BEFORE THE INDEPENDENT HEARINGS PANEL
OF HAMILTON CITY COUNCIL

UNDER	the Resource Management Act 1991 ("**RMA**")
AND	
IN THE MATTER	of Private Plan Change 17 to the Hamilton City Operative District Plan ("**PC17**")

STATEMENT OF EXPERT EVIDENCE OF CAMERON BESWICK INDER ON BEHALF OF FONTERRA LIMITED

TRANSPORT

7 OCTOBER 2025

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1. EXECUTIVE SUMMARY

1.1 PC17 proposes the rezoning of approximately 91 ha of land surrounding the Te Rapa Dairy Manufacturing Site ("**Manufacturing Site**") at Te Rapa North ("**Plan Change Area**") for industrial development, removing the Deferred Industrial Zone Overlay. The net developable area is approximately 53 ha due to topography, stormwater management requirements, and setting aside sufficient land for two future strategic transport projects by the Hamilton City Council ("**Council**"), namely:

(a) The Northern River Crossing ("**NRC**") arterial that is proposed to pass through the Plan Change Area in an east-west direction: and

(b) The retrofitting of Bus Rapid Transit ("**BRT**") on Te Rapa Road in a north-south direction through the Plan Change Area.

1.2 Neither project has been investigated by Council in detail or route protected via a designation in the Hamilton City Operative District Plan ("**ODP**"). Therefore, the Plan Change process has allowed for both projects to the extent feasible given the limited information available. Council is ultimately responsible for providing the strategic transport infrastructure in the city.

1.3 The Integrated Transport Assessment ("**ITA**") prepared to support PC17 demonstrates that, with recommended infrastructure upgrades and staging, the transportation effects of PC17 can be managed and mitigated to acceptable levels.

1.4 Subsequent transport modelling and assessment updates post-lodgement of the PC17 application have resulted in revised infrastructure staging provisions annexed in **Attachment 2** and summarised in Table 1 below:

Table 1

Minimum Infrastructure Requirement	Net Developable Area / Peak Hour Traffic Generation Trigger
An initial section of Structure Plan Spine Road as a continuous connection to Old Ruffell Road.	Up to 20 ha in the Plan Change Area West Block, or weekday pm peak generating less than 325 vehicles per hour through Old Ruffell Road.

Upgrade of Old Ruffell Road to Old Ruffell Road Collector cross-section standard. Walking and cycling connection between Te Rapa Road and Old Ruffell Road stub.	
The above infrastructure, plus Access 2 Intersection and associated walking and cycling, public transport infrastructure. Four continuous traffic lanes on Te Rapa Road between the Hutchinson Road roundabout and the Access 2 intersection.	Between 20.1 ha and 35 ha in the West and North Blocks of the Plan Change Area, or weekday pm peak exceeding 325 vph through Old Ruffell Road.
All the above infrastructure, plus upgrade to Te Rapa Road / Ruffell Road intersection.	Up to 42 ha in the Plan Change Area, or a cumulative average weekday pm peak traffic volume up to 685 vehicles per hour.
All the above infrastructure, plus completion of the safety upgrades identified in the Ruffell Road Level Crossing Safety Impact Assessment such that the level crossing is reopened to traffic.	A cumulative average weekday pm peak traffic volume exceeding 685 vehicles per hour in the Plan Change Area, and The weekday am peak hour volume on Te Kowhai Road eastbound approach to the Te Rapa Road / Te Kowhai Road roundabout exceeding 790 vehicles per hour.
A road connection through the Dairy Manufacturing Site connecting the South Block to existing Te Rapa Road.	Any industrial / commercial activity in the Plan Change Area South Block.

No vehicle access from any South Block industrial activity to Meadow View Lane south of RP 58.	

1.5 All land use or subdivision applications up to a cumulative total of 42 ha (net developable) that fail to meet the minimum infrastructure requirement are required to be supported by a Simple ITA that meets the requirements of section 15-2 of the District Plan.[1]

1.6 Furthermore, a Broad ITA is triggered for any industrial / commercial activity consent where the cumulative net developed area will exceed 42 ha or generates a cumulative average weekday pm peak traffic volume exceeding 685 vehicles per hour.[2]

1.7 The recommended infrastructure upgrades in the Simple and Broad ITAs, or such alternatives accepted by Council, KiwiRail Holdings Limited ("**KiwiRail**") and New Zealand Transport Agency Waka Kotahi ("**NZTA**") (the latter two where approval is legally required), must be completed prior to the section 224(c) certificate for subdivision under the RMA being issued.[3]

1.8 Other important transport provisions in the Plan Change include future proofing for a direct rail freight connection and providing generous building setbacks along the East-West Road and Te Rapa Road frontages to allow for the potential future NRC arterial and BRT strategic transport infrastructure (by the Council).

1.9 From a transport perspective, PC17 aligns with national, regional, and local transport strategies and supports economic growth, resilience, and safety.

2. INTRODUCTION

Qualifications and Experience

2.1 My full name is Cameron Beswick Inder. I am a Principal Transportation Engineer and the transportation engineering manager at Bloxam Burnett & Olliver ("**BBO**"), a firm of consulting engineers, planners and surveyors based in Hamilton. I have been employed by BBO since 2004.

1 Rule 3.9.3.2(a).
2 Rule 3.9.3.2(b).
3 Rule 3.9.3.2(c).

2.2 My professional qualifications and affiliations include a Bachelor of Engineering (Civils) degree from the University of Auckland (1998). I am a Chartered Professional Engineer and a Chartered Member of Engineering New Zealand. I am also a member of the Engineering NZ Transportation Group.

2.3 I have 25 years' experience in the field of transportation and traffic engineering gained through employment in New Zealand and the United Kingdom.

2.4 I have experience in transportation and traffic engineering matters associated with resource management, including effects assessment for resource consents, subdivisions, plan changes and structure plans. I also have experience in the design of traffic infrastructure and facilities, road safety engineering, traffic calming, urban design, subdivision design, and traffic modelling.

2.5 I have appeared as expert transport planning and engineering witness at hearings on numerous occasions including:

(a) Titanium Park Limited and Rukahia Properties Limited Private Plan Change 20 – Northern Precinct to the Waipā District Plan (2023)

(b) Ambury Properties Limited Private Plan Change to the Proposed Waikato District Plan (Ohinewai, 2020)

(c) Rings Scenic Tours Private Plan Change to the Matamata-Piako District Plan (Hobbiton, 2019)

(d) Waikato Regional Airport Limited Private Plan Change 10 to the Waipā District Plan (Hamilton Airport, 2018)

Involvement in PC17

2.6 I have been engaged by Fonterra Limited ("**Fonterra**") to prepare expert transport planning and engineering evidence for PC17.

2.7 Prior to that I was involved in the development of PC17 from the first draft of the Structure Plan, including directing and assisting with the transport assessment work undertaken by my colleague Mr Siva Balachandran.[4] I also carried out the technical review of the ITA and authored the Summary of Updates memo on transport matters ("**Supplementary Transport Memo**") in

[4] Siva Balachandran (BEng (Civil Engineering), CPEng, CMEngNZ)) is a qualified Transportation Engineer employed by BBO.

Appendix 4 of the Supplementary Information Report submitted to Council on 21 August 2025 by Harrison Grierson ("**Supplementary Information Report**").

2.8 My role also involved attending consultation meetings with representatives of the Council, KiwiRail and Empire Corporation Limited, in relation to transport planning and engineering matters of PC17.

Code of Conduct

2.9 I confirm that I have read the Expert Witness Code of Conduct set out in the Environment Court's Practice Note 2023. I have complied with the Code of Conduct in preparing this evidence and I agree to comply with it while giving oral evidence before the Hearings Commissioners. This written evidence is within my area of expertise except where I state that I am relying on the evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

3. PC17

3.1 PC17 has been prepared to rezone approximately 91ha of land surrounding the Te Rapa Dairy Manufacturing Site ("**Manufacturing Site**"). PC17 proposes to amend the ODP's planning maps by removing the Deferred Industrial Zone Overlay from the Plan Change Area and amending the provisions of the Te Rapa North Industrial Zone ("**TRNIZ**") to enable its intended future industrial use.

3.2 The extent of the Plan Change Area is shown in Figure 1 below.

Figure 1: Plan Change Area Boundaries.

4. SCOPE OF EVIDENCE

4.1 My statement of evidence will:

(a) outline the existing transportation environment and future planned transport infrastructure.

(b) summarise the key findings from the ITA undertaken in relation to PC17.

(c) explain the approach taken for the ITA modelling, the consultation with the Council concerning the scenarios to run in the Waikato Regional Transport Model for PC17 and why these were chosen.

(d) explain the revised transport assessment/modelling work undertaken and why.

(e) explain the resulting changes to the proposed PC17 infrastructure provisions and Structure Plan.

(f) respond to transport matters raised in the Council Officer's Section 42A Report ("**Section 42A Report**").

(g) respond to transport matters raised in submissions; and

(h) provide an overall conclusion on Fonterra's application for PC17 from a transport perspective.

5. EXISTING ENVIRONMENT AND FUTURE PLANNED TRANSPORT INFRASTRUCTURE

5.1 The Plan Change Area is approximately 91 ha located at the northern extent of Te Rapa, Hamilton, and is currently used for rural and rural-residential purposes. The Plan Change Area is bounded by the Waikato River to the east, the North Island Main Trunk ("**NIMT**") rail line to the west, Bern Road at the northern end and Old Ruffell Road and Ruffell Road at the southern end. The Manufacturing Site is adjacent to the Plan Change Area and is not included in PC17.

5.2 Te Rapa Road is a major arterial passing through the Plan Change Area, with an Average Daily Traffic volume of approximately 14,600 vehicles per day and a posted speed of 80 km/h. State Highway 1C (Waikato Expressway) ("**SH1C**") and the Rotokauri industrial and residential growth area are located immediately west of the Plan Change Area although there is presently no direct connection to either from PC17 due to the temporary closure of the Ruffell Road railway level crossing.

5.3 The SH1C Horotiu Interchange is located approximately 1.6 km to the north of the Plan Change Area where full access to SH1C is provided.

5.4 Public transport in proximity to the Plan Change Area is presently limited to the 21 Northern Connector bus route which travels from the Hamilton Transport Centre via Te Rapa Road to Ngāruawāhia and Huntly. Several services per week extend to Te Kauwhata, Pokeno, Tuakau and Pukekohe. The service uses two existing bus stops located near Manufacturing Site interchange access on Te Rapa Road.

5.5 Presently, there are no formal pedestrian paths or cycling network facilities on Te Rapa Road through, or in proximity to, the Plan Change Area.

5.6 Key future transport infrastructure and land use projects nearby include the NRC arterial, the Te Awa Lakes residential and commercial development with associated transport upgrades to Te Rapa Road in proximity to the Plan Change Area, and potentially a BRT service extending alongside or within Te Rapa Road.

5.7 Neither the NRC arterial or BRT have been investigated by Council in detail or route protected via a designation in the ODP. Therefore, the Plan Change process has allowed for both projects to the extent feasible given the limited information available. Council is ultimately responsible for investigating and route protecting the strategic transport infrastructure in Hamilton city.

6. NRC

6.1 The NRC is a long-term strategic network road connecting from Koura Drive on the west side of the NIMT, through the Plan Change Area in a west-east direction and crossing the Waikato River to connect with Resolution Drive on the north-east side of Hamilton. While it is indicatively shown in Council's Infrastructure Strategy and the ODP as a future major arterial, there is presently no confirmed alignment for the NRC corridor, and no investigations have been undertaken to identify the intended location for the bridge over the Waikato River.

6.2 The Council's Long-Term Plan shows an initial fund of approximately $6 million is planned for the 2029-31 period, most likely to undertake the initial investigation and route protection work. In the meantime, the work I have done ensures the PC17 Structure Plan and associated plan provisions do not preclude future delivery of the NRC arterial by the Council.

7. BRT

7.1 The BRT corridor is identified and indicatively named "**RT1**" in the Hamilton-Waikato Metro Spatial Plan Transport Programme Business Case ("**the Metro Spatial Plan**"). The service is proposed to connect from Te Awa Lakes development area, through the Plan Change Area and the Hamilton City Central Business District ("**CBD**") to Hamilton International Airport. There is presently no confirmed alignment or funding for the RT1 corridor, but Fonterra has ensured the PC17 Structure Plan and proposed plan provisions do not preclude its future delivery.

8. INTEGRATED TRANSPORT ASSESSMENT AND PC17 TRANSPORT PROVISIONS

8.1 This section summarises the ITA that supported the lodged PC17 request. Some of the information has since been updated based on feedback from engagement with the Council and KiwiRail, resulting in the position put forward in my Supplementary Transport Memo. I address these changes in Section 9 of my evidence.

8.2 The trip generation calculations for PC17 are set out in the ITA[5]. This was based on a survey-derived traffic generation rate of 16.3 trips/ha (net developed land) and available information at the time that the 91 ha within the Plan Change Area would provide approximately 63 ha of net developable land

5 ITA, Section 6.

for industrial activities. The 28 ha balance is needed for riparian and flood prone areas, roads, reserves, landscape bunds, stormwater management devices and the proposed rail siding.

8.3 On that basis, the ITA states that PC17 is expected to generate approximately 1,030 trips per peak hour when complete and occupied by industrial activities.

Transport Modelling

8.4 Transport modelling using the Waikato Regional Transport Model ("**WRTM**") as a primary input, is current best practice when assessing network transport effects of a plan change. The WRTM is jointly owned by NZTA and several Waikato-based councils (including the Council) and is managed on their behalf by Waikato Local Authority Shared Services Limited (trading as "**Co-Lab**")

8.5 I have extensive experience in transport modelling including running proposed development scenarios using the WRTM. The time and costs involved are significant. Each request to run variants through the master model requires ownership partner approval of each proposed development scenario to be modelled. For this reason, my team and I carefully plan the development scenarios intended for modelling in the WRTM as it is not feasible (nor necessary) to model every iterative change to the proposed land-use or road network during the evolution phase of a plan change.

8.6 For PC17, the Council is the key owner partner to approve any proposed WRTM scenarios since the Plan Change Area is wholly within Hamilton City's district. To avoid potential disagreements about modelling methodology and the risk of rework on time and cost, I met with the Council's Transport Planning, Strategy and Programming Team together with Harrison Grierson Limited and Fonterra's PC17 team on several occasions in 2024 to discuss and agree the proposed WRTM scenarios.

Ruffell Road rail level crossing

8.7 One of the key discussion points was the status of the Ruffell Road rail level crossing that was closed in 2021, and whether this was permanent or temporary. The Council advised that it understood the crossing closure is temporary but several significant safety upgrades are necessary for KiwiRail to be satisfied it can function safely and be reopened. The temporary nature of the closure is evident by the original barrier arm mechanisms and flashing light and bell poles remaining in place along with the level crossing pavement.

8.8 The various safety issues were discussed, and Council advised the primary safety matter is the proximity of the Onion Road intersection with Ruffell Road to the level crossing. This will be resolved when the Onion Road realignment project occurs, enabling Onion Road to be stopped so there is no intersection. The Council agreed that it is likely all other safety issues can be addressed with various improvements to the approach roads.

8.9 On that basis it was agreed with the Council that the 2035 and 2045 development scenarios in the WRTM to inform the ITA, should assume the Ruffell Road level crossing is open where the modelled network excludes the NRC or an interim stage of the NRC from Koura Drive to Te Rapa Road.

Development scenarios

8.10 The following five future development scenarios for PC17 were scoped by BBO and reviewed and approved by the Council for running in the WRTM:

(a) 2035 Baseline model: Includes Te Awa Lakes development and no PC17.

(b) 2035 Development Scenario 1: Baseline + Partial PC17 (33 ha occupied)

(c) 2045 Development Scenario 2: Baseline + Full PC17 and partial East/West road.

(d) 2045 Development Scenario 3: Baseline + Full PC17 and East/West road from Koura Drive to Te Rapa Road (interim stage of the NRC), and

(e) 2045 Development Scenario 4: Baseline + Full PC17 and completed NRC arterial.

8.11 The first three WRTM scenarios assume the Ruffell Road level crossing will be reopened as agreed during model scoping discussions with the Council. Scenarios 3 and 4 were requested by the Council to provide an understanding of the redistribution effect of the NRC, both as an initial stage from Koura Drive (grade separated crossing over the railway line) to Te Rapa Road, and as a completed Waikato River crossing transport corridor.

8.12 The ITA modelling for PC17 demonstrated that, with a range of new and upgraded transport infrastructure to enable access as development proceeds,

the receiving network is expected to function with generally acceptable performance with PC17 traffic included.

8.13 The Horotiu Interchange western roundabout and Te Rapa Road / Base Parade intersection are the two locations where capacity issues were identified as potentially requiring future intervention before completing the PC17 development if the NRC is not constructed (both performing at Level of Service ("**LOS**") F). For both cases, various options to improve the LOS were identified in the ITA but were not included in the proposed rule provisions.[6]

8.14 This is because the long-term transport network could include the NRC by 2045, and the modelling demonstrates this will alleviate these wider network congestion issues which are the result of cumulative growth in the northern Te Rapa and Rotokauri areas.

8.15 Similarly, the BRT service from the CBD to Te Awa Lakes may exist, which will facilitate greater use of PT for commuter trips, but also reduce capacity for traffic at intersections on Te Rapa Road.

8.16 Given the various uncertainties identified above, previous proposed rule 3.9.4.2(b) required a Broad ITA to accompany any development or subdivision application in the Plan Change Area. This would "identify and evaluate the effects of all cumulative development in the Structure Plan area on the infrastructure identified for improvements in 3.9.4.2", taking into consideration the effect of NRC if further certainty and timing for the road exists.

8.17 The infrastructure and development staging assessment in the ITA informed the proposed Structure Plan roads and connection points to the wider network. The following components have since been deleted from the prescribed list of infrastructure improvements to be undertaken for any development in the Plan Change Area following further assessment work described in the next section of my evidence:

(a) Access 1 Intersection with Te Rapa Road (ultimately to become the NRC intersection with Te Rapa Road).

(b) A new public road (East - West Road) between Te Rapa Road and the Structure Plan spine road ("**Spine Road**") (ultimately to become the NRC arterial).

6 Refer BBO ITA sections 8.3.8.1 – 8.3.8.4, and 8.3.10.2.

(c) Capacity upgrade at Te Rapa Road / McKee Street intersection (signalised by Te Awa Lakes in accordance with ODP rule).

(d) Increased capacity at Te Rapa Road / Ruffell Road intersection.

(e) Increased capacity at Te Rapa Road / Kapuni Street intersection, and

(f) Lane marking changes on Te Kowhai Road at Te Rapa Road / Te Kowhai Road / Church Road roundabout.

8.18 Items (a) and (b) are no longer necessary to provide access to the Plan Change Area while items (c) to (f) are able to be evaluated by the revised rule requiring a Broad ITA when the cumulative net developed area in the Plan Change Area exceeds 42 ha or generates a combined average weekday pm peak traffic volume exceeding 685 vehicles per hour ("**vph**") (two-way).[7]

9. UPDATED MODELLING AND INTERSECTION CAPACITY ASSESSMENTS

9.1 As outlined in my Supplementary Transport Memo, further assessment work has been undertaken since the PC17 application was lodged, which has resulted in an amended set of transport infrastructure staging provisions.

9.2 The further transport assessment work was undertaken post-lodgement in response to the following:

(a) Further discussions with KiwiRail in relation to requirements to reopen the Ruffell Road rail level crossing (which our modelling reflected being reopened within 10 years).

(b) Aligning the infrastructure staging better with the staged provision of major utility services for the Plan Change Area. The expected net developable area for PC17 has also reduced following design refinements for PC17.

(c) The traffic generation by Te Awa Lakes development in the version of the WRTM used for the five PC17 scenarios was significantly greater than the Residential and Business 6 subdivision consent Integrated Traffic Assessment (by Stantec) had determined and subsequently became conditions of consent.

9.3 As outlined in the Supplementary Transport Memo, reopening the Ruffell Road rail level crossing is contingent firstly on a Level Crossing Safety Impact

[7] Rule 3.9.3.2(b).

Assessment ("**LCSIA**") being completed in accordance with KiwiRail's requirements. Then, the identified safety improvements being completed to the satisfaction of KiwiRail and Council.

9.4 Fonterra commissioned an LCSIA in late August 2025 to confirm the safety improvements needed for the crossing to reopen. I have been advised the LCSIA could take 8 – 10 weeks to complete and will need approval from KiwiRail before being finalised, therefore it will not be available for reference in this statement of evidence.

9.5 However, from discussions to date between Fonterra and KiwiRail, I understand the key required safety improvements are likely to include:

(a) Closing Onion Road at Ruffell Road, thereby deleting the intersection

(b) Realignment of Ruffell Road to reduce the crossing skew angle

(c) Management of heavy vehicles turning left out and right into the access at Old Ruffell Road / Ruffell Road intersection to manage movements.

9.6 My Supplementary Transport Memo contains three sketches that indicatively show the above safety improvements for context.

9.7 Similarly identified in my Supplementary Transport Memo, the consented Te Awa Lakes traffic generation is approximately 1000 vph less than the volume in the version of the WRTM received for the PC17 modelling. This has a material effect on the baseline traffic volumes on Te Rapa Road, and the transport infrastructure required to accommodate PC17 in addition to Te Awa Lakes traffic which is considered part of the baseline receiving environment. This is discussed further below.

9.8 Furthermore, the total net developable area within the Plan Change Area has been revised down from 63 ha to approximately 53 ha. This reduces the total projected peak hour trip generation for PC17 from around 1030 vph to 860 vph.

9.9 For these reasons (LCSIA timeframe and updated traffic generation), I considered it prudent to update the baseline transport environments for 2035 and 2045 in the WRTM and run two further development scenarios. The outputs were then used to update the network effects and associated infrastructure requirements for PC17 on the basis that Ruffell Road level crossing remains closed.

9.10 The further WRTM scenarios are described as:

(a) 2035 Baseline (Ruffell Road level crossing closed).

(b) 2035 Baseline + PC17 Scenario A (42 ha). Level crossing closed.

(c) 2045 Baseline + PC17 Scenario B (52.5 ha). Level crossing closed.

Baseline transport environment

9.11 As mentioned above, the 2035 WRTM baseline was updated to generate 500 vehicle trips / peak hour from Te Awa Lakes. The 2045 scenario has 722 vph generated by Te Awa Lakes, in accordance with the Integrated Transport Assessment undertaken for the completed consented Te Awa Lakes development. While the consented Te Awa Lakes development includes an additional 2,500 m^2 of retail not previously anticipated by the Te Awa Lakes Plan Change, it excludes (for reasons outlined below) any traffic generation from the Major Facilities Zone that envisaged a Hotel and an Adventure Park.

9.12 The Te Awa Lakes consent application Broad Integrated Transport Assessment ("**Stantec ITA**") states:

> subsequent development in the Major Facilities zone will necessarily also have to take into account the cumulative trip generating effects, as is required by Rule 3.8.5.3.2 of the Structure Plan. On the basis of the proposal set out in this application and adopting the same land use assumption as the Structure Plan provides for in the Major Facilities zone, it is evident the total cumulative demand in that case will be greater than the basis of assessment for the Structure Plan. The difference being equivalent to the total discretionary Retail trip demands. <u>It will however fall to that application to make the necessary cumulative effects assessment required of it and to address any consequent further mitigation if any is required</u>.
>
> (emphasis added)

9.13 The above statement aligns with my opinion that the Major Facilities Zone traffic does not form part of the transport baseline environment. The Stantec ITA did not assess the potential additional traffic loading requirements on its recommended design for the Te Rapa Road / McKee Street intersection upgrade. The updated transport modelling and assessment for PC17 is consistent with this approach since the scope and timing of any proposed

activities in the Major Facilities Zone, as well as the traffic generation has a high degree of uncertainty.

9.14 The same applies to the five listed and two referred projects under the Fast-track Approvals Act 2024 for residential and commercial land use activities in Hamilton. As none of the substantive applications for the projects have been lodged at the present time, and due to the degree of uncertainty, it is appropriate they too are excluded from the transport baseline environment for PC17.

9.15 In terms of the PC17 Structure Plan network, I reiterate that the revised models exclude the Access 1 intersection to Te Rapa Road along with the East-West road connection between Te Rapa Road and the Spine Road that were previously identified as required infrastructure to enable development. These components are no longer essential infrastructure for PC17.

9.16 Instead, Access 1 for the Structure Plan is now proposed as a continuous connection (not an intersection) to Old Ruffell Road (previously Access 3). This is discussed further in Section 11 of my evidence.

9.17 On this basis, the revised WRTM volume projections were then run through SIDRA Intersection software to update the following key intersection models on the wider network (as assessed in the ITA):

(a) SH1C / Te Rapa Road interchange (Horotiu Interchange roundabouts).

(b) Te Rapa Road / Hutchinson Road roundabout.

(c) Te Rapa Road / Access 2 intersection.

(d) Te Rapa Road / McKee Street intersection (signalised configuration).

(e) Te Rapa Road / Ruffell Road signalised intersection.

(f) Te Rapa Road / Kapuni Street intersection, and

(g) Te Rapa Road / Te Kowhai Road / Church Road roundabout.

9.18 The following summarises the findings of the updated modelling assessment which has then informed the updated infrastructure requirements. A supporting technical note sets out the modelling inputs and results, in **Attachment 1**.

9.19 The updated model results demonstrate that most of the listed intersections are expected to operate with good to acceptable LOS with PC17 development completed and fully occupied. Two intersections that demonstrate potential future capacity issues are:

(a) Te Rapa Road / Ruffell Road signalised intersection,

(b) Te Rapa Road / Te Kowhai Road roundabout.

9.20 Both will require modifications to improve capacity and maintain acceptable LOS when the cumulative net developable land in PC17 West Block and North Blocks exceeds 35 ha. This is captured in the infrastructure provisions[8] described below.

10. UPDATED INFRASTRUCTURE AND DEVELOPMENT STAGING

10.1 Back-calculations and further intersection modelling with SIDRA software shows that an initial 20 ha net developable area in the West Block can be accessed entirely through Access 1 (Old Ruffell Road) and the Te Rapa Road / Ruffell Road signal intersection. The infrastructure staging table in the provisions[9] is updated to reflect this.

10.2 No intersection or mid-block upgrades are required other than upgrading approximately 150 m of Old Ruffell Road to Collector-like standard (discussed above). A pm peak hour traffic generation cap of 325 vph is also included in the proposed rule to address land use occurring in the Plan Change Area without subdivision.

10.3 Industrial development exceeding 20 ha in the West Block requires the Access 2 intersection to be constructed and a further section of the Spine Road to be constructed to connect the additional development area to the Access 2 intersection. The north and south sections of Spine Road can remain disconnected up to 35 ha of cumulative net developable area in the West and North Blocks, or until the weekday pm peak traffic volume accessing via Old Ruffell Road exceeds 325 vph.

10.4 No other capacity or infrastructure upgrades are required on the wider network up to 35 ha in the West and North Blocks. Additionally, traffic generation associated with the 7 ha South-East Block can also be accommodated on the network at this time with no further infrastructure upgrades. That brings the

8 Rule 3.9.3.2.

9 Rule 3.9.3.2(i – xix).

overall net developable area to 42 ha with the Spine Road connected through the West Block and Accesses 1 and 2 constructed.

10.5 Overall, the Access 2 intersection functions at an acceptable LOS C with PC17 completed. However, before the Spine Road connects through the West Block some individual turning movements at the Access 2 intersection are projected to operate at LOS E with average delays of (65 to 75 sec/veh) in the weekday am and pm peak hours with completed development. The affected turning volumes are all small (between 7 vph and 28 vph) and the resulting queues are insignificant for these movements. Therefore, I am satisfied that the performance effects are minor and not unusual for low volume turning movements at an intersection of this size on a major arterial road.

10.6 The revised modelling for the Access 2 intersection has resulted in a revised indicative layout for the signalised intersection as shown in **Figure 1**. Previously the layout included a left turn slip lane on the southbound approach of Te Rapa Road that is unlikely to be achievable due to the proximity of the private property boundary on the east side. Also, the industrial road approach from the west previously had a single shared through / right turn lane, and now an exclusive right turn lane.

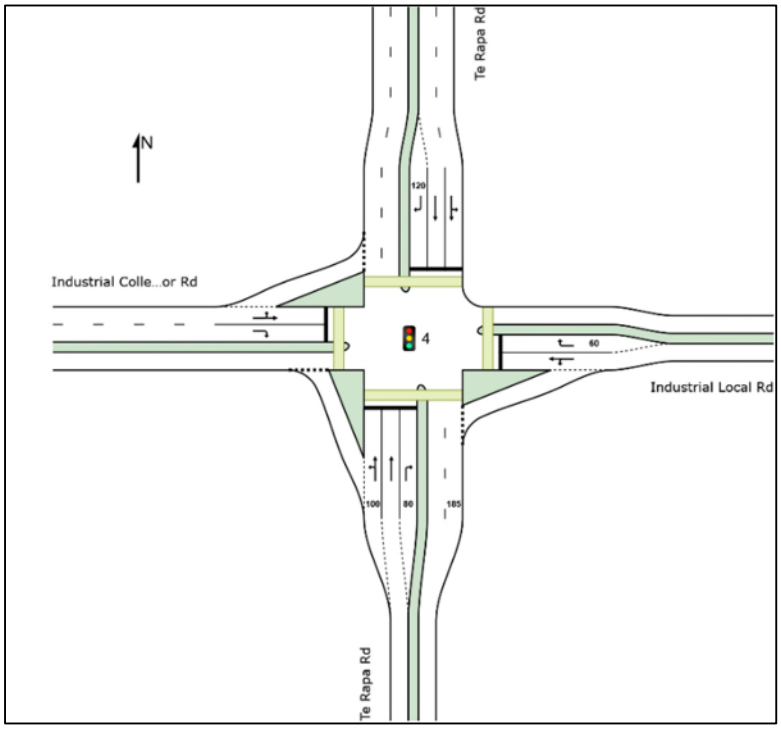


Figure 1: Access 2 Indicative Intersection Design

10.7 The Structure Plan Spine Road must be connected through the West Block between the Access 2 Intersection and Old Ruffell Road to provide a more

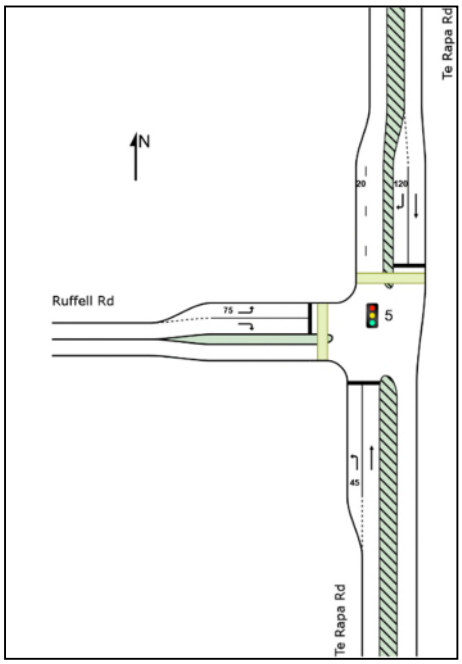
even distribution of traffic between Access 1 and Access 2 for any industrial or commercial development exceeding a combined 35 ha (net developable area) across the West Block and North Blocks of the Plan Change Area, or if the weekday average pm peak traffic volume generated by those blocks combined exceeds 570 vph. This is captured in the infrastructure provisions table.[10]

10.8 The connected Spine Road enables traffic arriving or departing either north or south of the Plan Change Area to avoid adding to the already high through movement volumes at the Te Rapa Road / Access 2 intersection, the Te Rapa Road / McKee Street intersection, and the Te Rapa Road / Ruffell Road intersection. The connected Spine Road also enables public transport to be routed through the West Block to improve travel mode options for employees and reduce reliance on commuting trips by private vehicle.

In addition to the connected Spine Road, the Te Rapa Road approaches to the Te Rapa Road / Ruffell Road signal intersection performance are projected to decline to LOS D when net developable area exceeds 42 ha. This can be mitigated through the addition of a second northbound and southbound through movement lane on Te Rapa Road. The updated modelling for the intersection identifies that an additional northbound and southbound through movement lane on Te Rapa Road will acceptably mitigate the effects (see

10.9 **Figure 2** below).

Existing



Recommended Upgrade

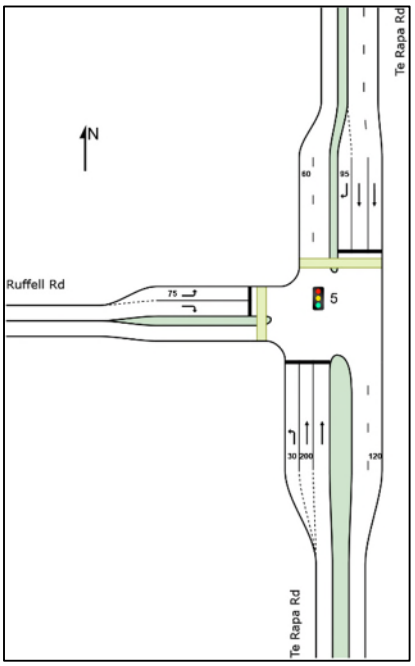


Figure 2: Existing intersection (left) and recommended upgrade (right)

10 Rule 3.9.3.2(xii)

10.10 Furthermore, if the weekday am peak hour average traffic volume on Te Kowhai Road eastbound approach entering the Te Rapa Road / Te Kowhai Road roundabout exceeds 790 vph then there is a need to evaluate the feasibility of completing the necessary safety improvements to reopen the Ruffell Road level crossing. If that proves unfeasible then the PC17 provisions require any further development beyond 42 ha net developable area to be subject to the recommendations of a Broad ITA (that meets the requirements of section 15-2 of the ODP), or such alternatives accepted by Council, Kiwi Rail and NZTA (the latter two where approval is legally required) being implemented, prior to the section 224(c) certificate for subdivision under the) RMA being issued.[11]

10.11 Overall, the revised modelling demonstrates that most of the intersections of interest will perform at an acceptable overall LOS C or better (Average Intersection delay of 20 – 35 seconds per vehicle ("**s/veh**")) with completed development of the Plan Change Area, subject to the various identified infrastructure upgrades in Rule 3.9.3.2 being undertaken.

