Ngarara Farm Development

MAYPOLE ENVIRONMENTAL LTD

Integrated Transport Assessment

001 | 1

18 December 2014

Ngarara

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Ngarara

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A		Draft for internal comment	SCMH	IMD	AWB
B	16 October 2014	Updated to include 1parking space per multi-unit + 54HH	SCMH	IMD	AWB
C	21 November 2014	Updated with DJT comments	IMD	IMD	DJT
D	16 December 2014	Practice reviews carried out, comments addressed	IMD	MWH	MWH
1	18 December 2014	NDP issue	IMD	MWH	MWH

Contents

Executive Summary

The Discretionary Activity Standards for Neighbourhood Development Plan applications within the Ngarara Zone require a range of supporting assessments, including an Integrated Traffic Assessment ("ITA") under Rule D.11.2.3 (iv) which requires an assessment to determine the traffic effects on the local (Kapiti Coast) and regional road networks and where identified as necessary, the form of mitigation to address these effects.

In addition, for the purposes of an application for the Waimeha Neighbourhood Development Area ("NDA"), the ITA is to address the traffic effects in excess of those from a threshold totalling 265 household units ("HHUs") and include assessment on;

a. Trip generation
b. Public transport provision
c. Walk and cycling planning
d. Emissions
e. Travel Plan
f. Intersection Capability

The Waimeha Structure Plan identifies a hierarchy of roads, divided into Primary and Secondary Connections. The hierarchy proposed as part of this NDA is consistent with the principles described in the Structure Plan.

Using the outputs from the Kapiti Transport Model (KTM3)[1], the ITA has assessed the following issues that relate to this development and drawn conclusions as follows:

a. Trip generation

- The ITA has used outputs from the KTM3 model as the basis for the assessment of traffic effects associated with the proposed Waimeha Neighbourhood and the wider Ngarara development. The traffic generation assumptions used in this modelling are considered to be appropriate.
- Traffic generated by the proposed Waimeha neighbourhood and wider Ngarara development can be easily accommodated and will have negligible adverse effect on the adjacent road network. No mitigation is required.

b. Public transport provision

- The existing public transport provision along Te Moana Road provides a good level of service for the site. Te Ara Nui o Ngarara and the Main Streets have been designed to provide access for buses and bus stopping facilities. This level of provision is considered to be appropriate.

c. Walk and cycling planning

- The site is highly accessible to all users including car drivers, pedestrians, cyclists, public transport users and the mobility impaired. No additional facilities are recommended in addition to those proposed in this report;

[1] KTM3 is owned by Kapiti Coast District Council and maintained by Beca.

- Specific consideration has been given to pedestrians, cyclists and the mobility impaired, with dedicated shared paths for these users. An inter-connected open space network provides an alternative to the road network for active mode users.

d. Emissions

- There is very limited data available on the likely changes in vehicle kilometres travelled (VKT) as a result of the development due to the residents of this development presumably relocating from other residential areas. Depending on the type of residence future residents were living in, residents may reduce or increase their CO2 emission footprint depending on their current access to employment and amenities by active modes and public transport.
- It is not considered appropriate to quantify the likely emissions impacts of the development, rather give an indication of the potential CO2 considerations under a number of assumptions:
- A total of 1,400 vehicle movements per day in 2021, or approximately 500,000 per year;
- By providing for walkable amenities and encouraging walkablility through generous walkways and cycleways additional vehicle trips increasing CO2 emissions can be minimised

e. Travel Plan

- The travel planning recommendations included in this report will contribute to a strong sense of place within the community and will reduce the reliance of the community on single occupancy vehicle travel.

f. Intersection Capability

- The intersection of Te Ara Nui o Ngarara and Te Moana Road can easily accommodate the full proposed quantum of traffic associated with the wider Ngarara development with low levels of delay and a very good level of service. No additional mitigation measures are required to accommodate traffic associated with the development.
- Parking and access provision and layout are sufficient and appropriate for the proposed land uses and compliant with relevant District Plan requirements.

This ITA concludes that the proposal would have a less than minor effect on the safety and operation of the local and regional transportation network and no mitigation measures are recommended.

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to ***examine the likely transportation effects of the proposed Waimeha neighbourhood and the way in which these effects will affect the existing road network, public transport, and other related transportation issues such as pedestrian, cycle and bridle facilities*** in accordance with the scope of services set out in the contract between Jacobs and the Client. That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

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1. Introduction

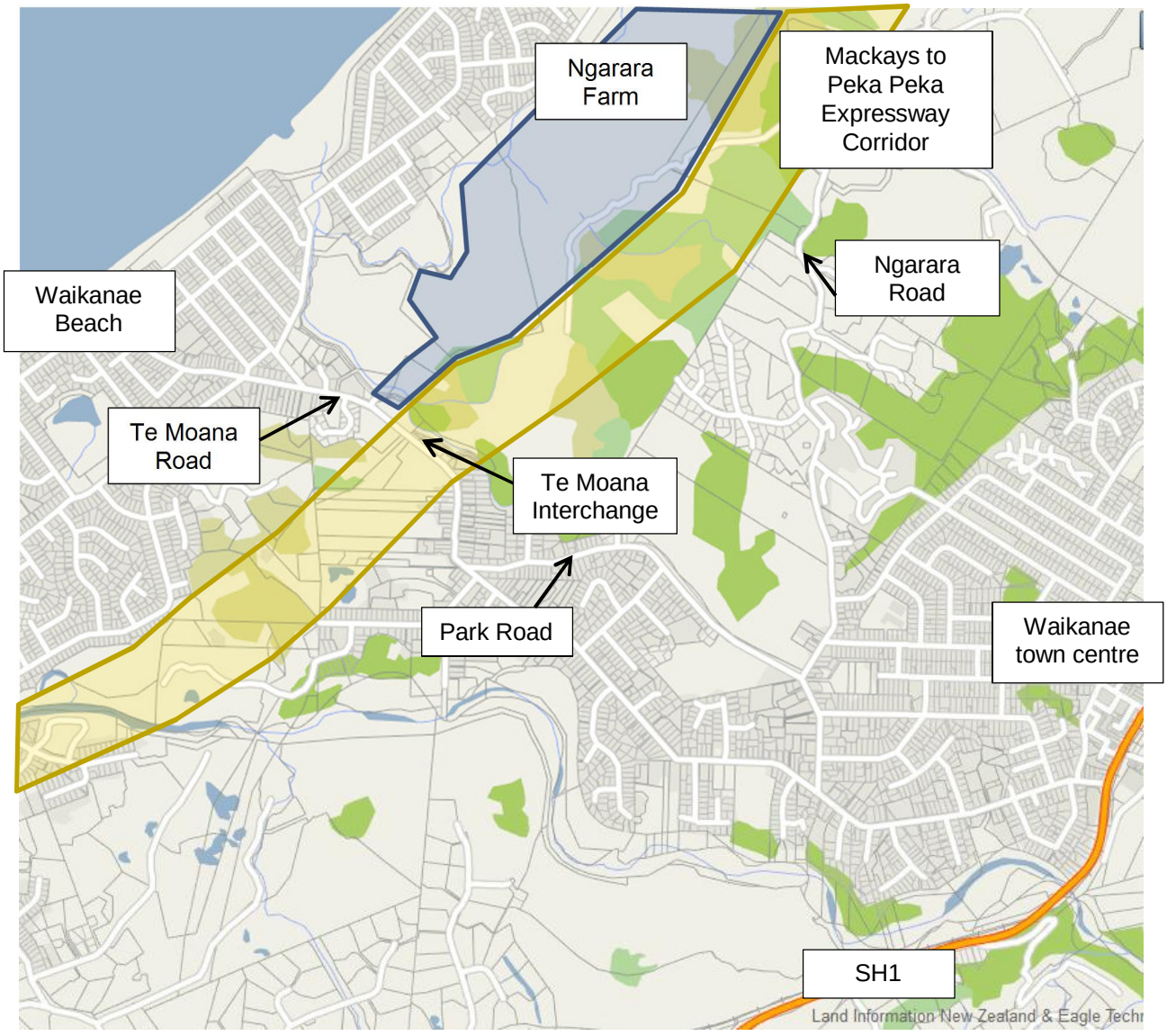
Jacobs has been commissioned to develop an Integrated Transportation Assessment (ITA) for the proposed ***Waimeha*** neighbourhood, which is located within the Ngarara development, to support the application for Neighbourhood Development Plan (NDP) consent.

Each NDP is required to have regard to the identified assessment criteria, which includes demonstrating its consistency with the Ngarara Zone Structure Plan, comprising the environmental outcomes and anticipated form of development. Regarding Waimeha, which is the subject of this NDP application, the Plan outlines the purpose of this area as providing a high density core (mixed use), lower density residential outer, a school, and playing fields. It relies on access from Te Moana Road and is anticipated to have up to 780 household units.

This report examines the likely transportation effects of the proposed Waimeha neighbourhood and the way in which these will affect the existing road network, public transport, and other related transportation issues such as pedestrian, cycle and bridle facilities.

The location of the Ngarara Farm site is shown in Figure 1.1.

Figure 1.1 : Site Location



The Ngarara development will ultimately include three neighbourhoods with a range of lot sizes, linked by quiet roads, cycle paths and walkways. Other land uses which enhance the proposed form will also be included, such as small scale service, retail and community activities. The settlement will be accessed from Te Moana Road and Ngarara Road. Plan Change 80 (PC80) was adopted into the Kapiti Coast District Council (KCDC) Operative District Plan in 2010, to provide for this development.

This report specifically addresses the Waimeha neighbourhood, within the Ngarara development. Waimeha will initially only be accessible from Te Moana Road. Once the remaining neighbourhoods are constructed, access via Ngarara Road will also be possible.

It is important to note that PC80 made reference to Waimeha as a much larger neighbourhood. Since PC80 was adopted, the NZ Transport Agency has purchased a significant portion of the original Waimeha neighbourhood for the proposed Mackays to Peka Peka (M2PP) section of the Kapiti Expressway. This land purchase has effectively divided the PC80 Waimeha neighbourhood into two; Waimeha North and Waimeha South. Waimeha North is the subject of this ITA and is referred to as "*Waimeha*" within this report.

It is the intention of this ITA to examine not only the traditional traffic impacts of the development, but also to describe the relationship of the proposed development to the surrounding road network and its integration with pedestrian, cyclist, public transport and mobility impaired access.

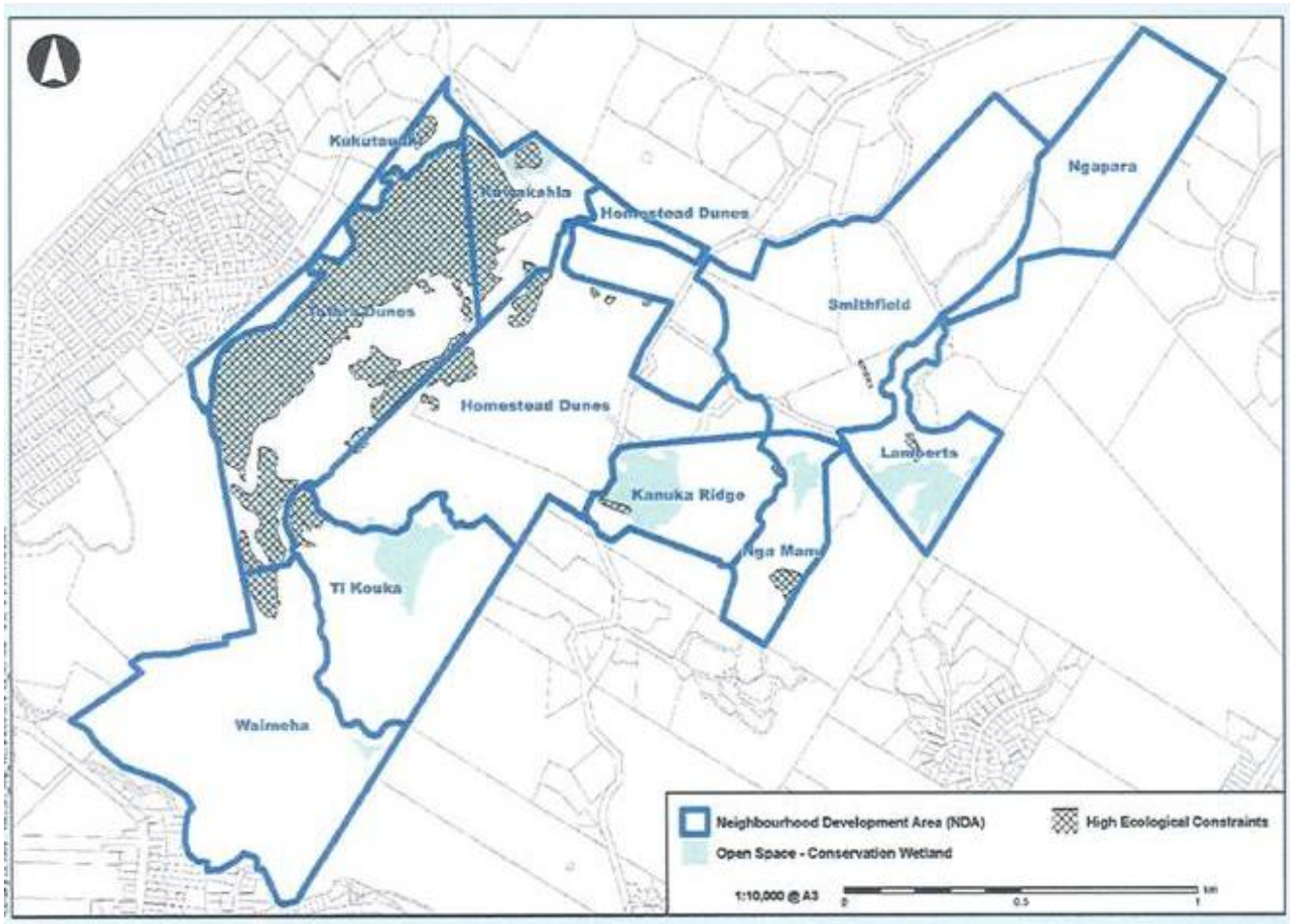
From a transport planning perspective, the important issues that relate to this development are:

- Assessing the impact of Ngarara Farm traffic on the adjacent road network;
- The accessibility of the site to all users including car drivers, pedestrians, cyclists, public transport users and the mobility impaired;
- Measures to minimise travel to the site by private car, and to reduce potential congestion on the adjacent road network as a result of the proposed development;
- The integration of public transport routes and stops with the proposed development;
- The integration of pedestrian and cycle facilities with the proposed development;
- The integration of mobility impaired visitor requirements with the proposed development; and
- Parking provision and layout should be sufficient and appropriate for the proposed land uses.

2. Background

The Ngarara Zone and Ngarara Precinct were created under Plan Change 80 (PC80); which was led by KCDC and became operative on 22nd March 2010. The Ngarara Zone and the Ngarara Precinct each have separate structure plans in the KCDC District Plan. The Ngarara Zone is for an urban development, whereas the Ngarara Precinct caters for rural residential development. The two structure plans contain neighbourhood development areas (NDAs). Ngarara, and the 11 NDAs it created, are shown Figure 2-1 below.

Figure 2-1 : Ngarara Zone and Precinct



The Ngarara Zone area changed the prescribed land use from rural to an integrated mixed use urban development area focussed on a number of residential clusters. PC80 set the policy direction for this area and also provided an indicative concept plan for each neighbourhood. When PC80 became operative, Maypole Environmental Ltd owned the land within the Ngarara Zone in its entirety.

The plan change provided for master planning to be completed through the resource consent process by applying for neighbourhood development plan (NDP) consent. Each NDP is required to have regard to the identified assessment criteria, which includes demonstrating its consistency with the Ngarara Zone Structure Plan, comprising the environmental outcomes and anticipated form of development.

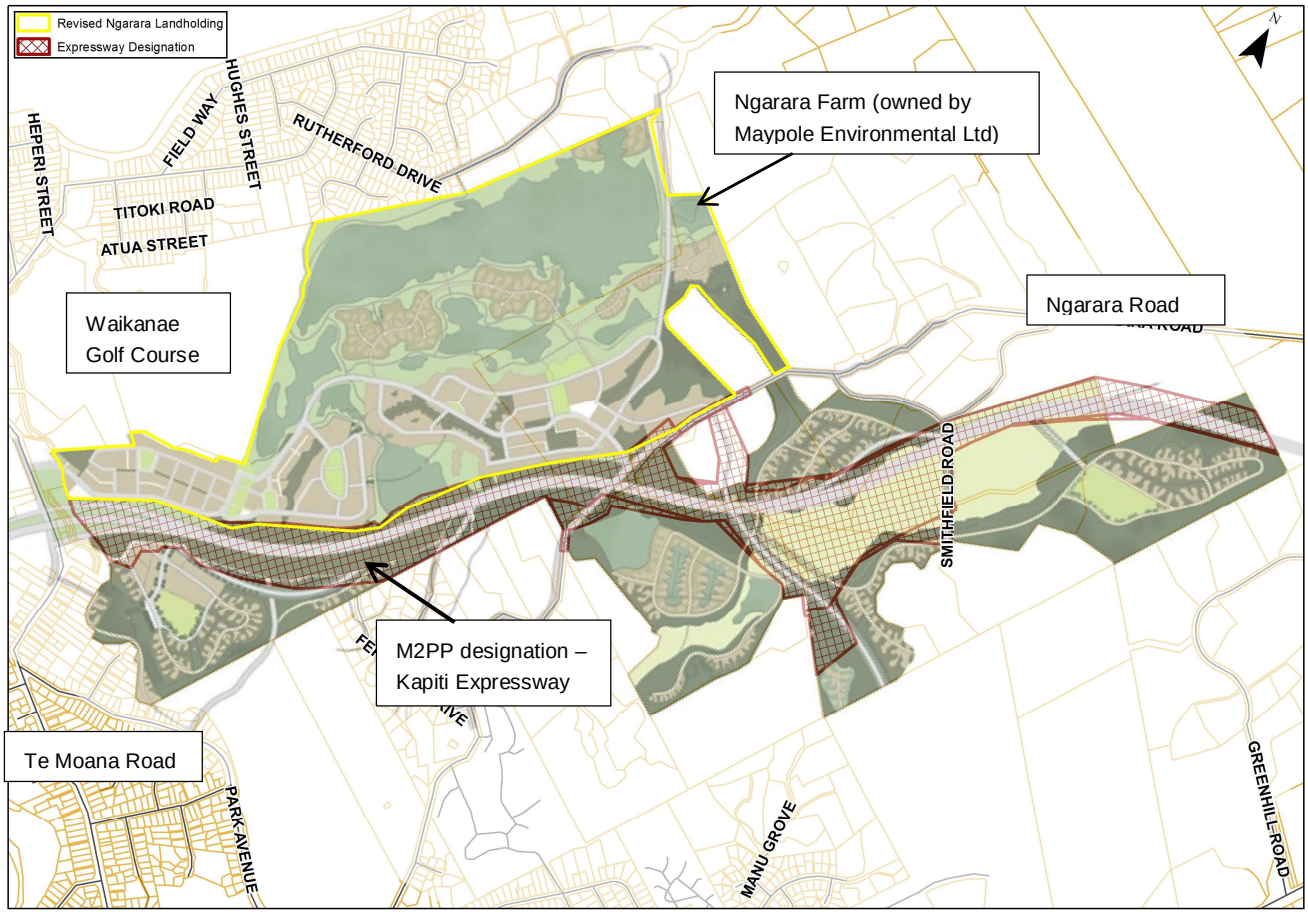
Regarding Waimeha, which is the subject of this NDP application, the Plan outlines the purpose of this area as providing a high density core (mixed use), lower density residential outer, a school, and playing fields. It relies on access from Te Moana Road and is anticipated to have up to 780 household units.

In 2013 the NZ Transport Agency (the Transport Agency) purchased land, designated for the purpose of Mackays to Peka Peka (M2PP) section of the Kapiti Expressway project, from Maypole.

Figure 2-2 shows the M2PP designation and the extent of the property now owned by Maypole. Of the original neighbourhoods envisaged by PC80, only the following are now within Maypole property:

- Waimeha North
- Te Kouka
- Homestead
- Kukutakaki
- Kawakahia
- Totara

Figure 2-2 : Plan Change 80 area – including M2PP designation



This ITA examines only the **Waimeha** neighbourhood in detail, as part of this NDP application. Figure 2-3 shows the proposed layout of the Waimeha neighbourhood.

Figure 2-3 : Waimeha Proposed Layout

3. Existing Conditions

Ngarara is located to the north of Te Moana Road, between Waikanae and Waikanae Beach in the Kapiti Coast District. The property is bounded by Te Moana Road to the south, the proposed M2PP section of the Kapiti Expressway to the east, Ngarara Road to the north and an area of protected wetland to the west. The Waikanae Golf Course is located on its south western boundary.

3.1 Existing Use

The Ngarara site has been utilised as a 280 Ha family farm. There is also a nationally significant wetland covering 28 hectares. Existing vehicle movements are very limited and associated with operation of the farm. There are two residential dwellings on the site, which is accessed via Park Road and Ngarara Road. The location of these roads is shown in Figure 1.1. The site is now an active construction site where the M2PP designation traverses the farm.

In 2010, PC 80 was approved and is included in the Operative District Plan. PC80 provides for the level of development described in Table 3-1.

Table 3-1 : PC80 – Permitted Development

NDA	Maximum HHU	Purpose
Waimeha	780	High density core (mixed use), lower density outer residential, school, playing fields, relies on access from Te Moana Road
Ti Kouka	300	High density residential (40 HHU/ha), medium residential (25 HHU/ha) and low residential density (16 HHU/ha)
Homestead Dunes	340	Intensive mixed use 'Nodes', medium to lower density residential, wetland and ecological constraints influence this NDA
Totara Dunes	30	Low impact, low density residential. Most ecologically sensitive and lowest density area in Ngarara
Kanuka Ridge	80	Low density residential dwellings
Nga Manu Eco-Commercial	15	Visitor Centre and focus on self-catering bush lodges next to the existing reserve.
TOTAL	**1,545**	

Te Moana Road

The Transport Agency's land purchase to enable the construction of the M2PP section of the Kapiti Expressway means that only the developable areas, shown in Table 3-2 are owned by Maypole. Waimeha North is the subject of this ITA.

Table 3-2 : Ngarara – (2014 Maypole Environmental Ltd owned land)

NDA	Maximum HHU	Purpose
Waimeha North	480	High density core (mixed use), lower density outer residential, school, playing fields, relies on access from Te Moana Road
Ti Kouka	300	High density residential (40 HHU/ha), medium residential (25 HHU/ha) and low residential density (16 HHU/ha)
Homestead Dunes	340	Intensive mixed use 'Nodes', medium to lower density residential, wetland and ecological constraints influence this NDA

NDA	Maximum HHU	Purpose
Kukuataki	5	Low impact residential
Kawakahia	15	Low impact residential and boutique accommodation
Totara Dunes	30	Low impact, low density residential. Most ecologically sensitive and lowest density area in Ngarara
TOTAL	**1,170**	

3.2 Adjacent Road Network

Te Moana Road is classified as a Collector Road in the operative Kapiti Coast District Plan and carries traffic volumes of approximately 5,000 – 10,000 vehicles per day. Traffic volumes are generally heavier close to the Waikanae town centre and much lower towards Waikanae beach. Te Moana Road is the main link between the Waikanae Township, State Highway One (SH1) and Waikanae Beach. It also serves as a residential road, providing direct access to residences along its length.

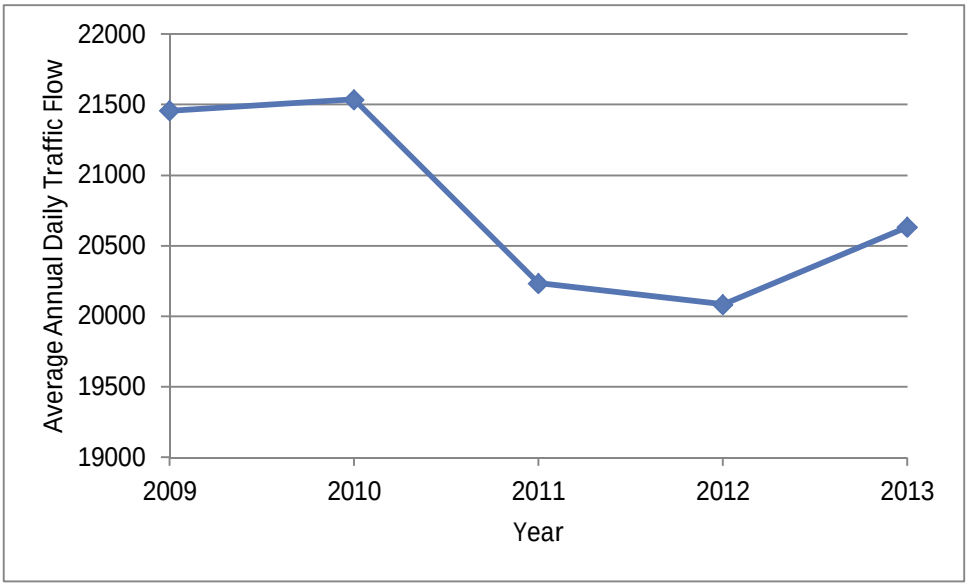
Te Moana Road is a two-way single carriageway road with footpaths and street lighting on both sides of the carriageway. At the eastern end of Te Moana Road there is a flush median that restricts the available parking on both sides, but when travelling west, this median is replaced by a dashed centreline, and parking is provided on both the northern and southern sides of the road. This parking is rarely used due to the generous on-site parking provision of the adjacent dwellings. This is illustrated in the photos in Appendix A.

There are a number of smaller, local roads surrounding the proposed settlement. These local roads provide access to mainly residential and rural properties. Ngarara Road will have direct connection with the proposed settlement once it is fully developed. Ngarara Road is a local road that carries less than 1,000 vehicles per day. In the more urbanised area, around the Te Moana Road intersection, Ngarara Road is a two-way single carriageway road with an overall width of 10.5m. Pedestrian footpaths and street lighting are provided on this section of the road. As the road travels north into a more rural location, consistent with the nature of the area, the carriageway reduces to 5.0m in width and no longer provides footpaths or street lighting.

SH1 runs to the east of the Ngarara development, providing access to Otaki to the north and Paraparaumu to the south. In the vicinity of the proposed settlement, SH1 is a two-way single carriageway road and at the last recorded count, carried approximately 20,633 vehicles per day[1] in 2013.

Traffic growth patterns between 2009 and 2013 are illustrated in Figure 3-1 below. This shows an overall decline in traffic volumes since 2009, increasing slightly since 2012.

- Figure 3-1 – Traffic Growth on State Highway 1 – 2009-2013



The Mackays to Peka Peka (M2PP) section of the Kapiti Expressway will pass immediately to the east of Ngarara. The Expressway will replace the existing SH1 route as the main north-south through route in this area. An interchange is proposed at Te Moana Road, approximately 120m from the Ngarara access. In 2021 it is expected to carry approximately 13,000 vehicles / day, north of the Te Moana Road interchange and 18,000 vehicles / day, south of the Te Moana Road interchange[2]. The Expressway and interchange will be controlled by the Transport Agency.

When the Expressway is completed, traffic patterns in the vicinity of Ngarara are expected to be:

- High traffic flows on Te Moana Road (11,600[3] ADT in 2021);
- Low traffic volumes on Ngarara Road (700[4] ADT in 2021);
- Traffic from the Ngarara neighbourhoods gain access to the adjacent road network via the Te Moana Road and Ngarara Road intersections only.

3.3 Crash History

Crash data from 2009 to 2013 was extracted from the Transport Agency CAS database. See Appendix B for the crash report. Areas selected to investigate for crash information are:

- 50m radius from the Te Moana Road / SH1 intersection;
- 50m radius from the Te Moana Road / Ngarara Road intersection;
- Te Moana Road in the vicinity of the proposed Ngarara development intersection and Kapiti Expressway interchange; and
- Ngarara Road in the vicinity of the proposed Ngarara development intersection.

All investigated areas are highlighted in red in Figure 3-2 below, which also shows the collision types and locations of the 28 crashes over the four areas.

[2] Traffic volumes taken from KTM3 model, August 2014
[3] Traffic volumes taken from KTM3 model, August 2014
[4] Traffic volumes taken from KTM3 model, August 2014

Figure 3-2: Collision diagram

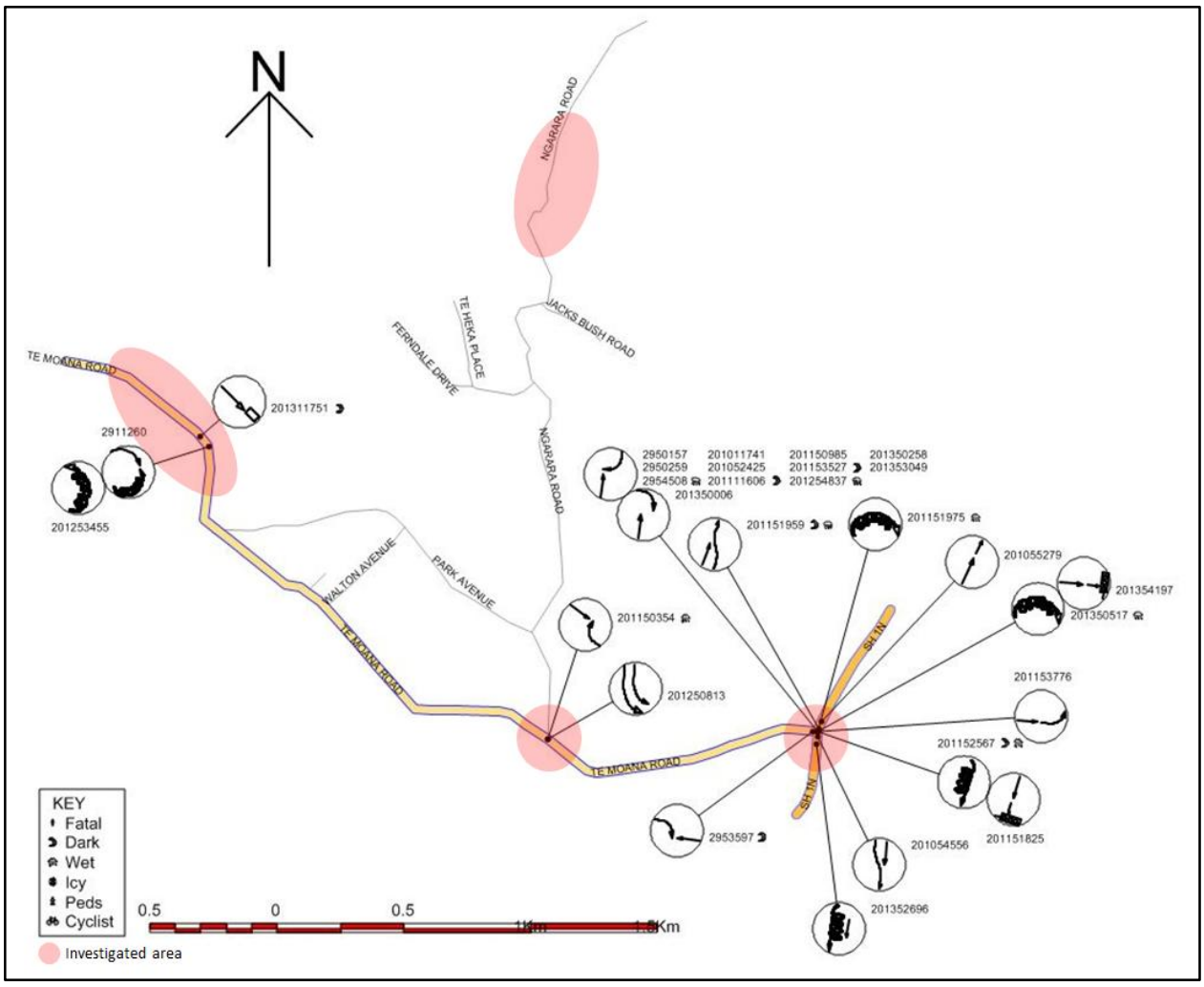
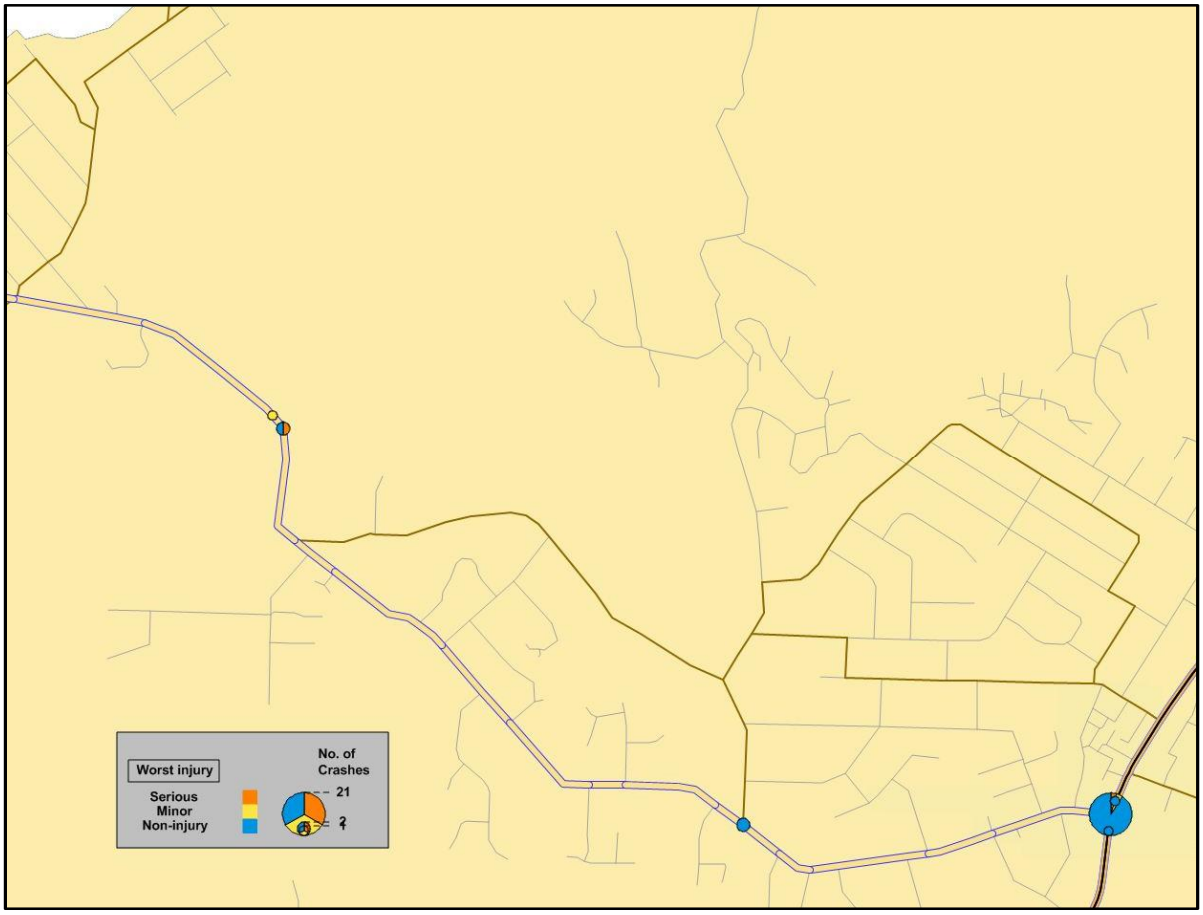


Figure 3-3 below indicates the severity of each crash.

Figure 3-3: Severity of crashes



There have been three crashes on Te Moana Road in the vicinity of the proposed Ngarara development access and Kapiti Expressway interchange. Two of these are due to loss of control. One was a non-injury crash while turning into an access way and the other was on the curve of road, which resulted in a serious injury. The third crash was a collision with a parked car at night time, and resulted in a minor injury. A corner is located on Te Moana Road approximately at the location of these crashes, causing this slightly higher than average injury crash rate.

The crash rate due to loss of control on Te Moana Road in the vicinity of the proposed Ngarara development access and Kapiti Expressway interchange is expected to reduce because the additional intersections will cause drivers to slow, so the potential for loss of control reduces. However, other types of crashes, such as rear-ends, may occur, at these intersections unless they are designed appropriately.

The TANON / Te Moana Road intersection, which acts as the main entrance to the site, will increase the perception by drivers that they are within an urban environment, where slower speeds are required and greater potential for conflict between road users may existing. The design of this intersection is cognisant of safety considerations and will be designed to ensure that sight line requirements are achieved and signage and dimensions are consistent with safe requirements.

There have been no crashes on Ngarara Road adjacent to the location of the proposed Ngarara development intersection.

At the Ngarara Road / Te Moana Road intersection there have been two non-injury crashes. Both crashes were as a result of turning through the intersection. In one case a truck turned from the wrong lane and in the other a van failed to give way when turning during wet weather. The driver in the second case was a migrant who failed to adjust to NZ driving rules. The crash rate at this intersection may increase slightly due to increased traffic

through the intersection as a result of the Ngarara development but will remain below the average injury crash rate for an intersection of this type.

There have been 23 crashes at the SH1 / Te Moana Road intersection. 13 of these were because vehicles failed to give way when turning, one of which resulted in a serious injury and another which happened during the dark resulted in a minor injury.

In total three of these crashes happened in the dark, and two in wet conditions. Four crashes were due to rear ending at lights or in queues. Four were due to loss of control, two while turning in wet conditions and the other two while on the roadway, one of these during dark, wet conditions. The final two crashes were due to incorrect lane merging, one during dark, wet conditions.

It is expected that the crash rate at the SH1 / Te Moana Road intersection will reduce when the Kapiti Expressway is built because vehicles will use the Kapiti Expressway instead of SH1 so volumes on SH1 will decrease.

Overall the injury crash rate for the SH1 / Te Moana Road intersection is average for this type of intersection. It is expected that the crash rate at this intersection will reduce when the Kapiti Expressway is built because vehicles will use the Kapiti Expressway instead of SH1 so volumes on SH1 will decrease.

