Papanui PAK’nSAVE Integrated Transport Assessment

Foodstuffs South Island Ltd

Insightful solutions. Empowering advice.

Papanui PAK'nSAVE Integrated Transport Assessment

Foodstuffs South Island Ltd

Quality Assurance Information

Prepared for:	Foodstuffs South Island Ltd
Job Number:	FSIL-J047
Prepared by:	Jay Baththana, Senior Transportation Engineer
	Jared White, Senior Transportation Engineer
Reviewed by:	Dave Smith, Technical Director

Date issued	Status	Approved by
		Name
4 July 2018	Draft for project team review	Ann-Marie Head
25 July 2018	Second draft	Ann-Marie Head
7 August 2018	Third draft	Ann-Marie Head
4 May 2019	Fourth draft	Dave Smith
20 May 2019	Final	Dave Smith

T +64 9 486 0898 (Akld)
T +64 3 377 4703 (Chch)
F +64 3 377 4700
E admin@ably.com

Auckland
Level 8, 57 Fort Street
PO Box 911336
Auckland 1142
New Zealand

Christchurch
Level 1, 137 Victoria Street
PO Box 25350
Christchurch 8144
New Zealand

www.ably.com

Executive Summary

Foodstuffs propose to:

a) establish, operate and maintain a supermarket and associated fuel facility, ancillary offices, car parking, access, signage and landscaping at 171 Main North Road;

b) provide an emergency coordination facility at 171 Main North Road;

c) alter the existing site access and relocate existing car parks for the existing Foodstuffs South Island Limited Head Office; and

d) alter access arrangements for the retail and commercial tenancies located at 3-7 Northcote Road, Papanui, Christchurch.

A key feature of the proposal is a new signalised intersection on Main North Road providing safer and more efficient access for vehicles to and from the entire site and improved pedestrian access across Main North Road. Signal optimisation is also proposed at the Main North Road / Northcote Road / QEII Drive signals to improve both the safety and efficiency performance of the intersection.

In transport terms, the only new trip generating activities of the proposal are the supermarket and fuel facility. This Integrated Transport Assessment has been prepared to investigate the traffic and transport elements of the proposal and how it affects the surrounding transport network. To enable the adequate assessment of effects of the road network a microsimulation model has been built and run in s-Paramics (Paramics) informed by demands from Christchurch City Council's CAST Model.

The Paramics model investigated the following development scenarios:

- 2018 Base without development
- 2021 Base (includes Christchurch Northern Corridor (CNC) project)
- 2021 with Development
- 2031 Base (includes current 2 Lydia Street consented activity and Northcote Road four-laning)
- 2031 with Development.

The modelling results conclude that for the viability of the proposed development, the CNC, which is currently being constructed, will need to be operating to reduce traffic demands on the Main North Road and Cranford Street corridors. Also, whilst the supermarket has a large traffic generating footprint the total number of new trips on the network is 20% or around 100 trips in and 100 trips out of the site in peak hour. When these new trips are dispersed around the local area their effects are minimal. The remaining 80% of trips are already on the network as they pass-by the site or are trips diverted from elsewhere on the local network which essentially add the proposed site as an intermediate trip destination in a series of linked trips in the model.

Consistent with local and regional transport policy, the development will promote active transport modes by providing excellent pedestrian and cyclist infrastructure such as signalised pedestrian crossings across Main North Road, pedestrian linkages within the car park and between adjacent sites, visitor and staff cycle parking and end-of-trip cycle facilities. The development is also well positioned to benefit from the excellent public transportation services along Main North Road. Alternative travel modes to private car will be promoted by creating personalised Travel Plans for supermarket staff.

The proposal is consistent with most of the Transport rules of the Christchurch District Plan. The potential transport effects of the few non-compliances has been assessed and mitigated by appropriate design elements.

There are several benefits to the transportation network that are delivered as part of this proposal, including:

- the introduction of signals on Main North Road which improves connectivity for vehicles wishing the access existing activity along the corridor with a significant increase in the throughput of the local area and improved travel times for local and through trips on key corridors;
- excellent integration with current and future roading projects including the Christchurch Northern Corridor and future four laning of Northcote Road;
- improved pedestrian connectivity including a safe signalise crosswalk at the new signals on Main North Road;
- an opportunity for the introduction of a northbound bus priority phase and flexibility regarding the location of public transport stops;
- improved safety and efficiency at the adjacent Main North Road / QEII Drive / Northcote Road signals through minor changes in the layout and revised phasing; and

- an Emergency Coordination Facility (ECF) which will operate temporarily during a Civil Defence emergency, and road network operations are likely to be significantly disrupted during this time, noting that the site is well located in terms of accessing the Christchurch Strategic road network and beyond.

Overall, the proposed development can be supported from a traffic and transportation perspective and it is considered that there are no traffic related reasons why consent should not be granted.

Contents

Tables

Figures

1. Introduction

1.1 Initial Assessment and Consent Application

In August 2018 Foodstuffs submitted an initial application for resource consent for the Pak'n'Save which was accompanied by an ITA (version - FSIL-J047rpt1 Papanui Pak'n'Save ITA 070817 Final - dated 7th August 2018). The transport effects on the local road network was based on an s-Paramics microsimulation transport model which had been specifically built by Abley for this purpose.

Subsequent to Council's review of the ITA several queries were raised regarding the model through a Section 92 Request process. The Abley team (Ann-Marie Head, Dave Smith and Jared White) met with Council (Andy Milne, Mark Gregory and Hamid Mirbaha) on 25 September 2018 and have continued to work collaboratively with Council's modellers to address the RFI items raised relating to transport modelling and the agreed changes in methodology and reporting are addressed implicitly in this updated ITA. This is also reflected in the formal Section 92 response which accompanies the application. Key to this collaboration was to agree upon the choice of platform, methodology and validity of the models which have been used to inform the updated assessment of transportation effects.

The calibrated Paramics model has been retained but the future year demands have been informed by extracting a cordon of demand from the Council's CAST model removing the initial dependency on the CTM model for growth in traffic which has a coarser network and basic traffic assignment feature compared to CAST.

The proposals including the signalised access on Main North Road for the site has also been subject to a Road Safety Audit (RSA) undertaken by two independent engineers. The RSA highlighted some aspects of the signal design and wider site plan that required modification. A separate response to the RSA has more details on this but the required changes have been incorporated into the design and analysis presented in this updated ITA.

1.2 Proposal

Foodstuffs propose to:

a) establish, operate and maintain a supermarket and associated fuel facility, ancillary offices, car parking, access, signage and landscaping at 171 Main North Road;
b) provide an emergency coordination facility at 171 Main North Road;
c) alter the existing site access and relocate existing car parks for the existing Foodstuffs South Island Limited Head Office; and
d) alter access arrangements for the retail and commercial tenancies located at 3-7 Northcote Road, Papanui, Christchurch.

The development site will be referred to herein as the FSIL Site. Abley Limited (Abley) has been commissioned by FSIL to provide transport advice and prepare an Integrated Transport Assessment (ITA) with respect to the FSIL Site. This report provides an assessment of the transportation effects of the proposal. It has been prepared in accordance with the Operative Christchurch District Plan Transportation rules and Christchurch City Council (CCC) Integrated Transport Assessment Guidelines (September 2015).

The proposal includes an Emergency Coordination Facility (ECF) which will operate temporarily during a Civil Defence emergency. It is not appropriate to assess the transport effects of this use in the same way as a typical land use activity. During this time, the facility will be under the control of Civil Defence to manage the logistics of the operations. Furthermore, road network operations are likely to experience significant disruptions and will have very different travel patterns relative to day-to-day operations.

During an emergency situation, access for heavy vehicles from the strategic road network, the resilience of the road network to continue to provide access to the site, and the location of this facility to provide a coordinated Civil Defence response to the Christchurch urban area and beyond are important factors.

Report Structure

This report is divided into sections to aid understanding of the assessment methodology:

- Existing site information
  - Locality, zoning, existing land use
- Existing transport data
  - Road geometry, road hierarchy, existing vehicle flows, public transport and road safety
- Proposed activity
  - A description of the proposal giving specific attention to the transport related components
- Appraisal of transport effects
  - An assessment of the anticipated trip generation, parking demand and access arrangements
- Christchurch District Plan assessment
  - An assessment of the proposal against the transport provisions of the Operative Christchurch District Plan
- Assessment of Non-Compliances
  - An assessment of the non-compliances.
- Conclusions

2. Existing Site Information

2.1 Locality

The FSIL Site is located across 165-171 Main North Road and 3-7 Northcote Road, Christchurch, which is located approximately 5km north of the Christchurch CBD and 7.5km east of the Christchurch International Airport. The development site in the context of the wider area is shown in **Figure 2.1**.

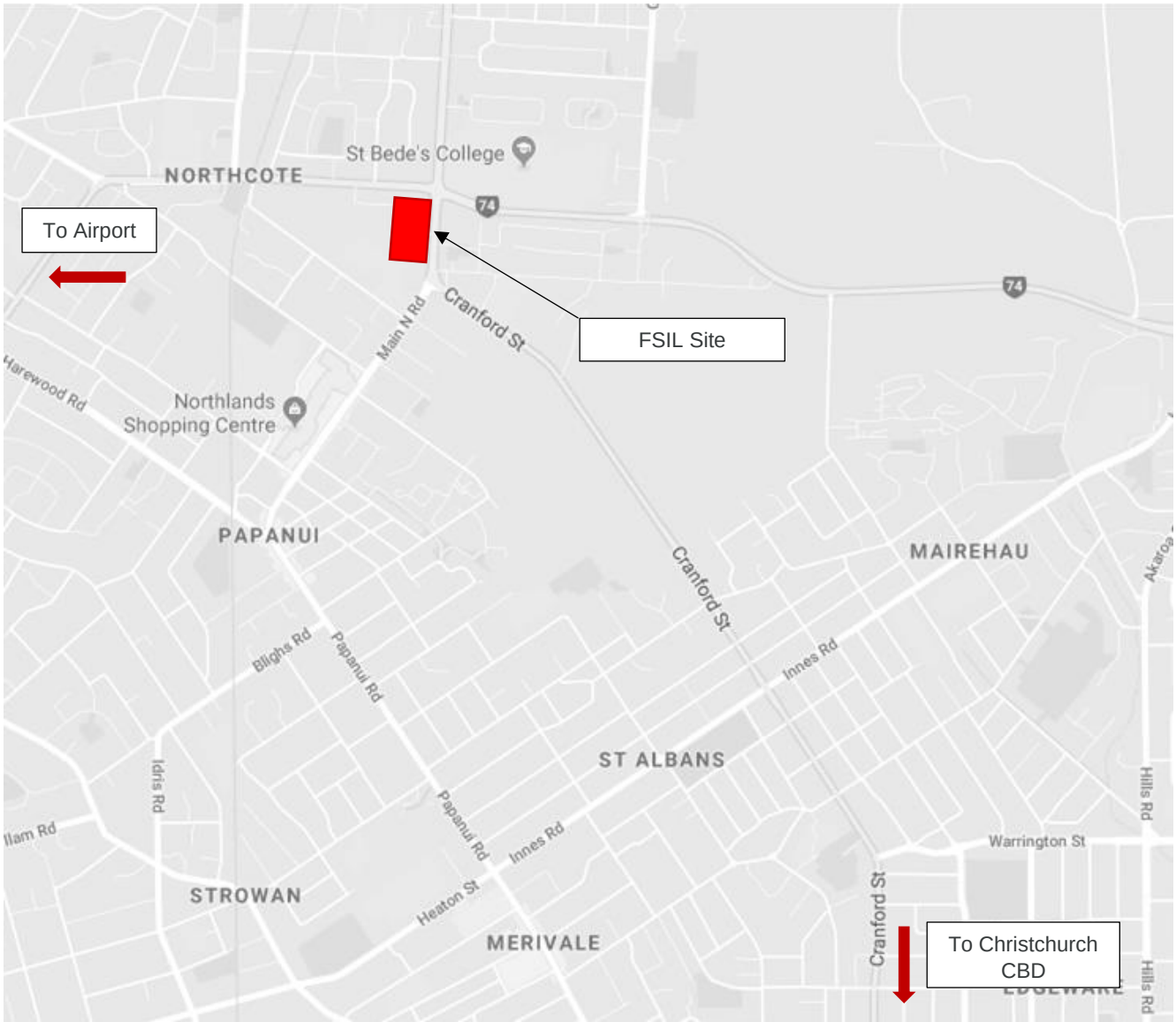


Figure 2.1 Development site location

2.2 Zoning

According to the Christchurch District Plan, the FSIL Site spans across the Industrial General Zone, Commercial Local Zone and Residential Suburban Zone. **Figure 2.2** shows the land use zoning of the FSIL site as well as that of the wider area.

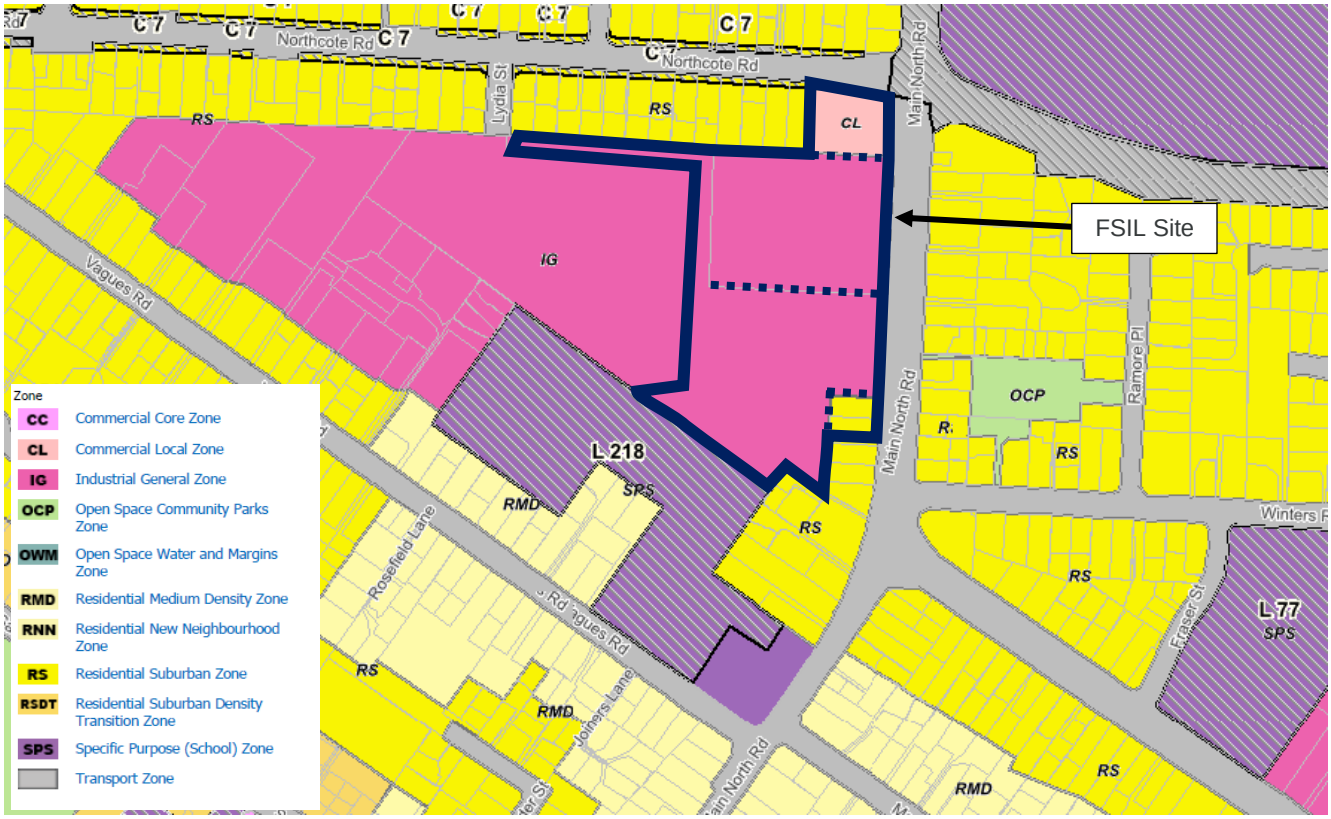


Figure 2.2 CCC Zoning map

2.3 Existing Land Use

The FSIL site is currently occupied by the following activities;

- A bottling plant operated by Murdochs Manufacturing, (FSIL subsidiary). The bottling plant operates 5 days a week and employs approximately 10-12 staff. A total of 78 parking spaces are associated with the bottling plant.
- The FSIL Head Office which has a GFA of 6435m^2 employs approximately 400 employees. Approximately 320 parking spaces are associated with this activity.

A car mechanic, a vacant retail shop and 49 associated car parking spaces are located within the Commercial Local Zone on the southwest corner of the Main North Road and Northcote Road intersection. A warehouse housing Toll NZ bounds the site to the west, St Joseph's Primary School bounds the site to the south of the site and St Bede's College is located at the northeast corner of the Main North Road and Northcote Road intersection. With the exception of the above activities, the surrounding land use is predominantly residential.

Vehicle access to the FSIL site is provided via a Right of Way (ROW) connecting Lydia Street and Main North Road, multiple vehicle crossings located along Main North Road (5 vehicle crossings) and Northcote Road (1 vehicle crossing). All accesses on Main North Road are left in left out only. The surrounding land use and vehicle access arrangement is shown in **Figure 2.3**.

Figure 2.3 Development site and surrounding land use

3. Existing Transport Environment

3.1 Road Geometry

Main North Road

Main North Road which provides primary access to the FSIL Site is classified as a Minor Arterial in the Christchurch District Plan (CDP). In the vicinity of the site the carriageway is 24m wide with two lanes of traffic and a bus lane/ parking lane in each direction separated by a 4m wide raised median (4m). Parking is permitted on the bus lanes outside of 3pm - 6pm (Northbound) and 7am – 9am (Southbound). Generous footpaths are provided on both sides of the road. The posted speed limit in the vicinity of the site has recently been reduced from 60km/h to 50 km/h.

Northcote Road

Northcote Road which provides direct access to the Commercial Local Zone is classified as a Major Arterial in the CDP. In the vicinity of the site the carriageway is 13-14m wide with two lanes of traffic in the eastbound direction and one lane in the westbound direction. Parking is not permitted on either side of the road. Generous footpaths are provided on both sides of the road. The posted speed limit in the vicinity of the site is 50km/h.

Lydia Street

Lydia Street connects the FSIL Site to Northcote Road via a Right of Way (ROW). Lydia Street is a two-way two-lane road with a 11m wide carriageway. The main vehicle access to the Toll NZ site is located at the end of Lydia Street, therefore is generally exposed to a high volume of heavy vehicles. As well as providing access to the Toll NZ site, Lydia Street provides vehicle access to four residential properties. Unrestricted parking is permitted on the eastern side of Lydia Street and footpaths are located on both sides of Lydia Street providing pedestrian access to the residential properties from Northcote Road.

Main North Road/ Lydia Street Right of Way (ROW)

A ROW dissects the FSIL Site and connects Main North Road to Lydia Street. The ROW is approximately 10m wide at the Main North Road end and approximately 9m wide at the Lydia Street end. It forms a priority controlled left in left out only intersection with Main North Road. The ROW provides access to the FSIL Site and Toll NZ site.

Main North Road/ Northcote Road intersection

The signalised four leg intersection of Main North Road and Northcote Road permits all vehicle turning movements with right turn bays and left slip lanes provided on all approaches. Signalised pedestrian crossings are also provided on all approaches. Painted cycle lanes are provided on the north and south approaches. The intersection layout is shown in **Figure 3.1.**

Figure 3.1 Main North Road/ Northcote Road intersection

Main North Road/ Cranford Street intersection

The signalised three leg intersection of Main North Road and Cranford Street permits all vehicle turning movements with right turn bays and left slip lanes provided on applicable approaches. A bus priority lane is located on the south approach. Signalised pedestrian crossings are provided on the south and east approaches and painted cycle lanes are provided on all approaches. The intersection layout is shown in **Figure 3.2**.

Figure 3.2 Main North Road/ Cranford Street intersection

Road Classification

The CDP road classification for the roads in the vicinity of the site are shown in **Figure 3.3**, which shows that the FSIL site has excellent connectivity to the Arterial road network of Christchurch.

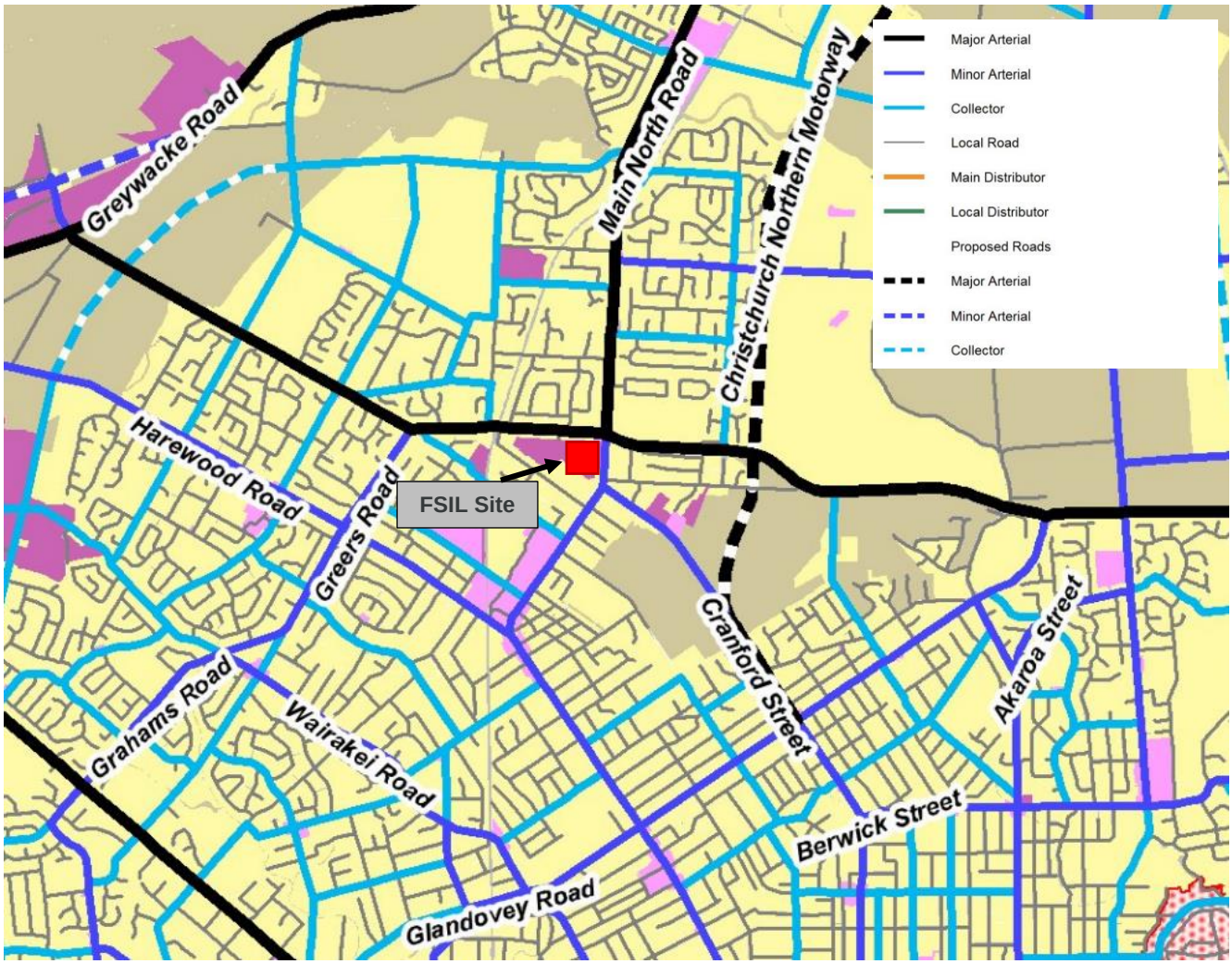


Figure 3.3 CDP Road Classification

3.2 Traffic Volumes

Traffic surveys were conducted on Thursday 8 March 2018 at the Main North Road/ Northcote Road intersection and the Main North Road/ Cranford Road intersection where all traffic movements were recorded. The results are summarised in **Table 3.1.** The daily flow has been sourced from CCC traffic counts.

Table 3.1 Directional Traffic Volumes

Corridor	Direction	Peak Hour (VPH)	Daily Flow (Estimated VPD)
Main north Road	Northbound	1778	20000
	Southbound	1196	20000
Northcote Road	Eastbound	1097	13500
	Westbound	994	13500
Cranford Street	Eastbound	789	10500
	Westbound	1063	10500

The current network operations and performance has been assessed as part of the S-Paramics model which is detailed in **Chapter 8**.

3.3 Public Transport

The FSIL site is well connected by public transport. The bus stop for all northbound/ westbound services is located outside the site. The bus stop for southbound/ eastbound services is located in line with the site across Main North Road. All bus routes with typical headways and bus stop locations are shown in **Figure 3.4**. Bus shelters are provided at the two bus stops on Main North Road.

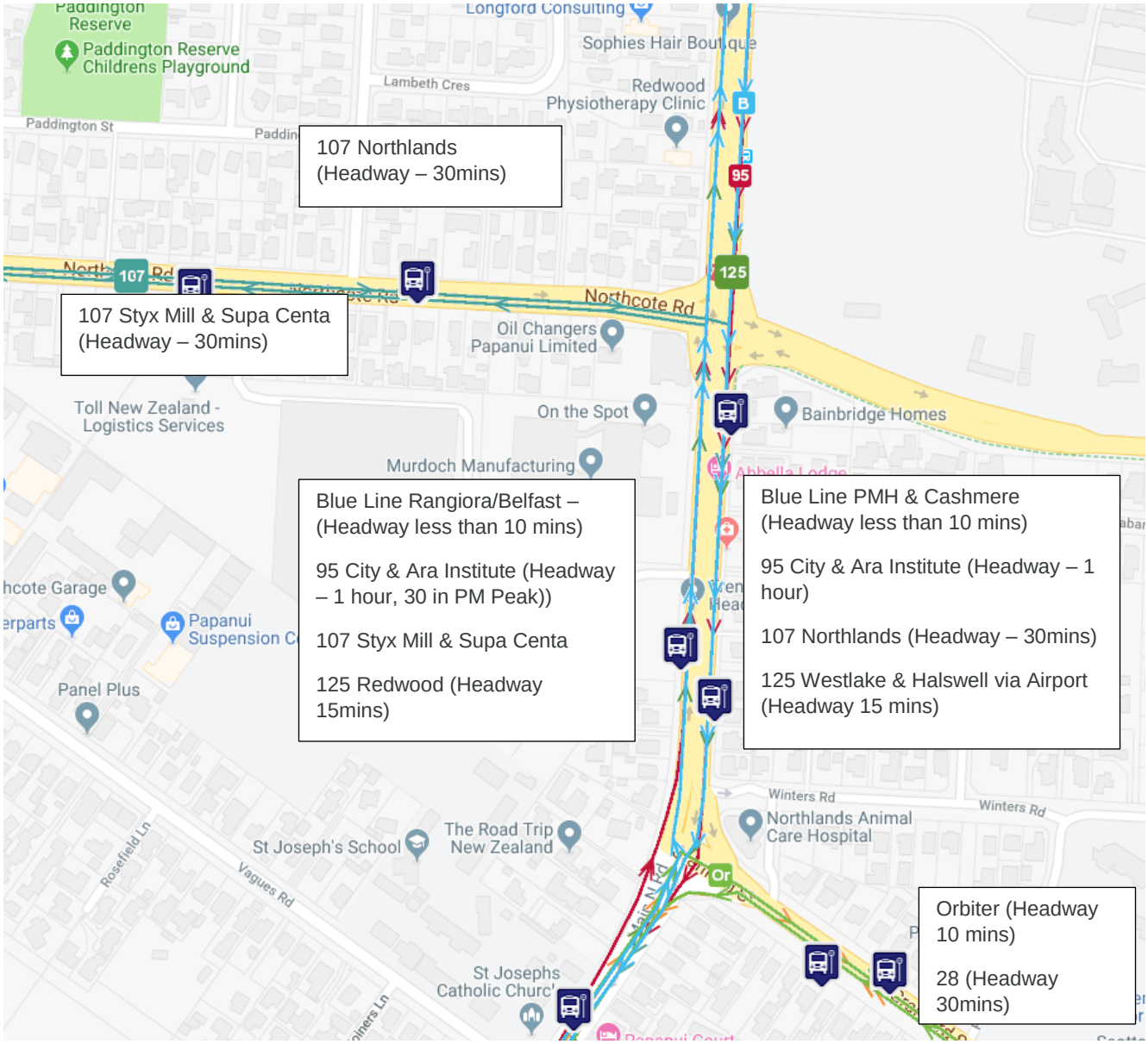


Figure 3.4 Bus routes and bus stop locations

It is noted that when the Paramics model was calibrated for 2018 conditions the Orbiter travelled along QEII Drive in both westbound and eastbound directions to connect Papanui and Shirley. In January 2019 the Orbiter route was permanently changed from QEII Drive to Cranford Street due to local road changes resulting from the Christchurch Northern Corridor (CNC) project.