10.12 The Access 2 intersection has most movements performing at LOS C and D (average delay between 25 - 55 s/veh). Some turning movements operate at LOS E, which predominantly applies to right turn traffic movements and side road traffic movements through the intersection during the interim development period when the Spine Road is not fully connected through the West Block. For this reason, I recommend that the Spine Road is connected for any development exceeding 35 ha net developable area in the West and North Blocks combined.[12] Almost all other movements at the key intersections perform efficiently at LOS B and LOS C (10 – 35 s/veh respectively).

10.13 As demonstrated by the updated modelling, intersections that are no longer likely to need capacity or safety upgrades include the Ruffell Road / Old Ruffell Road intersection unless the level crossing is reopened. The ITA assessment at that time will evaluate the need for improvements at the intersection.[13]

10.14 The same conclusion applies from the updated modelling for the Te Rapa Road / McKee Street intersection. The signalised upgrade identified in the Stantec ITA will satisfactorily accommodate the additional traffic associated with PC17 without causing unacceptable effects. This upgrade is required by condition 72(i) in the Te Awa Lakes land development consent.

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11 Rule 3.9.3.2(c).

12 Rule 3.9.3.2(xii).

13 Rule 3.9.3.2(b).

10.15 An upgrade to the Te Rapa Road / Ruffell Road intersection for the PC17 development is triggered by cumulative development in the Plan Change Area reaching 42 ha as identified in the revised provisions.[14] This requires adding a second northbound and southbound lane on Te Rapa Road at the intersection. Given the proximity to the McKee Street intersection, it is likely the upgrade will involve extending the four lanes on the southern approach of the McKee Street intersection (provided during that intersection upgrade) to the Te Rapa Road / Ruffell Road intersection to complete four full traffic lanes between the two intersections.

11. REVISED ACCESS 1 CONNECTION TO THE SPINE ROAD

11.1 As stated above, Access 1 is now proposed as a continuous connection of the Spine Road to Old Ruffell Road.

11.2 Therefore, a 150 m long section of Old Ruffell Road, between Ruffell Road and the Spine Road will require upgrading for consistency with the Spine Road Collector cross-section standard. The legal road reserve width of Old Ruffell Road is 20.1 m, so cannot meet the full 24.1 m wide PC17 Collector Road typical cross-section standard. Given this constraint, I recommend that Old Ruffell Road is instead upgraded to a Collector-like standard which excludes the 2.0 m wide central flush median, narrows the services berm to 1.5 m and the 1.5 m wide footpath that exists for a short length on the northeast side of Old Ruffell Road is upgraded to a 2.5 m wide shared walking and cycling path.[15]

11.3 **Figure 3** shows the current formation of Old Ruffell Road on Google Street View while **Figure 4** illustrates my recommended upgrade for Old Ruffell Road to a Collector-like standard.

14 Rule 3.9.3.2(xiv).

15 Figure 3.9.2.5(e).

Figure 3: Existing Old Ruffell Road Formation

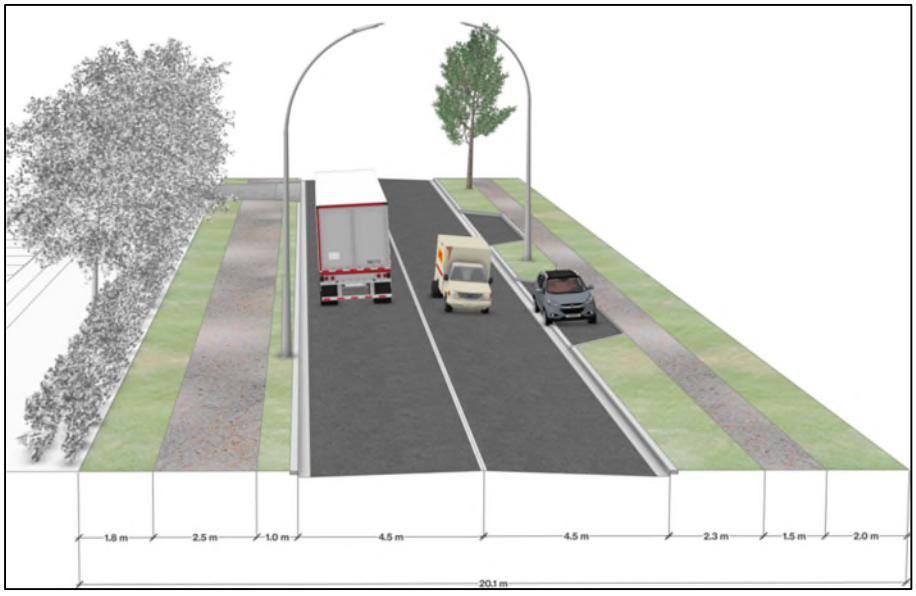

Figure 4: Old Ruffell Road Upgrade Cross-Section

11.4 **Figure 5** illustrates how the Structure Plan Spine Road is proposed as a continuous connection to Old Ruffell Road.

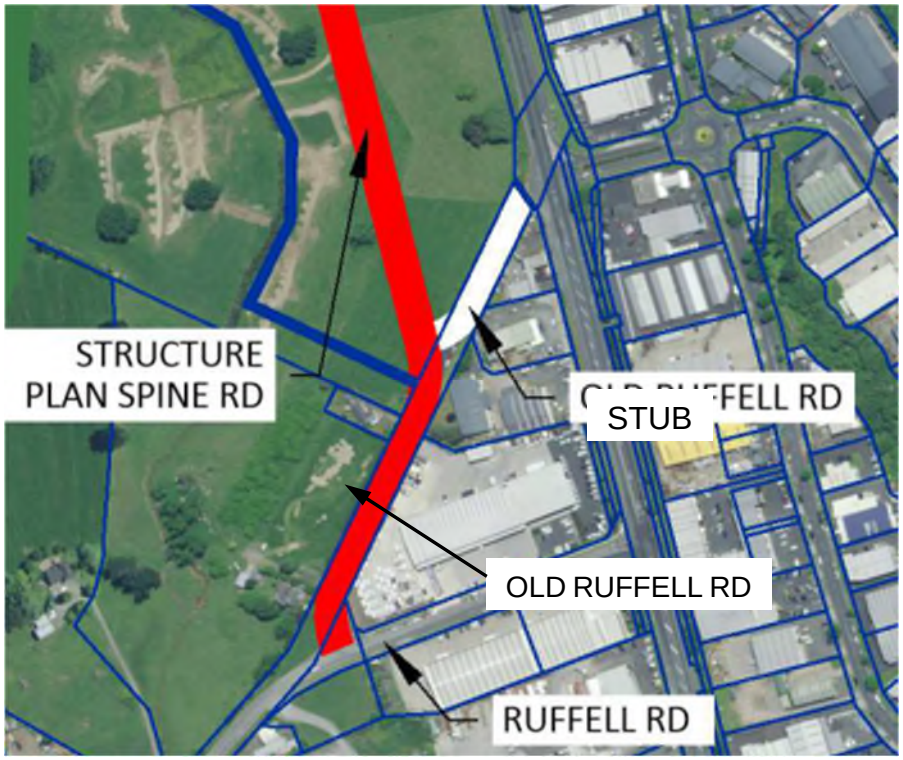

Figure 5: Spine Road Proposed Connection to Old Ruffell Road

11.5 The remaining stub of Old Ruffell Road which is approximately 100 m long and shown in white in **Figure 5** above, will connect into the Spine Road as a simple Tee-intersection for access to the three industrial properties north of the connection point. The stub road will remain a local road so does not require upgrade to Collector-like standard.

11.6 Old Ruffell Road is already stopped at its northern end by Te Rapa Road, so no further upgrade or legal process is required. However, I have proposed in the plan provisions[16] that a walking and cycling connection is provided between the Old Ruffell Road stub and Te Rapa Road opposite McKee Street since the Te Rapa Road / McKee Street intersection will be upgraded to signal control as a condition of the Te Awa Lakes development consent. The upgrade to signals is likely to include a signal-controlled pedestrian crossing over Te Rapa Road that will be convenient to access from Old Ruffell Road stub.

12. UPDATED INFRASTRUCTURE STAGING PROVISIONS

12.1 Based on the updated modelling and assessment work undertaken, I recommend the revised PC17 Transport Infrastructure Staging provisions included in **Attachment 2**, be adopted with the revised Structure Plan.

16 Rule 3.9.3.2(ii).

12.2 These updates replace the original staging recommendations in the ITA and reflect the most current understanding of infrastructure requirements and development sequencing to mitigate the potential transport effects of PC17.

13. SECTION 42A REPORT

13.1 I have reviewed the transport related matters raised in the Section 42A Report by Mr McGahan (and supporting Transportation Assessment Peer Review by Naomi McMinn) and respond as follows.

Infrastructure triggers

13.2 The comments by Mr McGahan all relate to the updated set of transport infrastructure staging and provisions contained in the Supplementary Transport Memo.

13.3 The intent of the prescribed development and infrastructure Stages 1A, 1B and Stage 2 included in the Supplementary Transport Memo was to provide greater clarity about the transport infrastructure staging requirements, not less clarity. It identified two options the developer could take for Stage 1 development up to defined net developable area maximums, and one option for Stage 2 development (PC17 complete), each being subject to specific transport infrastructure upgrades / requirements as listed. Development would be a controlled activity if the noted list of infrastructure upgrades / requirements for each stage was implemented.

13.4 This removed the relevance of the infrastructure triggers contained in the notified version of PC17. However, Mr McGahan's comments have now been superseded. As explained in Mr Grala's evidence, the PC17 provisions have been further updated to delete the prescribed development Stages 1A, 1B and Stage 2 and to reinstate the table of transport infrastructure triggers and provisions (although updated to reflect the updated modelling results).

Minor Updates

13.5 Mr McGahan makes six key observations about the PC17 ITA.[17] The first two observations are no longer accurate, so I provide the following edits in bold and strike-through text to clarify the proposal based on the updated PC17 Structure Plan:

> (a) **Three** ~~Four~~ transport access points are proposed for the Plan Change Area. Two from Te Rapa Road and one from Old Ruffell Road.

17 Section 42A Report at [6.6] – [6.11].

> (b) PPC17 **allows for** ~~includes~~ provision an East-West Road to support the future Northern River Crossing (NRC). The proposed alignment meets geometric standards for a 70 km/h design speed **through the West Block of the Plan Change Area** and aligns with the anticipated overbridge connection to Koura Drive.

NRC

13.6 Mr McGahan states that several key issues remain, based on Ms McMinn's transport review.[18] I note these comments stemmed from Ms McMinn's initial review of the notified PC17, but some remain relevant, so I have addressed them below.

13.7 One statement[19] raised the following concerns:

> The proposal has not adequately provided for the NRC, considered the effects of the rail level crossing on Ruffell Road not being opened to traffic, and there is a risk to the future of the strategic network (NRC and Bus Rapid Transport corridor).

13.8 There are three points in that statement. My response to the first point about the NRC not being adequately provided for, is that the proposed Structure Plan clearly shows the NRC and the intent that it will connect in future from Koura Drive through the PC17 Plan Change Area to Te Rapa Road. There are no rules in the proposed provisions that trigger the NRC design or construction because it is not essential infrastructure to support the development of Plan Change Area, based on the updated modelling and assessment undertaken.

13.9 It is relevant at this point to remember that the NRC is, presently, an indicative road. It is a dashed line showing a potential future arterial road in the ODP Transport Corridor Hierarchy and the Council's Infrastructure Strategy 2021 – 2051 that passes through the southern end of the Plan Change Area. It has no statutory standing.

13.10 It is Council proposed infrastructure and there are no investigations or process currently underway to identify and protect the preferred route. I am also not aware of any design drawings that identify its likely future form and function. The earliest funding for investigations is identified for 2030 in Council's current Long-Term Plan.

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18 Section 42A Report at [6.23].

19 Section 42A Report at [6.23].

13.11 On that basis, from a transportation perspective it would have been a reasonable option to proceed with PC17 without making allowance for the NRC because there is no requirement to protect the route.

13.12 However, Fonterra through PC17 has undertaken considerable work to identify a reasonable corridor alignment for this *potential* future road and provided generous building setbacks to protect the corridor from development.

13.13 The identified corridor through the Plan Change Area is the result of work by the PC17 project team applying preliminary engineering design for road grades and geometry based on a 70 km/h design speed, with consideration of the levels required to grade separate Koura Drive extension over Onion Road and the NIMT railway lines, then connect to a bridge across the stream corridor in the West Block before intersecting with Te Rapa Road. The location for the intersection affords the Council significant flexibility to identify an optimum road alignment and bridge crossing point over the Waikato River, assuming a 90 km/h design speed. This work is described in Section 4 of the ITA.

13.14 Associated with that, PC17 allows for a 34.8 m wide corridor with a 6.5 m building set-back along the indicative NRC alignment on the Structure Plan. This provision sterilises approximately 2.6 ha (48 m wide by 550 m long excluding the stream gully) of Fonterra's developable land, which is not insignificant when the total developable land area in Plan Change Area is just over 50 ha.

13.15 Therefore, I consider PC17 has more than adequately provided for the NRC.

13.16 I acknowledge the revised PC17 infrastructure provisions no longer require construction of the East-West Road (an early NRC component) or the NRC–Te Rapa Road intersection (formerly Access 1) to enable development. The updated modelling and assessments found these to be unnecessary, which is beneficial for PC17 as it avoids potentially years of delay before the Council undertakes the necessary investigations to finalise the NRC arterial design and location. However, importantly, the Structure Plan and provisions are designed to enable the East-West Road, or sections of it to be constructed as part of PC17 development if it is beneficial for the development at the time.

Ruffell Road Level Crossing

13.17 Regarding Ms McMinn's second point in the statement (my paragraph 13.7) above.

> …the effects of the rail level crossing on Ruffell Road not being opened to traffic…

13.18 I consider this has been adequately addressed through the further WRTM scenarios and updated modelling assessments in the technical note, as discussed in my evidence.

NRC and BRT

13.19 Regarding the third point:

> ...there is a risk to the future of the strategic network (NRC and Bus Rapid Transport corridor)...

13.20 I understand this comment relates to Ms McMinn's opinion that the proposed provisions in the notified PC17 lacked requirements for construction of these strategic transport projects to support PC17 and did not identify who is responsible for their construction.

13.21 While that is not entirely true of the notified PC17 plan provisions (Access 1 and a section of the East-West Road was required), it is true of the updated PC17 plan provisions which contain no requirement to construct either of the strategic transport projects because neither is necessary for mitigating PC17 transport effects. Contrary to Ms McMinn's concern that there is a risk to the future of these future projects I consider the risk is reduced due to PC17.

13.22 Then and now in the updated Structure Plan and proposed provisions, generous building setbacks are included for the NRC corridor and Te Rapa Road as a way of future proofing the ability for the Council to provide both long-term transport projects. The responsibility for designating and later constructing the NRC and the BRT corridor does not sit with Fonterra or the future developer/s of the Plan Change Area. Both the NRC and the BRT provide a significantly wider benefit for future transport in Hamilton than just serving PC17, so both are Council's responsibility to investigate, protect and deliver.

13.23 I consider that both the NRC and the BRT corridor (which is also an indicative long-term proposal with no detail, program or formal protection) are adequately protected in the provisions based on the proposed building setbacks from the NRC and Te Rapa Road (refer Rule 12.4.1) to minimise the risk of undermining these potential transport projects in future.

WRTM scenarios

13.24 The Section 42A report also comments on the WRTM scenarios used for the ITA as follows:[20]

> The Integrated Transport Assessment (ITA) supporting the notified PPC17 presented several Waikato Regional Transportation Model (WRTM) scenarios, none of which presented a scenario that matches the PPC17 development and transport network staging. Ms McMinn considers that the WRTM scenarios should be updated to match the proposed staging and with the Ruffell Road rail level crossing closed and the ITA updated to ensure that the safety and efficiency effects on Ruffell Road and the wider transport network are acceptable.

13.25 I disagree with this and refer to my earlier statement in paragraphs 8.5 – 8.11 above, outlining the process that was adopted for the WRTM modelling of the original development and network scenarios. Ms McMinn was not engaged as the transport reviewer for the Council at the time the WRTM scenario scoping meetings were held with the Council's Transport Planning and Strategy Team. It appears Ms McMinn may not have been aware that the WRTM scenarios and assessment scope were agreed with the assumption that the level crossing would be open given that it was the Council's understanding the closure is temporary until safety upgrades can be made – one of which requires the completion of Onion Road realignment by a third party.

13.26 I also disagree that the WRTM scenarios should match the proposed development staging. Where feasible yes, but strategic level transport modelling using the WRTM is usually an early input to inform more detailed analysis work that underpins the findings in an integrated transport assessment. The development scenarios chosen for modeling in the WRTM are designed with broad knowledge of the expected outcome, but the detailed analysis can identify the need for changes to the proposal.

13.27 In my experience it is rare that the WRTM scenarios match the development sequencing that is adopted in the plan provisions because it is not feasible to model every network or land use change in the WRTM when the effect of adding or deleting an access location or a road link in the network, or changes to land use can be adequately determined using the WRTM models on hand together with first principles for trip generation, assignment and distribution combined with engineering judgement and manual analysis. The standard

20 Section 42A Report at [6.23].

transport modelling and assessment process was undertaken for PC17 and informed the finer grained intersection modelling presented in the ITA, and ultimately the recommended infrastructure provisions.

13.28 I have applied the same methodology when scoping and running the three updated WRTM models. As an example, the 2035 PC17 Scenario A model reflects just one infrastructure and land use sequence in the updated infrastructure provisions. It represents 42 ha of land use in the Plan Change Area with the Ruffell Road level crossing open and the interim Spine Road (in two parts). Manual back-calculations and further intersection modelling identifies that an initial 20 ha can be developed with sole access to Old Ruffell Road without requiring any capacity upgrades to existing intersections, and up to 35 ha can be accommodated with two access points before the Spine Road must be connected through the area. Both development area triggers are included in the updated infrastructure provisions despite there being no matching WRTM scenario.

13.29 As stated previously, the revised WRTM models were run with the Ruffell Road level crossing closed, and the resulting traffic distribution and volumes were used to update the finer grained intersection models. This addresses a key concern of Ms McMinn about the WRTM modelling for the ITA.

Insufficient information

13.30 Mr McGachan also states:[21]

> The Supplementary Information outlines transport infrastructure staging that differs from the notified version of PPC17. Ms McMinn considers that currently, there remains insufficient detail to fully assess the transport effects of PPC17.

13.31 The updated infrastructure provisions supported by my evidence and the Technical Note (**Attachment 1**) provide updated detail supporting my assessment. In my view, there is more than sufficient detail to fully assess the transport effects of PC17.

Te Awa Lakes

13.32 Mr McGahan also states:[22]

21 Section 42A Report at [6.23].
22 Section 42A Report at [6.23].

> The Te Awa Lakes Structure Plan requires upgrades to Te Rapa Road once traffic exceeds 500 vehicles per hour (vph). PPC17 proposes an additional 410 vph without corresponding improvements, raising concerns about the adequacy of proposed mitigations. The full Te Awa Lakes Structure Plan traffic should be considered as part of the 2045 baseline.

13.33 The first sentence in the statement forms the foundation of the concern raised in the second sentence but is incorrect. The November 2023 development consent for Te Awa Lakes contains condition 72 that stipulates the transport improvements to be completed before any s223 certificate for subdivision is issued. The improvements include upgrading Te Rapa Road / Mckee Street to a signalised intersection and addressing any transferred effects at the Te Rapa Road / Kapuni Street intersection. The Stantec ITA illustrates the intersection upgrade layout to accommodate the development related traffic.

13.34 For reference I have copied condition 72 and 73 from the Te Awa Lakes development consent below.

72. *Prior to any section 223 certificate for subdivision under the Resource Management Act being issued in the Medium Density Residential zone or the Business 6 zone, or prior to any building being occupied or open for use in the Major Facilities zone, the following improvements are to be completed,* ***except that Council may accept a bond and/or a Private Developer Agreement for an alternative completion timing****:*
    - i. *The Te Rapa Road/McKee Street intersection is to be signalised, including any additional works to address adverse transferred effects associated with the signalisation, at the Te Rapa Road/Kapuni Street intersection;*
    - ii. *A pedestrian crossing facility is to be constructed at the existing bus stops on Te Rapa Road adjacent to the Structure Plan area and a bus shelter is to be constructed at the western bus stop location;*
    - iii. *The Te Awa River Ride path from and within the Structure Plan area to Pukete Road is to be upgraded in accordance with CPTED principles. In addition, as much existing cycle route that is within the road corridor as practicable is to be replaced with riverside cycle path from the Structure Plan area to Pukete Road;*
    - iv. *Te Rapa Road on-road cycle safety improvements including targeted road markings, signage and road surfacing work between Hutchinson Road and Church Road; and*
    - v. *Shared path connection along Horotiu Bridge Road from the Te Awa River Ride path to Horotiu Primary School.*

73. *No development in the Medium Density Residential zone or the Business 6 zone or Major Facilities zone shall generate more than 500 vehicle movements in the peak hour measured cumulatively across all zones.*

13.35 House and land packages in Stage 1 at Te Awa Lakes are for sale off the plans now and construction is underway.[23] Therefore, in my opinion the improvements required by condition 72 are likely to be completed soon.

13.36 On this basis, the updated modelling for PC17 (outlined in the Technical Note at **Attachment 1**) was completed with the Te Rapa / McKee intersection

23 https://www.teawalakes.co.nz/selling-now/stage-1/.

upgrade as the baseline, and it demonstrates that up to 20 ha of industrial development in the Plan Change Area can access the existing network through Old Ruffell Road without triggering the need for further upgrades, including at Te Rapa Rd / McKee Street signal intersection.

13.37 Under that scenario the existing Ruffell Road / Old Ruffell Road intersection experiences negligible delay, operating at LOS A and requires no improvements. The Te Rapa Road / Ruffell Road signal intersection also functions well at LOS B in the am peak and acceptably at LOS C in the pm peak with traffic for the 20 ha development all accessing through Ruffell Road to the signal intersection. This is with the Ruffell Road level crossing closed.

13.38 Similarly, the modelling for Te Rapa Road / McKee Street intersection shows no further upgrade is required after Te Awa Lakes has completed the signal upgrade. However, a line marking change to provide twin right-turn lanes from McKee Street would help improve the intersections' performance.

13.39 With Stage 1 in Te Awa Lakes underway, I consider it unlikely that the Te Rapa Road / McKee Street intersection upgrade is not completed before the first industrial lots in PC17 are occupied.

13.40 Section 10 of my evidence outlines the other infrastructure upgrades and development area trigger points proposed for PC17.

13.41 Lastly, I disagree with the statement that:[24]

> The full Te Awa Lakes Structure Plan traffic should be considered as part of the 2045 baseline.

13.42 Section 9.11 - 9.14 of my evidence explains why the Major Facilities Zone is not part of transport baseline environment, and I note the same position was adopted in its integrated transport assessment for Te Awa Lakes development consent when assessing the form of upgrade required to Te Rapa / Mckee Street intersection.

Dependence on Ruffell Road rail level crossing

13.43 Mr McGahan states:[25]

> The proposal (and the modelling) depends on reopening the Ruffell Road rail level crossing, which remains uncertain. While the revised Structure Plan shows a future connection to Koura

24 Section 42A Report at [6.23].
25 Section 42A Report at [6.23].

> Drive via the NRC corridor, this requires an overbridge and access through land outside PPC17. Responsibility for constructing the link and protecting the corridor remains unclear. There is a risk that development could proceed without the East-West Road, compromising Hamilton's strategic transport network and the future delivery of the NRC.

13.44 Section 9 of my evidence outlines the further transport modelling undertaken with the rail level crossing open. As stated earlier in my response to the Section 42A Report, the responsibility for designating and constructing the NRC and the BRT corridor is the Council's since they provide a significantly wider benefit and strategic purpose for future transport in Hamilton than just serving PC17.

Consistency with the Council's long-term transport strategy

13.45 Mr McGahan states: [26]

> The amended provisions do not trigger infrastructure consistent with Hamilton's long-term transport strategy. While Access 1 and the East-West Road are shown on the Revised Structure Plan, they are not activated by the provisions.

13.46 The proposed transport provisions have been revised but for the reasons set out above, do not require the East-West Road (future NRC) to be constructed to enable development. This is not inconsistent with Hamilton's long-term transport strategy. The Structure Plan shows the key transport corridors and connections through the development area and includes the NRC corridor.

13.47 The inclusion of a road on a Structure Plan does not mean the development requires it. It provides an expectation of what will be built in future and therefore what must be allowed for while developing the area but does not assign responsibility for delivery of specific infrastructure. This is the case for the NRC (or East-West Road in the interim). As stated earlier, the responsibility for delivery of the NRC sits with Council and is not changed by PC17.

13.48 Access 1 is now via Old Ruffell Road (previously called Access 3) and is activated by the proposed provisions for the first 20 ha of development in the Plan Change Area. The previous Access 1 connection to Te Rapa Road is no longer required for developing the Plan Change Area.

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26 Section 42A Report at [6.23].

Connection to arterial network

13.49 Mr McGahan states:[27]

> Stage 1A allows development with sole access via Old Ruffell Road (Access 3), without requiring a direct connection to the arterial network. This could result in inefficient and indirect transport outcomes.

13.50 Stage 1A no longer exists in the revised infrastructure staging provisions but access for the first 20 ha of developable land is still proposed solely via Old Ruffell Road (Access 1 on the revised Structure Plan). I have discussed the details of the proposed connection in Section 11 of my evidence, and I disagree that it is not a direct connection to the network. PC17 includes a continuous connection of the Spine Road and Old Ruffell Road with an upgrade to approximately 150 m of Old Ruffell Road to a Collector-like standard in accordance with the typical cross-section in my evidence Figure 2.

13.51 Ruffell Road is already a Collector Road in the Council's network hierarchy. Connecting PC17 traffic to Ruffell Road via the upgraded Old Ruffell Road is consistent with the surrounding land-use and the type of traffic it carries. The intersection of Old Ruffell Road and Ruffell Road has good sight distance, low traffic volumes and was constructed to accommodate industrial traffic. In my opinion, the revised Access 1 proposal makes efficient use of existing resources and while not having a direct connection with Te Rapa Road, the small deviation via the Old Ruffell Road / Ruffell Road intersection does not result in inefficient transport outcomes of any significance.

Recommended staging table

13.52 Lastly, Mr McGahan states:[28]

> To improve clarity and alignment with HCC's expectations, Ms McMinn recommends that a staging table be provided within PPC17 which outlines:
>
> • Land use and development areas (with indicative staging).
>
> • Infrastructure provision.
>
> • Timing and delivery responsibilities.

27 Section 42A Report at [6.23].

28 Section 42A Report at [6.24].

> In addition, Ms McMinn considers that the table should be specific to each development stage and formatted in accordance with HCC's preferred structure.

13.53 I consider that most of the above recommendations are addressed through the revised infrastructure staging table and provisions. However, specifying timing and delivery responsibilities for the infrastructure is more appropriate for inclusion in a private development agreement with the Council. I note the implementation of the identified upgrades / infrastructure is subject to the net developable land area thresholds or relevant traffic volume limits being met as set out in the PC17 provisions, but the timing of this is presently unknown.

14. RESPONSE TO SUBMISSIONS ON TRANSPORT MATTERS

14.1 I have read the submissions and further submissions received that relate to transport or traffic matters, and I address these below.

Transport Effects of PC17 on Meadow View Lane Residents

14.2 Sam and Alisa Colemans' (Submitter 004) submission raised concerns about the lack of assessment of potential transportation effects on Meadow View Lane.

14.3 Related to the above, the Colemans' submit that the proposed PC17 provision 12.5.1a has not been addressed or explained in any PC17 documentation and it is unclear why it has been proposed.

14.4 In response to the Colemans' concerns vehicle access to the South-East Block (south of the Manufacturing site) will not be via Meadow View Lane from the Pukete Road end. It is expected that the development of this Block is subject to public access being provided through the existing private access road that serves the Manufacturing site. The revised infrastructure staging table includes the following provisions[29]:

> A road connection being provided through the existing Dairy Manufacturing Site from the Fonterra Block and Meadow View Block to access through the interchange on Te Rapa Road.
>
> And,
>
> No vehicle access is provided from any Industrial activity in the South Block to Meadow View Lane south of RP 58.

29 Rule 3.9.3.2(xviii) and (xix).

14.5 For this reason, the ITA modelling and the revised modelling assessments described above have shown traffic associated with the Southern Blocks accessing through the existing Manufacturing Site and not through Meadow View Lane. It is called a "Restricted Access" because it is restricted to pedestrians and cyclists and closed to vehicles in the same way as the existing restricted access at the north end of Meadow View Lane.[30]

14.6 Therefore, I do not expect there to be any traffic effects due to PC17 on existing Meadow View Lane residents or at the Meadow View Lane / Pukete Road intersection.

14.7 In my opinion, it is unlikely that a formal road stopping will be undertaken at the future Restricted Access location (at the southern boundary of the South-East Block) for two reasons:

(a) Maintaining public access by walking and cycling requires a public access corridor or reserve. The public road corridor already exists.

(b) The ability to provide a future full access road connection using Meadow View Lane from Pukete Road to the Manufacturing Site might be preferable in the long-term to support full build out and connection of the remaining Deferred Industrial Zone overlay land areas. The proposed PC17 restricted access to Meadow View Lane ensures the long-term option for traffic connectivity is not precluded. However, such a connection would likely be subject to the NRC not being designated and built.

NZTA's Submission

14.8 NZTA submitted in support of PC17 to the extent outlined in its submission. Its primary area of interest for PC17 is ensuring the two roundabout intersections of the Horotiu Interchange / SH1C remain operating safely and efficiently in future.

14.9 NZTA notes:

> If the Northern River Crossing is delayed beyond 2045, separate mitigation has been identified to address the LOS F eastbound Great South Road through movement at the western roundabout for Scenario 3. However, this mitigation has not been identified as an upgrade under '3.9.4.2 Transport

30 Rule 12.5.1.

> Infrastructure Upgrades' of the proposed plan change provisions.

14.10 In relation to the LOS F performance in the ITA for the western roundabout, this is no longer relevant and has been updated following the revised modelling and assessment detailed in the Technical Note (**annexed** as Attachment "**1**"). Table No: 55 to Table No: 66 in the Technical Note present the interchange performance based on the revised WRTM volume projections. The updated results indicate that the interchange roundabouts are expected to perform satisfactorily with PC17 development completed. Therefore, the mitigation measures discussed in the ITA are unlikely to be required. NZTA further stated in its submission:

> The NZ Transport Agency note that all Land Development Plan consent applications, and resource consent applications in the Te Rapa North Industrial Structure Plan area, will require a broad ITA in accordance with 3.9.4.2 (b). The ITA is to include evidence of consultation with NZTA. On this basis, NZTA is satisfied that there will be an opportunity at resource consent stage to provide further input.

14.11 Based on the revised modelling and assessment results, the Broad integrated transport assessment requirement for all land development consent applications in accordance with 3.9.4.2 (b) has been superseded by the revised provision that triggers a broad integrated transport assessment when:

> Any resource consent application in the Te Rapa North Industrial Structure Plan area where the cumulative net developed area exceeds 42 ha, or generates a cumulative average weekday pm peak traffic volume exceeding 680 vhp (two-way)

14.12 In my opinion, this is a more appropriate 'trigger' for a Broad ITA than previously requiring it for all land use or subdivision consents. That is because the extensive modelling and assessment work undertaken to date for PC17 provides sufficient confidence that the network can readily accommodate up to 42 ha of net developable land development in the Plan Change Area with the transport upgrades identified in the revised infrastructure staging provisions. There is no need to repeat the work at significant cost.

14.13 However, there is less certainty about the transport environment beyond the 42 ha net developable area (approximately 10 years' worth) due to various other factors such as the status of the Ruffell Road rail level crossing, traffic growth rates on Te Rapa Road and Te Kowhai Road, the status and likely

timing of the NRC, the amount of completed development in Te Awa Lakes, and whether any, some or all of the listed and referred Fast-track projects in Hamilton have been realised.

Horotiu Farms Limited And Te Awa Lakes Unincorporated Joint Venture Submission

14.14 The Horotiu Farms Limited And Te Awa Lakes Unincorporated Joint Venture (Te Awa Lakes) ("**TAL**") submission generally supports the proposed provisions relating to transport infrastructure but with the following amendments in relation to upgrades to be included as provisions in PC17. I provide my response to these suggested changes after each item.

14.15 TAL submission point [14.11] seeks:

> That adequate land is to be set aside at Access 2 to support future development of the Horotiu East South (HES) area as has been described in the ITA. Further provisions should be included in the plan change and structure plan to ensure that this occurs.

14.16 A 10 m building setback is provided for the Plan Change Area fronting the west boundary of Te Rapa Road to allow for the future Access 2 intersection. A further 5 m building setback is provided on the east side to future proof the road corridor for inclusion of the future BRT service. This applies to land in Fonterra's ownership.

14.17 TAL submission point [14.28] states:

> The East West Arterial Road corridor is proposed to be stage constructed as 2 lanes, (initially one in each direction). To ensure the road corridor is protected for its long-term arterial function, the plan change should include an access restriction, to ensure any interim or long-term development adjacent to the corridor locates its access from an alternate road frontage. Further provisions should be included in the plan change and structure plan to ensure that this occurs.

14.18 I agree with this proposed access restriction for any park of the East-West Road corridor that is constructed, to protect the potential future function as an arterial road. All industrial property access within the Plan Change Area is intended to be achieved from Local and Collector road frontages.

14.19 TAL submission point [14.29] states:

> Provision for cycling must be provided on the local roads and on a single sided shared path on the internal collector roads as industrial development will be established on both sides of the road corridors. The potential consequence of a cyclist colliding with a truck within these industrial zones has a high probability of resulting in serious and/or fatal outcomes. Further provisions should be included in the plan change and structure plan to ensure that this occurs.

14.20 Related to this, TAL submission point [14.29] states:

> The proposed 4.0m carriageways are narrower than the District Plan Appendix 15, Table 15-5aii 4.5m requirements, further compounding safety risk for cyclists. The existing District Plan standard of 4.5m should be adopted to avoid safety outcomes for walking and cycling being compromised from the minimum safe recommended levels in the District Plan. Further provisions should be included in the plan change and structure plan to ensure that this occurs.

14.21 Furthermore, TAL submission point [14.29] states:

> Collector and local road cross sections should be amended to be consistent with the District Plan requirements, to support safe pedestrian, cycle and vehicle movement outcomes.