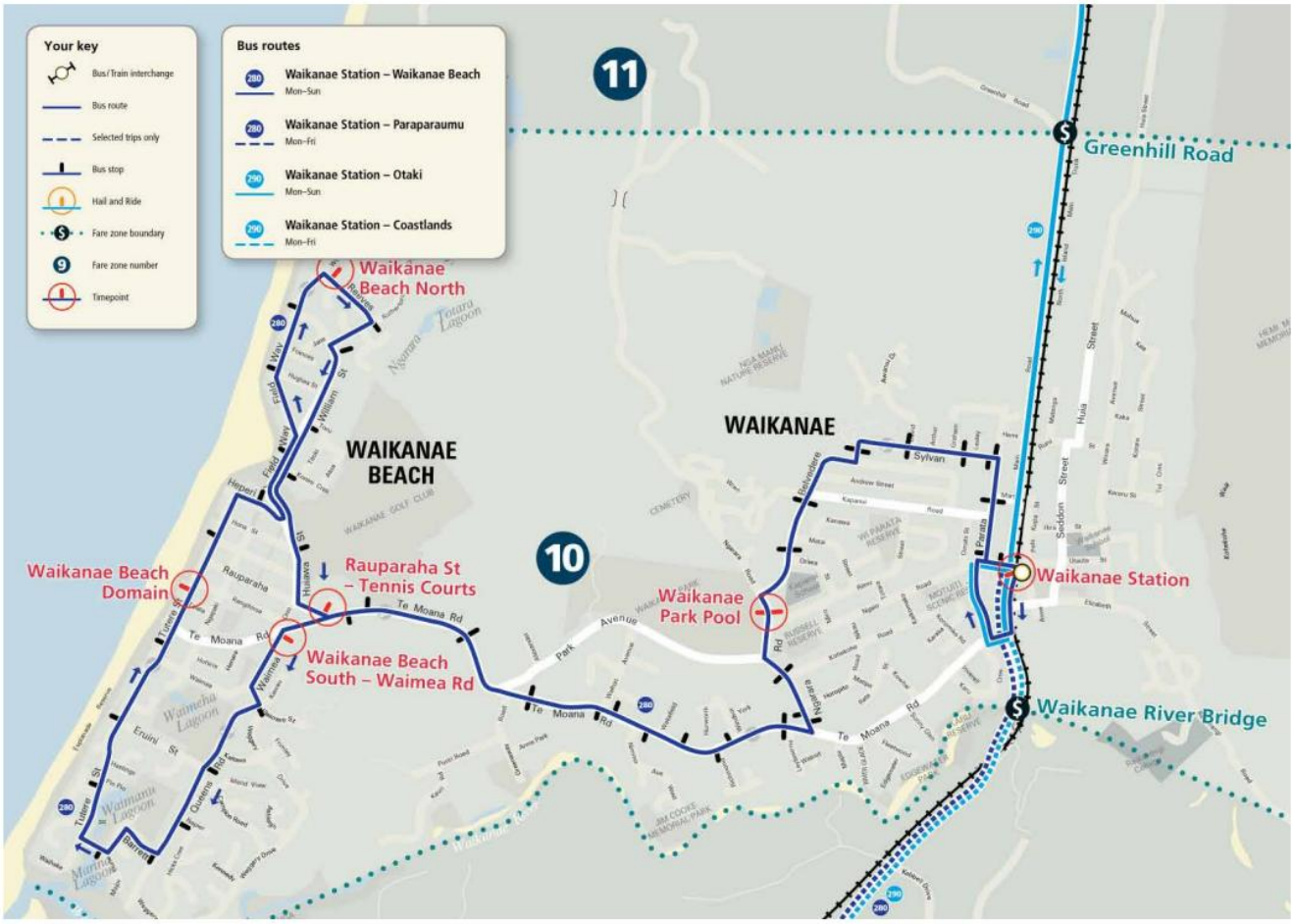
Overall, crash rates may increase in this area due to the addition of the TANON / Te Moana Road intersection and the Kapiti Expressway interchange however, are likely to remain lower than average for these types of facilities. As such no additional mitigation measures are recommended.

3.4 Existing Public Transport

Waikanae has a regular bus service (Route 280)[5] which is provided by the Greater Wellington Regional Council (GWRC). This service operates in a regular loop between Waikanae Station and Waikanae Beach. The route is shown in Figure 3-4. The service operates with a frequency of 20-30 minutes in peak periods and hourly between 10am – 2pm and after 7pm. The bus service has its first departure at 5.25am and last departure at 9.18pm. One bus departing at 8.48am does the Route 280 loop and continues on to Paraparaumu. One bus departing Paraparaumu at 2.35pm travels to Waikanae and does the Route 280 loop. The service operates hourly on the weekends with the first service departing at 7.18am and the last service departing at 9.18pm. Most services are scheduled to line up with train arrivals and departures.

[5] Bus: http://www.metlink.org.nz/assets/New-PDF-timetables/Misc.--Bus-200/280-290mar-2013.pdf
Train (Waikanae Station): http://www.metlink.org.nz/assets/New-PDF-timetables/Train/WRC-KPL-web-July-2014.pdf

Figure 3-4 : Route 280



Train services to Waikanae Station are provided by Tranz Metro. The Western Corridor Plan was adopted by the Region in April 2006 and included extension of rail electrification to Waikanae. The Waikanae train station was upgraded as part of this work and the rail line has been twin tracked between Paraparaumu and Waikanae. This has led to a significant increase in the network's capacity and reliability.

The Wellington region also has a new fleet of electric trains which provide 30% extra passenger capacity. Each of the new units has a multi-function area for bicycles, large luggage and wheelchairs. A level access floor section provides easy access for passenger with limited mobility. The units also have heating and air conditioning, public address systems and automated audio and visual station announcements.

Train services operate between Wellington and Waikanae and from Paekakariki to Waikanae in the frequencies outlined in Table 3-3 below. Trips between Waikanae and Wellington are well serviced in the mornings and evenings for commuters, and include late night services early on Saturday and Sunday mornings. There is also an early morning service between Paekakariki and Waikanae.

Table 3-3: Train service frequencies

Train Services		First departure	Last departure	Frequency (mins)
Wellington - Waikanae	AM Peak	5:52 AM	8:44 AM	20 - 40
	Midday off peak	9:14 AM	2:44 PM	30
	PM Peak	3:20 PM	6:00 PM	15 - 25

	Evening off peak	6:14 PM	11:14 PM	30
	Saturdays	6:14 AM	11:14 PM	30-60
	Sunday and Public Holidays	7:14 AM	11:14 PM	30-60
Note there are services departing Wellington at 12:14 AM and 1:14 AM on Saturday and Sunday mornings				
Waikanae - Wellington	AM Peak	5:00 AM	8:30 AM	20 - 30
	Midday off peak	9:00 AM	3:30 PM	30
	PM Peak	4:05 PM	8:00 PM	15 - 30
	Evening off peak	8:00 PM	11:00 PM	60
	Saturdays	5:00 AM	11:00 PM	30 - 60
	Sunday and Public Holidays	6:00 AM	11:00 PM	30 - 60
Note there are services departing Waikanae at 12:01 AM on Saturday and Sunday mornings				
Paekakariki - Waikanae	AM Peak	4:36 AM	8:00 AM	30 - 120
	Saturdays	4:36 AM	7:36 AM	60
	Sunday and Public Holidays	5:36 AM	7:36 AM	60

This represents a good level of public transport provision and indicates that both bus and rail services are already easily accessible to the Waimeha neighbourhood. As discussed above, most bus services are scheduled to align with train arrivals and departures providing a good level of integration between modes and therefore an attractive proposition for Waimeha residents.

4. Proposed Development

The ultimate Ngarara development will comprise three neighbourhood villages (Waimeha, Ti Kouka and Homestead) spread out over approximately 130 Ha of land. The guiding design principles for Ngarara, as defined in the structure planning work defined in the operative District Plan, are:

- compact development footprints;
- connecting open spaces;
- protecting natural edges;
- reinforcing street patterns; and
- development of appropriate built forms.

These principles have been used to develop a built environment that will sensitively integrate with the identified ecological, landscape and cultural heritage values of the site and be designed to promote community engagement. Figure 4-1 shows an indicative layout for the overall Ngarara development.

Figure 4-1 : Overall Ngarara development

The overall Ngarara settlement will cover an area of 130 Ha and promote travel via active modes through its inherent design. Road cross sections are of a liveable scale, local services, commercial and retail facilities are within walking distance of most households and large open spaces are provided to encourage activity. Shared walking and cycling facilities are provided to link neighbourhood and provide attractive spaces to move.

A shared walking, cycling, bridle path will also be provided by the Transport Agency adjacent to the Ngarara development as part of the M2PP project. Active mode facilities within Ngarara have been designed to connect easily and legibly to this facility.

All infrastructure will be designed to have low impact on the environment, and will blend in with the natural topography of the surrounding land forms. In line with the operative District Plan, the proposed development

will allow up to 1,149 house hold units (HHU), with a range of densities. The proposed development will also provide commercial and service activities, education, retail, offices, workshops, and tourist facilities such as accommodation, restaurants and community areas.

This report specifically addresses the Waimeha neighbourhood. Figure 4-2 shows the proposed layout for that area.

Figure 4-2 : Waimeha Neighbourhood looking for the Hilltop Village south

Table 4-1 : Proposed Waimeha Development

Type	Description	Total Area (m^2)	Average Lot Size	Number of Lots
Open Space	Open space provides for the protection of dunes above 16m ASL and for key off road pedestrian / cycle links through the development. The natural depression in the middle of Waimeha has been retained to provide for stormwater collection / retention as well as being an important open space. Note that the area excludes Taewapirau	20,000	n/a	n/a
Apartment	Consists of three storey & loft apartment buildings with balconies. Yield is based on a plot ratio of 1.5:1 with an average apartment size of 100m²		100	120
Mixed Use	Retail on ground floor and apartment living above, 3-4 stories in height. Yield based on lot sizes averaging 250m², consisting of 50m² of retail and an apartment of 100-150m². Mixed use surrounds the proposed Village Green for all lots within a 500m radius.		250	40

Type	Description	Total Area (m^2)	Average Lot Size	Number of Lots
Density A	Typically consists of terrace housing or semi-detached dwellings, with their own outdoor living space and garaging. It is envisaged that these sites may be developed as a block by an individual developer. Design would ensure that each unit within a block is readily identifiable and is of a human scale. The design of each block would be subject to a Comprehensive Development Plan that would outline the architectural and landscape treatment proposed. Yield based on an average lot size of 300m².		300	50
Density B	Typically consists of individual dwellings, either single or two storey with some semi-detached dwellings. These lots are typically close to village amenities or high value open space. Yield based on an average lot size of 400m².		400	45
Density C	Typically consists of individual dwellings, either single or two storey and is ideally suited to housing companies. These lots have individual outdoor living areas and are suited to first home buyers or affordable housing. Yield based on an average lot size range 500-900m^2, with an average of 600m²		600	35
	TOTAL NUMBER OF LOTS (WAIMEHA)			**290**

4.1 Proposed Road Network

The Ngarara Zone Structure Plan defines the design principles that have guided the development of the vehicular and pedestrian movement network within overall Ngarara settlement and specifically within the Waimeha neighbourhood. These principles are:

- The street pattern responds to the topography;
- The street pattern provides vistas of important natural features within the surrounding landscape;
- There is a street hierarchy appropriate to the social, retail and residential requirements of the settlement;
- High quality landscape design is provided;
- Way-finding and legibility is promoted;
- The possibility for future commercial activity is facilitated within key areas easily accessible from the Expressway;
- Streets are for people and not just for cars; and
- Street layouts result in robust block structures that are suited to the land uses they contain.

The Structure Plan defines a naming convention for all roads within the development, such that all roads are prefixed with Te Ara O (The way / path of...) in keeping with the traditional Maori practice of labelling highways and routes. By way of example it is proposed that the main collector road connecting Te Moana Road and Ngarara Road be named Te Ara Nui O Ngarara (The big way of Ngarara).After engaging with Te Ati Awa we propose that the selection of street names is done in consultation with Te Ati Awa to enable each street to be named appropriately to the landscape in which it sits.

4.1.1 Proposed Street Hierarchy

The Ngarara Zone Structure Plan sets out some key principles regarding street hierarchy within the development area. Within the Waimeha neighbourhood and the wider Ngarara settlement, the following hierarchy of streets will be provided. The consistency of the proposed street hierarchy against the principles outlined in the Structure Plan is discussed below.

The Structure Plan refers to the Ngarara Link Road, with a proposed road reserve of 30m. This link road has been superseded by the proposed M2PP section of the Kapiti Expressway. As such, a new collector road, Te Ara Nui O Ngarara, is proposed through the site.

Te Ara Nui O Ngarara (TANON): This is a collector route through the Ngarara settlement, providing access to each neighbourhood and generous shared paths incorporating pedestrian and cycle facilities. The TANON is the main connection between the Ngarara neighbourhoods and acts as a vital artery for all modes of travel. The corridor has a suggested reserve width of **23m**, 3.5-3.2m lane widths and no central median proposed. Off-road 3.5-3.0m shared walking and cycling paths are provided along its length. Similar to the Ngarara Link Road, TANON brings economic and social benefits to the area. The reduced cross section of 23m is considered more appropriate for this scale of road than the 30m proposed for the Ngarara Link Road, since it no longer provides a strategic connection between longer distance strategic locations.

Main Street: Centrally located main streets will define commercial and social centres, consistent with the definition provided in the Structure Plan. These will contain a variety of land uses such as retail, community, commercial, residential and public open space. These sections have a suggested reserve width of 23m as well as provision for on-street parking and wider footpaths to enhance the liveable space within each centre. Although these streets have a similar road reserve width to the collector route, their purpose is quite different. The proposed 23m cross-section is wider than the 18m recommended in the Structure Plan. This largely reflects wider footpaths and increased dedicated cycle provision, to encourage greater active mode use to and through the commercial and social centres. It is envisaged that active modes would have greater priority over vehicle traffic on the Main Street.

Residential Streets and Lanes: These are generally narrow local roads through residential areas that accommodate low levels of local traffic. They are characterised by surfaces that accommodate slow vehicular and pedestrian routes and are designed with appropriate turning radii, surface materials, speed humps and other traffic-calming measures to ensure a pedestrian-priority environment. Suggested reserve width: 10-15m. This is to include a 6m wide carriageway, 1.8m footpaths and 2.1m for parking in some locations. This is consistent with the Structure Plan purpose and reserve width.

Rear Lanes: These will serve residential and commercial lots in medium to higher density areas and will provide for rear vehicular access to properties such that frontages are not dominated by garaging requirements. Suggested reserve width: 5m, opening to 6.5m where needed for car turning requirements. This is also consistent with the Structure Plan purpose and reserve width.

The proposed street hierarchy, for Waimeha, is shown in Figure 4-3. Proposed cross sections for each street type are provided in Appendix C. As described above, these are consistent with the street hierarchy, purpose and reserve widths recommended in the Structure Plan, with TANON providing the main collector function through the site and having traffic priority over other routes.

Figure 4-3 : Proposed Waimeha Street Hierarchy

4.2 Walking and Cycling Facilities

Currently in Kapiti, there is a well maintained network of footpaths alongside local, collector and arterial roads. This footpath network provides good facilities for those wishing to walk between residential, shopping and commercial activities in Waikanae.

KCDC also provides and maintains a number of well-developed, easily accessible walking, cycling and bridle paths in the Waikanae area, and these can be seen in Figure 4-4. The Council has developed a Cycle, Walkways and Bridleways Strategy[6] that will help to further improve the provision of this infrastructure over the next ten years.

[6] http://www.kapiticoast.govt.nz/Documents/Downloads/Strategies/Cycleways-Walkways-Bridleways-Strategy.pdf

Figure 4-4 : Kapiti walking, cycling and bridle facilities[7]

4.2.1 KCDC Cycle, Walkways and Bridleways Strategy

There are currently a number of walking, cycling and bridle tracks available in Kapiti, but feedback from the community has indicated that there is a need for a more comprehensive network of pathways and other facilities to link communities together, and provide continuous access that will meet and provide for the needs of different users.

The KCDC Strategy indicates that there need to be continuous links between destinations that people want to go to, including schools, places of employment, recreation and community facilities.

Future routes should include:

- Cycle routes both on and off the road.
- Pedestrian and walking routes both on and off the road, which will also cater for the mobility impaired.
- Bridleways both on and off the road, and where possible, separated from the other tracks.

[7] http://www.kapiticoast.govt.nz/Documents/Downloads/walkways-cycleways-bridleways/walking-and-cycling-guide.pdf

4.2.2 Proposed Walking, Cycling and Bridleway Facilities

Within the Ngarara development, dedicated pedestrian and cycle paths will provide important points of access for pedestrians and cyclists to and through each neighbourhood. All private lots that sit adjacent to a public open space will be designed to overlook the space and will have access into the public pedestrian/cycle path, where applicable.

Within the Waimeha neighbourhood, an off-road shared pedestrian/cycle path (width between 3.5 and 3.0m) will run the length of TANON. An off-road shared pedestrian / cycle path has been provided specifically to separate these modes from vehicular routes, providing a high degree of protection for less confident cyclists. The cross sections, showing these proposed facilities are provided at Appendix C.

Figure 4.5 shows a cross section of the 6m wide Greenway, which provides a central spine through the neighbourhood, connecting open spaces, residential and community areas along its length and an alternative walking and cycling route to TANON. This green spine has been centralised to maximise the number of lots that it can serve and has been aligned to provide direct off-road access to key destinations, connecting Taewapirau in the south with the Hilltop Village and wetland in the north of the site.

Importantly, only 1m width of crushed lime surfacing has been provided within the 6m cross section. The Greenway is intended to emulate the beach community of Waikanae, where formal paths, kerb and channel are not provided and people use this space to gather informally, sit and wander slowly, as such the grassed surface is intended to be used for walking and cycling. The sand sub-base means the grassed surface will be well drained and appropriate for walking in most conditions.

Figure 4.5 : Greenway Cross-Section

These facilities will connect with the proposed shared pedestrian, cycle, bridle path that runs alongside the Kapiti Expressway. Footpaths will connect to Te Moana Road and the existing footpath network.

In line with current sustainable development practices and the KCDC Strategy, pedestrian and cycle facilities will be provided to accommodate both recreational and commuter users, as well as the mobility impaired. Shared paths will be provided for recreational and mobility impaired users, with smooth surfaces to facilitate ease of movement for those using mobility scooters. Commuter users will be encouraged to use the road carriageway, to travel at higher speeds. Connections to the Expressway path will be clearly legible, for these users in particular, who may be travelling some distance.

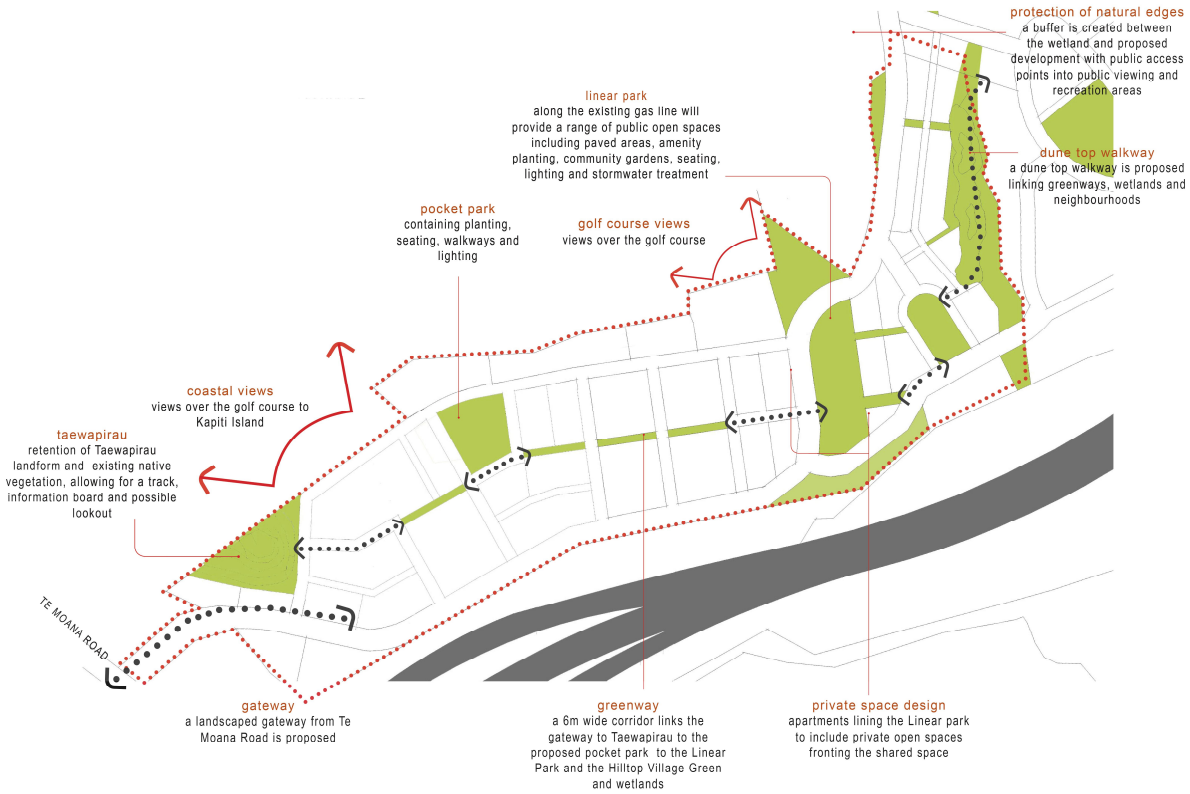
All neighbourhoods will have convenient access to pedestrian and cycle routes, enabling good permeability and providing linkages to encourage walking and cycling to and through each neighbourhood.

Generous open spaces will also be provided, with paths and cycleways forming part of a wider north-south recreational movement network that links Raumati and Peka Peka. Pedestrian routes will be designed to facilitate the movement of all pedestrians, especially those with disabilities, elderly and the young.

Figure 4.6 shows a plan of the proposed open space network, including connections via greenways along the length of the site.

In addition to the facilities discussed above, the provision of secure cycle parking facilities in convenient locations within individual sites is strongly encouraged at Ngarara. Other recommended facilities include changing facilities in employment areas. It is important that these facilities are appropriately considered and included at the beginning of the design process

Figure 4.6 : Proposed Open Space Network



4.2.3 Proposed Ngarara Public Transport

The ideology behind Ngarara is to create a sustainable and environmentally friendly community. As a result, it is important to offer an efficient integrated public transport service.

As detailed in Section 2.7, bus route 280 currently used Te Moana Road, adjacent to the proposed development. GWRC have yet to publish specific service plans for public transport services in Waikanae in response to the construction of the M2PP section of the Expressway, but have identified that servicing new residential settlements such as Ngarara would be essential. It is proposed that TANON would provide the main corridor for public bus services through the area, in the future. The carriageway cross section has been designed to allow for bus stops along its length. All residential neighbourhoods within Ngarara are located within easy walking distance of TANON.

The proposed Residential Streets will link each neighbourhood to TANON. The proposed road reserve width will be 15m and will accommodate swales, landscaping, a cycle/pedestrian corridor and parking clusters. The Residential Streets will also provide adequate road space for bus services, but it may be necessary to provide specialised areas for bus stop lay-bys so that stopped buses do not impede other through traffic. These bus stops will be located alongside and adjacent to the pedestrian paths. None of the Residential Streets are cul-de-sacs and a bus route through the site would follow a circuit so that turnaround areas are not required. Walking distances from the edge of the development to TANON are a maximum of 175m away.

5. Assessment Methodology

Two methodologies have been used to develop the traffic forecasts used in this ITA:

1) KCDC's Kapiti Traffic Model (KTM), specifically KTM3, is built in the SATURN software package and has been developed from the operative District Plan using the original trip rates associated with the plan change. Further information about KTM3 development can be found in "*NZ1-8829480-Kapiti Traffic Modelling Databook_1*" (. Assumptions used in KTM3 are discussed in Section 5.1.

2) Separately to the above, the design of the Waimeha neighbourhood has progressed as part of the NDP process to provide a more detailed estimate of the development quantum associated with that neighbourhood. Assumptions associated with this methodology are discussed in Section 5.2.

This section outlines the two traffic forecasting methodologies and recommends an approach to assess the transport effects of the Waimeha neighbourhood, in the context of the overall Ngarara development, on the road network.

5.1 Kapiti Traffic Model

KCDC's Kapiti Traffic Model (KTM) has been used to assess the traffic effects of the proposed Ngarara development. The model is currently maintained by Beca and uses the SATURN[8] software package.

The KTM2 series have been developed as part of the MacKays to Peka Peka (M2PP) and Peka Peka to Otaki (PP2O) expressway projects. Extensive sensitivity testing related to M2PP was undertaken in KTM2 and that model was subsequently enhanced and adopted for PP2O (KTM2.1). The economic evaluation of M2PP used KTM2.2 which is based on KTM2.1.

The latest model version is KTM3 and this model is currently under development. KTM3 includes enhancements to the local road network (and includes the revocation of SH1) and an update of land use assumptions. This model update is being produced for KCDC; a peer review is underway and is yet to be formally signed off. As such, output from KTM3 is used "at risk", however KCDC has confirmed that KTM3 is considered to be the most appropriate tool to **assess the potential traffic effects of Ngarara development options.**

The model covers a wide area of the Kapiti District from Raumati South to Peka Peka in the north and includes three modelled periods:

- AM peak: 8-9am
- Inter peak: 11:30am-12:30pm
- PM peak: 4:45-5:45pm

These periods correspond with the anticipated peak periods for the proposed development at Ngarara.

Figure 5-1 shows the network detail and zone locations in the KTM3 model. Table 5-1 names each zone and also indicates the volume of traffic in each zone in the KTM3 model. Following land purchase by the Transport Agency for the M2PP section of the Kapiti Expressway, only zones 198 – 202 are now within the land owned by Maypole Environmental Ltd.

[8] SATURN (Simulation and Assignment of Traffic to Urban Road Networks) is a suite of flexible network analysis programs developed at the Institute for Transport Studies, University of Leeds and distributed by WS Atkins of Epsom since 1981.

Figure 5-1 : KTM3 Network Detail - Ngarara

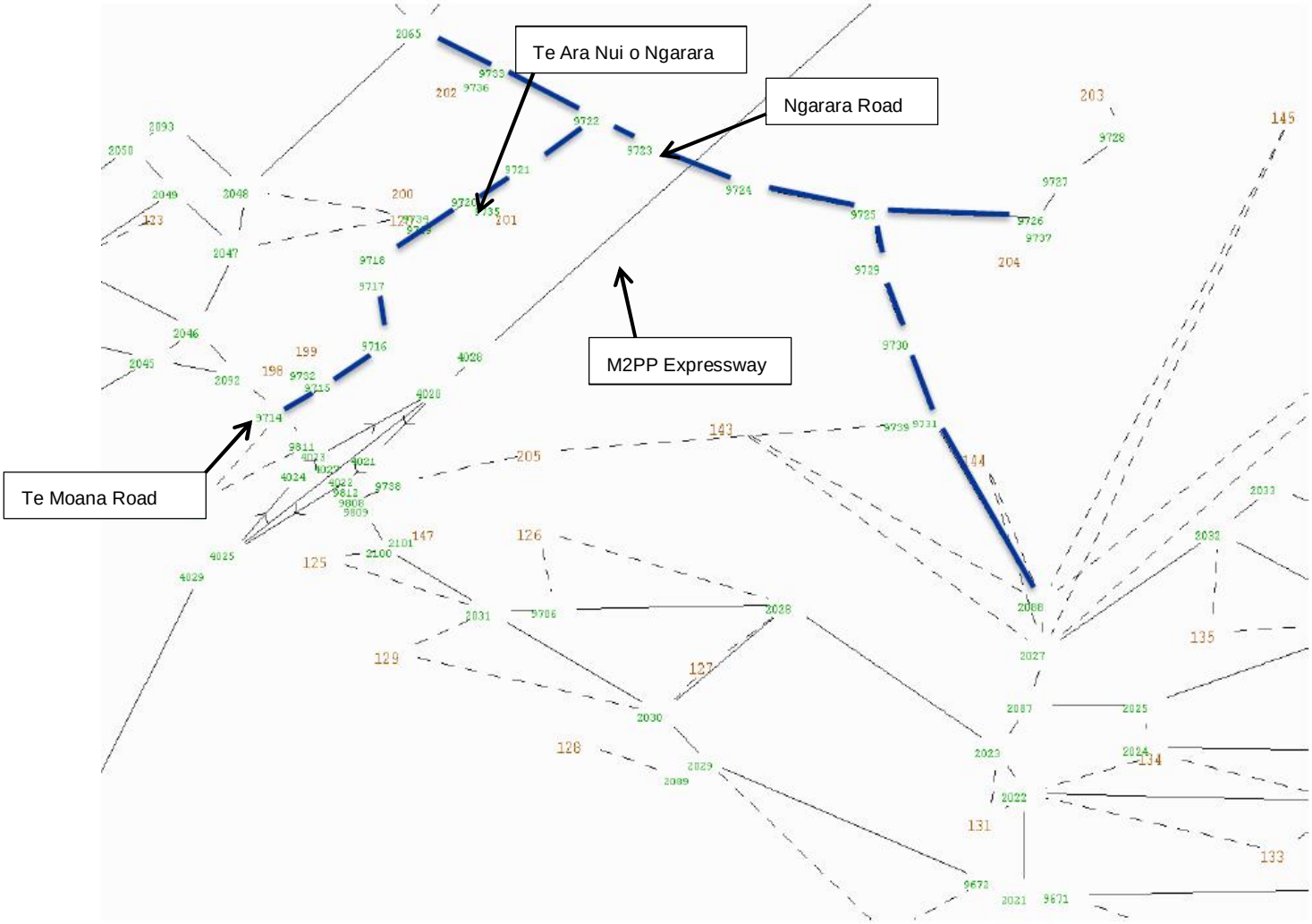


Table 5-1 : KTM3 2021 Zone Assumptions - Ngarara

Zone	Name	# Trips
198	Waimeha North	1350
199	Te Kouka	600
200	Totara	150
201	Homestead	950
202	Kawakahia / Kukutauaki	100
203	Ngapara / Lamberts	350
204	Kanuka Ridge / Nga Manu	300
205	Waimeha South	450
Total (whole PC80 area)		**4250**
Total (new Ngarara neighbourhoods)		**3150**

5.1.1 Modelled Land Use Assumptions

All land use assumptions outside of the Ngarara development are as documented in the Kapiti Traffic Modelling (KTM) Databook[9] (Appendix D).

The KTM Databook indicates that the forecast base models used in this assessment (KTM3) include permitted development in all zones including:

- Paraparaumu Town Centre;
- Paraparaumu Airport proposed Plan Change 73
- Property Ventures Limited permitted development
- Waikanae North Ltd (WNL)

KTM3 includes traffic generation volumes agreed as part of the PC80 process for Ngarara.

A **composite growth** approach[10] has been used in KTM3 to balance inconsistencies between the Wellington Transport Strategic Model (WTSM) and permitted developments including those above. 50% of the regional WTSM growth is assigned to each corresponding KTM3 zone. Zones which are associated with permitted developments, including those above, have full WTSM growth assigned and a proportion of the permitted development growth so that the total growth for the zone is 50% of the permitted development growth[11].

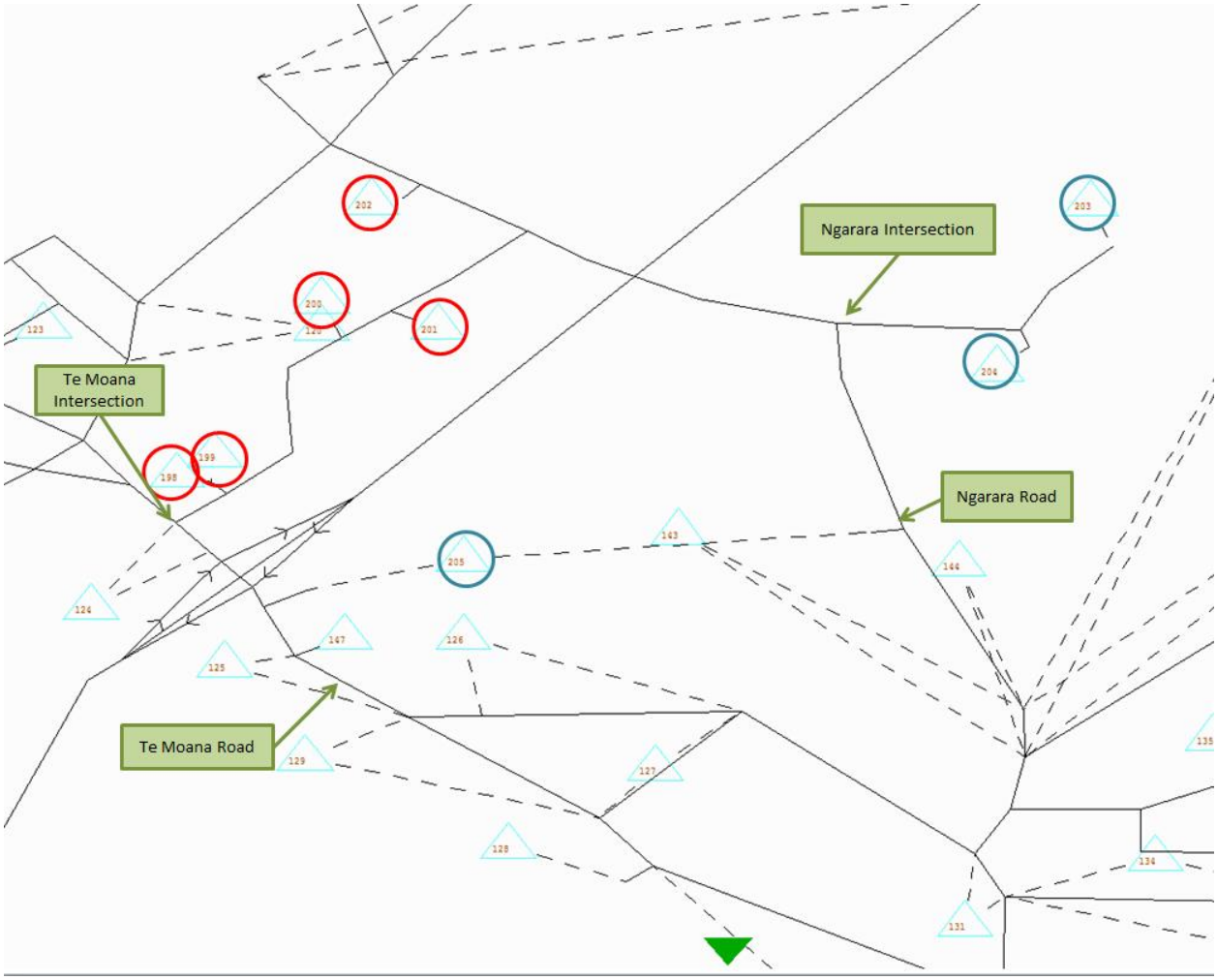
The M2PP Alliance have used traffic volumes based on composite growth forecasts have been used to develop the form of the signalised intersections at the Te Moana interchange as part of the M2PP project.

The eight zones representing the Ngarara development in KTM3 (zones 198 – 205, circled in Figure 5-2 below) are consistent with the original 11 neighbourhoods under PC80. As explained in Section 2, land for developments east of the proposed Kapiti Expressway has since been purchased by the Transport Agency. Therefore the neighbourhoods that now comprise the Ngarara development are Waimeha (zone 198), Ti Kouka (zone 199), Totara (zone 200), Homestead (zone 201) and Kawakahia / Kukutauaki (zone 202), circled in red below. Neighbourhoods no longer being progressed by Maypole Environmental Ltd are circled in blue below.

This ITA describes the transport effects associated with traffic from zone 198, Waimeha, only.

[9] Kapiti Traffic Modelling Databook, Beca, 5 May 2014
[10] A full growth scenario has not been developed for KTM3. Full growth comprises 100% of forecast growth from committed developments.
[11] The 50% growth scenario was developed and agreed between NZTA, KCDC and GWRC during the development and refinement of the KTM3 model for the M2PP project

Figure 5-2: Ngarara Zones in KTM3



5.1.2 Modelled Network Assumptions

The KTM3 model has been used for the purpose of this assessment. All modelled network assumptions are as documented in the KTM Databook and the Kapiti Traffic Model Information – Ngarara Farm report (Beca, 2014, see Appendix E).

The KTM3 model assumes that the M2PP section of the Kapiti Expressway will be in place and operational by 2021. The M2PP section is assumed to comprise a divided road constructed to expressway standard, with two lanes in each direction and an interchange at Te Moana Road, with full directional ramps, immediately adjacent to the proposed Ngarara development. The two interchange intersections on Te Moana Road will be signalised.

KTM3 includes Te Ara Nui o Ngarara (TANON), which passes through the site between Te Moana Road and Ngarara Road. Model zones, representing each neighbourhood, including Waimeha, are connected directly onto this road. This is generally consistent with the Ngarara Road Hierarchy plan shown in Figure 4-3. More detailed modelling of neighbourhood streets within the development has not been undertaken.

For this NDP application, the only access point for development traffic onto the adjacent road network is the intersection of Te Moana Road and TANON. The proposed layout and performance of this intersection is discussed in more detail in Section 6.1.

Once Ngarara is fully developed an intersection between TANON and Ngarara Road will also be provided. The performance and form of this intersection is not discussed in this ITA as it will not be provided as part of the Waimeha neighbourhood development.

5.2 Traffic Generation

During the Plan Change process, the exact type and scale of the development was uncertain. Therefore, a conservative assessment was undertaken, allowing for a large number of dwellings, and large areas for other land uses. The numbers used were maxima and are unlikely to be exceeded. As part of the NDP process, these numbers have become more certain. This section outlines the maxima agreed as part of the Plan Change process as well as the proposed traffic generation associated with the Waimeha neighbourhood and an indicative generation for the other neighbourhoods that now comprise the Ngarara development.

5.2.1 Trip Rates

During the PC80 process, published documentation within New Zealand and Australia, namely the RTA Guide to Traffic Generating Developments, the Transfund New Zealand Research Report No 209 and the New Zealand Trips and Parking Database, was used to develop trip rates associated with the proposed development.

The KTM originally used the PC80 trip rates as the basis for the calculation of traffic demand associated with the development. Since then, the model has been updated as described in the KTM Databook. Table 5-2 shows the trip rates adopted in KTM3.

We confirm that these trip rates are appropriate to estimate the likely traffic generation associated with this NDP application for Waimeha.

Table 5-2 : KTM3 Trip Rates

Land Use	Unit	AM Peak	Inter Peak	PM Peak	Daily
Residential	HHU	0.5	0.5	0.5	5
Office	100m^2	2	1	2	15
Retail	100m^2	4	10	20	120
Education	100m^2	2	3	1	30
Tourist	100m^2	0.7	0.5	0.6	9
Community	100m^2	2	4	2	15

5.2.2 Internal and External Trips

The rates described in Section 5.2.1 above have been used to calculate the overall volume of traffic that will be generated by the Waimeha neighbourhood and the overall Ngarara development. Traffic generation for the overall Ngarara development should be considered to be a high-level estimate only, intended to ensure primarily that intersection connections to the wider road network are designed with sufficient capacity such that these do not require redesign as development progresses after Waimeha.

