0.097	8.0	LOS A	0.2	1.1	0.12	0.97	0.12	39.0
5	T1	1846	7.0	1846	7.0	0.486	5.1	LOS A	0.2	1.1	0.00	0.57	0.00	50.2
23	R2	27	0.0	27	0.0	0.020	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	44.4
6u	U	7	0.0	7	0.0	0.020	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	39.8
Approach		1920	6.9	1920	6.9	0.486	5.2	LOS A	0.2	1.1	0.00	0.58	0.00	49.9
NorthWest: Te Rapa Rd														
27	L2	7	0.0	7	0.0	0.439	5.7	LOS A	0.0	0.0	0.00	0.20	0.00	57.0
11	T1	1632	7.0	1632	7.0	0.439	1.2	LOS A	0.0	0.0	0.00	0.20	0.00	58.6
12	R2	86	6.0	86	6.0	0.134	4.6	LOS A	0.0	0.0	0.00	0.56	0.00	45.2
12u	U	115	6.0	115	6.0	0.134	6.7	LOS A	0.0	0.0	0.00	0.56	0.00	46.4
Approach		1840	6.9	1840	6.9	0.439	1.7	NA	0.0	0.0	0.00	0.24	0.00	56.4
SouthWest: Sir Tristram Ave														
1	L2	49	6.0	49	6.0	0.032	5.6	LOS A	0.1	1.0	0.14	0.47	0.14	45.6
Approach		49	6.0	49	6.0	0.032	5.6	LOS A	0.1	1.0	0.14	0.47	0.14	45.6
All Vehicles		3809	6.8	3809	6.8	0.486	3.5	NA	0.2	1.1	0.00	0.41	0.00	52.8



Site: 3 [Te Rapa Rd / Sir Tristram Ave – Baseline 2031 + Development – Race Day PM Peak]

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m				
SouthEast: Te Rapa Rd														
4	L2	4	6.0	4	6.0	0.045	7.8	LOS A	0.0	0.1	0.06	1.00	0.06	39.6
5	T1	845	7.0	845	7.0	0.223	5.0	LOS A	0.0	0.1	0.00	0.57	0.00	50.3
23	R2	3	0.0	3	0.0	0.004	4.6	LOS A	0.0	0.0	0.00	0.60	0.00	44.1
6u	U	3	0.0	3	0.0	0.004	5.8	LOS A	0.0	0.0	0.00	0.60	0.00	39.4
Approach		855	6.9	855	6.9	0.223	5.1	LOS A	0.0	0.1	0.00	0.57	0.00	50.3
NorthWest: Te Rapa Rd														
27	L2	11	0.0	11	0.0	0.301	5.6	LOS A	0.0	0.0	0.00	0.20	0.00	56.9
11	T1	1112	7.0	1112	7.0	0.301	1.2	LOS A	0.0	0.0	0.00	0.20	0.00	58.7
12	R2	25	6.0	25	6.0	0.045	4.6	LOS A	0.0	0.0	0.00	0.57	0.00	45.1
12u	U	41	6.0	41	6.0	0.045	6.3	LOS A	0.0	0.0	0.00	0.57	0.00	46.4
Approach		1189	6.9	1189	6.9	0.301	1.4	NA	0.0	0.0	0.00	0.22	0.00	57.5
SouthWest: Sir Tristram Ave														
1	L2	106	6.0	106	6.0	0.068	4.7	LOS A	0.3	2.1	0.08	0.47	0.08	45.8
Approach		106	6.0	106	6.0	0.068	4.7	LOS A	0.3	2.1	0.08	0.47	0.08	45.8
All Vehicles		2150	6.9	2150	6.9	0.301	3.0	NA	0.3	2.1	0.00	0.37	0.00	53.7