14.22 The ODP road formation criteria for Local Industrial roads in Table 15-5aii identifies a 20 m wide corridor with a 9.0 m wide carriageway (unmarked) and cycling on-road shared in the movement lanes. The proposed PC17 Local Road formation is designed to be safer for cyclists, proposing 4.0 m wide lanes and a 2.0 m wide flush central median. The narrower line-marked lanes will help to reduce vehicle speeds while the flush median provides extra space for heavy vehicles to safely pass cyclists. The central median also provides extra width for heavy vehicles turning left or right into an access such that cyclists are less likely to be side swiped by a heavy vehicle. Therefore, in my opinion, the ODP formation of an unmarked 9.0 m wide carriageway would be less safe for cycling on road than the proposed PC17 formation for Local roads.

14.23 The proposed PC17 Collector Road carriageway width is 11.0 m as per the ODP formation standard (2x 4.5m lanes and a 2.0m wide flush median). It has a single sided shared walking and cycling path as suggested by TAL.

14.24 Furthermore, I note that Ms McMinn is comfortable with the road cross-sections proposed for PC17.

14.25 TAL submission point [14.30]:

> An appropriate future set-back of development from the Te Rapa Road frontage should be provided to support the Metro-spatial Plan identified future Bus Rapid Transit (BRT) system.

14.26 A combined 15 m building setback is included in the provisions for buildings fronting Te Rapa Road to allow for the future retro-fit of the BRT system. The BRT has no statutory protection via a designation or resource consent, and there are no designs in the Metro Spatial Plan on which to base appropriate setback distances. I consider that a reasonable estimation of the building setbacks has been made in the absence of information that provides a degree of certainty about the future BRT design or timeframe for implementation.

14.27 TAL submission point [14.32]:

> The assessment of the Te Rapa Road signalised intersection south of Hutchinson Road does not adequately resolve the intersection non-compliance with District Plan requirements, nor does it demonstrate how provision is intended to future-proof the area to enable development of the residual undeveloped land south of Hutchinson Road. The assessment identifies mitigation involving banning the northbound right turn from Te Rapa Road to the east, resulting in vehicles travelling a further 1km and u-turning at the Hutchinson Road roundabout to access the area east of Te Rapa Road. This is an adverse outcome in terms of providing for the PC17 land east of Te Rapa Road, the potential future undeveloped land south of Hutchinson Road and in terms of the Government Emissions Reduction Plan outcomes for the country. We seek that access at the intersection be further developed and the setting aside of land to be identified on the structure plan with supporting provisions to enable the plan change and to avoid sterilising the potential for the residual land to be developed in future.

14.28 The ODP provides “Guidance on efficiency” with “Desirable levels of service” in note 3 beneath Table 15-2b. These are not absolute compliance requirements, as interpreted by TAL. Also, banning the northbound right turn at Access 2 intersection would require a small number of vehicles that would make the right turn to travel an additional 700 m, not 1 km.

14.29 While the additional 700 metres of travel for a relatively small number of right-turning vehicles into the North Block may introduce a minor increase in vehicle kilometres travelled, it is unlikely to materially influence the broader outcomes

of the Government's Emissions Reduction Plan. This is particularly so when considered alongside the scale of residential development already consented at TAL, which is located a significantly greater distance from Hamilton's primary employment centres.

14.30 Further to these clarifications, the revised SIDRA modelling for the Access 2 intersection demonstrates the delay to right turning traffic at the intersection under the completed development scenario is less than the ODP desirable maximum of 55 sec / veh for strategic network roads. Refer to the SIDRA results in the Technical Note at **Attachment 1**.

14.31 I also note that the banning of the right turn movements at this intersection (and others on Te Rapa Road) in future is likely when a BRT system is accommodated.

14.32 Therefore, I disagree with TAL's claim that:

> This is an adverse outcome in terms of providing for the PC17 land east of Te Rapa Road, the potential future undeveloped land south of Hutchinson Road and in terms of the Government Emissions Reduction Plan outcomes for the country.

14.33 TAL submission point [14.33] states:

> The Te Rapa Road / McKee Street intersection upgrade including requiring 4 lanes continuously south to Ruffell Road intersection is supported and should be adopted.

14.34 The revised modelling for the Te Rapa Road / McKee Street intersection demonstrates that no further upgrade is required beyond that which TAL will undertake in accordance with their consent conditions to accommodate the Te Awa Lakes development traffic.

14.35 TAL submission point [14.34] states:

> The Te Rapa Road / Ruffell Road intersection form proposed is supported and should be adopted.

14.36 I agree.

14.37 TAL submission point [14.35] states:

> The Te Rapa Road / Kapuni Road intersection signalisation is supported and should be adopted.

14.38 The revised modelling and assessment work has identified that an alternative more feasible option in future may be to amend the intersection to permit only left in and left out ("**LILO**") movements for Kapuni Street traffic, instead of signalising the whole intersection. Kapuni Street is only 180 m long and provides direct access to three properties. Right turns in and out can reroute to either Church Road or Mckee Street to undertake a safer turning movement. A LILO treatment would also help to protect the strategic function of Te Rapa Road as a future BRT corridor by reducing the number of intersections along the route that introduce delay to the service.

14.39 Therefore, I have identified the Te Rapa Road / Kapuni Street intersection as a network component to be assessed as part of a Broad ITA that is triggered when the net developable area exceeds 42 ha.[31]

14.40 TAL submission point [14.36] states:

> The applicants traffic assessment identifies significant adverse change effects at the Horotiu interchange roundabouts because of the plan change and also identifies mitigation options that are considered valid. The mitigation infrastructure change is however not reflected in the infrastructure provisions of the plan change. Appropriate inclusion of the identified mitigation should be included in the upgrade and implementation table as per the applicants own assessment.

14.41 The updated Horotiu Interchange SIDRA models based on the revised WRTM scenarios shows that the two interchange roundabouts will perform significantly better than the information presented in the ITA for full buildout of PC17 and the consented Te Awa Lakes developments. Therefore, I consider the mitigation measures discussed in the ITA are no longer relevant.

14.42 Furthermore, TAL's further submission supports NZTA's determination on this matter, that a broad integrated transport assessment is proposed for land development or resource consents within the Plan Change Area (now triggered by exceeding 42 ha net developable area) such that there is another opportunity to address operational issues at the Interchange if they are likely. Therefore, this submission point appears to no longer be valid.

14.43 TAL submission point [14.12] states:

> Further provisions are required to address the following matters: Travel Demand Management measures targeted to minimise

31 Rule 3.9.3.2(b)(ii).

the potential for travel and therefore reduce/minimise the potential for vehicle emissions generation; Enablement of electric vehicle charging facility as a mechanism to minimise adverse vehicle emissions outcomes. Provisions relating to how "emissions reductions" outcomes can be achieved.

14.44 I disagree that further Travel Demand Management ("**TDM**") and emissions reductions provisions are required for PC17, for the following reasons:

(a) Measures to reduce the need to travel are already in the proposed provisions by enabling sufficient convenience retail to serve employment activities such as lunch bars, gyms, daycare, cafés, dry cleaners and hairdressers etc.

(b) Online video meetings are now regularly used by corporate workers, and often even preferred, which actively reduces the need for travel for day-to-day business interactions. Car-pooling among shift workers is also reasonably common but car-pooling cannot be enforced just because it is written in a TDM manual required by the ODP or a consent.

(c) The number 21 Northern Connector public transport service operates regularly from 6am to 8pm from the Transport Centre to Huntly and back, stopping on Te Rapa Road adjacent to the Plan Change Area. "Last mile" connections by walking, cycling or micro-mobility from Te Rapa Road is facilitated by the proposed PC17 collector road cross-section that includes a 3.0 m wide shared walking and cycling path connecting from Accesses 1 and 2 and continue the full length of the north / south collector road within the Plan Change Area. Local Roads will have a footpath on both sides of the road. Furthermore, the ODP provisions require end-of-trip facilities in new employment developments to make commuting by active modes a viable travel option.

(d) The Council and Waikato Regional Council's long-term aspiration to provide the BRT service through the Plan Change Area to Te Awa Lakes will make PT more attractive and convenient for people that work in the Plan Change Area. The BRT service combined with the above mentioned TDM measures will reduce travel emissions in time without the need for additional rules in the ODP.

14.45 Lastly, in relation to the submissions and further submissions opposing PC17 on the basis that the whole Deferred Industrial Zone Overlay should be

rezoned TRNIZ, it is my opinion based on our conservative modelling assessment work for the ITA that the remaining Te Rapa North Deferred Industrial Zone Overlay land on the eastern side of the railway line that is not included in Plan Change Area, is able to be developed in future for industrial land-use purposes subject to either of the following infrastructure requirements:

(a) The constructing the east / west section of the NRC between Koura Drive and Te Rapa Road including an intersection with Te Rapa Road; or

(b) In the absence of the east / west described above, some or all the following transport infrastructure upgrades may be needed:

  (i) An additional southbound through movement lane at Te Rapa Road / Ruffell Road intersection.

  (ii) Reopening the Ruffell Road rail level crossing.

  (iii) Capacity / queue storage increases at the signalised Te Rapa Road / McKee Street intersection.

  (iv) Additional walking, cycling and public transport connectivity to facilitate greater travel choices, and/or

  (v) Financial contributions toward the future BRT service.

15. CONCLUSION

15.1 In my opinion, the revised transport assessment modelling work and resulting revised transport infrastructure staging reflected in the proposed plan provisions for PC17 are sufficient to ensure any potential adverse transport effects on the receiving environment will be appropriately mitigated and therefore acceptable, if not minor.

Cameron Inder

7 October 2025

ATTACHMENT 1

Revised Transport Modelling and Assessment Technical Note

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Technical Note

From	Cameron Inder / Siva Balachandran	**No. of pages**	48
Date	27 September 2025	**No. of attachments**	0
Job No.	148020		
Project	Private Plan Change 17		
Subject	**PC17 Technical Modelling and Assessment Updates for Evidence**		

1. Introduction

This technical note provides supplementary information that forms part of the Statement of Evidence of Cameron Inder on transport planning matters for proposed Private Plan Change 17, by Fonterra Limited.

2. PC17 Transport Modelling

2.1 ITA Trip Generation

PC17 seeks to rezone a gross land area of approximately 91 ha. At the time transport modelling was undertaken in 2023/24 for the plan change application it was expected that approximately 79 ha of the site was capable of being developed for industrial purposes. Approximately 12 ha is identified as riparian and flood prone area.

Roads, reserves, landscape bunds, stormwater management devices and the proposed rail siding were then estimated to account for about 20% of the developable area, leaving a net developable area of approximately 63 ha as traffic generating developed land. The highest surveyed peak hour trip generation rate of 16.3 trips per net developable hectare was adopted to derive an estimated total trip generation of approximately 1,030 trips per peak hour for PC17 when fully developed and occupied for industrial purposes.

This was input to the Waikato Regional Transport Model ("**WRTM**"), which was supplied with a trip generation of 1,750 vehicles per peak hour for the Te Awa Lakes development.

2.2 Revised Trip Generation and Modelling

The transport modelling, assessment and resulting transport infrastructure provisions for PC17 have been updated post-lodgement as further refinement work was undertaken by BBO and the wider project team in response to submissions, continued liaison with Council and key stakeholders and to optimise/co-ordinate infrastructure staging.

The updates to the transport modelling included:

- Revised PC17 trip generation because the net developable area has reduced by 10 ha compared with the modelling undertaken for the Plan Change ITA.

- Revising the Te Awa Lakes development trip generation to reflect the consented peak hour totals of 500 vph (assumed for 10 years post-PC17) and 722 vph (assumed for 20 years post-PC17). Further information is provided in Section 2.2.1.
- A revised 2035 WRTM Baseline scenario
    - with updated Te Awa Lakes trip generation
    - without PC17 development
    - Ruffell Road level crossing closed
- New 2035 WRTM PC17 Scenario A
    - Baseline + 42 ha occupied in PC17
    - Ruffell Road level crossing closed
    - Structure Plan Spine Road not connected between Access 2 intersection and Ruffell Road
- New 2045 WRTM PC17 Scenario B
    - Baseline + Structure Plan area fully occupied
    - Ruffell Road level crossing closed
    - Structure Plan Spine Road connected between Access 2 intersection and Ruffell Road

Scenario A was coded in the WRTM with 42 ha of PC17 development consisting of 35 ha in the West and North blocks (14 ha accessing via Old Ruffell Road, 21 ha accessing via Access 2 intersection) and 7 ha in the South Block connecting to Te Rapa Road via the Fonterra Dairy Manufacturing Factory access road.

2.2.1 Te Awa Lakes Trip Generation

The total external trip generation (two-way volumes) forecasted at the time of the Te Awa Lakes Plan Change is summarised in the table below, obtained from Te Awa Lakes Land Development Plan Application Broad ITA (dated 17 March 2021).

Table No: 1

Area	AM 7-9am			PM 4-6pm		
	In	Out	Total	In	Out	Total
BP Station	28	9	37	30	63	93
Residential	221	696	917	732	241	973
Retail	26	8	34	23	46	69
Hotel	146	219	365	252	103	355
Adventure Park	68	76	144	116	133	249
Total	**489**	**1,008**	**1,497**	**1,153**	**586**	**1,739**

The recent land use consent for Te Awa Lakes development excluded the activities in the Major Facilities zone which at the time of Plan Change consisted of the Hotel and Adventure Park. This excluded a total 509 vph (two-hour volume) and 604 vph (two-hour volume) during the AM and PM peak periods respectively.

However, the consent approved an additional 2,500m^2 discretionary retail land use which, when combined with the residential and other business land uses results in a combined external trip generation of 600 vph and 722 vph during the AM and PM peak periods respectively as shown in

Table No: **2** (source: Te Awa Lakes Land Development Plan Application Broad ITA).

Table No: 2

Area	AM 7-9am			PM 4-6pm		
	In	Out	Total	In	Out	Total
BP Station	28	9	37	30	63	93
Residential	221	696	917	732	241	973
Retail	26	8	34	23	46	69
Retail – Discretionary Activity (2hr)	50	15	65	44	87	131
Total (2hr)	**325**	**728**	**1,053**	**829**	**437**	**1,266**
Total (1hr)	**185**	**415**	**600**	**473**	**249**	**722**

The Te Awa Lakes Land Development Plan Application Broad ITA states:

"*subsequent development in the Major Facilities zone will necessarily also have to take into account the cumulative trip generating effects, as is required by Rule 3.8.5.3.2 of the Structure Plan. On the basis of the proposal set out in this application and adopting the same land use assumption as the Structure Plan provides for in the Major Facilities zone, it is evident the total cumulative demand in that case will be greater than the basis of assessment for the Structure Plan. The difference being equivalent to the total discretionary Retail trip demands. It will however fall to that application to make the necessary cumulative effects assessment required of it and to address any consequent further mitigation if any is required.*".

This means the Major Facilities zone does not form part of the transport baseline environment. Accordingly, the updated PC17 transport modelling and assessment has not included it since:

- it is not consented
- the final scope and timing of proposed land use activities is unknown
- the cumulative effects of the traffic generation in addition to all existing and consented traffic must be assessed in an ITA by the developer if or when a consent application is lodged for any activity in the Major Facilities Zone.

2.2.2 Other Known Potential Development Areas in the north of Hamilton

The government's fasttrack.govt.nz website identifies five listed and two referred projects under the Fast-track Approvals Act 2024 for residential and commercial land use activities in Hamilton.

One of the listed projects is Te Awa Lakes, for which the application summary states, *"Develop approximately 2,500 residential dwellings (including affordable housing), a town centre, a business precinct, and a recreational precinct"*.

Like the other six Fast-track projects, the Te Awa Lakes Fast Track application is not consented and does not form part of the transport baseline environment. Therefore, the PC17 transport modelling and assessment has not included these proposals.

2.3 Updated WRTM Scenario Outputs

The figures in the following pages illustrate the updated peak hour traffic volume outputs (two-hour volumes) for the network surrounding PC17 for the three updated WRTM scenarios.

Figure 1: 2035 WRTM PC17 Baseline AM Peak

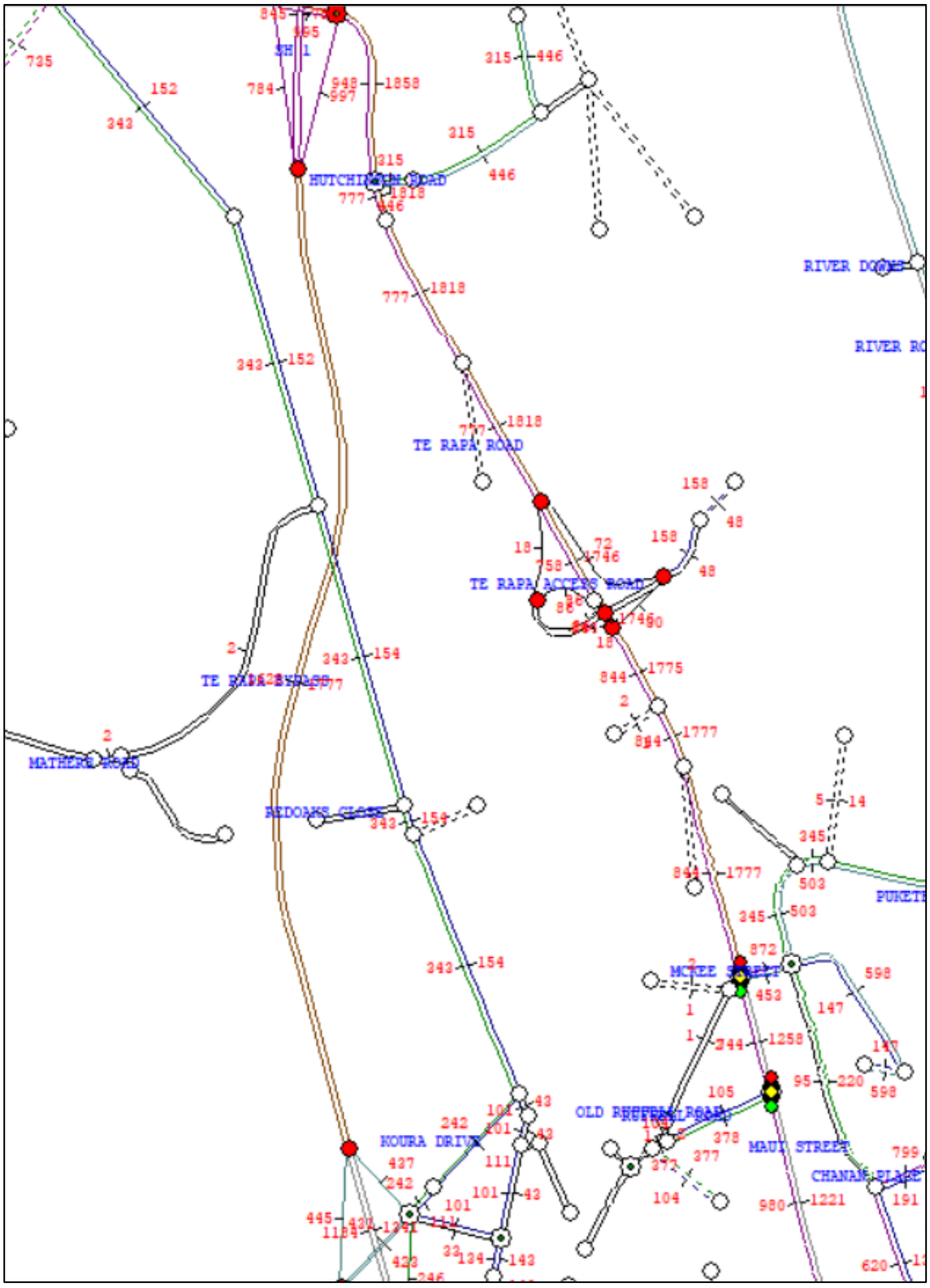


Figure 2: 2035 WRTM PC17 Baseline PM Peak

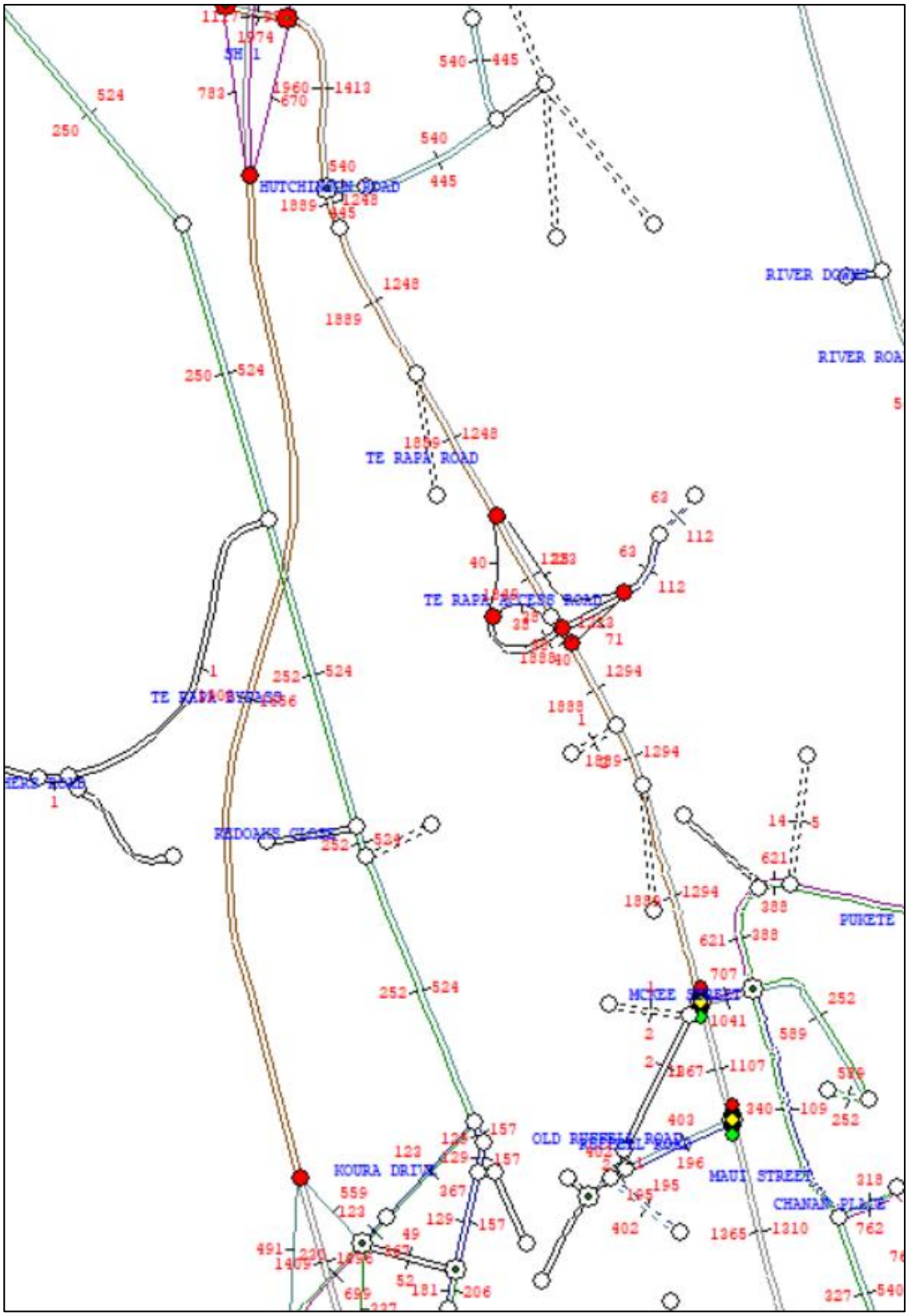


Figure 3: 2035 WRTM PC17 Scenario A - AM Peak

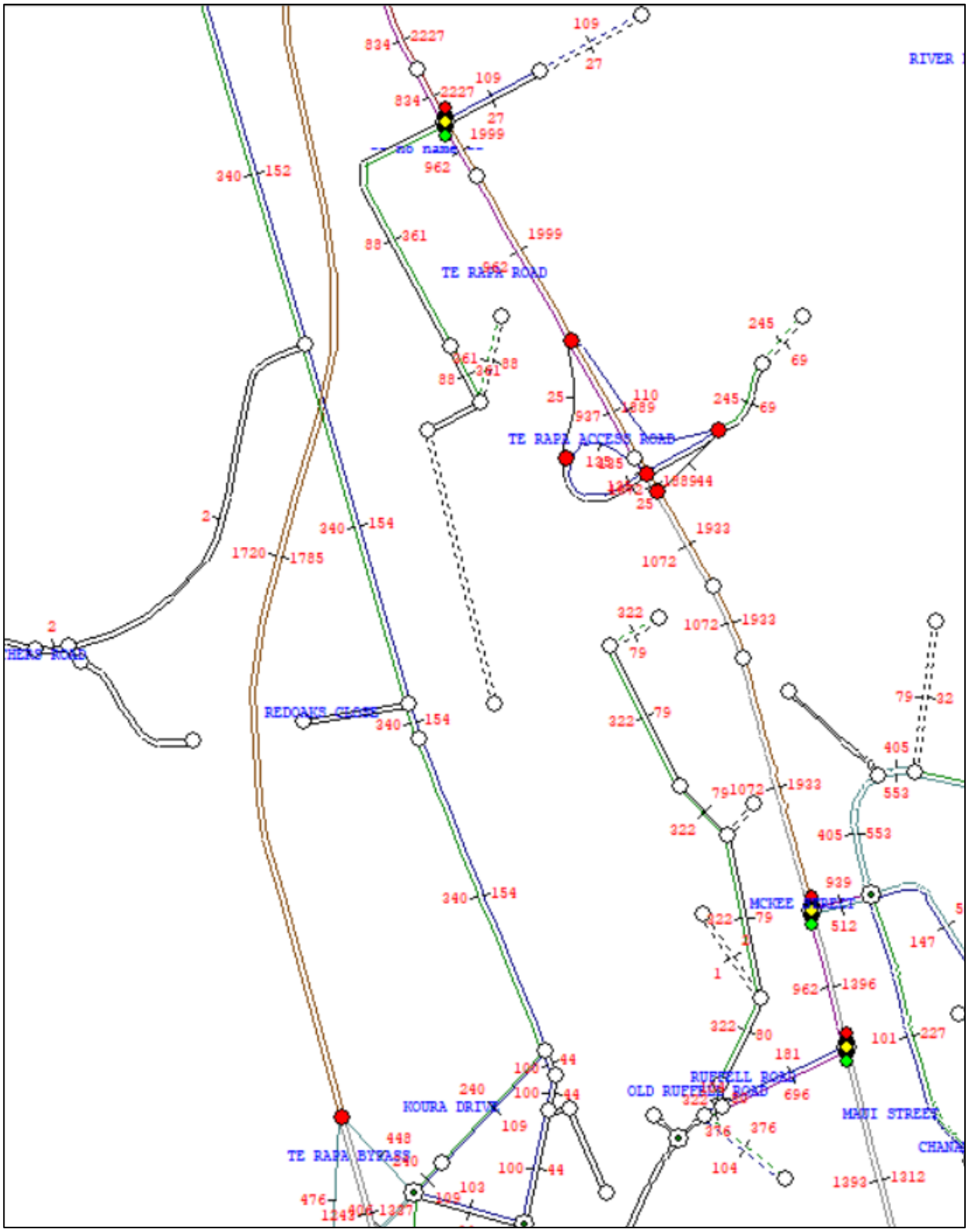


Figure 4: 2035 WRTM PC17 Scenario A - PM Peak

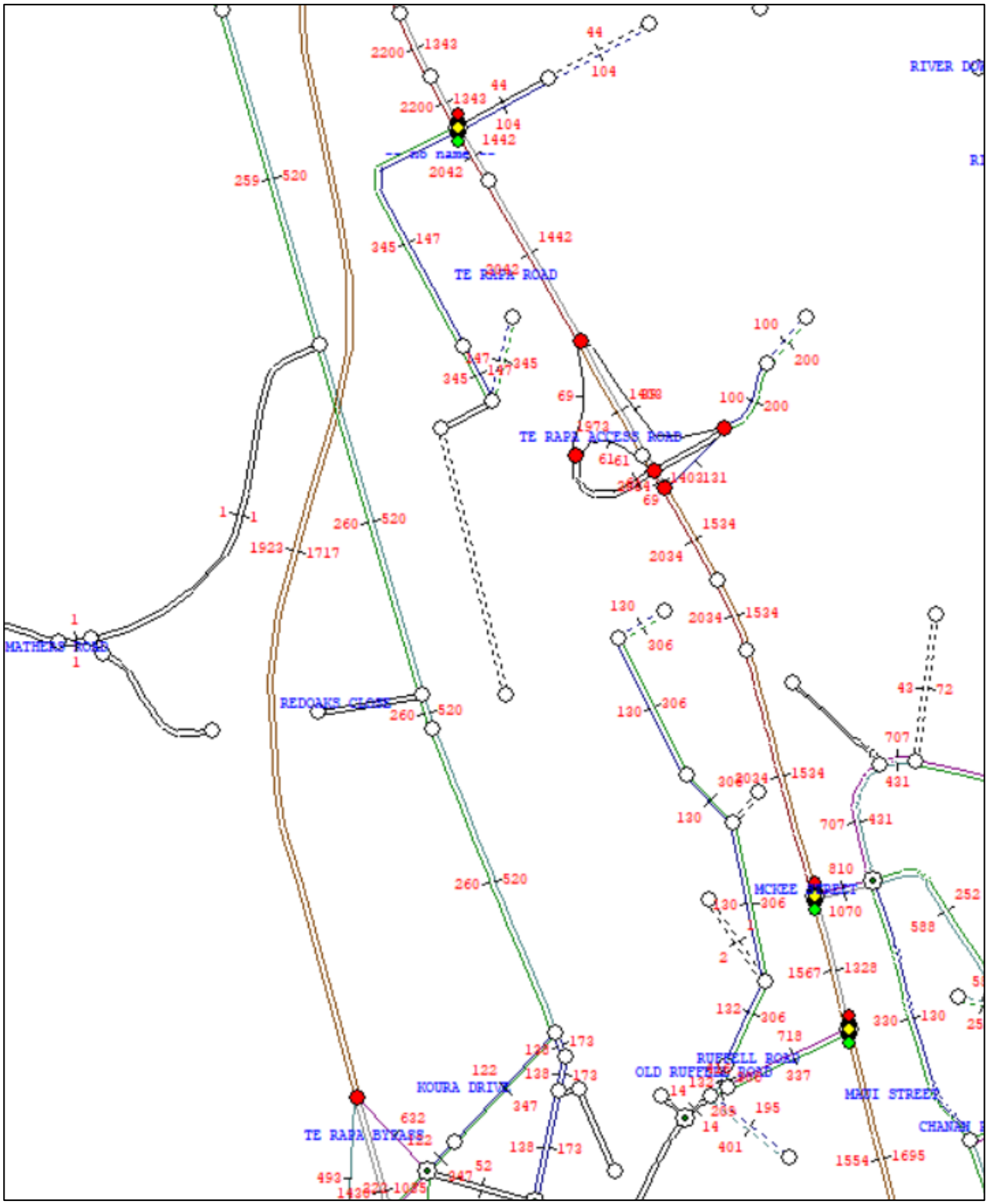


Figure 5: 2045 WRTM PC17 Scenario B (Fully Occupied) – AM Peak

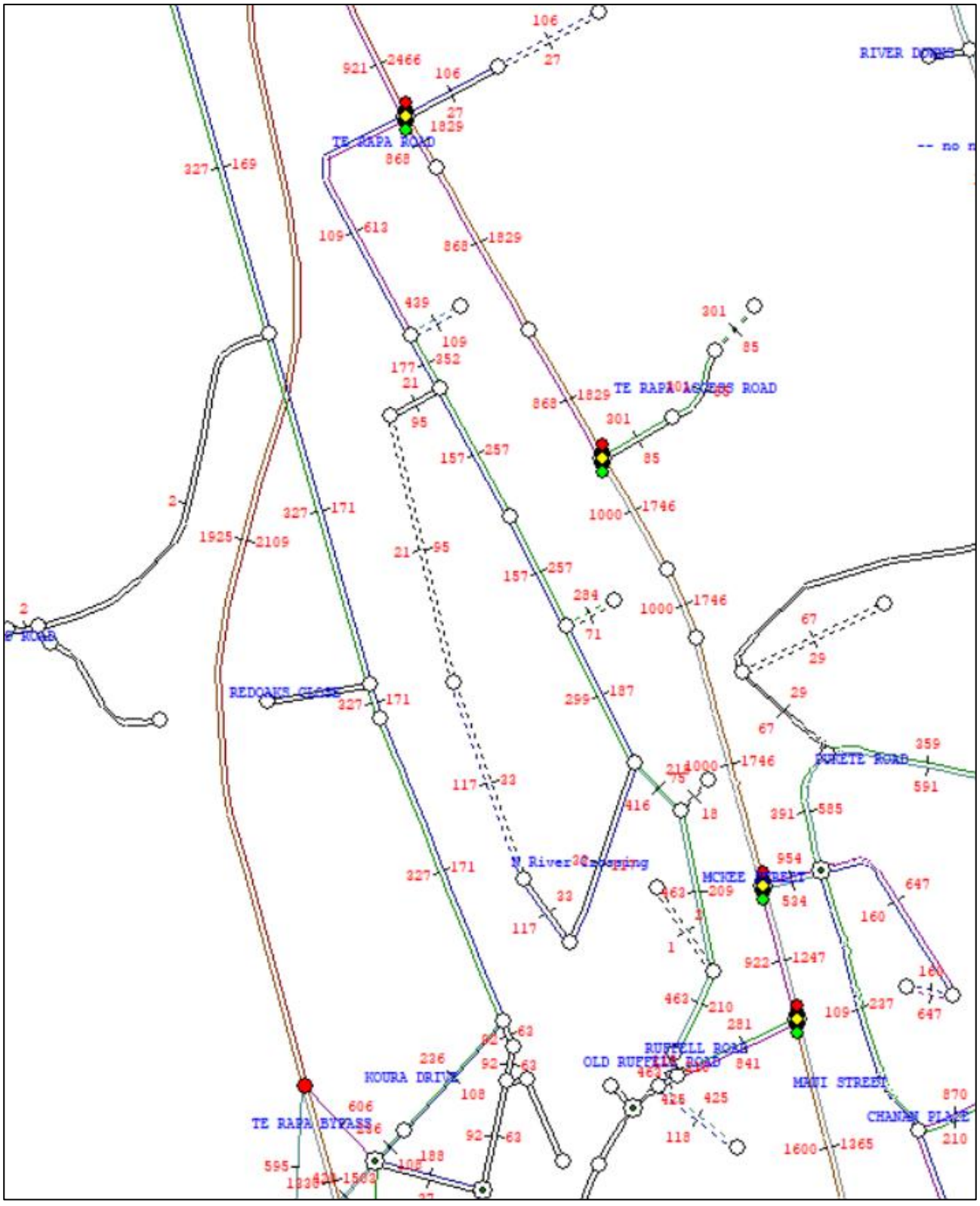
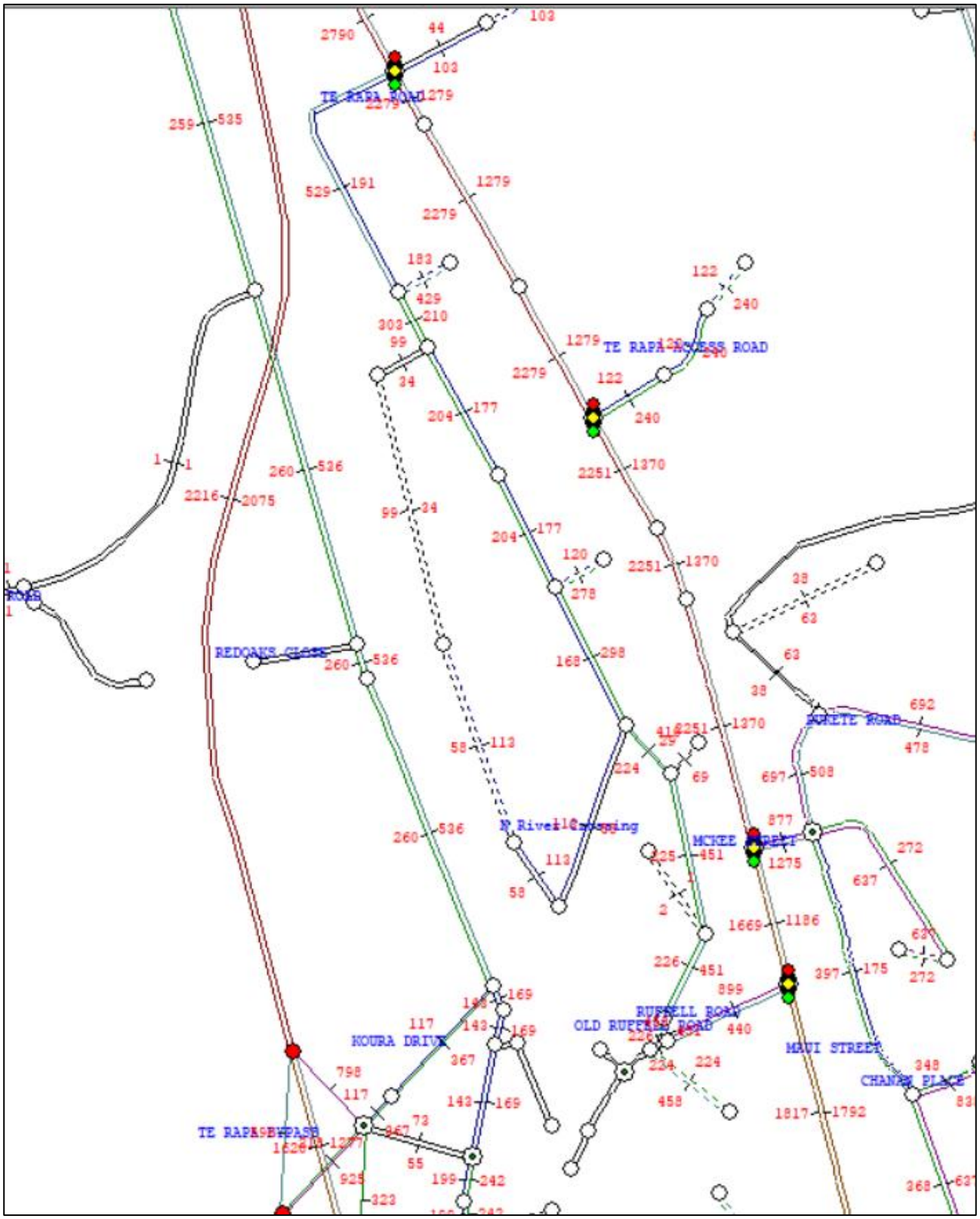


Figure 6: 2045 WRTM PC17 Scenario B (Fully Occupied) – PM Peak



2.3.1 Modelled Average Daily Traffic Volume Changes

Table No: 3 provides a comparison of the changes in Average Daily Traffic ("ADT") on strategic roads surrounding the Plan Change Area in the updated WRTM tests.