The Abley team have engaged with Environment Canterbury during the process of preparing this ITA regarding the proposal including consideration of the impact of the new signals on bus services, future bus services along the Main North Road

corridor, the location of bus stops on Main Norther Road and opportunities for bus priority at the new signals. Our team will continue to engage with Environment Canterbury staff throughout the application process.

3.4 Walking and Cycling

Pedestrian footpaths exist on both Main North Road and Northcote Road corridors and formal crossing facilities across Main North Road are only provided at the Cranford Street and Northcote Road signalised intersections.

Cycle routes in the vicinity of the site are shown in **Figure 3.5**. The Northern Line Cycleway which connects Belfast and South Hagley Park and the Central City can be accessed at the Northcote Road/ Vagues Road intersection located less than 1km west of the site. The Papanui Parallel Cycleway can be accessed at the Main North Road/ Sawyers Arms intersection located 700m south of the site. Northcote Road provides a westbound on-street cycleway and cyclists are permitted to use the bus lanes on Main North Road and short sections of painted cycle lane on the approaches to the Main North Road / Northcote Road intersection. The cycle infrastructure in the vicinity of the development site is shown in **Figure 3.5**.

Figure 3.5 Cycle infrastructure in the vicinity of FSIL Site

3.5 Road Safety

To understand the safety performance of the local network adjacent to the FSIL site has been undertaken using the NZ Transport Agency Crash Analysis System (CAS) database over the five year period from 2014 to 2018 (inclusive) and also includes crashes recorded in 2019 year-to-date. Four searches are reported below with crash diagrams and key observations documented.

Main North Road / Northcote Road / QEII Drive intersection

A total of 35 crashes were identified as shown in **Figure 3.6** including:

- 23 Crossing/turning crashes
- 7 merging crashes, five at night and of these five, three were under rainy conditions.
- 62.86% of crashes failed to give way or stop.
- 34.39% of crashes had poor observation

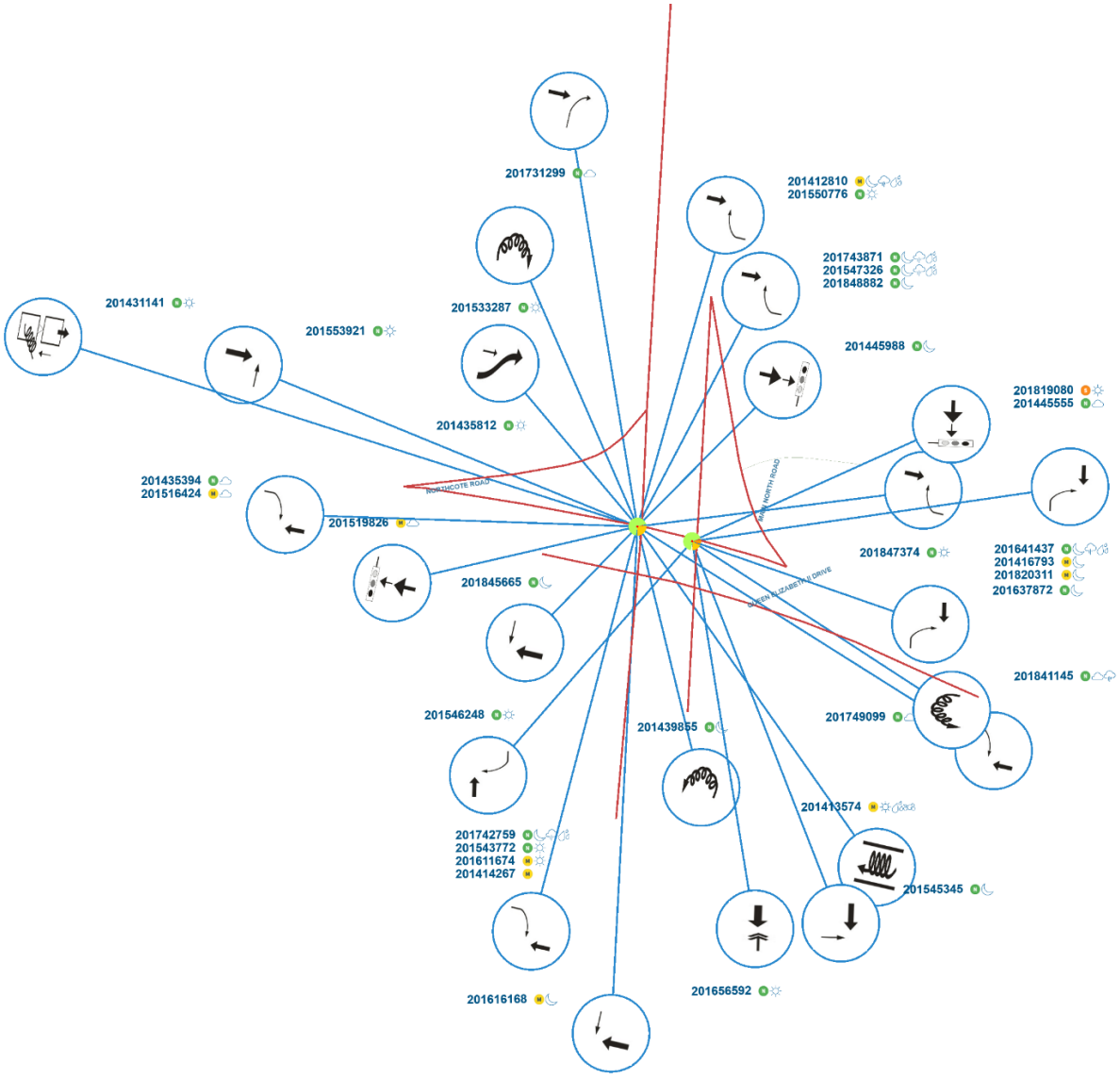


Figure 3.6 Main North Road / Northcote Road / QEII Drive Crash Data

Main North Road / Cranford Street intersection

A total of 17 crashes were identified as shown in **Figure 3.7** including:

- 8 crashes were Rear end/ obstruction type crashes
- 4 were loss of control/head on while another 4 were crossing/turning.
- Biggest two crash factors were poor observation and incorrect lanes or position.
- Most crashes were in light/overcast conditions with 40% being wet conditions.

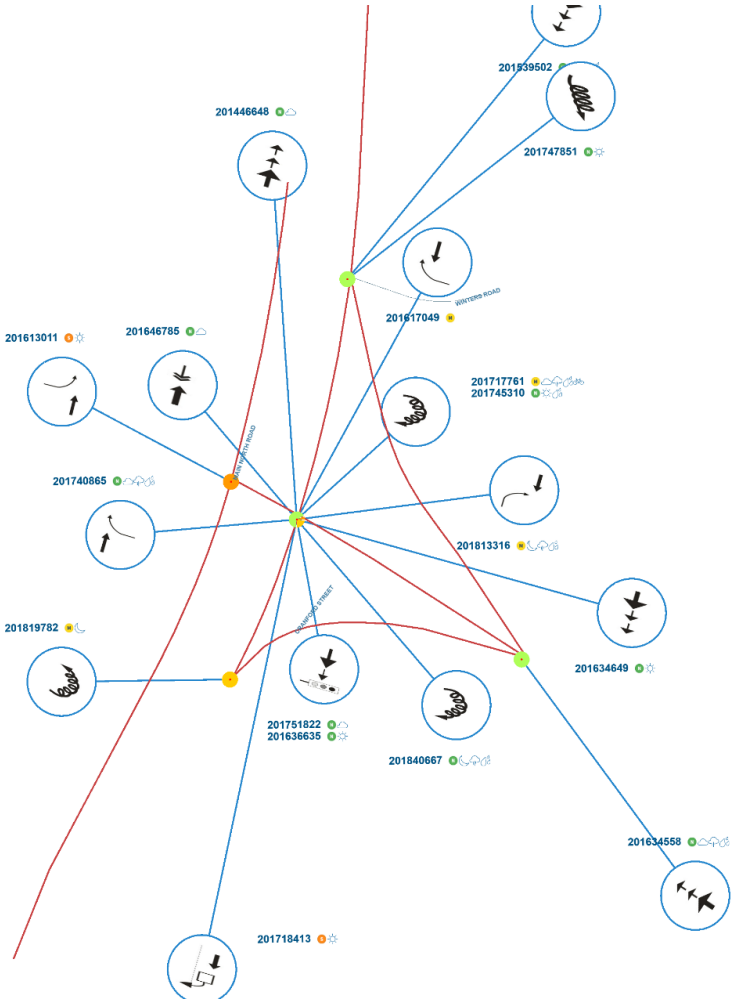


Figure 3.7 Main North Road / Cranford Street Crash Data

Main North Road and Northcote Road corridors

A total of 19 crashes were identified as shown in **Figure 3.8** and **Figure 3.9** including:

- 11 crashes were rear end/obstruction and five were overtaking crashes.
- Poor observation and incorrect lane or position were the main crash factors.
- Most crashes were in light/overcast conditions.
- A further two crashes were identified at the Lydia Street intersection, both rear rend crashes

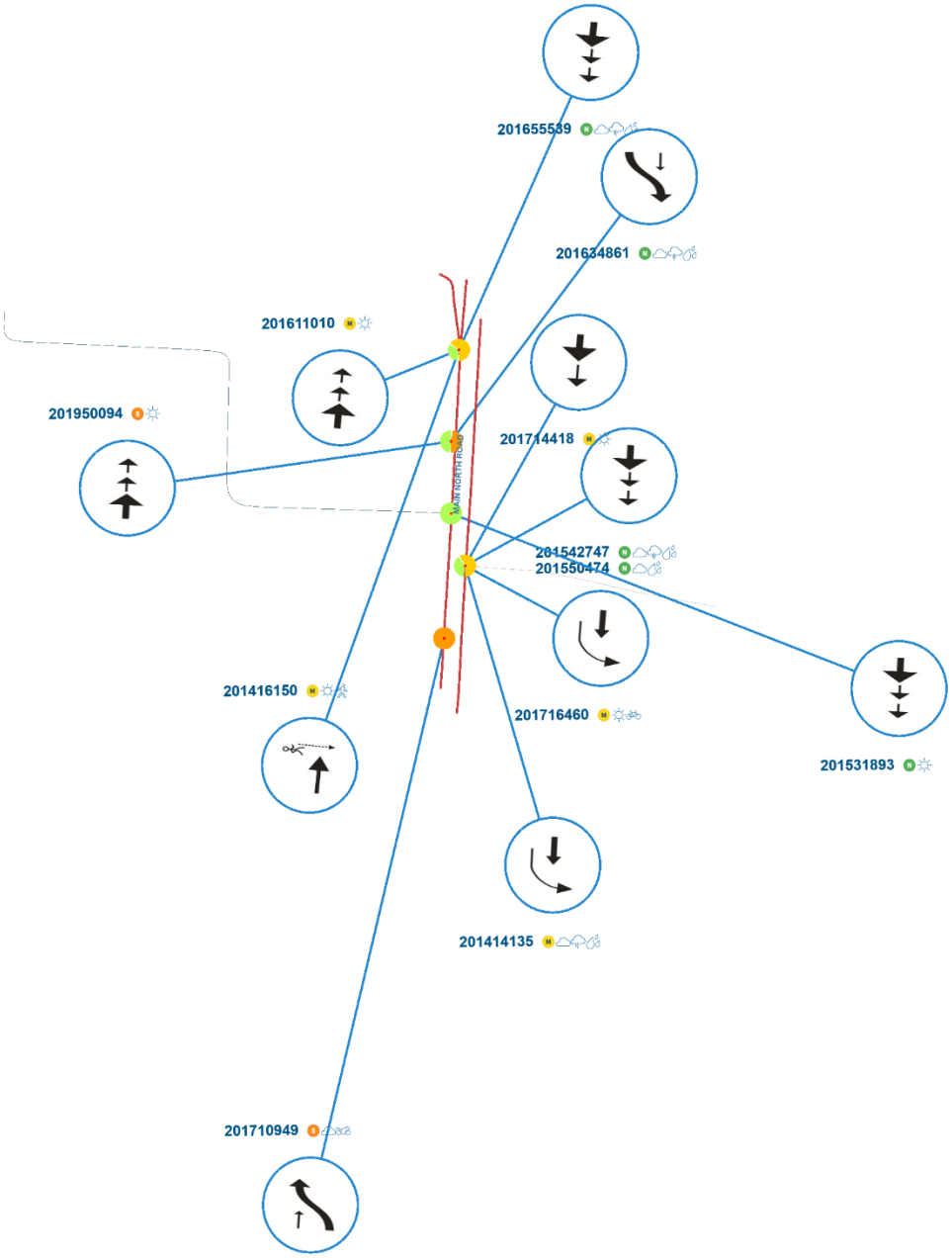


Figure 3.8 Main North Road between Northcote Road and Cranford Street Crash Data

Summary of crash reports

A total of 73 crashes were recorded in the past five years aggregated across the two Main North Road intersections, Lydia Street intersection and Main North Road and Northcote Road corridors between these intersections. Additional investigation of crashes which resulted in fatal or serious injury and crashes involving cyclist or pedestrians have been undertaken and the corresponding crash report are included in Appendix C.

There were no fatalities and six of the 73 crashes resulted in serious injuries. Of these six serious injury crashes:

- Two occurred at each of the Main North Road intersections and two along the Main North Road corridor
- Key crash factors included vehicles following too closely, speeding, failure to give way and attention diverted by other traffic indicating the causes were largely due to driver behaviour

Only one of the 73 crashes involved a pedestrian resulting in a minor injury with a young pedestrian running across Main North Road heedless of traffic. Two of the 73 crashes involved cyclists, both resulting in minor injury, one involving a vehicle travelling too quickly and losing control whilst towing in slippery conditions at the Cranford Street intersection, and the second involving a car failing to give way to a southbound cyclist at the Winters Road access on Main North Road. The above crash figure is considered a relatively low number of crashes involving active road users and there are no consistent themes which isolate a specific risk to pedestrians and cyclists. Improved crossing opportunities on the Main North Road corridor proposed as part of the application would improve active road user's safety.

The large number of reported crashes on the local road environment in the last five years is a reflection of the high vehicle volumes on both the Main North Road and Northcote Road corridors and the level of conflict at the two signalised intersections. Looking forwards there are some mitigating factors to improve safety in the vicinity of the site, some of which are occurring regardless of the proposal and some of which are delivered as part of this proposal. These are as follows:

- The posted speed along the Main North Road corridor and through the two intersections has recently been reduced from 60 kph to 50 kph.
- The CNC will reduce traffic flows along the Main North corridor by 17% (refer section 8.4 for more details).
- A new signalised intersection on Main North Road is proposed to access the FSIL site and this will include crosswalks with full pedestrian protection on both the site access and Main North Road (northern) approaches (refer section 8.9 for more details).
- The operation of the Main North Road / Northcote Road / QEII Drive signals is proposed to be optimised which includes the removal of right turn traffic filtering across two through lanes of traffic on both Main North Road approaches (refer section 8.2 for more details).

The combined effect of the above measures will result in a reduction in traffic volumes, reduction in vehicle speeds, improved safety for pedestrians and removal of right turning conflicts is expected to improve the safety of the road network for all road users in the vicinity of the site.

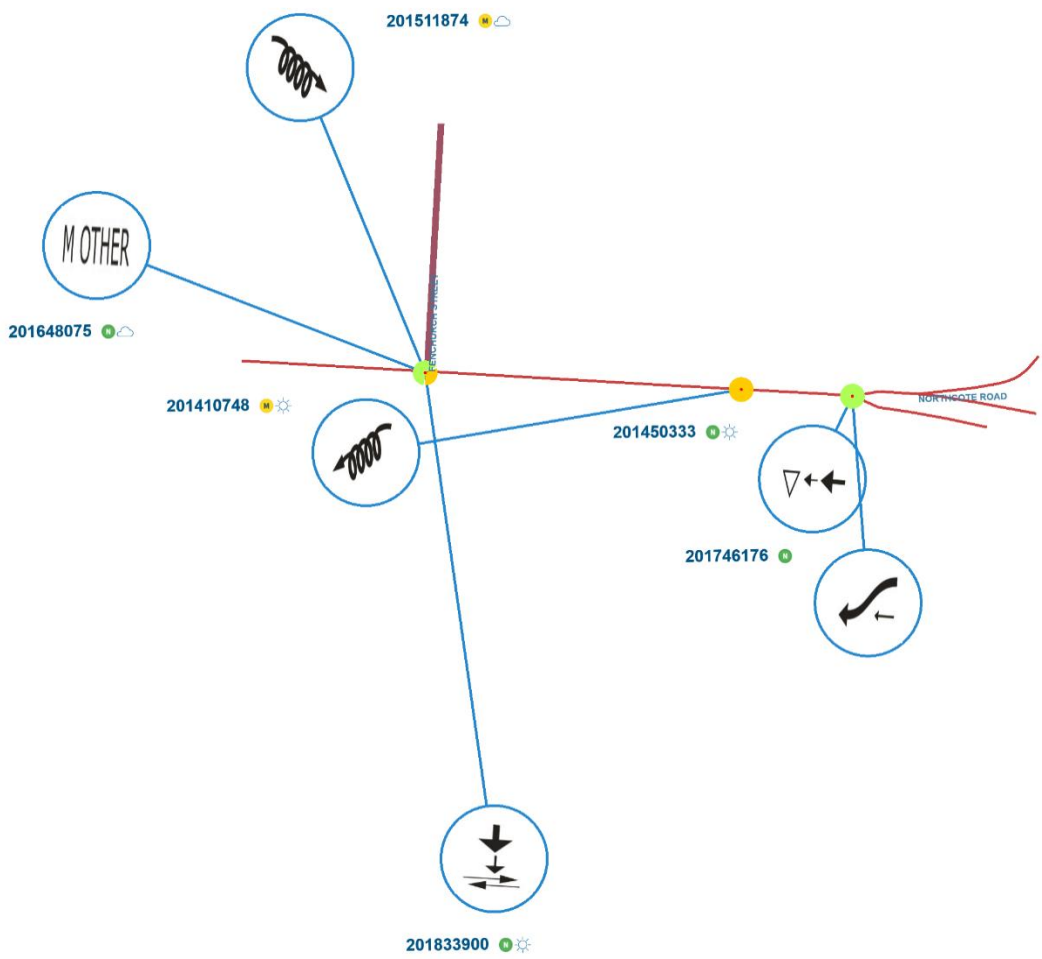


Figure 3.9 Northcote Road from Lydia Street to Main North Road Crash Data

3.6 Consented Developments

There is one major development nearby that has Resource Consent which is the old distribution warehouse at 2 Lydia Street. The consent (RMA92029705) allows for a mix of activities with a shared 370 space car park. The large building will be split into varying sizes and potential activities are likely to include a Gym, Child Care facility, 12 indoor netball courts and a range of indoor entertainment activities such as ten pin bowling, trampolining, climbing walls and laser strike. Consent was granted in November 2015, has not yet been given effect to, and will otherwise lapse in November 2020.

Through the consenting process the Council imposed conditions of consent and the main transport related condition involves the intersection of Lydia Street and Northcote Road. The consent states that prior to the site operating the right turn out of Lydia Street shall be banned and remain so if Northcote Road is four laned in the future. The intersection control will remain as a priority-controlled intersection with either configuration of Northcote Road. Traffic signals are not required as condition of this consent.

As noted previously in this ITA the ownership of 2 Lydia Street has changed, therefore the existing consent is likely to lapse and a school is now expected to be operational on this site in 2023. Please refer to section 3.7 for more details.

The proposed Cranford Basin housing development has been included in the 2031 traffic assessment scenario. Cranford Basin proposes to provide 370 houses within 38 hectares of land located around the Cranford Basin.

3.7 Recent Developments at 2 Lydia Street

At the time at which the modelling work supporting this Integrated Transport Assessment was undertaken unimplemented consent RMA92029705 for a sports development at 2 Lydia Street was considered to form part of the existing environment. While the consent does not lapse till November 2020, it was publicly announced in March 2019 that Marion College intend to occupy the site by 2023. Following this announcement, it is now considered unlikely that this consent will be implemented and is not considered to form part of the existing environment in 2021.

The Catholic Diocese will take over possession of the land in 2021 when the existing lease for Toll Logistics who currently tenant the site will expire. Given Marion College is yet to obtain the necessary planning approvals or designations required to occupy this site, the college cannot be considered to form part of the existing environment in 2021. However, given the recent announcements, it is considered appropriate to provide commentary on how the proposed development would integrate with the proposal for Marion College to be located at Lydia Street.

The school is reported to be expected to be operational in 2023 meaning the sports facility is highly unlikely to be operational at all in the 2021 assessment year. The current tenant of 2 Lydia Street, Toll Logistics, plan to relocate to Hornby in 2020 and the registered owner of the site is now the Roman Catholic Bishop of the Diocese of Christchurch.

In consideration of the most likely use of the site, the 2021 modelling assessment assumes that there is no activity at 2 Lydia Street as the future College is likely to be under construction at that time. Given the modelling was undertaken before this announcement, the 2031 modelling assessment includes activity commensurate with the consented activity (a sports development). This is considered appropriate for inclusion given it is highly conservative, and the sports activity is expected to have a higher level of trip generation during the critical evening peak hour compared to an education facility or any permitted industrial activity that could rightfully occur on the site. It is further noted that the proposal to change the use of the 2 Lydia Street site to include education activity will be subject to its own assessment of traffic and transportation effects at the time at which an application is made accordingly.

For the school to operate out of Lydia Street it is likely that traffic signals will be reconsidered at the Lydia St intersection with Northcote Road to enable staff, students and parents to safely cross Northcote Road to access the facility by all modes of transport. For this reason, we have included traffic signals at the Northcote Road / Lydia Street intersection in the 2031 assessment. Given that much of the analysis behind this revised ITA was prepared prior to these announcements the existing traffic generation activity of the sports facility has been retained for 2 Lydia Street in the 2031 future baseline. By retaining the level of traffic generation associated with an indoor sports centre in the evening peak future baseline, the assessment is highly conservative as the level of trip generation associated with a school is expected to be much lower than that of the current consented activity.

Preliminary modelling has confirmed that the installation of traffic signals at Lydia Street in 2031 is not a requirement to accommodate the proposed supermarket development as there is little right turn demand out of Lydia Street in the evening peak hour. The installation of signals on Main North Road adjacent to the supermarket development provides excellent connectivity to the wider network and therefore the development is not reliant on a right turn out of Lydia Street to access destination to the north or east. This notwithstanding it is recommended that the right turn out of Lydia Street should be banned to ensure safe and efficient operation of the Lydia Street approach to this intersection. The introduction of any new activity with significant traffic and/or pedestrian and cyclist generation at 2 Lydia Street such as a sports development or a school would likely require a safer and high capacity form of intersection control such as signals.

The assessment of effects in 2021 assumes that 2 Lydia Street does not include any activity as it is likely that the current consent will lapse and the proposed school will be under construction prior to opening in 2023. Acknowledging that if the current industrial activity were to remain on site than the network operation is unlikely to change as the combined Toll Driveway and Automated Gate traffic volumes in the evening peak hour is only 11 vehicles two-way which equates to one vehicle every 5-6 minutes and will have no noticeable effect on the network.

3.8 Proposed Transport Upgrades

The Christchurch Northern Corridor (CNC) project is currently under construction and is expected to be operational in 2020. The CNC includes a four lane divided carriageway from the existing northern motorway at the Waimakariri River to QEII Drive with a four lane extension from QEII Drive through to Cranford Street. The completed CNC is included in the 2021 and 2031 modelling assessment.

The CCC Long Term Plan has funding set aside for the four laning of Northcote Road between 2022-2025, however plans for the four laning project are currently on hold and no clear direction is available yet on the final scheme. The four laning of Northcote Road is included in the 2031 modelling assessment only. Further details regarding these assumptions are included in **Chapter 8**.

4. Proposed Development

Description of Proposal

Foodstuffs propose to:

a) establish, operate and maintain a supermarket and associated fuel facility, ancillary offices, car parking, access, signage and landscaping at 171 Main North Road;
b) provide an emergency coordination facility at 171 Main North Road;
c) alter the existing site access and relocate existing car parks for the existing Foodstuffs South Island Limited Head Office; and
d) alter access arrangements for the retail and commercial tenancies located at 3-7 Northcote Road, Papanui, Christchurch.

Key elements of the proposed development include:

Proposed Supermarket

- Demolition of the vacant former industrial and office buildings associated with Murdoch Manufacturing at 171 Main North Road;
- New 6890m² PAK'nSAVE supermarket, with the structural integrity of an IL4 building;
- New PAK'nSAVE fuel facility;
- New infrastructure and utilities to provide for 3 days of self-sufficiency for emergency response, including: sewer and stormwater containment; new waste water and fresh water tanks; and permanent on-site diesel generators;
- Use of an existing on-site well for emergency purposes pursuant to a separate resource consent;
- Piping of the Lydia Street Drain associated with realignment and landscaping of the existing right of way access;
- New signalised intersection on Main North Road providing all movement access to / from the proposed supermarket, existing retail buildings and Foodstuffs Head Office;
- Car parking, cycle parking, site access, vehicle delivery, servicing and on-site manoeuvring arrangements;
- New building and freestanding signage associated with the supermarket and fuel facility;
- Removal of three trees located within the Main North Road median; and
- On-site landscaping.

Existing Foodstuffs Head Office

- No changes are proposed to the existing Foodstuffs Head Office building, with the existing lawfully established activity remaining;
- Relocation of primary car park access point further South on Main North Road as a result of the above proposed supermarket establishment, including new vehicle access arrangements;
- Relocation of six existing car parks;
- Relocation of existing on-site freestanding sign to be adjacent to the new accessway;
- Restrict the south most access to afterhours only; and
- Improved vehicle integration with the wider site

Existing Retail and Commercial Activities at 3-7 Northcote Road

- Retention of the existing retail building and automotive servicing facility located at the corner of Main North Road and Northcote Road;
- Associated car park and access redesign to integrate this site with the proposed supermarket site; and
- Relocation of two existing car parks to accommodate the link to adjacent supermarket site.

Emergency Coordination Facility (ECF)

- Provide for the establishment of a resilience and emergency response function (emergency coordination facility), using both new and existing facilities on the site, including: the Proposed Supermarket, Foodstuffs Existing Head Office and associated site access and car parking.

Future Vehicle Access

Primary vehicle access to the FSIL Site will be via a new signalised intersection on Main North Road. The intersection will provide all turning movements to/from the FSIL Site and are also proposed to include signalised pedestrian crossings on the north and west approaches. No U-turns will be allowed at the intersection.

Due to the location of the new signalised intersection the main access to the FSIL Head Office will be relocated. Therefore, the number of vehicle accesses on Main North Road will not change. No changes to the existing access on Northcote Road or the Lydia Street ROW is proposed. The permissible vehicle movements at all vehicle crossings to the FSIL Site are listed below and locations are shown in Figure 4.1;

- Access 1 – Left in only (existing)
- Access 2 – Left-in/ left out access (existing)
- Access 3 - New signalised access intersection – All turning movements
- Access 4 – Left-in/ left-out access (relocated)
- Access 5 – Left in/ left out access (existing) – after hours only
- Access 6 – All turning movements (existing)
- Access 7 – Left-in/ left out access (existing)

Vehicles Interaction Between Head Office and the Site

FSIL proposes to include changes to the head office shift times as part of the proposal as an initiative to spread the trip generation during the evening peak period. A survey of the Foodstuffs head office on Thursday, 8 March 2018 between 4pm and 6pm shows that approximately 52% of trips generated by the head office occurred over 20 minutes, between 4:30pm and 4:50pm, coinciding with the existing shift ending time at 4.30pm. Foodstuffs head office trip generation has been redistributed between 4:00pm and 5:15pm in the 2021 and 2031 models to reflect the proposed operational changes. The existing and adjusted trip generation profiles are included in **Appendix 1**.

Vehicles exiting the Foodstuffs head office site can access the wider network using access 3, 4 and 5. In response to the safety audit included in Appendix D to this report (refer section 2.5 of Appendix D) concerns were raised that if vehicles exiting Head Office blocked the efficient operation of the internal roundabout adjacent to access 3 this could have the potential to restrict vehicles from turning into the site from Main North Road. It is proposed that no stopping pavement marking be included to ensure compliant use of the roundabout and reduce the likelihood of driver's blocking the roundabout.