When considering the trip rates in Table 5-2, it is important to note that not all of this traffic will be distributed onto the road network outside of the Ngarara development itself.

Although the large majority of residential trips are likely to be distributed externally, particularly during peak periods, as residents commute to work, retail traffic for the proposed local shops is likely to be generated predominantly from residents stopping to buy coffee on the way to work or milk on the way home and therefore does not constitute an additional new trip on the wider road network.

Table 5-3 describes the proportion of development traffic that is expected to be distributed onto Te Moana Road and from there, to the wider network.

Table 5-3 : Proportion of development traffic distributed on external road network

Land Use	AM Peak	Inter Peak	PM Peak	Daily	Explanation
Residential	0.9	0.9	0.9	0.9	Mostly commute externally to work
Office	0.5	0.5	0.5	0.5	Some live/work spaces
Retail	0.2	0.7	0.2	0.5	Mostly for residents. Some external during inter peak to visit cafes etc.
Education	0.6	0.6	0.6	0.6	Mostly for residents. Some residents from nearby might be attracted by a new childcare facility, for example
Tourist	0.9	0.9	0.9	0.9	Mostly for visitors to the area
Community	0.6	0.6	0.6	0.6	Mostly for residents. Some residents from nearby might be attracted by a new bowls club or playgroup.

5.2.3 Development Staging

It is envisaged that the proposed development will be constructed in a number of stages over a period of approximately 15 years. Table 5-4 shows the proposed staging for the Waimeha neighbourhood. Table 5-5 shows indicative staging for the rest of the Ngarara development. Table 5-6 summarises the total development across Ngarara.

Table 5-4: Development staging – Waimeha only

Year End	Residential (HH Units, rounded to nearest 5)	Office (GFA m²)	Local Retail (GFA m²)	Open Space (m²)	Education (m²)
2016	45	0	750	0	0
2021	135	500	750	0	4500
2026	140	0	0	0	0
2031	20	0	0	0	0
Total	**340**	**500**	**1,500**	**22,900**	**4,500**

Table 5-5: Development staging – rest of Ngarara

Year End	Residential (HH Units, rounded to nearest 5)	Office (GFA m²)	Local Retail (GFA m²)	Open Space (m²)	Education (m²)
2016	0	0	0	0	0
2021	20	0	0	0	0
2026	230	0	250	0	0
2031	310	0	250	0	0
Total	**560**	**0**	**500**	**60,655**	**0**

Table 5-6: Ngarara Development Staging

Year End	Residential (HH Units, rounded to nearest 5)	Office (GFA m²)	Special Retail (GFA m²)	Open Space (m²)	Education (m²)
2016	45	0	750	0	0
2021	150	500	750	0	4500
2026	375	0	250	0	0
2031	330	0	250	0	0
Total	**900**	**500**	**2,000**	**83,655**	**4,500**

5.2.4 Waimeha Traffic Generation (NDP)

Table 5-7 shows the total volume of traffic generated by the proposed Waimeha neighbourhood, using the development staging summarised in Table 5-4.

Table 5-8 shows the volume of traffic generated by the Waimeha neighbourhood and expected to be distributed onto the external road network via the proposed intersection at Te Moana Road. This calculation uses the factors specified in Table 5-3[12].

Table 5-7 : Total Waimeha Traffic Generation

Year	AM peak	Inter Peak	PM peak	Daily
2016	54	99	174	1135
2021	251	365	446	4135
2026	323	437	518	4855
2031	332	446	527	4945

Table 5-8 : External Waimeha Traffic Generation

Year	AM peak	Inter Peak	PM peak	Daily
2016	27	74	51	662
2021	153	261	174	2567
2026	218	325	239	3215
2031	226	334	247	3296

5.2.5 Ngarara Traffic Generation (NDP)

This report specifically addresses the traffic likely to be generated by the Waimeha neighbourhood. However, it is important to consider, at a high level, the volume of traffic likely to be generated by the remainder of the Ngarara development. This is important, primarily to ensure that intersections with the adjacent road network are designed with sufficient capacity to accommodate traffic generated by the development as a whole.

These neighbourhoods have not yet been developed in detail however Table 5-9 provides an indication of the traffic likely to be generated by these areas in the future and Table 5-10 provides an indication of the volume of

[12] These tables, and those in Section 5.2.5 following, were generated using the factors in Sections 5.2.1 and 5.2.2 and the development staging tables in Section 5.2.3

traffic expected to be distributed onto the external road network via the proposed intersection at Te Moana Road. These traffic generation volumes have been calculated using the development quanta described in Table 5-4, Table 5-5 and Table 5-6. These traffic volumes are referred to subsequently in this report as the NDP projections.

Table 5-9 : Overall Ngarara Traffic Generation 2031

	AM peak	Inter Peak	PM peak	Daily
Waimeha	332	446	527	4945
Rest of Ngarara	300	330	380	3400
Total	**632**	**776**	**907**	**8345**

Table 5-10 : External Ngarara Traffic Generation 2031

	AM peak	Inter Peak	PM peak	Daily
Waimeha	226	334	247	3296
Rest of Ngarara	256	287	272	2820
Total	**482**	**621**	**519**	**6116**

5.2.6 Comparison of Traffic Forecasts

Table 5-11 compares the total traffic generation forecast for the Ngarara development (all neighbourhoods) in KTM3 and NDP projections. The NDP projections are based on the quanta of development activity described in Table 5-10.

Table 5-11: External Traffic Generation – (NDP forecast vs KTM3) Full Ngarara development

Year		AM peak	Inter Peak	PM peak	Daily
2021	**NDP**	161	269	182	2652
	KTM3	191	187	246	2702
2031	**NDP**	482	621	519	6116
	KTM3	578	651	744	9017

KTM3 forecast traffic volumes are generally higher than the traffic volumes calculated using the NDP forecast development quanta. This indicates that the KTM3 composite growth model is a good approximation of likely traffic generation associated with the proposed Ngarara development.

As the KTM3 volumes are slightly higher than those calculated using NDP development quanta, they will give a more robust view of the likely performance of the adjacent road network when the Ngarara development is complete. As such, the **KTM3 outputs** are considered to be appropriate and have been used in this report to assess the likely performance of the adjacent road network and the transportation effects associated with overall Ngarara development.

Table 5-12 compares development staging assumptions (using traffic volumes as an approximation of development) between KTM3 and the NDP for 2021 and 2031.

KTM3 assumes a uniform 33% development by 2021 for all neighbourhoods, while the NDP process has identified that Waimeha will develop ahead of the other Ngarara neighbourhoods, and would be largely complete by 2021.

Table 5-12: Ngarara staging assumptions by neighbourhood

Neighbourhood	KTM3 development		NDP forecast development quanta	
	2021	2031	2021	2031
Waimeha	33%	67%	78%	22%
Rest of Ngarara	33%	67%	3%	97%

These differing staging assumptions mean that more traffic is forecast to be generated by 2021, in the Waimeha neighbourhood, in comparison with KTM3. In addition, the NDP has a greater proportion of development occurring in the Waimeha neighbourhood compared with the rest of the Ngarara development than KTM3 (KTM3 assumes relatively equal traffic generation across zones). This is shown in Table 5-13.

Table 5-13: Waimeha traffic generation comparison (NDP vs KTM3)

Year		AM peak	Inter Peak	PM peak	Daily
2021	NDP	251	365	446	4135
	KTM3	73	97	128	1355
2031	NDP	332	446	527	4945
	KTM3	221	294	389	4105

For the reasons above, when assessing the likely performance of the adjacent road network and the transportation effects associated with the Waimeha neighbourhood only, in Section 6, NDP forecast traffic volumes are used.

5.3 Performance Measures

The performance measures used to assess the traffic effects of the proposed Waimeha neighbourhood on the adjacent road network are:

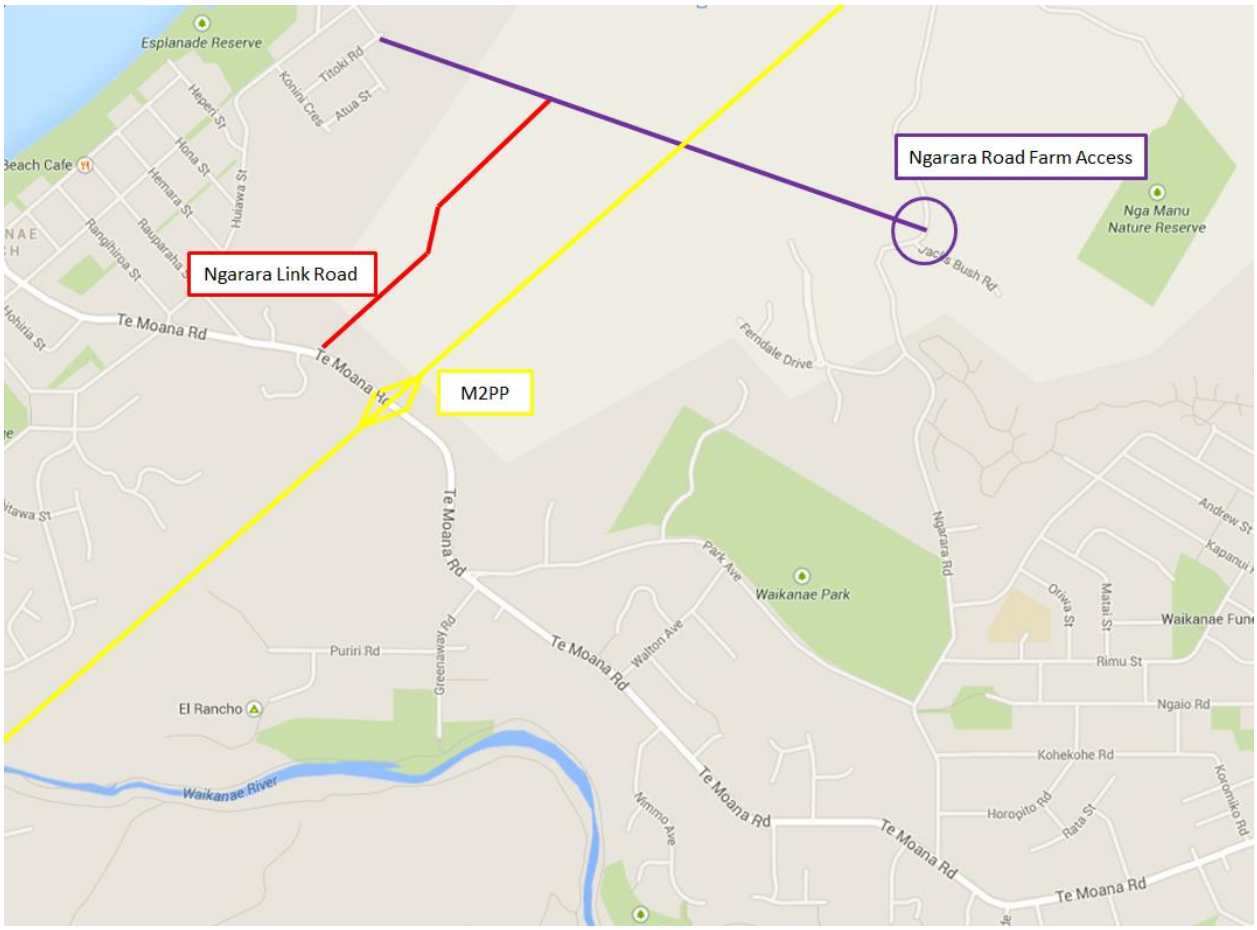
- Traffic volumes on key sections of the network (forecast flows);
- Forecast intersection performance;
- Te Moana Road Level of Service (LOS)[13]
- Approach delays

[13] Level of Service (LOS) is a measure of intersection performance based on average intersection delay. LOS used in this report has been determined using the HCM (2000) methodology and a table of definitions is provided in Appendix F

6. Assessment of Effects

Figure 6-1 shows the location of key areas for assessment.

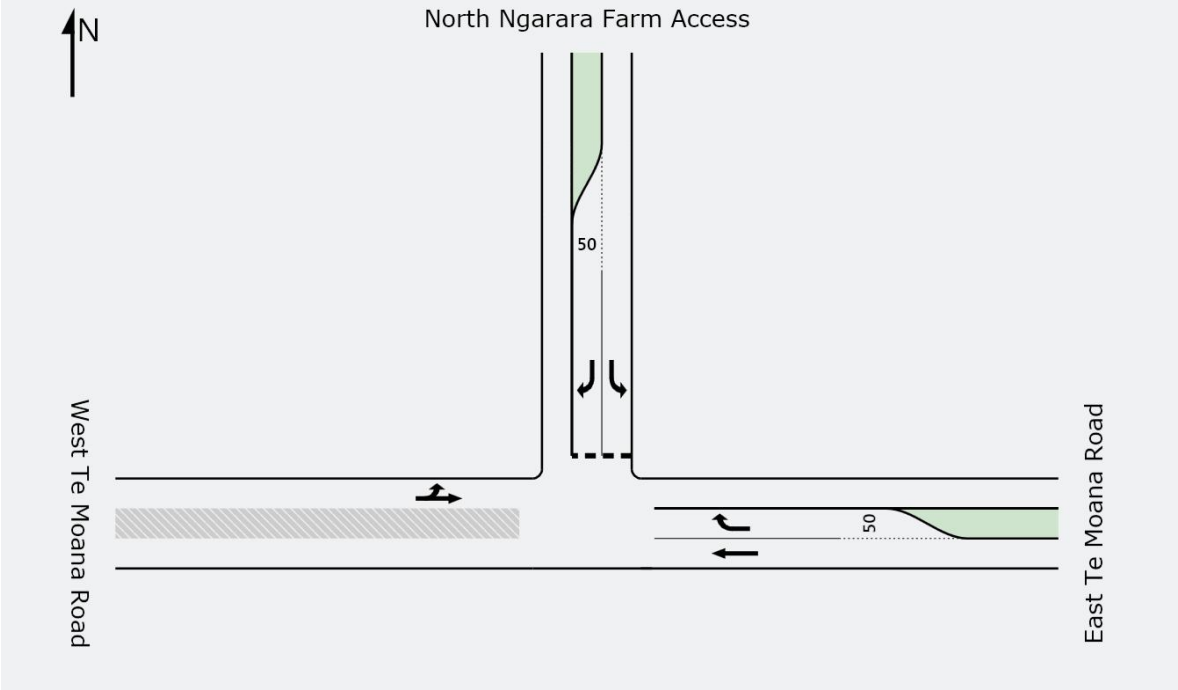
Figure 6-1: Location Plan - key areas for assessment



6.1 Te Ara Nui o Ngarara / Te Moana Road Intersection

The Te Moana Road / Te Ara Nui o Ngarara (TANON) intersection was assessed using the SIDRA modelling tool. Figure 6-2 shows the proposed intersection layout in SIDRA.

Figure 6-2: SIDRA intersection layout



Three demand scenarios were tested:

1. NDP forecast, external demand for Waimeha only
2. KTM3 demand, for full Ngarara development
3. NDP forecast, overall demand for full Ngarara development, as a sensitivity test to Scenario 2.

Scenario 1 uses NDP forecast demand for external trips from the Waimeha neighbourhood only. This scenario assesses the performance of the intersection when Waimeha is fully developed.

Table 6-1 shows the average delay and corresponding LOS for the Te Moana Road / TANON intersection, as output by the SIDRA models. In 2031, with the Waimeha neighbourhood complete, the intersection operates at LOS A overall. The poorest performing movement (right turn from TANON during the PM peak) operates at LOS D. Detailed SIDRA outputs for all scenarios are provided in Appendix F.

These results indicate that the proposed intersection layout has sufficient capacity to accommodate the full quantum of development proposed. Therefore, the layout in Figure 6-2 is the recommended layout of the intersection when Waimeha is fully developed.

Table 6-1: Te Moana Road / TANON intersection – Scenario 1

Time Period	AM				PM			
Year	2021		2031		2021		2031	
	Average Delay (s)	LOS	Average Delay (s)	LOS	Average Delay (s)	LOS	Average Delay (s)	LOS
Te Ara Nui o Ngarara	11	B	13	B	9	A	10	A
Te Moana Road East	1	A	1	A	1	A	1	A
Te Moana Road West	0	A	0	A	0	A	0	A
Total	**2**	**A**	**2**	**A**	**1**	**A**	**2**	**A**

For Scenario 2, 2021 vehicle demands were taken directly from the KTM3 composite model. As a 2031 KTM3 model has not been developed yet, 2021 demands for turns in and out of TANON were factored by 3.03 to give 2031 turn volumes[14].

Table 6-2 shows the average delay and corresponding LOS for the Te Moana Road / TANON intersection, as output by the Scenario 2 SIDRA models. In 2031, with the full Ngarara development complete, the intersection operates at LOS A overall. The poorest performing movement (right turn from TANON during the PM peak) operates at LOS D.

These results indicate that the proposed intersection layout has sufficient capacity to accommodate the full quantum of development proposed. Therefore, the layout in Figure 6-2 remains the recommended layout of the intersection.

Table 6-2: Te Moana Road / TANON intersection – Scenario 2

Time Period	AM				PM			
Year	2021		2031		2021		2031	
	Average Delay (s)	LOS	Average Delay (s)	LOS	Average Delay (s)	LOS	Average Delay (s)	LOS
Te Ara Nui o Ngarara	11	B	18	C	9	A	12	B
Te Moana Road East	1	A	3	A	2	A	4	A
Te Moana Road West	0	A	0	A	0	A	1	A
Total	**2**	**A**	**6**	**A**	**2**	**A**	**5**	**A**

Scenario 3 has been undertaken as a sensitivity test to Scenario 2. Rather than use only external trips from all Ngarara neighbourhoods (as Scenario 2), this test assumes 100% of all traffic generated by development activity is external to the site and uses the TANON / Te Moana Road intersection (volumes shown in Table 5-9). This test is intended to use the maximum possible traffic volumes from the full Ngarara development, to test the capacity of the TANON / Te Moana Road intersection.

Table 6-3 below shows the average delay and corresponding LOS for the Te Moana Road / TANON intersection, as output by the SIDRA models. Delays on some approaches increase by 1 to 2 seconds but there is no noticeable reduction in the performance of any movement in Scenario 3. This indicates that the proposed intersection layout in Figure 6-2 has sufficient capacity to accommodate all traffic likely to be generated by the full Ngarara development.

Table 6-3: Te Moana Road / TANON intersection – Scenario 3

Time Period	AM				PM			
Year	2021		2031		2021		2031	
	Average Delay (s)	LOS	Average Delay (s)	LOS	Average Delay (s)	LOS	Average Delay (s)	LOS
Te Ara Nui o Ngarara	12	B	19	C	10	A	14	B
Te Moana Road East	2	A	3	A	3	A	4	A
Te Moana Road West	0	A	0	A	1	A	1	A

[14] Trips on Te Moana Road heading east or west are not associated with the Ngarara development so the same demand levels have been used across all three scenarios. Therefore KTM2.2 composite volumes for these trips were investigated to find the percent uplift between 2021 and 2031[14]. The percent uplift was applied to KTM3 2021 volumes for these trips to determine the likely 2031 volumes.

Time Period	AM				PM			
Year	2021		2031		2021		2031	
	Average Delay (s)	LOS	Average Delay (s)	LOS	Average Delay (s)	LOS	Average Delay (s)	LOS
Total	**2**	**A**	**6**	**A**	**3**	**A**	**5**	**A**

6.2 Adjacent Network Assessment

Table 6-4 shows the daily traffic volumes on key roads in 2021, according to KTM3 and the corresponding LOS for each link. Link LOS definitions are provided in Appendix G. Traffic generation associated with the Ngarara development is included in these volumes. The difference in volumes on Te Moana Road occurs because the majority of trips into or out of the Ngarara development use Te Moana Road East.

Table 6-4: KTM3 two way traffic volumes on key links

	ADT	AM		IP		PM	
		Flow (Two Way)	LOS	Flow (Two Way)	LOS	Flow (Two Way)	LOS
Te Moana Road West	9400	800	B	650	B	800	B
Te Moana Road East	11600	1000	C	800	B	1000	C
Kapiti Expressway North	13100	1000	A	1000	A	950	A
Kapiti Expressway South	19800	1600	A	1550	A	1500	A
Ngarara Road	700	50	A	50	A	50	A
Te Ara Nui o Ngarara	3000	200	A	200	A	250	A

Key intersections on the network adjacent to Ngarara are Te Moana Road / TANON (assessed above), Kapiti Expressway interchange (eastern and western intersections) and Ngarara Road / TANON. Table 6-5 describes the average intersection delay and corresponding LOS for each intersection, with demands taken from the 2021 KTM3 model.

Table 6-5: KTM3 2021 intersection delays and LOS for key intersections

	AM		IP		PM	
	Average Delay (s)	LOS	Average Delay (s)	LOS	Average Delay (s)	LOS
Interchange West Ramp	19	B	19	B	24	C
Interchange East Ramp	27	C	19	B	17	B
Ngarara Road / TANON intersection	2	A	3	A	3	A

Table 6-5 indicates that all intersections perform within acceptable LOS (LOS C or better) and levels of delay, when traffic from the development is included on the network.

6.3 M2PP Interchange

The M2PP Alliance is responsible for the design of the Te Moana Road interchange intersections, based on traffic volumes from KTM2.1. Comparisons of flows through the interchange between KTM2.1 and KTM3 in Table 6-6 below show KTM2.1 and KTM3 have similar flow volumes. Therefore the assumptions made within this report regarding traffic associated with Waimeha and the wider Ngarara development using KTM3 is that the proposal would have a negligible effect on the design of these intersections.

Table 6-6: KTM2.1 vs KTM3 interchange flows (2021)

	AM			IP			PM		
	KTM2.1	**KTM3**	**Difference**	**KTM2.1**	**KTM3**	**Difference**	**KTM2.1**	**KTM3**	**Difference**
West Interchange	1,080	1,160	70	810	950	140	1,070	1,250	180
East Interchange	1,210	1,230	20	790	900	110	940	1,040	100

6.4 External Traffic Distribution

Select link analysis was carried out for the Ngarara development zones in KTM3 to confirm external trip distribution patterns.

Approximately 25% of trips leaving the Ngarara site in the AM peak head south on the Kapiti Expressway, and the same volume return from the south along the Kapiti Expressway in the PM peak. Approximately 10% of trips use the Kapiti Expressway to travel north and approximately 10% also head west along Te Moana Road to surrounding residential areas. The remainder of the trips have their origin or destination in Waikanae town centre. This pattern occurs in both the AM and PM peaks.

This distribution of traffic is consistent with the mix of residential development envisaged for Ngarara, where a significant proportion of residents take advantage of the site's proximity to the Expressway to commute longer distances, while others work more locally in the Kapiti area.

6.5 Emissions

The NZTA Economic Evaluation Manual (EEM) specifies vehicle emission calculations based on travel speeds, distances and traffic volumes. This is typically used to assess the impacts of significant changes in infrastructure, such as the provision of new motorway links, rather than for the assessment of developments.

There is very limited data available on the likely changes in vehicle kilometres travelled (VKT) as a result of the development due to the residents of this development presumably relocating from other residential areas. Depending on the type of residence future residents were living in, residents may reduce or increase their CO2 emission footprint depending on their current access to employment and amenities by active modes and public transport.

It is not considered appropriate to quantify the likely emissions impacts of the development, rather give an indication of the potential CO2 considerations under a number of assumptions:

- A total of 1,400 vehicle movements per day in 2021, or approximately 500,000 per year;
- By providing for walkable amenities and encouraging walkablility through generous walkways and cycleways additional vehicle trips increasing CO2 emissions can be minimised

7. Parking and Access

7.1 Parking Requirements

The parking and loading requirements for each activity are derived from the KCDC District Plan. Sufficient parking will be provided on an incremental basis as development proceeds, in line with the ratios set out in District Plan to accommodate demand associated with each activity until they reach the maxima set out below.

KCDC District Plan Part J specifies the number of parking spaces that are required for a range of activities. .

summarises these requirements.

Table 7.1 : KCDC District Plan Parking Requirements

Activity	Requirement
Residential	2 per dwelling (includes garage or carport)
Multi-unit residential	1.5 per dwelling unit (includes garage or carport)
Retail (neighborhood or local shops)	2 in street lay by or 3 per 100m^2 GFA
Office	3 per 100m^2
Community	The specific activities and associated GFA likely to be located in each of these areas have not yet been defined. As the District Plan has differing parking requirements dependent on the activity, it is proposed that parking provision for these activities is confirmed when these are better defined.
Open Space	

7.1.1 Proposed Parking Provision

Because this ITA is in support of an NDP application, the exact detail of each proposed activity has not yet been defined. However, all activities will be designed to ensure that their parking provision complies with District Plan requirements, with the exception of the multi-unit residential activity.

Within the Waimeha neighbourhood, a significant proportion of the residential dwellings are proposed to be multi-unit residential; i.e. townhouses and apartments. One parking space per dwelling unit will be provided across these dwelling types.

This is consistent with the Ngarara ideology, which is to create a sustainable and environmentally friendly community with reduced traffic demand. Proposed walking, cycling and public transport initiatives described in Section 4.2 will enable residents to be less car dependent for both local and longer distance trips.

The supply, management and pricing of parking directly affect the achievement of desirable transport and land use outcomes. Good parking management is vital for the safe and efficient operation of the road network, supporting the economic development of town centres as well as increased public transport use. Auckland's Proposed Unitary Plan (PAUP) provides a progressive view of parking policy, based on this philosophy. It recommends that terrace housing and apartment buildings provide a maximum of one parking space for one bedroom dwellings and not more than two parking spaces for dwellings with a greater number of bedrooms.[15]

It is acknowledged that Auckland conditions are not always directly applicable to more regional locations but in this instance, we consider that the comparison is valid. The Waimeha neighbourhood will comprise medium / high density dwellings located in close proximity to the existing bus route 280, which runs frequently between Ngarara and Waikanae town centre and train station. In addition, local shops and services will be located within

[15] Proposed Auckland Unitary Plan, section 3.2

easy walking distance of these residences and high quality walking and cycle facilities are proposed to encourage active mode use.

The development of the Waimeha neighbourhood will occur incrementally and parking facilities will also be provided on an incremental basis, compliant with the requirements in .

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7.1.2 Provision for Mobility Impaired Persons

Mobility parking spaces and suitable access routes between the mobility parking and the activity being served must be provided as part of car parking provisions. Section J1.2.4 requires parking spaces to be provided and designed for mobility impaired persons at a rate of

- One car park where 10 or less car parking spaces are provided;
- Two car parks where between 11 and 100 car parking spaces are provided, plus
- One additional car park for every additional 50 spaces, or part thereof, where more than 100 car parking spaces are provided.

Mobility parking spaces will be provided within each parking area to comply with the above.

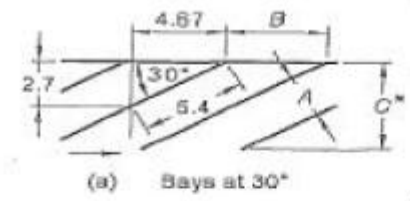
7.1.3 Parking Dimensions and Layout

Parking spaces will all be designed to comply with dimensions provided in section J.1.2.3 of the District Plan, which is shown in Figure 7-1, below.

The final layout adopted will depend on the area and shape of the land or floor space available and there are likely to be several alternative methods to achieve a satisfactory parking layout, with adequate access and manoeuvring space.

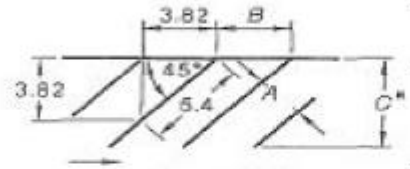
Figure 7-1 : District Plan Parking Dimensions

FIGURE 2.2 FROM AS/NZS 2890.1:2004



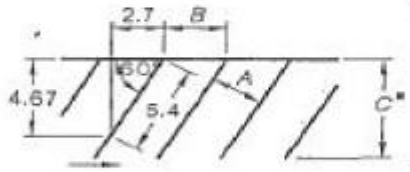
(a) Bays at 30°

User class (Note 1)	A (Notes 2 & 3)	B	C_1	C_2	C_3	Aisle width
1,1A	2.1	4.2	4.4	4.1	4.5	3.1
2	2.3	4.6	4.4	4.1	4.7	3.0
3	2.5	5.0	4.4	4.1	4.9	2.9
3A	2.5	5.0	4.4	4.1	4.9	3.45



(b) Bays at 45°

User class (Note 1)	A (Note 3)	B	C_1	C_2	C_3	Aisle width
1,1A	2.4	3.4	5.2	4.8	5.5	3.9
2	2.5	3.5	5.2	4.8	5.6	3.7
3	2.6	3.7	5.2	4.8	5.7	3.5
3A	2.6	3.7	5.2	4.8	5.7	4.2
4	(See Note 5)					



(c) Bays at 60°

User class (Note 1)	A (Note 3)	B	C_1	C_2	C_3	Aisle width
1,1A	2.4	2.75	5.7	5.1	5.9	4.9
2	2.5	2.90	5.7	5.1	6.0	4.6
3	2.6	3.00	5.7	5.1	6.0	4.3
3A	2.6	3.00	5.7	5.1	6.0	5.1
4	(See Note 5)					

(d) Bays at 90°

User class (Note 1)	A (Note 3)	B	C_1	C_2	C_3	Aisle width (Note 4)
1	2.4	2.4	5.4	4.8	5.4	6.2
1A	2.4	2.4	5.4	4.8	5.4	5.8
2	2.5	2.5	5.4	4.8	5.4	5.8
3	2.6	2.6	5.4	4.8	5.4	5.8
3A	2.6	2.6	5.4	4.8	5.4	6.6
3A	2.7	2.7	5.4	4.8	5.4	6.2
4	(See Note 5)					

*Dimension C is selected as follows (see Note 6):
C1—where parking is to a wall or high kerb not allowing any overhang.
C2—where parking is to a low kerb which allows 600 mm overhang in accordance with Clause 2.4.1(a)(i).
C3—where parking is controlled by wheelstops installed at right angles to the direction of parking, or where the ends of parking spaces form a sawtooth pattern, e.g. as shown in the upper half of Figure 2.4(b).

DIMENSIONS IN METRES

Source: KCDC District Plan Section J

7.1.4 Loading Space Requirements

District Plan Sections J.2.1 and J.2.2 have the following requirements:

(i) Every person who proposes to erect, re-erect, construct or reconstruct a building shall provide within the site, suitable and efficient accommodation for any loading or fuelling of vehicles which is likely to arise from the use of the building.

(ii) The method of loading shall at no time cause the footpath or access to adjacent property to be blocked nor shall it create a traffic hazard on the road.

(iii) Every loading space, together with access, shall be designed so that it is not necessary to reverse vehicles either on to or off the street.

The layout adopted will depend on the area and shape of the land available, the purpose of which loading is required, and functional design of the building. The layout shall generally be of sufficient size to accommodate the following design vehicles:

- *In all industrial and commercial zones, a 90 percentile design two-axled truck, as defined by the Ministry of Transport.*
- *On all industrial and commercial sites where articulated vehicles are likely to be used, the layout shall be designed to accommodate such vehicles.*

All activities will be designed to be compliant with these requirements. It is not expected that the activities proposed within the Waimeha neighbourhood would generate significant demand for heavy vehicle loading facilities. It is expected that the largest vehicle likely to make deliveries to the site would be a rubbish truck. The neighbourhood shops may receive deliveries from a medium sized rigid truck. On street loading zones will be provided in each mixed use centre to provide for courier vans and small truck deliveries.

7.2 Access Requirements

District Plan Section J.4.1 states that *"Every owner or occupier shall provide vehicular access to his property, over his land or by mutual right of way or service lane for parking or loading. In respect of sites containing non-residential activities and which provide more than 6 car parks, two-way accesses shall be a minimum of 6 metres wide. All other accesses shall be a minimum of 3 metres wide."*

Each individual land parcel will be provided with vehicular access in compliance with this requirement.

For vehicular access locations, Section J.4.1 states:

(a) At intersections carrying traffic volumes of 1,000 vehicles or more in any peak hour, or at which traffic signals are operating, no part of a crossing point shall be located within 30 metres of an intersection or within 60 metres on the departure side of an urban state highway intersection. The distance is measured from the intersecting point of the kerb lines or road edge lines.

(b) For intersections having volumes less than 1,000 vehicles in any peak hour; the minimum distance between the crossing point and the roadway edge or kerb line shall be:

- *9.0 metres measured from the intersecting point of the kerb lines or road edge lines or 4.5 metres from the tangent point of the kerb lines or road edge whichever is greater.*
- *12.0 metres where a "Stop" or "Give Way" control exists on the roadway measured from the intersecting point of the kerb lines or road edge lines.*

(d) In respect of major traffic activities (refer to Part Q for definition), no crossing point shall be closer to any intersection than the distance specified in the following table. Distances are measured in metres to the intersecting kerb line. Accesses shall comply with the sight distances specified in Table I below.

TABLE I

FRONTAGE ROAD	DISTANCE FROM		
	Arterial	Principal	Local
Major Arterial	60 m	45 m	30 m
Principal and Minor	45 m	30 m	30 m
Local	30 m	30 m	15 m

(vii) All vehicle accesses shall be designed, constructed and maintained to ensure that:

- *they are able to be used in all weather conditions,*

- *they have no adverse impact on the roadside drainage system, and*
- *surface water and detritus (including gravel and silt) does not migrate onto the highway pavement.*

(viii) Where the access is proposed to a rural road, the design and construction of the access shall comply with the standards indicated on Diagrams 2, 3 or 4 depending upon the activity served by the proposed access.

(ix) Heavy vehicle accesses, including those for milk tankers and stock trucks, shall be designed and constructed to carry the volume and weight of traffic likely to use the access. The surface shall be constructed to the same standard as the adjacent road carriageway. This requirement shall be deemed to have been complied with if the first 12 metres of the accessway, measured from the near edge of the carriageway, is so constructed.

The access shall also be designed and constructed so that heavy vehicles do not have to cross the road centre line when making a left turn.

(x) The width of the access way at the property boundary be no greater than 9 metres and not less than 6 metres for commercial activities, and 3 metres for other lots.

These access requirements will be complied with for all accessways that form part of the Waimeha neighbourhood. All vehicle crossings will be designed in accordance with these requirements. No part of the Waimeha neighbourhood will have access directly onto Te Moana Road or any other high volume roads.

8. Sustainable Travel

The purpose of a travel plan is to reduce vehicular trip generation and to encourage other modes of transport. This provides a measurable sustainability improvement for a community, by reducing the level of vehicle emissions and encouraging active modes such as walking and cycling.

A travel plan could be developed in conjunction with the residential and retail community in the Ngarara area. An additional benefit of a community based travel planning programme is that it can provide a focal point for the community and a method to develop a sense of belonging and meaningful engagement across the community. The travel plan could be lead by Council.

Some key components of travel plans are described below.

8.1 Car Pooling

Car pooling, or ride sharing, is simply sharing a car instead of always driving on your own. It reduces each passenger's transport costs, cuts the number of cars on the road, and cuts down polluting emissions. Neighbourhood residents could be encouraged to share car journeys. Car pooling also connects people within a community and can contribute strongly to the feeling of 'belonging' within a residential area. This could be linked to GWRC's car share scheme.

8.2 Public Transport

A good standard of public transport is available in the vicinity of the development. Buses connect regularly with the Waikanae train station as well as Waikanae and Paraparaumu town centres. Incentives could be provided through the travel plan for residents and businesses to encourage public transport use.

A local community shuttle bus could also be developed to enable less mobile residents to access services outside of the Ngarara development.

8.3 Cycling

Cycling is an easy way to get fit and have fun and as such cycling should be encouraged. Bicycle parks and secure lockers should be provided to encourage cycling to work.

A 'Bike Buddies' programme could be implemented in the community; the Bike Buddies programme involves pairing up current cyclists with a friend who is interested in cycling along a similar route. Before the buddies begin cycling together both need to demonstrate that they are equipped for safe cycling.

8.4 School Travel Plans

Although a school is not currently proposed as part of the Waimeha neighbourhood, if one were provided, a school travel plan should be encouraged to reduce dependence on car based travel.

9. KCDC District Plan Summary of Requirements

The transport criteria in the KCDC District Plan assist in assessing the likely impacts of a proposal. Table 9-1 outlines the assessment against the relevant transportation rules of the District Plan and indicates that the proposed development complies with these rules.

Table 9-1 : District Plan Assessment Criteria (Volume 1, Part J)

Rule	Assessment
J.1 – Parking Standards Parking spaces shall be provided as follows; Dwellings: 2 per dwelling unit. Multi-unit dwellings: 1.5 per dwelling unit. Day Care Centres: 1 per staff member and provision for a stand off-street for the loading and unloading of passengers. Primary and Secondary Schools: 1 per two staff.	Will comply for all activities except multi-unit residential One parking space per dwelling will be provided for multi-unit residential dwellings.
J1.2.4 - Mobility Parking The parking area shall contain the following: 0-10: one car park 11-100: two car parks More than 100: Two car parks plus one additional car park for every 50 additional spaces or part thereof	Will comply
J.1.2 – Parking Space and Manoeuvring dimensions Every parking space and manoeuvring area must comply with dimensions given in Figure 7-1	Will comply
J.2.1 - Provision of Loading Space Site should have suitable and efficient accommodation for any loading or fuelling of vehicles which is likely to arise from the use of the building. Loading shall not cause footpath or access to adjacent property to be blocked or create a traffic hazard on the road. Loading space and access shall be designed so that it is not necessarily for vehicles to reverse on to or off the street.	Will comply
J.4.1 – Access Site shall have vehicular access over site land or by mutual right of way or service lane for parking or loading. Sites containing non-residential activities with more than 6 car parks, two-way accesses shall be a minimum of 6 metres wide. All other accesses shall be a minimum of 3 metres wide.	Will comply

10. Summary and Recommendations

This report examines the likely transportation effects of the proposed Waimeha neighbourhood and the way in which these effects will affect the existing road network, public transport, and other related transportation issues such as pedestrian, cycle and bridle facilities.

The Ngarara Zone and Structure Plan was adopted by KCDC and forms part of the operative District Plan.

Waimeha will initially only be accessible from Te Moana Road. Once the remaining neighbourhoods are constructed, access via Ngarara Road will also be possible.

This report has examined the traditional traffic impacts of the development as well as the relationship of the proposed development to the surrounding road network and its integration with pedestrian, cyclist, public transport and mobility impaired access.