It is also noted that Stage 2 includes traffic growth on the network associated with other land use in 2045, defined by Future Proof growth projections.

Table No: 3

Changes in ADT (vehicles per day)			
Road Section	**Baseline Scenario (Ruffell Rd Level Crossing Closed)**	**Stage 1 (Ruffell Rd Level Crossing Closed) (% Change)**	**Stage 2 (Ruffell Rd Level Crossing Closed) (% Change)**
Te Rapa Road (between SH1C interchange and Hutchinson Rd)	18,276	19,792 (8.3%)	23,643 (29.4%)
Te Rapa Road (between Dairy Manufacturing Site and McKee St)	16,637	18,296 (10.0%)	18,309 (10.0%)
Te Rapa Road (between Ruffell Rd and Kapuni St)	13,940	16,358 (17.3%)	18,359 (31.7%)
Te Rapa Road (between Kapuni St and Church Rd)	18,871	21,157 (12.1%)	23,134 (22.6%)
Te Rapa Road (between Church Rd and The Base Parade)	17,830	20,007 (12.2%)	22,851 (28.2%)
Te Rapa Road (between The Base Parade and Wairere Dr)	31,608	33,475 (5.9%)	36,046 (14.0%)
Hutchinson Rd	5,828	5,828	8,581 (47.2%)
McKee St	8,437	9,031 (7.0%)	9,795 (16.1%)
Ruffell Rd (between Te Rapa Rd and Old Ruffell Rd)	3,065	5,231 (70.7%)	6,845 (123%)
Kapuni St	3,395	3,195 (-5.9%)	3,383 (-0.4%)
Te Kowhai Rd	12,458	13,441 (7.9%)	13,967 (12.1%)
Church Rd	7,345	7,590 (3.3%)	8,713 (18.6%)

The key intersections on the network assessed in this technical note include:

- Access 1: via Ruffell Road / Old Ruffell Road intersection
- Access 2: Te Rapa Road signalised intersection south of Hutchinson Road
- Te Rapa Road / Hutchinson Road roundabout
- Te Rapa Road / McKee Street signalised intersection
- Te Rapa Road / Ruffell Road signalised intersection
- Te Rapa Road / Kapuni Street signalised intersection
- Te Rapa Road / Te Kowhai Road / Church Road roundabout
- Te Rapa Road / The Base Parade / Eagle Way signalised intersection
- SH1C / Te Rapa Road interchange (Horotiu Interchange)

2.4 Intersection Capacity Performance

2.4.1 Ruffell Road / Old Ruffell Road Intersection (Access 1)

The intersection performance results of the give-way controlled access intersection during peak hours based on the latest WRTM outputs are presented in Table No: 4 to Table No: 7.

Table No: 4

2035 Stage 1 AM Peak – Ruffell Rd / Old Ruffell Rd Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Ruffell Rd															
5	T1	All MCs	225	5.0	225	5.0	0.242	0.2	LOS A	1.2	8.8	0.16	0.27	0.16	48.2
6	R2	All MCs	193	10.0	193	10.0	0.242	4.9	LOS A	1.2	8.8	0.16	0.27	0.16	46.8
Approach			418	7.3	418	7.3	0.242	2.4	NA	1.2	8.8	0.16	0.27	0.16	47.6
North: Old Ruffell Rd															
7	L2	All MCs	47	10.0	47	10.0	0.034	4.8	LOS A	0.1	1.0	0.15	0.50	0.15	45.5
9	R2	All MCs	1	10.0	1	10.0	0.034	7.2	LOS A	0.1	1.0	0.15	0.50	0.15	45.4
Approach			48	10.0	48	10.0	0.034	4.9	LOS A	0.1	1.0	0.15	0.50	0.15	45.5
West: Ruffell Rd															
10	L2	All MCs	1	0.0	1	0.0	0.033	4.6	LOS A	0.0	0.0	0.00	0.01	0.00	48.7
11	T1	All MCs	61	5.0	61	5.0	0.033	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	49.9
Approach			62	4.9	62	4.9	0.033	0.1	NA	0.0	0.0	0.00	0.01	0.00	49.9
All Vehicles			528	7.3	528	7.3	0.242	2.3	NA	1.2	8.8	0.14	0.26	0.14	47.6

Table No: 5

2035 Stage 1 PM Peak – Ruffell Rd / Old Ruffell Rd Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Ruffell Rd															
5	T1	All MCs	120	5.0	120	5.0	0.122	0.6	LOS A	0.5	3.8	0.29	0.33	0.29	48.1
6	R2	All MCs	76	10.0	76	10.0	0.122	5.6	LOS A	0.5	3.8	0.29	0.33	0.29	46.7
Approach			196	6.9	196	6.9	0.122	2.6	NA	0.5	3.8	0.29	0.33	0.29	47.5
North: Old Ruffell Rd															
7	L2	All MCs	178	10.0	178	10.0	0.146	5.7	LOS A	0.6	4.7	0.36	0.57	0.36	45.0
9	R2	All MCs	1	10.0	1	10.0	0.146	7.1	LOS A	0.6	4.7	0.36	0.57	0.36	44.9
Approach			179	10.0	179	10.0	0.146	5.7	LOS A	0.6	4.7	0.36	0.57	0.36	45.0
West: Ruffell Rd															
10	L2	All MCs	1	0.0	1	0.0	0.127	4.6	LOS A	0.0	0.0	0.00	0.00	0.00	48.7
11	T1	All MCs	242	5.0	242	5.0	0.127	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
Approach			243	5.0	243	5.0	0.127	0.1	NA	0.0	0.0	0.00	0.00	0.00	49.9
All Vehicles			618	7.1	618	7.1	0.146	2.5	NA	0.6	4.7	0.19	0.27	0.19	47.7

Table No: 6

2045 Stage 2 AM Peak – Ruffell Rd / Old Ruffell Rd Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h

East: Ruffell Rd														
5	T1	All MCs	229	5.0	229	5.0	0.298	0.3	LOS A	1.7	12.4	0.20	0.32	0.20	47.9
6	R2	All MCs	276	10.0	276	10.0	0.298	5.0	LOS A	1.7	12.4	0.20	0.32	0.20	46.5
Approach			505	7.7	505	7.7	0.298	2.8	NA	1.7	12.4	0.20	0.32	0.20	47.1
North: Old Ruffell Rd														
7	L2	All MCs	100	10.0	100	10.0	0.110	4.9	LOS A	0.4	3.3	0.21	0.51	0.21	45.3
9	R2	All MCs	26	10.0	26	10.0	0.110	8.4	LOS A	0.4	3.3	0.21	0.51	0.21	45.2
Approach			126	10.0	126	10.0	0.110	5.6	LOS A	0.4	3.3	0.21	0.51	0.21	45.2
West: Ruffell Rd														
10	L2	All MCs	2	0.0	2	0.0	0.037	4.6	LOS A	0.0	0.0	0.00	0.02	0.00	48.7
11	T1	All MCs	68	5.0	68	5.0	0.037	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	49.9
Approach			71	4.9	71	4.9	0.037	0.1	NA	0.0	0.0	0.00	0.02	0.00	49.9
All Vehicles			702	7.8	702	7.8	0.298	3.1	NA	1.7	12.4	0.18	0.32	0.18	47.0

Table No: 7

2045 Stage 2 PM Peak – Ruffell Rd / Old Ruffell Rd Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Ruffell Rd															
5	T1	All MCs	128	5.0	128	5.0	0.170	0.9	LOS A	0.8	6.2	0.36	0.41	0.36	47.6
6	R2	All MCs	129	10.0	129	10.0	0.170	5.8	LOS A	0.8	6.2	0.36	0.41	0.36	46.2
Approach			258	7.5	258	7.5	0.170	3.4	NA	0.8	6.2	0.36	0.41	0.36	46.9
North: Old Ruffell Rd															
7	L2	All MCs	261	10.0	261	10.0	0.222	5.9	LOS A	1.0	7.4	0.40	0.59	0.40	44.9
9	R2	All MCs	3	10.0	3	10.0	0.222	8.0	LOS A	1.0	7.4	0.40	0.59	0.40	44.8
Approach			264	10.0	264	10.0	0.222	5.9	LOS A	1.0	7.4	0.40	0.59	0.40	44.9
West: Ruffell Rd															
10	L2	All MCs	3	0.0	3	0.0	0.140	4.6	LOS A	0.0	0.0	0.00	0.01	0.00	48.7
11	T1	All MCs	264	5.0	264	5.0	0.140	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	49.9
Approach			267	4.9	267	4.9	0.140	0.1	NA	0.0	0.0	0.00	0.01	0.00	49.9
All Vehicles			789	7.5	789	7.5	0.222	3.1	NA	1.0	7.4	0.25	0.34	0.25	47.2

The modelling assessment indicates that the access intersection will operate well within its practical capacity in all infrastructure stages.

Additional intersection modelling was undertaken to understand the land area that could be developed if the Plan Change Area was to be serviced by only the Access 1 intersection. The 2035 baseline scenario traffic flows, and manual distribution of the trips generated by PC17 based on turning movement percentages obtained from the 2035 Stage 1 WRTM outputs indicated that approximately **20 ha (net)** of PC17 can be serviced by a single access.

Table No: 8 and Table No: 9 below present the intersection performance of Access 1 intersection with 20 ha of PC17 developed. No upgrades are required.

Table No: 8

2035 AM Peak – Ruffell Rd / Old Ruffell Rd – 20ha of PC17															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Ruffell Rd															

5	T1	All MCs	226	5.0	226	5.0	0.295	0.2	LOS A	1.6	12.2	0.19	0.31	0.19	47.9
6	R2	All MCs	276	10.0	276	10.0	0.295	4.9	LOS A	1.6	12.2	0.19	0.31	0.19	46.5
Approach			502	7.7	502	7.7	0.295	2.8	NA	1.6	12.2	0.19	0.31	0.19	47.1
North: Old Ruffell Rd															
7	L2	All MCs	67	10.0	67	10.0	0.047	4.9	LOS A	0.2	1.4	0.15	0.50	0.15	45.5
9	R2	All MCs	1	10.0	1	10.0	0.047	8.0	LOS A	0.2	1.4	0.15	0.50	0.15	45.4
Approach			68	10.0	68	10.0	0.047	4.9	LOS A	0.2	1.4	0.15	0.50	0.15	45.5
West: Ruffell Rd															
10	L2	All MCs	1	0.0	1	0.0	0.033	4.6	LOS A	0.0	0.0	0.00	0.01	0.00	48.7
11	T1	All MCs	62	5.0	62	5.0	0.033	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	49.9
Approach			63	4.9	63	4.9	0.033	0.1	NA	0.0	0.0	0.00	0.01	0.00	49.9
All Vehicles			634	7.7	634	7.7	0.295	2.8	NA	1.6	12.2	0.16	0.30	0.16	47.2

Table No: 9

2035 PM Peak – Ruffell Rd / Old Ruffell Rd – 20ha of PC17															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Ruffell Rd															
5	T1	All MCs	114	5.0	114	5.0	0.138	0.7	LOS A	0.6	4.8	0.32	0.37	0.32	47.8
6	R2	All MCs	102	10.0	102	10.0	0.138	5.6	LOS A	0.6	4.8	0.32	0.37	0.32	46.4
Approach			216	7.4	216	7.4	0.138	3.0	NA	0.6	4.8	0.32	0.37	0.32	47.1
North: Old Ruffell Rd															
7	L2	All MCs	241	10.0	241	10.0	0.196	5.7	LOS A	0.9	6.5	0.36	0.57	0.36	45.0
9	R2	All MCs	1	10.0	1	10.0	0.196	7.3	LOS A	0.9	6.5	0.36	0.57	0.36	44.9
Approach			242	10.0	242	10.0	0.196	5.7	LOS A	0.9	6.5	0.36	0.57	0.36	45.0
West: Ruffell Rd															
10	L2	All MCs	1	0.0	1	0.0	0.124	4.6	LOS A	0.0	0.0	0.00	0.00	0.00	48.7
11	T1	All MCs	235	5.0	235	5.0	0.124	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
Approach			236	5.0	236	5.0	0.124	0.1	NA	0.0	0.0	0.00	0.00	0.00	49.9
All Vehicles			694	7.5	694	7.5	0.196	2.9	NA	0.9	6.5	0.23	0.32	0.23	47.2

2.4.2 Access 2: Te Rapa Road Signalised Intersection south of Hutchinson Road

Figure 7 illustrates the signalised intersection layout modelled in SIDRA for Access 2. The results of the peak hour modelling for the infrastructure stages based on the latest WRTM outputs are presented in Table No: 10 to Table No: 13.

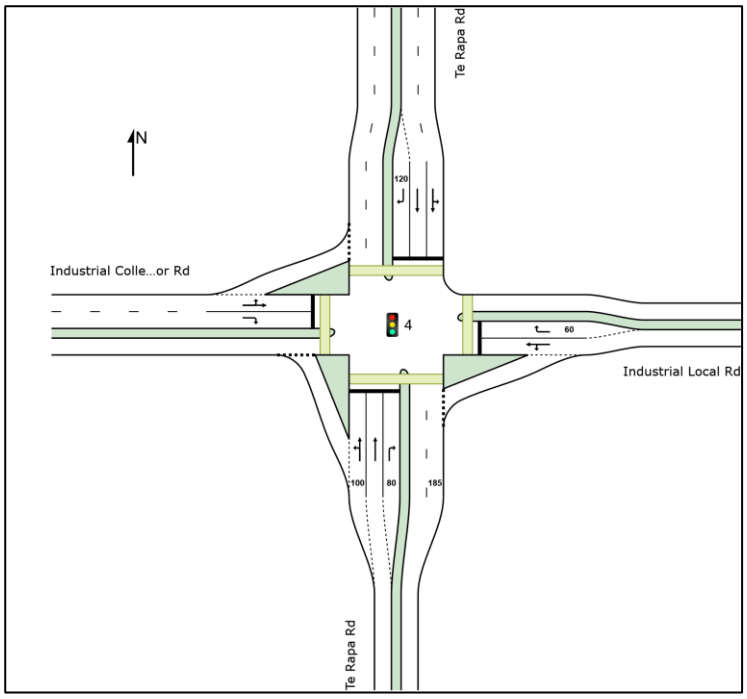


Figure 7: Te Rapa Road / Access 2 Signalised Intersection Layout

Table No: 10

2035 Stage 1 AM Peak – Access 2 Vehicle Movement Performance																
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
1	L2	All MCs	85	10.0	85	10.0		0.660	9.2	LOS A	13.2	104.7	0.96	0.85	0.96	28.0
2	T1	All MCs	469	17.8	469	17.8		0.660	47.4	LOS D	13.6	109.8	0.96	0.83	0.96	28.3
3	R2	All MCs	23	9.9	23	9.9	*	0.244	62.6	LOS E	1.3	9.8	0.99	0.71	0.99	14.0
Approach			578	16.4	578	16.4		0.660	42.4	LOS D	13.6	109.8	0.96	0.83	0.96	27.8
East: Industrial Local Rd																
4	L2	All MCs	7	16.9	7	16.9		0.015	14.8	LOS B	0.2	1.6	0.63	0.60	0.63	28.5
5	T1	All MCs	1	10.0	1	10.0		0.015	41.3	LOS D	0.2	1.6	0.63	0.60	0.63	35.9
6	R2	All MCs	7	14.3	7	14.3	*	0.080	61.4	LOS E	0.4	3.2	0.97	0.66	0.97	20.5
Approach			16	15.3	16	15.3		0.080	38.3	LOS D	0.4	3.2	0.79	0.63	0.79	23.6
North: Te Rapa Rd																
7	L2	All MCs	42	7.9	42	7.9		0.672	48.9	LOS D	23.8	179.2	0.84	0.76	0.84	30.6
8	T1	All MCs	1165	9.0	1165	9.0	*	0.672	22.9	LOS C	25.6	193.1	0.82	0.74	0.82	35.1
9	R2	All MCs	132	8.0	132	8.0		0.222	33.2	LOS C	5.1	38.2	0.76	0.74	0.76	33.9
Approach			1339	8.9	1339	8.9		0.672	24.7	LOS C	25.6	193.1	0.81	0.74	0.81	34.8
West: Industrial Collector Rd																
10	L2	All MCs	24	15.0	24	15.0		0.032	9.1	LOS A	0.4	3.2	0.51	0.61	0.51	42.2
11	T1	All MCs	1	15.0	1	15.0	*	0.032	75.3	LOS E	0.4	3.2	0.51	0.61	0.51	39.5
12	R2	All MCs	28	15.0	28	15.0		0.310	63.5	LOS E	1.6	12.6	1.00	0.72	1.00	22.9
Approach			54	15.0	54	15.0		0.310	39.2	LOS D	1.6	12.6	0.77	0.67	0.77	30.4
All Vehicles			1986	11.3	1986	11.3		0.672	30.4	LOS C	25.6	193.1	0.86	0.76	0.86	32.3

Table No: 11

2035 Stage 1 PM Peak – Access 2 Vehicle Movement Performance																
	Turn		Demand Flows		Arrival Flows						95% Back Of Queue					

Mov ID	Mov Class	[Total	HV]	[Total	HV]		Deg. Satn	Aver. Delay	Level of Service	[Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
		veh/h	%	veh/h	%		v/c	sec		veh	m				km/h
South: Te Rapa Rd															
1	L2 All MCs	41	10.0	41	10.0		0.726	7.6	LOS A	22.1	162.9	0.89	0.81	0.89	34.0
2	T1 All MCs	1139	6.1	1139	6.1	*	0.726	27.1	LOS C	22.2	163.5	0.89	0.80	0.89	34.8
3	R2 All MCs	13	10.3	13	10.3		0.112	54.5	LOS D	0.6	4.4	0.97	0.68	0.97	16.0
Approach		1193	6.3	1193	6.3		0.726	26.7	LOS C	22.2	163.5	0.89	0.80	0.89	33.4
East: Industrial Local Rd															
4	L2 All MCs	25	10.1	25	10.1		0.036	11.4	LOS B	0.4	3.3	0.54	0.62	0.54	32.5
5	T1 All MCs	1	10.0	1	10.0	*	0.036	33.7	LOS C	0.4	3.3	0.54	0.62	0.54	39.3
6	R2 All MCs	35	5.8	35	5.8		0.299	52.5	LOS D	1.6	11.9	0.99	0.72	0.99	22.4
Approach		61	7.7	61	7.7		0.299	35.2	LOS D	1.6	11.9	0.79	0.68	0.79	24.9
North: Te Rapa Rd															
7	L2 All MCs	14	7.0	14	7.0	*	0.540	75.0	LOS E	11.7	88.9	0.87	0.75	0.87	29.4
8	T1 All MCs	727	9.9	727	9.9		0.540	23.4	LOS C	14.5	109.8	0.83	0.72	0.83	34.7
9	R2 All MCs	44	7.0	44	7.0		0.383	53.0	LOS D	2.1	15.4	0.99	0.74	0.99	28.6
Approach		785	9.7	785	9.7		0.540	25.9	LOS C	14.5	109.8	0.84	0.72	0.84	34.0
West: Industrial Collector Rd															
10	L2 All MCs	112	10.0	112	10.0		0.155	14.9	LOS B	2.5	18.7	0.57	0.67	0.57	40.7
11	T1 All MCs	1	10.0	1	10.0		0.155	36.5	LOS D	2.5	18.7	0.57	0.67	0.57	37.2
12	R2 All MCs	89	10.0	89	10.0	*	0.792	57.8	LOS E	4.5	34.4	1.00	0.93	1.31	24.0
Approach		202	10.0	202	10.0		0.792	34.0	LOS C	4.5	34.4	0.76	0.79	0.90	32.3
All Vehicles		2241	7.9	2241	7.9		0.792	27.3	LOS C	22.2	163.5	0.86	0.77	0.87	33.3

Table No: 12

2045 Stage 2 AM Peak – Access 2 Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%		v/c	sec		veh	m				km/h
South: Te Rapa Rd																
1	L2	All MCs	17	10.0	17	10.0		0.707	14.2	LOS B	11.3	90.9	0.99	0.89	1.05	27.9
2	T1	All MCs	484	17.8	484	17.8		0.707	48.0	LOS D	11.4	91.6	0.99	0.88	1.05	28.6
3	R2	All MCs	21	9.9	21	9.9	*	0.190	53.2	LOS D	1.0	7.5	0.98	0.70	0.98	15.7
Approach			522	17.3	522	17.3		0.707	47.1	LOS D	11.4	91.6	0.99	0.87	1.04	26.5
East: Industrial Local Rd																
4	L2	All MCs	6	16.9	6	16.9		0.015	10.9	LOS B	0.1	0.9	0.65	0.59	0.65	30.6
5	T1	All MCs	1	10.0	1	10.0		0.015	38.0	LOS D	0.1	0.9	0.65	0.59	0.65	37.8
6	R2	All MCs	9	14.3	9	14.3		0.088	52.5	LOS D	0.4	3.4	0.97	0.67	0.97	22.4
Approach			17	15.1	17	15.1		0.088	36.0	LOS D	0.4	3.4	0.83	0.63	0.83	24.9
North: Te Rapa Rd																
7	L2	All MCs	42	7.9	42	7.9		0.717	42.2	LOS D	21.0	158.4	0.90	0.80	0.90	30.5
8	T1	All MCs	1089	9.0	1089	9.0	*	0.717	24.1	LOS C	22.4	168.6	0.89	0.79	0.89	34.5
9	R2	All MCs	351	8.0	351	8.0		0.647	35.7	LOS D	14.2	106.5	0.92	0.83	0.92	33.1
Approach			1482	8.7	1482	8.7		0.717	27.4	LOS C	22.4	168.6	0.90	0.80	0.90	34.0
West: Industrial Collector Rd																
10	L2	All MCs	60	15.0	60	15.0		0.079	15.0	LOS B	1.3	10.3	0.57	0.65	0.57	40.6
11	T1	All MCs	1	15.0	1	15.0		0.079	35.2	LOS D	1.3	10.3	0.57	0.65	0.57	37.1
12	R2	All MCs	4	15.0	4	15.0	*	0.039	52.2	LOS D	0.2	1.5	0.96	0.64	0.96	25.2
Approach			65	15.0	65	15.0		0.079	17.7	LOS B	1.3	10.3	0.60	0.65	0.60	39.4

All Vehicles	2086	11.1	2086	11.1	0.717	32.1	LOS C	22.4	168.6	0.91	0.81	0.92	32.0

Table No: 13

2045 Stage 2 PM Peak – Access 2 Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
1	L2	All MCs	12	10.0	12	10.0		0.856	17.3	LOS B	29.5	217.6	0.97	0.99	1.11	30.2
2	T1	All MCs	1308	6.1	1308	6.1	*	0.856	39.1	LOS D	31.5	231.8	0.97	0.98	1.11	31.0
3	R2	All MCs	12	10.3	12	10.3		0.102	58.3	LOS E	0.5	4.0	0.97	0.67	0.97	16.1
Approach			1332	6.2	1332	6.2		0.856	39.1	LOS D	31.5	231.8	0.97	0.98	1.10	29.0
East: Industrial Local Rd																
4	L2	All MCs	21	10.1	21	10.1		0.028	11.9	LOS B	0.4	3.1	0.52	0.60	0.52	32.0
5	T1	All MCs	1	10.0	1	10.0		0.028	32.0	LOS C	0.4	3.1	0.52	0.60	0.52	38.9
6	R2	All MCs	38	5.8	38	5.8	*	0.322	52.1	LOS D	1.7	12.8	0.99	0.73	0.99	22.5
Approach			60	7.4	60	7.4		0.322	37.6	LOS D	1.7	12.8	0.81	0.68	0.81	24.4
North: Te Rapa Rd																
7	L2	All MCs	14	7.0	14	7.0		0.529	73.6	LOS E	11.2	85.1	0.87	0.75	0.87	29.4
8	T1	All MCs	702	9.9	702	9.9		0.529	23.4	LOS C	13.8	105.1	0.83	0.72	0.83	34.6
9	R2	All MCs	99	7.0	99	7.0	*	0.849	59.3	LOS E	5.1	37.7	1.00	0.98	1.43	27.3
Approach			815	9.5	815	9.5		0.849	28.6	LOS C	13.8	105.1	0.85	0.75	0.90	33.2
West: Industrial Collector Rd																
10	L2	All MCs	284	10.0	284	10.0		0.369	15.7	LOS B	6.9	52.8	0.63	0.72	0.63	40.4
11	T1	All MCs	1	10.0	1	10.0	*	0.369	42.4	LOS D	6.9	52.8	0.63	0.72	0.63	36.8
12	R2	All MCs	24	10.0	24	10.0		0.212	51.7	LOS D	1.1	8.4	0.98	0.71	0.98	25.3
Approach			309	10.0	309	10.0		0.369	18.6	LOS B	6.9	52.8	0.66	0.72	0.66	39.0
All Vehicles			2516	7.8	2516	7.8		0.856	33.1	LOS C	31.5	231.8	0.89	0.86	0.98	31.5

The phase sequence proposed for the intersection is a typical “variable phasing lead-lag right turns” sequence, as shown in Figure 8.

Figure 8: Proposed Phase Sequence – Te Rapa Rd / Access 2 Intersection

The Access 2 signalised intersection was modelled with two continuous approach and exit lanes on Te Rapa Road northern arm between Hutchinson Road roundabout and Access 2 due to the relatively short distance between the two intersections.

Although some of the turning movements from Te Rapa Road operate with an average delay of more than a minute during the peak periods in Stages 1 and 2, the volume of right / left turning vehicles are low, the 95th percentile back of queue distance is not significant and queued vehicles clear the intersection in one green phase in most cases.

The modelling results also indicate that average delay achieved by all approaches to the intersection during peak periods in all infrastructure stages are well within the guidance provided in Appendix 15 Table 15-2b of the District Plan (i.e. average delay not exceeding 55 seconds on strategic network major and minor arterial roads, and no greater than 80 seconds for all other transport corridors).

2.4.3 Te Rapa Road / Hutchinson Road Roundabout

The existing roundabout configuration modelled in SIDRA is illustrated in Figure 9, and Figure 10 demonstrates the update proposed with four-lanes on the southern arm of the roundabout to connect to the Access 2 intersection to the south as part of Infrastructure Stage 2. The intersection performance results for all infrastructure stages during peak periods are presented in Table No: 14 to Table No: 19.