The modelling assessment in this ITA has been informed by preliminary runs which have allowed direct access from the Foodstuffs head office to the internal roundabout and have also restricted access. There was no evidence in the model of vehicles blocking the roundabout to the extent that vehicles entering the site from Main North Road would be impeded causing safety issues but it is acknowledged that this is contingent on compliant vehicle behaviour (and a modelling assessment is limited in its ability to mimic widespread poor behaviour). A contingency is that the operation of the internal roundabout could be carefully monitored and if required the head office approach to the internal roundabout could be controlled during periods of high demand where any such non-compliant behaviour is extensive.

To provide a conservative analysis the modelling assessment in this report assumes a worst-case scenario whereby there is a form of control in place to restrict access to the roundabout during the evening peak hour. This conservatively ensures there is sufficient capacity at other site access locations and across the wider site to accommodate head office vehicles at this time.

Future on-site car parking

The proposed car parking changes are summarised in **Table 4.1**. Six car parking spaces will be relocated from the existing ROW to the first aisle of the Head Office car park to accommodate the supermarket vehicle access. Two car parking spaces within the General Retail site will also be relocated to accommodate the internal roundabout.

In summary, 200 new parking spaces will be introduced to the FSIL Site with no changes to the number of spaces provided at the FSIL Head Office or General Retail sites.

Table 4.1 Car parking changes

Car park	Existing	Proposed	Net Change
General Retail (3-7 Northcote Road) (Car park 1)	49	49	-2
Bottling plant / Future PAK'nSAVE site including basement (Car park 2)	78	278	+200
FSIL Head Office Site (Car park 3) including the spaces located along the ROW west of the supermarket	320	320	No change

The proposed site plan is shown in **Figure 4.1**.

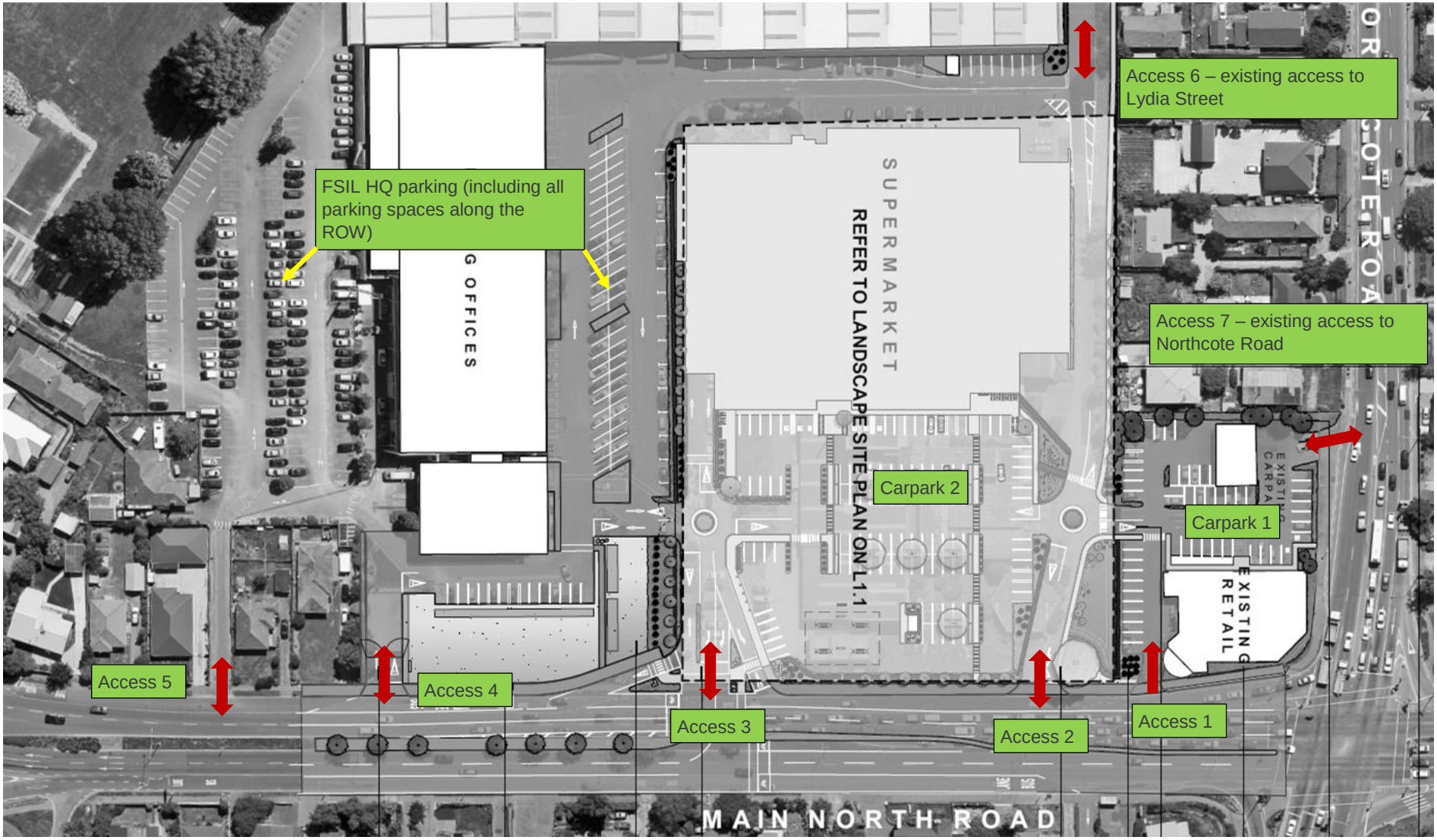


Figure 4.1 FSIL Development Site Plan

5. Integration with Strategic Planning Framework

This section assesses the consistency of the FSIL development with the Christchurch Transport Strategic Plan (2012-2042) (CTSP).

The Integrated Transport Assessment Guidelines September 2015 prepared by CCC states that consistency with the following actions of the CTSP is desired;

- 1.3.1 – Integration of land use;
- 1.3.3 – Influencing travel choice;
- 2.1.2 – Rebuilding suburban centres
- 2.2.1 – Right location, right design, right function, right time
- 2.2.2 – Transit orientated development;
- 2.3.1 – Safer system;
- 4.1.1 – Reshape travel demand to reduce emissions and oil dependence.

Integration of land use; Right location, right design, right function, right time; Land value capture, incentives and promotion of development near public transport

The development is located on a Minor Arterial Road with excellent connectivity to the arterial road network as well as to public transport services. The volume of trip generation expected from the FSIL Site will be appropriate compared to the expected traffic flow of an Arterial road. The property at 2 Lydia Street has resource consent to convert the existing warehouse type activity to a variety of activities such as Gym, Child Care facility, indoor netball courts and a range of indoor entertainment activities, and more recently has been signalled as a secondary school. This provides future opportunity to link trips together to create multi-purpose trips, reducing the impact on the surrounding road network and intersection performance.

Furthermore, a supermarket adjacent to an office activity (FSIL Head Office) that employs approximately 400 staff offers more opportunity for FSIL employees to trip chain and reduce single journey car travel. When the internal road network was designed, consideration was given to ensure that the FSIL Site and the 2 Lydia Street site could work cohesively providing pedestrian and cycle links as well as to promote multi-purpose travel.

Influencing travel choice; Helping people to make informed decisions about available travel choices, Reshape travel demand to reduce emissions and oil dependence; Transit orientated development

The FSIL site is located on an excellent public transport corridor with regular bus services. The FSIL Site also links well with two major cycleways and provides pedestrian connections to nearby facilities. Covered staff cycle parking as well as showers and changing facilities will be provided on site for those wishing to use active travel modes. All staff will be encouraged to use active modes or public transportation to and from work through an employee Travel Plan. The Travel Plan will give each employee details of all alternative travel options, travel times and the benefits of using these modes of travel. The travel plan will support the strategic transport objective of "*People need to know what travel options are available, their benefits and costs in order to make well-informed decisions about the way they travel*".

Electric car charging stations will be provided on-site to encourage electric car usage. Periodic updates to the travel plan will be made to ensure employees are aware of any significant road closures, public transport route changes, cycle and walking infrastructure changes.

Safer systems

The FSIL Site will be consistent with the safer systems approach and will have positive road safety outcomes by;

- Removing the need to perform U-Turn manoeuvres at the Main North Road/ Northcote Road intersection by providing a controlled right turn facility at the new signalised intersection.
- Providing a controlled pedestrian crossing facility on Main North Road linking the FSIL Site to the residential areas to the east and between the northbound and southbound bus stops.
- Consolidating deliveries to minimise heavy vehicle usage and restricting delivery and servicing so that they do not overlap with customer traffic or the network peak.

- Applying Crime Prevention Through Environmental Design principles to ensure a safer environment for all users
- Including safe and clearly marked pedestrian pathways through the site.
- Integrate road safety practices into employee travel plans.

6. Accessibility of the Proposal

This section provides a summary of the accessibility of the development for all users and the suitability of all modes serving the development.

Accessibility Metrics

The CCC Integrated Transport Assessment Guidelines (September 2015) provides a series of maps that can be used to describe the accessibility of a development site. The maps show the site experiences very high levels of accessibility by all modes to employment and Key Activity Centres (KACs) in Christchurch as follows:

- Accessibility to jobs by private vehicle 2016 AM peak – the site is located within the area that has access to more than 100,000 jobs
- Accessibility to Key Activity Centres by cycle 2016 AM Peak – located within 5 minutes duration to the nearest KAC and within 10 minutes to the next nearest KAC.
- Accessibility to Key Activity Centres by Public Transport 2016 AM Peak – located within the 5 minutes duration to the nearest KAC and within 10 minutes to the next nearest KAC.
- Accessibility to Key Activity Centres by Private Vehicle 2016 AM Peak – located within the 2 minutes duration to the nearest KAC and within 5 minutes to the next nearest KAC.

Public Transport

The development site is located on a key bus corridor with frequent services. The new signalised intersection will include a pedestrian crossing which will give customers a safe passage to the bus stop located in the southbound direction. The internal pedestrian connections provide direct and protected (signalised or raised crossings) pedestrian access to the bus stops on both sides of Main North Road.

Walking and Cycling

The site has been designed to ensure that pedestrians can conveniently walk between the developments within the wider site and the adjacent road network. Pedestrian accessibility will be significantly improved by the new signalised crossing across Main North Road. A two-staged pedestrian crossing with a protected pedestrian refuge will be provided on the north approach of the new signalised intersection. Proposed pedestrian connections are shown in **Figure 6.1**. The new pedestrian crossing will increase pedestrian safety which is an appropriate mitigation in reflection of the high collective risk profile (road safety) of the corridor.

The pedestrian accessibility improvements are highlighted in the walking catchment diagrams shown in **Figure 6.2** .and **Figure 6.3**. These diagrams have been produced using a 5km/h walking speed.

The provision of cycle parking and end of trip facilities will encourage customers and employees to cycle.

The car park has been designed in line with Crime Prevention Through Environmental Design (CPTED) principles. All PAK'nSAVE customer cycle parking spaces will be provided along the main façade of the supermarket to provide passive surveillance of bicycles. The car park and areas with pedestrian movement will be lit to an appropriate level to maximise safety.

Vehicle access and parking layouts of the proposal have been compared against the CCC District Plan requirements in **Chapter 9**.

Figure 6.1 Pedestrian connections from/to the proposed site

Figure 6.2 Existing pedestrian catchment

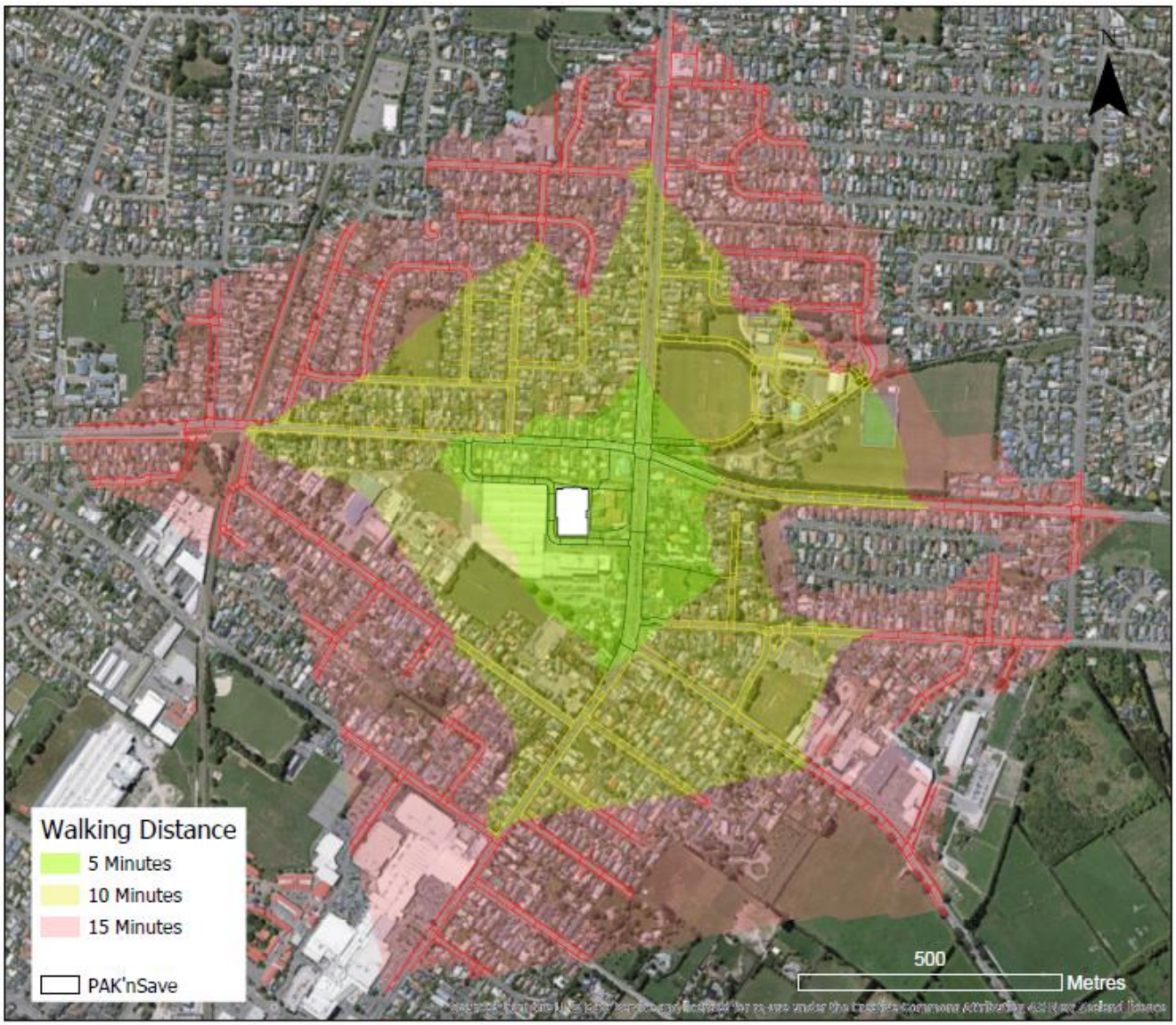


Figure 6.3 Future pedestrian catchment

Emergency Vehicle Access

The FSIL Site is proposed to be used as an emergency response function (emergency coordination facility (ECF)). In an emergency, vehicle access is critical to the operations of the ECF. The FSIL Site has direct access to the Christchurch Arterial Road Network via multiple vehicle crossings located on Main North Road and Northcote Road. Being part of the Christchurch Arterial Road network, it is anticipated that these roads would receive immediate attention from CCC following a disaster event as they are the most critical roads in the road hierarchy in terms of their movement function. Therefore, this site, at the intersection of two arterial roads, is well located in terms of access to the strategic road network post event.

Three vehicle accesses (two on Main North Road and the Lydia Street ROW) can be used by a 19m semi-trailer to access the loading area and car park during these times.

Helicopter access to the ECF may be necessary. As the type or dimensions of helicopters that would be used at the ECF are unknown a dedicated helicopter landing area cannot be established. However, the centre of the PAK'nSAVE car park would have an area (a diameter of 35m) that could be clear of any obstructions (no wheel stops/ planter boxes) to ensure a helicopter could land if or when necessary. There are also appropriate places for landings on adjacent properties such as St Bede's College playing fields.

7. Travel Characteristics and Trip Generation

7.1 Vehicle Trip Generation

The Trips Database Bureau (TDB or TRICS) which is New Zealand's pre-eminent source of trips and parking information for land use activities has been referred to source trip and parking rates for the supermarket. The TDB records shows that the average peak hour trip generation for supermarkets is 15.7 vehicle trips per 100m^2 GFA (excluding double counts of sites) and typically a trip rate of 15 vehicle trips per 100m^2 GFA would be assumed for supermarkets in the range of 3000 to 5000 sqm GFA, however for those sites which have been surveyed post-2005 there is a very clear relationship between trip rates and supermarket GFA as shown in **Figure 7.1** below.

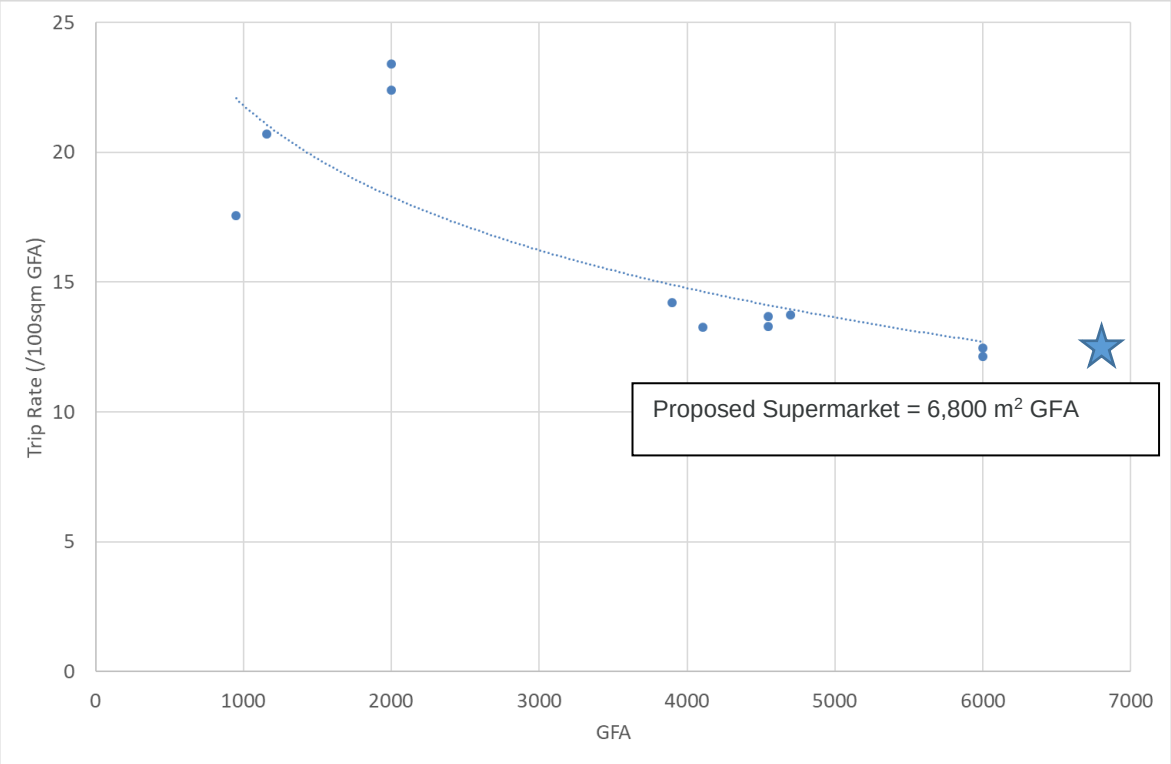


Figure 7.1 Relationship between trip rate and supermarket size

The two surveys of supermarkets of greater than 5,000 sqm GFA that are available within the TDB database both correspond to the Wainoni Pak'n Save in Christchurch and were recorded on 18 May 2010 and 7th July 2011 with peak hour trip rates of 12.13 and 12.47 trips per 100sqm GFA respectively. Pak'n Save Wainoni was 6000 sqm GFA which is smaller than the proposed supermarket in this application. Therefore, adopting a trip rate of 12.5 trips per 100sqm GFA for the proposed supermarket is conservative as it is higher than the two Wainoni surveys and relates to a larger supermarket.

There were four further supermarket surveys for medium size supermarkets in the range of 4,000-5,000 sqm GFA.Two surveys were from a Countdown in Church Corner, Christchurch, one is a Pak'n Save in Tauranga and the final supermarket was a New World in Rolleston. The peak hour trip rates associated with these four surveys were in the range 13.25-13.74 trips per 100sqm GFA. Acknowledging that these four surveys relate to much smaller supermarkets and that there is a clear inverse relationship between supermarket size and trip rate as evidenced in Figure 7.1, the average across all six supermarket surveys greater than 6,000 sqm GFA in 13.09 trips per 100sqm GFA which is only slightly higher than the 12.5 assumed in this application for a supermarket which is nearly 13-65% larger in floor area than the supermarkets from the six surveys.

It is anticipated that the fuel court will generate approximately 15 trips per fuel pump however as the fuel court for this site is associated with the supermarket 95% of the fuel court trips are likely to be linked to the supermarket. Foodstuffs South Island has provided data from other supermarkets with a fuel court which shows that 95% of all customers at fuel courts are also customers of the adjacent supermarket.

The *'NZTA Research Report 453 Trips and parking related to land use'* has been examined to identify the anticipated trip generation of the general retail land uses of the FSIL Site. A trip rate of 18.9 vehicle trips per 100m2 per hour has been applied to the General Retail/ Motor Servicing land use (3-7 Northcote Road) of the FSIL Site.

The office (FSIL HQ) land use of the FSIL Site has been excluded from this analysis as no changes to the office floor area or number of employees is proposed.

The proposed supermarket development is therefore estimated to generate approximately 860 trips in the peak hour, which are evenly split between inbound and outbound trips. Similarly, the general retail activity is estimated to generate 146 two - way trips in the peak hour.

The FSIL Site is currently occupied by a number of land uses and this composition is expected to change with the new proposal. The application of the trip generation of each component is summarised in **Table 7.1**

Table 7.1 Development trip generation

Land Use	GFA/ Units	Baseline Trip Generation (existing)	Trip Rate	Future Trip Generation
General Retail	774m^2	Vacant property therefore not included	18.9 per 100m^2	155 two-way trips added
Motor Servicing	277m^2	Included		No change
Bottling Plant	5700m^2	Included		No change (minimal)
FSIL Head Office	6435m^2	Included		No change
PAK'nSAVE	6890m^2	-	12.5 per 100m^2	870 two-way trips added
Fuel Court	8 fuel pumps	-	15 per pump	6 two-way trips added
Total new trips	-	-	-	1031 two-way trips added

Note: Trip generation is from the translated CAST Two-hour demand matrices so differ slightly to the proposed rates

Traffic generating activities have a range of different trip types associated with them with a proportion of trips being new to the road network. New developments, such as the one proposed, provide an alternative source of similar activities nearby so a proportion of trips can be associated with trips already being made on the network. These trips are known as pass-by for trips travelling past the proposed access point and diverted trips for trips in close proximity to the site but not directly passing. The CCC development contributions policy from 2009 sets out the proportion of trips for different activities into three categories being primary trips (new), diverted trips and pass-by trips.

The split of trips for the different activities proposed are shown in **Table 7.2** as well as the total number of trips associated with those categories. The lack of retail outlet for the petrol station and associated linking with the supermarket as described earlier means the remaining 5% have been added to the supermarket pass-by component.

Table 7.2 Development trip types and proportion (CCC Development Contribution Policy 2009)

trip type	Primary	Divert	Pass-by
PAK'nSAVE Supermarket	20%	50%	30%
	174	435	261
Petrol station (typical %)	5%	20%	75%
	0	0	6
General retail (3-7 Northcote Road)	20%	50%	30%
	31	78	46
FSIL Site	205	513	313

The mix of primary, diverted and pass by trips draws directly on the rates quoted in the CCC Development Contribution Policy 2009 (20% primary, 50% diverted, 30% pass by). A recent University of Canterbury research project undertaken by Nairn and Steedman (2015) surveyed the trip types for five Christchurch supermarket and found that during the evening peak hour the average split across all sites was more even at 34% primary, 32% diverted and 34% pass by.

The percentage of diverted and pass by trips (collectively) is expected to be much higher given the site fronts onto a main arterial (Main North Road) and a number of other arterials are in close proximity to the site (Northcote Road, QE II Drive and Cranford Street). For this reason, a lower percentage of 20% primary trips is considered to be more appropriate.

The split between divert and pass by trips at this location is somewhat subjective given that the development is located adjacent to a major north-south arterial and a major east-west arterial. Nairn and Steedman (2005) conclude that the percentage of diverted trips is greater for those sites with a neighbouring arterial in close proximity which further validates the higher-than-average percentage of diverted trips included in our the ITA.

The split of trips to include within the modelling are 20% primary, 50% diverted, 30% pass by. The effects of the anticipated trip generation on the wider transport network is discussed in **Section 8.**

7.2 Other Transport Modes

The TRICS New Zealand and Australia online trip and parking database was examined to understand the likely pedestrian, cyclist and bus passenger trip generation of the development. TRICS included three supermarket sites in Christchurch which presented an average of 74% car driver, 2.5% car passenger, 19.5% pedestrian, 2.5% cyclist and a 1.5% bus passenger mode share.

The supermarket is the only new trip generator within the development therefore the demand from other activities is expected to be as per existing. The supermarket is expected to generate 870 two-way vehicle trips (refer **Table 7.1**) in the evening peak hour which accounts for 74% mode share, the supermarket is anticipated to generate approximately 233 pedestrian movements, 31 cycle movements and 18 bus passenger movements in the evening peak hour. The site is located with excellent pedestrian connections as shown in **Figure 6.1** therefore the anticipated pedestrian volume can be accommodated. The footpath on Main North Road is 3m wide along the supermarket frontage which provides ample capacity for the anticipated pedestrian movements. The pedestrian refuge will be 5m by 2m which allows two-way pedestrian flow and ample capacity to accommodate a group of pedestrians. Cyclists will have access to two major cycleways within 1km from the site.

The site is also serviced by four bus routes with the B line being the most frequent service, operating with a headway of 10 minutes in both directions in the peak hour. Overall there are approximately 20 bus services passing through the site in the peak hour. The anticipated bus passenger trip generation is less than one passenger per bus therefore is considered minimal impact on bus capacity.

7.3 Parking Supply and Demand

Car parking will be provided across the FSIL Site with internal connectivity, however certain car parking areas will be restricted for the use of a specific activity. The PAK'nSAVE supermarket will provide a total of 278 car parking spaces (note that 78 spaces currently exist on this portion of the site). 168 of these spaces will be located within the underground car park with another 110 located at ground level. A total of 8 mobility car parking spaces will also be provided split between the two car park levels.

Six of the existing FSIL head office parking spaces will be relocated from the ROW to the first aisle of the FSIL Head Office car park due the vehicle access changes. These spaces will only be used by Head Office employees and visitors as the car park has been designed in a way that discourages supermarket customers from using the car park. Steel swing gates will be used to close the car park outside of office hours to ensure safety and amenity is preserved.

There will be no changes to the Head Office site activity. The existing parking supply of 49 spaces at the General Retail activity will be kept the same by relocating 2 spaces within the site.

Vehicles exiting the Foodstuffs head office carpark can access the wider network either directly onto Main North Road or via the internal roundabout located adjacent to the supermarket and proposed Main North Road signals. They can also connect to the wider network. More details regarding the access arrangements is included in **Figure 4.1**.

7.4 Servicing and delivery arrangements

The supermarket will be serviced by approximately 25-30 deliveries a day (50-60 vehicle movements a day). A breakdown of the expected delivery vehicle types is shown in **Table 7.3**. In order to minimise the conflict between delivery vehicles and customer vehicles, all heavy vehicle deliveries to the site will take place outside the peak customer hours of 3pm – 6pm.