The Waimeha Structure Plan identifies a hierarchy of roads, divided into Primary and Secondary Connections. The hierarchy proposed as part of this NDA is consistent with the principles described in the Structure Plan.

The Waimeha neighbourhood will comply with the relevant sections of the KCDC District Plan with the exception that parking for multi-unit residential activities will be provided at a rate of one space per dwelling rather than 1.5 spaces as recommended in the District Plan.

Using the outputs from the KTM3 model, the ITA has assessed the following issues that relate to this development and drawn conclusions as follows:

a. Trip generation

- The ITA has used outputs from the KTM3 model as the basis for the assessment of traffic effects associated with the proposed Waimeha Neighbourhood and the wider Ngarara development. The traffic generation assumptions used in this modelling are considered to be appropriate.
- Traffic generated by the proposed Waimeha neighbourhood and wider Ngarara development can be accommodated easily and will have negligible adverse effect on the adjacent road network. No mitigation is required.

b. Public transport provision

- The existing public transport provision along Te Moana Road provides a good level of service for the site. Te Ara Nui o Ngarara and the Main Streets have been designed to provide access for buses and bus stopping facilities. This level of provision is considered to be appropriate.

c. Walk and cycling planning

- The site is highly accessible to all users including car drivers, pedestrians, cyclists, public transport users and the mobility impaired. No additional facilities are recommended in addition to those proposed in this report;
- Specific consideration has been given to pedestrians, cyclists and the mobility impaired, with dedicated shared paths for these users. An inter-connected open space network provides an alternative to the road network for active mode users.

d. Emissions

- There is very limited data available on the likely changes in vehicle kilometres travelled (VKT) as a result of the development due to the residents of this development presumably relocating from other residential areas. Depending on the type of residence future residents were living in, residents may reduce or increase their CO2 emission footprint depending on their current access to employment and amenities by active modes and public transport.
- It is not considered appropriate to quantify the likely emissions impacts of the development, rather give an indication of the potential CO2 considerations under a number of assumptions:

- A total of 1,400 vehicle movements per day in 2021, or approximately 500,000 per year;
- By providing for walkable amenities and encouraging walkablility through generous walkways and cycleways additional vehicle trips increasing CO2 emissions can be minimised

e. Travel Plan

- The travel planning recommendations included in this report will contribute to a strong sense of place within the community and will reduce the reliance of the community on single occupancy vehicle travel.

f. Intersection Capability

- The intersection of Te Ara Nui o Ngarara and Te Moana Road can easily accommodate the full proposed quantum of traffic associated with the wider Ngarara development with low levels of delay and a very good level of service. No additional mitigation measures are required to accommodate traffic associated with the development.
- Parking and access provision and layout are sufficient and appropriate for the proposed land uses and compliant with relevant District Plan requirements.

This report concludes that the development proposed for the Waimeha neighbourhood will have a negligible transportation effect on the adjacent road network. As such, no mitigation is required to offset any adverse effects.

Appendix A. Te Moana Road – Existing Condition

Figure A.1 : Te Moana Road (west) layout - flush median and no parking

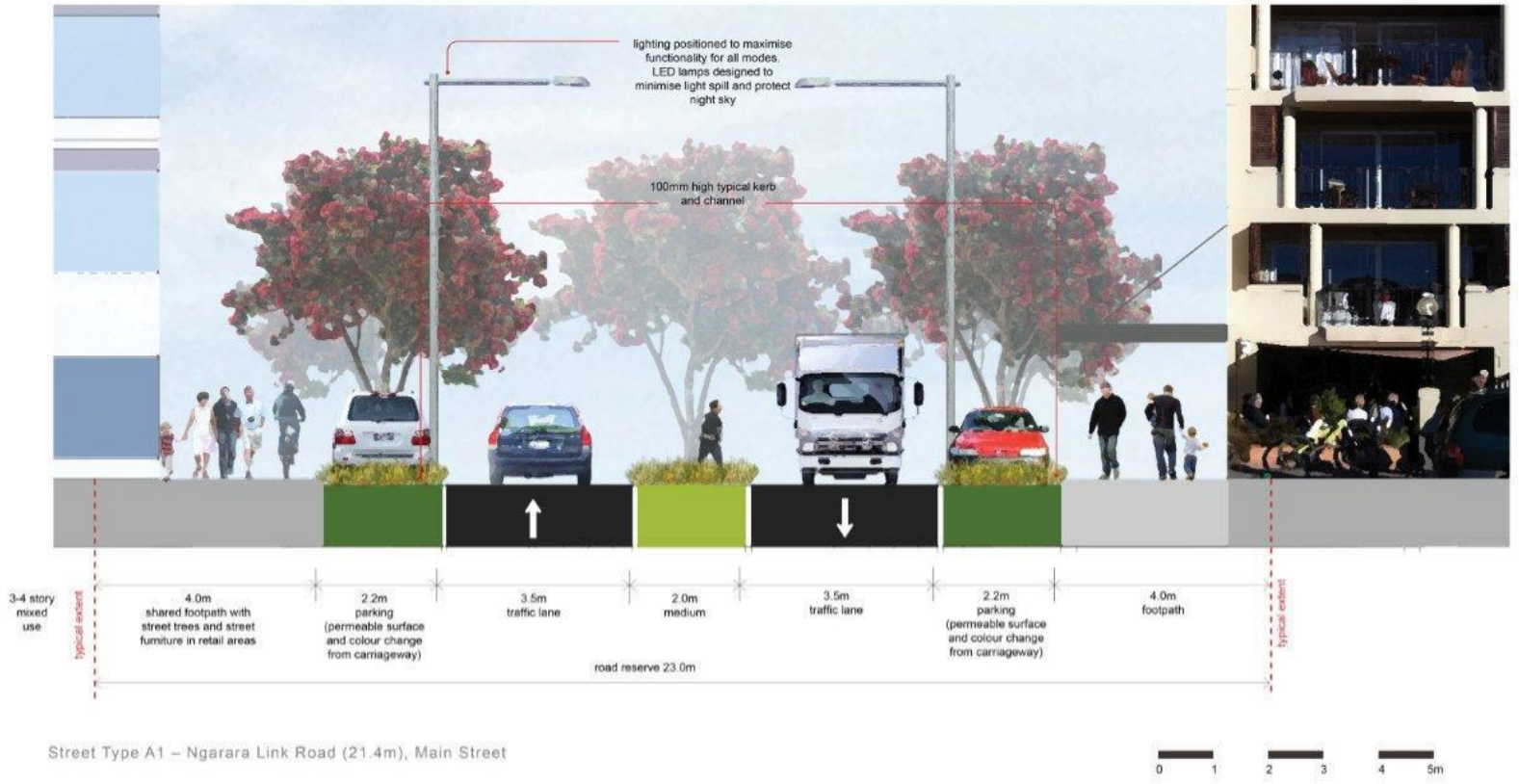
Figure A.2 : Te Moana Road (east) – no median and parking permitted

Appendix B. Crash Reports

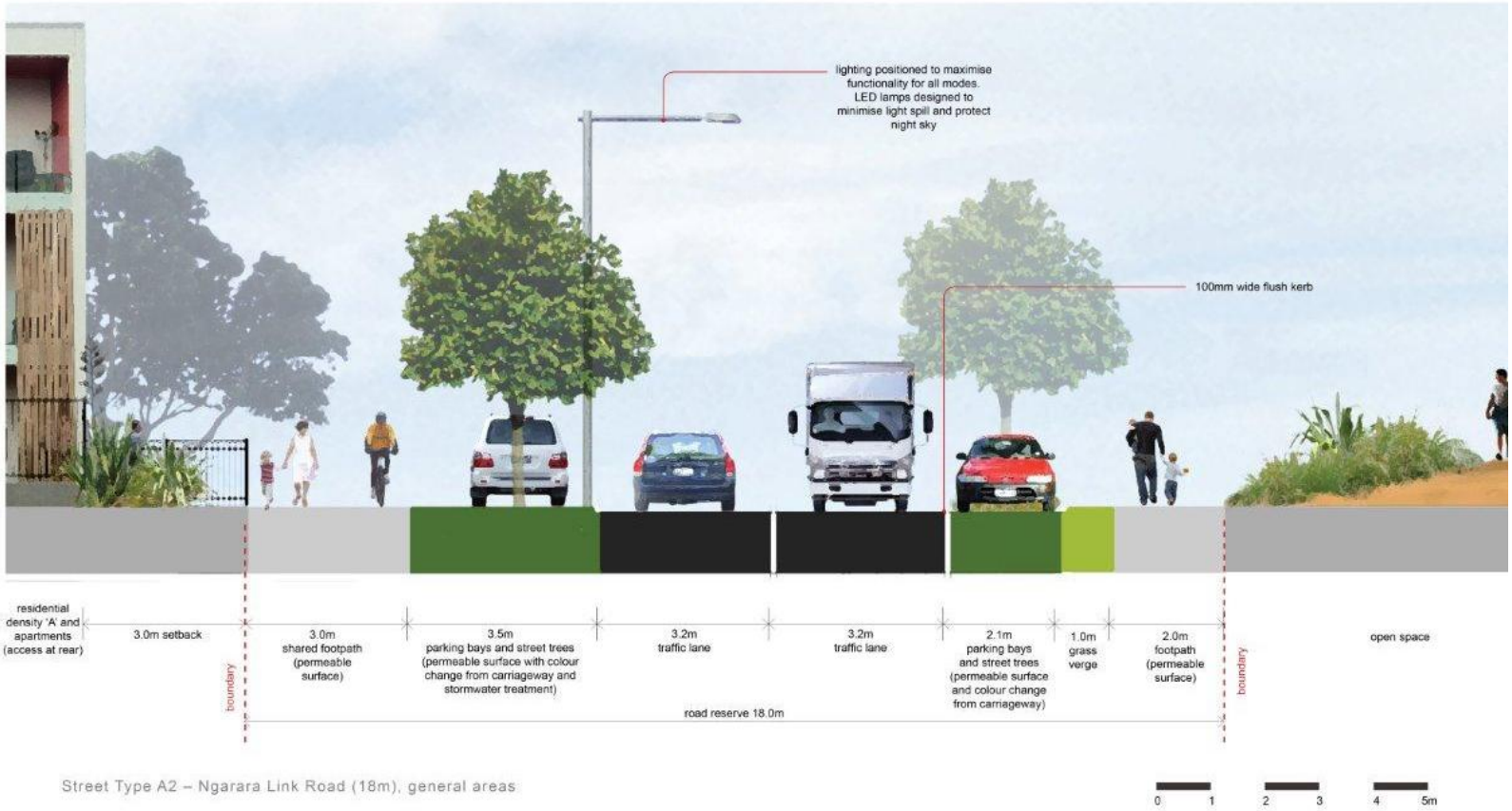
First Street	Distance	D I R	Second street or landmark	Crash Number	Date DD/MM/YYYY	Day DDD	Time HHMM	Description of Events	Crash Factors (ENV = Environmental factors)	Road	Natural Light	Weather	Junction	Cntrl	Tot F A T	Inj S E R	M I N
NGARARA ROAD		I	TE MOANA ROAD	201250813	21/03/2012	Wed	1048	TRUCK1 and CAR2 both SBD on NGARARA ROAD and turning; collided	TRUCK1 turned left from incorrect lane CAR2 overtaking on left, misjudged intentions of another party	Dry	Overcast	Fine	T Type Junction	Give Way Sign			
TE MOANA ROAD		I	NGARARA ROAD	201150354	05/02/2011	Sat	1705	VAN2 turning right hit by oncoming SUV1 EBD on TE MOANA ROAD	VAN2 failed to give way when turning to non-turning traffic, overseas/migrant driver failed to adjust to NZ road rules and road conditions	Wet	Overcast	Mist	T Type Junction	Give Way Sign			
TE MOANA ROAD	350	N	PARK AVENUE	2911260	03/03/2009	Tue	1400	CAR1 NBD on TE MOANA ROAD lost control on curve and hit CAR2 head on	CAR1 fatigue (drowsy, tired, fell asleep)	Dry	Bright	Fine	Unknown	Nil		1	
TE MOANA ROAD	350	N	PARK AVENUE	201253455	30/09/2012	Sun	1541	SUV1 NBD on TE MOANA ROAD lost control turning left, SUV1 hit Post Or Pole	SUV1 wrong pedal, impared ability due to old age	Dry	Overcast	Fine	Unknown	Nil			
TE MOANA ROAD	400	N	PARK AVENUE	201311751	18/05/2013	Sat	1830	CAR1 SBD on TE MOANA ROAD hit parked veh, CAR1 hit Parked Vehicle	CAR1 too far left/right, misjudged speed of own vehicle	Dry	Dark	Fine	Unknown	Nil			1
TE MOANA ROAD	20	W	SH 1N	2953597	16/07/2009	Thu	2043	CAR2 turning right hit by oncoming CAR1 WBD on TE MOANA ROAD	CAR2 failed to give way when turning to non-turning traffic ENV: entering or leaving service station	Dry	Dark	Fine	Driveway	Nil			
1N/1012/4.722	40	N	TE MOANA ROAD	201055279	15/10/2010	Fri	1850	CAR1 NBD on SH 1N hit rear end of CAR2 stopped/moving slowly	CAR1 did not stop at steady red light, failed to notice car slowing, fatigue (drowsy, tired, fell asleep)	Dry	Overcast	Fine	Unknown	Nil			
1N/1012/4.752	10	N	TE MOANA ROAD	201151959	08/05/2011	Sun	1830	CAR1 NBD on SH 1N changing lanes to left hit TRUCK2	CAR1 didnt see/look behind when changing lanes, position or direction	Wet	Dark	Fine	T Type Junction	Nil			
1N/1012/4.762		I	TE MOANA ROAD	201153527	14/08/2011	Sun	2011	CAR2 turning right hit by oncoming SUV1 NBD on SH 1N	CAR2 failed to give way when turning to non-turning traffic, didnt see/look when required to give way to traffic from another direction	Dry	Dark	Fine	T Type Junction	Traffic Signal			
1N/1012/4.762		I	TE MOANA ROAD	201151975	26/04/2011	Tue	0730	CAR1 EBD on TE MOANA ROAD lost control turning right, CAR1 hit Tree on right hand bend	CAR1 too fast for conditions, lost control due to road conditions ENV: strong wind	Wet	Overcast	Light Rain	T Type Junction	Traffic Signal			
1N/1012/4.762		I	TE MOANA ROAD	201151825	17/04/2011	Sun	1330	MOTOR CYCLE1 SBD on SH 1N hit rear end of CAR2 stop/slow for signals	MOTOR CYCLE1 following too closely, misjudged intentions of another party CAR2 suddenly braked	Dry	Bright	Fine	T Type Junction	Traffic Signal			
1N/1012/4.762		I	TE MOANA ROAD	201150985	24/03/2011	Thu	0930	VAN2 turning right hit by oncoming CAR1 NBD on SH 1N	VAN2 failed to give way when turning to non-turning traffic, didnt see/look when required to give way to traffic from another direction	Dry	Bright	Fine	T Type Junction	Traffic Signal			
1N/1012/4.762		I	TE MOANA ROAD	201111606	03/04/2011	Sun	1910	CAR2 turning right hit by oncoming CAR1 NBD on SH 1N	CAR2 failed to give way when turning to non-turning traffic, didnt see/look when required to give way to traffic from another direction	Dry	Dark	Fine	T Type Junction	Traffic Signal			3
1N/1012/4.762		I	TE MOANA ROAD	201011741	06/03/2010	Sat	1330	MOTOR CYCLE2 turning right hit by oncoming CAR1 NBD on SH 1N	MOTOR CYCLE2 failed to give way when turning to non-turning traffic, attention diverted by other traffic, didnt see/look when visibility obstructed by other vehicles	Dry	Bright	Fine	T Type Junction	Traffic Signal		1	
1N/1012/4.762		I	TE MOANA ROAD	2954508	01/09/2009	Tue	0950	VAN2 turning right hit by oncoming SUV1 NBD on SH 1N	VAN2 failed to give way when turning to non-turning traffic, didnt see/look when required to give way to traffic from another direction ENV: heavy rain	Wet	Overcast	Heavy Rain	T Type Junction	Traffic Signal			

First Street	Distance	D I R	Second street or landmark	Crash Number	Date DD/MM/YYYY	Day DDD	Time HHMM	Description of Events	Crash Factors (ENV = Environmental factors)	Road	Natural Light	Weather	Junction	Cntrl	Tot Inj F A T	S E R	M I N
1N/1012/4.762		I	TE MOANA ROAD	2950259	24/01/2009	Sat	1511	CAR2 turning right hit by oncoming CAR1 NBD on SH 1N	CAR2 failed to give way when turning to non-turning traffic, overseas/migrant driver failed to adjust to NZ road rules and road conditions	Dry	Overcast	Fine	T Type Junction	Traffic Signal			
1N/1012/4.762		I	TE MOANA ROAD	201052425	20/05/2010	Thu	1245	CAR2 turning right hit by oncoming CAR1 NBD on SH 1N	CAR2 failed to give way when turning to non-turning traffic, didnt see/look when required to give way to traffic from another direction	Dry	Bright	Fine	T Type Junction	Traffic Signal			
1N/1012/4.762		I	TE MOANA ROAD	2950157	09/01/2009	Fri	1250	CAR2 turning right hit by oncoming CAR1 NBD on SH 1N	CAR1 did not stop at steady amber light CAR2 failed to give way when turning to non-turning traffic, did not stop at steady amber arrow	Dry	Overcast	Fine	T Type Junction	Traffic Signal			
1N/1012/4.762		I	TE MOANA ROAD	201350006	15/01/2013	Tue		TRUCK1 NBD on SH 1N hit VAN2 turning right onto SH 1N from the left	TRUCK1 did not stop at steady red light, failed to notice traffic lights	Dry	Bright	Fine	T Type Junction	Traffic Signal			
1N/1012/4.762 MAIN		I	TE MOANA ROAD	201152567	11/07/2011	Mon	1805	CAR1 SBD on SH 1N MAIN lost control but did not leave the road, CAR1 hit Traffic Island	CAR1 alcohol test above limit or test refused	Wet	Dark	Light Rain	T Type Junction	Traffic Signal			
1N/1012/4.762 MAIN ROAD		I	TE MOANA ROAD	201254837	22/12/2012	Sat	1100	CAR2 turning right hit by oncoming CAR1 NBD on SH 1N MAIN ROAD	CAR2 failed to give way when turning to non-turning traffic	Wet	Overcast	Light Rain	T Type Junction	Traffic Signal			
1N/1012/4.762 MAIN ROAD		I	TE MOANA ROAD	201353049	14/08/2013	Wed	1426	CAR2 turning right hit by oncoming CAR1 NBD on SH 1N MAIN ROAD	CAR2 failed to give way when turning to non-turning traffic, didnt see/look when required to give way to traffic from another direction	Dry	Overcast	Fine	T Type Junction	Traffic Signal			
1N/1012/4.762 MAIN ROAD		I	TE MOANA ROAD	201350258	15/02/2013	Fri	1300	TRUCK2 turning right hit by oncoming CAR1 NBD on SH 1N MAIN ROAD	TRUCK2 failed to give way when turning to non-turning traffic, misjudged intentions of another party	Dry	Bright	Fine	T Type Junction	Traffic Signal			
TE MOANA ROAD		I	MAIN ROAD	201350517	04/02/2013	Mon	1624	VAN1 EBD on TE MOANA ROAD lost control turning right on right hand bend	VAN1 too fast entering corner, lost control under heavy acceleration ENV: road slippery (rain), heavy rain	Wet	Overcast	Heavy Rain	T Type Junction	Traffic Signal			
TE MOANA ROAD		I	1N/1012/4.762	201354197	26/10/2013	Sat	1515	VAN1 EBD on TE MOANA ROAD hit rear end of CAR2 stop/slow for signals	VAN1 following too closely	Dry	Bright	Fine	T Type Junction	Traffic Signal			
TE MOANA ROAD		I	1N/1012/4.762	201153776	23/09/2011	Fri	1804	SUV1 EBD on TE MOANA ROAD hit rear of left turning SUV2	SUV1 following too closely, failed to notice car slowing	Dry	Bright	Fine	T Type Junction	Traffic Signal			
1N/1012/4.782	20	S	TE MOANA ROAD	201054556	22/09/2010	Wed	1207	TRUCK1 SBD on SH 1N changing lanes to left hit CAR2	TRUCK1 incorrect merging/diverging manoeuvre, didnt see/look behind when changing lanes, position or direction	Dry	Bright	Fine	Unknown	Nil			
1N/1012/4.812	50	S	TE MOANA ROAD	201352696	23/06/2013	Sun	1400	SUV1 SBD on SH 1N lost control while overtaking	SUV1 too far left/right, misjudged speed of own vehicle	Dry	Bright	Fine	Unknown	Nil			

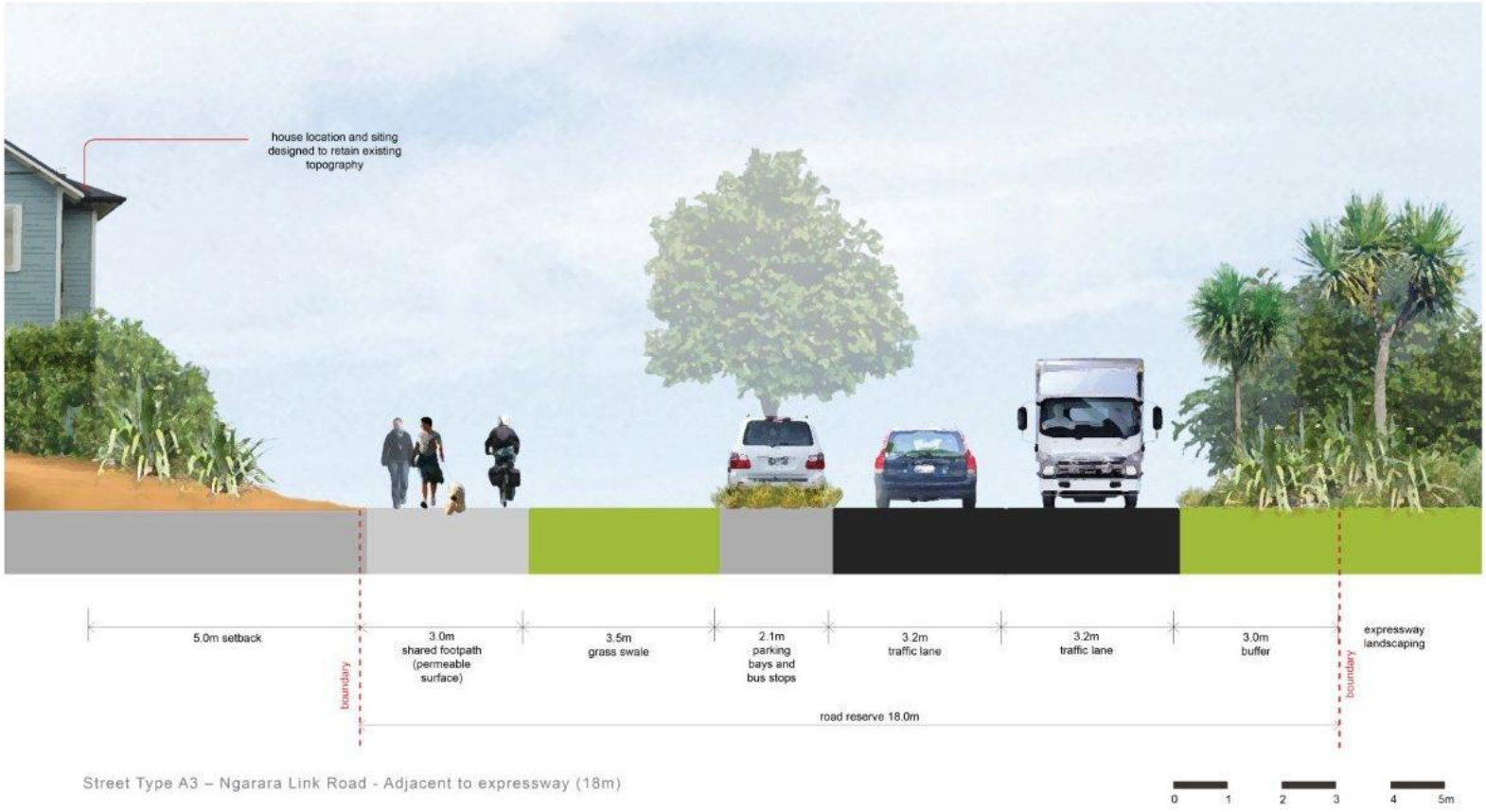
Appendix C. Design Concept Plans



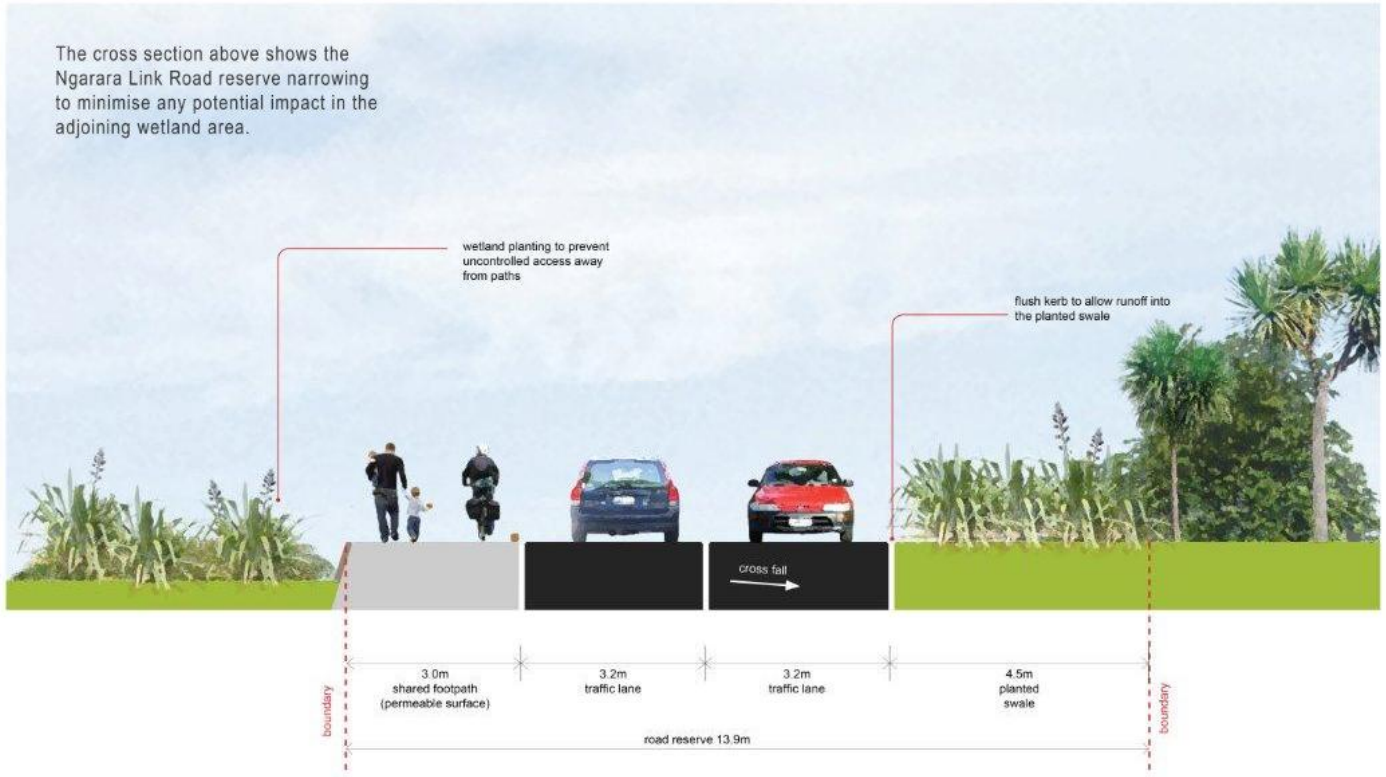
Street Type A1 – Ngarara Link Road (21.4m), Main Street



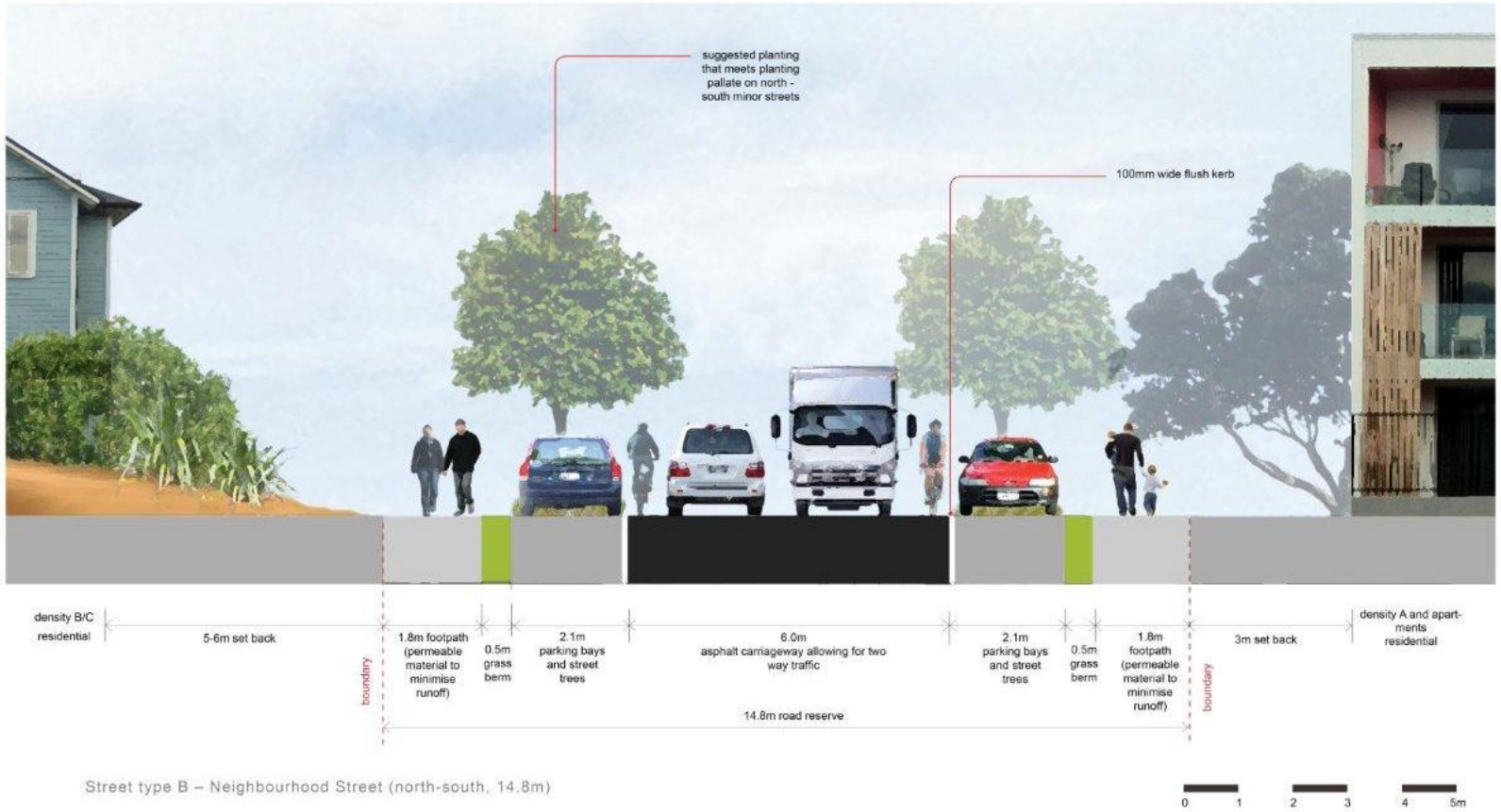
Street Type A2 – Ngarara Link Road (18m), general areas



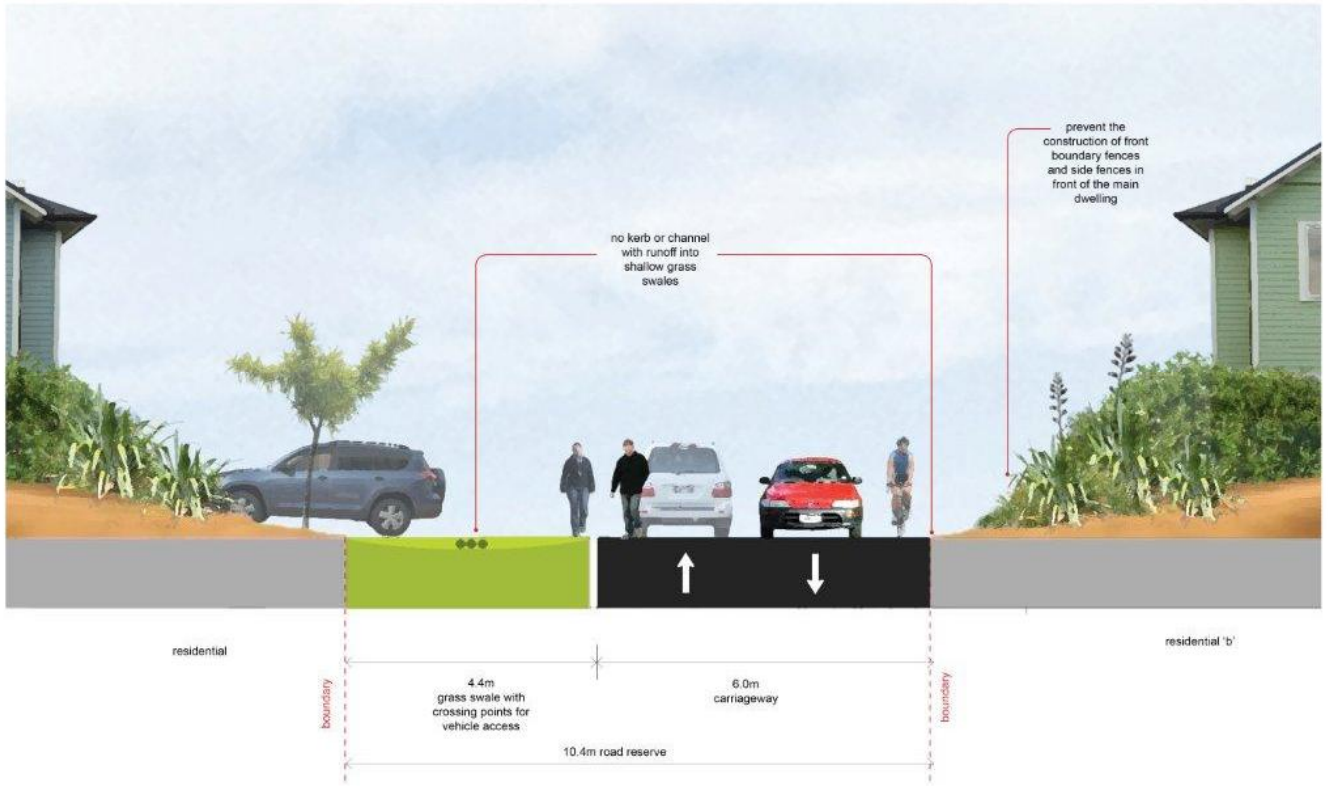
Street Type A3 – Ngarara Link Road - Adjacent to expressway (18m)



Street Type A4 – Ngarara Link Road - Adjacent to wetland (13.9m)



Street type B – Neighbourhood Street (north-south, 14.8m)



Street type C – Neighbourhood Street (east-west - 10.4m)

Street type D - Private Accessway (6m)

Appendix D. Kapiti Traffic Modelling Databook

Report

Kapiti Traffic Modelling Databook

Prepared for Kapiti Coast District Council (Client)

By Beca Ltd (Beca)

5 May 2014

Revision History

Revision Nº	Prepared By	Description	Date
1.0	Martin Peat	Draft for Discussion	11 Apr 2014
2.0	Alan Kerr	Incorporating client feedback	17 Apr 2014
3.0	Alan Kerr	Incorporating comments from Don Wignall	5 May 2014
4.0	Martin Peat	KTM3 Assumptions	17 June 2014

Document Acceptance

Action	Name	Signed	Date
Prepared by	Martin Peat		
Reviewed by	Alan Kerr		
Approved by	Alan Kerr		
on behalf of	Beca Ltd		

Table of Contents

1 Model Background

The KTM2 series have been developed as part of the MacKays to Peka Peka (M2PP) and Peka Peka to Otaki (PP2O) expressway prokects. An early descision was made to enhance the previous KTM SATURN model so that it could be used to appraise the various options for both projects.

The KTM and Otaki North SATURN models were subsequently combined to create a new model covering the Kapiti Coast and up to Otaki, known as KTM2.

Extensive sensitivity testing related to M2PP was undertaken in KTM2 and that model was subsequently enhanced and adopted for PP2O (KTM2.1). The economic evaluation of M2PP used KTM2.2 which is based on KTM2.1. Further detail on the inputs and assumptions of each of the three core models is outlined in the following sections.

Table 1-1 – Summary of KTM Series

Model Name	KTM2	KTM2.1	KTM2.2
Purpose(s)	■ M2PP AEE traffic models ■ Other sensitivity testing	■ PP2O Transport Assessment	■ M2PP Economic Evaluation
Inputs & assumptions	■ Base Year 2010 ■ Forecast Years 2016, 2026 & 2031 ■ WTSM: 2006-based ■ WTSM Land-use: Medium Growth ■ 197 zones	■ Base Year 2010 ■ Forecast Years 2021, 2031 & 2041 ■ WTSM: 2011-based ■ WTSM Land-use: Medium Growth ■ 197 zones	■ Base year 2010 ■ Forecast Years 2021, 2031 & 2041 ■ WTSM: 2011-based ■ WTSM Land-use: Medium Growth ■ 205 zones ■ Ngarara zone refinement
Documentation	Model validation and forecasting reports: ■ Traffic Modelling Report ■ Assessment of Traffic Effects Report	■ PP2O Documentation (Technical Report 6, Appendix C): – KTM2 Base Model Revisions – Summary of Impacts – KTM2.1 Forecasting – Summary of Impacts – Includes Peer Review ■ KTM2.1 Forecasting Process	M2PP Economic Evaluation Report

1.1 Model Purpose

The intention is to update the Model for use by Council (and other entities, particularly NZ Transport Agency) for a range of different purposes. These include:

- District Plan / Structure Plan review – The models will be used to provide an assessment of proposed land use patterns and to testsignificant concentrations of development and activities within the District. It is important that the Council has access to the most recent SATURN model prior to any formal hearings to provide evidence of traffic capacity as and when this is required.