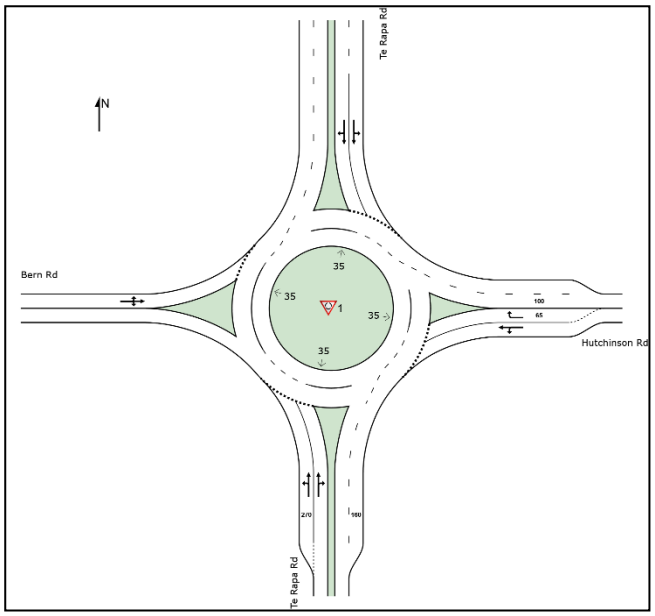


Figure 9: Existing Te Rapa Rd / Hutchinson Rd Roundabout Layout

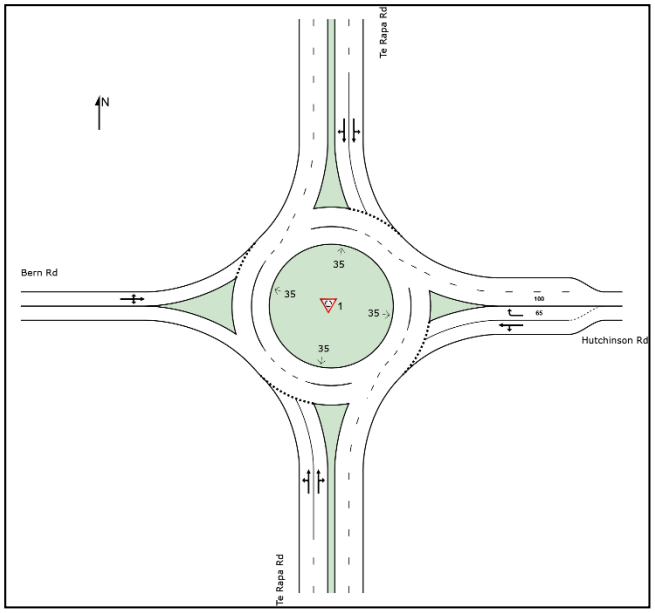


Figure 10: Four Lanes on Southern Arm of Te Rapa Rd / Hutchinson Rd Roundabout Layout

Table No: 14

2035 Baseline AM Peak – Te Rapa Rd / Hutchinson Rd RAB – Existing Layout Figure 9															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
1	L2	All MCs	1	0.0	1	0.0	0.194	2.7	LOS A	1.0	8.2	0.32	0.26	0.32	45.7

2	T1	All MCs	418	22.3	418	22.3	0.194	2.3	LOS A	1.0	8.2	0.32	0.30	0.32	46.9
3	R2	All MCs	48	4.1	48	4.1	0.194	8.1	LOS A	1.0	7.8	0.33	0.35	0.33	45.4
Approach			467	20.4	467	20.4	0.194	2.9	LOS A	1.0	8.2	0.32	0.30	0.32	46.8
East: Hutchinson Rd															
4	L2	All MCs	116	3.7	116	3.7	0.147	5.5	LOS A	0.6	4.2	0.59	0.65	0.59	45.6
5	T1	All MCs	1	0.0	1	0.0	0.147	4.4	LOS A	0.6	4.2	0.59	0.65	0.59	42.3
6	R2	All MCs	152	2.1	152	2.1	0.146	9.6	LOS A	0.6	4.3	0.57	0.74	0.57	41.5
Approach			268	2.8	268	2.8	0.147	7.8	LOS A	0.6	4.3	0.58	0.70	0.58	43.2
North: Te Rapa Rd															
7	L2	All MCs	141	2.9	141	2.9	0.384	2.4	LOS A	2.3	17.5	0.20	0.24	0.20	46.9
8	T1	All MCs	977	10.9	977	10.9	0.384	2.3	LOS A	2.3	17.5	0.20	0.23	0.20	47.7
9	R2	All MCs	1	0.0	1	0.0	0.384	7.7	LOS A	2.3	17.5	0.21	0.22	0.21	26.2
Approach			1119	9.9	1119	9.9	0.384	2.3	LOS A	2.3	17.5	0.20	0.23	0.20	47.6
West: Bern Rd															
10	L2	All MCs	4	25.0	4	25.0	0.012	4.4	LOS A	0.0	0.4	0.49	0.57	0.49	42.0
11	T1	All MCs	1	0.0	1	0.0	0.012	3.4	LOS A	0.0	0.4	0.49	0.57	0.49	41.0
12	R2	All MCs	4	25.0	4	25.0	0.012	10.4	LOS B	0.0	0.4	0.49	0.57	0.49	42.3
Approach			9	22.2	9	22.2	0.012	6.9	LOS A	0.0	0.4	0.49	0.57	0.49	42.1
All Vehicles			1864	11.5	1864	11.5	0.384	3.3	LOS A	2.3	17.5	0.29	0.32	0.29	46.8

Table No: 15

2035 Baseline PM Peak – Te Rapa Rd / Hutchinson Rd RAB – Existing Layout Figure 9															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
1	L2	All MCs	4	25.0	4	25.0	0.430	3.2	LOS A	2.8	20.7	0.41	0.28	0.41	44.3
2	T1	All MCs	971	8.5	971	8.5	0.430	2.5	LOS A	2.8	20.7	0.42	0.33	0.42	46.5
3	R2	All MCs	133	2.1	133	2.1	0.430	8.4	LOS A	2.7	20.0	0.43	0.39	0.43	45.1
Approach			1107	7.8	1107	7.8	0.430	3.2	LOS A	2.8	20.7	0.42	0.33	0.42	46.4
East: Hutchinson Rd															
4	L2	All MCs	86	2.9	86	2.9	0.104	4.6	LOS A	0.4	2.9	0.52	0.58	0.52	45.9
5	T1	All MCs	1	0.0	1	0.0	0.104	3.7	LOS A	0.4	2.9	0.52	0.58	0.52	42.8
6	R2	All MCs	174	1.3	174	1.3	0.155	9.0	LOS A	0.7	4.7	0.51	0.69	0.51	41.7
Approach			261	1.8	261	1.8	0.155	7.5	LOS A	0.7	4.7	0.51	0.65	0.51	43.0
North: Te Rapa Rd															
7	L2	All MCs	183	1.8	183	1.8	0.316	2.7	LOS A	1.8	13.4	0.31	0.30	0.31	46.2
8	T1	All MCs	643	12.2	643	12.2	0.316	2.4	LOS A	1.8	13.6	0.32	0.28	0.32	47.2
9	R2	All MCs	4	25.0	4	25.0	0.316	8.4	LOS A	1.8	13.6	0.33	0.27	0.33	25.7
Approach			831	10.0	831	10.0	0.316	2.5	LOS A	1.8	13.6	0.32	0.29	0.32	46.9
West: Bern Rd															
10	L2	All MCs	1	0.0	1	0.0	0.005	5.2	LOS A	0.0	0.1	0.64	0.60	0.64	41.7
11	T1	All MCs	1	0.0	1	0.0	0.005	4.8	LOS A	0.0	0.1	0.64	0.60	0.64	40.5
12	R2	All MCs	1	0.0	1	0.0	0.005	10.7	LOS B	0.0	0.1	0.64	0.60	0.64	42.3
Approach			3	0.0	3	0.0	0.005	6.9	LOS A	0.0	0.1	0.64	0.60	0.64	41.6
All Vehicles			2202	7.9	2202	7.9	0.430	3.4	LOS A	2.8	20.7	0.39	0.35	0.39	46.2

Table No: 16

2035 Stage 1 AM Peak – Te Rapa Rd / Hutchinson Rd RAB – Figure 10															
Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed

			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Te Rapa Rd															
1	L2	All MCs	1	0.0	1	0.0	0.208	2.7	LOS A	1.1	9.1	0.32	0.26	0.32	45.6
2	T1	All MCs	453	22.3	453	22.3	0.208	2.3	LOS A	1.1	9.1	0.33	0.30	0.33	46.9
3	R2	All MCs	48	4.1	48	4.1	0.208	8.1	LOS A	1.1	8.7	0.33	0.35	0.33	45.5
Approach			502	20.5	502	20.5	0.208	2.9	LOS A	1.1	9.1	0.33	0.30	0.33	46.8
East: Hutchinson Rd															
4	L2	All MCs	120	3.7	120	3.7	0.171	5.9	LOS A	0.7	5.0	0.64	0.71	0.64	45.0
5	T1	All MCs	1	0.0	1	0.0	0.171	5.2	LOS A	0.7	5.0	0.64	0.71	0.64	41.4
6	R2	All MCs	147	2.1	147	2.1	0.153	10.1	LOS B	0.7	4.7	0.62	0.77	0.62	41.3
Approach			268	2.8	268	2.8	0.171	8.2	LOS A	0.7	5.0	0.63	0.74	0.63	43.0
North: Te Rapa Rd															
7	L2	All MCs	141	2.9	141	2.9	0.465	2.5	LOS A	3.1	23.7	0.22	0.24	0.22	46.8
8	T1	All MCs	1218	10.9	1218	10.9	0.465	1.9	LOS A	3.1	23.8	0.23	0.23	0.23	47.6
9	R2	All MCs	1	0.0	1	0.0	0.465	7.7	LOS A	3.1	23.8	0.24	0.23	0.24	26.1
Approach			1360	10.0	1360	10.0	0.465	2.0	LOS A	3.1	23.8	0.23	0.23	0.23	47.5
West: Bern Rd															
10	L2	All MCs	4	25.0	4	25.0	0.012	4.5	LOS A	0.0	0.4	0.50	0.58	0.50	41.9
11	T1	All MCs	1	0.0	1	0.0	0.012	3.4	LOS A	0.0	0.4	0.50	0.58	0.50	40.9
12	R2	All MCs	4	25.0	4	25.0	0.012	10.0	LOS A	0.0	0.4	0.50	0.58	0.50	42.3
Approach			9	22.2	9	22.2	0.012	6.8	LOS A	0.0	0.4	0.50	0.58	0.50	42.0
All Vehicles			2140	11.6	2140	11.6	0.465	3.0	LOS A	3.1	23.8	0.30	0.31	0.30	46.8

Table No: 17

2035 Stage 1 PM Peak – Te Rapa Rd / Hutchinson Rd RAB – Figure 10

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
1	L2	All MCs	4	25.0	4	25.0	0.491	3.3	LOS A	3.4	25.2	0.43	0.29	0.43	44.1
2	T1	All MCs	1148	6.2	1148	6.2	0.491	2.5	LOS A	3.4	25.2	0.44	0.33	0.44	46.5
3	R2	All MCs	137	1.7	137	1.7	0.491	8.4	LOS A	3.3	24.4	0.45	0.38	0.45	45.0
Approach			1289	5.8	1289	5.8	0.491	3.1	LOS A	3.4	25.2	0.44	0.33	0.44	46.3
East: Hutchinson Rd															
4	L2	All MCs	91	3.0	91	3.0	0.110	4.5	LOS A	0.4	3.1	0.53	0.59	0.53	45.8
5	T1	All MCs	1	0.0	1	0.0	0.110	3.8	LOS A	0.4	3.1	0.53	0.59	0.53	42.7
6	R2	All MCs	169	0.9	169	0.9	0.153	9.1	LOS A	0.7	4.7	0.52	0.69	0.52	41.7
Approach			261	1.7	261	1.7	0.153	7.5	LOS A	0.7	4.7	0.53	0.66	0.53	43.1
North: Te Rapa Rd															
7	L2	All MCs	179	1.6	179	1.6	0.330	2.8	LOS A	1.9	14.2	0.32	0.30	0.32	46.2
8	T1	All MCs	694	9.1	694	9.1	0.330	2.3	LOS A	1.9	14.2	0.33	0.28	0.33	47.1
9	R2	All MCs	4	25.0	4	25.0	0.330	8.4	LOS A	1.9	14.2	0.34	0.27	0.34	25.7
Approach			877	7.7	877	7.7	0.330	2.4	LOS A	1.9	14.2	0.33	0.29	0.33	46.9
West: Bern Rd															
10	L2	All MCs	1	0.0	1	0.0	0.005	5.6	LOS A	0.0	0.1	0.67	0.62	0.67	41.3
11	T1	All MCs	1	0.0	1	0.0	0.005	5.2	LOS A	0.0	0.1	0.67	0.62	0.67	40.1
12	R2	All MCs	1	0.0	1	0.0	0.005	11.0	LOS B	0.0	0.1	0.67	0.62	0.67	42.0
Approach			3	0.0	3	0.0	0.005	7.3	LOS A	0.0	0.1	0.67	0.62	0.67	41.2
All Vehicles			2431	6.0	2431	6.0	0.491	3.3	LOS A	3.4	25.2	0.41	0.35	0.41	46.2

Table No: 18

2045 Stage 2 AM Peak – Te Rapa Rd / Hutchinson Rd RAB – Figure 10															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
1	L2	All MCs	1	0.0	1	0.0	0.259	3.2	LOS A	1.4	11.9	0.47	0.33	0.47	44.8
2	T1	All MCs	496	22.3	496	22.3	0.259	2.9	LOS A	1.4	11.9	0.47	0.37	0.47	46.3
3	R2	All MCs	58	4.1	58	4.1	0.259	8.7	LOS A	1.4	11.3	0.47	0.42	0.47	44.9
Approach			555	20.4	555	20.4	0.259	3.5	LOS A	1.4	11.9	0.47	0.37	0.47	46.2
East: Hutchinson Rd															
4	L2	All MCs	208	3.7	208	3.7	0.312	6.7	LOS A	1.4	10.0	0.70	0.77	0.72	44.6
5	T1	All MCs	1	0.0	1	0.0	0.312	5.9	LOS A	1.4	10.0	0.70	0.77	0.72	40.5
6	R2	All MCs	279	2.1	279	2.1	0.301	10.5	LOS B	1.4	10.2	0.69	0.80	0.69	41.1
Approach			488	2.8	488	2.8	0.312	8.9	LOS A	1.4	10.2	0.69	0.79	0.70	42.6
North: Te Rapa Rd															
7	L2	All MCs	168	2.9	168	2.9	0.500	2.5	LOS A	3.7	28.0	0.26	0.25	0.26	46.5
8	T1	All MCs	1275	10.9	1275	10.9	0.500	2.0	LOS A	3.7	28.0	0.27	0.24	0.27	47.4
9	R2	All MCs	1	0.0	1	0.0	0.500	7.8	LOS A	3.7	28.0	0.28	0.24	0.28	26.0
Approach			1444	9.9	1444	9.9	0.500	2.1	LOS A	3.7	28.0	0.27	0.24	0.27	47.3
West: Bern Rd															
10	L2	All MCs	4	25.0	4	25.0	0.014	5.1	LOS A	0.1	0.4	0.57	0.62	0.57	41.4
11	T1	All MCs	1	0.0	1	0.0	0.014	4.0	LOS A	0.1	0.4	0.57	0.62	0.57	40.3
12	R2	All MCs	4	25.0	4	25.0	0.014	10.6	LOS B	0.1	0.4	0.57	0.62	0.57	41.8
Approach			9	22.2	9	22.2	0.014	7.5	LOS A	0.1	0.4	0.57	0.62	0.57	41.5
All Vehicles			2497	10.9	2497	10.9	0.500	3.7	LOS A	3.7	28.0	0.40	0.38	0.40	46.1

Table No: 19

2045 Stage 2 PM Peak – Te Rapa Rd / Hutchinson Rd RAB – Figure 10															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
1	L2	All MCs	4	25.0	4	25.0	0.633	3.7	LOS A	5.4	39.6	0.56	0.33	0.56	43.4
2	T1	All MCs	1393	6.2	1393	6.2	0.633	2.9	LOS A	5.4	39.6	0.57	0.37	0.57	45.9
3	R2	All MCs	237	1.7	237	1.7	0.633	8.9	LOS A	5.2	38.2	0.58	0.45	0.58	44.4
Approach			1634	5.6	1634	5.6	0.633	3.7	LOS A	5.4	39.6	0.57	0.38	0.57	45.7
East: Hutchinson Rd															
4	L2	All MCs	95	3.0	95	3.0	0.123	4.7	LOS A	0.5	3.7	0.57	0.61	0.57	45.7
5	T1	All MCs	1	0.0	1	0.0	0.123	4.0	LOS A	0.5	3.7	0.57	0.61	0.57	42.5
6	R2	All MCs	194	0.9	194	0.9	0.184	9.3	LOS A	0.9	6.1	0.57	0.71	0.57	41.5
Approach			289	1.6	289	1.6	0.184	7.8	LOS A	0.9	6.1	0.57	0.68	0.57	42.8
North: Te Rapa Rd															
7	L2	All MCs	285	1.6	285	1.6	0.416	3.3	LOS A	2.7	20.0	0.48	0.38	0.48	45.5
8	T1	All MCs	720	9.1	720	9.1	0.416	2.9	LOS A	2.7	20.0	0.49	0.36	0.49	46.5
9	R2	All MCs	4	25.0	4	25.0	0.416	9.1	LOS A	2.6	19.8	0.50	0.35	0.50	25.4
Approach			1009	7.1	1009	7.1	0.416	3.0	LOS A	2.7	20.0	0.49	0.37	0.49	46.2
West: Bern Rd															
10	L2	All MCs	1	0.0	1	0.0	0.006	7.0	LOS A	0.0	0.2	0.76	0.68	0.76	40.4
11	T1	All MCs	1	0.0	1	0.0	0.006	6.6	LOS A	0.0	0.2	0.76	0.68	0.76	38.9
12	R2	All MCs	1	0.0	1	0.0	0.006	12.4	LOS B	0.0	0.2	0.76	0.68	0.76	41.1
Approach			3	0.0	3	0.0	0.006	8.7	LOS A	0.0	0.2	0.76	0.68	0.76	40.3

All Vehicles	2936	5.7	2936	5.7	0.633	3.9	LOS A	5.4	39.6	0.54	0.41	0.54	45.6

The modelling assessment indicates that the roundabout will continue to operate well within its practical capacity in all infrastructure stages.

2.4.4 Te Rapa Road / McKee Street Signalised Intersection

The Te Rapa Road / McKee Street intersection is to be upgraded to signal control as part of the effects mitigation by Te Awa Lakes development[1]. Figure 11 illustrate the intersection layout that were modelled by Stantec in the Te Awa Lakes Land Development Plan Application ITA (dated 17 March 2021) to support the full land development consent by Te Awa Lakes. This includes an extra southbound exit lane and a northbound through movement lane on Te Rapa Road.

Table No: 20 to Table No: 25 present the intersection performance results based on the latest WRTM outputs.

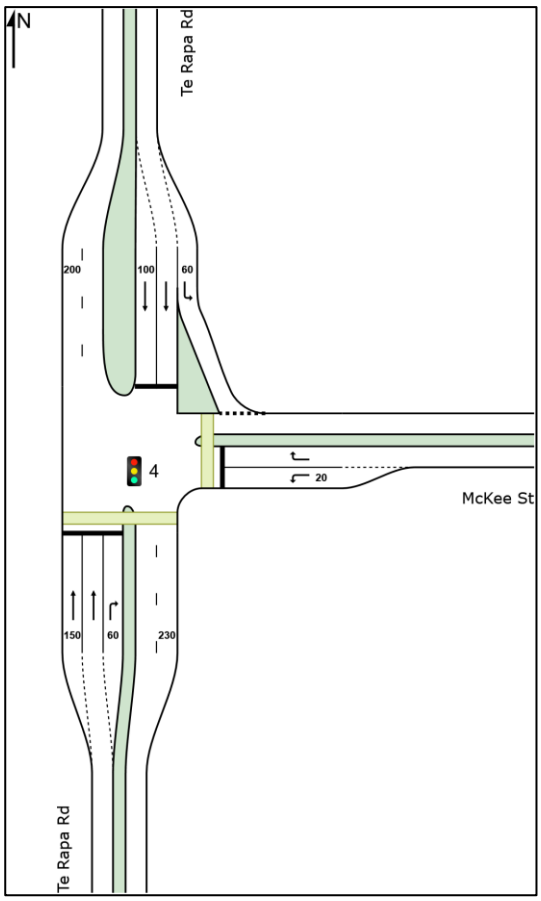


Figure 11: Te Rapa Rd / McKee St Signalised Intersection Layout – Te Awa Lakes

Table No: 20

2035 Baseline AM Peak – Te Rapa Rd / McKee St – Te Awa Lakes Layout														
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h

[1] Rule 3.8.5.3.1(a)(i) in the Hamilton City Operative District Plan and Condition 72(i) in resource consent number 010.2021.00011468.006

South: Te Rapa Rd															
2	T1	All MCs	295	17.9	295	17.9		0.162	7.5	LOS A	2.1	16.7	0.55	0.45	0.55	44.0
3	R2	All MCs	152	9.9	152	9.9	*	0.674	31.8	LOS C	4.3	32.3	1.00	0.87	1.16	21.4
Approach			446	15.1	446	15.1		0.674	15.8	LOS B	4.3	32.3	0.71	0.59	0.76	36.6
East: McKee St															
4	L2	All MCs	60	17.0	60	17.0		0.072	13.4	LOS B	0.8	6.6	0.54	0.66	0.54	31.7
6	R2	All MCs	213	14.4	213	14.4	*	0.492	24.8	LOS C	5.0	39.1	0.90	0.79	0.90	31.7
Approach			273	14.9	273	14.9		0.492	22.3	LOS C	5.0	39.1	0.82	0.76	0.82	31.2
North: Te Rapa Rd															
7	L2	All MCs	372	7.9	372	7.9		0.288	6.3	LOS A	2.4	17.8	0.38	0.61	0.38	42.1
8	T1	All MCs	696	9.0	696	9.0	*	0.673	20.3	LOS C	8.7	65.7	0.94	0.84	1.00	36.5
Approach			1067	8.6	1067	8.6		0.673	15.4	LOS B	8.7	65.7	0.75	0.76	0.78	38.0
All Vehicles			1786	11.2	1786	11.2		0.674	16.5	LOS B	8.7	65.7	0.75	0.72	0.78	36.7

Table No: 21

2035 Baseline PM Peak – Te Rapa Rd / McKee St – Te Awa Lakes Layout

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
2	T1	All MCs	679	6.1	679	6.1		0.428	13.2	LOS B	6.8	50.2	0.75	0.64	0.75	40.5
3	R2	All MCs	119	10.3	119	10.3	*	0.653	34.3	LOS C	3.6	27.1	1.00	0.85	1.15	20.5
Approach			798	6.7	798	6.7		0.653	16.3	LOS B	6.8	50.2	0.79	0.67	0.81	37.7
East: McKee St																
4	L2	All MCs	184	10.1	184	10.1		0.182	19.0	LOS B	2.4	18.4	0.50	0.68	0.50	33.1
6	R2	All MCs	424	5.8	424	5.8	*	0.800	35.6	LOS D	12.4	91.4	0.96	0.96	1.17	30.3
Approach			608	7.1	608	7.1		0.800	30.6	LOS C	12.4	91.4	0.82	0.88	0.96	27.2
North: Te Rapa Rd																
7	L2	All MCs	294	7.0	294	7.0		0.218	5.9	LOS A	1.6	12.2	0.32	0.59	0.32	42.4
8	T1	All MCs	463	9.9	463	9.9	*	0.594	23.2	LOS C	6.1	46.6	0.95	0.79	0.97	35.1
Approach			757	8.8	757	8.8		0.594	16.5	LOS B	6.1	46.6	0.71	0.72	0.72	37.3
All Vehicles			2163	7.6	2163	7.6		0.800	20.4	LOS C	12.4	91.4	0.77	0.75	0.82	34.5

Table No: 22

2035 Stage 1 AM Peak – Te Rapa Rd / McKee St – Te Awa Lakes Layout

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
2	T1	All MCs	409	17.9	409	17.9		0.214	7.4	LOS A	3.0	24.0	0.55	0.46	0.55	44.1
3	R2	All MCs	168	9.9	168	9.9	*	0.692	32.9	LOS C	5.0	37.7	1.00	0.88	1.16	21.0
Approach			578	15.5	578	15.5		0.692	14.8	LOS B	5.0	37.7	0.68	0.58	0.73	37.5
East: McKee St																
4	L2	All MCs	74	17.0	74	17.0		0.090	17.3	LOS B	1.1	8.8	0.56	0.67	0.56	31.1
6	R2	All MCs	235	14.4	235	14.4	*	0.607	30.6	LOS C	6.1	48.1	0.94	0.82	0.96	30.6
Approach			308	15.0	308	15.0		0.607	27.4	LOS C	6.1	48.1	0.85	0.79	0.87	28.8
North: Te Rapa Rd																
7	L2	All MCs	396	7.8	396	7.8		0.307	6.5	LOS A	2.8	20.9	0.38	0.62	0.38	41.9
8	T1	All MCs	765	9.0	765	9.0	*	0.689	20.7	LOS C	10.0	75.7	0.94	0.84	1.00	36.3
Approach			1161	8.6	1161	8.6		0.689	15.9	LOS B	10.0	75.7	0.75	0.77	0.79	37.8

All Vehicles	2047	11.5	2047	11.5	0.692	17.3	LOS B	10.0	75.7	0.74	0.72	0.78	36.3

Table No: 23

2035 Stage 1 PM Peak – Te Rapa Rd / McKee St – Te Awa Lakes Layout

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
2	T1	All MCs	766	6.1	766	6.1		0.474	13.1	LOS B	7.7	56.6	0.76	0.66	0.76	40.6
3	R2	All MCs	151	10.3	151	10.3	*	0.812	36.9	LOS D	4.8	36.2	1.00	0.99	1.42	19.6
Approach			917	6.8	917	6.8		0.812	17.0	LOS B	7.7	56.6	0.80	0.71	0.87	37.3
East: McKee St																
4	L2	All MCs	203	10.1	203	10.1		0.203	19.4	LOS B	2.7	20.6	0.51	0.68	0.51	32.9
6	R2	All MCs	422	5.8	422	5.8	*	0.841	39.0	LOS D	13.2	97.1	0.98	1.02	1.29	29.0
Approach			625	7.2	625	7.2		0.841	32.7	LOS C	13.2	97.1	0.83	0.91	1.04	26.3
North: Te Rapa Rd																
7	L2	All MCs	323	7.0	323	7.0		0.245	6.2	LOS A	2.0	14.9	0.35	0.60	0.35	42.2
8	T1	All MCs	573	9.9	573	9.9	*	0.722	24.9	LOS C	8.0	61.0	0.98	0.90	1.12	34.4
Approach			896	8.9	896	8.9		0.722	18.1	LOS B	8.0	61.0	0.75	0.79	0.84	36.5
All Vehicles			2438	7.7	2438	7.7		0.841	21.4	LOS C	13.2	97.1	0.79	0.79	0.90	34.0

Table No: 24

2045 Stage 2 AM Peak – Te Rapa Rd / McKee St – Te Awa Lakes Layout

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
2	T1	All MCs	364	17.9	364	17.9		0.200	7.7	LOS A	2.6	21.1	0.57	0.47	0.57	43.9
3	R2	All MCs	189	9.9	189	9.9	*	0.737	32.0	LOS C	5.4	41.2	1.00	0.92	1.23	21.3
Approach			554	15.1	554	15.1		0.737	16.0	LOS B	5.4	41.2	0.72	0.63	0.79	36.4
East: McKee St																
4	L2	All MCs	84	17.0	84	17.0		0.097	14.9	LOS B	1.1	9.1	0.53	0.67	0.53	32.0
6	R2	All MCs	237	14.4	237	14.4	*	0.578	27.3	LOS C	5.7	44.8	0.92	0.80	0.92	31.5
Approach			321	15.0	321	15.0		0.578	24.0	LOS C	5.7	44.8	0.82	0.77	0.82	30.2
North: Te Rapa Rd																
7	L2	All MCs	384	7.9	384	7.9		0.306	6.6	LOS A	2.7	20.4	0.40	0.62	0.40	41.8
8	T1	All MCs	665	9.0	665	9.0	*	0.689	21.4	LOS C	8.5	64.5	0.96	0.86	1.04	35.9
Approach			1049	8.6	1049	8.6		0.689	16.0	LOS B	8.5	64.5	0.75	0.77	0.81	37.6
All Vehicles			1924	11.5	1924	11.5		0.737	17.3	LOS B	8.5	64.5	0.75	0.73	0.80	36.1

Table No: 25

2045 Stage 2 PM Peak – Te Rapa Rd / McKee St – Te Awa Lakes Layout

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
2	T1	All MCs	804	6.1	804	6.1		0.546	17.3	LOS B	9.9	73.2	0.83	0.71	0.83	38.3
3	R2	All MCs	172	10.3	172	10.3	*	0.907	47.2	LOS D	6.7	51.3	1.00	1.14	1.67	16.9
Approach			976	6.8	976	6.8		0.907	22.5	LOS C	9.9	73.2	0.86	0.79	0.97	34.4
East: McKee St																

4	L2	All MCs	233	10.1	233	10.1	0.213	21.1	LOS C	3.1	23.8	0.46	0.67	0.46	33.5
6	R2	All MCs	512	5.8	512	5.8 *	0.890	48.3	LOS D	19.9	146.4	0.99	1.08	1.37	26.6
Approach			744	7.1	744	7.1	0.890	39.8	LOS D	19.9	146.4	0.83	0.95	1.08	24.0
North: Te Rapa Rd															
7	L2	All MCs	341	7.0	341	7.0	0.247	6.0	LOS A	2.1	15.7	0.31	0.59	0.31	42.4
8	T1	All MCs	460	9.9	460	9.9 *	0.663	28.1	LOS C	7.1	54.3	0.98	0.85	1.05	33.0
Approach			801	8.7	801	8.7	0.663	18.7	LOS B	7.1	54.3	0.69	0.74	0.73	36.0
All Vehicles			2521	7.5	2521	7.5	0.907	26.4	LOS C	19.9	146.4	0.80	0.82	0.93	31.6

Although the modelling assessment indicates that the Te Rapa Road / McKee Street signalised intersection will operate well within its practical capacity in all infrastructure stages, the 95th percentile queue distance achieved on McKee Street is significant in all infrastructure stages during the PM peak period. The 95th percentile queue distance extends beyond the existing McKee Street / Maui Street roundabout which is approximately 90 m from the Te Rapa Road signalised intersection.

The capacity and efficiency of the Te Rapa Road / McKee Street signalised intersection can be improved by modifying the left turn lane on McKee Street to a shared left turn and right turn lane as shown in Figure 12. Table No: 26 to Table No: 28 present the improved intersection performance results during the PM peak period with the modified lane configuration.

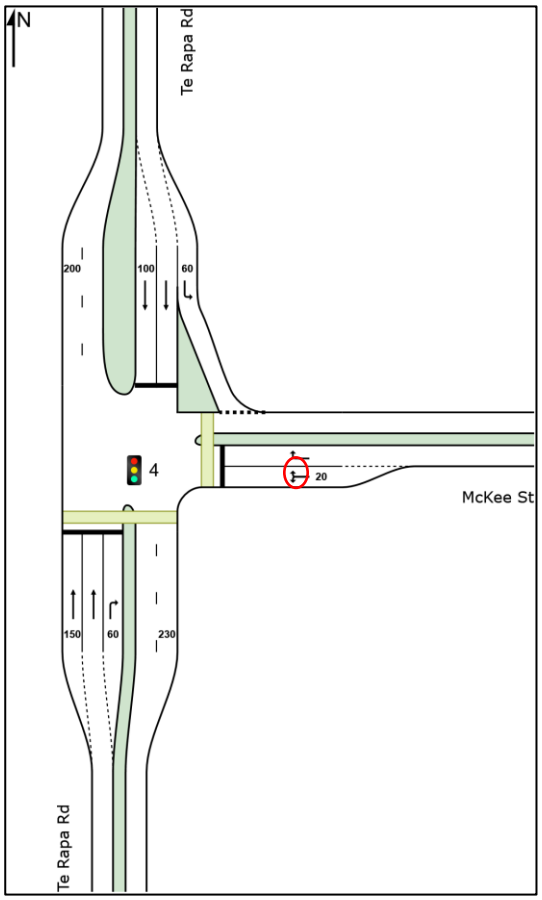


Figure 12: Te Rapa Rd / McKee St Signalised Intersection Layout – Modified

Table No: 26

2035 Baseline PM Peak – Te Rapa Rd / McKee St – Figure 12																
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h

South: Te Rapa Rd															
2	T1	All MCs	679	6.1	679	6.1	0.384	9.5	LOS A	5.4	39.6	0.69	0.59	0.69	42.7
3	R2	All MCs	119	10.3	119	10.3	* 0.561	28.8	LOS C	3.0	22.6	0.99	0.80	1.05	22.5
Approach			798	6.7	798	6.7	0.561	12.4	LOS B	5.4	39.6	0.73	0.62	0.74	40.0
East: McKee St															
4	L2	All MCs	184	10.1	184	10.1	0.670	18.9	LOS B	7.2	53.8	0.90	0.86	0.98	26.2
6	R2	All MCs	424	5.8	424	5.8	* 0.670	28.4	LOS C	7.2	53.8	0.92	0.86	1.01	32.5
Approach			608	7.1	608	7.1	0.670	25.5	LOS C	7.2	53.8	0.92	0.86	1.00	29.3
North: Te Rapa Rd															
7	L2	All MCs	294	7.0	294	7.0	0.227	6.1	LOS A	1.6	12.0	0.37	0.61	0.37	42.2
8	T1	All MCs	463	9.9	463	9.9	* 0.557	19.2	LOS B	5.2	39.4	0.94	0.77	0.94	37.0
Approach			757	8.8	757	8.8	0.557	14.2	LOS B	5.2	39.4	0.72	0.71	0.72	38.6
All Vehicles			2163	7.6	2163	7.6	0.670	16.7	LOS B	7.2	53.8	0.78	0.72	0.81	36.5

Table No: 27

2035 Stage 1 PM Peak – Te Rapa Rd / McKee St – Figure 12

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
2	T1	All MCs	766	6.1	766	6.1		0.433	9.9	LOS A	6.3	46.1	0.71	0.61	0.71	42.6
3	R2	All MCs	151	10.3	151	10.3	*	0.710	30.4	LOS C	4.0	30.1	1.00	0.90	1.24	21.9
Approach			917	6.8	917	6.8		0.710	13.3	LOS B	6.3	46.1	0.76	0.66	0.80	39.4
East: McKee St																
4	L2	All MCs	203	10.1	203	10.1		0.696	20.2	LOS C	7.6	57.4	0.91	0.88	1.02	25.8
6	R2	All MCs	422	5.8	422	5.8	*	0.696	29.7	LOS C	7.6	57.4	0.93	0.88	1.06	32.1
Approach			625	7.2	625	7.2		0.696	26.6	LOS C	7.6	57.4	0.93	0.88	1.05	28.7
North: Te Rapa Rd																
7	L2	All MCs	323	7.0	323	7.0		0.255	6.4	LOS A	2.0	14.5	0.39	0.62	0.39	42.0
8	T1	All MCs	573	9.9	573	9.9	*	0.689	21.1	LOS C	6.9	52.5	0.97	0.87	1.08	36.1
Approach			896	8.9	896	8.9		0.689	15.8	LOS B	6.9	52.5	0.76	0.78	0.83	37.8
All Vehicles			2438	7.7	2438	7.7		0.710	17.6	LOS B	7.6	57.4	0.80	0.76	0.87	36.0

Table No: 28

2045 Stage 2 PM Peak – Te Rapa Rd / McKee St – Figure 12

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
2	T1	All MCs	804	6.1	804	6.1		0.482	11.9	LOS B	7.4	54.7	0.76	0.65	0.76	41.4
3	R2	All MCs	172	10.3	172	10.3	*	0.859	36.8	LOS D	5.3	40.2	1.00	1.07	1.57	19.7
Approach			976	6.8	976	6.8		0.859	16.3	LOS B	7.4	54.7	0.80	0.73	0.90	37.7
East: McKee St																
4	L2	All MCs	233	10.1	233	10.1		0.850	30.5	LOS C	12.3	92.3	0.97	1.04	1.35	22.0
6	R2	All MCs	512	5.8	512	5.8	*	0.850	40.6	LOS D	12.3	92.3	0.98	1.06	1.39	28.8
Approach			744	7.1	744	7.1		0.850	37.5	LOS D	12.3	92.3	0.98	1.05	1.38	24.8
North: Te Rapa Rd																
7	L2	All MCs	341	7.0	341	7.0		0.257	6.1	LOS A	1.9	14.1	0.36	0.61	0.36	42.3
8	T1	All MCs	460	9.9	460	9.9	*	0.587	21.2	LOS C	5.6	42.4	0.95	0.79	0.97	36.0

Approach	801	8.7	801	8.7	0.587	14.8	LOS B	5.6	42.4	0.70	0.71	0.71	38.2
All Vehicles	2521	7.5	2521	7.5	0.859	22.1	LOS C	12.3	92.3	0.82	0.82	0.98	33.6

Additional intersection modelling was undertaken to understand the land area that could be developed if the Plan Change Area was to be serviced by only the proposed Access 1 intersection (i.e. Ruffell Road / Old Ruffell Road intersection). The 2035 baseline scenario traffic flows, and manual distribution of the trips generated by PC17 based on turning movement percentages obtained from the 2035 Stage 1 WRTM outputs indicated that approximately **20 ha (net)** of PC17 can be serviced by a single access.