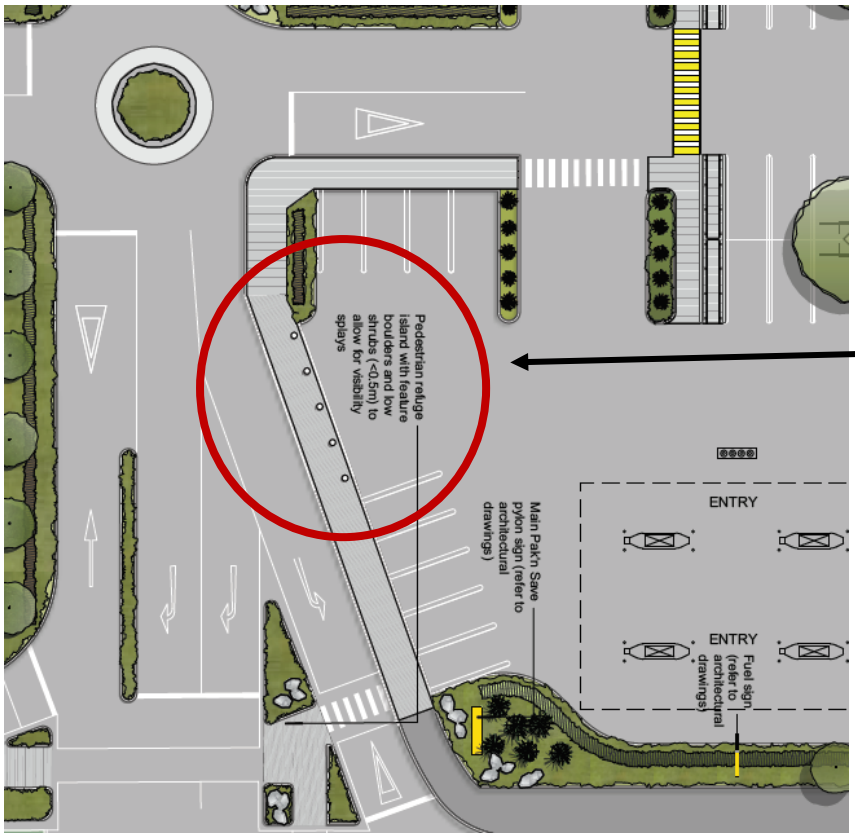
Table 7.3 Delivery vehicle types and movements

Delivery/Service Vehicle Type	Number of Vehicle Movements	% Vehicles
Heavy Truck & Trailer	4	7%
Semi & Trailer	8	14%
Medium Truck	22	39%
Light Truck	8	14%
Van	14	25%
Total	56	100%

The supermarket will be serviced by two service/ delivery yards as shown in **Figure 7.3**. All delivery trucks except fresh produce deliveries will use the main service/ delivery yard canopy located along the northern boundary of the supermarket. All delivery vehicles will enter the site and the loading dock in a forward gear and exit the loading dock and the site in a forward gear. The swept paths of a semi-trailer (largest vehicle expected to service the site) accessing the service yard is shown in Appendix B. The fresh produce truck will travel along the western façade of the building to a loading dock located at the south west corner of the site and turn around (3-point turn) as shown in Appendix B.

The swept paths of a fuel tanker accessing the site is shown in Appendix B. The fuel tanker will enter the site via the Lydia Street ROW and exit via the signalised intersection using the fuel tanker only exit shown in **Figure 7.2**. It should be noted that the fuel tanker will access the site outside of the supermarket operating hours to eliminate any conflict with customers. It is recommended that the applicant includes a consent condition restricting fuel tanker movements to be outside of supermarket operating hours.

Figure 7.2 Removal bollards at fuel tanker exit



The fuel tanker will exit via an exclusive access which will not be available for customers using removable bollards or a gate

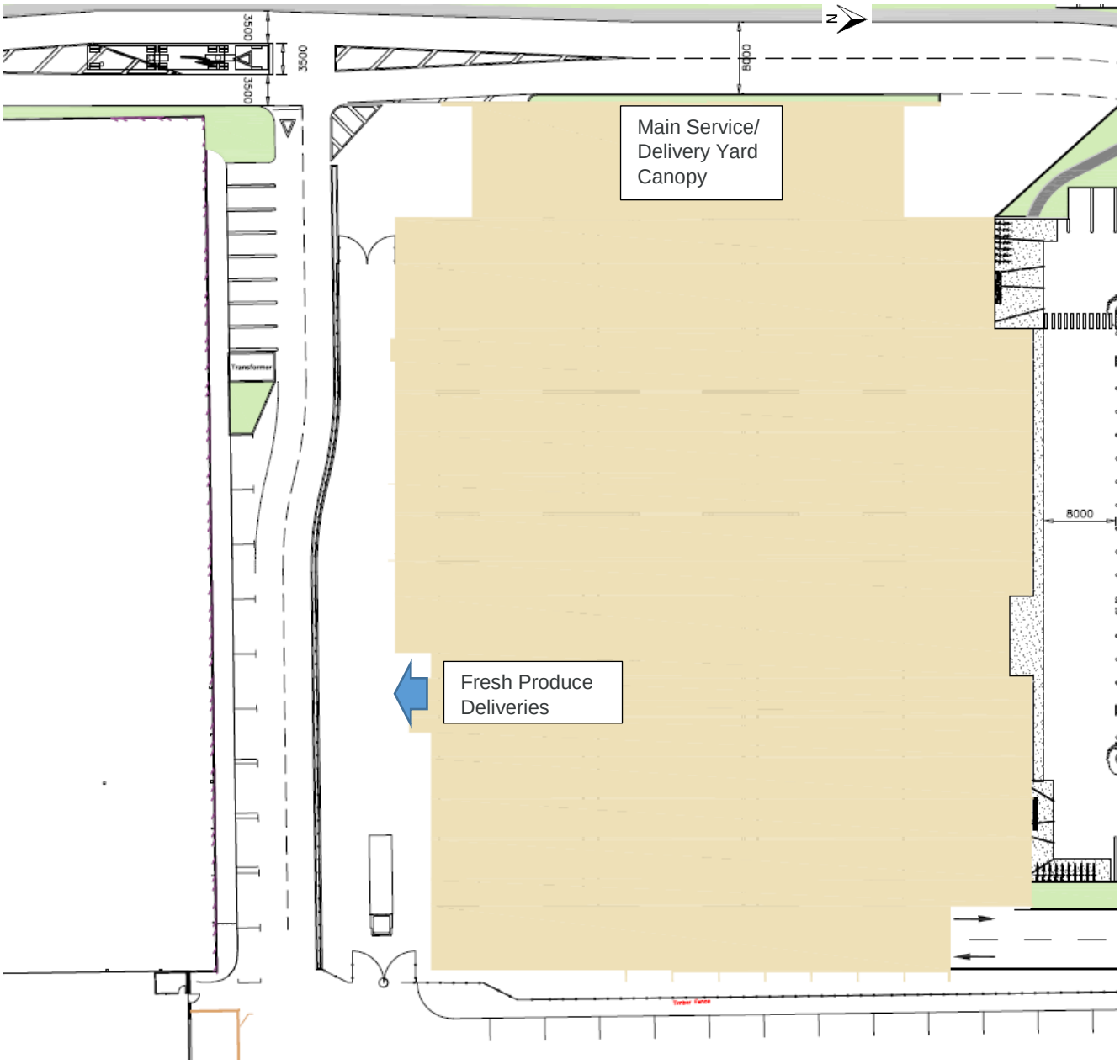


Figure 7.3 Delivery/ servicing yard locations

8. Transport Modelling Assessment

8.1 Introduction

The section of Main North Road adjacent to the site is heavily congested in the northbound direction during the evening peak period and is one of the issues that the CNC is proposed to remedy. The queuing on the section between Cranford Street and Northcote Road is essentially the bottleneck for commuting trips leaving the City in the evening and once the queue extends back to Cranford Street the other approaches to the intersection breakdown due to reduced downstream capacity.

To enable the adequate assessment of effects of the road network to be understood a microsimulation model has been set up in s-Paramics (Paramics). The model covers an area large enough to reasonably reflect the current extents of congestion and to enable realistic route choice to and from the existing site from the surrounding areas noting the restrictive left in and out configurations on the existing Main North Road access points.

The Paramics model has been developed with the following scenarios:

- 2018 Base
- 2021 Base (includes CNC)
- 2021 with Proposed Development
- 2031 Base (includes current 2 Lydia Street consented activity)
- 2031 with Proposed Development

The model periods for all the model scenarios include the following, except for the 2018 Base scenario where the morning peak period is not included:

- Morning peak period (7am to 9am)
- Evening warm-up period (3pm to 4pm)
- Evening peak period (4pm to 6pm)

The setup of the models and calibration is described in more detail in Appendix A. This includes how the demands for the model have been developed for the base year. The future (2021 and 2031) demands or trip matrices for the peak periods were obtained from the Christchurch Assignment and Simulation Traffic Model (CAST) by way of a sub-area extracted from the wider CAST model. Appendix A provides more detail on this.

The Abley team undertook an extensive review of the validation of the base year CAST model in the vicinity of the proposal as well as a review of the robustness of the future forecast models. This involved providing feedback to the Council modelling team and several elements of the CAST model were corrected, improved and refined to ensure that it is fit-for-purpose to inform the Paramics model supporting this assessment.

Council and Abley agreed that the CAST model is appropriately calibrated and validated in the vicinity of the site to support this assessment although the CAST base year model has too much traffic in the evening peak turning right from Main North Road into Cranford Street. This means that the cordons passed to Paramics will over-predict the demand for this movement and the subsequent modelled performance of the Main North Road / Cranford Street signals in both CAST and Paramics model will be worse than is likely to occur in practice. This provides for an overly conservative set of modelling results with respect to delays at the Main North Road / Cranford Street signals in the evening peak.

Paramics model outputs will vary from one model run to the next because of the inherent stochastic assignment process. The modelling assessment has been based on three consecutive model runs.

The demands from CAST show that the morning peak hour is from 8:00am to 9:00am while the evening peak hour is from 4:30pm to 5:30pm. The evening peak hour is the critical scenario as the demands are higher than the morning peak hour demands. This section provides a summary of key intersections' performance for the evening peak hour for the five model scenarios. The key intersections are:

- Main North Road/ QEII Drive/ Northcote Road

- Main North Road/ Cranford Street
- Main North Road/ Vagues Road
- Main North Road/ Sawyers Arms
- Northcote Road/ Lydia Street
- Northcote Road/ Vagues Road
- New signalised site access on Main North Road (for scenarios with the proposed development)

One of the key metrics reported is the Level of Service (LOS) at an approach level and overall at each intersection. Typically, in assessments of intersections in peak demand periods the industry best practice is to keep the operation of an intersection at or below LOS D. A general description of level of service is shown in **Table 8.1**.

Table 8.1 Level of Service (LOS) general descriptions

Level of Service Band	General Traffic Flow Description
LOS A	Primarily free-flow operation
LOS B	Reasonably unimpeded operation
LOS C	Stable operation
LOS D	A less stable condition in which small increases in flow may cause substantial increases in delay and decreases in travel speed
LOS E	Characterised by unstable operation and significant delay
LOS F	Characterised by flow at extremely low speed. Congestion is likely occurring at the boundary intersections, as indicated by high delay

In conjunction with the network performance, the model operation has been reviewed to assess the impact of the proposed changes and identify any operational issues such as queue propagation on intersection approaches affecting capacity and queue discharge at nearby intersections. Performance of the road network in each of the scenarios is described below with a summary at the end of the section.

8.2 Traffic Signal Optimisation

During the RSA process the storage of the right turn bay to enter the site was reviewed and safety concerns raised around the modelled queue lengths and potential for them to block the median side southbound lane on Main North Road. The RSA and response in Appendix D has more detail on this. To lengthen this lane the right turn bay from Main North Road into QEII Drive would need to be shortened but the base models generally showed this bay to be well utilised due to the high right turn demand in the evening peak. This right turn movement required significant green time to ensure that queues from the right turn bay did not propagate back and cause issues upstream like the current through movement does.

The future turning movements at the Main North Rd/QEII/Northcote Rd intersection were analysed and it was deemed appropriate for the northern and southern approaches of Main North Road to be given separate phases. This enables the lane allocation to be changed on the approaches to improve the balance of vehicles in each lane during peak times. To achieve this the middle lane which is currently an exclusive through lane can be transformed to a share through and right turn lane. This spreads the flows and queues more evenly across the lanes and allows the phase times to be rationalised acknowledging that traffic volumes on the northern approach to the intersection reduce significantly after the CNC is operational. Introducing exclusive phases for the Main North Road northern and Main North Road southern approach also removes right turn filtering across multiple lanes which is an existing road safety issue at this intersection.

For the reasons outlined above the 2021 and 2031 modelling assumes that Main North Road northern and southern approaches will operate as separate phases with no right turn filtering occurring and the southern approach is reconfigured from the current two through lanes and one exclusive right turn lane to an exclusive through, shared through-right and exclusive right turn lane.

The resultant improvement in the safety and efficiency of the intersection means that the northbound right turn bay has much less queuing enabling the length of the right turn bay to be shortened, and has in turn enabled this space to be reallocated to

provide a generous length of southbound right turn bay at the site access signals on Main North Road. This is shown on the site plan included in Appendix B.

To enable the new phasing in the SCATS signal control system the main phase (Phase A or the stretch phase) would need to be reconsidered. Earlier discussion with Council indicated that the Northcote Road/QEII Drive corridor would become an important route for CNC access so the stretch phase could be reassigned to the eastbound/westbound through movement traffic phase. The new phasing arrangement was presented to CCC at a meeting on 29 April 2019 and was well received, However, it is noted that further discussion with Christchurch Transport Operations Centre (CTOC) staff is required.

It is noted that the performance of this intersection is sensitive to the allocation of green times on each of the phases and to the overall cvcle time. The intersection currently runs with a relatively short cycle time of 85 seconds during peak periods and it is noted that many large intersections in urban areas would run at 120 seconds or potentially more during peak times. A longer cycle time increases the capacity of an intersection as there is proportionately less all red (and inter-green) time and extending the cycle time will be an effectively way of catering for more demand in the future. To be conservative the modelling assessment presented in this ITA maintains the current 85 second peak period cycle time which is considered to be relatively short for an intersection of this type.

As requested by CCC, vehicle tracking was undertaken to investigate the viability of two vehicles turning right simultaneously. A 23m B-Double truck side by side with an 8m medium rigid truck was tested. Preliminary tracking shows that that the two vehicles can turn side by side with adequate clearance. However, it is noted that tracking was undertaken on an aerial image and that it should be undertaken on a topography survey for accurate results.

8.3 Treatment of Northcote Road / Lydia Street Intersection

Preliminary modelling demonstrated that delays for right turning traffic out of Lydia Street were unacceptable and that the right turn out should be banned or a controlled intersection introduced at Northcote Road / Lydia Street. Banning the right turn out of Lydia Street results in previously right turning traffic turning left instead and then travelling southbound via Vagues Road or Sawyers Arms Road to access the wider network, or results in higher flows through the current right of way to access the wider network. The supermarket activity will have direct access to Main North Road with full turning movements available at the new signalised intersection adjacent to the supermarket. On this basis it is recommended that supermarket traffic using the right of way to access the wider network be limited to vehicles turning left out of or right in to Lydia. Banning the right turn out of Lydia Street is the only treatment required at the Lydia Street and Northcote Road intersection to support this proposal.

In the longer term it is anticipated that with development of additional activity on the 2 Lydia Street site and the four laning of the Northcote Road corridor a fully signalised intersection at Northcote Road and Lydia Street is considered likely to be required to enable safe and efficient vehicle, cycle and pedestrian movement directly from the Lydia Street site. The 2031 model makes this assumption and includes a signalised intersection. For clarity, the proposed supermarket activity does not facilitate the need for a signalised intersection at Lydia Street.

Preliminary modelling indicated that additional traffic on the 2 Lydia Street site which would correspond with the current consented activity (a sports development) would increase the number of left turners out by approximately 110 vehicles per hour (less than two vehicles per minute) and right turners in by 50 vehicles per hour (less than one vehicle per minute) in the evening peak. The total increase in delay for left turners out was two seconds and for right turners in was 14 seconds deteriorating from LoS D to LoS E. As discussed in section 3.7, the level of traffic in the evening peak associated with a sports development is significantly higher than that associated with an education facility or industrial activity, and it would be expected that the Northcote Road / Lydia Street intersection would benefit from the introduction of signal controls to support additional activity on the Lydia Street site

8.4 2018 Base Year

The general operation of the base network has been described in the calibration section in Appendix A. This part of the Christchurch road network is well known for long delays and queuing associated with the weekday commuter peak periods. The PM peak hour volumes on the network are shown in **Figure 8.1** with peak hour traffic volume on Main North Road, within the site frontage, at approximately 2,900 two way vehicles per hour (vph). The operational metrics of the key intersections of are detailed further in this section.

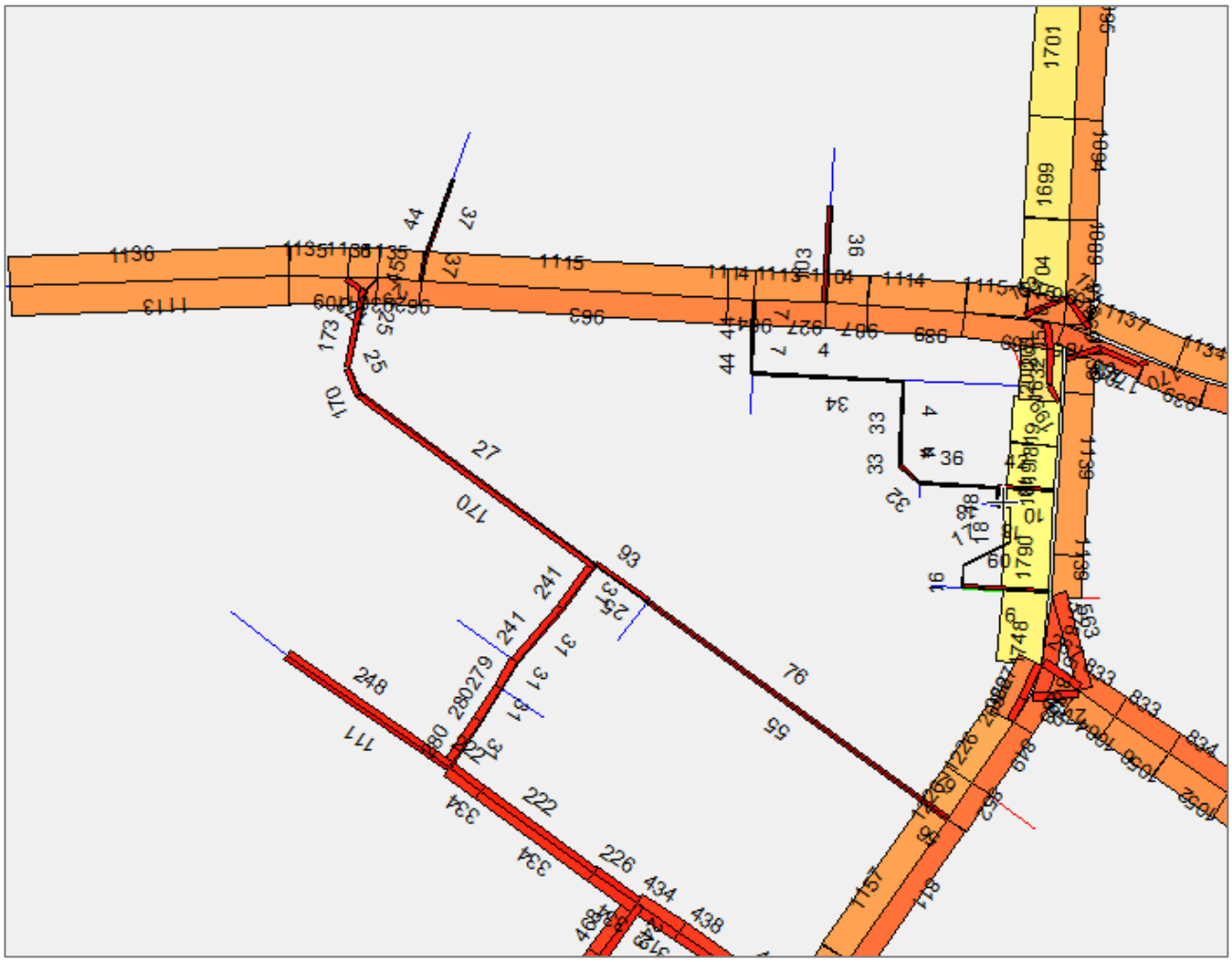


Figure 8.1 2018 Base volume plot - PM peak hour

The travel times along key routes are shown in **Table 8.2**. The main northbound movements suffer the worst excess travel time of 3 minutes and 19 seconds extra on the Main North Road route and an additional 5 minutes and 45 seconds on the Cranford Street Route. The eastbound movement does not fare much better with 2 minutes and 55 seconds excess travel time for the route along Northcote Road.

Table 8.2 2018 Network Travel Times

Route	Movement	Average Travel Time (seconds)	Modelled Minimum Travel Time	Average Excess Travel Time
Main North Road to the North	Northbound	263	64	199
	Southbound	221	119	102
Cranford Street to the North	Northbound	448	103	345
	Southbound	127	49	78
QEII Drive – Northcote Road	Eastbound	248	73	175
	Westbound	137	80	57

Queue propagation of northbound traffic on Main North Road at the Main North Rd/QEII Dr/Northcote Rd intersection affects capacity and queue discharge at downstream intersections resulted in poor LOS for northbound movements on Main North Road and turning movements onto Main North Road from the side roads. Poor LOS is expected for eastbound movements on Northcote Road during the evening peak hour. This is due to the eastbound queues on Northcote Road extending from

the Main North Road/ QEII/ Northcote intersection beyond the Northcote Rd/Lydia St intersection and reaching the Northcote Road/ Vagues Road intersection at times

8.5 2021 Future Year

The 2021 future network assumes the CNC will be operating reducing the traffic demands on the Main North Road and Cranford Street corridors. The 2021 base evening peak period (4pm to 6pm) demands show a total of 11,948 trips on the network. This is a 2.4% reduction when compared to the 2018 evening peak period (4pm to 6pm) demands of 12,236 trips.

There are significant improvements from the 2018 base with the overall intersection delay per vehicle decreasing from 91 to 56 seconds at Main North Rd/QEII Dr/Northcote Rd intersection and 64 to 28 seconds at the Main North Rd/Cranford St intersection during the PM peak hour. This demonstrates the effectiveness of the CNC in relieving congestion along Main North Road. The PM peak hour volumes on the network are shown in **Figure 8.2**.

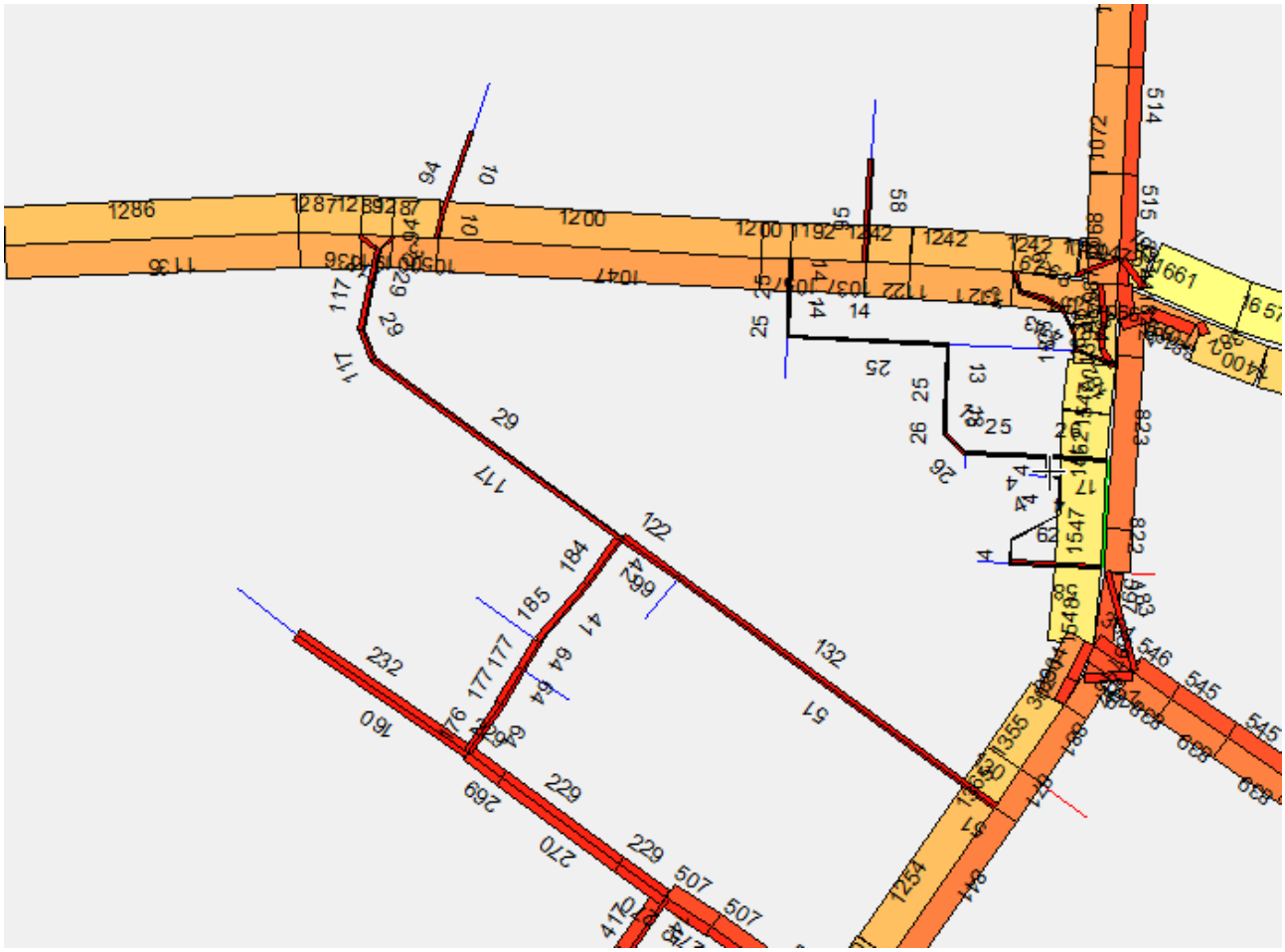


Figure 8.2 2021 Base volume plot - PM peak hour

A comparison between the modelled flows shows that the two-way traffic volume on Main North Road adjacent to the site reduce by about 17% from approximately 2,900vph in 2018 to 2,400vph in 2021.

8.6 2021 with Development

The worst approach at the Main North Rd/QEII/Northcote Rd intersection operates slightly worst under the development scenario with an average delay of 85.0 seconds during the peak hour up from 78.8 seconds in the 2021 base scenario. The well-coordinated northbound peak direction helps to push through the additional redistributed trips on the southern approach with approach delays decreasing from 56.0 seconds to 30.7 seconds. Overall the Main North Rd/QEII Dr/Northcote Rd

intersection operates at LOS D with an average delay of 48.6 seconds down from 55.5 seconds (LOS E) in the 2021 base scenario.

The forecast PM peak hour traffic volumes on the network are shown in **Figure 8.3** and a comparison with the volumes in the 2021 Base scenario is shown in **Figure 8.4**.