- Town Centres Project – The model requires updating to allow the testing and adjustment of different access configurations (e.g. SH1/Kāpiti Road) and to provide a defensible record of credible preparatory work to withstand scrutiny during formal processes.
- Expressway issues – The model could be used to assess implementation (e.g. PP2O construction assessments), detailed design and consultation.
- SH1 (revocation) issues – The model could be used to assess implementation, detailed design, consultation and funding related discussions.
- Development Assessments – The model will be especially important for all major proposals, smaller proposals on critical parts of the network, and for private plan changes or non-complying activities - i.e. those not envisaged within the district plan.
- RMA Hearings (RMA/Designations – Council / Commissioner based) – The model could be used for internal Council considerations and to issue agreed information to participants.
- Board of Inquiry (RMA / Designations) – The model will be essential to fully develop proposals and to prepare Council responses.
- RMA Appeals (Environment Court) – The model will provide input to internal Council considerations and to issue agreed information to participants.
- Funding Applications – The model will inform the preparation of applications of the required standard to obtain NLTF funding.
- Network Management – The model will inform internal Council processes to prepare management plans, forward improvement plans and programmes for elected member consideration and public consultation.
- Basis for other detailed models - The SATURN model will often be used to provide a context for more detailed junction or network models (such as Paramics or SIDRA). In these cases the method to be used to calculate future demand for input to these detailed models needs careful consideration. The choices for this include:
  - Taking actual model flows for future years directly from the model.
  - Factoring actual base year counts using model derived increases for each link or O/D pair.
  - Adding the absolute change in link demand or O/D pair demand to actual base year counts .
  - Hybrid method (half absolute change and half proportionate increase)

2 KTM2

The KTM2 was created from the merging of the KTM and Otaki North SATURN models to create a new model covering the Kapiti Coast and up to Otaki. The model has two sets of demand based on different land use assumptions and treatment of local developments.

2.1 Land Use Assumptions

Two different growth forecasts were prepared in KTM2 relating to the treatment of local developments:

- A 'Composite' growth forecast that includes a portion[1] of the expected local development at these specific sites but re-allocates growth so as to retain similar regional total growth levels. The composite growth is discussed further in **Section 2.1.1**
- A 'Full' growth scenario that includes full development of these known local developments.[2]

In addition to the regional population and employment forecasts, further detailed trip generation and trip distribution assumptions were incorporated for four key developments within the study area:

- Paraparaumu Town Centre (a mix of residential, retail and mixed use);
- Kāpiti Airport (predominantly a mix of retail, office and warehousing / distribution);
- Waikanae North (two mainly residential developments at Ngarara and Waikanae North); and
- Otaki (mixed use development, situated off Riverbank Road).

The following assumptions were made:

- All developments assumed the same 'phasing[3]' for completion and this was derived from WTSM growth rates;
- Agreed trip rates that were used during the plan change submissions and are based upon the most up-to-date knowledge regarding planned land uses at each of the sites;
- All predicted trips to and from each development were incorporated into the demand matrices.

2.1.1 Composite Growth Approach

The Composite growth balances inconsistencies between WTSM and identified development growth, whereby the regional future year forecasts are based on WTSM yet also take account of the major developments planned for the area.

Whilst some of the known developments are accounted for in the WTSM forecasts, the full extent of each development and the precise location within the region may not be fully reflected. A composite method to account for both WTSM growth and development growth was been used, whereby 50% of the regional WTSM growth is taken for each KTM2 zone unless the KTM2 zone contains specific

[1] Or at least slower growth rates than expected locally.

[2] At rates of growth in line with local and developer expectations.

[3] 'Phasing' in this context is defined as the percentage of which the developments are complete in each of the three forecast years (i.e. 2021, 2031 and 2041).

consented developments, in which case the full level of WTSM growth is taken along with a proportion of development growth such that the overall growth in trip generation for that zone is equal to 50% of the development trip generation total. Further detail on this methodology can be found in the M2PP SATURN Model Forecasting Report (June 2011)

Table 2-1 – KTM2 Demand Assumptions

Demand Scenario	Land Use Assumption
Composite	■ For the four key developments (Airport, Paraparaumu Town Centre, Waikanae North, Ngarara): – 33% complete by 2016 – 84% complete by 2026 – 100% complete by 2031 ■ Bunnings development is an additive matrix ■ The Composite Growth Approach is outlined in the M2PP Traffic Modelling Report, Appendix G
Full	■ Airport – Using Tim Kelly's estimated number of trips rather than applying trip rates to assumed land use. ■ Paraparaumu Town Centre –2016 land use adopted from the Peter Knight evidence note (Review of Proposed Plan Change 72A, McDermott Miller Ltd., 29 October 2007) and Opus trip rates as used in the plan change process –2026 land use as outlined in Don Wignall's email of 26 October 2011 'Full Development' - Model Sensitivity Testing. ■ Waikanae North – Land use as outlined in Don Wignall's email of 26 October 2011 'Full Development' - Model Sensitivity Testing and SKM trip rates from TIA. Assumption is these trip rates are for Cars/LCVs only. ■ Ngarara Zone & Precinct – Land use as outlined in Don Wignall's email of 26 October 2011 'Full Development' - Model Sensitivity Testing and SKM trip rates from TIA. Note that the maximum assumed number of residential dwellings is 1,689. ■ Bunnings development is an additive matrix

2.2 WTSM Option RoNS Schemes

WTSM Option models include the Roads of National Significance (RoNS) outlined in **Table 2-2**. The KTM2 Option traffic models contain the M2PP and the PP2O RoNS schemes only.

Table 2-2 – KTM2 WTSM Option RoNS Schemes

RoNS Traffic Scheme	2016	2026	2031
Otaki to north of Levin[4]	No	Yes	Yes
Peka Peka to Otaki (PP2O)	Yes	Yes	Yes
MacKays to Peka Peka (M2PP)	Yes	Yes	Yes

[4] It is understood the Otaki to north of Levin scheme is not in the WTSM modelled area but acts as an external route zone. As such, the presence of this Project is not expected to have much impact on the WTSM demands.

Linden to MacKays (Transmission Gully)	No	Yes	Yes
Ngauranga to Aotea Quay (NtAQ)	Yes	Yes	Yes
Terrace Tunnel Duplication	No	Yes	Yes
Basin Reserve	Yes	Yes	Yes
Airport to Mt Victoria Tunnel	Yes (in part)	Yes	Yes
Other			
Petone to Grenada link road	No	Yes	Yes

2.3 Project Model Traffic Schemes

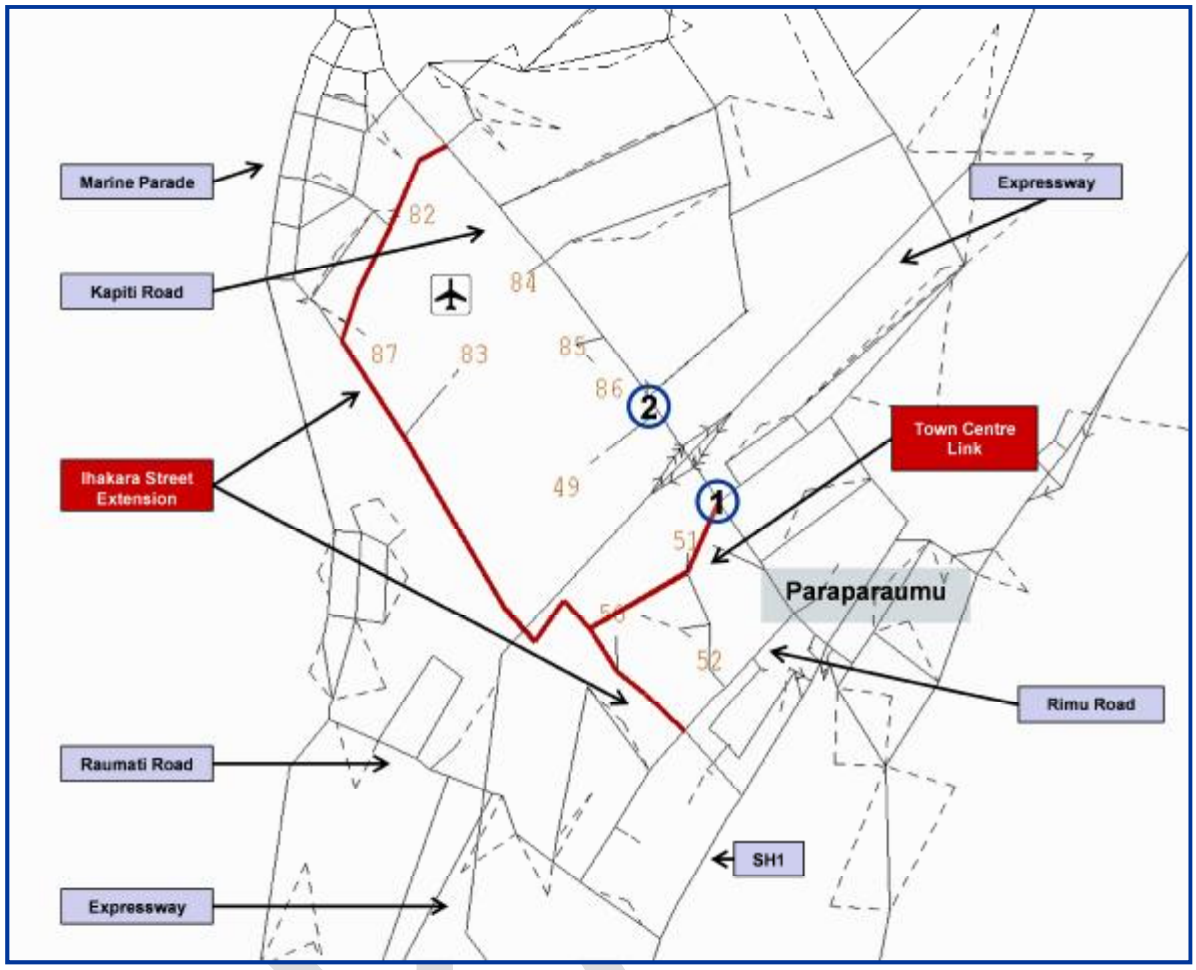
There are various permutations of the KTM2 traffic schemes which helped to inform the M2PP AEE and associated sensitivity testing. The standard KTM2 assumptions are identified below in **Table 2-3** and **Figure 2-1**. Further sensitivity tests and model applications are detailed in **Sections 2.4** and **2.5**.

Table 2-3 – KTM2 Local Traffic Schemes

	KTM2 Traffic Model, "Composite Growth"				**KTM2** Traffic Model, "Full Growth[5]"			
	Do Minimum		**Option**		**Do Minimum**		**Option**	
Scheme	2016	2026	2016	2026	2016	2026	2016	2026
Ihakara Street Extension	X	✓	X	✓	n/a	n/a	n/a	✓
Paraparaumu Town Centre	X	✓	X	✓	n/a	n/a	n/a	✓
Signals at Arawhata / Kapiti Road[6]	✓	✓	✓	✓	n/a	n/a	n/a	✓
Signals at Milne Drive & Te Roto Drive[7]	✓	✓	✓	✓	n/a	n/a	n/a	✓

[5] Only the KTM2 2026 Option model was used for "full" growth testing.
[6] Associated with the Paraparaumu Town Centre development.
[7] Associated with the Bunnings Development in Paraparaumu.

Figure 2-1 – Ihakara Street Extension and Town Centre Link (all model versions)



Notes:

- Ihakara Street Extension and Town Centre link shown in red
- Point 1 = Signals at Arawhata / Kapiti Road (associated with Town Centre development)
- Point 2 = Signals at Milne Drive and Te Roto Drive (associated with Bunnings development)
- Zones 82 – 87 inclusive = Airport
- Zone 49 = Bunnings development (includes background growth)
- Zones 50 – 52 inclusive = Paraparaumu Town Centre

2.4 Model Applications

In addition to the core evaluation of M2PP, KTM2 has been used for the following projects:

Table 2-4 – Model Applications

Application	Model Version	Date
Maypole land valuation	KTM2 v23-25	March 2013
Kapiti Road Workshop	KTM2 v 16	March 2012
Additional Modelling Scenario	KTM2 v 20	Oct 2012
Bunnings	KTM2 v 13a	Jan 2012
Full Growth Sensitivity Testing	KTM2 v 12	Dec 2011

2.5 Version Control

Version	Network Basis	Demand Basis	Description
1	-	Composite	Demand from WTSM, with composite adjustments and no Riverbanks development
2	v1	Controlled	Controlled Growth
3	v2	Composite	Network: ■ Tutenakai Street changes ■ Option signals changed from VISSUM ■ Centroids changed in town centre / airport development
4	v2	Composite	Network: ■ Tutenakai Street changes - removed ■ Option signals changed from VISSUM ■ Centroids changed in town centre / airport development ■ PPM values changed for AM / IP
5	v4	Controlled	
6	v4	Composite	Network: ■ Milne Cres and Ihakara St extension removed
7	v6	Controlled	Network: ■ Milne Cres and Ihakara St extension removed
8	v6	Composite rev	**Design model** ■ Ngarare Development Added ■ Centroids changed around Ngarara ■ Corrected Knobs ■ Bus Lines added ■ Latest Peka Peka Interchange added
9	v8	Controlled rev	**Economics Model**
10	v8	Composite rev	**Design model** Sent to KCDC ■ Updated signals at Te Moana, Elizabeth St and Kapiti Rd
11	v10	Controlled rev	**Economics Model**

12a-f			Sensitivity testing: 1 M2PP Option full sensitivity development - No local development roads 2 M2PP Option full sensitivity development - With local development roads 3 M2PP Option full sensitivity development - With local development roads plus 4-lane Kapiti Road (inc. signals Milne Drive & Te Roto Drive) 4 As V12B with northbound expressway off-ramp at Ihakara Street 5 As V12D but with the additional right-turn movement allowed from the NB off-ramp towards Paraparaumu Town Centre 6 As V12E but with south-facing ramps (signalised)
13	v8	Composite rev3	**Design model** Demand: ■ Ngarara demand now split 30% to/from zone 145 & 70% to from zone 147 ■ Zone 148 to have no Ngarara demand ■ Distribution for zone 145 unchanged ■ Distribution for zone 147 taken from existing zone 148 Network: ■ Further changes to Ngarare loading locations - zones 145 & 147 active, zone 148 no longer used ■ Zone 147 connected to Te Moana Rd via priority T ■ Otaihanga/SH1 roundabout added in Option (only)
13a	V13	Composite rev3	**Bunnings development modelling** Demand: ■ Traffic demand matrices include development trips to / from zone 49 (Milne Drive) Network: ■ Left hand slip lane from Kapiti Road into Te Roto Drive ■ Traffic signals at Te Roto Drive and Milne Drive
13b-d	v13	v13	Sensitivity testing of M2PP ramps 1 (Bunnings) 2 As V13 but with northbound expressway off-ramp at Ihakara Street 3 As V13B but with the additional right-turn movement allowed from the NB off-ramp towards Paraparaumu Town Centre 4 As V13C but with south-facing ramps (signalised)
14	v13	Controlled rev3	**Economics Mode**

			Demand: ■ Ngarara demand now split 30% to/from zone 145 & 70% to from zone 147 ■ Zone 148 to have no Ngarara demand ■ Distribution for zone 145 unchanged ■ Distribution for zone 147 taken from existing zone 148l
15	v13		Demand: ■ Uses matrices specified in either Version13 (for Composite demand) or Version14 (for Capped demand) Network ■ Based on Version 13 networks but without elastic demand option for Do Minimum
16	v12		Networks as V12B but with the removal of Ihakara Street Extension. Reduced airport growth
17	v13	Composite rev3	2026 network signals at Arawhata and Kapiti Rd changed to Priority junction. Based off the V13 model
18	v13a	V12a	Demand is "Full Growth" plus Bunnings Development
19	v13	v13	Demand: ■ Matrices from v13 run used - POST elastic assignment, so demand matrices are the same as used for v13 assignment Network: ■ Version 13 networks with elastic assigment turned off ■ Otaihanga roundabout copied from Option network and replaces priority intersection in DM
20	v13a	v13a Composite Growth + Bunnings	**KCDC Additional Scenario** Demand: ■ Airport development capped at District Plan threshold (102,900m2 GFA) ■ Bunnings development included Network: ■ No Ihakara Street Extension ■ No Town Centre Link ■ Signals at Milne and Te Roto ■ Signals at Arawhata Road
21	v18	v12a - Full Growth +	Network:

		Bunnings	■ Kapiti Rd / Airport access (near Arko Place) (Test 2-lane entry / exit) ■ Kapiti Rd / Airport access (near Lake View Cr) (Test 2-lane Roundabout; 2-lane entry / exit) ■ Kapiti Rd / Town centre link (Test Signal optimisation) ■ Tutanekai St / Arawhata Rd (Test 1-lane Roundabout) ■ Warrimoo St / Kapiti Rd (Test Signals) ■ Ihakara St / Rimu Rd intersection (Test 2-lane Roundabout)
22	V13		Network: ■ PP2O expressway removed.
23	V13a	V13c & V13d	Network: ■ Improved network precision (including zone system) around Ngarara Development ■ 5th arm added into southern roundabout ■ Model run as part of Maypole (Ngarara) development testing Testing the impact of the Ngarara development, not the impacts of the Expressway. The Do Minimum in this case is the Option Network but with no Ngarara development.
24	V18	V12b & V12c	As V18 with improved network precision around Ngarara + signals at Te Moana Road interchange. Model run as part of Maypole (Ngarara) development testing. ■ Not taken forward
25	V18	V12b & V12c	As V18 with improved network precision around Ngarara. Model run as part of Maypole (Ngarara) development testing

3 KTM2.1

KTM2.1 was developed as an update from KTM2 to appraise the Peka Peka to Otaki Expressway project using the new WTSM model (2011-based) and a medium growth scenario for its three forecast years of 2021, 2031 and 2041.

KTM2.1 is currently being used as part of the M2PP minimum requirements. The Do Minimum model includes M2PP and the Option model was used to assess PP2O.

3.1.1 Base Model Revisions

The WTSM model was re-based to 2011 and as such an alternative forecasting approach was considered before creating the new forecast KTM2.1 traffic demand matrices. The KTM2 made use of the 2006-based WSTM and an assumed 1% traffic growth per annum to 2010. A calibration/validation exercise was undertaken to ensure modelled traffic flows and patterns matched observed data as closely as possible. During the update to KTM2.1, no calibration/validation exercise was undertaken and, as such, it was very important to ensure that the new KTM2.1 2011 prior matrix closely correlated to the KTM2 2010 prior matrix before implementing any KTM2 matrix estimation adjustment factors.

In order to understand the differences, the KTM2.1 prior assignment outputs were run through the KTM2 validation analysis spread-sheets. This indicated a reasonable correlation between the KTM2 prior and KTM2.1 prior assignments for which to apply the KTM2 matrix estimation adjustment factors. Subsequently, the KTM2 2010 matrix estimation adjustment factors were applied to the KTM2.1 2011 prior matrices to create the final KTM2.1 2011 assignment matrices from which to apply the new WTSM forecast growth.

The base model was revised to improve the existing KTM2 base model validation (network speeds and travel times) in and around the Otaki area whilst maintaining the integrity of the previous validation in the MacKays to Peka Peka (M2PP) area. Improvements focussed on the network travel times through Otaki town centre, and hence the overall travel time route along SH1 from Waitohu Valley Road (north of Otaki) to Peka Peka Road. Further information on the base model changes is available in the technical note *KTM2 Base Model Revisions – Summary of Impacts (October 2012)*.

3.1.2 Forecasting

The KTM2.1 model obtains future demand forecasts from the updated (2011 base) WTSM model, rather than the original (2006 base) WTSM model used for KTM2. The updated WTSM and KTM2.1 operate under three forecast years, i.e. 2021, 2031 and 2041, which differs from the years used in KTM2 (2010, 2016 and 2026)

The future year growth (2011-2021, 2011-2031, 2011-2041) was applied to the KTM2 2010 validated base year matrix using the same method for applying the impacts of matrix estimation, i.e. a mix of additive and multiplicative growth.

3.2 Land Use Assumptions

Table 3-1 – KTM2.1 Demand Assumptions

Demand Scenario	Land Use Assumption
Composite	■ For the four key developments (Airport, Paraparaumu Town Centre, Waikanae North, Ngarara): – 59% complete by 2021

	– 100% complete by 2031 ■ Bunnings development is an additive matrix ■ Otaki Riverbank Development (as per KTM2.1 Forecasting – Summary of Impacts note)
Full	■ N/A

3.3 WTSM Option RoNS Schemes

WTSM Option models include the Roads of National Significance (RoNS) outlined in **Table 3-2**. The KTM2.1 Option traffic models contain the M2PP and the PP2O RoNS schemes only.

Table 3-2 – KTM2.1 WTSM Option RoNS Schemes

RoNS Traffic Scheme	2021	2031	2041
Otaki to north of Levin	No	Yes	Yes
Peka Peka to Otaki (PP2O)	Yes	Yes	Yes
MacKays to Peka Peka (M2PP)	Yes	Yes	Yes
Linden to MacKays (Transmission Gully)	No	Yes	Yes
Ngauranga to Aotea Quay (NtAQ)	Yes	Yes	Yes
Terrace Tunnel Duplication	No	Yes	Yes
Basin Reserve	Yes	Yes	Yes
Airport to Mt Victoria Tunnel	No	Yes	Yes
Other			
Petone to Grenada link road	No	Yes	Yes

3.4 Project Model Traffic Schemes

Assumptions on traffic schemes associated with local developments were updated for KTM2.1, with only a "Composite Growth" scenario developed. The KTM2.1 assumptions for each forecast year are identified in **Table 3-3**.

Table 3-3 – KTM2.1 Local Traffic Schemes

	KTM2.1 Traffic Model, "Composite Growth"				**KTM2.1** Traffic Model, "Full Growth[8]"			
	Do Minimum		**Option**		**Do Minimum**		**Option**	
Scheme	2021	2031	2021	2031	2021	2031	2021	2031
Ihakara Street Extension	X	✓	X	✓	n/a	n/a	n/a	n/a
Paraparaumu Town Centre	X	✓	X	✓	n/a	n/a	n/a	n/a
Signals at Arawhata / Kapiti Road	X	✓	X	✓	n/a	n/a	n/a	n/a
Signals at Milne Drive & Te Roto Drive	X	X	X	X	n/a	n/a	n/a	n/a

3.5 Version Control

Version	Year	Demand Scenario	Description
KTM2.1	2010	2010 Base	Main Rd / Mill Rd roundabout capacity reductions, pre/post nodes added, signal at Arthur St to simulate zebra crossing.
KTM2.1	2021	KTM2.1, Medium	2021 forecast model for use with PP2O project
KTM2.1	2031	KTM2.1, Medium	2031 forecast model for use with PP2O project
KTM2.1	2031	KTM2.1, High	2031 forecast model (high growth) for use with PP2O project
KTM2.1	2041	KTM2.1, Medium	2041 forecast model for use with PP2O project

[8] There is no "full" growth model associated with KTM2.1.

4 KTM2.2

The economic evaluation for M2PP was completed in April 2013 using an updated version of KTM2.1. This update incorporated revisions tested in KTM2 and was primarily focussed on the Ngarara development.

The Ngarara development trips and distribution in KTM2.2 are the same as those used in the valuation process for the area of land (undertaken in KTM2) that will be acquired from Maypole Environment, with adjustment for the new forecast years. This update enhanced the zone structure of the development and is detailed in **Figure 4-1**.

The KTM2.2 base model and the forecasting process are identical to KTM2.1.

4.1.1 Weekend and Holiday Periods

The KTM Saturn models cover three peaks, but the models do not represent off-peak, weekend or holiday traffic. For the economic analysis, annualisation factors were developed for five periods: weekday, 'normal' Saturday and Sunday and 'holiday' Saturday and Sunday. A typical 24-hour flow profile was developed in 15-minute time slices for each and a model selected to represent each time slice based on the magnitude and pattern of traffic flows. More detailed information on this methodology is presented in the M2PP Economic Evaluation Report (May 2013).

4.2 Land Use Assumptions

Table 4-1 – KTM2.2 Demand Assumptions

Demand Scenario	Land Use Assumption
Composite	▪ As for KTM2.1 'Composite' land use, plus: ▪ New Ngarara trips and zone system –73% completed by 2021 –205 zone system
Full	▪ As above but with "full" (larger amount) development

4.3 WTSM Option RoNS Schemes

As for KTM2.1

4.4 Version Control

Version	Demand Scenario	Description
DM1	Composite Growth	Composite Growth Model - basis for M2PP BCR refresh work (April 2013)
OPT1	Composite Growth	Composite Growth Model - basis for M2PP BCR refresh work (April 2013)
DM2	Full Growth	Full Growth Model - basis for M2PP BCR refresh work (April 2013)
OPT2	Full Growth	Full Growth Model - basis for M2PP BCR refresh work (April 2013)
OPT1a	Composite Growth	As OPT1 but with Do Minimum Demand
OPT2a	Full Growth	As OPT2 but with Do Minimum Demand

4.5 Project Model Traffic Schemes

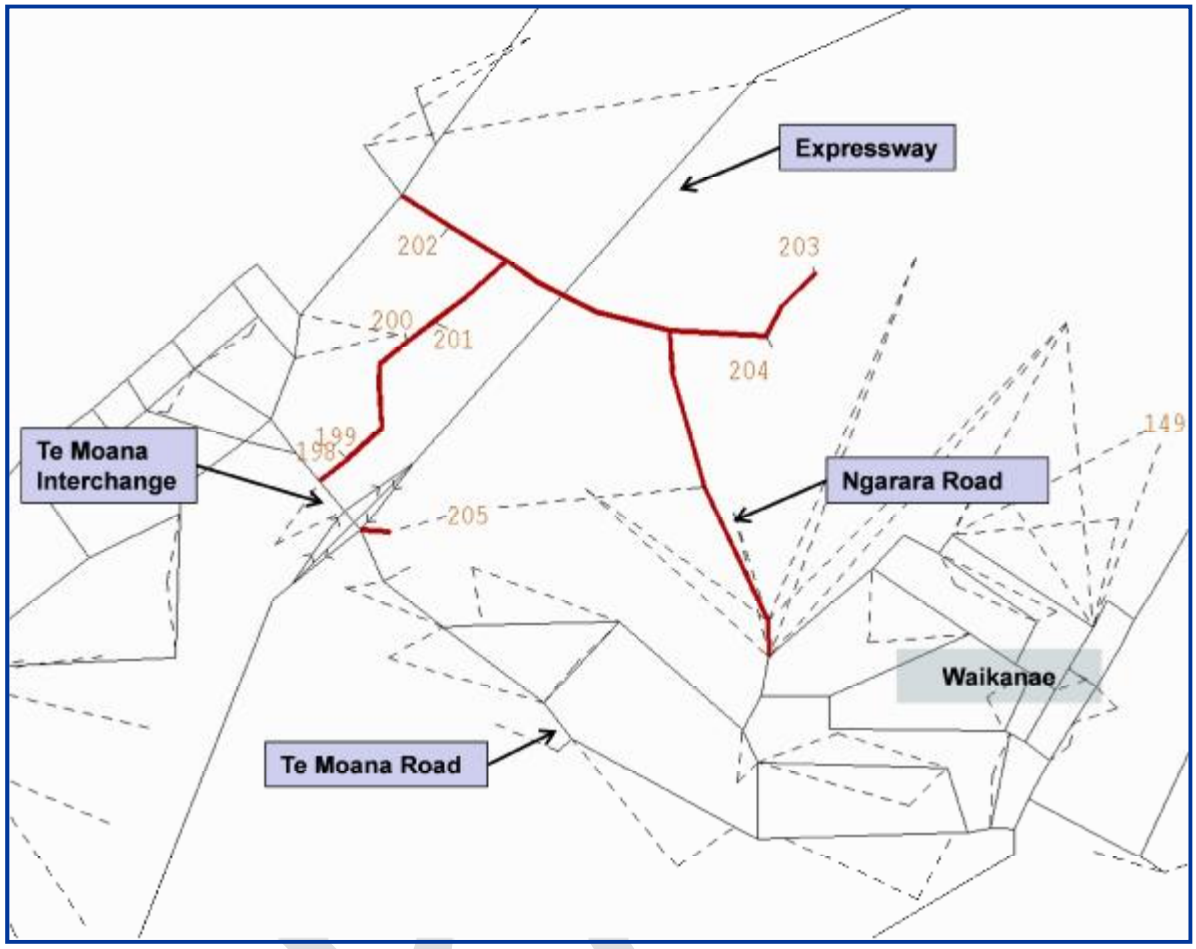
Table 4-2 – KTM2.2 Local Traffic Schemes

	KTM2.2 Traffic Model, "Composite Growth"				**KTM2.2** Traffic Model, "Full Growth"			
	Do Minimum		**Option**		**Do Minimum**		**Option**	
Scheme	2021	2031	2021	2031	2021	2031	2021	2031
Ihakara Street Extension[9]	X	✓	X	✓	✓	✓	✓	✓
Paraparaumu Town Centre	X	✓	X	✓	X	✓	X	✓
Signals at Arawhata / Kapiti Road	✓	✓	✓	✓	✓	✓	✓	✓
Signals at Milne Drive & Te Roto Drive	✓	✓	✓	✓	✓	✓	✓	✓
(Ngarara development[10])	✓	✓	✓	✓	✓	✓	✓	✓

[9] The Ihakara Street Extension is directly linked to the airport development growth. The development threshold in which the Ihakara Street Extension is required under the District Plan is 102,900m^2. The 2021 KTM2.2 "composite" model assumes a level of development below this threshold and so therefore would not be required under the District Plan. In 2031, this threshold is exceeded and, hence, is included. The 2021 KTM2.2 "full" growth model assumes a level of development that would require the Ihakara Street Extension to be in place.

[10] Improved network infrastructure and zone system (moving from 197 zones as in KTM2 and KTM2.1, to 205 zones in KTM2.2).

Figure 4-1 – Improved Ngarara Development Area (applicable to KTM2 Maypole Application and KTM2.2 only[11])



Notes:

- Improved Ngarara Development road infrastructure shown in red
- Zones 198 – 205 inclusive = Ngarara development
- Zone 149 = Waikanae North development

[11] All other KTM2 applications and KTM2.1 assume zones 145 (Ngarara Road, 30% of trips) and 147(Te Moana Road, 70% of trips) for the Ngarara development.

5 Related Models

Model Name	Software	Extent	Year(s)	Demand (which KTM/version)	Purpose
Kapiti Corridor Model	Linsig 3.2.16	Kapiti Road from Arawhata Road to Milne / Te Roto Drive	2026	KTM 2.1	Develop signalized layout for Arawhata Road and confirm that the corridor operations comply with M2PP minimum requirements.
Te Moana Interchange Model	Linsig 3.2.16	Te Moana Interchange	2026	KTM 2.1	Confirm that operations comply with M2PP minimum requirements
Kapiti Road Operational Model	Vissim	Kapiti Road from Arawhata Road to Milne / Te Roto Drive	2010, 2016, 2026	KTM2.0	Operational model to assess merging, weaving and blocking back at key intersections
Bunnings Transportation Assessment	S-Paramics	Kapiti Road from Amohia St/Main Road to Milne / Te Roto Drive	2010, 2016	KTM	Bunnings Transportation Assessment
Various	SIDRA	Interchanges ■ Poplar Ave ■ Te Moana Road ■ Peka Peka Road	2010, 2016, 2026	KTM2.0	Interchange performance
Various	SIDRA	■ SH1/Poplar Ave ■ Ihakara Street/Rimu Road ■ SH1/Otaihanga Road ■ SH1/Te Moana Road	2016	KTM2.0	Construction traffic testing: ■ 2016 Do Minimum ■ 2016 with construction traffic

6 Kapiti Road and SH1 Revocation

The KTM2 series of models was developed to assess the M2PP expressway (KTM2 and KTM2.2) and PP2O (KTM2.1). As such, the difference between the Option and Do Minimum models are the expressways. At this stage, no additional improvements to local roads have been modelled over and above the Do Minimum assumptions.

6.1 Kapiti Road

At present, treatment of Kapiti Road improvements in KTM2, KTM2.1 and KTM2.2 are limited to the intersection upgrades assumed in the Local Traffic Schemes tables associated with each model. These are:

- Signals at Arawhata / Kapiti Road
- Signals at Milne Drive & Te Roto Drive (on Kapiti Road)
- Interchange with the Expressway

6.2 SH1 Revocation

SH1 revocation plans have been reviewed and the revocation is planned to include:

- (old) SH1 corridor width reduces from around 18m to 11m or 10 m between Raumati and Paraparaumu
- Roundabout planned for Raumati Road intersection
- Roundabout or signals planned for Ihakara Street intersection
- Raised table in Paraparaumu Town Centre providing pedestrian connections between Coastlands/Kapiti Lights and the railway station
- Minor changes to the Kapiti Road intersection
- Reconfiguration of Te Moana intersection
- Improved pedestrian crossing provision through Waikanae Town Centre
- Future roundabout assumed for access to Waikanae North
- Corridor width reduces from 16m to 10m north of Waikanae (including removal of passing lane)

Otaihanga Road roundabout is outside the scope of the SH1 revocation but is included as part of M2PP.

6.3 Te Moana Road

The existing model shows a design at the interchange that is now understood to be out of date. This will have to be updated when the model is reviewed.

7 Next Steps: Baseline Modelling moving forward

Further development of the KTM series of models is recommended to build on the improvements made up to KTM2.2. The next steps proposed are:

- Demand Assumptions
  - Updated land use assumptions. A meeting should be held with Council (including Council Land Use planners, to agree land use assumptions going forward)
  - Review assumptions relating to infill (as above)

  - Incorporate the latest information regarding local developments (such as the Airport development)
- Network
  - Include a more detailed local road network representation. This will include Iver Traske Place through the town centre and other areas where additional detail is required on the local network (to be agreed with Council officers)
  - Review model zone structure in light of network changes
  - Incorporate SH1 revocation plans
  - Add Kapiti Road improvements (including those improvements already implemented, such as the signals at the Aquatic Centre)

These model developments will be agreed with KCDC in conjunction with the development of a scope of work. It is likely that these changes will result in a new version of the Kapiti Traffic Model being produced (KTM 3.0). This will be developed for a post-expressway future year. Due to the significance of the changes, it is recommended that some form of partial validation is undertaken based on current year data.

8 KTM3.0

KTM3.0 is designed to build on previous work undertaken. A workshop was held with KCDC on 21 May 2014 to develop land use and network assumptions for a post-expressway future year (nominally 2017) and 2021.

8.1 Methodology

KTM2.2 models were developed for forecast years of 2021and 2031, this was based on WTSM forecasts and superseded previous 2016 and 2026 KTM2.0 models. For KTM3.0, a post-expressway forecast at 2017 will be developed by interpolating between the 2011 base model and 2021 forecast (with M2PP). A 2014 model will be developed using a similar interpolation between 2011 and 2021 and will be used to sense check traffic volumes against observed counts in 2014. These demand matrices will be based on a composite growth approach, however all key developments will be incorporated.

8.1.1 2017 Demand

Interpolation to create 2017 matrices will be done using the 'raw' composite matrices, ie before specific matrix adjustments are applied for Airport, Town Centre, Ōtaki Riverbank, Waikanae and Ngarara developments. In effect this will capture background growth in traffic demand. There is a degree of uncertainty around the level of growth from 2011 to 2017[12] and 2017 to 2021; therefore a 2014 model was proposed to provide a sense check.

8.1.2 2014 Demand

Interpolation to create 2014 matrices will be done using the 'raw' composite matrices and no additional trip generation will be applied to the 2014 demand. In effect this will provide a measure of background growth in traffic volumes and ascertain a level of confidence to apply to 2017 forecasts.

8.1.3 Treatment of Key Developments

The key developments of Airport, Town Centre, Ōtaki Riverbank, Waikanae and Ngarara will be applied in a consistent method to that used in KTM2.0 and KTM2.1. From a starting point using a composite growth matrix, the developments are added in the following order:

1 Ōtaki Riverbank
2 Ngarara
3 Airport
4 Waikanae North
5 Paraparaumu
6 Bunnings

The land use assumptions for each development are detailed in the following section and are presented in the same method as used for previous modelling.

[12] Growth in traffic volumes of 1.5% has been observed on SH1 from 2011 to 2013 at the NZ Transport Agency count site on SH1 north of Ihakara Street.

8.2 KTM3.0 Land Use Assumptions

Development	KTM3.0 Assumption	Previous Assumption
Ōtaki Riverbank	The effective area likely to be developed in the near future has halved in size. ■ 20% development is assumed at 2017 and the same amount in 2021	■ Previously 35% was assumed at 2016 and then 59% at 2021
Ngarara Farm	■ Assume that Ngarara Farm will be 20% complete by 2017 ■ Assume 33% by 2021 ■ Apply to both residential and retail commercial	Previous assumptions were: ■ 2016 33% ■ 2021 73% ■ 2026 100%
Waikanae North	Development assumption is based on an uptake of approximately 55 lots per year ■ 2017 assume 300 lots (38%) ■ 2021 assume 500 lots (63%) Commercial land uses: ■ 2017 0% ■ 2021 33% (based on previous 2016 assumption)	Previous assumptions were: ■ 2016 33% ■ 2021 73% ■ 2026 100%
Airport	Current assumptions, based on GFA are 30,000m^2 at 2017 and 40,000m^2+ at 2021 Using the staging plan and parcels this roughly equates to: ■ 2017: Stage 2 complete (excluding airport shift). Comprised of parcels 3, 6, 7 ■ 2021: Stage 3B in progress; parcels 3, 4 developed ■ This assumes part of parcels 1 & 2 is currently developed.	Previous assumptions were: ■ 2016 33% ■ 2021 73% ■ 2026 84%
Paraparaumu Town Centre	■ For 2017 is it proposed to use the PC72A trip generation as a proxy for an additional 5000sqm GFA commercial on opposite side of Rimu Rd to Coastlands ■ 2021 73%, same as previous	■ 2016 PC72A trip generation ■ 2021 73% ■ 2026 100%
Bunnings	As consented	As consented

8.2.1 Airport Development

The estimate of development is based on the following staging plan. The estimate development complete by 2017 (red) and 2021 (green) is highlighted.