Table No: 29 and Table No: 30 below present the intersection performance of Te Rapa Road / McKee Street intersection with 20 ha of PC17 developed. Although the LOS for northbound through movements on Te Rapa Road is LOS D in the PM peak period, the average delay achieved is 0.3 seconds per vehicle greater than the delay threshold for LOS C (i.e. 35 seconds per vehicle).

Table No: 29

2035 AM Peak – Te Rapa Rd / McKee St – 20ha of PC17

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
2	T1	All MCs	313	17.9	313	17.9		0.169	7.4	LOS A	2.2	17.8	0.55	0.45	0.55	44.1
3	R2	All MCs	160	9.9	160	9.9	*	0.725	33.2	LOS C	4.7	35.5	1.00	0.91	1.23	20.8
Approach			473	15.1	473	15.1		0.725	16.1	LOS B	4.7	35.5	0.70	0.61	0.78	36.3
East: McKee St																
4	L2	All MCs	66	17.0	66	17.0		0.081	14.3	LOS B	0.9	7.6	0.56	0.67	0.56	31.3
6	R2	All MCs	213	14.4	213	14.4	*	0.507	25.8	LOS C	5.1	40.2	0.90	0.79	0.90	31.4
Approach			279	15.0	279	15.0		0.507	23.1	LOS C	5.1	40.2	0.82	0.76	0.82	30.7
North: Te Rapa Rd																
7	L2	All MCs	372	7.9	372	7.9		0.288	6.3	LOS A	2.4	18.1	0.37	0.61	0.37	42.1
8	T1	All MCs	772	9.0	772	9.0	*	0.712	21.0	LOS C	10.1	75.8	0.95	0.87	1.04	36.2
Approach			1143	8.6	1143	8.6		0.712	16.2	LOS B	10.1	75.8	0.76	0.79	0.82	37.7
All Vehicles			1895	11.2	1895	11.2		0.725	17.2	LOS B	10.1	75.8	0.76	0.74	0.81	36.4

Table No: 30

2035 PM Peak – Te Rapa Rd / McKee St – 20ha of PC17

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
2	T1	All MCs	748	6.1	748	6.1		0.471	13.6	LOS B	7.7	56.7	0.77	0.66	0.77	40.3
3	R2	All MCs	132	10.3	132	10.3	*	0.722	35.3	LOS D	4.0	30.7	1.00	0.90	1.24	20.2
Approach			880	6.7	880	6.7		0.722	16.8	LOS B	7.7	56.7	0.80	0.70	0.84	37.5
East: McKee St																
4	L2	All MCs	194	10.1	194	10.1		0.191	19.1	LOS B	2.6	19.5	0.50	0.68	0.50	33.0
6	R2	All MCs	424	5.8	424	5.8	*	0.810	36.3	LOS D	12.6	92.9	0.96	0.97	1.19	30.0
Approach			618	7.2	618	7.2		0.810	30.9	LOS C	12.6	92.9	0.82	0.88	0.97	27.0
North: Te Rapa Rd																
7	L2	All MCs	294	7.0	294	7.0		0.220	6.1	LOS A	1.8	13.1	0.33	0.60	0.33	42.3
8	T1	All MCs	487	9.9	487	9.9	*	0.625	23.6	LOS C	6.6	49.8	0.96	0.82	1.00	34.9
Approach			781	8.8	781	8.8		0.625	17.0	LOS B	6.6	49.8	0.72	0.73	0.75	37.0

All Vehicles	2279	7.6	2279	7.6	0.810	20.7	LOS C	12.6	92.9	0.78	0.76	0.85	34.4

2.4.5 Te Rapa Road / Ruffell Road Signalised Intersection

The modelling of this intersection was based on the existing phase sequence provided by HCC. The intersection performance results presented below are based on the existing intersection layout (Figure 13) and the latest WRTM outputs.

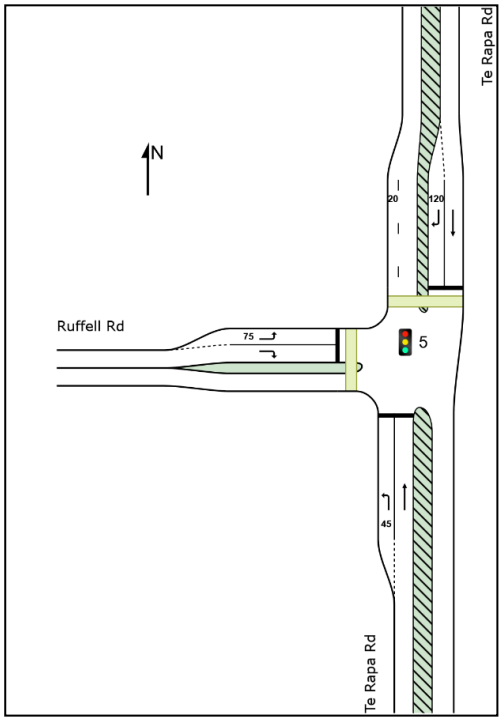


Figure 13: Existing Te Rapa Rd / Ruffell Road Signalised Intersection Layout

Table No: 31

2035 Baseline AM Peak – Te Rapa Rd / Ruffell Rd – Existing Layout

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
1	L2	All MCs	163	4.0	163	4.0		0.121	7.4	LOS A	1.6	11.2	0.28	0.61	0.28	44.3
2	T1	All MCs	426	15.9	426	15.9	*	0.482	13.4	LOS B	10.2	81.0	0.71	0.62	0.71	42.4
Approach			589	12.6	589	12.6		0.482	11.7	LOS B	10.2	81.0	0.59	0.62	0.59	42.8
North: Te Rapa Rd																
8	T1	All MCs	692	11.0	692	11.0		0.568	7.3	LOS A	13.5	103.2	0.58	0.53	0.58	45.5
9	R2	All MCs	64	6.5	64	6.5	*	0.453	42.5	LOS D	2.4	17.7	0.99	0.75	0.99	30.8
Approach			756	10.6	756	10.6		0.568	10.3	LOS B	13.5	103.2	0.62	0.55	0.62	43.8
West: Ruffell Rd																
10	L2	All MCs	21	8.2	21	8.2		0.036	22.3	LOS C	0.5	3.8	0.70	0.67	0.70	37.3
12	R2	All MCs	42	7.9	42	7.9	*	0.136	33.2	LOS C	1.3	9.9	0.88	0.72	0.88	33.5
Approach			63	8.0	63	8.0		0.136	29.6	LOS C	1.3	9.9	0.82	0.70	0.82	34.7
All Vehicles			1408	11.3	1408	11.3		0.568	11.7	LOS B	13.5	103.2	0.62	0.58	0.62	42.8

Table No: 32

2035 Baseline PM Peak – Te Rapa Rd / Ruffell Rd – Existing Layout

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
1	L2	All MCs	77	3.7	77	3.7		0.053	13.1	LOS B	0.7	5.0	0.21	0.59	0.21	44.7
2	T1	All MCs	720	6.7	720	6.7	*	0.684	20.5	LOS C	22.2	164.6	0.74	0.67	0.74	42.0
Approach			797	6.5	797	6.5		0.684	19.8	LOS B	22.2	164.6	0.69	0.67	0.69	39.2
North: Te Rapa Rd																
8	T1	All MCs	608	10.0	608	10.0		0.457	5.7	LOS A	11.3	86.2	0.45	0.41	0.45	46.4
9	R2	All MCs	38	7.1	38	7.1	*	0.338	52.9	LOS D	1.8	13.2	0.99	0.73	0.99	28.2
Approach			646	9.9	646	9.9		0.457	8.5	LOS A	11.3	86.2	0.48	0.43	0.48	44.7
West: Ruffell Rd																
10	L2	All MCs	78	5.6	78	5.6		0.159	31.9	LOS C	2.7	19.7	0.79	0.73	0.79	33.8
12	R2	All MCs	157	3.8	157	3.8	*	0.576	45.7	LOS D	6.9	49.7	0.98	0.80	0.98	30.0
Approach			235	4.4	235	4.4		0.576	41.1	LOS D	6.9	49.7	0.92	0.78	0.92	31.2
All Vehicles			1678	7.5	1678	7.5		0.684	18.4	LOS B	22.2	164.6	0.64	0.59	0.64	39.7

Table No: 33

2035 Stage 1 AM Peak – Te Rapa Rd / Ruffell Rd – Existing Layout

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
1	L2	All MCs	297	4.0	297	4.0		0.218	12.8	LOS B	3.4	24.8	0.30	0.63	0.30	44.1
2	T1	All MCs	540	15.9	540	15.9	*	0.719	21.8	LOS C	17.1	136.1	0.82	0.73	0.82	40.8
Approach			837	11.7	837	11.7		0.719	18.6	LOS B	17.1	136.1	0.63	0.70	0.64	39.5
North: Te Rapa Rd																
8	T1	All MCs	718	11.0	718	11.0		0.562	7.0	LOS A	14.8	113.3	0.54	0.49	0.54	45.7
9	R2	All MCs	121	6.5	121	6.5	*	0.736	49.7	LOS D	5.4	40.0	1.00	0.90	1.20	29.0
Approach			839	10.3	839	10.3		0.736	13.1	LOS B	14.8	113.3	0.61	0.55	0.64	42.2
West: Ruffell Rd																
10	L2	All MCs	39	8.2	39	8.2		0.068	25.6	LOS C	1.1	8.3	0.72	0.69	0.72	36.0
12	R2	All MCs	71	7.9	71	7.9	*	0.244	38.9	LOS D	2.6	19.6	0.91	0.75	0.91	31.8
Approach			109	8.0	109	8.0		0.244	34.2	LOS C	2.6	19.6	0.84	0.73	0.84	33.2
All Vehicles			1785	10.8	1785	10.8		0.736	17.0	LOS B	17.1	136.1	0.63	0.63	0.65	40.3

Table No: 34

2035 Stage 1 PM Peak – Te Rapa Rd / Ruffell Rd – Existing Layout

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
1	L2	All MCs	132	3.7	132	3.7		0.093	16.5	LOS B	1.2	8.8	0.23	0.60	0.23	44.6
2	T1	All MCs	776	6.7	776	6.7	*	0.839	33.1	LOS C	31.2	230.8	0.91	0.89	0.99	37.9
Approach			907	6.3	907	6.3		0.839	30.7	LOS C	31.2	230.8	0.81	0.85	0.88	35.1
North: Te Rapa Rd																
8	T1	All MCs	711	10.0	711	10.0		0.563	7.7	LOS A	15.6	118.6	0.56	0.51	0.56	45.2
9	R2	All MCs	65	7.1	65	7.1	*	0.550	51.2	LOS D	3.0	22.0	1.00	0.78	1.04	28.6
Approach			776	9.8	776	9.8		0.563	11.4	LOS B	15.6	118.6	0.60	0.53	0.60	43.2
West: Ruffell Rd																

10	L2	All MCs	141	5.6	141	5.6		0.252	28.7	LOS C	4.5	33.2	0.78	0.75	0.78	34.9
12	R2	All MCs	280	3.8	280	3.8	*	0.852	50.3	LOS D	13.4	97.1	1.00	1.00	1.27	28.9
Approach			421	4.4	421	4.4		0.852	43.1	LOS D	13.4	97.1	0.93	0.91	1.11	30.6
All Vehicles			2104	7.2	2104	7.2		0.852	26.0	LOS C	31.2	230.8	0.75	0.75	0.82	36.6

Table No: 35

2045 Stage 2 AM Peak – Te Rapa Rd / Ruffell Rd – Existing Layout

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
1	L2	All MCs	441	4.0	441	4.0		0.308	10.6	LOS B	5.1	36.6	0.28	0.63	0.28	44.4
2	T1	All MCs	520	15.9	520	15.9	*	0.682	17.4	LOS B	16.0	127.5	0.74	0.66	0.74	42.0
Approach			961	10.4	961	10.4		0.682	14.3	LOS B	16.0	127.5	0.53	0.64	0.53	41.3
North: Te Rapa Rd																
8	T1	All MCs	685	11.0	685	11.0		0.517	6.2	LOS A	13.7	104.7	0.48	0.44	0.48	46.1
9	R2	All MCs	64	6.5	64	6.5	*	0.569	54.2	LOS D	3.1	22.8	1.00	0.79	1.06	27.9
Approach			749	10.6	749	10.6		0.569	10.3	LOS B	13.7	104.7	0.53	0.47	0.53	43.7
West: Ruffell Rd																
10	L2	All MCs	34	8.2	34	8.2		0.070	31.1	LOS C	1.1	8.4	0.76	0.70	0.76	34.1
12	R2	All MCs	135	7.9	135	7.9	*	0.509	45.3	LOS D	5.8	43.7	0.97	0.79	0.97	30.1
Approach			168	8.0	168	8.0		0.509	42.4	LOS D	5.8	43.7	0.93	0.77	0.93	30.8
All Vehicles			1879	10.3	1879	10.3		0.682	15.2	LOS B	16.0	127.5	0.56	0.59	0.56	41.0

Table No: 36

2045 Stage 2 PM Peak – Te Rapa Rd / Ruffell Rd – Existing Layout

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
1	L2	All MCs	204	3.7	204	3.7		0.135	25.3	LOS C	2.0	14.2	0.18	0.59	0.18	44.9
2	T1	All MCs	858	6.7	858	6.7	*	0.983	86.0	LOS F	68.0	503.3	1.00	1.25	1.35	26.1
Approach			1062	6.2	1062	6.2		0.983	74.3	LOS E	68.0	503.3	0.84	1.13	1.12	24.7
North: Te Rapa Rd																
8	T1	All MCs	639	10.0	639	10.0		0.527	11.4	LOS B	19.2	145.7	0.57	0.52	0.57	43.3
9	R2	All MCs	54	7.1	54	7.1	*	0.612	69.6	LOS E	3.3	24.7	1.00	0.80	1.09	24.9
Approach			693	9.8	693	9.8		0.612	15.9	LOS B	19.2	145.7	0.60	0.54	0.61	41.0
West: Ruffell Rd																
10	L2	All MCs	118	5.6	118	5.6		0.195	43.4	LOS D	4.8	35.0	0.74	0.74	0.74	33.2
12	R2	All MCs	407	3.8	407	3.8	*	0.990	103.5	LOS F	33.1	239.1	1.00	1.18	1.52	21.3
Approach			525	4.2	525	4.2		0.990	90.0	LOS F	33.1	239.1	0.94	1.08	1.34	21.8
All Vehicles			2280	6.8	2280	6.8		0.990	60.2	LOS E	68.0	503.3	0.79	0.94	1.02	27.2

The modelling results indicate that significant delay is experienced by the right turn movements from Te Rapa Road and McKee Street during the PM peak period in Stage 2. This assessment identified that an additional northbound through lane is required at Te Rapa Road / Ruffell Road intersection in Stage 2. Considering that an additional southbound exit lane will be provided by Te Awa Lakes at the Te Rapa Road / McKee Street intersection, it is recommended that this lane be extended such that two full length approach lanes are provided at the Te Rapa Road / Ruffell Road intersection. Figure 14 illustrates the intersection layout required

for Stage 2 and the results of the intersection performance with the recommended upgrades to Te Rapa Road / Ruffell Road intersection are presented in Table No: 37 and Table No: 38.

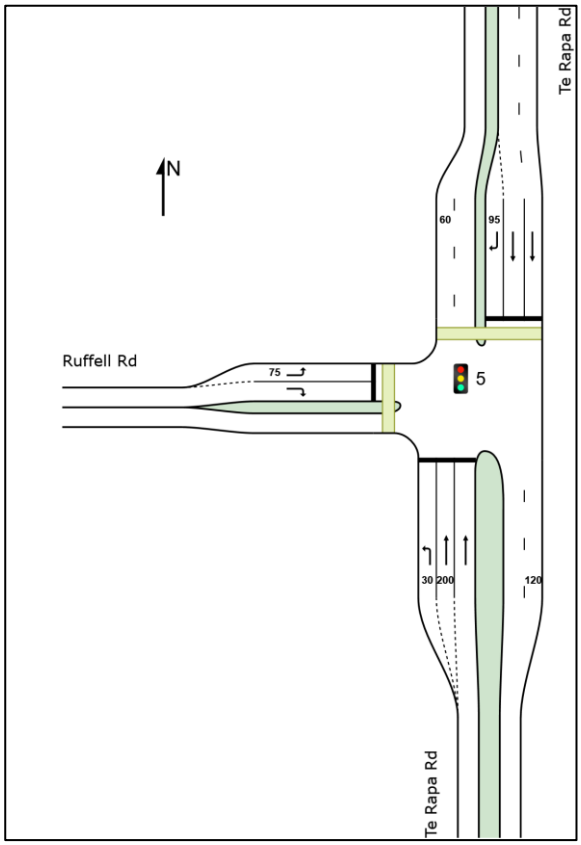


Figure 14: Te Rapa Rd / Ruffell Road Signalised Intersection Layout – Recommended Upgrades

Table No: 37

2045 Stage 2 AM Peak – Te Rapa Rd / Ruffell Rd – Recommended Upgrades																
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
1	L2	All MCs	441	4.0	441	4.0		0.350	8.3	LOS A	5.1	37.2	0.41	0.67	0.41	43.7
2	T1	All MCs	520	15.9	520	15.9	*	0.556	15.7	LOS B	9.3	73.8	0.80	0.68	0.80	41.2
Approach			961	10.4	961	10.4		0.556	12.3	LOS B	9.3	73.8	0.62	0.68	0.62	42.3
North: Te Rapa Rd																
8	T1	All MCs	685	11.0	685	11.0		0.393	7.5	LOS A	6.9	53.1	0.56	0.48	0.56	45.4
9	R2	All MCs	64	6.5	64	6.5	*	0.380	35.3	LOS D	2.0	14.6	0.98	0.75	0.98	32.9
Approach			749	10.6	749	10.6		0.393	9.9	LOS A	6.9	53.1	0.59	0.51	0.59	44.0
West: Ruffell Rd																
10	L2	All MCs	34	8.2	34	8.2		0.046	16.2	LOS B	0.6	4.5	0.62	0.66	0.62	39.8
12	R2	All MCs	135	7.9	135	7.9	*	0.339	27.2	LOS C	3.6	26.5	0.88	0.77	0.88	35.6
Approach			168	8.0	168	8.0		0.339	25.0	LOS C	3.6	26.5	0.83	0.75	0.83	36.4
All Vehicles			1879	10.3	1879	10.3		0.556	12.5	LOS B	9.3	73.8	0.63	0.61	0.63	42.3

Table No: 38

2045 Stage 2 PM Peak – Te Rapa Rd / Ruffell Rd – Recommended Upgrades																
Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed

			veh/h	%	veh/h	%		v/c	sec		veh	m				km/h
South: Te Rapa Rd																
1	L2	All MCs	204	3.7	204	3.7		0.150	7.1	LOS A	2.0	14.4	0.28	0.62	0.28	44.4
2	T1	All MCs	858	6.7	858	6.7	*	0.809	23.0	LOS C	23.1	171.2	0.88	0.83	0.95	38.1
Approach			1062	6.2	1062	6.2		0.809	20.0	LOS B	23.1	171.2	0.77	0.79	0.82	39.1
North: Te Rapa Rd																
8	T1	All MCs	639	10.0	639	10.0		0.370	9.7	LOS A	8.0	60.6	0.56	0.49	0.56	44.4
9	R2	All MCs	54	7.1	54	7.1	*	0.396	44.0	LOS D	2.1	15.4	0.99	0.74	0.99	30.4
Approach			693	9.8	693	9.8		0.396	12.3	LOS B	8.0	60.6	0.59	0.51	0.59	42.9
West: Ruffell Rd																
10	L2	All MCs	118	5.6	118	5.6		0.157	19.5	LOS B	2.7	19.9	0.65	0.71	0.65	38.6
12	R2	All MCs	407	3.8	407	3.8	*	0.826	39.0	LOS D	16.4	118.7	1.00	0.96	1.19	31.9
Approach			525	4.2	525	4.2		0.826	34.7	LOS C	16.4	118.7	0.92	0.91	1.07	33.2
All Vehicles			2280	6.8	2280	6.8		0.826	21.0	LOS C	23.1	171.2	0.75	0.73	0.81	38.6

Additional intersection modelling was undertaken to understand the land area that could be developed if the Plan Change Area was to be serviced by only the proposed Access 1 intersection (i.e. Ruffell Road / Old Ruffell Road intersection). The 2035 baseline scenario traffic flows, and manual distribution of the trips generated by PC17 based on turning movement percentages obtained from the 2035 Stage 1 WRTM outputs indicated that approximately **20 ha (net)** of PC17 can be serviced by a single access while ensuring that Te Rapa Road / Ruffell Road intersection performs satisfactorily with the LOS target for through movements on Te Rapa Road set at no worse than LOS C. This equates to approximately **325 trips per peak hour**. Table No: 39 and Table No: 40 below present the intersection performance of Te Rapa Road / Ruffell Road intersection with 20 ha of PC17 developed. No upgrades are required at the Te Rapa Road / Ruffell Road intersection

Table No: 39

2035 AM Peak – Te Rapa Rd / Ruffell Rd – 20 ha of PC7

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
1	L2	All MCs	357	4.0	357	4.0		0.298	9.1	LOS A	4.1	30.0	0.44	0.68	0.44	43.4
2	T1	All MCs	426	15.9	426	15.9	*	0.685	18.4	LOS B	10.8	86.0	0.90	0.81	0.95	40.1
Approach			783	10.5	783	10.5		0.685	14.1	LOS B	10.8	86.0	0.69	0.75	0.71	41.4
North: Te Rapa Rd																
8	T1	All MCs	692	11.0	692	11.0		0.641	8.7	LOS A	13.1	100.4	0.71	0.64	0.71	44.7
9	R2	All MCs	146	6.5	146	6.5	*	0.694	34.4	LOS C	4.4	32.9	1.00	0.88	1.18	33.1
Approach			838	10.2	838	10.2		0.694	13.1	LOS B	13.1	100.4	0.76	0.68	0.80	42.2
West: Ruffell Rd																
10	L2	All MCs	47	8.2	47	8.2		0.064	15.1	LOS B	0.8	5.9	0.61	0.67	0.61	40.3
12	R2	All MCs	83	7.9	83	7.9	*	0.229	26.1	LOS C	2.0	15.3	0.87	0.74	0.87	35.9
Approach			131	8.0	131	8.0		0.229	22.1	LOS C	2.0	15.3	0.78	0.72	0.78	37.4
All Vehicles			1752	10.2	1752	10.2		0.694	14.2	LOS B	13.1	100.4	0.73	0.72	0.76	41.4

Table No: 40

2035 PM Peak – Te Rapa Rd / Ruffell Rd – 20 ha of PC7

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd																
1	L2	All MCs	145	3.7	145	3.7		0.103	16.6	LOS B	1.4	9.8	0.24	0.60	0.24	44.6

2	T1	All MCs	720	6.7	720	6.7	*	0.833	34.2	LOS C	28.9	214.2	0.92	0.90	1.01	37.5
Approach			865	6.2	865	6.2		0.833	31.2	LOS C	28.9	214.2	0.80	0.85	0.88	34.9
North: Te Rapa Rd																
8	T1	All MCs	608	10.0	608	10.0		0.502	8.2	LOS A	13.1	99.9	0.55	0.50	0.55	44.9
9	R2	All MCs	72	7.1	72	7.1	*	0.597	51.0	LOS D	3.2	24.0	1.00	0.80	1.08	28.7
Approach			680	9.7	680	9.7		0.597	12.7	LOS B	13.1	99.9	0.60	0.53	0.61	42.5
West: Ruffell Rd																
10	L2	All MCs	160	5.6	160	5.6		0.264	26.8	LOS C	4.9	36.1	0.76	0.75	0.76	35.6
12	R2	All MCs	316	3.8	316	3.8	*	0.844	47.8	LOS D	14.8	106.8	1.00	0.98	1.24	29.5
Approach			476	4.4	476	4.4		0.844	40.8	LOS D	14.8	106.8	0.92	0.91	1.08	31.3
All Vehicles			2021	7.0	2021	7.0		0.844	27.2	LOS C	28.9	214.2	0.76	0.76	0.84	36.1

2.4.6 Te Rapa Road / Kapuni Street Intersection

The Infrastructure Baseline scenario results presented below relate to the existing give-way controlled intersection layout, as shown in Figure 15, for which the right turn movement from Kapuni Street fails before any PC17 traffic is added to the network.

This demonstrates that an upgrade of the intersection will be required to mitigate Te Awa Lakes development traffic effects.

This assessment recommends that a left-in-left-out ("**LILO**") intersection upgrade be investigated by the Council or Te Awa Lakes to accommodate the 2035 baseline traffic volumes. This is expected to improve the intersection performance as shown in Table No: 42 and Table No: 43.

If the intersection is upgraded to a LILO intersection, right turning traffic will be diverted to Te Rapa Road / McKee Street intersection and Te Rapa Road / Te Kowhai Road / Church Road roundabout. Effects at these intersections due to a LILO upgrade have not been assessed in this technical note as there is no confirmation on the upgrade that will be undertaken but could be assessed in PC17's subsequent land use / subdivision consent applications.

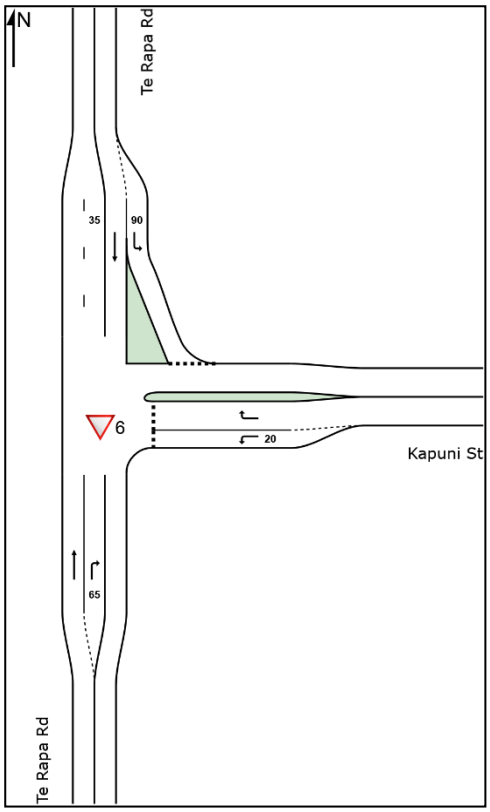


Figure 15: Existing Te Rapa Rd / Kapuni St Intersection Layout

Table No: 41

2035 Baseline AM Peak – Te Rapa Rd / Kapuni St Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
2	T1	All MCs	801	10.3	801	10.3	0.432	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	49.7
3	R2	All MCs	325	5.7	325	5.7	0.434	10.6	LOS B	2.5	18.2	0.70	0.96	0.99	40.1
Approach			1126	9.0	1126	9.0	0.434	3.2	NA	2.5	18.2	0.20	0.28	0.28	47.3
East: Kapuni St															
4	L2	All MCs	55	35.7	55	35.7	0.108	10.8	LOS B	0.4	3.3	0.63	0.83	0.63	39.6
6	R2	All MCs	7	25.0	7	25.0	0.430	131.0	LOS F	0.7	5.8	0.98	1.01	1.05	13.8
Approach			62	34.4	62	34.4	0.430	25.0	LOS D	0.7	5.8	0.68	0.85	0.68	32.4
North: Te Rapa Rd															
7	L2	All MCs	69	9.1	69	9.1	0.062	5.9	LOS A	0.2	1.8	0.39	0.57	0.39	43.2
8	T1	All MCs	671	11.9	671	11.9	0.365	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.8
Approach			740	11.6	740	11.6	0.365	0.7	LOS A	0.2	1.8	0.04	0.05	0.04	49.3
All Vehicles			1928	10.8	1928	10.8	0.434	2.9	NA	2.5	18.2	0.15	0.21	0.20	47.5

Table No: 42

2035 Baseline PM Peak – Te Rapa Rd / Kapuni St Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
2	T1	All MCs	819	6.9	819	6.9	0.432	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	49.7
3	R2	All MCs	94	18.3	94	18.3	0.248	15.2	LOS C	0.9	7.1	0.80	0.93	0.89	37.2

Approach		913	8.1	913	8.1	0.432	1.7	NA	0.9	7.1	0.08	0.10	0.09	48.6
East: Kapuni St														
4	L2 All MCs	223	8.3	223	8.3	0.534	16.8	LOS C	2.4	18.3	0.85	1.08	1.32	36.4
6	R2 All MCs	13	13.3	13	13.3	0.648	141.6	LOS F	1.1	8.9	0.99	1.03	1.13	13.0
Approach		236	8.6	236	8.6	0.648	23.5	LOS C	2.4	18.3	0.85	1.08	1.31	33.2
North: Te Rapa Rd														
7	L2 All MCs	34	17.6	34	17.6	0.025	5.0	LOS A	0.1	0.8	0.20	0.47	0.20	43.7
8	T1 All MCs	921	7.6	921	7.6	0.488	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	49.7
Approach		955	7.9	955	7.9	0.488	0.4	LOS A	0.1	0.8	0.01	0.02	0.01	49.5
All Vehicles		2103	8.1	2103	8.1	0.648	3.6	NA	2.4	18.3	0.13	0.17	0.19	47.2

Table No: 43

2035 Baseline AM Peak – Te Rapa Rd / Kapuni St LILO Intersection Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
2	T1	All MCs	801	10.3	801	10.3	0.432	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	49.7
Approach			801	10.3	801	10.3	0.432	0.2	NA	0.0	0.0	0.00	0.00	0.00	49.7
East: Kapuni St															
4	L2	All MCs	55	35.7	55	35.7	0.108	10.8	LOS B	0.4	3.3	0.63	0.83	0.63	39.6
Approach			55	35.7	55	35.7	0.108	10.8	LOS B	0.4	3.3	0.63	0.83	0.63	39.6
North: Te Rapa Rd															
7	L2	All MCs	69	9.1	69	9.1	0.039	4.6	LOS A	0.0	0.0	0.00	0.49	0.00	44.6
8	T1	All MCs	671	11.9	671	11.9	0.365	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.8
Approach			740	11.6	740	11.6	0.365	0.6	LOS A	0.0	0.0	0.00	0.05	0.00	49.4
All Vehicles			1596	11.8	1596	11.8	0.432	0.7	NA	0.4	3.3	0.02	0.05	0.02	49.3

Table No: 44

2035 Baseline PM Peak – Te Rapa Rd / Kapuni St LILO Intersection Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
2	T1	All MCs	819	6.9	819	6.9	0.432	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	49.7
Approach			819	6.9	819	6.9	0.432	0.2	NA	0.0	0.0	0.00	0.00	0.00	49.7
East: Kapuni St															
4	L2	All MCs	223	8.3	223	8.3	0.534	16.8	LOS C	2.4	18.3	0.85	1.08	1.32	36.4
Approach			223	8.3	223	8.3	0.534	16.8	LOS C	2.4	18.3	0.85	1.08	1.32	36.4
North: Te Rapa Rd															
7	L2	All MCs	34	17.6	34	17.6	0.020	4.6	LOS A	0.0	0.0	0.00	0.49	0.00	44.4
8	T1	All MCs	921	7.6	921	7.6	0.488	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	49.7
Approach			955	7.9	955	7.9	0.488	0.4	LOS A	0.0	0.0	0.00	0.02	0.00	49.5
All Vehicles			1997	7.6	1997	7.6	0.534	2.1	NA	2.4	18.3	0.09	0.13	0.15	48.2

2.4.7 Te Rapa Road / Te Kowhai Road / Church Road Roundabout

The existing roundabout layout modelled within SIDRA is shown Figure 16. The results of the intersection performance for all infrastructure stages during peak periods are presented in Table No: 45 to Table No: 50.