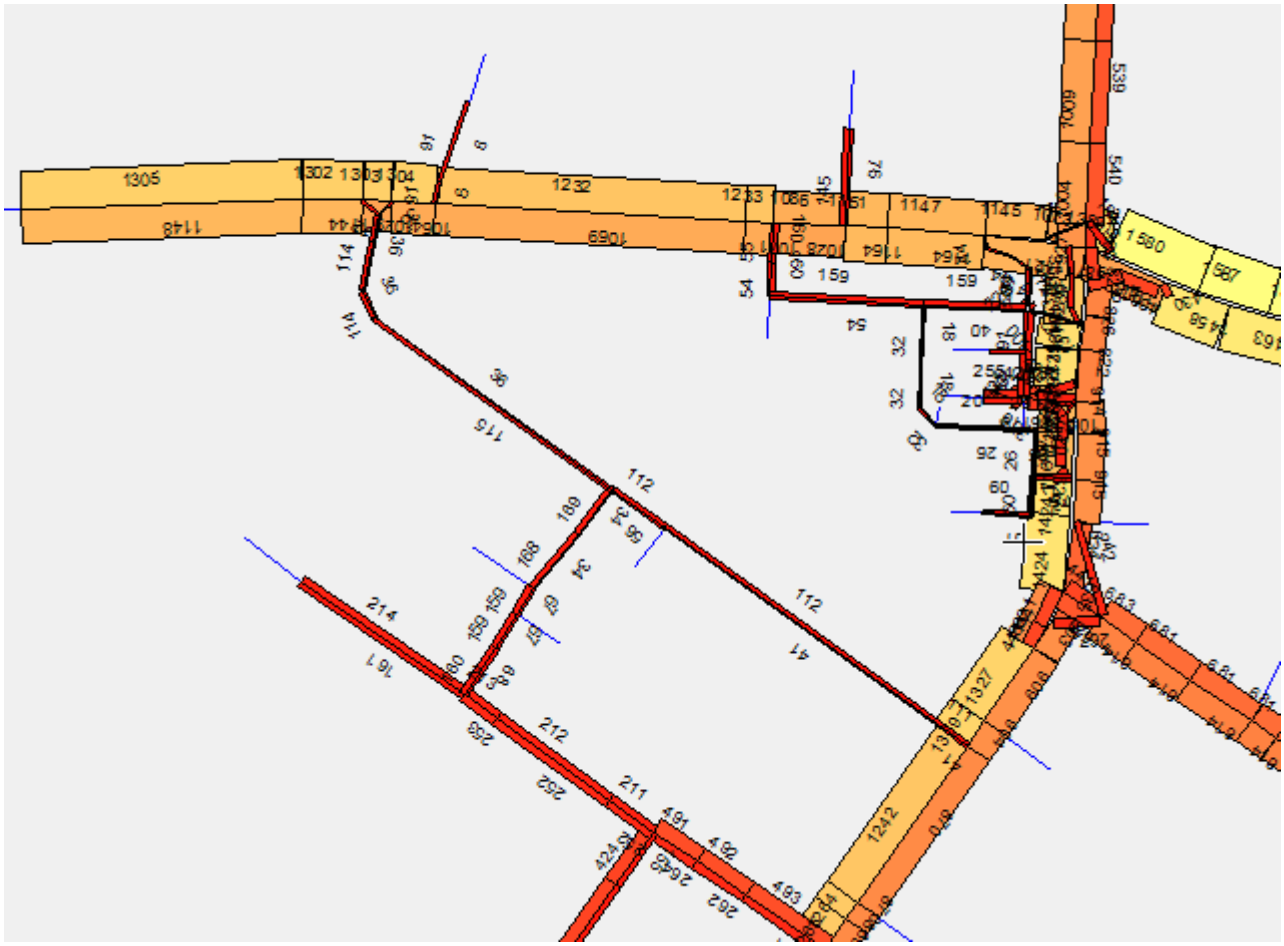


Figure 8.3 2021 with development volume plot – PM peak hour

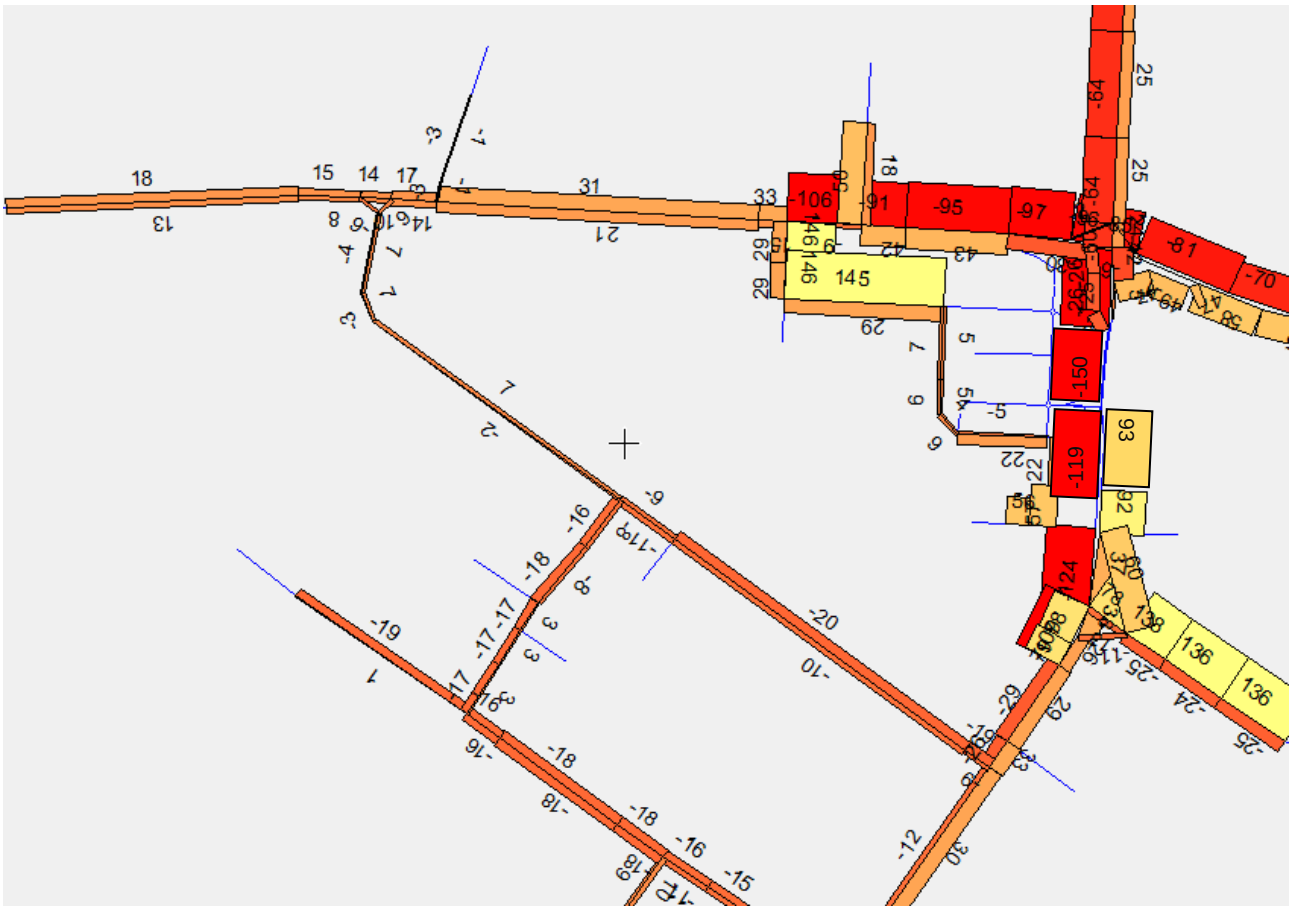


Figure 8.4 2021 with development - 2021 Base volume change plot - PM peak hour

Note that a limitation in the software display properties is that flow difference cannot be shown where network/ links between scenarios differ

Figure 8.4 shows that there is a general reduction in traffic volumes on the network. Northbound traffic on Main North Road adjacent to the site is expected to reduce by approximately 120vph to 150vph and eastbound traffic at the Main North/QEII/Northcote intersection is expected to reduce by 70vph to 100vph.

8.7 2031 Future Year Operation Summary

The 2031 Base scenario includes the consented development at 2 Lydia Street and the Cranford Basin housing development. The four laning of Northcote Road is one of Council's planned but not committed projects. Therefore, the design of the road corridor is not confirmed at this stage however, the likely form of the four laning of Northcote Road has been discussed with the Council.

Given the assumption that Marion College will operate out of 2 Lydia Street a full movements traffic signal intersection has been assumed for the Northcote Rd/Lydia St intersection. Permitted turning movements at the Northcote Rd/Vagues Rd intersection remained as existing with two eastbound and westbound lanes on Northcote Road.

Delays increase on parts of the road network in 2031 compared to the 2021 scenarios and some roads are forecast to be heavily congested such as Northcote Road. The forecast PM peak hour traffic volumes on the network are shown in **Figure 8.5** and a comparison with the volumes in the 2021 Base scenario is shown in **Figure 8.6**.

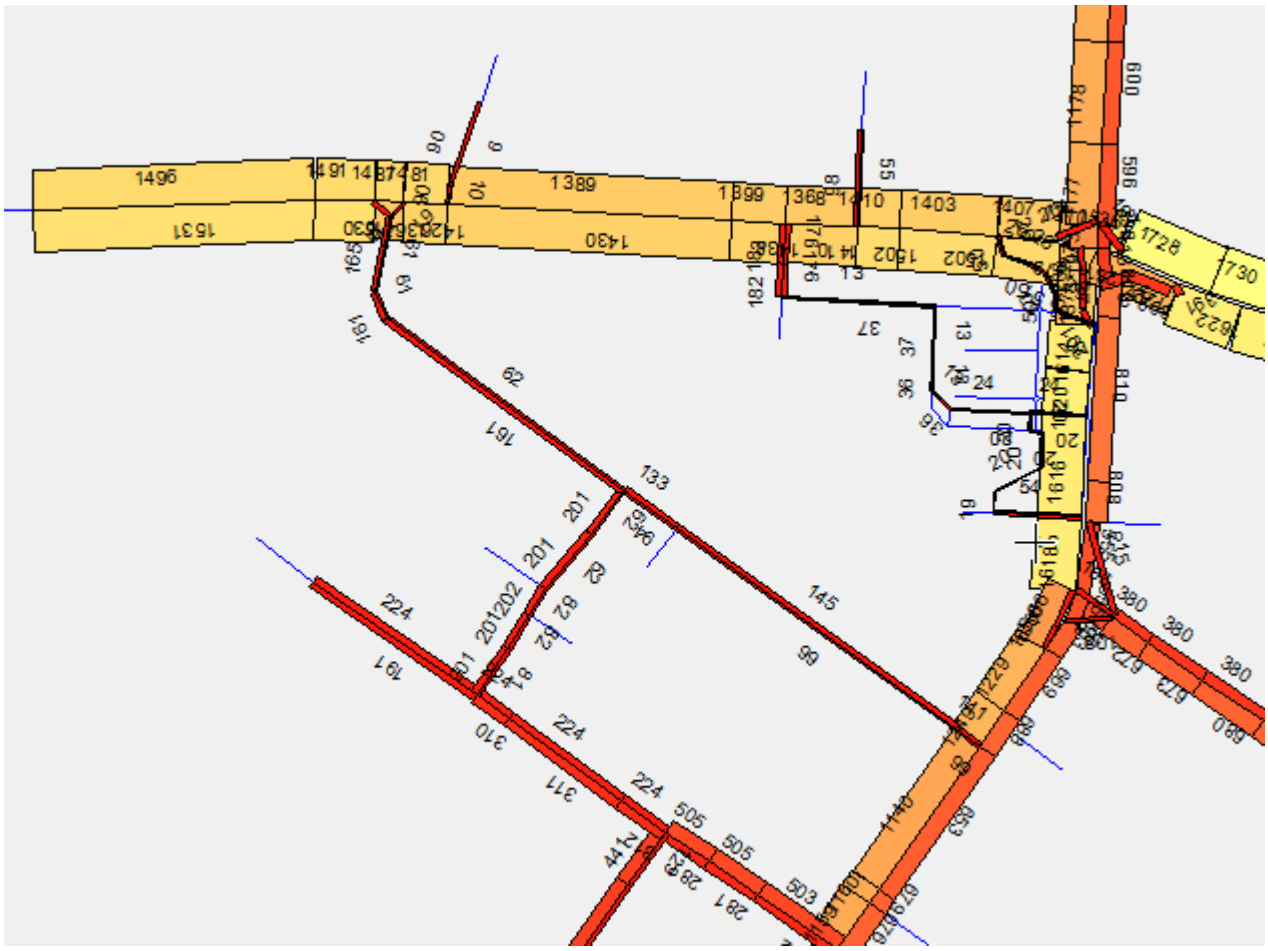


Figure 8.5 2031 Base volume plot - PM peak hour

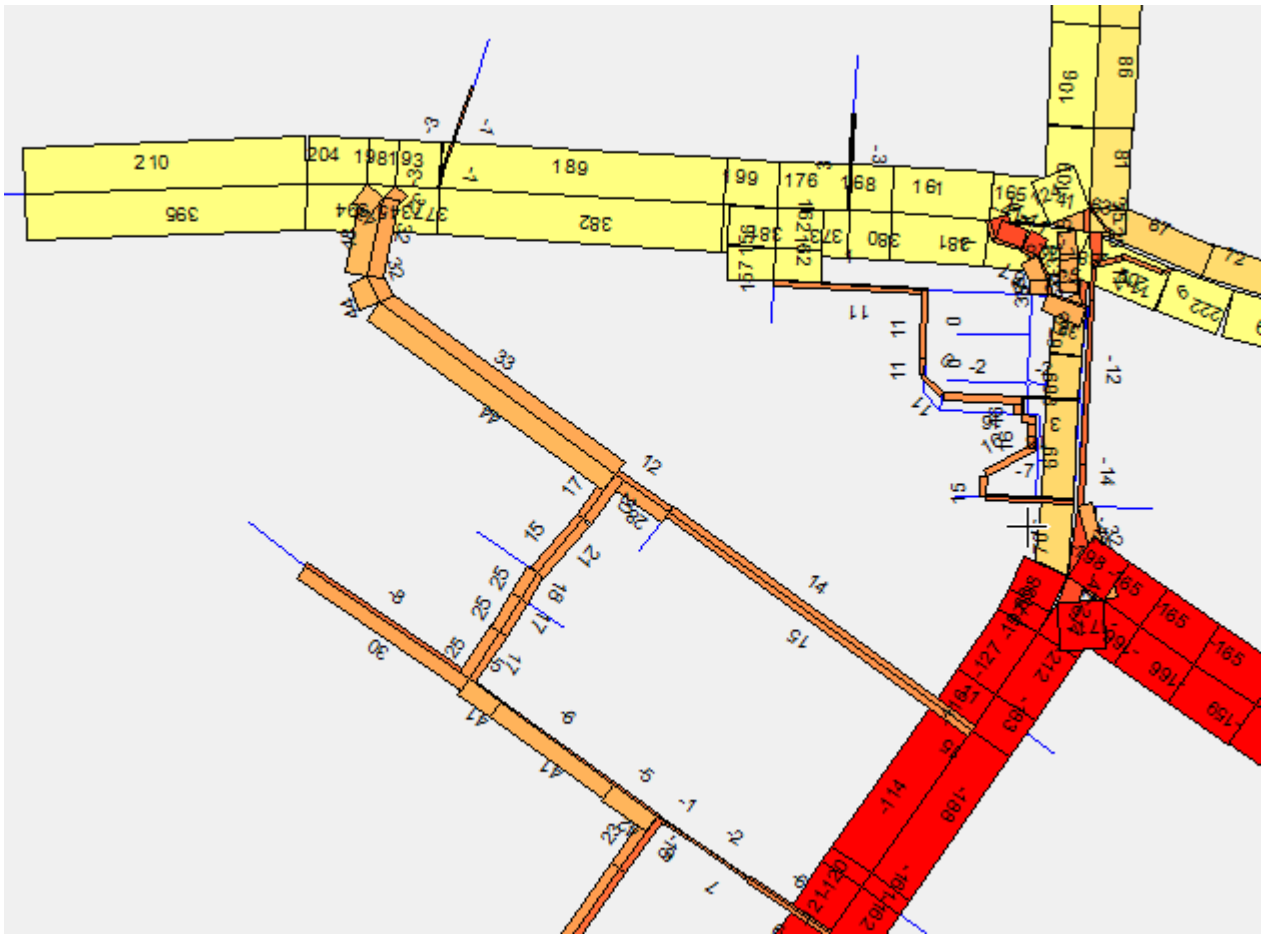


Figure 8.6 2031 Base - 2021 Base volume change plot - PM peak hour

Figure 8.6 shows reduction in traffic on Main North Road (south of Cranford Street) and Cranford Street. This could be attributed to the Cranford Basin development being included in the 2031 Base scenario. As part of the Cranford Basin development, a link will be provided to Cranford Street and will be used by through traffic to avoid Main North Road.

8.8 2031 with Development

In general the key intersections have a similar level of operation with the development in place. The forecast PM peak hour traffic volumes on the network are shown in **Figure 8.7** and a comparison with the volumes in the 2031 Base scenario is shown in **Figure 8.8**.

Figure 8.7 2031 with development volume plot - PM peak hour

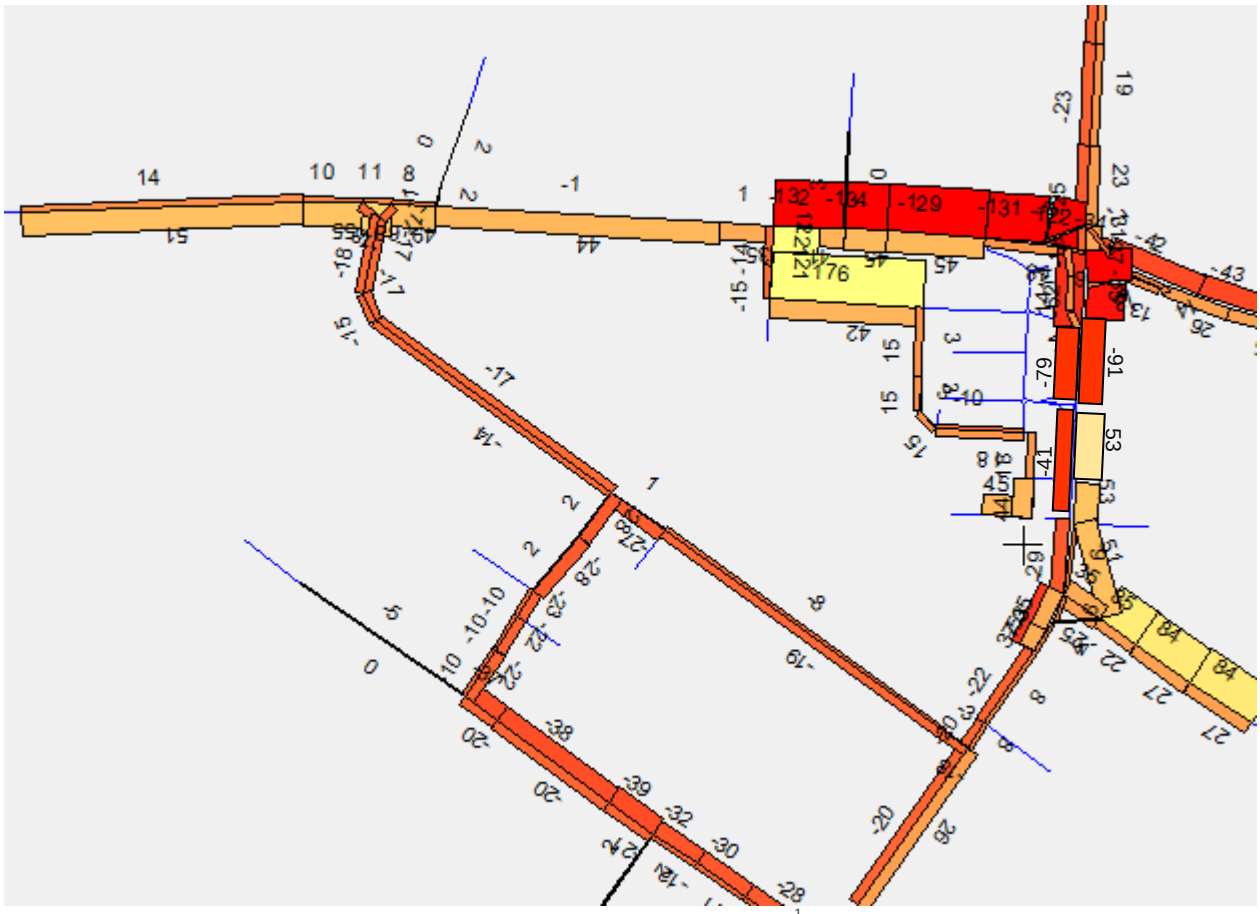


Figure 8.8 2031 with development - 2031 Base volume change plot - PM peak hour[1]

8.9 Intersection and Travel Time Comparisons

A comparison of the intersection LOS overall and by approach is show in **Table 8.3** to **Table 8.8** for the key intersection surrounding the development site. Following this there is a comparison of the modelled travel times on the main roads through the study area shown in **Table 8.9** for the morning peak hour and in **Table 8.10** for the evening peak hour.

[1] Note that a limitation in the software display properties is that flow difference cannot be shown where network/ links between scenarios differ.

Table 8.3 Main North Rd/QEII Dr/Northcote Rd intersection operation comparison – PM peak hour

Approach	2018 Base			2021 Base			2021 with development			2031 Base			2031 with development		
	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS
Main North Rd (North)	1075	64.7	E	505	34.6	C	535	41.4	D	590	84.5	F	613	63.6	E
QEII Dr (East)	940	41.2	D	1383	42.1	D	1438	39.3	D	1606	42.8	D	1633	41.7	D
Main North Rd (South)	1694	104.1	F	1523	56.0	E	1368	30.7	C	1536	52.8	D	1501	47.3	D
Northcote Rd (West)	1089	138.6	F	1208	78.8	E	1140	85.1	F	1401	135.6	F	1271	144.0	F
Intersection	4798	90.8	F	4619	55.5	E	4481	48.6	D	5133	75.9	E	5018	72.0	E

Table 8.4 Main North Rd/Cranford St intersection operation comparison – PM peak hour

Approach	2018 Base			2021 Base			2021 with development			2031 Base			2031 with development		
	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS
Main North Rd (North)	1125	20.5	C	761	32.8	C	670	42.1	D	752	30.7	C	594	41.6	D
Cranford St (East)	1052	114.7	F	829	35.8	D	804	36.7	D	666	113.8	F	685	67.7	E
Main North Rd (South)	1208	59.2	E	1305	19.2	B	1283	23.0	C	1166	31.8	C	1160	21.9	C
Intersection	3385	63.5	E	2896	27.5	C	2757	31.7	C	2585	52.6	D	2439	39.5	D

Table 8.5 Main North Rd/Vagues Rd intersection operation comparison - PM peak hour

Approach	2018 Base			2021 Base			2021 with development			2031 Base			2031 with development		
	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS
Main North Rd (North)	837	18.5	C	833	16.4	C	865	18.2	C	627	16.3	C	640	16.5	C
Main North Rd (South)	1132	67.7	F	1230	8.0	A	1206	11.2	B	1114	12.7	B	1079	9.2	A
Vagues Rd (West)	79	231.1	F	130	54.2	F	110	73.5	F	141	71.2	F	137	36.2	E
Intersection	2047	231.1	F	2193	54.2	F	2181	73.5	F	1882	71.2	F	1856	36.2	E

Table 8.6 Main North Rd/ Sawyers Arms Rd intersection operation comparison - PM peak hour

Approach	2018 Base			2021 Base			2021 with development			2031 Base			2031 with development		
	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS
Main North Rd (North)	788	23.1	C	789	20.2	C	824	20.3	C	599	19.8	B	630	20.0	B
Main North Rd (South)	900	61.6	E	1028	19.1	B	916	21.0	C	948	17.5	B	835	19.8	B
Sawyers Arms Rd (West)	443	118.2	F	571	46.0	D	494	48.1	D	568	45.6	D	476	42.0	D
Intersection	2131	59.1	E	2388	25.9	C	2234	26.7	C	2115	25.7	C	1941	25.3	C

Table 8.7 Northcote Rd/ Lydia St intersection operation comparison - PM peak hour

Approach	2018 Base			2021 Base			2021 with development			2031 Base			2031 with development		
	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS
Northcote Rd (East)	915	12.0	B	989	14.1	B	1016	8.3	A	1357	11.0	B	1435	11.2	B
Lydia St (South)	45	18.0	C	25	20.3	C	55	23.2	C	183	31.9	C	169	28.0	C
Northcote Rd (West)	1111	65.0	F	1199	16.6	C	1233	16.5	C	1391	112.9	F	1388	118.0	F
Intersection	2071	65.0	F	2213	20.3	C	2304	23.2	C	2931	60.7	E	2992	61.7	E

Table 8.8 Northcote Rd/Vagues Rd intersection operation comparison - PM peak hour

Approach	2018 Base			2021 Base			2021 with development			2031 Base			2031 with development		
	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS	Flow	App. Delay	App LOS
Northcote Rd (East)	962	21.0	C	1047	23.5	C	1069	23.9	C	1426	18.9	B	1482	11.7	B
Vagues Rd (South)	173	166.7	F	118	47.0	D	112	42.7	D	165	83.8	F	147	89.9	F
Northcote Rd (West)	1133	25.7	C	1285	13.8	B	1302	13.7	B	1478	98.4	F	1487	95.4	F
Intersection	2267	34.4	C	2450	19.6	B	2483	19.4	B	3069	60.7	E	3115	55.4	E

Table 8.9 Key network travel times comparison - AM peak hour

Route	Movement	2021 Base	2021 with development		2031 Base		2031 with development	
		Ave. Travel Time (s)	Ave. Travel Time (s)	Change from 2021 Base	Ave. Travel Time (s)	Change from 2021Base	Ave. Travel Time (s)	Change from 2031 Base
Main North Road to the north	Northbound	126	108	-18	115	-11	110	-5
	Southbound	133	139	7	131	-2	131	0
Cranford Street to the North	Northbound	137	147	10	176	39	166	-10
	Southbound	95	81	-13	105	11	98	-8
QEII Drive – Northcote Road	Eastbound	103	97	-6	101	-3	103	2
	Westbound	159	150	-9	147	-12	151	4

Table 8.10 Key network travel times comparison - PM peak hour

Route	Movement	2018 Base			2021 Base		2021 with development		2031 Base		2031 with development	
		Ave. Travel Time (s)	Min. Travel Time (s)	Total delay (s)	Ave. Travel Time (s)	Change from 2018 Base	Ave. Travel Time (s)	Change from 2021 Base	Ave. Travel Time (s)	Change from 2021Base	Ave. Travel Time (s)	Change from 2031 Base
Main North Road to the north	Northbound	269	81	188	126	-144	123	-3	201	75	178	-24
	Southbound	158	74	84	180	22	188	8	168	-12	191	23
Cranford Street to the North	Northbound	459	93	366	184	-275	163	-21	417	233	263	-154
	Southbound	109	49	60	106	-3	127	21	104	-3	135	31
QEII Drive – Northcote Road	Eastbound	275	76	199	162	-113	171	9	398	236	415	17
	Westbound	133	79	54	147	14	145	-2	145	-2	133	-12

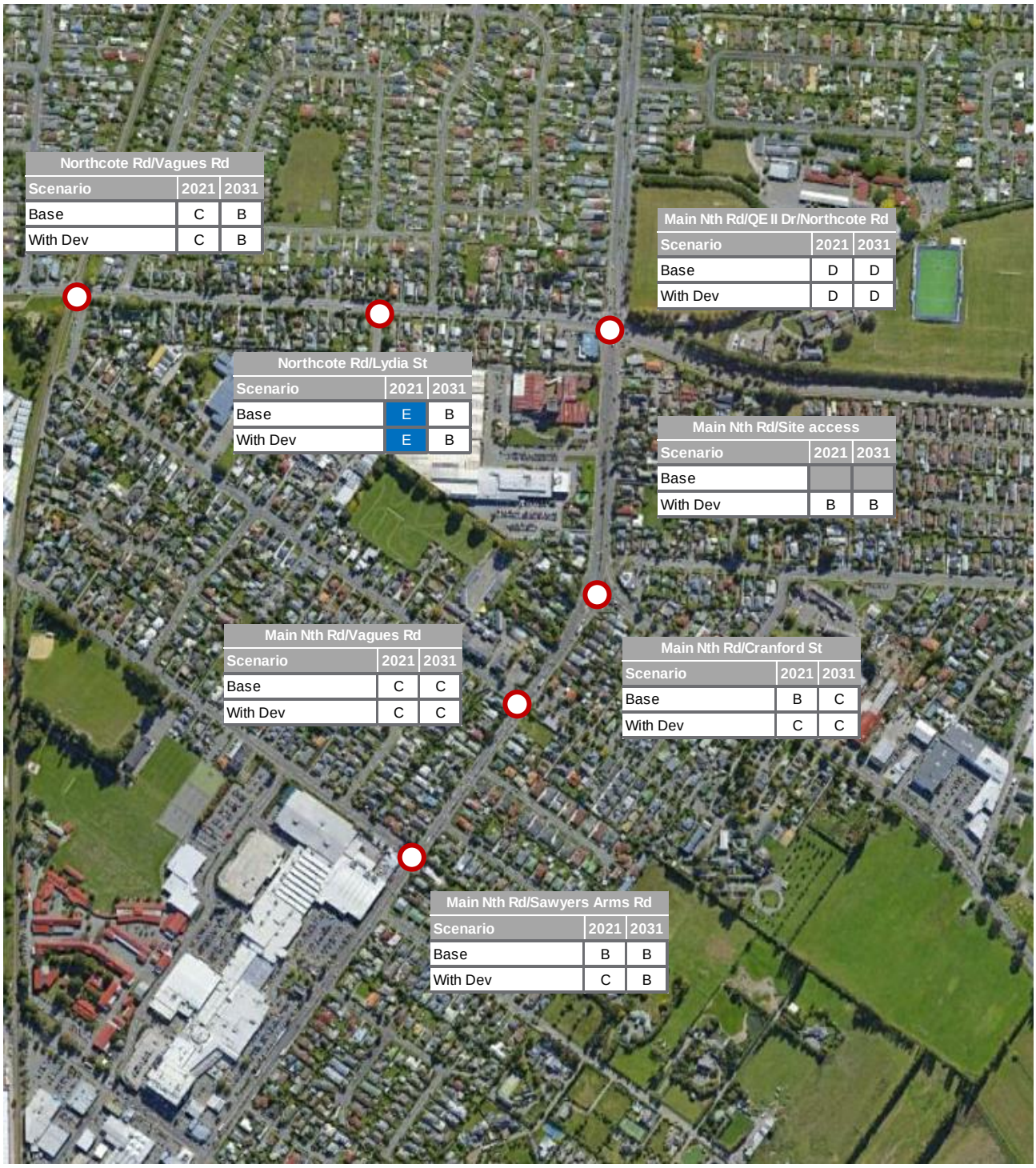


Figure 8.9 Overall Intersection Level of Service Summary AM Peak Hour

Figure 8.10 Overall Intersection Level of Service Summary PM Peak Hour

Key points from the intersection LOS comparisons in **Table 8.3** to **Table 8.8** include:

- Both Main North Rd/QEII Dr/Northcote Rd and Main North Rd/Cranford St intersections operate better with a lower overall intersection flow in all 2021 scenarios when compared to the 2018 Base scenario. This is a result of the CNC reducing the traffic demands on the Main North Road and Cranford Street corridors.
- All key intersections, in the 2021 scenarios with the proposed development, show a change in intersection delay within a few seconds when compared to the 2021 Base scenario. This shows that the proposed development does not result in deteriorating network performance with the introduction of the signals in Main North Road and change in traffic patterns of the development.
- The 2031 with development scenario shows an improvement to the overall performance of all key intersections when compared to the 2031 Base scenario. Traffic signal phasing and offsets have been carefully managed to coordinate many routes through the Main North Rd/QEII Dr/Northcote Rd and Main North Rd/Cranford St intersections.
- The 2031 scenarios show lower overall intersection flow at some of the intersections along Main North Road (Vagues Road and Sawyers Arms Road) when compared to the 2021 scenarios. The reduction in demands through these intersections could be attributed to the Cranford Basin development being included in the 2031 scenarios. As part of the Cranford Basin development, a link will be provided to Cranford Street and will be used by through traffic to avoid Main North Road.
- The congestion in the Base on Northcote Road creates queues back over the railway at time which affects the reported delays on the upstream intersections such as at Lydia Sta and Vagues Road on Northcote Road.
- The performance of the Northcote Road corridor in the future base scenarios could be improved by allocating more green time at the expense of other approaches, and more significantly the overall performance of the Main North Rd/QEII Dr/Northcote Rd intersection could be improved by increasing the cycle time from the current 85 seconds to 90 seconds or greater. This is discussed further in section 8.2.