Stage	Parcel	Activity	GFA	Stage	Parcel	Activity	GFA
2	1	LFR Trade	5,027	3C	11	Distribution	6,960
2	1	Office	1,200	3C	11	Office	2,000
2	2	LFR Bulk Retail	4,000	3C	12	Distribution	12,200
2	2	LFR Trade	3,000	3C	12	LFR Bulk Retail	4,000
2	2	Office	2,000	3C	12	Office	2,000
2	2	Storage	2,594	3C	14	Distribution	14,000
2	3	Convenience Retail	1,000	3C	14	Office	3,784
2	3	Distribution	5,569	3C	29	Airport (Maint & Freight)	2,000
2	3	Office	5,000	3C	29	Airport (Terminal)	20,000
2	6	Convenience Retail	1,262	4	17	Distribution	12,000
2	6	Office	2,000	4	17	Office	3,934
2	6	Storage	7,000	4	18	Convenience Retail	552
2	7	Convenience Retail	1,500	4	18	Distribution	7,400
2	7	Office	3,000	4	18	Office	2,000
2	7	Storage	5,894	4	22	Distribution	15,921
2	28	Airport (Maint & Freight)	2,000	4	22	Office	2,000
2	28	Airport (Terminal)	20,000	4	23	Petrol Station	1,822
3A	3	Supermarket	4,000	4	25	Distribution	9,607
3B	4	Distribution	4,000	4	25	Office	2,000
3B	4	Service	4,000	4	27	Airport (Hangers)	2,000
3B	5	Distribution	12,500	5	13	Distribution	17,340
3B	5	LFR Bulk Retail	8,462	5	13	LFR Bulk Retail	2,000
3B	5	Office	3,000	5	13	Office	2,000
3B	8	Petrol Station	1,616	5	15	Disaster Recovery	10,000
3B	8	Storage	3,000	5	15	Distribution	10,812
3B	9	Airport (Hangers)	4,000	5	15	Office	2,000
3B	9	Convenience Retail	264	5	19	Distribution	12,157
3B	9	Office	4,000	5	19	Office	2,000
3C	10	Convenience Retail	1,669	5	21	Distribution	10,000
3C	10	Hotel	7,000	5	21	Office	7,602

8.2.2 Paraparaumu Town Centre

The proposed land use for 2017 is shown in **Table 8-1**.

Table 8-1 – 2016/2017 Land Use Assumptions

Type	GFA (m^2)
Retail – LFR Comparison	20,000
Retail – supermarket	5,000
Retail – speciality	1,700
Retail – other (inc cafes etc)	2,300
Commercial/office	6,000
Apartments	9,300
Community facility	2,000
Total	**46,300**

8.3 Network Assumptions

The following sections outline changes to the road network from the 2011 base model. In particular, changes associated with the SH1 revocation and revitalisation, Kapiti Road corridor and additional network to support specific developments.

Figure 8-1 maps the additional road network assumed in 2017 and 2021 models.

8.3.1 Kapiti Road

In addition to the M2PP expressway, the following intersection upgrades are assumed at 2017:

- Signals at Arawhata / Kapiti Road
- Signals at Milne Drive & Te Roto Drive (on Kapiti Road)
- Signals for Aquatics Centre (existing)

An intersection improvement is assumed at Langdale Avenue in 2021 (confirm intersection form signals or roundabout?)

8.3.2 Other Network Assumptions

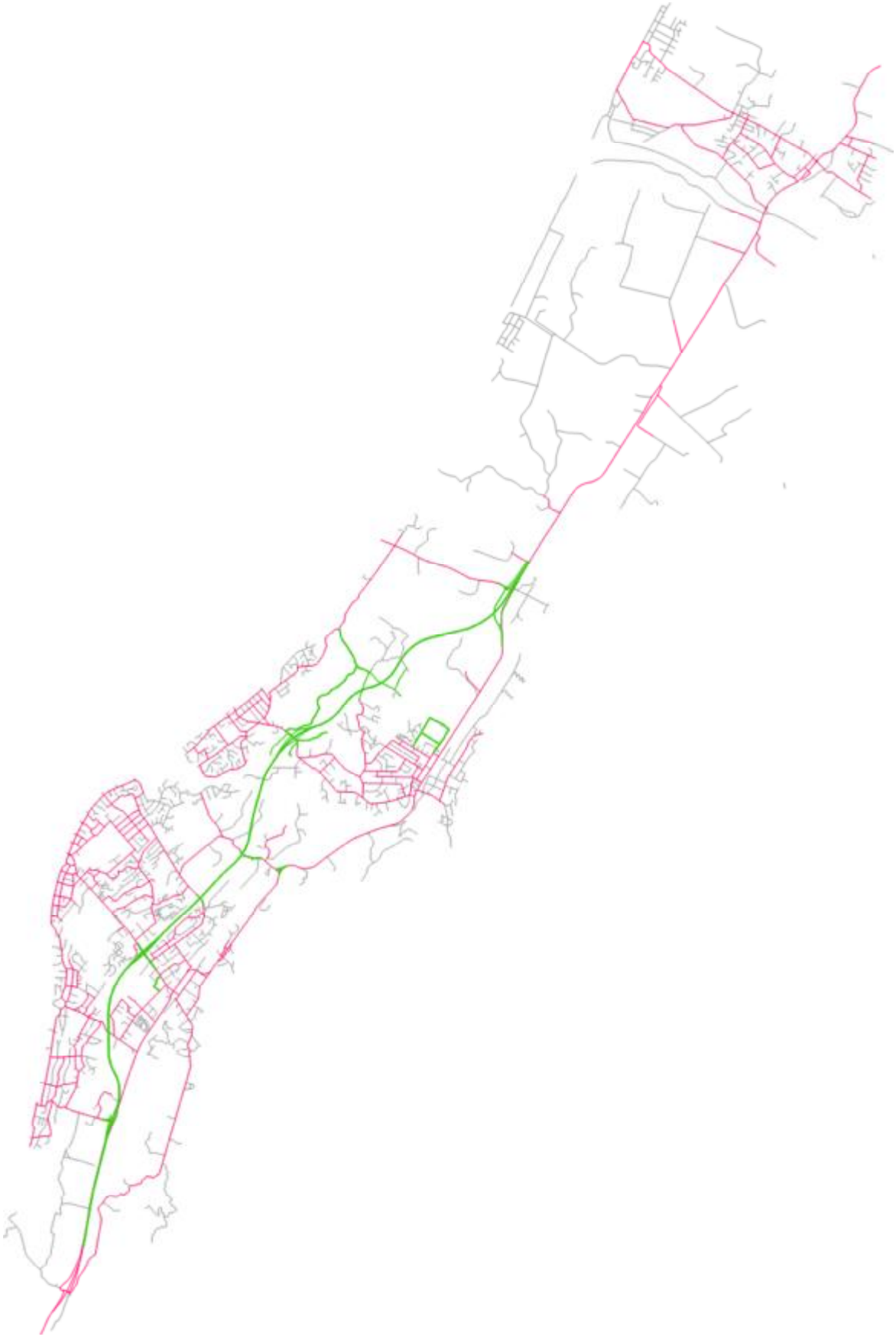
- No Ihakara Street extension in 2017 or 2021, this is expected by 2031.
- No town centre link in 2017 or 2021
- At Ngarara Farm an east west connection is constructed to Nga Manu (Smithfield connection) as part of the expressway, however the full east-west link including connection to old SH1 and Waikanae North is assumed as part of Ngarara 2031
- Connection between Waikanae North and old SH not assumed until 2031
- David Street connection in by 2017 along with some additional network refinement around Waikanae North
- Iver Trask Place (existing) is incorporated in the models

8.3.3 SH1 Revocation

This section outlines network changes to be modelled as part of the SH1 reconfiguration from Poplar Avenue to Peka Peka Road.

- Lane Configuration
  - Entire section to be modelled as 1 lane only (5m width);
  - Short (3 PCU) right turn bays to be provided Southbound, into both driveways immediately south of the Kapiti Rd/SH1 intersection;
  - Short Lanes / turn bays for right turners at intersections to be retained.
- Speed Limits / Environments
  - Poplar to Raumati: 80kph (currently 100kph);
  - Raumati to Ventnor Drive/Lindale: 50kph (currently 70-50kph);
  - Small area from just south of the car park exit to just before the entrance to Kapiti Lights (approx. 150m south of Kapiti Rd / SH1 intersection to 90m south of the intersection) to be coded as 30kph to replicate a 'raised table';
  - Lindale to north of Otaihanga: 80kph;
  - North of Otaihanga to Waikanae River Bridge: 80kph;
  - Waikanae River Bridge to Waikanae Urban Limit: 50kph;
  - Waikanae North to Peka Peka: 100kph (keeping the assumptions made immediately near the Peka Peka interchange as 50kph).
- Intersections (listed south to north)
  - Raumati Rd / SH1 to be modelled as a roundabout with single lanes on each approach and a single circulatory lane;
  - Ihakara St / SH1 to be modelled as a roundabout with single lanes on each approach and a single circulatory lane;
  - A new Pedestrian Crossing to be modelled on 'raised table' area described above;
  - Kapiti Rd / SH1 to be modelled with 2 lanes on each approach, a combined ahead/left lane and a separate right turn;
  - Otaihanga Rd / SH1 to be modelled as a roundabout with single lanes on each approach plus a left slip off Otaihanga Rd, with a single circulatory lane;
  - Te Moana Rd / SH1 to be modelled as a signalised intersection with one through lane in each direction and separate right turn lanes;
  - Elizabeth St / SH1 to be modelled as a signalised intersection with one through lane in each direction and separate right turn lanes;
  - Ngaio Rd / SH1 to be modelled as a signalised intersection with one through lane in each direction and separate right turn lanes.

Figure 8-1 – Future Year Additional Road Network



Appendix E. Kapiti Traffic Model Information – Ngarara Farm

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Report

Kapiti Traffic Model Information - Ngarara Farm

Prepared for Jacobs New Zealand Ltd

Prepared by Beca Ltd (Beca)

28 August 2014

Revision History

Revision Nº	Prepared By	Description	Date
1.0	**Martin Peat**	Draft for Client Comment	26 Aug 2014
2.0	**Martin Peat**	Second Draft for Comment	28 Aug 2014

Document Acceptance

Action	Name	Signed	Date
Prepared by	**Martin Peat**		28 Aug 2014
Reviewed by	**Alan Kerr**		28 Aug 2014
Approved by	**Alan Kerr**		28 Aug 2014
on behalf of	Beca Ltd		

Contents

Appendices

1 Introduction

Beca Ltd (Beca) has been commissioned by Jacobs New Zealand Ltd to provide information and output from the Kapiti Traffic Model relating to the Ngarara Farm development.

The KTM2 series have been developed as part of the MacKays to Peka Peka (M2PP) and Peka Peka to Otaki (PP2O) expressway projects. Extensive sensitivity testing related to M2PP was undertaken in KTM2[1] and that model was subsequently enhanced and adopted for PP2O (KTM2.1). The economic evaluation of M2PP used KTM2.2 which is based on KTM2.1.

The latest model version is KTM3 and this model is currently under development. KTM3 includes enhancements to the local road network (and includes the revocation of SH1) and an update of land use assumptions. This model update is being produced for Kapiti Coast District Council; a peer review is underway and is yet to be formally signed off. As such, output from KTM3 is used “at risk”.

This report summarises assumptions on network structure and trip generation relating to the Ngarara Farm development. The information provided should be read in conjunction with the Kapiti Traffic Model Databook (Revision 4, Beca, June 2014).

2 Network and Zone Structure

The network plan in **Figure 2-1** shows the network detail around the Ngarara Farm development in KTM3. Connections related to the Ngarara development are shown in blue and zones 198-205 represent the development area. The zone structure is based on the subdivisions identified in **Table 2-1** and mapped in **Figure 2-2**.

Zone	Subdivision
198	Waimeha North
199	Ti Kouka
200	Totara
201	Homestead
202	Kawakahia
	Kukutauaki
203	Ngapara
	Lamberts
204	Kanuka Ridge
	Nga Manu
205	Waimeha South

Table 2-1 – Ngarara Development Zones

[1] KTM2 v13 was used for the M2PP Assessment of Environmental Effects. KTM2 v23, v24, v25 are model scenarios developed for the Maypole (Ngarara) land valuation.

The network assumptions for each version of KTM are outlined in **Table 2-2**. KTM3 assumes Te Moana interchange is signalised and the Waimeha South subdivision joins Te Moana Road at a priority intersection.

Network	KTM2 v13	KTM2 v23	KTM2 v24	KTM2 v25	KTM2.1	KTM2.2	KTM3
Development Roads	X	✓	✓	✓	X	✓	✓
Te Moana Interchange							
Roundabout	✓	✓	X	✓	✓	✓	X
Signals	X	X	✓	X	X	X	✓
Waimeha South connection							
Interchange Roundabout	X	✓	X	✓	X	✓	X
Interchange Signals	X	X	✓	X	X	X	X
Priority	✓	X	X	X	✓	X	✓

Table 2-2 - Network Assumptions

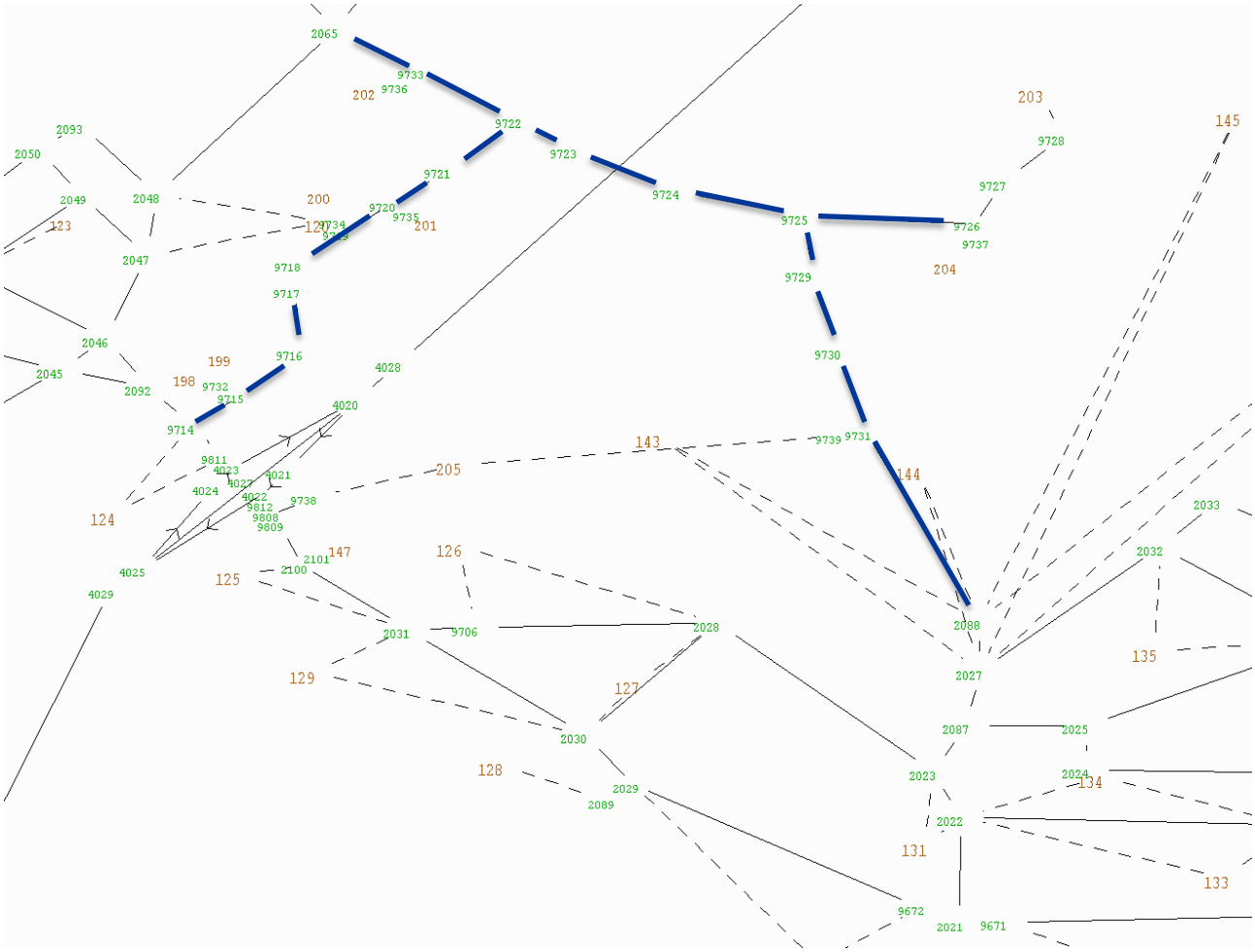


Figure 2-1 – KTM3 Network Detail for Te Moana and Ngarara Farm

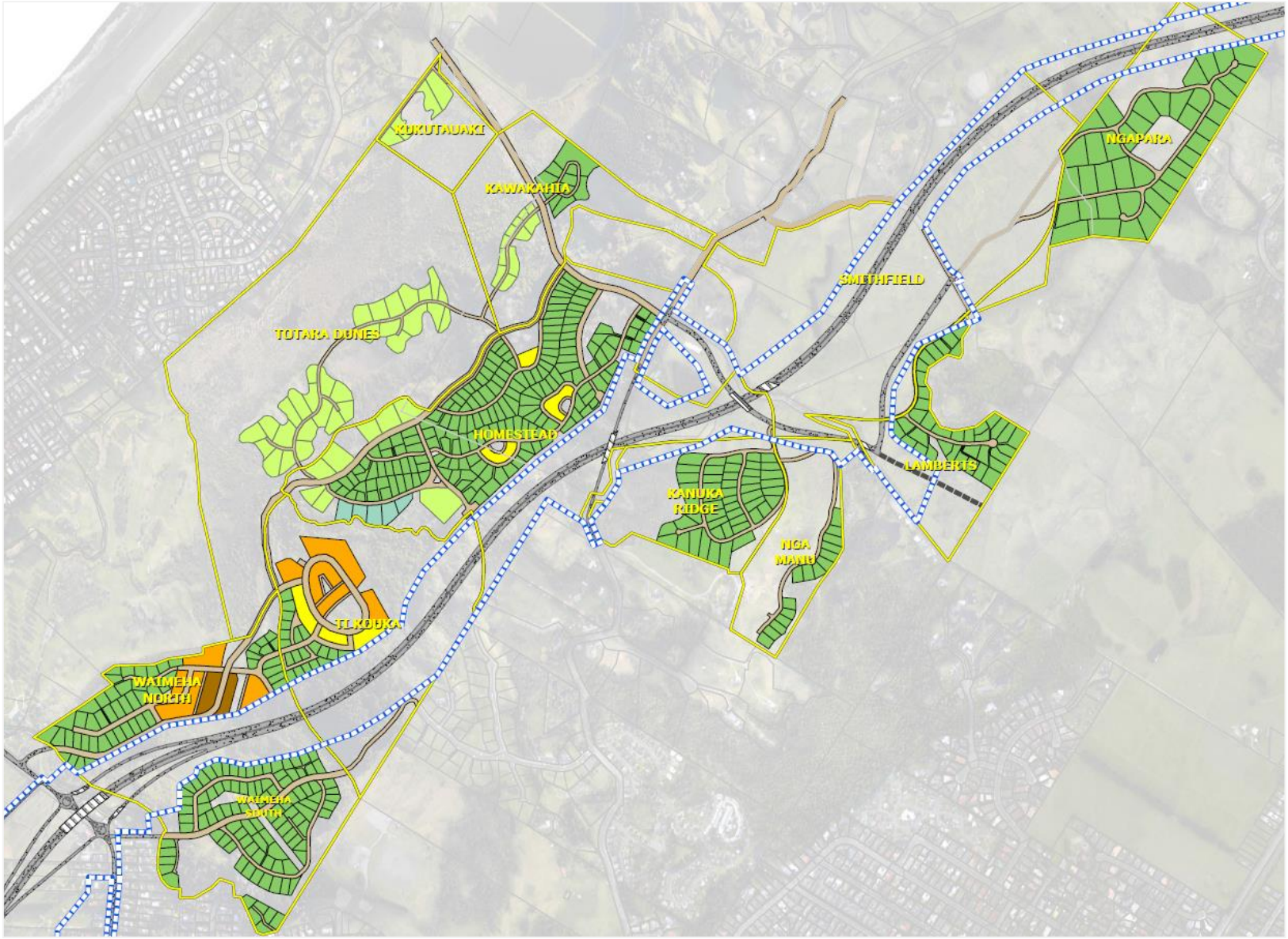


Figure 2-2 – Proposed development areas (Aurecon, March 2013)

Figure 2-3 shows the network detail included in KTM2 and KTM2.1. These models have less road infrastructure and zone detail supporting the Ngarara development. Zones 145 and 147 are used for the development.

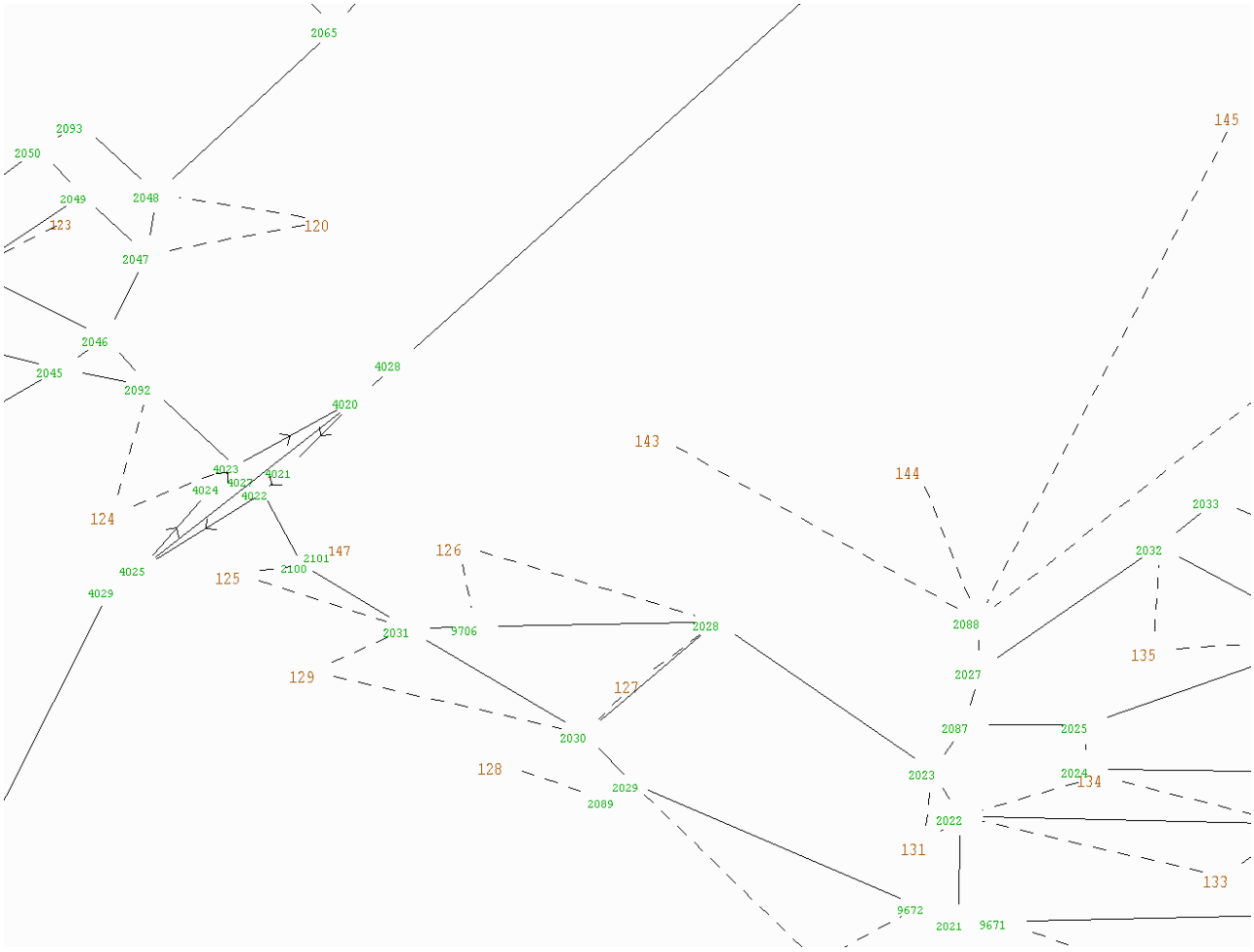


Figure 2-3 – Network for KTM2 and KTM2.1

3 Demand Assumptions

3.1 Trip Rates

Detailed trip generation for the Ngarara development was provided by Aurecon for the development of the Maypole scenarios (KTM2 v23 to v25) in *Technical Note 4 (Aurecon, March 2013)*. This information is used in KTM2 v23-v25; KTM2.2 and KTM3 and is re-printed as follows:

> *A number of trip generation sources were used to obtain residential trip generation rates. These were namely NZTA Report 453, Road and Traffic Authority (RTA) Trip Generation Guidelines and Institute of Transport Engineers (ITE) Trip Generation. An overall rate of trip generation per day and per peak hour was obtained from all these trip generation guidelines for comparison purposes. An inbound/outbound split was only available in the ITE trip generation guideline.*
>
> *These trip generation rates obtained from the guidelines are summarised in **Table 3-2**. The average trip rates used for the development areas are summarised in **Table 3-3**.*
>
> *It is assumed that the makeup of the trips will generally be light vehicles, with minimal HCV activity during peak periods. It is considered prudent to assess similar zones in the current modelling to ascertain the proportion of HCV's likely from a residential lot. There is no guidance as to the number of HCV trips generated from residential lots and thus a similar zone within the current model would provide this information.*
>
> *It is assumed that the proposed visitor centre in Kawakahia will not generate any trips during peak hour periods.*
>
> *The trip assumptions along with the average trip generation rates were used to derive the daily and peak hour trips for the development areas according to the different guidelines. These trip generation values are provided in **Table 3-4**. Note the split in and outbound is based on the ITE guidelines.*

The number of proposed household units within each development area is summarised in **Table 3-1** below. In general, a trip rate of 1 is assumed for the inter-peak (as used in KTM2 full growth scenario).

Neighbourhood/development area	Household units/Lots	
	KTM2 v23	KTM2 v24 & v25
Waimeha North	272	479
Ti Kouka	137	300
Homestead	206	340
Totara	30	30
Kanuka Ridge	50	80
Nga Manu	15	15
Ngapara	40	40
Lamberts	38	40
Kawakahia	20	20
Kukutauaki	4	4
Waimeha South	105	301
Total	**812**	**1649**

Table 3-1 – Anticipated number of household units within each development area

Source	Land use type	Daily trip generation rate per dwelling (veh/day)	AM Peak hour trip generation per dwelling (veh/hour)	PM Peak hour trip generation per dwelling (veh/hour)	AM Peak		PM Peak	
					Inbound trips	Outbound trips	Inbound trips	Outbound trips
RTA	Dwelling houses	9	0.85	0.85	-	-	-	-
NZTA Report 453	Dwelling (suburban)	10.9	1.2	1.2	-	-	-	-
	Dwelling (outer suburban)	8.2	0.9	0.9	-	-	-	-
ITE Trip Generation	Single - Family Detached housing	9.57	0.75	1.01	25%	75%	63%	37%
	Residential condominium/town house	5.81	0.44	0.52	19%	81%	64%	36%

Table 3-2 – Trip generation rates obtained for the Ngarara Development (Aurecon, March 2013)

Neighbourhood/development area	Daily trip generation rate per dwelling (veh/day)	AM Peak hour trip generation per dwelling (veh/hour)	PM Peak hour trip generation per dwelling (veh/hour)	AM Peak		PM Peak	
				Inbound trips	Outbound trips	Inbound trips	Outbound trips
Waimeha North – Dwellings/detached housing	9.4	1.00	1.00	25%	75%	65%	35%
Waimeha North – Townhousing	5.81	0.44	0.52	19%	81%	64%	36%
All other neighbourhoods	9.4	1.00	1.00	25%	75%	65%	35%

Table 3-3 – Average trip rates used for the Ngarara Development (Aurecon, March 2013)

Source		Daily trip generation (veh/day)	AM Peak hour trip generation (veh/hour)	PM Peak hour trip generation (veh/hour)	AM Peak		Inter-Peak		PM Peak	
					Inbound trips	Outbound trips	Inbound trips	Outbound trips	Inbound trips	Outbound trips
Waimeha North – Dwellings/single detached housing	102	960.6	102.0	102.0	26	77	51	51	66	36
Waimeha North – Town housing	170	987.7	74.8	88.4	14	61	37	44	57	32
Ti kouka	137	1290.2	137.0	137.0	34	103	69	69	89	48
Homestead	206	1940.0	206.0	206.0	52	155	103	103	134	72
Totara	30	282.5	30.0	30.0	8	23	15	15	20	11
Kanuka Ridge	50	470.9	50.0	50.0	13	38	25	25	33	18
Nga Manu	15	141.3	15.0	15.0	4	11	8	8	10	5
Ngapara	40	376.7	40.0	40.0	10	30	20	20	26	14
Lamberts	38	357.9	38.0	38.0	10	29	19	19	25	13
Kawakahia	20	188.4	20.0	20.0	5	15	10	10	13	7
Kukutauaki	4	38.0	4.0	4.0	1	3	2	2	3	1
Waimeha South	105				25	75	50	50	65	35
Total	**812**				**200**	**617**	**408**	**415**	**539**	**292**

Table 3-4 – Trip Generation for KTM2 v23 scenario (Aurecon, March 2013) – Composite Growth

Table 3-4 is applicable to KTM2 v23, KTM2.2 (composite growth scenario) and KTM3

Source		Daily trip generation (veh/day)	AM Peak hour trip generation (veh/hour)	PM Peak hour trip generation (veh/hour)	AM Peak		Inter-Peak		PM Peak	
					Inbound trips	Outbound trips	Inbound trips	Outbound trips	Inbound trips	Outbound trips
Waimeha North – Dwellings/single detached housing	179				45	135	90	90	117	63
Waimeha North – Town housing	299				25	107	150	150	100	56
Ti kouka	300				75	225	150	150	195	105
Homestead	340				85	255	170	170	221	119
Totara	30				8	23	15	15	20	11
Kanuka Ridge	80				20	60	40	40	52	28
Nga Manu	15				4	11	8	8	10	5
Ngapara	40				10	30	20	20	26	14
Lamberts	40				10	30	20	20	26	14
Kawakahia	20				5	15	10	10	13	7
Kukutauaki	4				1	3	2	2	3	1
Waimeha South	301				75	226	151	151	196	105
Total	**1648**				**362**	**362**	**362**	**362**	**362**	**362**

Table 3-5 – Trip Generation for KTM2 v24 & v25 scenario (Aurecon, March 2013) – Full Growth

Table 3-5 is applicable to KTM2 v24 & v25 and KTM2.2 (full growth scenario)

3.1.1 KTM2 and KTM2.1 Trip Rates – Composite Growth Scenario

The KTM2 and KTM2.1 models use the trip generation inputs summarised in **Table 3-6**.

Type	No of Dwellings / GFA / m2	Am Peak		IP Peak		Pm Peak	
		In	Out	In	Out	In	Out
Residential	2,868	115	459	144	144	336	181
Office (GFA)	51	37	7	15	15	8	31
Special retail (GFA)	88	27	18	55	55	100	100
Field (m2)	35	30	4	22	22	8	8
Education (m2)	23	19	2	14	14	5	5
Tourist (m2)	60	4	15	7	7	10	6
Community Uses (m2)	2	2	0	1	1	1	1
Total		**234**	**505**	**258**	**258**	**468**	**332**

Table 3-6 – Trip Generation for KTM2 and KTM2.1 (composite growth scenario)

3.1.2 KTM2 Trip Rates – Full Growth Scenario

The KTM2 full growth scenario use the trip generation inputs summarised in **Table 3-7**. KTM2.1 does not include a full growth scenario.

Type	No of Dwellings / GFA / m2	Am Peak		IP Peak		Pm Peak	
		In	Out	In	Out	In	Out
Residential	2,868	229	918	287	287	671	361
Office (GFA)	51	73	13	30	30	16	62
Special retail (GFA)	88	53	35	110	110	199	199
Field (m2)	35	60	7	43	43	15	15
Education (m2)	23	38	4	28	28	10	10
Tourist (m2)	60	7	29	14	14	20	11
Community Uses (m2)	2	3	0	2	2	1	1
Total		**464**	**1,006**	**514**	**514**	**931**	**658**

Table 3-7 – Trip Generation for KTM2 (full growth scenario)

3.2 Development Phasing and Demand

The phasing assumptions for each version of the KTM are outlined in **Table 3-8** for each future year modelled.

Year/Model	KTM2 v13	KTM2 v23-v25	KTM2.1	KTM2.2	KTM3
2016	33%	n/a	n/a	33%	n/a
2021	n/a	n/a	59%	73%	33%
2026	84%	100%	n/a	100%	n/a
2031	100%	n/a	100%	100%	100%

Table 3-8 – Ngarara Development Phasing Assumptions

A summary of the Ngarara development demand (assuming 100% development) is given in **Table 3-9**. It is noted that the Composite Growth approach was designed to balance regional growth forecasts with identified developments and this may some affect specific development growth.

Model	AM Peak		Inter-Peak		PM Peak	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
KTM2 v13 (Composite Growth)	232	503	257	257	465	329
KTM2 v23 (Composite Growth)	222	632			622	375
KTM2 v24 & v25 (Full Growth)	407	1149			1144	695
KTM2.1 (Composite Growth)	241	499	261	256	473	329
KTM2.2 (Composite Growth)	226	635	464	470	638	391
KTM2.2 (Full Growth)	395	1152	908	934	1141	727
KTM3 (Composite Growth)	226	635	464	470	638	391

Table 3-9 – Ngarara Development Demand (Total Vehicle Trips)

3.2.1 Breakdown of Trips in Development Zones

In KTM2 v13 and KTM2.1 development trips are split to Ngarara Road (30%) and Te Moana Road (70%)

The breakdown of trips in KTM2 v23-25 (Maypole application), KTM2.2 and KTM2.3 are shown in **Table 3-10** to **Table 3-14**. The distribution of trips (at a sector level) from the Ngarara development is provided in Appendix A for each model.