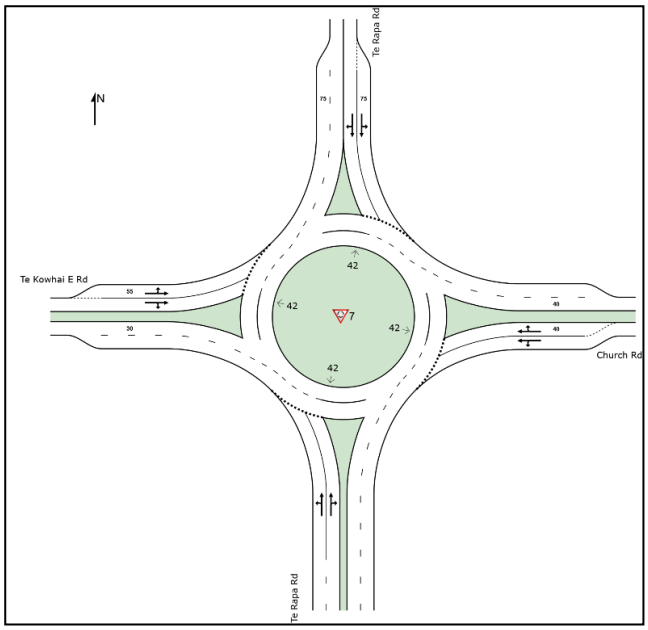


Figure 16: Existing Te Rapa Rd / Te Kowhai Rd / Church Rd Roundabout Layout

Table No: 45

2035 Baseline AM Peak – Te Rapa Rd / Church Rd RAB Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
1	L2	All MCs	188	4.8	188	4.8	0.436	3.7	LOS A	2.3	16.9	0.53	0.42	0.53	45.2
2	T1	All MCs	814	9.0	814	9.0	0.689	3.7	LOS A	6.1	45.7	0.62	0.54	0.68	46.1
3	R2	All MCs	300	7.0	300	7.0	0.689	10.2	LOS B	6.1	45.7	0.66	0.59	0.74	43.4
Approach			1302	7.9	1302	7.9	0.689	5.2	LOS A	6.1	45.7	0.62	0.54	0.67	45.5
East: Church Rd															
4	L2	All MCs	43	20.0	43	20.0	0.181	4.2	LOS A	0.8	6.4	0.60	0.42	0.60	44.6
5	T1	All MCs	146	10.0	146	10.0	0.181	3.1	LOS A	0.8	6.4	0.60	0.45	0.60	39.9
6	R2	All MCs	29	9.7	29	9.7	0.075	10.9	LOS B	0.3	2.2	0.60	0.69	0.60	42.0
Approach			219	11.9	219	11.9	0.181	4.4	LOS A	0.8	6.4	0.60	0.48	0.60	41.7
North: Te Rapa Rd															
7	L2	All MCs	32	5.6	32	5.6	0.387	4.0	LOS A	2.1	16.1	0.62	0.41	0.62	44.6
8	T1	All MCs	537	12.8	537	12.8	0.387	3.5	LOS A	2.1	16.1	0.63	0.47	0.63	46.1
9	R2	All MCs	158	18.8	158	18.8	0.387	10.6	LOS B	2.0	15.7	0.64	0.63	0.65	28.2
Approach			726	13.8	726	13.8	0.387	5.0	LOS A	2.1	16.1	0.63	0.50	0.64	41.8
West: Te Kowhai E Rd															
10	L2	All MCs	284	9.1	284	9.1	0.604	9.9	LOS A	5.0	37.7	0.90	0.94	1.20	41.8
11	T1	All MCs	203	6.5	203	6.5	0.604	8.2	LOS A	5.0	37.7	0.88	0.92	1.13	34.9
12	R2	All MCs	111	7.8	111	7.8	0.278	13.0	LOS B	1.4	10.5	0.78	0.82	0.78	40.0
Approach			598	8.0	598	8.0	0.604	9.9	LOS A	5.0	37.7	0.88	0.91	1.10	39.9
All Vehicles			2845	9.7	2845	9.7	0.689	6.1	LOS A	6.1	45.7	0.67	0.60	0.75	43.3

Table No: 46

2035 Baseline PM Peak – Te Rapa Rd / Church Rd RAB Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h

South: Te Rapa Rd														
1	L2	All MCs	168	5.8	168	5.8	0.439	6.6	LOS A	2.4	17.6	0.73	0.75	0.83	43.8
2	T1	All MCs	631	7.8	631	7.8	0.694	6.5	LOS A	5.9	44.4	0.81	0.89	1.08	45.2
3	R2	All MCs	165	9.4	165	9.4	0.694	13.3	LOS B	5.9	44.4	0.83	0.93	1.15	42.4
Approach			964	7.7	964	7.7	0.694	7.7	LOS A	5.9	44.4	0.80	0.87	1.05	44.6
East: Church Rd															
4	L2	All MCs	52	9.6	52	9.6	0.487	6.3	LOS A	3.1	22.5	0.82	0.72	0.96	43.4
5	T1	All MCs	383	4.4	383	4.4	0.487	5.4	LOS A	3.1	22.5	0.81	0.72	0.93	38.1
6	R2	All MCs	66	3.6	66	3.6	0.201	11.7	LOS B	0.9	6.6	0.73	0.77	0.73	41.5
Approach			501	4.8	501	4.8	0.487	6.3	LOS A	3.1	22.5	0.80	0.73	0.91	39.7
North: Te Rapa Rd															
7	L2	All MCs	27	6.5	27	6.5	0.563	4.6	LOS A	3.9	29.4	0.68	0.50	0.76	44.3
8	T1	All MCs	643	7.7	643	7.7	0.563	3.8	LOS A	3.9	29.4	0.68	0.52	0.76	46.1
9	R2	All MCs	474	8.1	474	8.1	0.563	11.1	LOS B	3.8	28.6	0.70	0.78	0.81	27.8
Approach			1144	7.8	1144	7.8	0.563	6.9	LOS A	3.9	29.4	0.69	0.63	0.78	37.8
West: Te Kowhai E Rd															
10	L2	All MCs	217	10.5	217	10.5	0.494	6.4	LOS A	3.6	26.9	0.82	0.74	0.93	43.8
11	T1	All MCs	204	7.5	204	7.5	0.494	5.2	LOS A	3.6	26.9	0.82	0.74	0.93	38.4
12	R2	All MCs	172	3.9	172	3.9	0.268	11.3	LOS B	1.4	10.2	0.73	0.79	0.73	40.2
Approach			593	7.5	593	7.5	0.494	7.4	LOS A	3.6	26.9	0.79	0.75	0.87	41.4
All Vehicles			3202	7.3	3202	7.3	0.694	7.1	LOS A	5.9	44.4	0.76	0.74	0.90	40.7

Table No: 47

2035 Stage 1 AM Peak – Te Rapa Rd / Church Rd RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
1	L2	All MCs	286	4.8	286	4.8	0.538	4.6	LOS A	3.4	25.3	0.61	0.54	0.66	44.8
2	T1	All MCs	988	9.0	988	9.0	0.851	6.5	LOS A	12.1	90.6	0.79	0.80	1.03	45.3
3	R2	All MCs	307	7.0	307	7.0	0.851	13.1	LOS B	12.1	90.6	0.85	0.88	1.14	42.2
Approach			1582	7.8	1582	7.8	0.851	7.4	LOS A	12.1	90.6	0.77	0.77	0.98	44.7
East: Church Rd															
4	L2	All MCs	44	20.0	44	20.0	0.195	4.3	LOS A	0.9	7.0	0.63	0.43	0.63	44.4
5	T1	All MCs	151	10.0	151	10.0	0.195	3.2	LOS A	0.9	7.0	0.62	0.46	0.62	39.8
6	R2	All MCs	34	9.7	34	9.7	0.081	11.2	LOS B	0.3	2.4	0.61	0.71	0.61	41.7
Approach			228	11.9	228	11.9	0.195	4.6	LOS A	0.9	7.0	0.62	0.49	0.62	41.5
North: Te Rapa Rd															
7	L2	All MCs	33	5.6	33	5.6	0.421	4.2	LOS A	2.4	18.6	0.65	0.44	0.67	44.4
8	T1	All MCs	564	12.8	564	12.8	0.421	3.7	LOS A	2.4	18.6	0.66	0.51	0.68	46.0
9	R2	All MCs	178	18.8	178	18.8	0.421	11.0	LOS B	2.3	18.3	0.67	0.67	0.71	28.1
Approach			775	13.9	775	13.9	0.421	5.4	LOS A	2.4	18.6	0.66	0.54	0.69	41.4
West: Te Kowhai E Rd															
10	L2	All MCs	325	9.1	325	9.1	0.845	26.1	LOS C	11.2	84.1	1.00	1.38	2.02	32.9
11	T1	All MCs	208	6.5	208	6.5	0.845	20.7	LOS C	11.2	84.1	0.97	1.27	1.78	24.9
12	R2	All MCs	109	7.8	109	7.8	0.389	16.3	LOS B	2.3	17.4	0.89	0.92	1.00	38.3
Approach			643	8.0	643	8.0	0.845	22.7	LOS C	11.2	84.1	0.97	1.27	1.77	32.0
All Vehicles			3228	9.6	3228	9.6	0.851	9.8	LOS A	12.1	90.6	0.77	0.79	1.04	41.4

Table No: 48

2035 Stage 1 PM Peak – Te Rapa Rd / Church Rd RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
1	L2	All MCs	188	5.8	188	5.8	0.507	7.7	LOS A	3.0	22.2	0.77	0.83	0.94	43.2
2	T1	All MCs	678	7.8	678	7.8	0.802	9.0	LOS A	8.6	64.1	0.88	1.05	1.36	43.9
3	R2	All MCs	194	9.4	194	9.4	0.802	16.2	LOS B	8.6	64.1	0.91	1.11	1.47	40.4
Approach			1060	7.7	1060	7.7	0.802	10.1	LOS B	8.6	64.1	0.87	1.02	1.30	43.3
East: Church Rd															
4	L2	All MCs	54	9.6	54	9.6	0.598	8.2	LOS A	4.3	31.3	0.89	0.95	1.15	42.9
5	T1	All MCs	411	4.4	411	4.4	0.598	7.2	LOS A	4.3	31.3	0.88	0.93	1.11	37.3
6	R2	All MCs	81	3.6	81	3.6	0.247	12.2	LOS B	1.2	8.5	0.79	0.83	0.79	41.0
Approach			545	4.8	545	4.8	0.598	8.0	LOS A	4.3	31.3	0.87	0.92	1.07	39.0
North: Te Rapa Rd															
7	L2	All MCs	23	6.5	23	6.5	0.667	5.7	LOS A	5.7	42.5	0.76	0.68	0.93	43.8
8	T1	All MCs	795	7.7	795	7.7	0.667	5.0	LOS A	5.7	42.5	0.76	0.70	0.93	45.7
9	R2	All MCs	508	8.1	508	8.1	0.667	12.6	LOS B	5.5	40.8	0.78	0.87	0.98	27.5
Approach			1326	7.8	1326	7.8	0.667	7.9	LOS A	5.7	42.5	0.77	0.76	0.95	38.0
West: Te Kowhai E Rd															
10	L2	All MCs	212	10.5	212	10.5	0.521	7.5	LOS A	4.0	30.1	0.87	0.83	1.02	43.3
11	T1	All MCs	194	7.5	194	7.5	0.521	6.1	LOS A	4.0	30.1	0.87	0.83	1.02	37.5
12	R2	All MCs	184	3.9	184	3.9	0.311	11.9	LOS B	1.7	12.5	0.79	0.81	0.79	39.9
Approach			589	7.4	589	7.4	0.521	8.4	LOS A	4.0	30.1	0.84	0.82	0.95	40.8
All Vehicles			3521	7.3	3521	7.3	0.802	8.7	LOS A	8.6	64.1	0.83	0.87	1.07	40.2

Table No: 49

2045 Stage 2 AM Peak – Te Rapa Rd / Church Rd RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
1	L2	All MCs	237	4.8	237	4.8	0.557	4.5	LOS A	3.7	27.5	0.61	0.53	0.67	44.8
2	T1	All MCs	1069	9.0	1069	9.0	0.882	7.3	LOS A	14.4	107.8	0.81	0.82	1.07	45.1
3	R2	All MCs	354	7.0	354	7.0	0.882	13.9	LOS B	14.4	107.8	0.90	0.94	1.23	41.7
Approach			1660	8.0	1660	8.0	0.882	8.3	LOS A	14.4	107.8	0.80	0.81	1.05	44.5
East: Church Rd															
4	L2	All MCs	60	20.0	60	20.0	0.220	4.6	LOS A	1.1	8.3	0.67	0.48	0.67	44.2
5	T1	All MCs	144	10.0	144	10.0	0.220	3.5	LOS A	1.1	8.3	0.67	0.51	0.67	39.3
6	R2	All MCs	37	9.7	37	9.7	0.091	11.8	LOS B	0.4	2.8	0.65	0.74	0.65	41.5
Approach			241	12.4	241	12.4	0.220	5.0	LOS A	1.1	8.3	0.67	0.54	0.67	41.4
North: Te Rapa Rd															
7	L2	All MCs	35	5.6	35	5.6	0.485	5.2	LOS A	3.1	24.3	0.74	0.59	0.82	44.0
8	T1	All MCs	615	12.8	615	12.8	0.485	4.8	LOS A	3.1	24.3	0.74	0.65	0.83	45.6
9	R2	All MCs	160	18.8	160	18.8	0.485	12.3	LOS B	2.9	23.1	0.74	0.79	0.86	27.9
Approach			809	13.7	809	13.7	0.485	6.3	LOS A	3.1	24.3	0.74	0.68	0.84	41.7
West: Te Kowhai E Rd															
10	L2	All MCs	376	9.1	376	9.1	1.205	211.4	LOS F	78.4	587.0	1.00	4.63	9.60	9.4
11	T1	All MCs	278	6.5	278	6.5	1.205	186.8	LOS F	78.4	587.0	0.99	4.22	8.64	5.2
12	R2	All MCs	172	7.8	172	7.8	0.554	21.0	LOS C	3.8	28.4	0.94	1.03	1.24	35.3
Approach			825	8.0	825	8.0	1.205	163.5	LOS F	78.4	587.0	0.99	3.74	7.54	9.8
All Vehicles			3536	9.6	3536	9.6	1.205	43.8	LOS D	78.4	587.0	0.82	1.44	2.49	28.0

Table No: 50

2045 Stage 2 PM Peak – Te Rapa Rd / Church Rd RAB Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
1	L2	All MCs	183	5.8	183	5.8	0.592	9.0	LOS A	3.8	28.4	0.82	0.91	1.08	42.3
2	T1	All MCs	781	7.8	781	7.8	0.937	17.2	LOS B	16.5	123.4	0.96	1.43	2.15	40.2
3	R2	All MCs	212	9.4	212	9.4	0.937	26.5	LOS C	16.5	123.4	1.00	1.59	2.50	34.4
Approach			1176	7.8	1176	7.8	0.937	17.6	LOS B	16.5	123.4	0.94	1.38	2.05	39.5
East: Church Rd															
4	L2	All MCs	82	9.6	82	9.6	0.755	11.7	LOS B	6.5	47.8	0.95	1.10	1.44	40.5
5	T1	All MCs	482	4.4	482	4.4	0.755	10.3	LOS B	6.5	47.8	0.93	1.07	1.36	34.0
6	R2	All MCs	83	3.6	83	3.6	0.313	12.7	LOS B	1.6	11.3	0.82	0.85	0.85	41.0
Approach			647	5.0	647	5.0	0.755	10.8	LOS B	6.5	47.8	0.92	1.05	1.31	36.6
North: Te Rapa Rd															
7	L2	All MCs	23	6.5	23	6.5	0.724	6.6	LOS A	6.9	51.2	0.82	0.82	1.06	43.5
8	T1	All MCs	856	7.7	856	7.7	0.724	5.9	LOS A	6.9	51.2	0.82	0.83	1.07	45.3
9	R2	All MCs	505	8.1	505	8.1	0.724	13.8	LOS B	6.5	48.6	0.83	0.94	1.12	27.3
Approach			1384	7.8	1384	7.8	0.724	8.8	LOS A	6.9	51.2	0.83	0.87	1.09	38.1
West: Te Kowhai E Rd															
10	L2	All MCs	245	10.5	245	10.5	0.687	11.5	LOS B	6.5	49.3	0.97	1.01	1.34	40.9
11	T1	All MCs	225	7.5	225	7.5	0.687	9.9	LOS A	6.5	49.3	0.97	1.01	1.34	33.7
12	R2	All MCs	186	3.9	186	3.9	0.366	13.1	LOS B	2.2	15.6	0.84	0.87	0.89	39.1
Approach			657	7.6	657	7.6	0.687	11.4	LOS B	6.5	49.3	0.94	0.97	1.21	38.7
All Vehicles			3864	7.3	3864	7.3	0.937	12.3	LOS B	16.5	123.4	0.90	1.07	1.44	38.5

Table No: 49 shows that the addition of the full PC17 Stage 2 development traffic to the network causes the left turn movement from Te Kowhai Road to Te Rapa Road to fail during the AM peak period.

This is because of the increase in northbound traffic volume on Te Rapa Road due to PC17, traffic growth on the network associated with other land use in 2045, and the closure of the Ruffell Road level crossing. A solution to increase the capacity for this movement is to modify the lane configuration of the shared through and left turning lane on Te Kowhai Road, to a left turn only lane while the adjacent right turn lane remains marked as shared through and right, as shown in Figure 17. The performance improvement of this lane marking change during Stage 2 AM peak period is presented in Table No: 51.

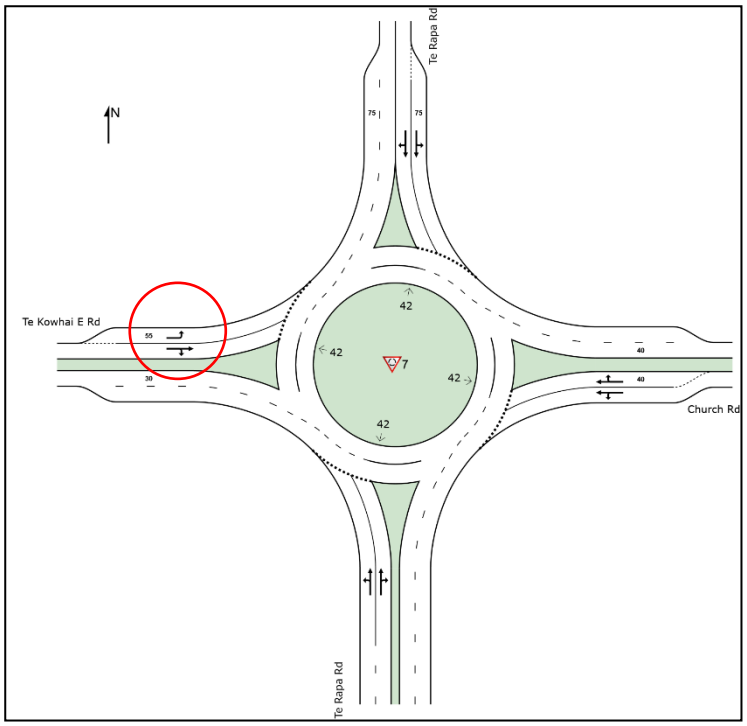


Figure 17: Recommended Te Rapa Rd / Te Kowhai Rd / Church Rd Roundabout Layout

Table No: 51

2045 Stage 2 AM Peak – Te Rapa Rd / Church Rd RAB – Modified Lane Configuration														
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
1	L2	All MCs	237	4.8	237	4.8	0.562	4.6	LOS A	3.8	28.3	0.62	0.53	0.68	44.7
2	T1	All MCs	1069	9.0	1069	9.0	0.888	7.6	LOS A	15.0	112.4	0.83	0.84	1.10	44.9
3	R2	All MCs	354	7.0	354	7.0	0.888	14.2	LOS B	15.0	112.4	0.92	0.96	1.27	41.5
Approach			1660	8.0	1660	8.0	0.888	8.6	LOS A	15.0	112.4	0.82	0.82	1.08	44.3
East: Church Rd															
4	L2	All MCs	60	20.0	60	20.0	0.232	4.6	LOS A	1.2	9.2	0.71	0.48	0.71	44.0
5	T1	All MCs	144	10.0	144	10.0	0.232	3.5	LOS A	1.2	9.2	0.70	0.51	0.70	39.0
6	R2	All MCs	37	9.7	37	9.7	0.096	12.0	LOS B	0.4	3.1	0.67	0.74	0.67	41.5
Approach			241	12.4	241	12.4	0.232	5.1	LOS A	1.2	9.2	0.70	0.54	0.70	41.3
North: Te Rapa Rd															
7	L2	All MCs	35	5.6	35	5.6	0.591	9.9	LOS A	5.8	45.0	0.94	0.88	1.19	41.7
8	T1	All MCs	615	12.8	615	12.8	0.591	9.7	LOS A	5.8	45.0	0.93	0.90	1.19	43.7
9	R2	All MCs	160	18.8	160	18.8	0.591	17.7	LOS B	5.2	41.0	0.92	0.93	1.20	26.5
Approach			809	13.7	809	13.7	0.591	11.3	LOS B	5.8	45.0	0.93	0.90	1.19	39.9
West: Te Kowhai E Rd															
10	L2	All MCs	376	9.1	376	9.1	1.047	100.2	LOS F	25.7	193.8	1.00	2.40	4.59	16.2
11	T1	All MCs	278	6.5	278	6.5	0.873	30.7	LOS C	12.2	90.3	1.00	1.47	2.21	21.0
12	R2	All MCs	172	7.8	172	7.8	0.873	37.1	LOS D	12.2	90.3	1.00	1.47	2.21	29.6
Approach			825	8.0	825	8.0	1.047	63.6	LOS E	25.7	193.8	1.00	1.89	3.30	19.3
All Vehicles			3536	9.6	3536	9.6	1.047	21.8	LOS C	25.7	193.8	0.88	1.07	1.60	35.7

While the performance of the through movement on Te Kowhai Road improves to LOS C, the left turn movement still fails. Further sensitivity checks on the traffic flows indicated that the roundabout (with the lane marking changes) will perform satisfactorily during Stage 2 AM peak period if the Te Kowhai Road

approach volumes do not exceed 792 vph. Therefore, this assessment recommends that the opportunity to reopen Ruffell Road level crossing be investigated when the average weekday AM peak traffic volume on Te Kowhai Road approach exceeds 790 vph (one-way).

Table No: 52

2045 Stage 2 AM Peak – Te Rapa Rd / Church Rd RAB – Modified Lane Configuration Sensitivity Check															
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Te Rapa Rd															
1	L2	All MCs	227	4.8	227	4.8	0.534	4.2	LOS A	3.4	25.3	0.60	0.49	0.63	44.9
2	T1	All MCs	1027	9.0	1027	9.0	0.845	6.2	LOS A	11.9	89.6	0.77	0.74	0.95	45.4
3	R2	All MCs	340	7.0	340	7.0	0.845	12.5	LOS B	11.9	89.6	0.84	0.84	1.08	42.2
Approach			1594	8.0	1594	8.0	0.845	7.3	LOS A	11.9	89.6	0.76	0.73	0.93	44.8
East: Church Rd															
4	L2	All MCs	58	20.0	58	20.0	0.216	4.5	LOS A	1.1	8.4	0.69	0.47	0.69	44.1
5	T1	All MCs	138	10.0	138	10.0	0.216	3.4	LOS A	1.1	8.4	0.68	0.50	0.68	39.2
6	R2	All MCs	35	9.7	35	9.7	0.089	11.8	LOS B	0.4	2.8	0.66	0.73	0.66	41.5
Approach			231	12.4	231	12.4	0.216	5.0	LOS A	1.1	8.4	0.68	0.53	0.68	41.4
North: Te Rapa Rd															
7	L2	All MCs	33	5.6	33	5.6	0.547	8.5	LOS A	5.0	38.3	0.90	0.82	1.08	42.7
8	T1	All MCs	590	12.8	590	12.8	0.547	8.3	LOS A	5.0	38.3	0.90	0.84	1.09	44.5
9	R2	All MCs	154	18.8	154	18.8	0.547	16.1	LOS B	4.5	35.3	0.89	0.88	1.10	26.9
Approach			777	13.7	777	13.7	0.547	9.8	LOS A	5.0	38.3	0.89	0.84	1.09	40.6
West: Te Kowhai E Rd															
10	L2	All MCs	361	9.1	361	9.1	0.905	40.1	LOS D	11.4	85.8	1.00	1.53	2.43	27.3
11	T1	All MCs	267	6.5	267	6.5	0.763	17.9	LOS B	8.2	61.0	1.00	1.20	1.68	27.0
12	R2	All MCs	165	7.8	165	7.8	0.763	24.4	LOS C	8.2	61.0	1.00	1.20	1.68	34.9
Approach			792	8.0	792	8.0	0.905	29.4	LOS C	11.4	85.8	1.00	1.35	2.02	28.9
All Vehicles			3394	9.6	3394	9.6	0.905	12.9	LOS B	11.9	89.6	0.84	0.89	1.21	40.0

2.4.8 Te Rapa Road / The Base Parade Intersection

Table No: 53 to Table No: 58 below present the intersection performances in all infrastructure stages based on the latest WRTM outputs. The mitigation options discussed in Sections 8.3.8.1 to 8.3.8.4 of the ITA are still considered relevant, with the results shown below for Stages 1 and 2 are based on changing the intersection's peak period signal phase sequence to a 'double diamond overlap' sequence.

Table No: 53

2035 Baseline AM Peak – Te Rapa Rd / The Base Parade Vehicle Movement Performance																
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Te Rapa Rd																
1	L2	All MCs	280	0.4	280	0.4	*	0.268	13.5	LOS B	5.4	38.2	0.55	0.71	0.55	41.6
2	T1	All MCs	1312	7.7	1312	7.7	*	0.886	45.9	LOS D	40.2	300.0	1.00	1.01	1.13	33.8
3	R2	All MCs	307	4.4	307	4.4		0.712	52.6	LOS D	16.6	120.6	0.98	0.86	1.00	31.5
Approach			1899	6.1	1899	6.1		0.886	42.2	LOS D	40.2	300.0	0.93	0.94	1.03	33.7
NorthEast: Eagle Way																
4	L2	All MCs	62	16.4	62	16.4		0.058	7.7	LOS A	0.8	6.2	0.29	0.58	0.29	44.1
5	T1	All MCs	6	0.0	6	0.0		0.018	42.7	LOS D	0.3	2.1	0.85	0.57	0.85	25.8
6	R2	All MCs	13	27.3	13	27.3	*	0.045	48.2	LOS D	0.6	5.2	0.86	0.67	0.86	29.6

Approach			81	16.8	81	16.8		0.058	16.8	LOS B	0.8	6.2	0.42	0.59	0.42	39.5
NorthWest: Te Rapa Rd																
7	L2	All MCs	72	6.2	72	6.2		0.058	7.2	LOS A	0.6	4.7	0.22	0.60	0.22	51.6
8	T1	All MCs	563	14.5	563	14.5		0.710	47.2	LOS D	15.4	121.2	0.98	0.85	1.01	33.2
9	R2	All MCs	52	0.0	52	0.0	*	0.463	67.1	LOS E	3.1	21.4	1.00	0.75	1.00	20.8
Approach			686	12.6	686	12.6		0.710	44.5	LOS D	15.4	121.2	0.90	0.82	0.93	33.5
SouthWest: The Base Parade																
10	L2	All MCs	26	0.0	26	0.0		0.042	12.9	LOS B	0.8	5.9	0.55	0.60	0.55	35.6
11	T1	All MCs	6	0.0	6	0.0		0.042	31.1	LOS C	0.8	5.9	0.55	0.60	0.55	36.7
12	R2	All MCs	104	1.1	104	1.1		0.176	51.0	LOS D	2.6	18.5	0.90	0.73	0.90	22.5
Approach			137	0.9	137	0.9		0.176	42.8	LOS D	2.6	18.5	0.82	0.70	0.82	24.8
All Vehicles			2803	7.7	2803	7.7		0.886	42.1	LOS D	40.2	300.0	0.90	0.89	0.97	33.4

Table No: 54

2035 Baseline PM Peak – Te Rapa Rd / The Base Parade Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Te Rapa Rd																
1	L2	All MCs	287	0.8	287	0.8		0.286	13.9	LOS B	5.5	38.9	0.58	0.72	0.58	41.3
2	T1	All MCs	811	9.0	811	9.0		0.759	41.9	LOS D	21.4	161.3	0.97	0.88	1.01	34.9
3	R2	All MCs	99	10.8	99	10.8	*	0.817	70.5	LOS E	6.1	46.9	1.00	0.93	1.29	26.9
Approach			1197	7.2	1197	7.2		0.817	37.6	LOS D	21.4	161.3	0.88	0.84	0.93	34.8
NorthEast: Eagle Way																
4	L2	All MCs	316	3.1	316	3.1		0.415	21.0	LOS C	10.5	75.3	0.69	0.75	0.69	37.9
5	T1	All MCs	14	0.0	14	0.0		0.038	41.5	LOS D	0.6	4.4	0.85	0.60	0.85	26.2
6	R2	All MCs	17	16.7	17	16.7	*	0.055	46.6	LOS D	0.8	6.3	0.85	0.68	0.85	30.1
Approach			346	3.6	346	3.6		0.415	23.0	LOS C	10.5	75.3	0.70	0.74	0.70	37.0
NorthWest: Te Rapa Rd																
7	L2	All MCs	51	5.5	51	5.5		0.050	25.9	LOS C	1.3	9.5	0.48	0.63	0.48	45.1
8	T1	All MCs	842	7.3	842	7.3	*	0.792	48.0	LOS D	23.3	173.3	0.99	0.91	1.05	34.3
9	R2	All MCs	24	0.0	24	0.0		0.185	62.4	LOS E	1.3	9.4	0.97	0.71	0.97	21.7
Approach			917	7.0	917	7.0		0.792	47.1	LOS D	23.3	173.3	0.96	0.89	1.02	33.0
SouthWest: The Base Parade																
10	L2	All MCs	134	0.8	134	0.8		0.142	7.0	LOS A	2.5	17.7	0.41	0.59	0.41	40.4
11	T1	All MCs	22	5.0	22	5.0		0.142	20.8	LOS C	2.5	17.7	0.41	0.59	0.41	41.7
12	R2	All MCs	751	0.2	751	0.2	*	0.802	51.9	LOS D	21.1	147.7	1.00	0.92	1.09	22.3
Approach			906	0.4	906	0.4		0.802	44.5	LOS D	21.1	147.7	0.90	0.86	0.98	24.2
All Vehicles			3366	5.0	3366	5.0		0.817	40.6	LOS D	23.3	173.3	0.89	0.85	0.94	31.8

Table No: 55

2035 Stage 1 AM Peak – Te Rapa Rd / The Base Parade – Double Diamond Overlap

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Te Rapa Rd																
1	L2	All MCs	265	0.4	265	0.4		0.214	16.3	LOS B	6.8	47.5	0.42	0.68	0.42	40.4
2	T1	All MCs	1592	7.7	1592	7.7	*	0.767	25.5	LOS C	39.9	297.9	0.83	0.76	0.83	42.9
3	R2	All MCs	299	4.4	299	4.4		0.588	32.2	LOS C	9.3	67.7	0.91	0.82	0.91	39.2
Approach			2156	6.3	2156	6.3		0.767	25.3	LOS C	39.9	297.9	0.79	0.76	0.79	41.0

NorthEast: Eagle Way															
4	L2	All MCs	54	16.4	54	16.4	0.043	7.9	LOS A	0.7	5.9	0.27	0.57	0.27	44.0
5	T1	All MCs	6	0.0	6	0.0	0.020	51.0	LOS D	0.3	2.4	0.86	0.58	0.86	23.6
6	R2	All MCs	12	27.3	12	27.3	0.167	76.8	LOS E	0.8	6.8	0.99	0.68	0.99	24.0
Approach			72	16.7	72	16.7	0.167	22.9	LOS C	0.8	6.8	0.44	0.59	0.44	36.9
NorthWest: Te Rapa Rd															
7	L2	All MCs	74	6.2	74	6.2	0.062	9.3	LOS A	0.7	5.3	0.20	0.60	0.20	51.6
8	T1	All MCs	591	14.5	591	14.5	0.561	44.6	LOS D	16.6	131.0	0.90	0.77	0.90	34.3
9	R2	All MCs	49	0.0	49	0.0 *	0.598	79.8	LOS E	3.5	24.4	1.00	0.78	1.07	18.6
Approach			714	12.7	714	12.7	0.598	43.4	LOS D	16.6	131.0	0.84	0.76	0.84	33.9
SouthWest: The Base Parade															
10	L2	All MCs	27	0.0	27	0.0	0.049	13.9	LOS B	1.0	7.1	0.53	0.60	0.53	34.6
11	T1	All MCs	6	0.0	6	0.0 *	0.049	36.1	LOS D	1.0	7.1	0.53	0.60	0.53	35.7
12	R2	All MCs	100	1.1	100	1.1 *	0.615	79.0	LOS E	3.5	25.0	1.00	0.79	1.08	17.4
Approach			134	0.8	134	0.8	0.615	63.6	LOS E	3.5	25.0	0.88	0.74	0.94	20.0
All Vehicles			3075	7.8	3075	7.8	0.767	31.1	LOS C	39.9	297.9	0.80	0.75	0.80	37.8

Table No: 56

2035 Stage 1 PM Peak – Te Rapa Rd / The Base Parade – Double Diamond Overlap

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Te Rapa Rd																
1	L2	All MCs	282	0.8	282	0.8		0.238	15.3	LOS B	6.8	48.1	0.46	0.69	0.46	40.2
2	T1	All MCs	908	9.0	908	9.0		0.702	35.7	LOS D	22.6	170.1	0.93	0.81	0.93	37.2
3	R2	All MCs	95	10.8	95	10.8	*	0.802	71.6	LOS E	6.0	45.7	1.00	0.91	1.27	26.6
Approach			1285	7.4	1285	7.4		0.802	33.9	LOS C	22.6	170.1	0.83	0.79	0.85	36.4
NorthEast: Eagle Way																
4	L2	All MCs	339	3.1	339	3.1		0.419	26.3	LOS C	12.4	88.8	0.72	0.75	0.72	36.7
5	T1	All MCs	14	0.0	14	0.0	*	0.043	47.1	LOS D	0.7	4.7	0.87	0.61	0.87	25.1
6	R2	All MCs	13	16.7	13	16.7		0.074	33.5	LOS C	0.4	3.4	0.93	0.67	0.93	33.7
Approach			365	3.4	365	3.4		0.419	27.3	LOS C	12.4	88.8	0.73	0.75	0.73	35.4
NorthWest: Te Rapa Rd																
7	L2	All MCs	89	5.5	89	5.5		0.062	18.2	LOS B	0.5	4.0	0.17	0.59	0.17	52.2
8	T1	All MCs	979	7.3	979	7.3	*	0.814	48.3	LOS D	28.2	209.5	0.98	0.92	1.05	34.7
9	R2	All MCs	13	0.0	13	0.0		0.132	66.5	LOS E	0.7	5.1	0.98	0.68	0.98	20.9
Approach			1081	7.1	1081	7.1		0.814	46.0	LOS D	28.2	209.5	0.91	0.89	0.98	33.5
SouthWest: The Base Parade																
10	L2	All MCs	136	0.8	136	0.8		0.195	9.6	LOS A	3.4	24.1	0.57	0.65	0.57	37.7
11	T1	All MCs	28	5.0	28	5.0		0.195	28.6	LOS C	3.4	24.1	0.57	0.65	0.57	38.9
12	R2	All MCs	728	0.2	728	0.2	*	0.827	56.1	LOS E	21.6	151.5	1.00	0.94	1.13	21.4
Approach			893	0.4	893	0.4		0.827	48.2	LOS D	21.6	151.5	0.92	0.89	1.02	23.3
All Vehicles			3624	5.2	3624	5.2		0.827	40.4	LOS D	28.2	209.5	0.87	0.84	0.92	32.2

Table No: 57

2045 Stage 2 AM Peak – Te Rapa Rd / The Base Parade – Double Diamond Overlap

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Te Rapa Rd																
1	L2	All MCs	257	0.4	257	0.4		0.201	17.3	LOS B	6.5	45.6	0.39	0.67	0.39	40.9

2	T1	All MCs	1669	7.7	1669	7.7	*	0.788	27.0	LOS C	44.3	330.5	0.82	0.76	0.82	42.9
3	R2	All MCs	306	4.4	306	4.4		0.626	36.5	LOS D	11.0	80.1	0.93	0.83	0.93	38.0
Approach			2233	6.4	2233	6.4		0.788	27.2	LOS C	44.3	330.5	0.79	0.76	0.79	40.1
NorthEast: Eagle Way																
4	L2	All MCs	60	16.4	60	16.4		0.050	9.1	LOS A	1.0	8.1	0.30	0.58	0.30	43.4
5	T1	All MCs	6	0.0	6	0.0		0.021	55.7	LOS E	0.4	2.6	0.88	0.59	0.88	22.5
6	R2	All MCs	12	27.3	12	27.3		0.178	82.0	LOS F	0.8	7.3	0.99	0.68	0.99	23.2
Approach			78	16.7	78	16.7		0.178	23.7	LOS C	1.0	8.1	0.45	0.59	0.45	36.6
NorthWest: Te Rapa Rd																
7	L2	All MCs	83	6.2	83	6.2		0.070	17.0	LOS B	0.9	6.6	0.21	0.60	0.21	51.4
8	T1	All MCs	713	14.5	713	14.5		0.615	48.2	LOS D	21.6	170.3	0.90	0.78	0.90	34.4
9	R2	All MCs	44	0.0	44	0.0	*	0.569	84.7	LOS F	3.3	23.1	1.00	0.77	1.05	17.8
Approach			840	12.9	840	12.9		0.615	47.0	LOS D	21.6	170.3	0.84	0.76	0.84	32.9
SouthWest: The Base Parade																
10	L2	All MCs	27	0.0	27	0.0		0.052	16.0	LOS B	1.1	8.0	0.55	0.61	0.55	33.3
11	T1	All MCs	6	0.0	6	0.0	*	0.052	40.8	LOS D	1.1	8.0	0.55	0.61	0.55	34.3
12	R2	All MCs	101	1.1	101	1.1	*	0.663	84.7	LOS F	3.8	27.0	1.00	0.81	1.12	16.6
Approach			135	0.8	135	0.8		0.663	68.7	LOS E	3.8	27.0	0.89	0.76	0.98	19.1
All Vehicles			3285	8.1	3285	8.1		0.788	33.8	LOS C	44.3	330.5	0.80	0.76	0.80	36.8

Table No: 58

2045 Stage 2 PM Peak – Te Rapa Rd / The Base Parade – Double Diamond Overlap																
Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Te Rapa Rd																
1	L2	All MCs	277	0.8	277	0.8		0.232	15.2	LOS B	6.7	47.0	0.45	0.69	0.45	40.3
2	T1	All MCs	1007	9.0	1007	9.0		0.749	35.9	LOS D	25.6	193.4	0.94	0.84	0.94	37.1
3	R2	All MCs	95	10.8	95	10.8	*	0.809	72.4	LOS E	6.0	46.2	1.00	0.92	1.28	26.5
Approach			1379	7.5	1379	7.5		0.809	34.3	LOS C	25.6	193.4	0.85	0.81	0.87	36.4
NorthEast: Eagle Way																
4	L2	All MCs	331	3.1	331	3.1		0.420	27.6	LOS C	12.4	89.4	0.73	0.76	0.73	36.3
5	T1	All MCs	14	0.0	14	0.0	*	0.043	47.8	LOS D	0.7	4.7	0.87	0.61	0.87	25.0
6	R2	All MCs	14	16.7	14	16.7		0.081	34.2	LOS C	0.5	3.8	0.93	0.67	0.93	33.5
Approach			358	3.5	358	3.5		0.420	28.7	LOS C	12.4	89.4	0.75	0.75	0.75	35.0
NorthWest: Te Rapa Rd																
7	L2	All MCs	117	5.5	117	5.5		0.081	19.5	LOS B	0.7	5.4	0.17	0.59	0.17	52.2
8	T1	All MCs	1042	7.3	1042	7.3	*	0.841	51.1	LOS D	31.5	234.4	0.99	0.95	1.09	34.1
9	R2	All MCs	14	0.0	14	0.0		0.145	68.2	LOS E	0.8	5.6	0.98	0.68	0.98	20.8
Approach			1173	7.1	1173	7.1		0.841	48.1	LOS D	31.5	234.4	0.91	0.92	1.00	32.8
SouthWest: The Base Parade																
10	L2	All MCs	151	0.8	151	0.8		0.201	10.4	LOS B	4.0	28.0	0.54	0.65	0.54	37.5
11	T1	All MCs	25	5.0	25	5.0		0.201	29.8	LOS C	4.0	28.0	0.54	0.65	0.54	38.7
12	R2	All MCs	711	0.2	711	0.2	*	0.844	58.8	LOS E	21.7	152.3	1.00	0.96	1.15	20.8
Approach			886	0.4	886	0.4		0.844	49.8	LOS D	21.7	152.3	0.91	0.90	1.03	22.9
All Vehicles			3796	5.3	3796	5.3		0.844	41.6	LOS D	31.5	234.4	0.87	0.86	0.93	32.0

2.4.9 SH1C / Te Rapa Road interchange (Horotiu Interchange)

Table No: 59 to Table No: 70 below present the interchange performances in all infrastructure stages based on the latest WRTM outputs. The latest modelling results indicate that the interchange performs satisfactorily in all stages and therefore mitigation measures discussed in the ITA are no longer relevant / required.