Overall, the adjacent road network operates better with the CNC and provision of the new signalised access on Main North Road does not adversely affect intersection performance. This is supported by the overall LOS figures where the LOS with the development is the same or better than in the base scenario.

Key points from the travel time comparisons in **Table 8.9** to **Table 8.10** include

- The AM peak results show minimal changes between the base years and the development and does not result in degradation of journey times on the road network. A key direction in the morning peak is southbound which increases by only 7 seconds in 2021 and does not change in 2031 with the development. This highlights that the evening peak is still the critical period for assessment particularly for supermarket activity.
- The 2018 Base scenario shows that the northbound movements experience over three minutes of delay along the Main North Road route and six minutes of delay along the Cranford Street route. The eastbound movement experiences over three minutes delay due to congestion.
- The improvement in network performance is apparent in the 2021 Base evening peak hour key route travel times when compared to the 2018 Base scenario. Travel times have (reduced) improved by 2-4 minutes on northbound and eastbound routes.
- The critical northbound journeys decrease by 3 to 21 seconds in the 2021 with development scenario while southbound journeys increased slightly by 8 to 21 seconds . Minor changes in the east-west journey times.
- The 2031 Base scenario travel time on the network generally increases when compared to the 2021 base scenario particularly for the northbound and eastbound movements.
- The 2031 with development scenario shows that the southbound journeys pick up between eight and 31 seconds additional travel time with some of this from the proposed new signalised access on Main North Road. The northbound journeys on Main North Road to the north generally decrease with the development included.

8.10 New signalised Main North Road access

The Foodstuffs Head Office is incorporated in the model as a separate zone. The 2021 and 2031 traffic demands were informed by the CAST model received from CCC. The existing Main North Road access points are left in / left out only requiring any trips from the office to the south to perform a U-turn at the Main North Rd/QEII Dr/Northcote Rd intersection or out of Lydia Street onto Northcote Road and Vagues Road to get back to Main North Road. In the 2018 base scenario there are 31 vehicles performing the U-turn movement while 85 vehicles exit the Head Office via Lydia Street during the 2018 evening peak hour (4:00pm to 5:00pm).

A feature of the new signals proposed for the supermarket is that it can be connected to the Head Office car park at the southern internal network roundabout. This provides the staff of the Head Office the option of turning right onto Main North Road. Previous modelling with the connection in place showed the number of U-turning vehicles dropping almost completely and significant drops in traffic exiting via Lydia Street. The results below represent no connection to the car park at the roundabout with the testing done in relation to the RSA.

Rat-running has not been included through the site including the right-of-way in the modelling assessment as the likelihood of rat-running is considered to be low. The left turn from Main North Road into Northcote Road is controlled by a free left turn and the modelling indicates that this is relatively free flowing. Conversely the right turn from Northcote Road into Main North Road does incur some delay during peak hours but the alternative of rat-running through the site involves a circuitous route via Lydia Street, the right-of-way and the supermarket carpark which is considered to be unattractive to road users and can be discouraged through the introduction of traffic calming measures throughout the carpark.

The PM peak hour operation of the proposed access signals are shown in **Table 8.11** and **Table 8.12** for 2021 and 2031 respectively with the proposed development.

Table 8.11 2021 with Development Intersection Operation – Proposed Signal Access on Main North Rd – PM peak hour

Approach	Movement	Flow	Average Delay	LOS	Approach Delay	Approach LOS
Main North Road (North)	Through	702	21.0	C	23.9	C
	Right	105	43.5	D		
Main North Road (South)	Left	252	10.2	B	16.5	B
	Through	1078	18.0	B		
Site access (West)	Left	223	12.2	B	27.4	C
	Right	200	44.3	D		
Intersection		2560			20.6	C

Table 8.12 2031 with Development Intersection Operation – Proposed Signal Access on Main North Rd – PM peak hour

Approach	Movement	Flow	Average Delay	LOS	Approach Delay	Approach LOS
Main North Road (North)	Through	619	21.5	C	25.1	C
	Right	84	51.8	D		
Main North Road (South)	Left	264	21.1	C	43.1	D
	Through	1226	47.8	D		
Site access (West)	Left	231	28.4	C	37.8	D
	Right	230	47.3	D		
Intersection		2655			37.4	D

Table 8.11 to **Table 8.12** show that the worst movement at the intersection is expected to operate at LOS D, the overall intersection operates well at LOS C in 2021 and LOS D in 2031 during the evening peak hour. Overall, the intersection is expected to operate at an acceptable LOS C/D for a peak demand period for all 2021 and 2031 scenarios.

Additional more refined modelling analysis has been prepared and is included as Appendix E to this ITA using SIDRA intersection modelling software. The SIDRA model has been prepared in response to some issues raised in the safety audit of the intersection design included as Appendix D to this ITA. This provides a more refined assessment than the s-Paramics modelling assessment and validated the safe and efficient performance of this intersection by:

- Incorporating pedestrian movements and demands,

- substantiating the effects of heavy vehicle movements, and
- assessing the 95th percentile queuing lengths to ensure the right hand turning bay is of sufficient length.

8.11 Bus travel times on Main North Road

As of January 2019, the Orbiter bus route changed from travelling along Main North Road and QEII Drive to travelling along Main North Road and Cranford Street. The Orbiter buses no longer travel along the frontage of the site on Main North Road. The only high frequency bus service on Main North Road within the site frontage is the Blue Line. Bus travel times for the Blue Line on Main North Road, between the south of the Main North Road/ Sawyers Arms Road intersection to the north of Main North Road/ QEII Drive/ Northcote Road intersection, for all six model scenarios are shown in **Table 8.13** for the evening peak hour.

Table 8.13 Bus (Blue Line) travel times on Main North Road – PM peak hour

Scenario		Northbound (s)	Southbound (s)
1	2021 Base	224	313
2	2021 with proposed development	166	304
4	2031 Base	266	302
5	2031 with proposed development	173	308

Table 8.13 shows that the northbound bus travel times decreases between one to one and a half minutes with the development for 2021 and 2031 respectively. This is likely due to improved progression through the signals with the proposed phasing and coordination in the northbound direction and also the bus priority at the access signals. The southbound travel times are fairly consistent between years with and without the development.

Overall, the proposed development will not adversely affect bus travel time on Main North Road when compared to the base scenario in both 2021 and 2031.

8.12 Vehicle travel totals

A useful comparison between different model scenarios is the average trip lengths and trip travel times. The morning and evening peak period statistics for three consecutive model runs for the 2021 and 2031 model scenarios are included in **Table 8.14** and **Table 8.15** respectively.

Table 8.14 Vehicle travel totals – AM peak period 7-9am

Scenario	Total Travel Time (s)	Total Distance (km)	Total Peak Trips	Average Trip Time (s)	Average Trip Distance (km)
2021 Base	1626259	16515	9935	164	1.66
2021 with proposed development	1625078	16130	10152	160	1.59
Change in 2021	**1181**	**385**	**217**	**4**	**0.07**
2031 Base	1677655	17178	10664	157	1.61
2031 with proposed development	1698008	17107	10870	156	1.57
Change in 2031	**-20353**	**171**	**206**	**1**	**0.04**

Table 8.15 Vehicle travel totals – PM peak period 4-6pm

Scenario	Total Travel Time (s)	Total Distance (km)	Total Peak Trips	Average Trip Time (s)	Average Trip Distance (km)
2021 Base	2238011	19729	11946	187	1.65
2021 with proposed development	2231769	20297	12948	172	1.56
Change in 2021	**6242**	**-568**	**1002**	**15**	**0.09**
2031 Base	4346824	21132	13392	325	1.58
2031 with proposed development	4223506	21440	14304	295	1.50
Change in 2031	**123318**	**-308**	**912**	**30**	**0.08**

The key observations are as follows:

- In the 2021 morning peak period there is a reduction in vehicle kilometres and travel time across the network as a result of the increased connectivity delivered by the new signals despite the increase in trips arising due to the development.
- By 2031 in the morning peak with increased demands across the network there is a modest increase in total travel tome but a net reduction in the distance travelled. Average trip times and distances all reduce.
- In both the 2021 and 2031 evening peak periods the increased connectivity delivered by the new signals results in a significant increase in the number of trips that can traverse the network between 4pm and 6pm with around 1000 additional trips moving through the study area.
- The reduction in congestion us also evident with a significant reduction in travel times at 2031 across the network despite the increase in the number of trips being accommodated within the two hour window.
- The increase in the number of trips accommodated also is also evident with an increase in the vehicles kilometres travelled, and the reduction in the average trip length of 15-30 seconds and up to 100 metres across the network.

In summary the local network is performing better in all scenarios as a result of the improved connectivity across the network, especially in the evening peak where traffic exiting the Foodstuff head office and adjacent activities have limited connectivity to travel south. These vehicles are generally using Northcote Road and Vagues or Sawyers Arms Road to travel back to Main North Road southbound.

8.13 Summary of Traffic Effects of Proposal

The supermarket has a large traffic generating footprint, however the number of new trips on the network is 20% or around 100 trips in and 100 trips out of the site in peak hour. When these new trips are dispersed around the local area their effects are minimised. The remaining 80% of trips are considered to be trips already on the network as they pass-by the site or are local trips which are diverted from other roads which are not directly adjacent to the site. These 80% of generated trips visit the proposed site as an intermediate trip destination in a series of linked trips in the model.

The key outcomes from the modelling assessment of traffic effects are as follows:

- Evening peak period traffic volumes along Main North Road adjacent to the site drop by 17% when the CNC becomes operational with total trips through the local area reducing by 2.4% by 2021.
- The introduction of the development including signalised site access on Main North Road at 2021 results in slightly lower traffic volumes adjacent to the site on Main North Road due to the introduction of a small delay at the signals, and further decreases in traffic volumes along Vagues and Sawyers Arm Roads due to improved connectivity enabled by the new signals on Main North Road (reducing the number of circuitous trips due to currently restricted movements on the Main North Road corridor).
- In 2031 the Northcote Road corridor is expected to be four-laned resulting in increased east-west traffic volumes connecting to QEII Drive and the CNC. The Cranford Basin link also provides an alternative corridor for traffic accessing Papanui resulting in lower traffic volumes at the northern end of Cranford Street and along Main North Road to the south of Cranford Street. Net traffic volumes adjacent to the site on Main North Road are largely unchanged.
- The introduction of the development including signalised site access on Main North Road at 2031 results in slightly lower traffic volumes adjacent to the site on Main North Road due to the introduction of a small delay at the signals, and further

decreases in traffic volumes along Vagues and Sawyers Arm Roads due to improved connectivity enabled by the new signals on Main North Road (reducing the number of circuitous trips due to currently restricted movements on the Main North Road corridor).

- Northbound evening peak travel times along Main North Road and Northcote/QEII corridors reduce by up 2-4 minutes per journey following the opening of the CNC with travel times decreasing slightly in northbound direction and increasing slightly in southbound direction with development traffic and introduction of signals in 2021.
- Travel times along the Main North Road and Northcote/QEII corridors deteriorate between 2021 and 2031 and generally reduce in northbound direction and increase slightly in southbound direction with development traffic and introduction of signals in 2031.
- Overall network performance in the morning peak hour with and without the development traffic demonstrates good level of service with:
  - Main North Road / QEII Drive operating at LoS D in 2021 and 2031
  - Northcote Road / Lydia Street operating at LoS E in 2021 only and improving with installation of signals at 2031
  - The new signals on Main North Road operating at LoS C
  - All other key intersections operating at LoS C or better
- Overall network performance in the morning peak hour with and without the development traffic demonstrates adequate level of service with:
  - Main North Road / QEII Drive operating at LoS E or better in 2021 and LoS E in 2031
  - Northcote Road / Vagues Road and Northcote Road / Lydia Street operating at LoS E in 2031
  - Main North Road / Vagues Road operating at LoS F in 2021 and 2031 but improving to LoS E in 2031 with development
  - The new signals on Main North Road operating at LoS D
  - All other key intersections operating at LoS D or better
- The new signalised access enables right turns to be executed on and off Main North Road which reduces the amount of traffic from the FSIL Head Office U-turning at the Main North Rd/QEII Dr/Northcote Rd intersection and travelling longer distances through the residential areas in the vicinity of Vagues Road. The reduction in U-turns is particularly helpful as these movements normally are undertaken at significantly reduced speed impacting the efficiency of the right turn movement.

It is concluded that the surrounding traffic network can absorb the additional demands and traffic redistribution of the proposed development without deterioration in network performance. Some elements of the network experience improved performance due to the introduction the site access signals on Main North Road and safer and more efficient lane configuration and phasing proposed at the QEII / Main North Road signals. Overall the effects of the development traffic are considered acceptable, subject to these changes in signals along Main North Road.

9. District Plan Assessment

9.1 Review of Proposal against the District Plan

An assessment of the proposal against the transport related rules of the Christchurch District Plan has been undertaken. The results of this are summarised in **Table 9.1**. Any non-compliances are further assessed in the subsequent sections of this report, with regard to the corresponding assessment matters stated in the Christchurch District Plan.

It should be noted that as the Gross Floor Area of the FSIL Head Office and the General Retail/ motor servicing activities are not proposed to change, the quantum of existing car parking supply at these sites will not change and cycle parking will be as currently provided.

Table 9.1 District plan rule assessment

Rule	Assessment	Status
7.4.3.1 Minimum number and dimensions of car parking spaces required		
7.4.3.1(a)(i) Car parks shall comply with Appendix 7.5.1		
Appendix 7.5.1: a. The minimum number of car parking spaces provided shall be in accordance with Table 7.5.1.1 and Table 7.5.1.2. Other retail activities or commercial services: Visitor: 4 spaces/100 m^2 GLFA for the first 20,000 m^2 GLFA; and 3.3 spaces/100 m^2 GLFA for the next 10,000 m^2 GLFA and 3 spaces/100 m^2 GLFA thereafter. 3 spaces/100 m^2 GLFA of any outdoor display area Staff: 0.5 spaces per 100m^2 GLFA Offices: Visitor: 5% of staff requirement (1 space minimum) Staff: 2.5 spaces per 100m^2 GFA	The proposed development consists of the following land use GFA's; • Supermarket with 8 fuel pumps 6600m^2 GFA (For the parking assessment the GFA has been used instead of the GLFA) • Supermarket office 290m^2 Application of parking reduction factors: **Public transport accessibility:** The FSIL site is located between 0-100m from a bus stop that is serviced by three services with a frequency of at least 15 minutes between 07:00 and 18:00 hours. Therefore, the maximum reduction factor of 16% is applied. **Access to a major cycle route:** The site is located between 601-1200m from the Northern line major cycle route. Therefore, a reduction factor of 5% is applied. A parking reduction factor of 21% has been applied to the supermarket and supermarket staff total parking requirement of 305 parking spaces. For the supermarket and supermarket office this results in a minimum requirement of 241 spaces (209 visitor and 32 staff parking spaces). A total of 278 car parks including 8 mobility spaces are proposed.	Complies
Appendix 7.5.1: b. Any space required for off-street parking other than for a residential activity shall be available for staff and visitors during the hours of operation and shall not be diminished by the subsequent erection of any structure, storage of goods, or any other use.	The FSIL office car park will be segregated from the supermarket/ general retail car parks. The objective is that the FSIL Head Office parking spaces will not be available for PAK'nSAVE customer use at any time. A swing gate will be used to close the office car park after hours of operation. All other parking spaces will be available for all hours of operation and not diminished by erection of any structure/storage of goods etc.	Complies
Appendix 7.5.1:	Staff parking will be provided as required in Appendix 7.5.1., However, it is proposed that staff parking spaces will not be marked.	Does not comply

c. All required staff car parking spaces shall be permanently marked and signed for the exclusive use of staff. Staff parking may be relocated within the site.		
Appendix 7.5.1: d. Mobility parking spaces shall be provided at the closest possible point to the accessible entrance to the activity with which they are associated, and the most direct route from the mobility car park spaces to the activity shall be accessible for people whose mobility is restricted. The spaces shall be clearly signed.	Mobility parking spaces will be provided in the vicinity of the main entrances to the building they serve. Each space will be marked and easily accessible for all users.	Complies
Appendix 7.5.1: e. All car parking spaces and aisle widths shall be laid out in accordance with Table 7.5.1.3 and Figure 1.	All car parking spaces and aisle widths are in accordance with Table 7.5.1.3 and Figure 1.	Complies
Appendix 7.5.1: f. Critical manoeuvring areas such as aisles in or between major structures, or changes in grade, shall be designed to accommodate the 99 percentile design vehicle as set out in Appendix 7.5.5.	All critical manoeuvring areas of the car park has been designed to accommodate the swept paths of a 99-percentile design vehicle.	Complies
Appendix 7.5.1: g. All other manoeuvring areas shall be designed to accommodate the 85 percentile design motor car as set out in Appendix 7.5.4.	All other manoeuvring areas of the car park has been designed to accommodate the swept paths of a 99-percentile design vehicle.	Complies
Appendix 7.5.1: h.	N/A	N/A
Appendix 7.5.1: i.	N/A	N/A
Appendix 7.5.1: j.	N/A	N/A
7.4.3.1(a)(ii) Car parks shall be provided at the minimum dimensions in Table 7.5.1.3 in Appendix 7.5.1.	Parking spaces will be of the following dimensions; Parking stall widths: 2.5m Aisle width: 7.0m Parking stall depth: 5.0m Total Width: 12.0m Mobility parking space dimensions are as below; Parking stall width: 3.6m Aisle width: 7.0m Parking stall depth: 5.0m Total width: 12.0m	Complies
7.4.3.1(a)(iii) At least the minimum number of mobility parking spaces in accordance with Table 7.5.1.2 in Appendix 7.5.1 shall be provided on the same site as the activity.	For all activities, Table 7.5.1.2 requires mobility parking spaces to be provided at a rate of 2 for the first 50 car parking spaces + 1 additional mobility parking space for every additional 50 car parking spaces or thereof. For the supermarket, the requirement is 7 mobility car parking spaces. A total of 8 is proposed. For the retail activity, the existing mobility car parking spaces will remain. For the Head Office activity, the existing mobility car parking spaces will remain.	Complies

	All parking spaces will be provided on the same site as the activity.	
7.4.3.2 Minimum number of cycle parking facilities required		
At least the minimum amount of cycle parking facilities in accordance with Appendix 7.5.2 shall be provided on the same site as the activity. Customer: 1 space/ 300m^2 GLFA Staff: 1 space/ 750m^2 GLFA	A minimum of 23 visitor cycle parking spaces and 9 staff cycle parking spaces are required for the supermarket component. The cycle parking provision meets the above requirement. Given the Gross Floor Area (GFA) or the number of employees of the Head Office development or the General Retail use is unchanged no changes to the existing cycle parking is proposed or necessary.	Complies
Appendix 7.5.2 Cycle parking facilities		
(a) Visitor Cycle parking spaces shall be provided as follows		
i) The number of visitor cycle parks provided on the same site as the activity shall be at least the minimum number of visitor cycle parks specified in Table 7.5.2.1. *For retail activities, outside the central city, visitor parking is to be provided at a minimum rate of 1 per 300m^2 of GFA.*	Given the GFA of the supermarket is 6,890m^2, a minimum of 23 visitor cycle parking spaces are required. 23 visitor cycle parking spaces will be provided on site.	Complies
ii) Stands shall be securely anchored to an immovable object. iii) Stands shall support the bicycle frame and front wheel. iv) Stands shall allow the bicycle frame to be secured.	Stands will be designed accordingly.	Complies
v) Cycle parking facilities shall be clearly signposted or visible to cyclists entering the site.	All cycle parking spaces will be located adjacent to the front façade of the building and as such will be clearly visible to the cyclists entering the site.	Complies
vi) Cycle parking facilities shall be located so as not to impede pedestrian thoroughfares including areas used by people whose mobility or vision is restricted.	Proposed location of cycle parking will not impede pedestrian thoroughfares.	Complies
vii) Cycle parking facilities shall be located so as not to impede pedestrian thoroughfares including areas used by people whose mobility or vision is restricted.	All cycle parking will be located away from vehicle manoeuvring areas	Complies
viii) Cycle parking facilities shall be located as close as possible to and no more than 30 metres from at least one main	Both locations where visitor cycle parking is proposed is within 30m of the main building entrance.	Complies

pedestrian public entrance to the building/activity		
ix) Lighting must comply with the lighting requirements in Rule 7.4.3.6 a.	Lighting will be provided accordingly	Complies
x) Stands shall have the minimum dimensions in Figure 2	Dimensions of the proposed cycle parking stands will be in accordance with the district plan requirement.	Complies
xi) Cycle parking facilities shall be available during the hours of operation and shall not be diminished by the subsequent erection of any structure, storage of goods, or any other use.	Cycle parking will be available for exclusive use of PAK'n SAVE customers during all times.	Complies
(b) Staff/residents/students cycle parking facilities shall be provided as follows:		
i) The number of staff/residents/students cycle parks provided shall be at least the minimum number of staff/residents/students cycle parks in Table 7.5.2.1. . *For retail activities, outside the central city, visitor parking is to be provided at a minimum rate of 1 per 750m^2 of GFA.*	Given the GFA of the supermarket is 6,890m2, a minimum of nine staff cycle parking spaces are required. Nine spaces are provided at basement level.	Complies
ii) Staff/residents/students cycle parking facilities shall be located so it is easily accessible for staff, residents or students of the activity.	Staff cycle parking is proposed within the basement of the supermarket. The vehicle ramp and customer lift will be used to access these spaces.	Complies
iii) Staff/ residents/ tertiary students' cycle parking facilities shall be located in: b) a covered area; and c) a secure area, unless located in an area where access by the general public is generally exclude	Staff cycle parking spaces will be located within the basement and hence will be covered. This area will also be secured through high fencing and a lockable gate will be provided.	Complies
iv) Where a stand is provided, it shall meet the visitor cycle parking requirements in (a) except for (a)(v) and (a)(viii).	All stands will be designed accordingly	Complies
v) Outside the Central City, the number of on-site cycle parking end of trip facilities provided shall be at least the minimum number of cycle parking end of trip facilities set out in Table 7.5.2.2.	Given that the proposed supermarket requires less than 10 staff cycle parking spaces, no end of trip facilities are required. However, lockers and showers will be available for employees.	Complies
7.4.3.3 Minimum number of loading spaces required		
Loading spaces shall comply with Appendix 7.5.3		
Appendix 7.5.3: (a)(i-iv). The minimum number of on-site loading spaces provided shall be in accordance with Table 7.5.3.1. Other retail activities or commercial services, if not specified above: 1 bay/ 1600 m^2 GLFA for the first 6,400 m^2 GLFA; and	For the supermarket activity, a minimum of 4 heavy vehicle loading bays are required for the supermarket component and 1 unmarked bay is required for the fuel court. A 12m x 48m service area and one 3.5m x 12m loading bay for the fresh produce truck will be provided. The service area dimensions allow for more than 4 trucks to enter and exit independently. Satisfying the requirement	Complies

1/ 5,000 m^2 GLFA thereafter.	for four heavy vehicle bays. An unmarked bay for fuel delivery is proposed next to the fill points.	
Appendix 7.5.3: (a)(v). Any space required for loading other than for a residential activity, fire stations and ambulance stations shall be available during the hours of operation and shall not be diminished by the subsequent erection of any structure, storage of goods, or any other use.	The loading areas will be available during the hours of operation and shall not be diminished by the subsequent erection of any structure, storage of goods or any other use.	Complies
Appendix 7.5.3:(a)(vi).	N/A	N/A
Appendix 7.5.3:(a)(vii).	N/A	N/A
Appendix 7.5.3: (b). Minimum loading area dimensions: (i) A Heavy Vehicle Bay shall comply with one of the following vehicle sizes in Table 7.5.3.2 (depending on the largest vehicle expected to use the loading space). For commercial and industrial sites where waste collection occurs internally, a loading space and associated manoeuvring area large enough to accommodate a medium rigid vehicle must be allowed for. (ii) A 99 percentile vehicle bay shall be designed to the following minimum standards in Table 7.5.3.3:	The loading area can accommodate the largest vehicle expected as shown in the swept path analysis in Appendix B.	Complies
7.4.3.4. Manoeuvring for parking and loading areas		
7.4.3.4.a Any vehicle with a vehicle access: On-site manoeuvring area shall be provided in accordance with Appendix 7.5.6.		
Appendix 7.5.6: (a). Parking spaces shall be located so as to ensure that no vehicle is required to carry out any reverse manoeuvring when moving from any vehicle access to any parking spaces, except for parallel parking spaces.	The proposed parking spaces are located such that the conditions of this rule are met.	Complies
Appendix 7.5.6: (b). Parking and loading spaces shall be located so that vehicles are not required to undertake more than one reverse manoeuvre when manoeuvring out of any parking or loading space.	The proposed parking spaces are located such that the conditions of this rule are met.	Complies
Appendix 7.5.6: (c). For any activity, the vehicle access manoeuvring area shall be designed to accommodate the 85th percentile design motor car, as specified in Appendix 7.5.4, as a minimum.	The vehicle access manoeuvring area has been designed to accommodate the 85th percentile design motor car as a minimum.	Complies
7.4.3.4.b Any vehicle with a vehicle access to: a major / minor arterial road; on-site manoeuvring area shall be provided to ensure that a vehicle can manoeuvre in a forward gear on to and off a site.	All vehicles will enter and exit the site in a forward gear.	Complies
7.4.3.5 Gradient of parking and loading areas		
7.4.3.5.(a)(i) All non-residential activities with vehicle access:	It is assumed that the site will be relatively level and gradients in the parking areas will be minimal.	**Can Comply**