	Development	AM Peak		PM Peak	
		Inbound Car/LCV trips	Outbound Car/LCV trips	Inbound Car/LCV trips	Outbound Car/LCV trips
198	Waimeha North (inc. retail, local convenience)	62	152	206	151
199	Ti Kouka	34	103	89	48
200	Totara Dunes	8	23	20	11
201	Homestead	52	155	134	72
202	Kukutauki & Kawakahia	6	18	16	8
203	Ngapara & Lamberts	20	59	51	27
204	Nga Manu & Kanuka Ridge	16	49	42	23
205	Waimeha South	25	75	65	35
	Total	**222**	**632**	**622**	**375**
	KTM2 v13 (Composite Growth)	199	412	374	283
	difference	*-23*	*-220*	*-249*	*-92*

Table 3-10 – Breakdown of Ngarara Trips for KTM2 v23 (2026, 100%)

	Development	AM Peak		PM Peak	
		Inbound Car/LCV trips	Outbound Car/LCV trips	Inbound Car/LCV trips	Outbound Car/LCV trips
198	Waimeha North (inc. retail, local convenience)	114	271	383	286
199	Ti Kouka	75	225	195	105
200	Totara Dunes	8	23	20	11
201	Homestead	85	255	221	119
202	Kukutauki & Kawakahia	6	18	16	8
203	Ngapara & Lamberts	20	60	52	28
204	Nga Manu & Kanuka Ridge	24	71	62	33
205	Waimeha South	75	226	196	105
	Total	**407**	**1149**	**1144**	**695**
	KTM2 v12 (Full Growth)	434	1401	1256	1199
	difference	*27*	*253*	*112*	*504*

Table 3-11 – Breakdown of Ngarara Trips for KTM2 v24 & v25 (2026, 100%)

	Development	AM Peak		Inter-Peak		PM Peak	
		Inbound Car/LCV trips	Outbound Car/LCV trips	Inbound Car/LCV trips	Outbound Car/LCV trips	Inbound Car/LCV trips	Outbound Car/LCV trips
198	Waimeha North (inc. retail, local convenience)	48	113	105	110	162	122
199	Ti Kouka	25	75	50	50	65	35
200	Totara Dunes	5	16	11	11	14	8
201	Homestead	38	113	75	75	98	53
202	Kukutauki & Kawakahia	4	13	9	9	11	6
203	Ngapara & Lamberts	14	43	28	28	37	20
204	Nga Manu & Kanuka Ridge	12	36	24	24	31	17
205	Waimeha South	18	55	37	37	47	26
	Total	**165**	**463**	**338**	**343**	**466**	**285**

Table 3-12 – Breakdown of Ngarara Trips for KTM2.2 Composite Growth (2021, 73%)

	Development	AM Peak		Inter-Peak		PM Peak	
		Inbound Car/LCV trips	Outbound Car/LCV trips	Inbound Car/LCV trips	Outbound Car/LCV trips	Inbound Car/LCV trips	Outbound Car/LCV trips
198	Waimeha North (inc. retail, local convenience)	90	202	255	255	303	232
199	Ti Kouka	55	164	110	110	142	77
200	Totara Dunes	5	16	11	11	14	8
201	Homestead	62	186	124	124	161	87
202	Kukutauki & Kawakahia	4	13	9	9	11	6
203	Ngapara & Lamberts	15	44	29	29	38	20
204	Nga Manu & Kanuka Ridge	17	52	35	35	45	24
205	Waimeha South	55	165	110	110	143	77
	Total	**303**	**843**	**682**	**682**	**858**	**531**

Table 3-13 – Breakdown of Ngarara Trips for KTM2.2 Full Growth (2021, 73%)

	Development	AM Peak		Inter-Peak		PM Peak	
		Inbound Car/LCV trips	Outbound Car/LCV trips	Inbound Car/LCV trips	Outbound Car/LCV trips	Inbound Car/LCV trips	Outbound Car/LCV trips
198	Waimeha North (inc. retail, local convenience)	22	51	47	50	73	55
199	Ti Kouka	11	34	23	23	29	16
200	Totara Dunes	2	7	5	5	6	3
201	Homestead	17	51	34	34	44	24
202	Kukutauki & Kawakahia	2	6	4	4	5	3
203	Ngapara & Lamberts	6	19	13	13	17	9
204	Nga Manu & Kanuka Ridge	5	16	11	11	14	8
205	Waimeha South	8	25	17	17	21	12
	Total	**75**	**210**	**153**	**155**	**211**	**129**

Table 3-14 – Breakdown of Ngarara Trips for KTM3 (2021, 33%)

4 Intersection Analysis

Turning movements and intersection delays for the following intersections are included in **Appendix B** for the AM and PM peak periods:

- Te Moana Road/Ngarara development access
  - West of Te Moana Interchange (node 9714)
  - East of Te Moana Interchange (node 9808)
- Te Moana Road/M2PP interchange intersections (nodes 4023, 4022)
- Te Moana Road/Ngarara Road (node 2021)
- Ngarara Road/Ngarara development access (node 9725)

Appendix A

Ngarara Development Trip Distribution

A.1 KTM2 v13 Ngarara Demand Distribution – Composite Growth (2026)

	Sector	AM Peak				Inter-Peak				PM Peak			
		Inbound		Outbound		Inbound		Outbound		Inbound		Outbound	
1	South - MacKays Crossing	7	4%	29	7%	6	3%	9	4%	28	7%	7	3%
2	North - Nth Peka Peka	16	8%	23	6%	8	4%	14	6%	14	4%	15	5%
3	Raumati Beach / South	3	2%	11	3%	3	2%	3	1%	6	2%	3	1%
4	Paraparaumu East	3	2%	15	4%	4	2%	4	2%	9	2%	5	2%
5	Paraparaumu Town Centre	2	1%	21	5%	7	3%	6	3%	16	4%	4	1%
6	Paraparaumu	5	2%	17	4%	7	3%	6	3%	15	4%	7	3%
7	Paraparaumu Beach	4	2%	19	5%	4	2%	3	2%	9	2%	4	2%
8	Otaihanga	5	2%	10	2%	7	3%	6	3%	12	3%	10	3%
9	Waikanae Beach	32	16%	38	9%	31	14%	31	14%	50	13%	42	15%
10	Waikanae	69	35%	142	35%	91	42%	87	41%	160	43%	94	33%
11	Waikanae East	37	19%	51	12%	24	11%	27	13%	20	5%	50	18%
12	Waikanae North	11	5%	12	3%	10	5%	9	4%	17	5%	19	7%
13	Peka Peka	5	3%	24	6%	12	6%	9	4%	18	5%	22	8%
	Total	**199**	**100%**	**412**	**100%**	**214**	**100%**	**215**	**100%**	**374**	**100%**	**283**	**100%**

A.2 KTM2 v23 Ngarara Demand Distribution – Composite Growth (2026)

	Sector	AM Peak				Inter-Peak				PM Peak			
		Inbound		Outbound		Inbound		Outbound		Inbound		Outbound	
1	South - MacKays Crossing	8	4%	45	7%					47	7%	10	3%
2	North - Nth Peka Peka	18	8%	36	6%					23	4%	20	5%
3	Raumati Beach / South	3	2%	16	3%					9	2%	4	1%
4	Paraparaumu East	3	2%	22	4%					15	2%	7	2%
5	Paraparaumu Town Centre	2	1%	33	5%					27	4%	5	1%
6	Paraparaumu	5	2%	26	4%					25	4%	10	3%
7	Paraparaumu Beach	4	2%	29	5%					15	2%	6	2%
8	Otaihanga	5	2%	15	2%					19	3%	13	3%
9	Waikanae Beach	36	16%	58	9%					83	13%	56	15%
10	Waikanae	77	35%	218	35%					267	43%	125	33%
11	Waikanae East	42	19%	78	12%					33	5%	66	18%
12	Waikanae North	12	5%	19	3%					28	5%	26	7%
13	Peka Peka	6	3%	36	6%					30	5%	29	8%
	Total	**222**	**100%**	**632**	**100%**					**622**	**100%**	**375**	**100%**

A.3 KTM2 v25 Ngarara Demand Distribution – Full Growth (2026)

	Sector	AM Peak				Inter-Peak				PM Peak			
		Inbound		Outbound		Inbound		Outbound		Inbound		Outbound	
1	South - MacKays Crossing	15	4%	82	7%					86	7%	18	3%
2	North - Nth Peka Peka	34	8%	66	6%					43	4%	38	5%
3	Raumati Beach / South	6	2%	30	3%					17	2%	7	1%
4	Paraparaumu East	6	2%	41	4%					28	2%	13	2%
5	Paraparaumu Town Centre	4	1%	60	5%					50	4%	10	1%
6	Paraparaumu	10	2%	46	4%					45	4%	19	3%
7	Paraparaumu Beach	8	2%	53	5%					28	2%	11	2%
8	Otaihanga	10	2%	28	2%					35	3%	24	4%
9	Waikanae Beach	65	16%	107	9%					153	13%	107	15%
10	Waikanae	141	35%	401	35%					490	43%	239	34%
11	Waikanae East	76	19%	144	13%					60	5%	126	18%
12	Waikanae North	22	5%	22	2%					52	5%	27	4%
13	Peka Peka	11	3%	66	6%					56	5%	55	8%
	Total	**407**	**100%**	**1149**	**100%**					**1144**	**100%**	**695**	**100%**

A.4 KTM2.1 Ngarara Demand Distribution – Composite Growth (2021)

	Sector	AM Peak				Inter-Peak				PM Peak			
		Inbound		Outbound		Inbound		Outbound		Inbound		Outbound	
1	South - MacKays Crossing	6	4%	24	8%	5	3%	7	5%	16	6%	6	3%
2	North - Nth Peka Peka	13	9%	21	7%	10	7%	14	9%	15	5%	20	10%
3	Raumati Beach / South	2	1%	6	2%	2	1%	2	1%	3	1%	2	1%
4	Paraparaumu East	2	1%	7	2%	2	1%	2	1%	6	2%	2	1%
5	Paraparaumu Town Centre	2	1%	13	4%	4	3%	4	2%	10	4%	3	1%
6	Paraparaumu	3	2%	12	4%	5	3%	4	3%	10	4%	5	3%
7	Paraparaumu Beach	4	3%	14	5%	3	2%	3	2%	6	2%	3	2%
8	Otaihanga	8	5%	11	4%	8	5%	7	5%	17	6%	10	5%
9	Waikanae Beach	25	18%	34	12%	26	17%	24	16%	43	15%	30	15%
10	Waikanae	46	32%	101	34%	59	39%	62	41%	108	39%	71	36%
11	Waikanae East	20	14%	33	11%	16	10%	16	10%	16	6%	27	14%
12	Waikanae North	7	5%	3	1%	6	4%	2	1%	12	4%	5	2%
13	Peka Peka	5	3%	14	5%	8	5%	6	4%	15	5%	11	6%
	Total	**142**	**100%**	**295**	**100%**	**153**	**100%**	**152**	**100%**	**278**	**100%**	**195**	**100%**

A.5 KTM2.2 Ngarara Demand Distribution – Composite Growth (2021)

	Sector	AM Peak				Inter-Peak				PM Peak			
		Inbound		Outbound		Inbound		Outbound		Inbound		Outbound	
1	South - MacKays Crossing	7	4%	38	8%	11	3%	16	5%	27	6%	9	3%
2	North - Nth Peka Peka	15	9%	32	7%	23	7%	31	9%	25	5%	29	10%
3	Raumati Beach / South	2	1%	10	2%	4	1%	3	1%	5	1%	3	1%
4	Paraparaumu East	2	1%	11	2%	4	1%	4	1%	10	2%	3	1%
5	Paraparaumu Town Centre	2	1%	20	4%	9	3%	8	2%	17	4%	4	1%
6	Paraparaumu	4	2%	19	4%	10	3%	9	3%	17	4%	7	3%
7	Paraparaumu Beach	5	3%	22	5%	6	2%	6	2%	10	2%	5	2%
8	Otaihanga	9	5%	18	4%	18	5%	16	5%	29	6%	15	5%
9	Waikanae Beach	30	18%	54	12%	57	17%	55	16%	72	15%	44	15%
10	Waikanae	53	32%	159	34%	132	39%	140	41%	182	39%	103	36%
11	Waikanae East	23	14%	52	11%	35	10%	36	10%	27	6%	39	14%
12	Waikanae North	9	5%	5	1%	14	4%	4	1%	20	4%	7	2%
13	Peka Peka	5	3%	23	5%	17	5%	15	4%	25	5%	17	6%
	Total	**165**	**100%**	**463**	**100%**	**338**	**100%**	**343**	**100%**	**466**	**100%**	**285**	**100%**

A.6 KTM2.2 Ngarara Demand Distribution – Full Growth (2021)

	Sector	AM Peak				Inter-Peak				PM Peak			
		Inbound		Outbound		Inbound		Outbound		Inbound		Outbound	
1	South - MacKays Crossing	12	4%	70	8%	22	3%	33	5%	50	6%	17	3%
2	North - Nth Peka Peka	27	9%	59	7%	46	7%	61	9%	46	5%	54	10%
3	Raumati Beach / South	4	1%	18	2%	8	1%	7	1%	10	1%	5	1%
4	Paraparaumu East	4	1%	19	2%	7	1%	8	1%	18	2%	6	1%
5	Paraparaumu Town Centre	3	1%	37	4%	18	3%	16	2%	32	4%	8	1%
6	Paraparaumu	7	3%	34	4%	21	3%	19	3%	31	4%	13	3%
7	Paraparaumu Beach	9	3%	40	5%	13	2%	12	2%	19	2%	10	2%
8	Otaihanga	16	6%	33	4%	36	5%	33	5%	53	6%	27	5%
9	Waikanae Beach	54	19%	98	12%	114	17%	109	16%	133	16%	82	15%
10	Waikanae	98	34%	289	34%	265	40%	278	41%	335	40%	192	36%
11	Waikanae East	43	15%	95	11%	71	11%	71	10%	50	6%	72	14%
12	Waikanae North	3	1%	9	1%	11	2%	7	1%	12	1%	12	2%
13	Peka Peka	10	3%	41	5%	34	5%	29	4%	45	5%	31	6%
	Total	**291**	**100%**	**842**	**100%**	**665**	**100%**	**682**	**100%**	**834**	**100%**	**531**	**100%**

A.7 KTM3 Ngarara Demand Distribution – Composite Growth (2021)

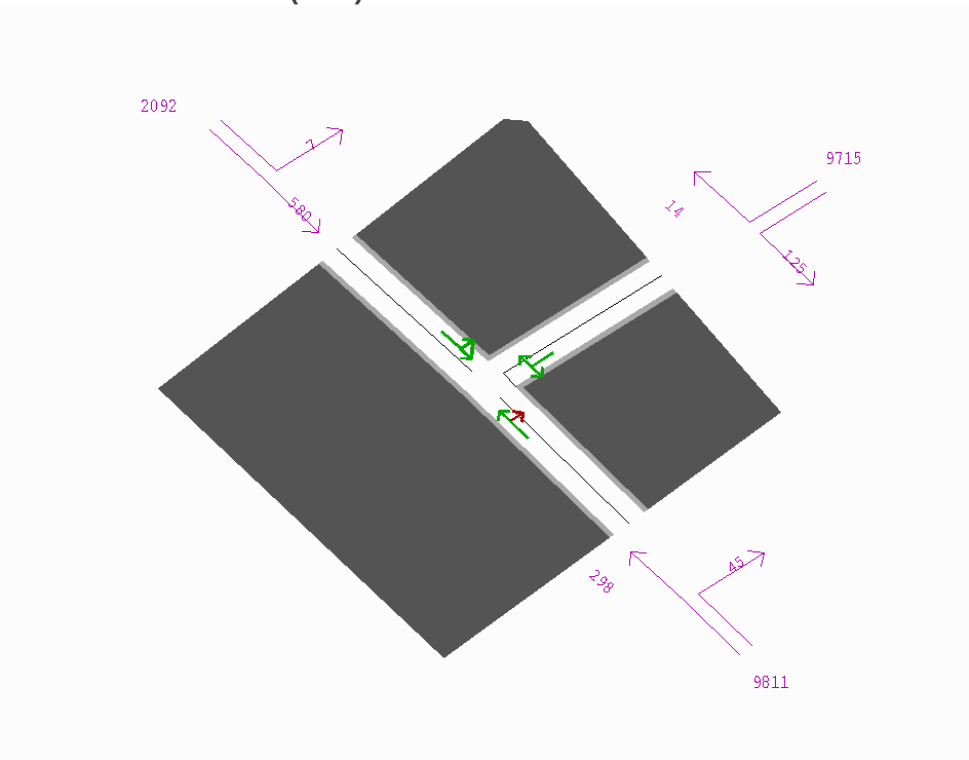
	Sector	AM Peak				Inter-Peak				PM Peak			
		Inbound		Outbound		Inbound		Outbound		Inbound		Outbound	
1	South - MacKays Crossing	3	4%	17	8%	5	3%	7	5%	12	6%	4	3%
2	North - Nth Peka Peka	7	9%	15	7%	10	7%	14	9%	11	5%	13	10%
3	Raumati Beach / South	1	1%	4	2%	2	1%	2	1%	2	1%	1	1%
4	Paraparaumu East	1	1%	5	2%	2	1%	2	1%	4	2%	1	1%
5	Paraparaumu Town Centre	1	1%	9	4%	4	3%	4	2%	8	4%	2	1%
6	Paraparaumu	2	2%	9	4%	5	3%	4	3%	8	4%	3	3%
7	Paraparaumu Beach	2	3%	10	5%	3	2%	3	2%	5	2%	2	2%
8	Otaihanga	4	5%	8	4%	8	5%	7	5%	13	6%	7	5%
9	Waikanae Beach	13	18%	24	12%	26	17%	25	16%	33	16%	20	15%
10	Waikanae	24	32%	72	34%	60	39%	63	41%	82	39%	47	36%
11	Waikanae East	11	14%	24	11%	16	10%	16	10%	12	6%	18	14%
12	Waikanae North	4	5%	2	1%	6	4%	2	1%	8	4%	3	2%
13	Peka Peka	2	3%	10	5%	8	5%	7	4%	11	5%	8	6%
	Total	**75**	**100%**	**210**	**100%**	**153**	**100%**	**155**	**100%**	**211**	**100%**	**129**	**100%**

Appendix B

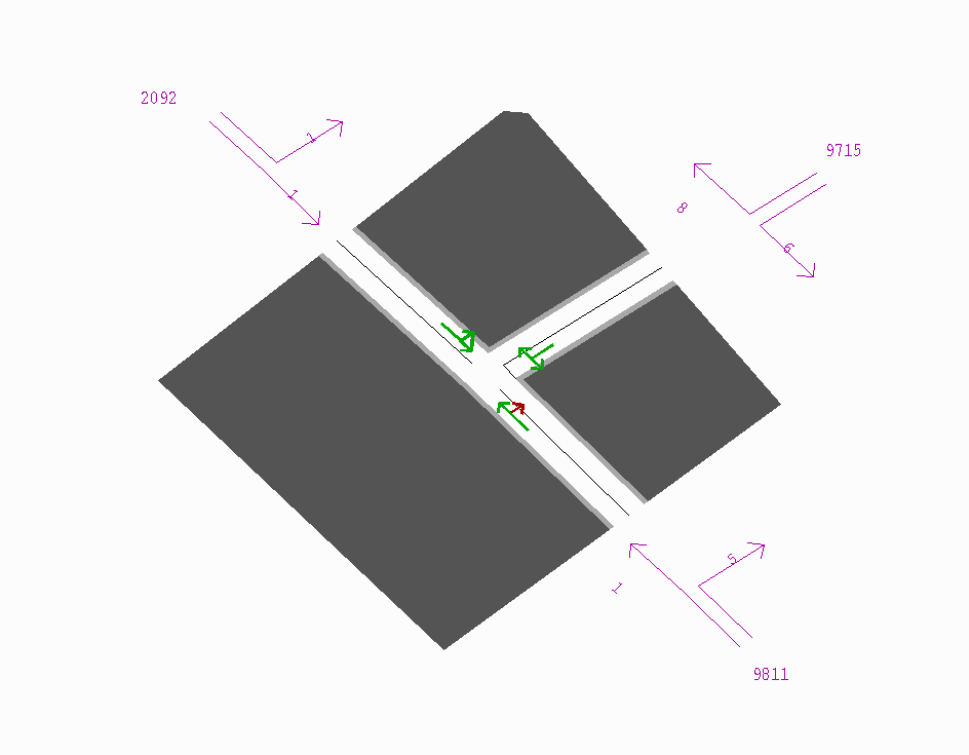
Intersection Analysis

B.1 Te Moana Road/Ngarara development access: west of Te Moana Interchange (node 9714)

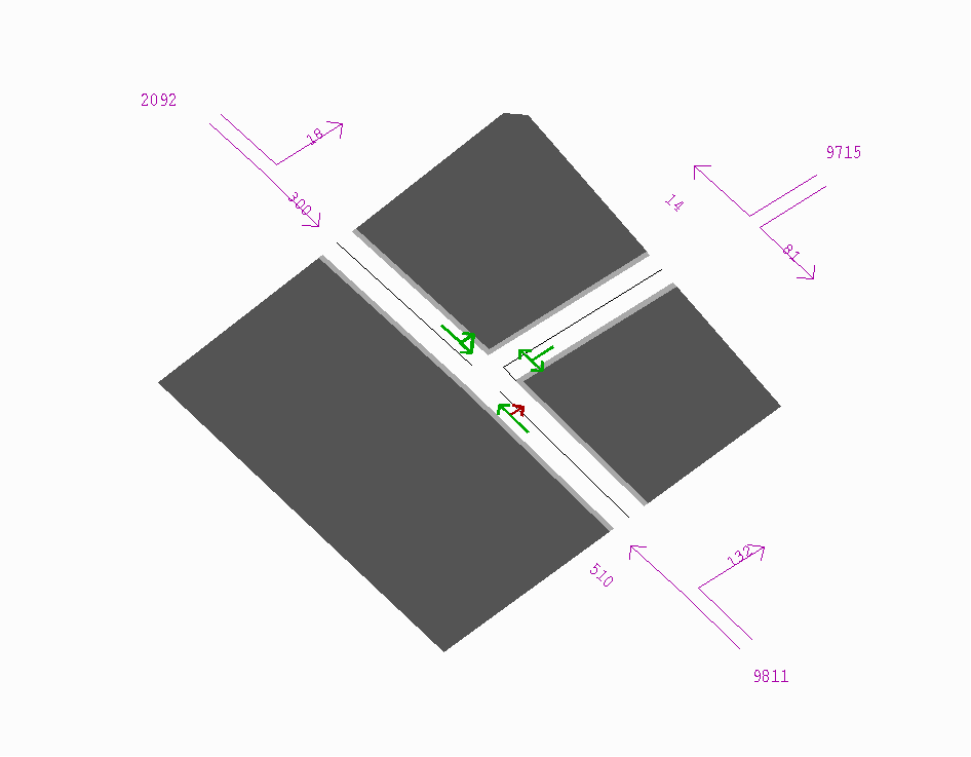
B.1.1 AM Peak – Demand Volumes (PCU)



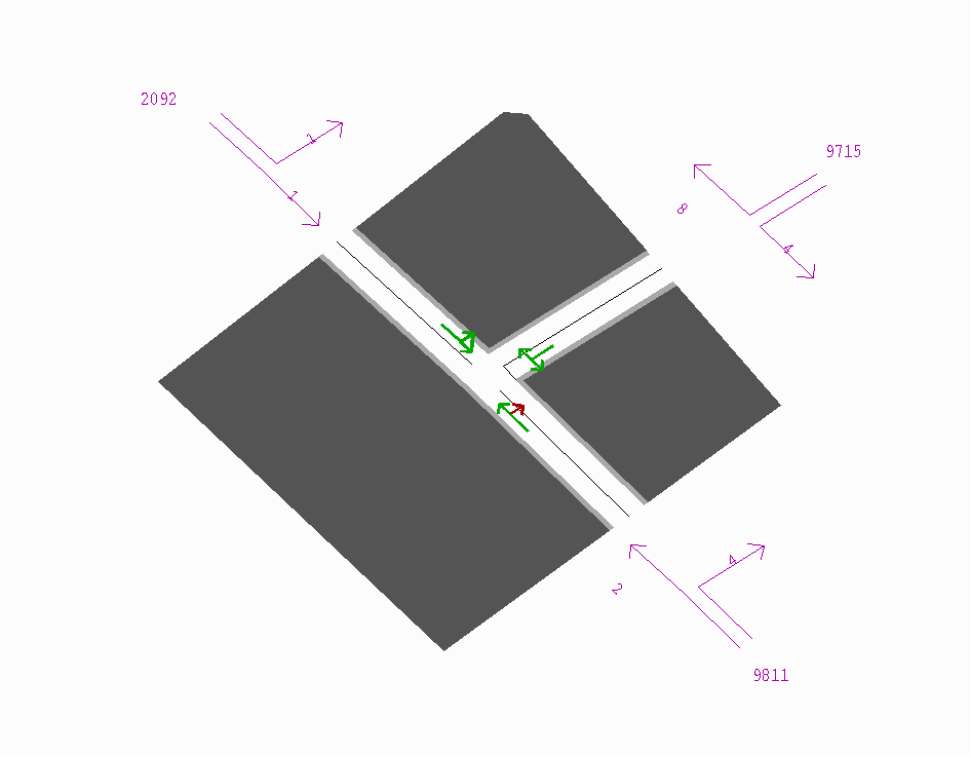
B.1.2 AM Peak – Delay (seconds)



B.1.3 PM Peak – Demand Volumes (PCU)

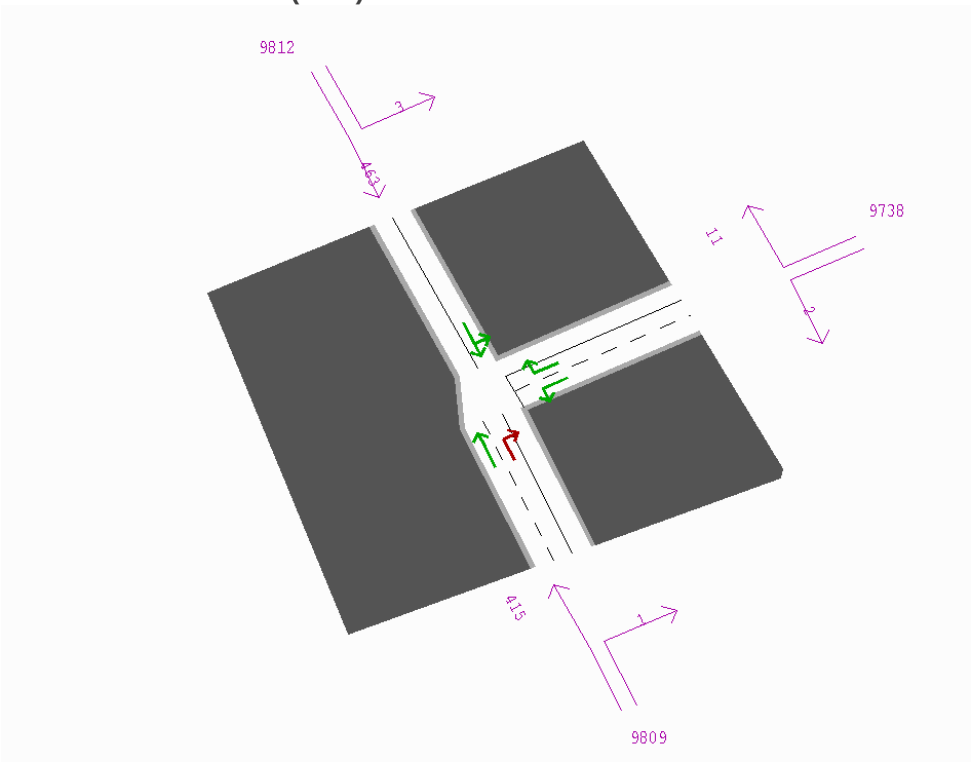


B.1.4 PM Peak – Delay (seconds)

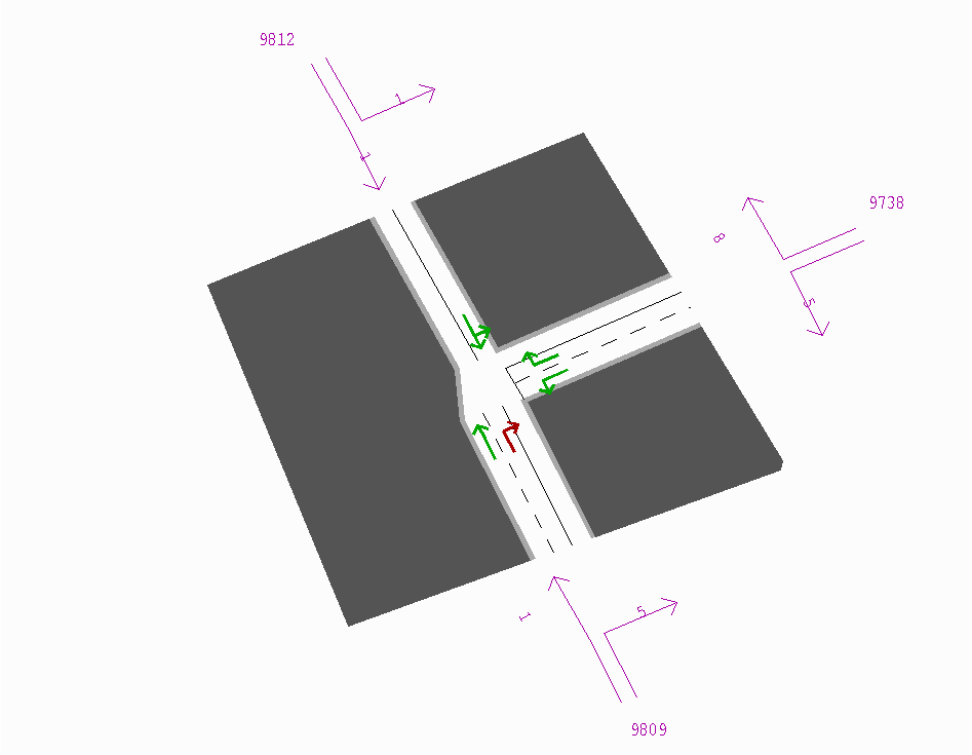


B.2 Te Moana Road/Ngarara development access: east of Te Moana Interchange (node 9808)

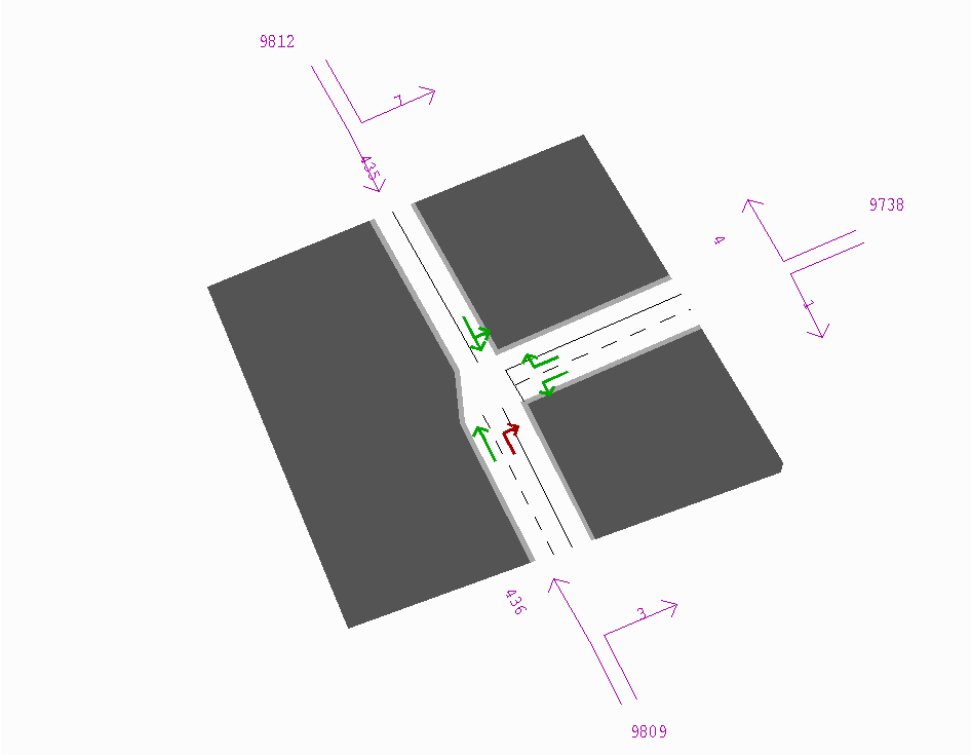
B.2.1 AM Peak – Demand Volumes (PCU)



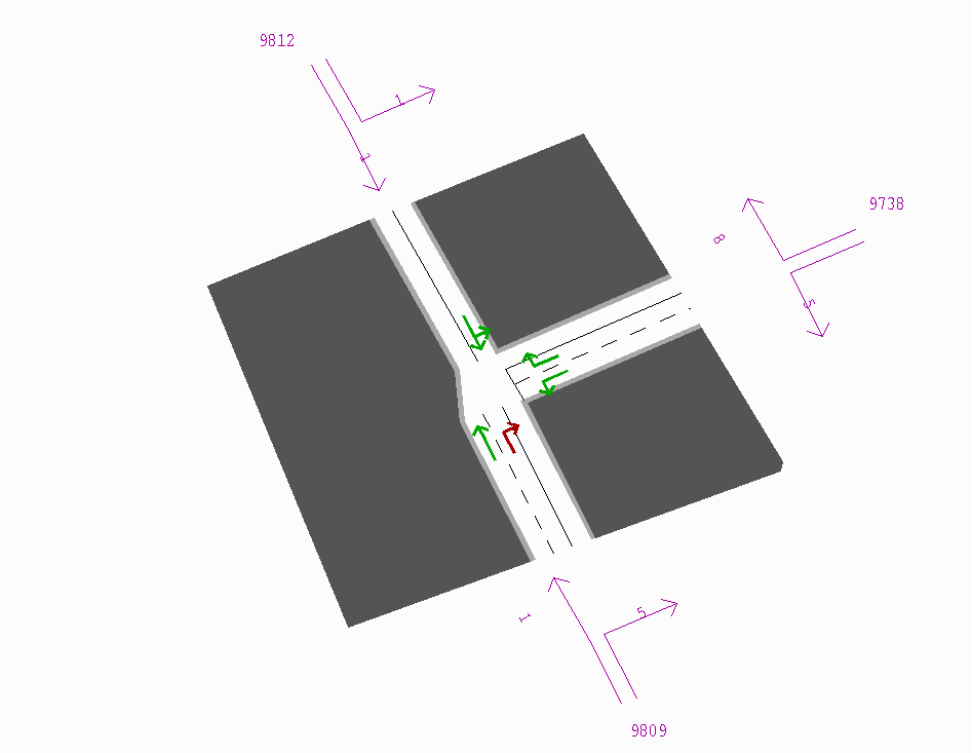
B.2.2 AM Peak – Delay (seconds)



B.2.3 PM Peak – Demand Volumes (PCU)

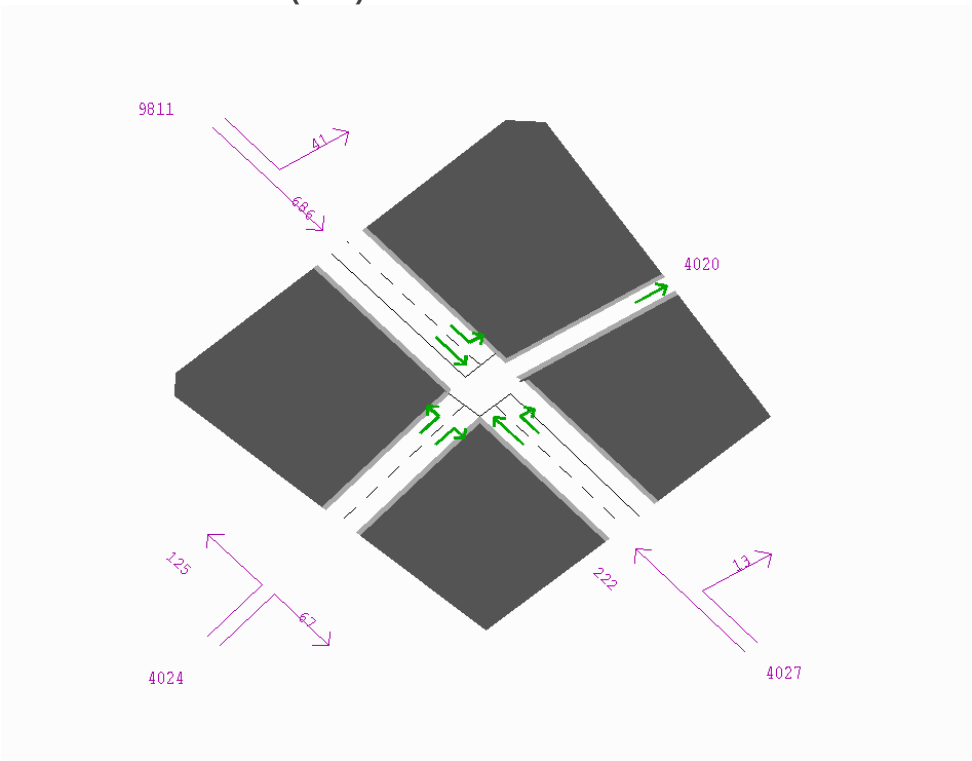


B.2.4 PM Peak – Delay (seconds)

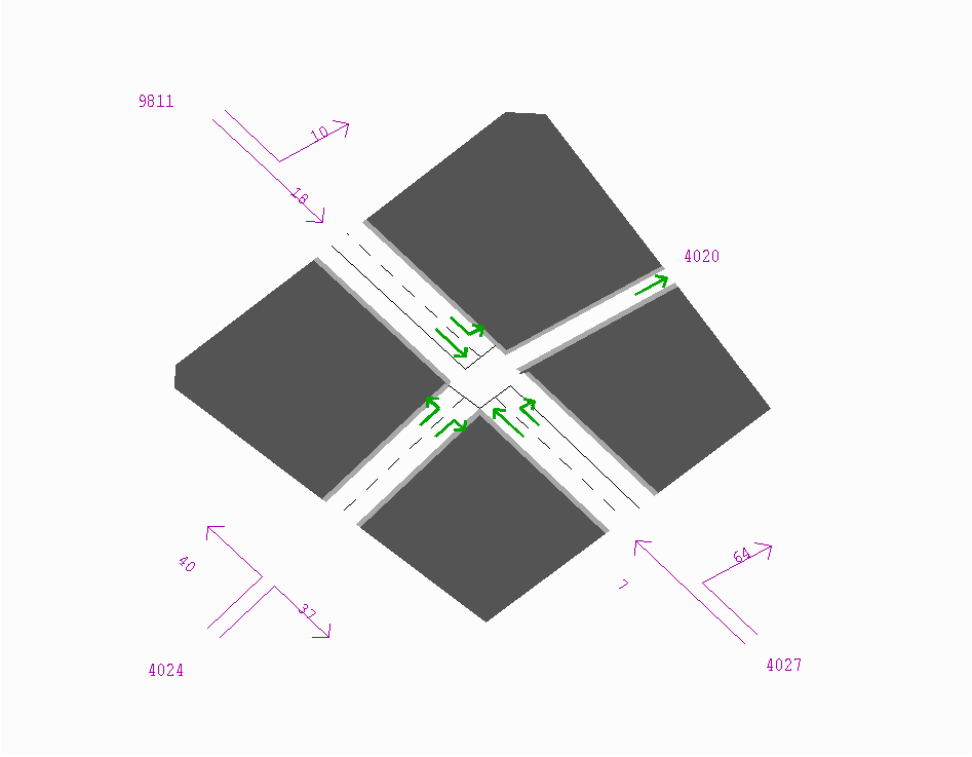


B.3 Te Moana Road/M2PP Interchange: northbound on/off-ramps (node 4023)

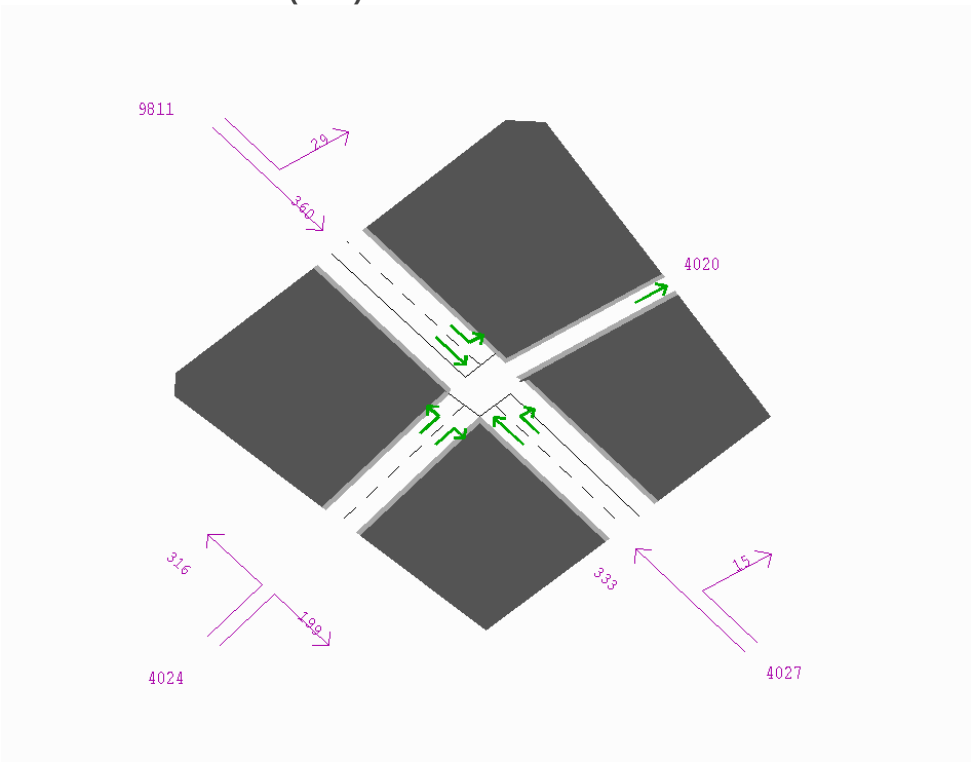
B.3.1 AM Peak – Demand Volumes (PCU)