Eastern Roundabout

Table No: 59

2035 Baseline AM Peak – Horotiu Interchange Eastern RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Te Rapa Rd															
1	L2	All MCs	83	0.0	83	0.0	0.308	6.7	LOS A	0.9	6.8	0.73	0.61	0.73	54.4
2	T1	All MCs	487	15.9	487	15.9	0.308	7.6	LOS A	0.9	6.8	0.74	0.63	0.74	46.2
Approach			571	13.6	571	13.6	0.308	7.4	LOS A	0.9	6.8	0.73	0.63	0.73	48.0
North: SH1C Off-Ramp 1															
3	L2	All MCs	401	15.2	401	15.2	0.311	8.7	LOS A	0.5	4.1	0.63	0.78	0.64	54.1
5	T1	All MCs	1	0.0	1	0.0	0.311	9.1	LOS A	0.5	3.9	0.64	0.84	0.67	55.8
4	R2	All MCs	111	12.1	111	12.1	0.311	16.1	LOS B	0.5	3.9	0.64	0.84	0.67	48.2
Approach			513	14.5	513	14.5	0.311	10.3	LOS B	0.5	4.1	0.63	0.79	0.64	53.2
West: Te Rapa Rd															
5	T1	All MCs	715	3.9	715	3.9	0.374	3.2	LOS A	0.0	0.0	0.00	0.34	0.00	53.6
6	R2	All MCs	516	4.2	516	4.2	0.374	9.3	LOS A	0.0	0.0	0.00	0.63	0.00	49.7
Approach			1231	4.0	1231	4.0	0.374	5.8	LOS A	0.0	0.0	0.00	0.46	0.00	51.8
All Vehicles			2314	8.7	2314	8.7	0.374	7.2	LOS A	0.9	6.8	0.32	0.58	0.32	51.4

Table No: 60

2035 Baseline PM Peak – Horotiu Interchange Eastern RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Te Rapa Rd															
1	L2	All MCs	71	0.0	71	0.0	0.490	5.7	LOS A	1.6	11.5	0.67	0.56	0.67	54.6
2	T1	All MCs	1075	6.3	1075	6.3	0.490	6.0	LOS A	1.6	11.5	0.69	0.57	0.69	46.6
Approach			1145	5.9	1145	5.9	0.490	5.9	LOS A	1.6	11.5	0.69	0.57	0.69	47.4
North: SH1C Off-Ramp 1															
3	L2	All MCs	362	11.7	362	11.7	0.227	7.3	LOS A	0.4	2.8	0.52	0.69	0.52	55.3
5	T1	All MCs	1	0.0	1	0.0	0.227	7.5	LOS A	0.3	2.6	0.53	0.74	0.53	58.5
4	R2	All MCs	78	9.7	78	9.7	0.227	14.2	LOS B	0.3	2.6	0.53	0.74	0.53	51.8
Approach			441	11.4	441	11.4	0.227	8.5	LOS A	0.4	2.8	0.52	0.70	0.52	54.9
West: Te Rapa Rd															
5	T1	All MCs	464	4.0	464	4.0	0.239	3.2	LOS A	0.0	0.0	0.00	0.34	0.00	53.5
6	R2	All MCs	321	4.7	321	4.7	0.239	9.3	LOS A	0.0	0.0	0.00	0.63	0.00	49.7
Approach			785	4.3	785	4.3	0.239	5.7	LOS A	0.0	0.0	0.00	0.46	0.00	51.9
All Vehicles			2372	6.4	2372	6.4	0.490	6.3	LOS A	1.6	11.5	0.43	0.56	0.43	50.7

Table No: 61

2035 Stage 1 AM Peak – Horotiu Interchange Eastern RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Te Rapa Rd															
1	L2	All MCs	91	0.0	91	0.0	0.323	6.7	LOS A	0.9	7.2	0.73	0.62	0.73	54.4
2	T1	All MCs	511	15.9	511	15.9	0.323	7.5	LOS A	0.9	7.2	0.74	0.63	0.74	46.2
Approach			601	13.5	601	13.5	0.323	7.4	LOS A	0.9	7.2	0.74	0.63	0.74	48.0
North: SH1C Off-Ramp 1															
3	L2	All MCs	494	15.2	494	15.2	0.385	9.8	LOS A	0.7	5.9	0.68	0.84	0.78	53.1
5	T1	All MCs	1	0.0	1	0.0	0.385	10.4	LOS B	0.7	5.4	0.69	0.89	0.82	54.9
4	R2	All MCs	113	12.1	113	12.1	0.385	17.5	LOS B	0.7	5.4	0.69	0.89	0.82	46.8
Approach			607	14.6	607	14.6	0.385	11.3	LOS B	0.7	5.9	0.68	0.85	0.79	52.3
West: Te Rapa Rd															
5	T1	All MCs	865	3.9	865	3.9	0.417	3.2	LOS A	0.0	0.0	0.00	0.36	0.00	53.2
6	R2	All MCs	506	4.2	506	4.2	0.417	9.3	LOS A	0.0	0.0	0.00	0.61	0.00	50.4
Approach			1372	4.0	1372	4.0	0.417	5.5	LOS A	0.0	0.0	0.00	0.45	0.00	52.1
All Vehicles			2580	8.7	2580	8.7	0.417	7.3	LOS A	0.9	7.2	0.33	0.59	0.36	51.4

Table No: 62

2035 Stage 1 PM Peak – Horotiu Interchange Eastern RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Te Rapa Rd															
1	L2	All MCs	117	0.0	117	0.0	0.559	5.9	LOS A	1.9	14.2	0.71	0.58	0.72	54.4
2	T1	All MCs	1201	6.3	1201	6.3	0.559	6.5	LOS A	2.0	14.6	0.73	0.61	0.76	46.3
Approach			1318	5.8	1318	5.8	0.559	6.4	LOS A	2.0	14.6	0.72	0.61	0.76	47.4
North: SH1C Off-Ramp 1															
3	L2	All MCs	375	11.7	375	11.7	0.235	7.4	LOS A	0.4	2.9	0.53	0.70	0.53	55.3
5	T1	All MCs	1	0.0	1	0.0	0.235	7.6	LOS A	0.4	2.8	0.54	0.74	0.54	58.5
4	R2	All MCs	77	9.7	77	9.7	0.235	14.3	LOS B	0.4	2.8	0.54	0.74	0.54	51.7
Approach			453	11.4	453	11.4	0.235	8.6	LOS A	0.4	2.9	0.53	0.70	0.53	54.9
West: Te Rapa Rd															
5	T1	All MCs	499	4.0	499	4.0	0.247	3.2	LOS A	0.0	0.0	0.00	0.35	0.00	53.3
6	R2	All MCs	312	4.7	312	4.7	0.247	9.3	LOS A	0.0	0.0	0.00	0.62	0.00	50.1
Approach			811	4.2	811	4.2	0.247	5.6	LOS A	0.0	0.0	0.00	0.45	0.00	52.0
All Vehicles			2581	6.3	2581	6.3	0.559	6.5	LOS A	2.0	14.6	0.46	0.58	0.48	50.6

Table No: 63

2045 Stage 2 AM Peak – Horotiu Interchange Eastern RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Te Rapa Rd															
1	L2	All MCs	159	0.0	159	0.0	0.430	7.3	LOS A	1.3	10.2	0.80	0.66	0.80	53.9
2	T1	All MCs	616	15.9	616	15.9	0.430	8.7	LOS A	1.3	10.2	0.81	0.69	0.83	45.0
Approach			775	12.6	775	12.6	0.430	8.4	LOS A	1.3	10.2	0.80	0.68	0.83	47.6
North: SH1C Off-Ramp 1															
3	L2	All MCs	558	15.2	558	15.2	0.437	10.6	LOS B	0.9	7.3	0.70	0.88	0.87	52.5
5	T1	All MCs	1	0.0	1	0.0	0.437	11.2	LOS B	0.8	6.6	0.71	0.93	0.91	54.2

4	R2	All MCs	117	12.1	117	12.1	0.437	18.3	LOS B	0.8	6.6	0.71	0.93	0.91	45.9
Approach			676	14.7	676	14.7	0.437	11.9	LOS B	0.9	7.3	0.71	0.88	0.88	51.7
West: Te Rapa Rd															
5	T1	All MCs	884	3.9	884	3.9	0.436	3.2	LOS A	0.0	0.0	0.00	0.35	0.00	53.3
6	R2	All MCs	548	4.2	548	4.2	0.436	9.3	LOS A	0.0	0.0	0.00	0.62	0.00	50.2
Approach			1433	4.0	1433	4.0	0.436	5.5	LOS A	0.0	0.0	0.00	0.45	0.00	52.0
All Vehicles			2883	8.8	2883	8.8	0.437	7.8	LOS A	1.3	10.2	0.38	0.62	0.43	50.9

Table No: 64

2045 Stage 2 PM Peak – Horotiu Interchange Eastern RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Te Rapa Rd															
1	L2	All MCs	165	0.0	165	0.0	0.705	8.9	LOS A	3.7	27.1	0.85	0.78	1.06	53.3
2	T1	All MCs	1421	6.3	1421	6.3	0.705	10.0	LOS A	3.7	27.1	0.86	0.81	1.11	43.8
Approach			1586	5.7	1586	5.7	0.705	9.8	LOS A	3.7	27.1	0.86	0.80	1.11	45.2
North: SH1C Off-Ramp 1															
3	L2	All MCs	432	11.7	432	11.7	0.278	7.8	LOS A	0.5	3.5	0.57	0.73	0.57	55.0
5	T1	All MCs	1	0.0	1	0.0	0.278	8.0	LOS A	0.4	3.3	0.58	0.77	0.58	58.0
4	R2	All MCs	80	9.7	80	9.7	0.278	14.8	LOS B	0.4	3.3	0.58	0.77	0.58	51.1
Approach			513	11.4	513	11.4	0.278	8.9	LOS A	0.5	3.5	0.57	0.73	0.57	54.6
West: Te Rapa Rd															
5	T1	All MCs	574	4.0	574	4.0	0.288	3.2	LOS A	0.0	0.0	0.00	0.35	0.00	53.4
6	R2	All MCs	374	4.7	374	4.7	0.288	9.3	LOS A	0.0	0.0	0.00	0.62	0.00	49.9
Approach			947	4.3	947	4.3	0.288	5.6	LOS A	0.0	0.0	0.00	0.46	0.00	51.9
All Vehicles			3046	6.2	3046	6.2	0.705	8.4	LOS A	3.7	27.1	0.54	0.68	0.67	49.3

Western Roundabout

Table No: 65

2035 Baseline AM Peak – Horotiu Interchange Western RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: SH1C Off-Ramp 2															
1	L2	All MCs	412	5.3	412	5.3	0.279	7.4	LOS A	0.5	3.8	0.54	0.67	0.54	57.0
5	T1	All MCs	1	0.0	1	0.0	0.279	7.1	LOS A	0.5	3.8	0.54	0.67	0.54	57.7
2	R2	All MCs	60	2.3	60	2.3	0.279	13.5	LOS B	0.5	3.8	0.54	0.67	0.54	52.1
Approach			473	4.9	473	4.9	0.279	8.2	LOS A	0.5	3.8	0.54	0.67	0.54	56.7
East: Great South Rd															
3	T1	All MCs	349	9.1	349	9.1	0.209	3.4	LOS A	0.0	0.0	0.00	0.39	0.00	55.7
4	R2	All MCs	248	23.8	248	23.8	0.209	9.5	LOS A	0.0	0.0	0.00	0.58	0.00	45.7
Approach			598	15.2	598	15.2	0.209	5.9	LOS A	0.0	0.0	0.00	0.47	0.00	51.5
West: Great South Rd															
5	L2	All MCs	45	21.1	45	21.1	0.494	6.5	LOS A	1.6	11.5	0.63	0.54	0.63	55.0
6	T1	All MCs	1173	4.2	1173	4.2	0.494	6.2	LOS A	1.6	11.5	0.64	0.55	0.64	51.1
Approach			1218	4.8	1218	4.8	0.494	6.3	LOS A	1.6	11.5	0.64	0.55	0.64	51.4
All Vehicles			2288	7.6	2288	7.6	0.494	6.6	LOS A	1.6	11.5	0.45	0.56	0.45	52.7

Table No: 66

2035 Baseline PM Peak – Horotiu Interchange Western RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: SH1C Off-Ramp 2															
1	L2	All MCs	378	4.8	378	4.8	0.323	9.4	LOS A	0.6	4.5	0.67	0.78	0.67	55.4
5	T1	All MCs	1	0.0	1	0.0	0.323	8.6	LOS A	0.6	4.5	0.67	0.78	0.67	56.1
2	R2	All MCs	79	1.5	79	1.5	0.323	15.0	LOS B	0.6	4.5	0.67	0.78	0.67	49.6
Approach			458	4.2	458	4.2	0.323	10.3	LOS B	0.6	4.5	0.67	0.78	0.67	54.8
East: Great South Rd															
3	T1	All MCs	627	4.1	627	4.1	0.388	3.4	LOS A	0.0	0.0	0.00	0.39	0.00	55.9
4	R2	All MCs	526	8.9	526	8.9	0.388	9.4	LOS A	0.0	0.0	0.00	0.60	0.00	48.0
Approach			1154	6.3	1154	6.3	0.388	6.1	LOS A	0.0	0.0	0.00	0.48	0.00	52.3
West: Great South Rd															
5	L2	All MCs	49	13.3	49	13.3	0.378	7.9	LOS A	1.1	8.3	0.74	0.63	0.74	54.6
6	T1	All MCs	705	5.0	705	5.0	0.378	8.1	LOS A	1.1	8.3	0.75	0.65	0.75	50.2
Approach			755	5.5	755	5.5	0.378	8.1	LOS A	1.1	8.3	0.75	0.64	0.75	50.7
All Vehicles			2366	5.6	2366	5.6	0.388	7.6	LOS A	1.1	8.3	0.37	0.59	0.37	52.4

Table No: 67

2035 Stage 1 AM Peak – Horotiu Interchange Western RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: SH1C Off-Ramp 2															
1	L2	All MCs	408	5.3	408	5.3	0.319	7.6	LOS A	0.6	4.4	0.56	0.70	0.56	56.5
5	T1	All MCs	1	0.0	1	0.0	0.319	7.2	LOS A	0.6	4.4	0.56	0.70	0.56	56.6
2	R2	All MCs	126	2.3	126	2.3	0.319	13.6	LOS B	0.6	4.4	0.56	0.70	0.56	50.5
Approach			536	4.6	536	4.6	0.319	9.1	LOS A	0.6	4.4	0.56	0.70	0.56	55.6
East: Great South Rd															
3	T1	All MCs	356	9.1	356	9.1	0.218	3.4	LOS A	0.0	0.0	0.00	0.39	0.00	55.7
4	R2	All MCs	267	23.8	267	23.8	0.218	9.5	LOS A	0.0	0.0	0.00	0.58	0.00	45.6
Approach			623	15.4	623	15.4	0.218	6.0	LOS A	0.0	0.0	0.00	0.47	0.00	51.3
West: Great South Rd															
5	L2	All MCs	44	21.1	44	21.1	0.559	7.5	LOS A	2.0	14.6	0.73	0.62	0.76	54.3
6	T1	All MCs	1245	4.2	1245	4.2	0.559	7.5	LOS A	2.0	14.6	0.75	0.64	0.79	50.2
Approach			1289	4.8	1289	4.8	0.559	7.5	LOS A	2.0	14.6	0.75	0.64	0.79	50.4
All Vehicles			2448	7.4	2448	7.4	0.559	7.5	LOS A	2.0	14.6	0.52	0.61	0.54	52.0

Table No: 68

2035 Stage 1 PM Peak – Horotiu Interchange Western RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: SH1C Off-Ramp 2															
1	L2	All MCs	371	4.8	371	4.8	0.345	10.0	LOS B	0.7	5.0	0.70	0.81	0.71	54.7
5	T1	All MCs	1	0.0	1	0.0	0.345	9.2	LOS A	0.7	5.0	0.70	0.81	0.73	55.1
2	R2	All MCs	98	1.5	98	1.5	0.345	15.6	LOS B	0.7	5.0	0.70	0.81	0.73	48.3
Approach			469	4.1	469	4.1	0.345	11.2	LOS B	0.7	5.0	0.70	0.81	0.71	53.9
East: Great South Rd															
3	T1	All MCs	663	4.1	663	4.1	0.430	3.4	LOS A	0.0	0.0	0.00	0.38	0.00	56.0

4	R2	All MCs	615	8.9	615	8.9	0.430	9.4	LOS A	0.0	0.0	0.00	0.61	0.00	47.7
Approach			1278	6.4	1278	6.4	0.430	6.3	LOS A	0.0	0.0	0.00	0.49	0.00	52.0
West: Great South Rd															
5	L2	All MCs	49	13.3	49	13.3	0.419	9.0	LOS A	1.3	9.6	0.82	0.67	0.82	54.1
6	T1	All MCs	714	5.0	714	5.0	0.419	9.4	LOS A	1.3	9.6	0.82	0.70	0.84	49.1
Approach			763	5.5	763	5.5	0.419	9.4	LOS A	1.3	9.6	0.82	0.70	0.83	49.6
All Vehicles			2511	5.7	2511	5.7	0.430	8.1	LOS A	1.3	9.6	0.38	0.61	0.39	51.8

Table No: 69

2045 Stage 2 AM Peak – Horotiu Interchange Western RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: SH1C Off-Ramp 2															
1	L2	All MCs	428	5.3	428	5.3	0.356	8.1	LOS A	0.7	5.0	0.60	0.73	0.60	56.0
5	T1	All MCs	1	0.0	1	0.0	0.356	7.6	LOS A	0.7	5.0	0.60	0.73	0.60	56.2
2	R2	All MCs	142	2.3	142	2.3	0.356	14.0	LOS B	0.7	5.0	0.60	0.73	0.60	50.0
Approach			572	4.5	572	4.5	0.356	9.6	LOS A	0.7	5.0	0.60	0.73	0.60	55.1
East: Great South Rd															
3	T1	All MCs	397	9.1	397	9.1	0.258	3.4	LOS A	0.0	0.0	0.00	0.38	0.00	55.8
4	R2	All MCs	337	23.8	337	23.8	0.258	9.5	LOS A	0.0	0.0	0.00	0.59	0.00	45.3
Approach			734	15.8	734	15.8	0.258	6.2	LOS A	0.0	0.0	0.00	0.48	0.00	50.9
West: Great South Rd															
5	L2	All MCs	47	21.1	47	21.1	0.624	9.6	LOS A	2.8	20.2	0.83	0.73	0.97	53.7
6	T1	All MCs	1289	4.2	1289	4.2	0.624	9.8	LOS A	2.8	20.2	0.84	0.76	1.01	48.8
Approach			1337	4.8	1337	4.8	0.624	9.7	LOS A	2.8	20.2	0.84	0.76	1.01	49.1
All Vehicles			2642	7.8	2642	7.8	0.624	8.7	LOS A	2.8	20.2	0.55	0.67	0.64	51.1

Table No: 70

2045 Stage 2 PM Peak – Horotiu Interchange Western RAB Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: SH1C Off-Ramp 2															
1	L2	All MCs	373	4.8	373	4.8	0.411	11.8	LOS B	1.0	6.9	0.75	0.86	0.83	53.0
5	T1	All MCs	1	0.0	1	0.0	0.411	10.9	LOS B	1.0	6.9	0.77	0.88	0.91	52.8
2	R2	All MCs	145	1.5	145	1.5	0.411	17.3	LOS B	1.0	6.9	0.77	0.88	0.91	45.1
Approach			519	3.8	519	3.8	0.411	13.3	LOS B	1.0	6.9	0.76	0.87	0.86	51.6
East: Great South Rd															
3	T1	All MCs	688	4.1	688	4.1	0.506	3.4	LOS A	0.0	0.0	0.00	0.35	0.00	56.6
4	R2	All MCs	814	8.9	814	8.9	0.506	9.4	LOS A	0.0	0.0	0.00	0.63	0.00	47.1
Approach			1502	6.7	1502	6.7	0.506	6.6	LOS A	0.0	0.0	0.00	0.50	0.00	51.4
West: Great South Rd															
5	L2	All MCs	56	13.3	56	13.3	0.600	17.9	LOS B	3.0	22.0	1.00	0.96	1.43	47.8
6	T1	All MCs	802	5.0	802	5.0	0.600	19.1	LOS B	3.0	22.0	0.99	0.98	1.45	39.9
Approach			858	5.5	858	5.5	0.600	19.0	LOS B	3.0	22.0	0.99	0.98	1.45	40.6
All Vehicles			2879	5.8	2879	5.8	0.600	11.5	LOS B	3.0	22.0	0.43	0.71	0.59	48.1

3. Recommendations

The following transportation infrastructure provisions are recommended as a result of the revised modelling and assessment, to mitigate the potential transport effects associated with PC17.

- Up to 20 ha of land (net) within the West Block of PC17 Structure Plan may be developed with access to Old Ruffell Road, subject to:
    - Construction of the Structure Plan Spine Road in general accordance with the Structure Plan and Collector Road typical cross-section, connecting continuously to Old Ruffell Road.
    - Upgrade of Old Ruffell Road to a Collector-like standard between the Spine Road and Ruffell Road.
    - The cumulative average weekday peak traffic volume accessing through Old Ruffell Road does not exceeding 325 vehicles per hour, two-way.
- Up to 35 ha of land (net) within the West and North Blocks of Te Rapa North Structure Plan may be developed subject to the above infrastructure being completed plus:
    - Construction of a new four-leg signalised intersection on Te Rapa Road in general accordance with Access 2 on the Structure Plan.
    - Provision of four continuous traffic lanes on Te Rapa Road between the Hutchinson Road roundabout and the new Access 2 intersection.
    - Construction of the Structure Plan Spine Road in general accordance with the Structure Plan and Collector Road typical cross-section, connecting the additional development triggering this upgrade to the Access 2 intersection.
- Up to 42 ha of land (net) within the Te Rapa North Structure Plan area may be developed subject to the above infrastructure being completed plus:
    - Design and construction of a capacity upgrade to Te Rapa Road / Ruffell Road intersection (additional northbound and southbound through movement lanes).
- Completion of PC17 Te Rapa North Structure Plan area development subject to the above infrastructure being completed and:
    - A Broad ITA being provided in support of the consent application with recommendations for any further infrastructure upgrades to be undertaken to adequately mitigate the assessed cumulative effects of the proposed development in the Structure Plan area.
    - The ITA evaluates the feasibility of completing any LCSIA identified safety upgrades if the average weekday am peak hour traffic volume on the eastbound approach entering the Te Rapa Road / Te Kowhai Road / Church Road roundabout meets or exceeds 790 vehicles per hour.
    - The ITA includes evidence of consultation with Waka Kotahi NZ Transport Agency, KiwiRail (where relevant), Fonterra Limited and the Waikato Regional Council and how any feedback from these organisations has been addressed.
    - The recommended infrastructure upgrades in the ITA, or such alternatives accepted by Hamilton City Council, KiwiRail and NZTA (as required) are completed.

ATTACHMENT 2

Revised PC17 Transport Infrastructure Staging provisions

Minimum Infrastructure Requirement	Implementation Trigger
i. A Collector Road (Structure Plan Spine Road) is designed and constructed in general accordance with the Structure Plan and typical cross-section shown in Figure 3.9.2.5.c, as a continuous connection to Old Ruffell Road including a Tee- intersection with the Spine Road for the remaining Old Ruffell Road stub, and future proofing for a four-leg intersection between the Spine Road and the planned Northern River Crossing arterial. ii. Upgrade of Old Ruffell Road to Old Ruffell Road Collector cross-section standard between the Structure Plan Spine Road and Ruffell Road, including provision for a walking and cycling connection between Te Rapa Road and Old Ruffell Road stub opposite the Te Rapa Road / McKee Street intersection.	To be completed prior to: i. Any section 224c certificate for subdivision under the Resource Management Act 1991 ('RMA') being issued that takes the cumulative net developable area in the West Block of the Structure Plan area to no more than 20 ha: or, ii. Any industrial / commercial activity within the West Block of the Structure Plan area generating a cumulative average weekday pm peak traffic volume up to 325 vehicles per hour (two-way), accessing via Old Ruffell Road;
iii. Completion of items i – ii, above. iv. Design and construction of a new four-leg signalised intersection on Te Rapa Road in general accordance with Access 2 on the Structure Plan. v. A Collector Road (Structure Plan Spine Road) is designed and constructed in general accordance with the Structure Plan and typical cross-section shown in Figure 3.9.2.5.c, connecting the additional development triggering this upgrade to the Access 2 intersection. vi. New northbound and southbound bus stops located on the Te Rapa Road south leg of the Access 2 intersection vii. Shared walking and cycling paths on both sides of Te Rapa Road connecting Access 2 intersection to the new bus stops viii. Provision of four continuous traffic lanes on Te Rapa Road between the Hutchinson Road roundabout and the new Access 2 intersection	To be completed prior to: i. Any section 224c certificate for subdivision under the Resource Management Act 1991('RMA') being issued that takes the cumulative net developable area in the West and North Blocks of the Structure Plan area to between 20.1 ha and 35 ha: or, ii. Any industrial / commercial activity in the West and/or North Blocks of the Structure Plan area that generates a cumulative average weekday pm peak traffic volume exceeding 325 vehicles per hour (two-way), accessing via Old Ruffell Road.

ix. x.	Provision of a shared walking and cycling path on the eastern side of Te Rapa Road connecting to the existing shared path from Hutchinson Rd Permanent closure of two existing vehicle crossings to #1426 Te Rapa Road and provision of one new commercial vehicle crossing to the same property from the new eastern leg of the Access 2 intersection	
xi. xii.	Completion of items i – x, above. The Collector (Spine) Road is connected through the Structure Plan West Block between the Access 2 Intersection and Old Ruffell Road.	To be completed prior to: i. Any section 224c certificate for subdivision under the Resource Management Act 1991('RMA') being issued that takes the cumulative net developable area in the West and North Blocks of the Structure Plan area over 35 ha: or, ii. Any industrial / commercial activity in the West and North Blocks of the Structure Plan area that generates a cumulative average weekday pm peak traffic volume exceeding 570 vehicles per hour (two-way)
xiii. xiv.	Completion of items i – xii, above. Design and construction of a capacity upgrade to Te Rapa Road / Ruffell Road intersection (additional northbound and southbound through movement lanes).	To be completed prior to: i. Any section 224c certificate for subdivision under the Resource Management Act 1991('RMA') being issued that takes the cumulative net developable area in Te Rapa North Structure Plan area up to 42 ha: or, ii. Any industrial / commercial activity in the Te Rapa North Structure Plan area that generates a cumulative average weekday pm peak traffic volume up to 685 vehicles per hour (two-way)
xv. xvi.	Completion of items i – xiv, above. A Level Crossing Safety Impact Assessment (LCSIA) for the Ruffell Road level crossing that demonstrates the further upgrades (if any) required to safely	To be completed prior to: i. Any industrial / commercial activity in the Te Rapa North Structure Plan area that generates a cumulative average weekday pm peak traffic

	reopen the temporary closure of the level crossing.	volume exceeding 685 vehicles per hour (two-way), and
xvii.	Completion of the identified safety upgrades to the satisfaction of KiwiRail and Hamilton City Council, and the reopening of level crossing to traffic in both directions	ii. The average weekday am peak hour traffic volume on Te Kowhai Road eastbound approach entering the Te Rapa Road / Te Kowhai Road roundabout exceeds 790 vehicles per hour.
xviii.	A road connection being provided through the existing Dairy Manufacturing Site from the Fonterra Block and Meadow View Block to access through the interchange on Te Rapa Road.	To be completed prior to: i. Any section 224c certificate for subdivision under the Resource Management Act 1991 ('RMA') being issued for development within the South Block.
xix.	No vehicle access is provided from any Industrial activity in the South Block to Meadow View Lane south of RP 58.	

a. All applications that fail to meet Rule 3.9.3.2(i)-(xiv) shall be supported by a Simple ITA that meets the requirements of section 15-2 of the District Plan.

b. All applications in the Te Rapa North Industrial Structure Plan subject to Rule 3.9.3.2(xvi)-(xiviii) shall be supported by a Broad ITA that meets the requirements of section 15-2 of the District Plan, and that:

i. identifies and evaluates the transport effects of all cumulative development in the Structure Plan area on the infrastructure identified for improvements in the Table included in Section 3.9.2.2 (above).

ii. assesses the capacity and safety effects for the following existing key intersections and provides recommendations for appropriate effects mitigation where required.

- SH1C Horotiu Interchange roundabouts
- Te Rapa Road / McKee Street signalised intersection
- Te Rapa Road / Ruffell Road signalised intersection
- Te Rapa Road / Kapuni Street intersection
- Te Rapa Road / Te Kowhai Road / Church Road intersection
- Old Ruffell Road / Ruffell Road intersection

iii. evaluates the feasibility of completing any LCSIA identified safety upgrades.

iv. includes evidence of consultation with Waka Kotahi NZ Transport Agency, KiwiRail (where relevant), Fonterra Limited and the Waikato Regional Council and how any feedback from these organisations has been addressed.

v. provides recommendations for any further infrastructure upgrades to be undertaken to adequately mitigate the assessed cumulative effects of the proposed development in the Structure Plan area.

c. The recommended infrastructure upgrades in the Broad ITA, or such alternatives accepted by Hamilton City Council, Kiwi Rail and NZTA (the latter two where approval is legally required), are completed prior to the section 224c certificate for subdivision under the Resource Management Act 1991 ('RMA') being issued.