Gradient of surfaces at 90 degrees to the angle of parking (i.e. parking stall width) shall be ≤ 1:16 (6.25%)		
7.4.3.5.(a)(ii) All non-residential activities with vehicle access: Gradient of surfaces parallel to the angle of parking (i.e. parking stall length) shall be ≤ 1:20 (5%)	It is assumed that the site will be relatively level and gradients in the parking areas will be minimal.	**Can Comply**
7.2.3.5.(a)(iii) All non-residential activities with vehicle access: Gradient of mobility car park spaces shall be ≤ 1:50 (2%)	It is assumed that the site will be relatively level and gradients in the parking areas will be minimal.	**Can Comply**
7.4.3.6 Design of parking and loading areas		
7.4.3.6.a All non-residential activities with parking and/or loading areas used during hours of darkness: Lighting of parking and loading areas shall be maintained at a minimum level of two lux, with high uniformity, during the hours of operation.	The site has been designed as such to meet this requirement. A lighting plan has been submitted as part of the application.	**Can Comply**
7.4.3.6.b Any urban activity, except: residential activities containing less than three car parking spaces; or sites where access is obtained from an unsealed road; or temporary activities: The surface of all car parking, loading, and associated access areas shall be formed, sealed and drained and car parking spaces permanently marked.	The site will be formed, sealed and drained. Car parking spaces will be permanently marked.	Complies
7.4.3.7 Access Design		
7.4.3.7.a Any activity with vehicle access, the vehicle access shall be provided in accordance with Appendix 7.5.7		
Appendix 7.5.7: a. All vehicle access to and within a site shall be in accordance with the standards set out in Table 7.5.7.1 below.	For an activity that has more than 15 car parking spaces, Minimum legal width (m): 6.5m Minimum formed width (m): 5.5m Maximum formed width (m): 9.0m Three of the proposed accesses including the new signalised vehicle access will not comply with this rule.	**Does not comply**
Appendix 7.5.7: b. Any vehicle accesses longer than 50 metres and with a formed width less than 5.5 metres wide shall provide passing opportunities (with a minimum width of 5.5 metres) at least every 50 metres, with the first being at the site boundary.	All proposed vehicle accesses are wider than 5.5m and provide for two-way vehicle movement.	Complies
Appendix 7.5.7: c. Where a vehicle access serves nine or more parking spaces or residential units and there is no other pedestrian and/or cycle access available to the site then a minimum 1.5 metres wide space for pedestrians and/or cycle shall be provided and the legal width of the access shall be increased by 1.5 metres.	Separate pedestrian access from all frontage streets are proposed.	Complies
Appendix 7.5.7: d. All vehicle access to and within a site in a residential zone shall allow clear visibility above 1	N/A	N/A

metre for a width of at least 1.5 metres either side of the entrance for at least 2 metres measured from the road boundary.		
Appendix 7.5.7: e. Where parking spaces are provided in separate areas, then the connecting vehicle access between the parking areas shall be in accordance with the standards in Table 7.10 based on the number of parking spaces served.	Parking is provided on the same site as the activity.	Complies
Appendix 7.5.7: f. The minimum and maximum widths shall be measured at the road/property boundary and apply within the site until the first vehicle control point.	Noted.	Complies
Appendix 7.5.7: g. For the purposes of access for firefighting, where a building is either: located in an area where no fully reticulated water supply system is available; or located further than 75 metres from the nearest road that has a fully reticulated water supply system including hydrants (as required by NZS 4509:2008), vehicle access shall have a minimum formed width of 3.5 metres and a height clearance of 4 metres. Such vehicle access shall be designed to be free of obstacles that could hinder access for emergency service vehicles.	The access has been designed to accommodate access for firefighting.	Complies
Appendix 7.5.7: h. In car park buildings there shall be a vertical clearance of not less than 2.5m above car park spaces for people whose mobility is restricted, and along the full length of any accessible route providing vehicular access to those car park spaces.	All mobility spaces will have a minimum of 2.5m vertical clearance	Complies
Appendix 7.5.7: i. Where a mix of activities is proposed, the largest relevant dimension is applicable.	Noted.	N/A
Appendix 7.5.7: j. Emergency service facilities do not need to comply with the maximum formed width, unless located on a key pedestrian frontage.	Noted.	N/A
Appendix 7.5.7: m. The maximum gradient at any point on a vehicle access shall be in accordance with Table 7.11, except a maximum gradient of 1 in 5 (minimum 4.0m long transition ramps for a change of grade 1 in 8 or greater) shall apply for accesses that are identified in 1(f).	It is assumed that the accesses and ramp to basement car parking will comply with these gradients. These will be confirmed at detailed design stage of the project.	Can Comply
Appendix 7.5.7: n. The maximum change in gradient without a transition shall be no greater than 1 in 8 (12.5%). Changes of grade of more than 1 in 8 (12.5%) shall be separated by a minimum transition length of 2 metres (see Figure 9 for an example).	It is assumed that the accesses and ramp to basement car parking will comply with these gradients. These will be confirmed at detailed design stage of the project.	Can Comply

Appendix 7.5.7: o. Where the gradient exceeds 1 in 10 (10%) the vehicle access is to be sealed with a surface that enables safe access in wet or icy conditions.	All vehicle accesses will be sealed.	Can Comply
Appendix 7.5.7: p. Where a vehicle access serves more than six car parking spaces (or more than six residential units) and a footpath is provided on the frontage road, the gradient of the first 4.5 metres measured from the road boundary into the site shall be no greater than 1 in 10 (10%) (see Figure 10 for an example)	It is assumed that the accesses will comply with these gradients. These will be confirmed at detailed design stage of the project.	Can Comply
7.4.3.7.b Any activity providing 4 or more car parking spaces or residential units. Queuing Spaces shall be provided in accordance with Appendix 7.5.8		
Appendix 7.5.8: a. On-site queuing spaces shall be provided for all vehicles entering a parking or loading area in accordance with Table 7.5.8.1. b. Queuing spaces shall be available during hours of operation. c. Where the parking area has more than one access the number of parking spaces may be apportioned between the accesses in accordance with their potential usage for the calculation of the queuing space. d. Queuing space length shall be measured from the road boundary to the nearest vehicle control point or point where conflict with vehicles already on the site may arise (see Figure 8).	Accesses serving 51-150 parking spaces have a minimum queuing space of 18m. Accesses serving over 150 parking spaces require a queuing distance of at least 24m. The queueing space availability and expected use for each activity for each access is listed below; Signalised Supermarket Access – 27m (50% Supermarket, 50% FSIL Head Office) Supermarket/ General Retail Access – 36m (30%Supermarket and 20% General Retail) General Retail Access on Main North Road - 7.5m (40% use) General Retail Access on Northcote Road – 7.5m (40% Use) FSIL HQ Access – 24m (50%use) based on the expected use the queuing space available at each access is satisfactory. Queuing space at the proposed accesses will be available throughout the relevant hours of operation.	Complies
74.3.7.c Any vehicle access: to an urban road serving more than 15 car parking spaces or more than 10 heavy vehicle movements per day; and/or on a key pedestrian frontage. Either an audio and visual method of warning pedestrians of the presence of vehicles or a visibility splay in accordance with Appendix 7.5.9 shall be provided. If any part of the access lies within 20m of a Residential Zone any audio method should not operate between 8pm and 8am.	Visibility splays as per Appendix 7.5.9 will be provided at all vehicle accesses.	Complies
7.4.3.8 Vehicle crossings		
7.4.3.8.a Any activity with a vehicle access to any road or service lane A vehicle crossing shall be provided constructed from the property boundary to the edge of the carriageway / service lane.	The vehicle crossings will be provided and constructed from the property boundary to the edge of the carriageway. .	Complies
7.4.3.8.b Any vehicle crossing on an arterial road or collector road with a speed limit 70 kilometres per hour or greater.	N/A	N/A

7.4.3.8.c Any vehicle crossing to a rural selling place	N/A	N/A
7.2.3.8.d Any vehicle crossing on a road with a speed limit 70 kilometres per hour or greater	N/A	N/A
7.4.3.8.e. Any activity with a vehicle crossing The maximum number of vehicle crossings shall be in accordance with Table 7.5.11.2 in Appendix 7.5.11. For a development fronting a Minor Arterial and a road frontage of >100m, two accesses are permitted.	Table 7.5.11.2 states that the maximum number of vehicle crossings for a development with more than 100m Arterial Road frontage is 2 vehicle crossings. As a collective the proposal will provide five vehicle crossings on Main North Road, which is the same as the existing arrangement. No changes to the vehicle crossing on Northcote Road is proposed. .	Does not comply
7.4.3.8.f Any activity with a vehicle crossing The minimum distance between a vehicle crossing and an intersection shall be in accordance with the Table 7.5.11.4 in Appendix 7.5.11.	As the frontage road is an Arterial road, the crossing must be at least 30m from any intersecting roads. All new vehicle accesses are more than 30m away from adjacent intersections, measured according to Figure 16 of Appendix 7.5.11.	Complies
7.4.3.8.g Any vehicle crossing on a rural road	N/A	N/A
7.4.3.10 High trip generators		
7.4.3.10 High trip generator assessment	Resource consent under Rule 7.4.2.3 RD1 is required for retail activities with more than 500m^2 GLFA. Matters over which Council reserves its control or restricts its discretion shall be limited to Rule 7.4.4.19 – High trip generators.	**Full ITA required**

10. Assessment of Non-Compliances

7.4.3.1(a)(i) Staff parking spaces

In line with Crime Prevention Through Environmental Design (CPTED) practice, it is proposed that staff parking spaces will not be marked. Marking staff parking spaces may generate unwanted attention and vehicles in these spaces may be targeted as they are likely to be unattended for a longer period (7-8 hours). Accordingly, the impact of this non-compliance will be negligible.

7.4.3.7 Access Design

The width of the relocated accesses on Main North Road are wider than the maximum permissible width of 9m. The signalised access is approximately 25m wide and the FSIL Head Office access is approximately 9.5m wide.

The signalised access has adequate sight lines in both directions and will provide a signalised pedestrian crossing with a red arrow for left turning vehicles. This means that pedestrian safety will not be compromised by the width of the crossing. Given traffic movement at the intersection is controlled by traffic signals the excess width of the access will not have any adverse effects on the operations of Main North Road.

The proposed FSIL Head Office access is 0.5m wider than the maximum permissible width of 9.0m, which is a non-compliance. The access provides acceptable sight distance in both directions. The access is left in left out only for vehicle movements therefore the potential for conflict at this access is minimised and lesser than a full movement intersection. Accordingly, it is considered that the impact of this non-compliance would be negligible.

7.4.3.8. Vehicle Crossings

Rule 7.4.3.8 e states that a development with access from an Arterial Road with more than 100m road frontage should have a maximum of two vehicle crossings. The proposed development as a collective will provide five vehicle crossings, which is the same as what is currently provided.

However, it should be noted that even though the proposal falls under one resource consent application, the FSIL site consists of three separate activities, namely, FSIL Head Office, PAK'nSAVE supermarket and the General Retail at the corner of Main North Road and Northcote Road. The FSIL Head Office will be serviced by two exclusive vehicle crossings. The supermarket will be serviced by two vehicle crossings on Main North Road and the General Retail will use one existing vehicle crossing. Therefore, individually each activity satisfies the requirements of this rule. However, the vehicle crossing associated with the signalised access (primarily the supermarket access) will be shared between all three activities.

All accesses other than the signalised vehicle crossing will be left-in left out only where the conflict between pedestrians and turning vehicles is lesser than a full movement intersection. To ensure that pedestrian safety is not compromised, no vegetation greater than 0.5m in height or permanent structures will be located within the 2.5m x 5m pedestrian visibility splays at all vehicle crossings. The signalised access which will be the most heavily used access will provide a signalised pedestrian crossing to ensure safe pedestrian movement. Consequently, it is considered that the impact of this non-compliance would be negligible.

7.4.4.19 High trip generators

The proposed supermarket development triggers the high traffic generator rule due to the development size (greater than 500m^2 of retail area) and hence a full ITA has been prepared. The relevant assessment matters have been considered below.

1. *Access and manoeuvring (safety and efficiency): Whether the provision of access and on-site manoeuvring area associated with the activity, including vehicle loading and servicing deliveries, affects the safety, efficiency, accessibility (including for people whose mobility is restricted) of the site, and the transport network (including considering the road classification of the frontage road).*

With the exception of the signalised intersection, all other vehicle accesses of the development will be left-in/ left out only. These type of access perform more safely than full movement intersections due to the reduced potential for conflict between vehicle movements. Apart from the minor one-way inbound access serving the general retail site, all vehicle accesses to the

site are located at least 50m apart reducing any confusion on where the vehicles will be turning into. All delivery vehicles will be restricted to one left-in/ left-out access limiting conflict with the majority of the FSIL Site customers/ employees. The signalised intersection will provide a much safer environment for motorists to access the Main North Road corridor and will significantly reduce the proportion of riskier u-turning manoeuvres at the Main North Road/Northcote Road intersection. The signalised intersection will also provide pedestrians with a safe crossing facility on a corridor that is lacking a controlled pedestrian crossing. This will benefit people accessing existing and proposed activities on foot and will also provide better access to the bus stops located on Main North Road.

2. *Design and Layout: Whether the design and layout of the proposed activity maximises opportunities, to the extent practicable, for travel other than by private car, including providing safe and convenient access for travel by such modes.*

The development will promote active travel modes by providing appropriate infrastructure. New pedestrian paths are designed to link the development to the footpaths on the surrounding road network including a new footpath along the Lydia Street ROW and internal footpath connections between the different activities including between the Head Office, supermarket and general retail activities. On site customer and staff cycle parking provisions will appeal to prospective users and users will be able to connect to two CCC Major Cycleways within 700m of the site. The supermarket will also provide electric car charging facilities to promote the use of electric cars.

3. *Heavy vehicles: For activities that will generate more than 250 heavy vehicle trips per day, whether there are any effects from these trips on the roading infrastructure.*

Heavy vehicle movements to/from the site will be less than 250 heavy vehicle trips a day. Therefore, no adverse effects on the roading infrastructure is expected.

4. *Accessibility of the location: Whether the proposed activity has demonstrated the accessibility of the site by a range of transport modes and whether the activity's location will minimise or reduce travel to and from the activity by private vehicles and encourage public and active transport use.*

The development provides opportunities for customers who wish to travel by alternative modes. However, given the nature of the development it is unlikely that all customers will visit by alternative modes due to the inconvenience of carrying groceries. The accessibility of the site was investigated in Section 4 which shows the existing pedestrian, cycle and public transport infrastructure and how the development connects to the available infrastructure. It is recommended that a Travel Plan is developed for all supermarket employees to promote alternative modes of transport and the benefits of using these modes.

5. *Network effects: Having particular regard to the level of additional traffic generated by the activity and whether the activity is permitted by the zone in which it is located, whether measures are proposed to adequately mitigate the actual or potential effects on the transport network arising from the anticipated trip generation (for all transport modes) from the proposed activity, including consideration of cumulative effects with other activities in the vicinity, proposed infrastructure, and construction work associated with the activity.*

As explained in Section 5, from a motor vehicle point of view, approximately 80% of customers expected at the supermarket are considered to be already on the road network. The modelling assessment examined the cumulative effects of the development with other committed developments on the adjacent transport network and concluded that the FSIL Site will function at an acceptable performance when the Christchurch Northern Corridor is operational.

The development is located on an Arterial road which is well serviced by public transport services that run at a high frequency. The CCC Public Transport Infrastructure Long Term Plan 2015-2025 (July 2017) sets out level of service and performance measures for Public Transport Infrastructure activity in Christchurch. The target is to increase journey reliability by reducing the percentage variation from the scheduled time for core routes by 2025. The Blue line which passes the FSIL site is listed as a core route. The performance target is to reduce the variation from 3.4% to less than 2% for the Blue line by 2025.The increase in bus reliability will significantly influence public transport ridership. A reliable and on time service will ensure that employees can arrive/ depart work on time and customers can plan their trips better.

11. Conclusion

Foodstuffs South Island Limited proposes to:

a) establish, operate and maintain a supermarket and associated fuel facility, ancillary offices, car parking, access, signage and landscaping at 171 Main North Road;
b) provide an emergency coordination facility at 171 Main North Road;
c) alter the existing site access and car parking arrangements for the existing Foodstuffs South Island Limited Head Office; and
d) alter access arrangements for the retail and commercial tenancies located at 3-7 Northcote Road, Papanui, Christchurch.

A key feature of the proposal is a new signalised intersection on Main North Road providing safer and more efficient access for vehicles to and from the entire site and improved pedestrian access across Main North Road. This when combined with the optimised operation of the Main North Road corridor results in a reduction in local traffic circulating through residential streets to connect to the wider network.

The only new trip generating activity of the proposal is the supermarket and fuel facility. A Full Integrated Transport Assessment is required to support the proposal as the size of the supermarket triggers the High Trip Generator rule. To assess the effects of the proposal on the surrounding transport network a microsimulation model has been set up in s-Paramics (Paramics). The model has been developed in consultation with CCC staff and covers an area large enough to reasonably reflect the current extents of congestion and to enable realistic route choice to and from the site from the surrounding areas.

The modelling results indicate that the development traffic can be absorbed by the surrounding road network when the Christchurch Northern Corridor is operational. Some elements of the network experience improved performance due to the introduction the site access signals on Main North Road and safer and more efficient lane configuration and phasing proposed at the QEII / Main North Road signals. Overall the effects of the development traffic are considered acceptable.

The proposal has been assessed against the transport related rules of the Christchurch City Council Operative District Plan, and complies with most transport rules, except the rules regarding access design, and number of vehicle crossings. These non-compliances have been further assessed and due to mitigating design elements of the proposal, it can be concluded that no notable effects are expected as a result of the non-compliances.

Consistent with local and regional transport policy, the development will promote active transport modes by providing excellent pedestrian and cyclist infrastructure such as signalised pedestrian crossings, pedestrian linkages within the car park, and visitor and staff cycle parking. The development is also well positioned to benefit from the excellent public transport services along Main North Road. Alternative travel modes to private car will be promoted by creating personalised Travel Plans for both supermarket and FSIL Head Office staff.

The ECF will operate temporarily during a Civil Defence emergency and during this time, the facility will be under the control of Civil Defence to manage the logistics of the operations. Road network operations are likely to be disrupted and will have very different travel patterns to day to day operations. The site has direct access to the Christchurch Arterial Road Network via multiple vehicle crossings located on Main North Road and Northcote Road. Being part of the Christchurch Arterial Road network, it is anticipated that these roads would receive immediate attention from CCC following a disaster event as they are the most critical roads in the road hierarchy in terms of their movement function. Therefore, this site, at the intersection of two arterial roads, is well located in terms of access to the strategic road network post event.

Overall, the proposed development can be supported from a traffic and transportation perspective and it is considered that there are no traffic related reasons why consent should not be granted.

Appendix A
Paramics Model Setup and Calibration

A1 Paramics Model Setup

A1.1 2018 Base Model

Model Network and Zone System

Paramics models operate by utilising a set of traffic demands based on trips in the modelled network having an origin and destination and these are combined into a matrix form. The origins and destinations are at zones in the model and the zone system derived is shown in **Figure A1.1** as well as the basic road network structure that was adopted.

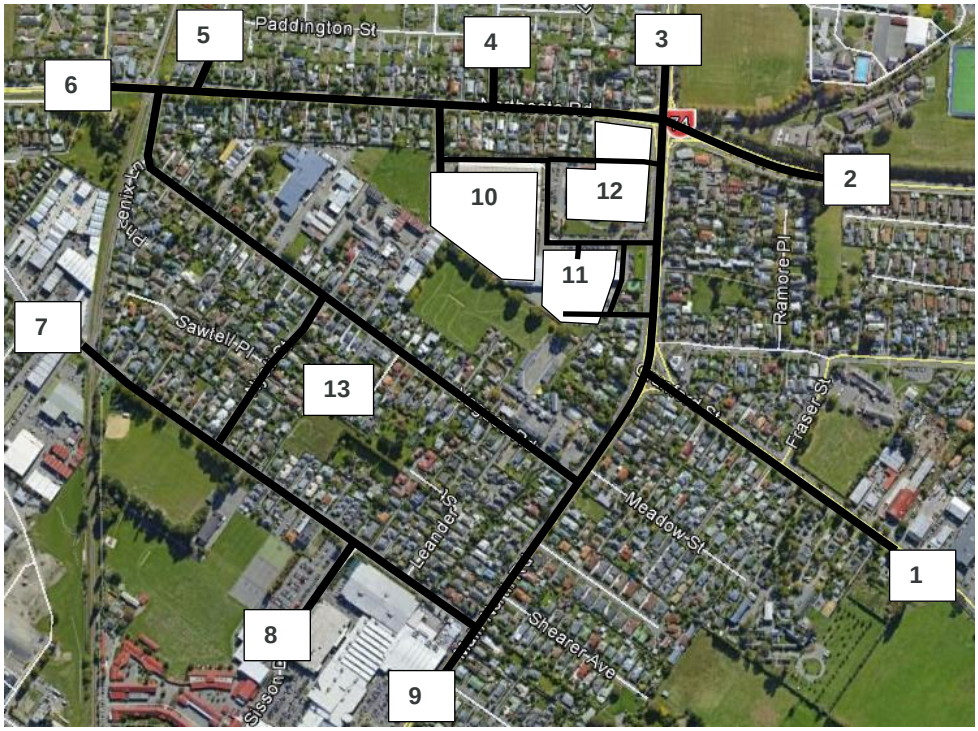


Figure A1.1 Network and zone system

The zones are at the extents of the model area (Zones 1-9) with some internal zones to represent the residential activity (Zone 13), Foodstuffs Head Office (Zone 11), Toll site (Zone 10) and the supermarket / retail site (Zone 12).

Base Year Demands (2018)

The key input for the traffic demand process are traffic counts at the Cranford Street and Northcote Road intersections on Main North Road. The surveys were undertaken between 4pm and 6pm on Thursday 8 March 2018. In days leading up to the survey the intersection of QEII Drive and Grimseys Road was closed as part of the CNC works to upgrade the intersection. Advice from NZTA around the closure was that an extra 400 vehicles per hour would use the Main North Rd/QEII Dr/Northcote Rd intersection in the evening peak hour.

The traffic at the external entry points to the model have been distributed to the other zone destinations based on the most likely route pattern for each of the turning movements. Downstream turning patterns were used to assist with this manual distribution pattern. This process was done iteratively until a basic trip matrix was complete which was then furnessed to ensure total trips in and out of the zones were as close as possible to the observed values.

The vehicle trips were then broken down into vehicle types creating a light vehicle matrix and a heavy vehicle matrix on a percentage basis. This was done based on the origin-destination zone combination to keep the larger vehicles to the arterial roads.

The travel time surveys were undertaken in parallel with the turning movement survey. The routes covered Main North Road from Sawyers Arms Road to Momorangi Crescent, Cranford Street from McFaddens Road up to the northern point (Momorangi Cresent) on Main North Road and the Northcote Road/QEII Drive corridor from the railway to Winters Road.

A1.2 2018 Base Year Calibration

As already noted the immediate road network currently suffers with congestion so there are many factors and traffic behaviours that come into play. The way these factors combine and interact drive the way the traffic builds up each evening peak and given the number of factors involved it is of no surprise that on-road experiences vary from day to day.

Preloading and Queuing

During site visits to observe traffic behaviours it was noted that the northbound flow on Main North Road at the site started to breakdown during the hour before the modelled two-hour peak. This meant that reasonable queues had built up prior to 4pm. From 3pm to 4pm the excess queuing of note was on Main North Road northbound between Northcote and Cranford Streets and westbound on Northcote Road from Main North Road intersection. In order for queues to develop in the peak period a pre-peak hour, or warm up period, has been estimated based on the shape of the peak period matrix.

The issue with Northcote Road appeared to be stemming from the rail crossing at Vagues Road where the pedestrian crossing was being called frequently while students were using the railway shared path to cross Northcote Road. The queue extended back to Main North Road at times but this reduced by about two thirds heading into the 4pm peak period. The crossing was only being called every two cycles on average in the peak period. In the model the crossing has been set up to be called every cycle in the pre-peak and every second cycle in the peak period.

The Main North Road queue was dependent on the discharge through the signals and the arrivals from upstream sources. The signals where discharging the full northbound queue at the start of the pre-peak but as the demand rate picked up the excess queue from vehicles that did not clear in one cycle began to build up. In one cycle the signals managed to clear about 15 to 17 vehicles in each of the through lanes on Main North Road which is around the length of the right turn bay. It was noted that there is space for approximately 30 more vehicles behind before the queue would block back to the Cranford Street intersection. This means that the signals were only clearing about one third of the queue once it backed up to Cranford Street. The screen shot in **Figure A1.2** shows a model run at 3:55pm with the queue discharging at Northcote Road and just filling up at the Cranford Street end. At this stage the space available once the queue compressed was just enough for the arriving traffic from Cranford Street and Main North Road.

Figure A1.2 Queuing in Main North Road

SCATS Data

SCATS data was collected on the 22 November 2017 which is after the opening of the Western Belfast Bypass and included the following intersections:

- Main North Road / Northcote Road / QEII Drive
- Main North Road / Cranford Street
- Main North Road / Sawyers Arms Road
- Northcote Road / Vagues Road
- Sawyers Arms Road / Sissons Drive

The SCATS data included traffic volume information from the detectors and traffic signal phasing. The volume data was useful in determining the arrival profile of traffic in five minute intervals. The phasing data allowed average phase times to be calculated for use in the peak period.

The Main north Road corridor typically operated on an 85 second cycle so this was adopted for the model and allowed coordination where possible. The "A" phase from the three signals on Main North Road were tracked over the peak period to obtain offsets between the signals. The Sawyers Arms intersection was set to time zero and the Cranford Street intersection was offset by 45 seconds. The Northcote/QEII intersection was offset by a further 10 seconds.

The Northcote Road / Vagues Road intersection and the Sawyers Arm Road / Sissons Drive intersection operated on independent cycle times so the average phase times at each intersection were adopted. The offsets were left at zero as the signals would naturally get out of sync with the Main North Road corridor.

Signal Amber Settings

The four timed settings at amber times are usually set to the following in the NZ context:

- Red to green amber time – 0 seconds (a UK feature only)
- Red to green reaction delay –2 seconds (sometimes 1 second)
- Green to red amber time – 4 seconds
- Green to red reaction delay – 2 seconds

Prior to calibration the settings were adopted in the standard arrangement but watching the simulation there were vehicles passing over the stop lines well into the red time. It appeared that the red to green reaction delay was operative but the level of adherence to the green to red reaction delay was uncertain, so a new set of settings was adopted to control the phase termination and inter-green times as follows:

- Red to green amber time – 0 seconds
- Red to green reaction delay –2 seconds
- Green to red amber time – 2 seconds
- Green to red reaction delay – 0 seconds

Under standard timings the all red time is set to 1 second for a 5 second inter-green but this was increased to 3 or 4 seconds under the new settings to maintain the full inter-green period. There was much better adherence to the red signal. Where traffic was observed to be continuously pushing the amber running time to the limit the all red was reduced to 2 seconds and the green time increased to maintain the average phase time. This was quite typical of the right turn movements that had a leading green arrow.

Reverse Priority

A common feature in queued or very slow-moving traffic is the courtesy of traffic on the main road stopping to let traffic enter from a side road. This helps to reduce queues on the side roads but can worsen or create queues on the main road. There are several points along the Main North Road corridor where this occurs which is at the two FSIL Head Office exit points and at Vagues Road. Paramics has a force merge/force across feature but this was not sufficient to cater for the observed demands from these traffic sources which were being absorbed into the main traffic stream. Yellow box junctions have been set up at these locations and various adherence levels have been used for the main road movements until the most likely absorption was achieved.

A yellow box junction was also applied to the Main North Road / Cranford Street intersection, so traffic did not enter the intersection before the exit point to the north was clear. The Cranford Street traffic was observed to be more adherent to this than Main North Road so accordingly it has a higher adherence factor.

Reverse priority was also observed on Cranford Street in the commercial areas near the Caltex Station and this has been basically represented by stopping a north-westbound vehicle in this location on Cranford Street for 20 seconds every three minutes from 14:45 to 17:21. This aligns with probable high exit flows from this area and the time when queues are at or beyond this location.

Link Speed Limits

One feature of recent modelling we have undertaken in other locations where there is severe congestion is the queue dissipation appears to behave more like a standard urban 50 km/h link than the stated speed limit. The northbound link speed has been set to 50kmph on Main North Road up to Northcote Road. Southbound is set to the current 60km/h limit as it generally free-flows in this manner. Cranford Street has a 50 km/h link speed from where it diverges from 1 to 2 lanes northwest bound up to Main North Road otherwise set to the posted 60km/h limit.

Mean Headway

One setting that has been changed in this model is the Mean Headway which helps to determine the separation of vehicles when travelling in close proximity. The default value is 1.1 seconds and this was changed incrementally to see the effects on congestion in the model. This parameter has a reasonable effect on model queuing and with all the other settings selected the best value for Mean Headway was selected at 1.41 seconds. Note that the slider to select this value in Paramics has issues with value rounding (1.41 shows as 1.40 and 1.40 will show as 1.30) so this was changed directly in the configuration text file. At default levels the queue dissipation appeared to be overly optimistic.

Cranford Street Approach Coding

The southern approach of Main North Road to the intersection of Cranford Street appears simple but this approach flares from one lane to two lanes over a distance of around 45m then immediately a right turn bay begins to develop all while traversing a curve to the left. When the model was first set up the approach was coded in this fashion with a single lane diverging into two lanes and finally three lanes leading into the intersection. The right turn bay would block back to occupy one lane of the two-lane section as observed on street. This meant at times the through movement was serviced by a full single lane and short lane. When this occurred in the model the vehicles would not fully utilise the short lane for the through movement reducing the throughput and making queuing worse than it should.

Multiple methods were tried to encourage through vehicles to use the full and the short lane and the only arrangement that would work was with three full lanes. There is one link with two lanes for the through movement from the point where two lanes develop on street. The right turn was split out into sperate links and then the right turn lane starting point (i.e. the Paramics “stop-line”) is overlapped on the central through lane. This was done so if the right turn lane queue was long enough it would block the through vehicles while much better reflection of observed lane utilisation on the through lanes. This layout is shown in **Figure A1.3**.

The only disadvantage was on occasions a through vehicle would appear to move over a stationary right turn vehicle as it there is effectively three lanes modelled at this point. This is perhaps countered by not being able to model vehicles cutting into the bus lane to pass the point where the queue from the right turn blocks back which was observed on street. Overall the layout adopted presents the best reflection of on street operation.