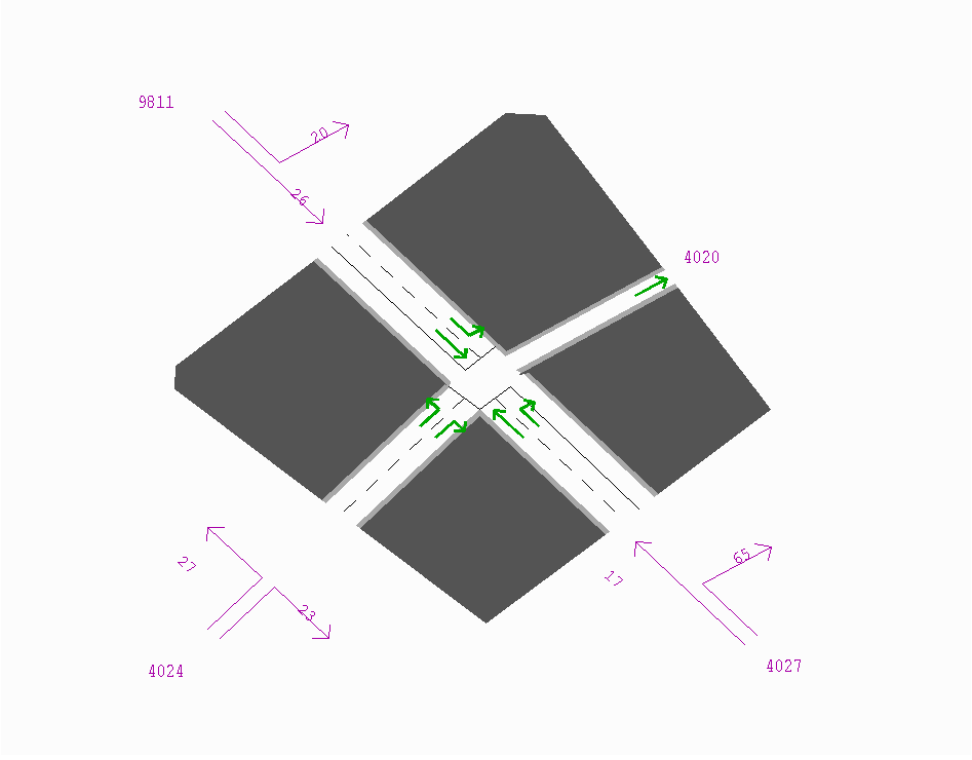
B.3.2 AM Peak – Delay (seconds)



B.3.3 PM Peak – Demand Volumes (PCU)

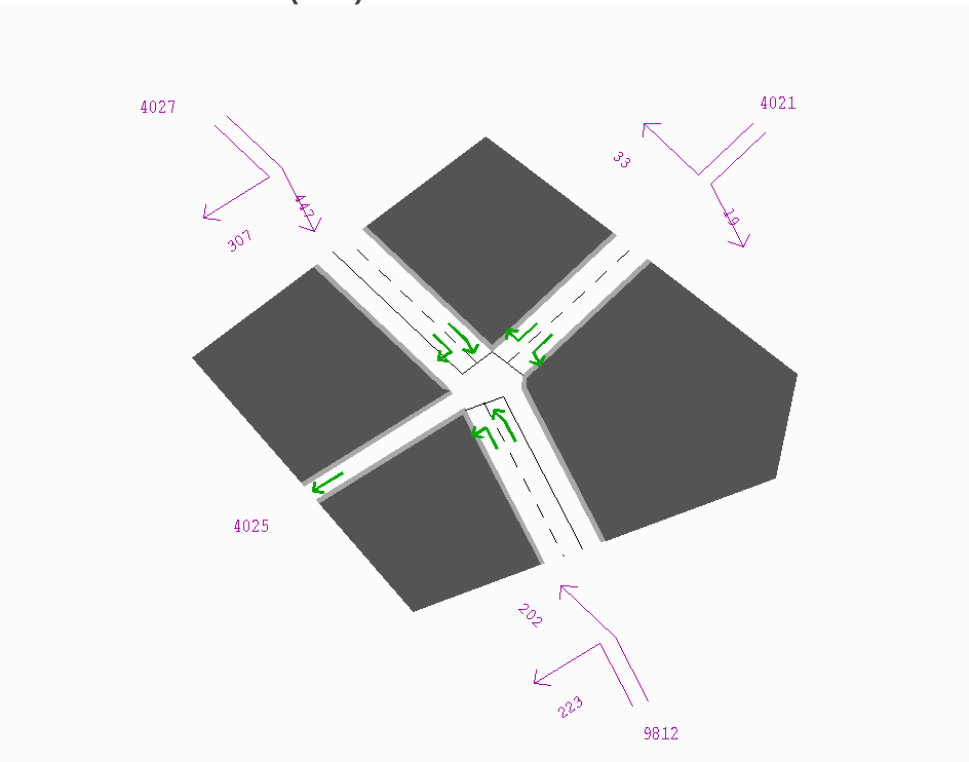


B.3.4 PM Peak – Delay (seconds)

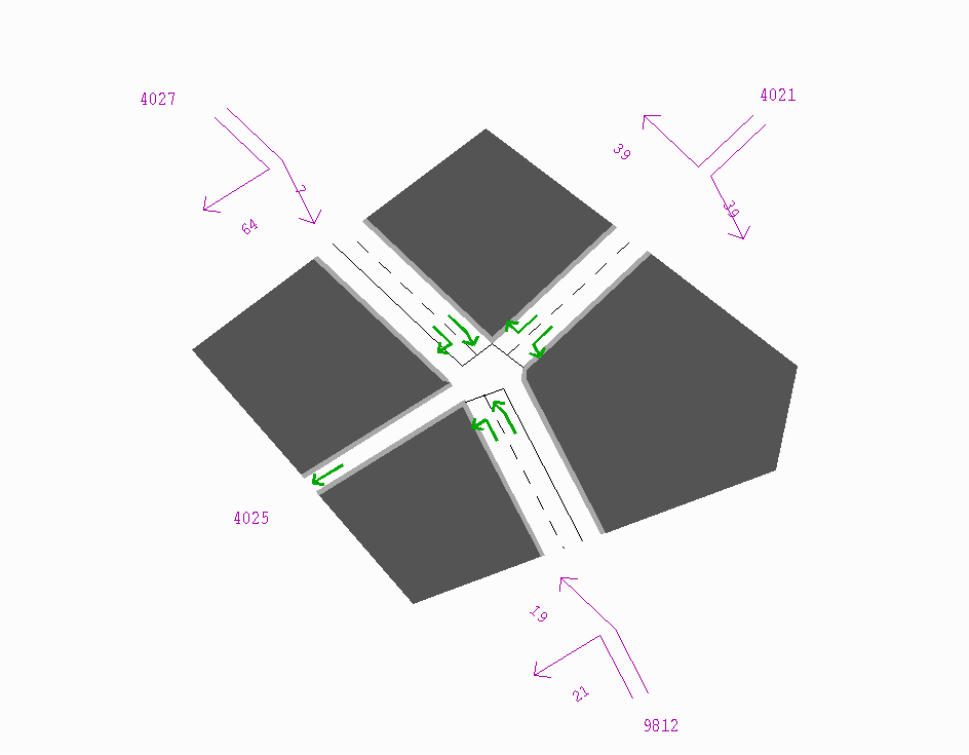


B.4 Te Moana Road/M2PP Interchange: southbound on/off-ramps (node 4022)

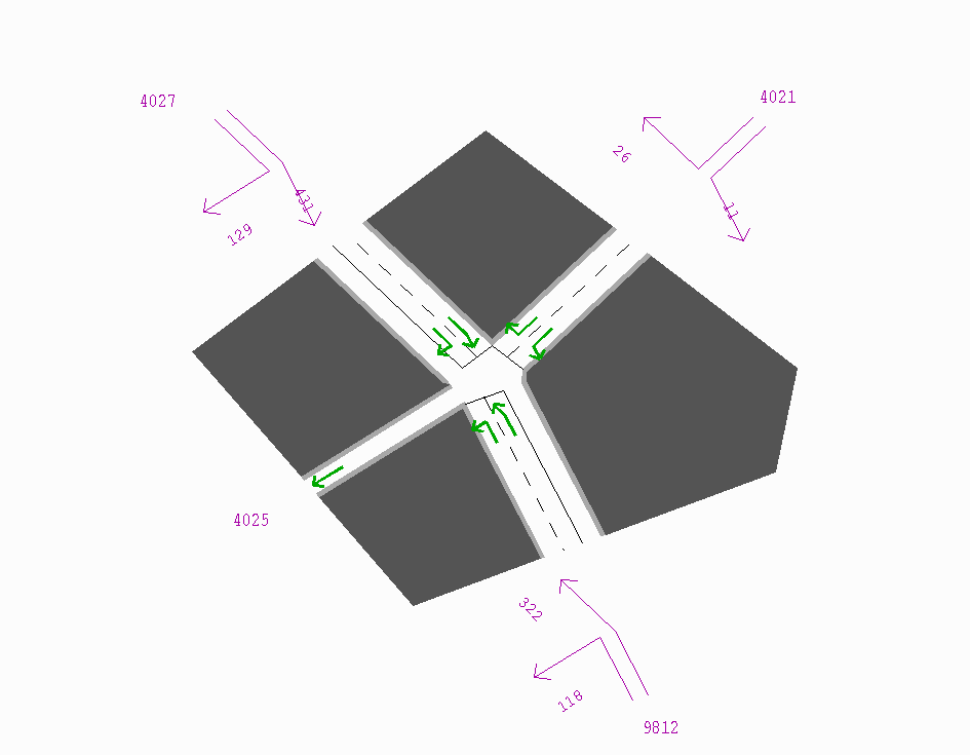
B.4.1 AM Peak – Demand Volumes (PCU)



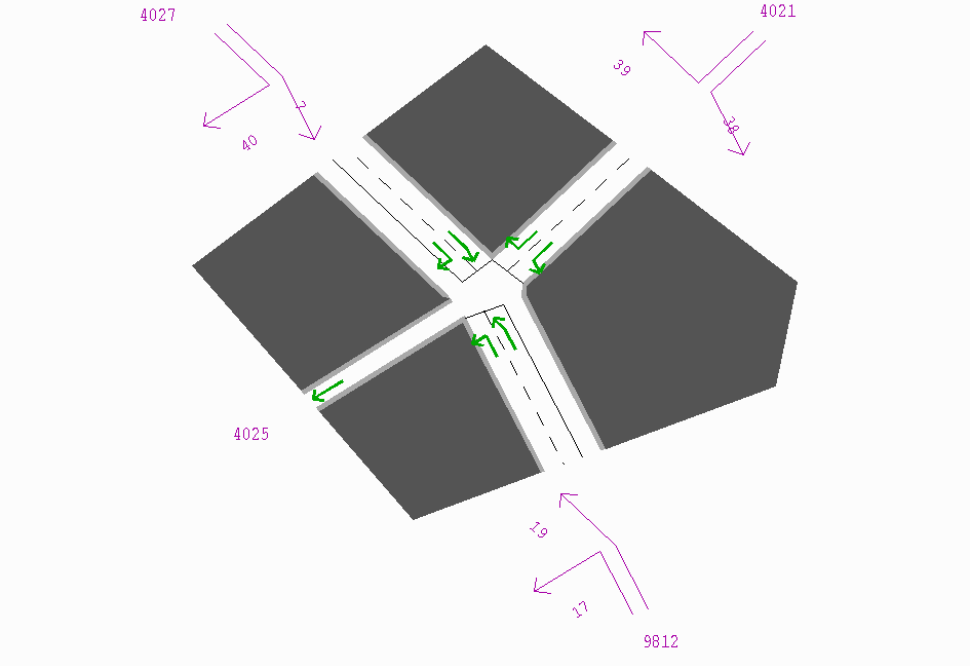
B.4.2 AM Peak – Delay (seconds)



B.4.3 PM Peak – Demand Volumes (PCU)

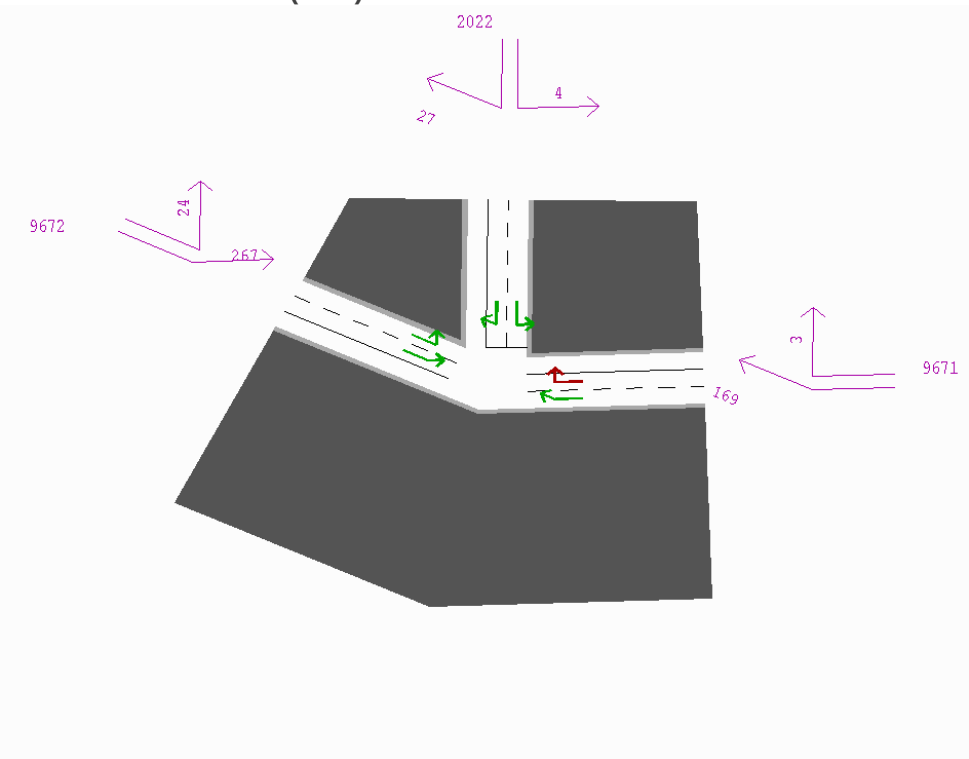


B.4.4 PM Peak – Delay (seconds)

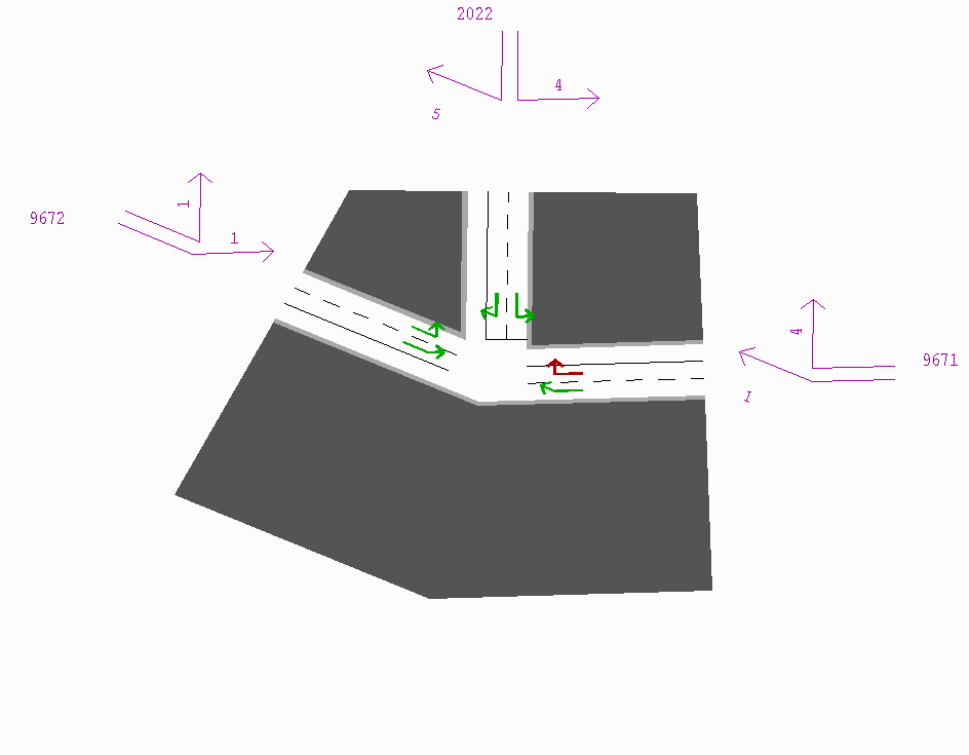


B.5 Te Moana Road/Ngarara Road (node 2021)

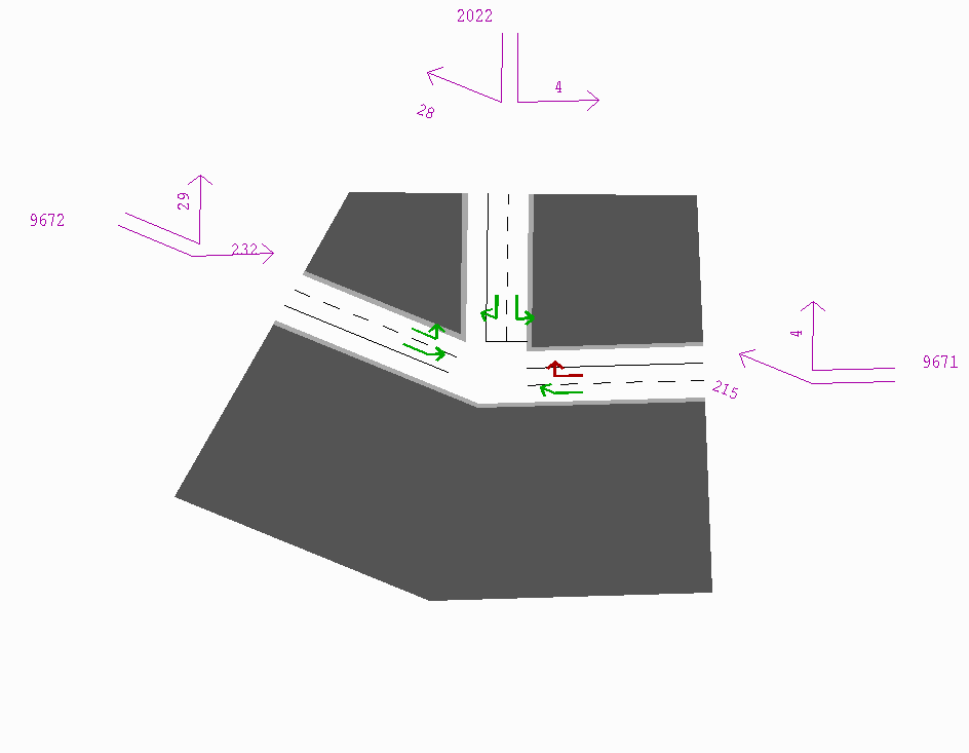
B.5.1 AM Peak – Demand Volumes (PCU)



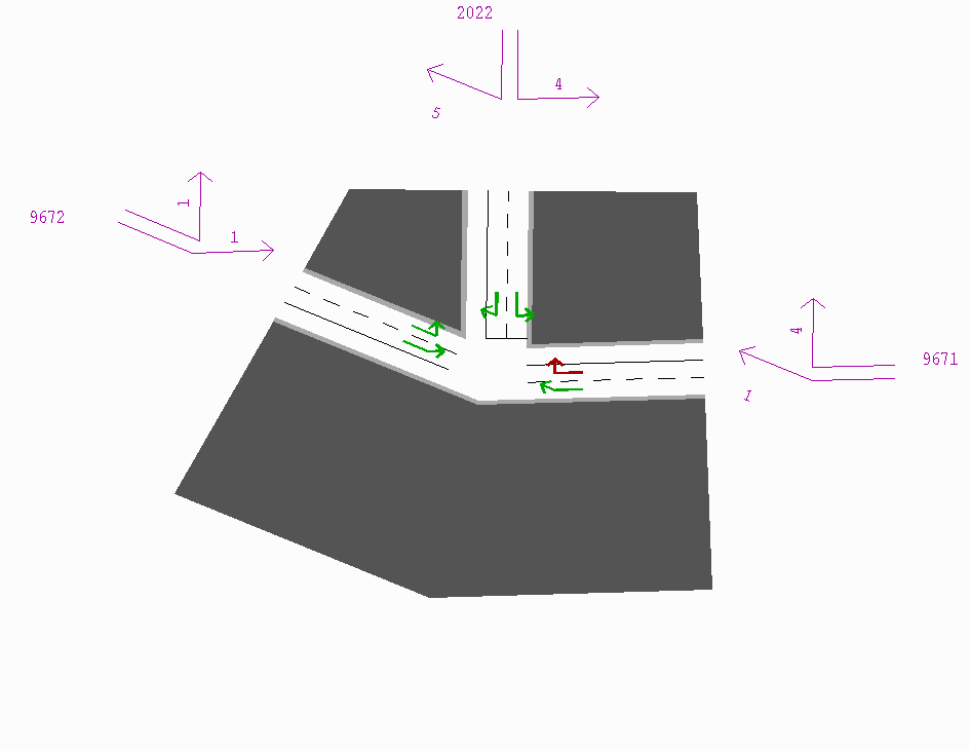
B.5.2 AM Peak – Delay (seconds)



B.5.3 PM Peak – Demand Volumes (PCU)

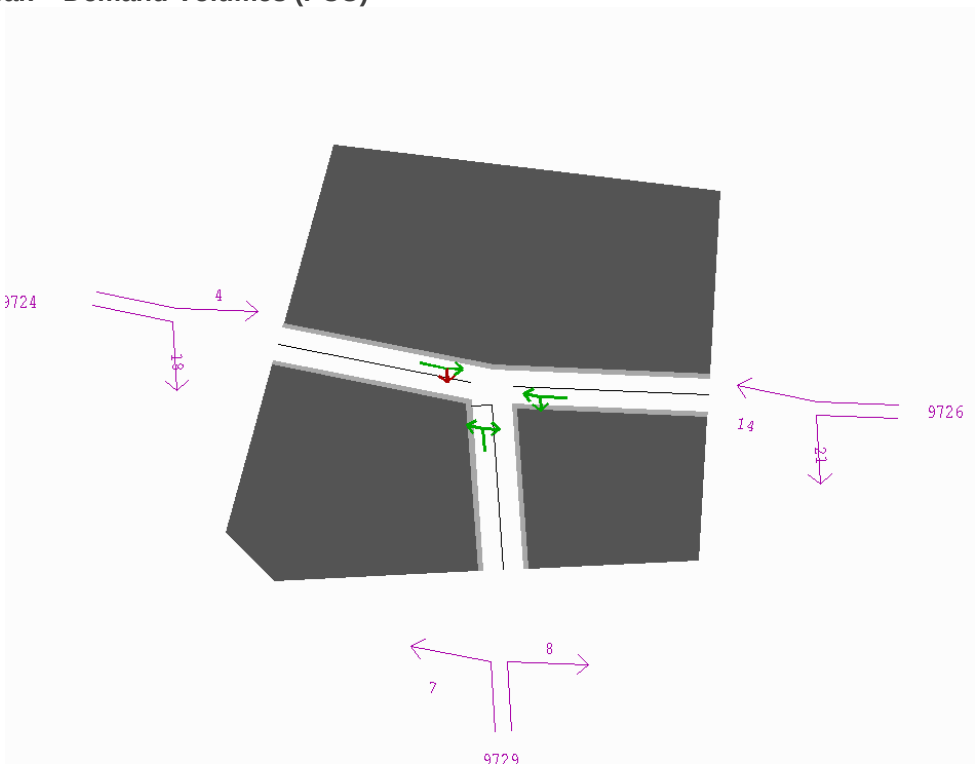


B.5.4 PM Peak – Delay (seconds)

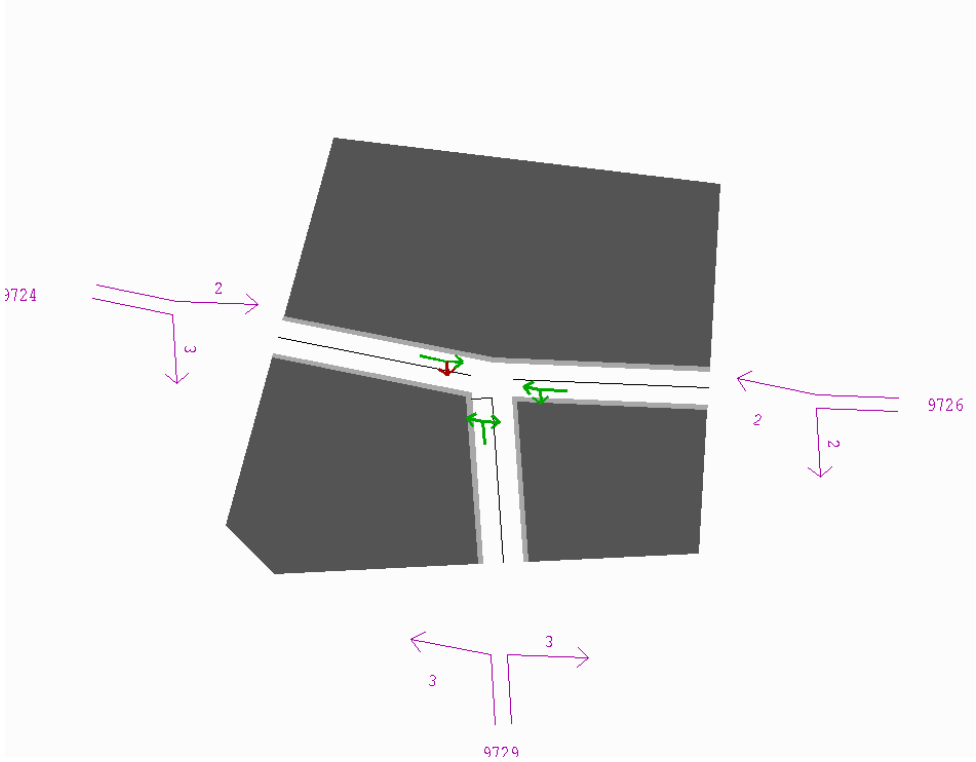


B.6 Ngarara Road/Ngarara development access (node 9725)

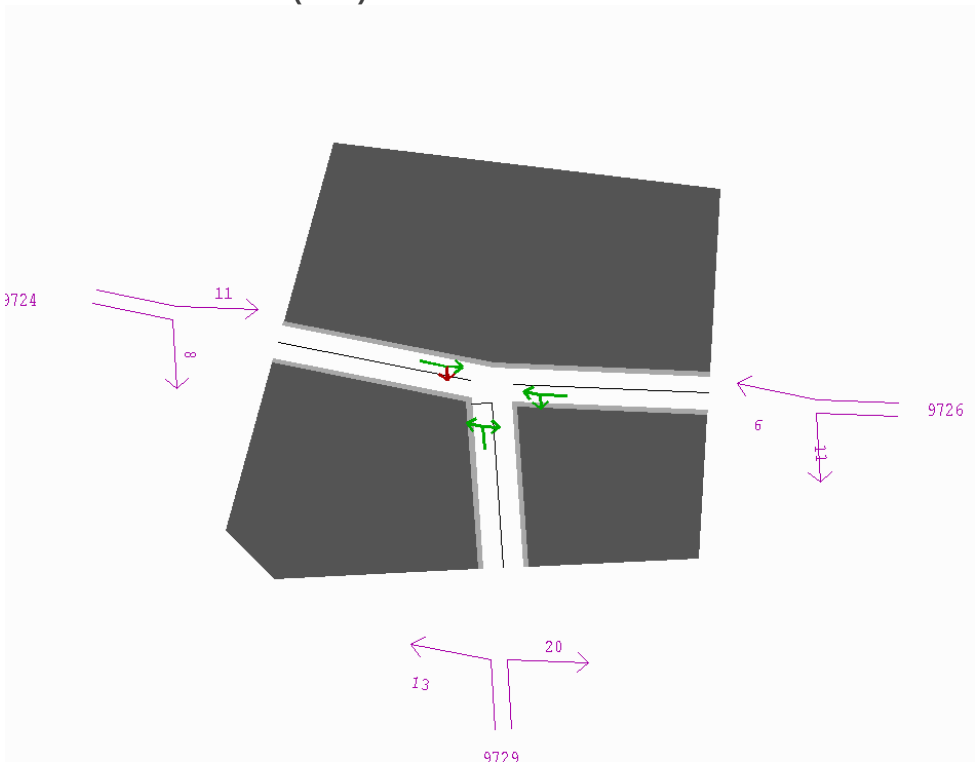
B.6.1 AM Peak – Demand Volumes (PCU)



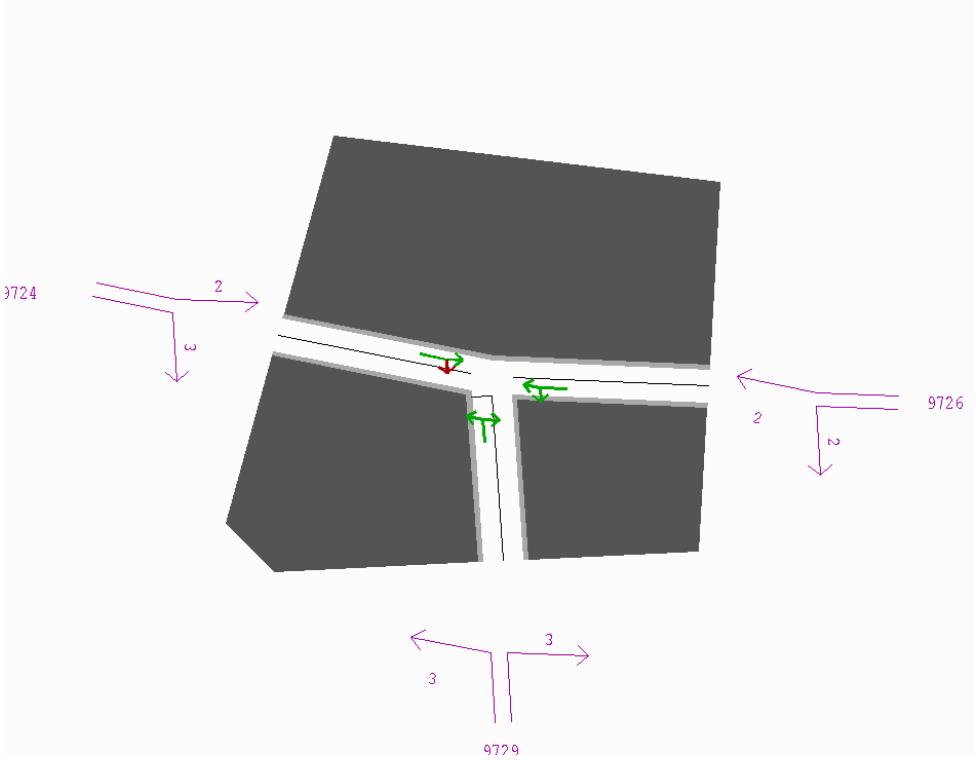
B.6.2 AM Peak – Delay (seconds)



B.6.3 PM Peak – Demand Volumes (PCU)



B.6.4 PM Peak – Delay (seconds)



Appendix F. SIDRA

F.1 Level of Service

Table F.1 : Intersection LOS definitions

Delay (HCM 2000) method for Level of Service definitions based on delay only (for vehicles)

Level of Service	Control delay per vehicle in seconds (d)		
	Signals (*SIDRA standard default for roundabouts*)	"SIDRA Roundabout LOS" option	Sign Control
A	d ≤ 10	d ≤ 10	d ≤ 10
B	10 < d ≤ 20	10 < d ≤ 20	10 < d ≤ 15
C	20 < d ≤ 35	20 < d ≤ 35	15 < d ≤ 25
D	35 < d ≤ **55**	35 < d ≤ **50**	25 < d ≤ **35**
E	**55** < d ≤ 80	**50** < d ≤ 70	**35** < d ≤ 50
F	80 < d	70 < d	50 < d

F.2 Gap acceptance

Gap acceptance parameters were used as per Table 12.2.5 in the SIDRA user guide. The table is based on AUSTROADS (2002, 2005) Guides and the recommended SIDRA intersection values were chosen.

Movement	Critical Gap (s)	Follow-up Headway (s)
Right turn from Te Moana Road East	4.0	2.0
Left turn from TANON	4.5	2.5
Right turn from TANON	5.5	3.5

F.3 SIDRA outputs

Table F.2 : Movement Summary 2021 AM

MOVEMENT SUMMARY — **Site: 2021 AM Te Moana Ngarara Farm Access**

2021 AM Te Moana Road / Ngarara Farm access
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: East Te Moana Road											
5	T	314	14.0	0.176	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
6	R	47	0.0	0.053	9.4	LOS A	0.2	1.5	0.56	0.75	40.8
Approach		361	12.2	0.176	1.2	NA	0.2	1.5	0.07	0.10	48.6
North: North Ngarara Farm Access											
7	L	132	0.0	0.195	10.5	LOS B	0.7	5.2	0.59	0.84	39.9
9	R	15	0.0	0.053	17.7	LOS C	0.2	1.1	0.74	0.91	35.0
Approach		146	0.0	0.195	11.2	LOS B	0.7	5.2	0.61	0.85	39.3
West: West Te Moana Road											
10	L	7	0.0	0.333	6.4	LOS A	0.0	0.0	0.00	0.92	43.3
11	T	611	8.0	0.333	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		618	7.9	0.333	0.1	NA	0.0	0.0	0.00	0.01	49.9
All Vehicles		1125	8.2	0.333	1.9	NA	0.7	5.2	0.10	0.15	47.8

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

Processed: Monday, 8 September 2014 1:38:07 PM
SIDRA INTERSECTION 5.1.5.2006
Project: C:\Users\shall\Documents\projects\Ngarara\Te Moana Ngarara Access.sip
8000028, SINCLAIR KNIGHT MERZ PTY LTD, ENTERPRISE

SIDRA INTERSECTION

Table F.3 : Movement Summary 2021 PM

MOVEMENT SUMMARY — **Site: 2021 PM Te Moana Ngarara Farm Access**

2021 PM Te Moana Road / Ngarara Farm access
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: East Te Moana Road											
5	T	537	6.0	0.286	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
6	R	139	0.0	0.107	7.8	LOS A	0.5	3.3	0.43	0.66	41.7
Approach		676	4.8	0.286	1.6	NA	0.5	3.3	0.09	0.13	48.0
North: North Ngarara Farm Access											
7	L	85	0.0	0.084	7.9	LOS A	0.3	2.3	0.41	0.66	41.8
9	R	15	0.0	0.053	17.4	LOS C	0.2	1.1	0.74	0.91	35.1
Approach		100	0.0	0.084	9.3	LOS A	0.3	2.3	0.46	0.69	40.7
West: West Te Moana Road											
10	L	19	0.0	0.181	6.4	LOS A	0.0	0.0	0.00	0.89	43.3
11	T	316	8.0	0.181	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		335	7.5	0.181	0.4	NA	0.0	0.0	0.00	0.05	49.6
All Vehicles		1111	5.2	0.286	1.9	NA	0.5	3.3	0.09	0.16	47.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

Processed: Monday, 8 September 2014 1:38:10 PM
SIDRA INTERSECTION 5.1.5.2006
Project: C:\Users\shall\Documents\projects\Ngarara\Te Moana Ngarara Access.sip
8000028, SINCLAIR KNIGHT MERZ PTY LTD, ENTERPRISE

SIDRA INTERSECTION

Table F.4 : Movement Summary 2031 AM

MOVEMENT SUMMARY

Site: 2031 AM Te Moana Ngarara Farm Access

2031 AM Te Moana Road / Ngarara Farm access
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: East Te Moana Road											
5	T	318	14.0	0.178	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
6	R	142	0.0	0.180	10.4	LOS B	0.7	5.1	0.62	0.86	39.9
Approach		460	9.7	0.180	3.2	NA	0.7	5.1	0.19	0.27	46.4
North: North Ngarara Farm Access											
7	L	398	0.0	0.677	17.1	LOS C	4.9	34.4	0.82	1.21	35.4
9	R	44	0.0	0.213	23.8	LOS C	0.7	4.8	0.83	0.96	31.7
Approach		442	0.0	0.677	17.8	LOS C	4.9	34.4	0.82	1.19	35.0
West: West Te Moana Road											
10	L	22	0.0	0.381	6.4	LOS A	0.0	0.0	0.00	0.91	43.3
11	T	684	8.0	0.381	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		706	7.7	0.381	0.2	NA	0.0	0.0	0.00	0.03	49.8
All Vehicles		1608	6.2	0.677	5.9	NA	4.9	34.4	0.28	0.42	43.8

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

Table F.5 : Movement Summary 2031 PM

MOVEMENT SUMMARY

Site: 2031 PM Te Moana Ngarara Farm Access

2031 PM Te Moana Road / Ngarara Farm access
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: East Te Moana Road											
5	T	601	6.0	0.320	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
6	R	422	0.0	0.350	8.7	LOS A	2.0	13.9	0.54	0.76	41.3
Approach		1023	3.5	0.350	3.6	NA	2.0	13.9	0.22	0.32	46.0
North: North Ngarara Farm Access											
7	L	260	0.0	0.271	8.6	LOS A	1.2	8.3	0.50	0.74	41.4
9	R	45	0.0	0.308	33.8	LOS D	1.0	6.9	0.90	1.00	27.5
Approach		305	0.0	0.308	12.3	LOS B	1.2	8.3	0.56	0.77	38.5
West: West Te Moana Road											
10	L	57	0.0	0.217	6.4	LOS A	0.0	0.0	0.00	0.86	43.3
11	T	345	8.0	0.217	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		402	6.9	0.217	0.9	NA	0.0	0.0	0.00	0.12	48.9
All Vehicles		1731	3.7	0.350	4.5	NA	2.0	13.9	0.23	0.35	45.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

Appendix G. Link Level of Service Definitions

Definitions of LOS				Table 1
LOS	AustRoads Description	Waikato Regional Transport Model LOS criteria		
		Link (vehicles per lane per hour)	Intersection delay (seconds/veh)	
			Priority*	Signal/Rotary**
LOS F	Forced flow. The amount of traffic approaching a point exceeds that which can pass it. Flow breakdowns occur, and queuing and delays occur.	In excess of **900-1700** depending on link type	In excess of 50 sec	In excess of 80 sec
LOS E	Traffic volumes are at or close to *capacity and there is virtually no freedom* to select desired speed and to manoeuvre within the traffic stream. Flow is unstable and *minor disturbances within the traffic stream will cause breakdowns in operation.*	Between **720-900** and **1360-1700** depending on link type	35 - 50 sec	55 - 80 sec
LOS D	Approaching unstable flow where *all drivers are severely restricted* in their freedom to select desired speed and to manoeuvre within the traffic stream. The general level of *comfort and convenience is poor* and small increases in traffic flow will cause operational problems.	Between **585-720** and **1105-1360** depending on link type	25 - 35 sec	35 - 55 sec
LOS C	Stable flow but most drivers *are restricted to some extent* in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of *comfort and convenience has declined noticeably.*	Between **450-585** and **850-1105** depending on link type	15 - 25 sec	20 - 35 sec
LOS B	Stable flow where drivers still *have reasonable freedom* to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is less than LOS A.	Between **0** and **450-850** depending on link type	0 - 15 sec	0 - 20 sec
LOS A	Free flow in which drivers are *virtually unaffected* by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high and the general level of *comfort and convenience is excellent.*			