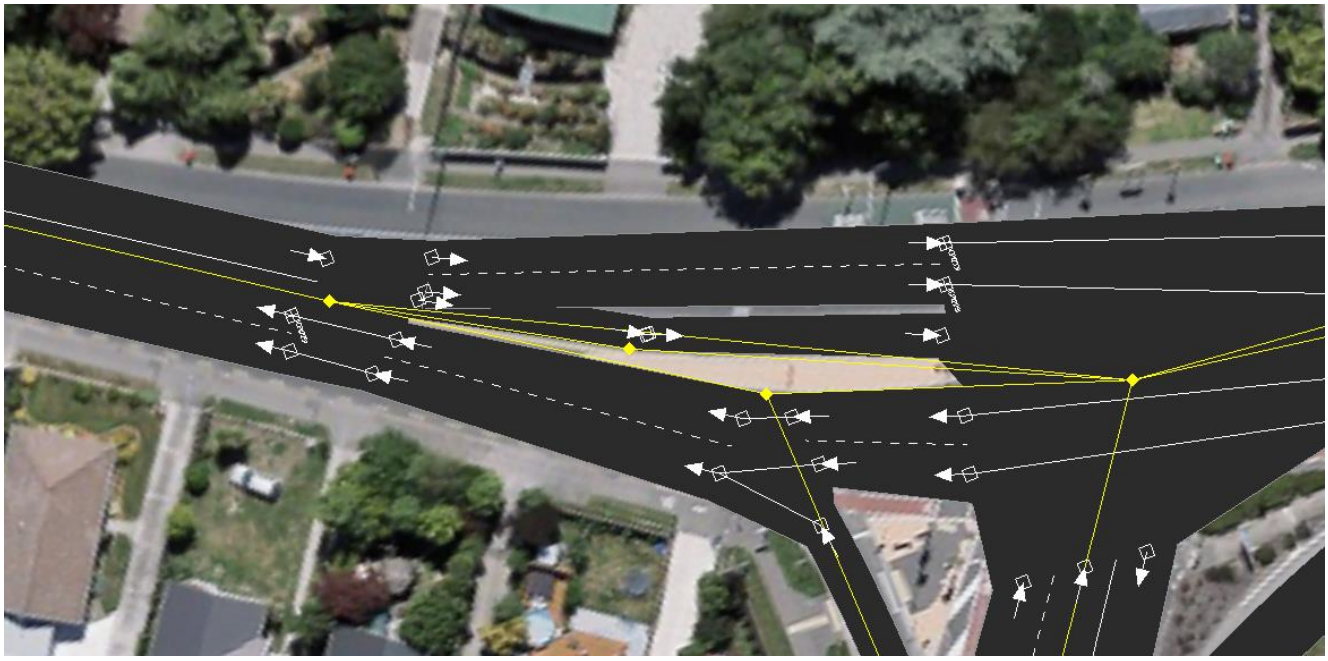


Figure A1.3 Cranford Street and Main North Road intersection

A1.3 2018 Base Year Validation

Turning movements at key intersections

Three key intersections in the base model has been validated to ensure they are appropriate and validated against surveyed count data. These include:

- Main North/ QEII/ Northcote intersection
- Main North/ Cranford intersection
- Main North/ Vagues intersection

The modelled and surveyed turning movements at the three intersections for the period of 4pm to 6pm are shown in **Figure A1.1** to **Figure A1.3** respectively.

Table A1.1 Main North/ QEII/ Northcote intersection

Movement Description		4pm to 5pm					5pm to 6pm					4pm to 6pm				
Approach	**Movement**	**Model**	**Survey**	**diff**	**GEH**	**%**	**Model**	**Survey**	**diff**	**GEH**	**%**	**Model**	**Survey**	**diff**	**GEH**	**%**
North	Left	162	155	7	0.6	105%	171	156	15	1.2	110%	333	311	22	1.2	107%
North	Through	702	694	8	0.3	101%	747	742	5	0.2	101%	1449	1436	13	0.3	101%
North	Right	158	149	9	0.7	106%	168	154	14	1.1	109%	326	303	23	1.3	108%
East	Left	156	179	-23	1.7	87%	170	179	-9	0.6	95%	326	357	-31	1.7	91%
East	Through	550	557	-7	0.3	99%	613	557	56	2.3	110%	1163	1114	49	1.5	104%
East	Right	141	150	-9	0.7	94%	155	150	6	0.4	104%	296	299	-3	0.2	99%
South	Left	199	168	31	2.3	118%	201	164	37	2.7	123%	400	332	68	3.6	120%
South	Through	1362	1380	-18	0.5	99%	1396	1406	-10	0.3	99%	2758	2786	-28	0.5	99%
South	Right	204	207	-3	0.2	99%	209	206	3	0.2	101%	413	413	0	0.0	100%
West	Left	160	166	-6	0.5	96%	163	148	15	1.2	110%	323	314	9	0.5	103%
West	Through	737	731	6	0.2	101%	748	785	-37	1.3	95%	1485	1516	-31	0.8	98%
West	Right	198	200	-2	0.1	99%	198	198	0	0.0	100%	396	398	-2	0.1	99%
Intersection		4729	4735	-6	0.1	100%	4939	4844	95	1.4	102%	9668	9579	89	0.9	101%

Table A1.2 Main North/ Cranford intersection

Movement Description		4pm to 5pm					5pm to 6pm					4pm to 6pm				
Approach	**Movement**	**Model**	**Survey**	**diff**	**GEH**	**%**	**Model**	**Survey**	**diff**	**GEH**	**%**	**Model**	**Survey**	**diff**	**GEH**	**%**
North	Left	540	491	49	2.2	110%	563	539	24	1.0	104%	1103	1030	73	2.2	107%
North	Through	568	583	-15	0.6	97%	578	572	6	0.3	101%	1146	1155	-9	0.3	99%
East	Left	281	254	27	1.7	111%	270	281	-11	0.7	96%	551	535	16	0.7	103%
East	Right	780	809	-29	1.0	96%	798	864	-66	2.3	92%	1578	1673	-95	2.4	94%
South	Through	912	831	81	2.7	110%	952	877	75	2.5	109%	1864	1708	156	3.7	109%
South	Right	251	298	-47	2.8	84%	267	311	-44	2.6	86%	518	609	-91	3.8	85%
Intersection			3332	3266	66	1.1	102%	3428	3444	-16	0.3	100%	6760	6710	50	0.6

Table A1.3 Main North/ Vagues intersection

Movement Description		4pm to 5pm					5pm to 6pm					4pm to 6pm				
Approach	**Movement**	**Model**	**Survey**	**diff**	**GEH**	**%**	**Model**	**Survey**	**diff**	**GEH**	**%**	**Model**	**Survey**	**diff**	**GEH**	**%**
North	Through	799	773	26	0.9	103%	797	773	24	0.9	103%	1596	1546	50	1.3	103%
North	Right	54	90	-36	4.2	60%	55	94	-39	4.5	59%	109	184	-75	6.2	59%
South	Left	9	17	-8	2.2	53%	1	17	-16	5.3	6%	10	34	-24	5.1	29%
South	Through	1096	1067	29	0.9	103%	1156	1016	140	4.2	114%	2252	2083	169	3.6	108%
West	Left	68	156	-88	8.3	44%	70	151	-81	7.7	46%	138	307	-169	11.3	45%
West	Right	8	4	4	1.6	200%	8	4	4	1.6	200%	16	8	8	2.3	200%
Intersection			1983	2107	-124	2.7	94%	2047	2055	-8	0.2	100%	4030	4162	-132	2.1

The GEH statistic is used to compare surveyed and modelled counts because it is tolerant of relative and absolute errors, e.g. larger percentage differences on lower counts and larger absolute differences on higher counts Most of the GEH values in **Table A1.1** to **Table A1.3** are less than 5 with the exception of few turning movements at the Main North Road/ Vagues Road intersection. It is noted that the observed counts are four years old (from 2014) and the model is generally high for the Main North Road through movements. It is also noted that the capacity of the adjacent Main North Road /Sawyers Arms Road signals has been increased between 2014 and 2018 with an extended left turn lane which may explain why the Paramics model has slightly lower left turn volumes out of Vagues Road compared to the 2014 survey.

Overall, the modelled turning movements at key intersections validate well with the surveyed turning movements.

Travel Time

Some key routes through the model have been checked against an average Thursday travel time observed in March 2018 to ensure that network speed coding is in the right order. A comparison of the observed travel times against the model average path journey times are shown in **Table A1.**. Timing points for each route are shown in **Figure A1.4**.

Figure A1.4 Travel time timing points

Table A1.4 Travel time comparisons

Route	Mean surveyed travel times (s)	Mean modelled travel times (s)	Difference (s)	Difference (%)	Comments
C - N	425	459	34	8%	Survey times mostly in 5-6pm hour so comparison with modelled 5-6pm.
E - W	189	133	-56	-30%	Input volumes have been adjusted due to the closure of Grimseys Road so the model operates faster.
N - C	124	109	-15	-12%	Survey times mostly in 4-5pm hour so comparison with modelled 4-5pm
N - S	164	158	-6	-4%	Survey times mostly in 5-6pm hour so comparison with modelled 5-6pm.
S - N	247	237	-10	-4%	Survey times across both hours so comparison with modelled 4-6pm.
W - E	273	275	3	1%	Comparison with modelled 5-6pm.

The comparisons in **Table A1.** show most of the key routes are within 15% or one minute except for the E-W route. These indicate that the model generally reflects existing speed conditions on the major links.

A1.4 Future 2021 and 2031 Models

The future models are informed by the Christchurch Assignment and Simulation Traffic Model (CAST) by way of a sub-area extracted from the wider CAST model.

Model Network and Zone System

The 2021 and 2031 zone system are similar to the 2018 base model with an addition of three new zones to represent the residential activity (Zone 14 and 15) and the existing retail activity at the southwest corner of the Main North/QEII/Northcote intersection (Zone 16). The adopted model network and zone system for 2021 and 2031 models without the proposed development are shown in **Figure A1.5**.

Figure A1.5 2021 and 2031 model network and zone system without the proposed development

The 2021 and 2031 model network and zone system with the proposed development is similar to that shown in **Figure A1.5** with the following changes to the site:

- A new signalised intersection on Main North Road which provides all turning movements to and from the site; and
- Relocation of the existing access to the Foodstuffs Head Office on Main North Road.

The future 2021 and 2031 vehicle access arrangement without and with the proposed development is shown in **Figure A1.7** and **Figure A1.8** respectively.

Figure A1.6 Future vehicle access without proposed development

Figure A1.7 Future vehicle access with proposed development

The 2021 network is similar to the 2018 network except for four-laning on QEII Drive. There are some changes to the signal operations to account for changes in traffic patterns where necessary.

The 2031 network includes the four-laning of Northcote Road since the 2018 Council Long Term Plan programmes this project to be implemented in the period from 2023 to 2026. Further operational changes are made to the signals as required.

Bus services adopted in the 2021 and 2031 models are the same as the 2018 base model.

Preloading and Queuing

The pre-peak hour (3pm to 4pm), or warm up period, has been estimated based on the 2018 base model matrix. The 3pm to 4pm demand is approximately half of the two-hour peak period (4pm to 6pm) demand.

Foodstuffs Head Office Trip Generation Profile

A survey of the Foodstuffs head office on Thursday, 8 March 2018 between 4pm and 6pm shows that approximately 52% of trips generated by the head office occurred over 20 minutes, between 4:30pm and 4:50pm, coinciding with the existing shift ending time at 4.30pm. Foodstuffs proposed to include changes to the head office shift times as part of the proposal as an initiative to spread the peak 20-minute trip generation during the evening peak period. Foodstuffs head office trip generation has been redistributed between 4:00pm and 5:15pm in the 2021 and 2031 models to reflect the proposed operational changes. The existing and adjusted trip generation profiles are included in **Figure A1.8**.

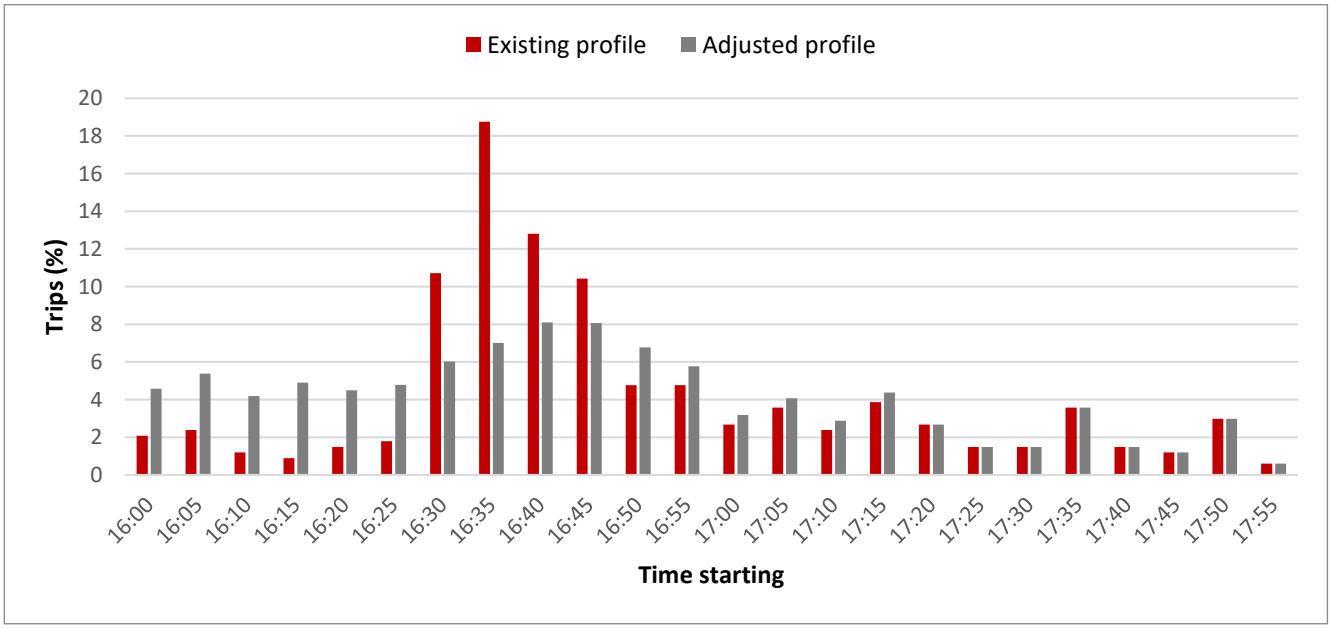


Figure A1.8 Existing and adjusted Foodstuffs head office trip generation profiles

2021 and 2031 Demands

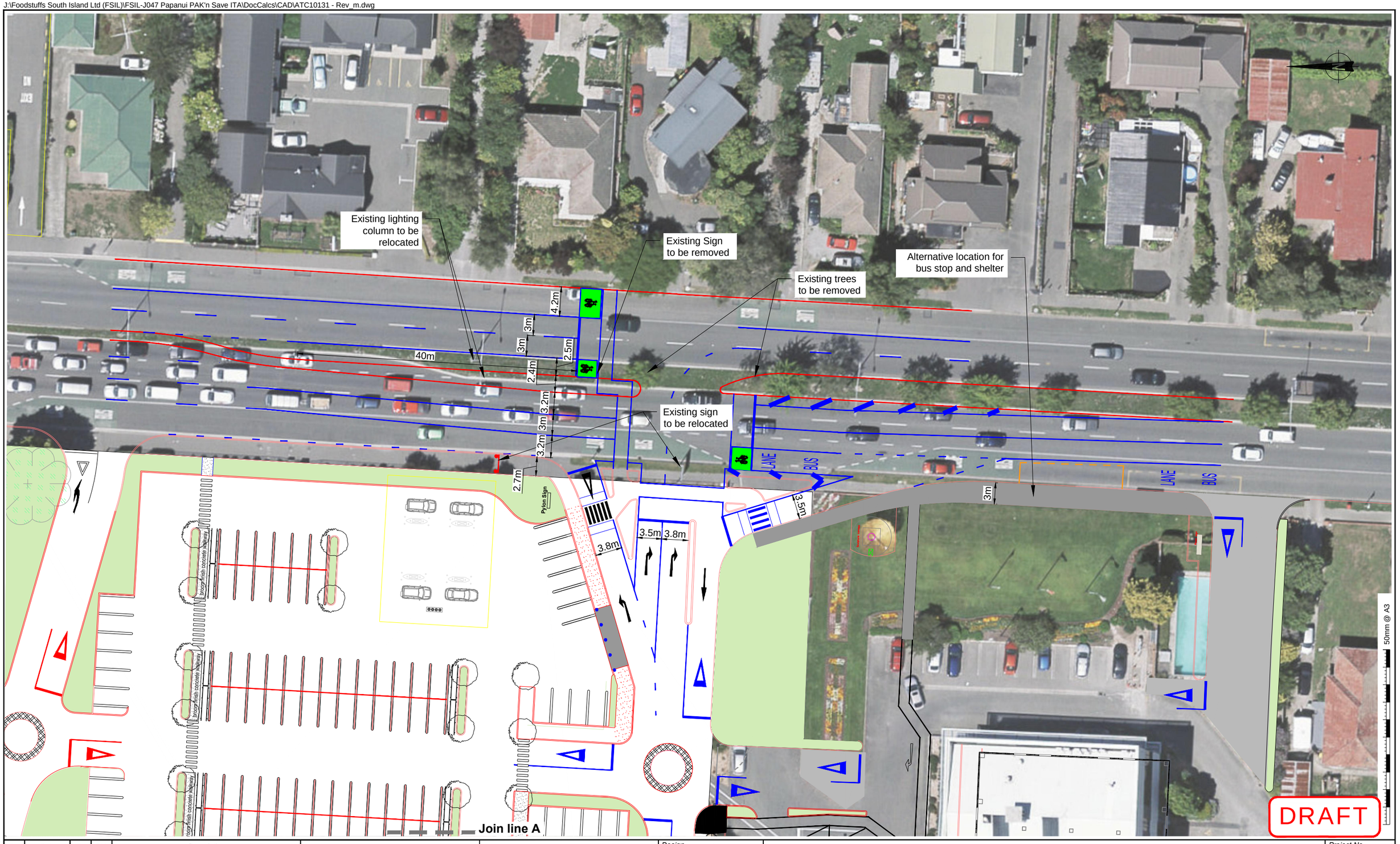
The CAST model was used to inform the future year demand scenarios. The trip generation for the proposed supermarket has been adjusted from the initial ITA rate of 15 trips per 100m^2 GFA to 12.5 trips per 100m^2 GFA as discussed in Section 7.1.

2 Lydia Street Development Demands

Future tests include 2 Lydia Street demands as part of the base in 2031. The future year demand scenarios with the development on 2 Lydia Street was informed by CAST. Traffic to and from 2 Lydia Street has right of way off Main North Road and has been modelled with access via the new signalised access on Main North Road in the scenario with the proposed development.

Appendix B
Swept path analysis

J:\Foodstuffs South Island Ltd (FSIL)\FSIL-J047 Papanui PAK'n Save ITA\DocCalcs\CAD\ATC10131 - Rev_m.dwg



Rev	Date	By	Chk	Description
F	01/06/2018	AW	JB	Realigned aisles and roundabout configuration
G	12/06/2018	AW	JB	Added FSIL Car park layout as provided
L	19/12/2018	GB	AMH	Free left turn added at signalised intersection
D	21/05/2018	AW	JB	Added access to FSIL HQ car park, northern site edits
E	28/05/2018	AW	JB	Modified Car Park and Access

abley

FOODSTUFFS South Island Limited

Design	AW/JB
Drawn	AW
Checked	JB/AMH
Issued	10/04/2019
Scale	1:500 @ A3

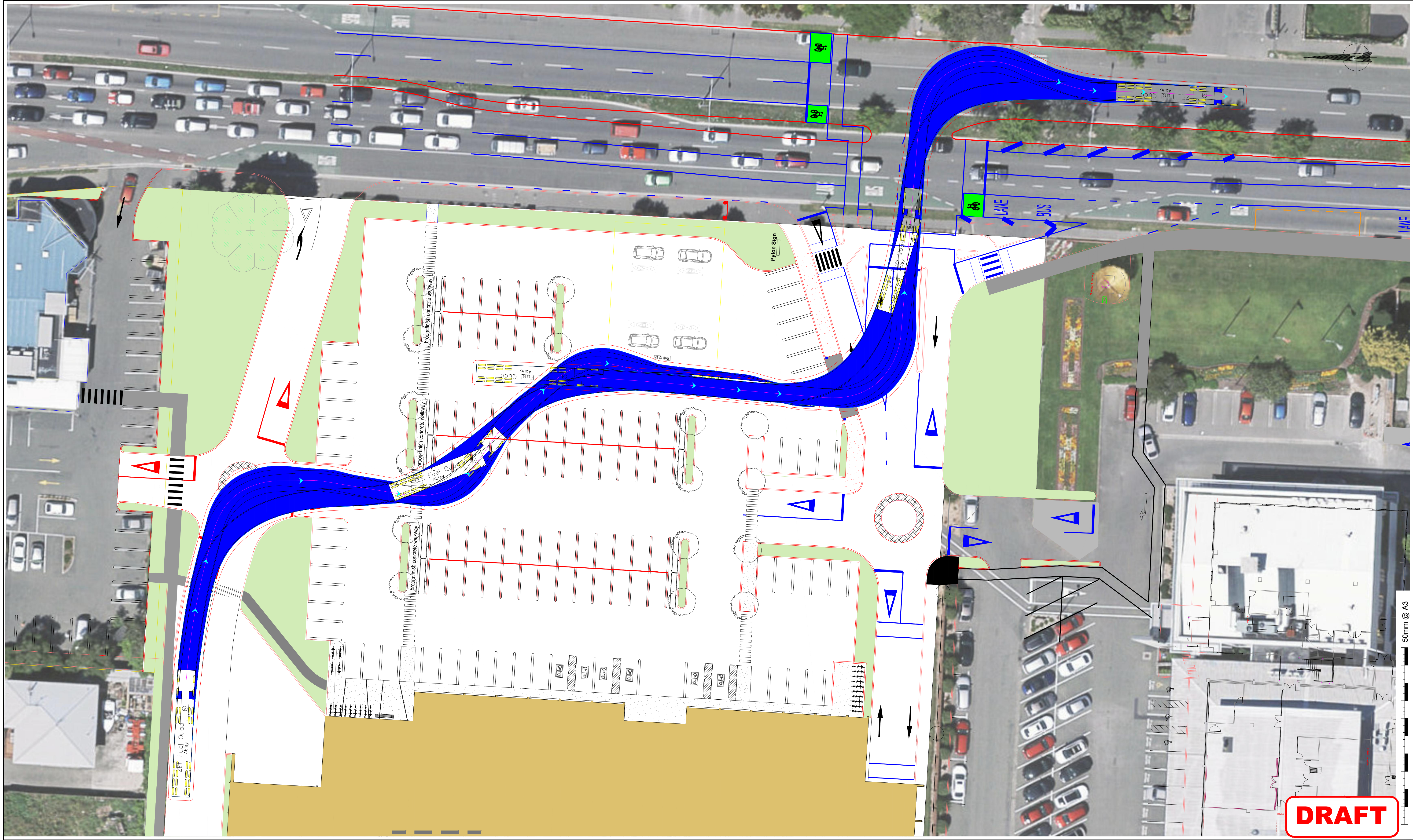
FSIL PAK N SAVE Papanui

Proposed Site Layout

Main Access Signalised Intersection

Project No.	FSIL-J047
Dwg #	ATC10131
Sheet	1
Revision	M

J:\Foodstuffs South Island Ltd (FSIL)\FSIL-J047 Papanui PAK'n Save ITA\DocCalcs\CAD\ATC10131 - Rev_m.dwg



Rev	Date	By	Chk	Description
F	01/06/2018	AW	JB	Realigned aisles and roundabout configuration
G	12/06/2018	AW	JB	Added FSIL Car park layout as provided
L	19/12/2018	GB	AMH	Free left turn added at signalised intersection
D	21/05/2018	AW	JB	Added access to FSIL HQ car park, northern site edits
E	28/05/2018	AW	JB	Modified Car Park and Access

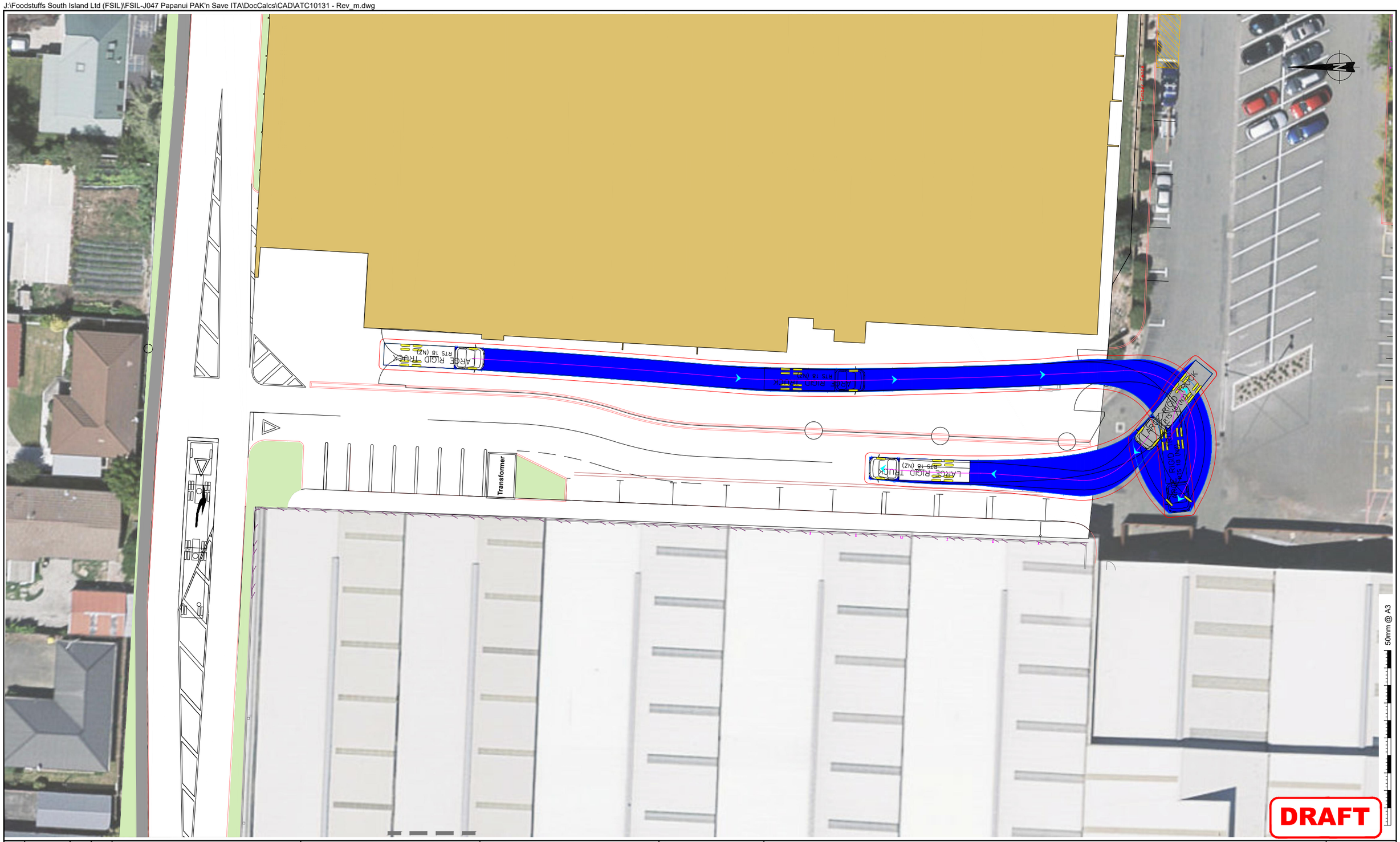
Design	AW/JB
Drawn	AW
Checked	JB/AMH
Issued	21/05/2019
Scale	1:500 @ A3

FSIL PAK N SAVE Papanui

Proposed Site Layout
Vehicle Tracking
Fuel Tanker

Project No.	FSIL-J047
Dwg #	ATC10131
Sheet	1
Revision	M

J:\Foodstuffs South Island Ltd (FSIL)\FSIL-J047 Papanui PAK'n Save ITA\DocCalcs\CAD\ATC10131 - Rev_m.dwg



Rev	Date	By	Chk	Description
F	01/06/2018	AW	JB	Realigned aisles and roundabout configuration
G	12/06/2018	AW	JB	Added FSIL Car park layout as provided
L	19/12/2018	GB	AMH	Free left turn added at signalised intersection
D	21/05/2018	AW	JB	Added access to FSIL HQ car park, northern site edits
E	28/05/2018	AW	JB	Modified Car Park and Access

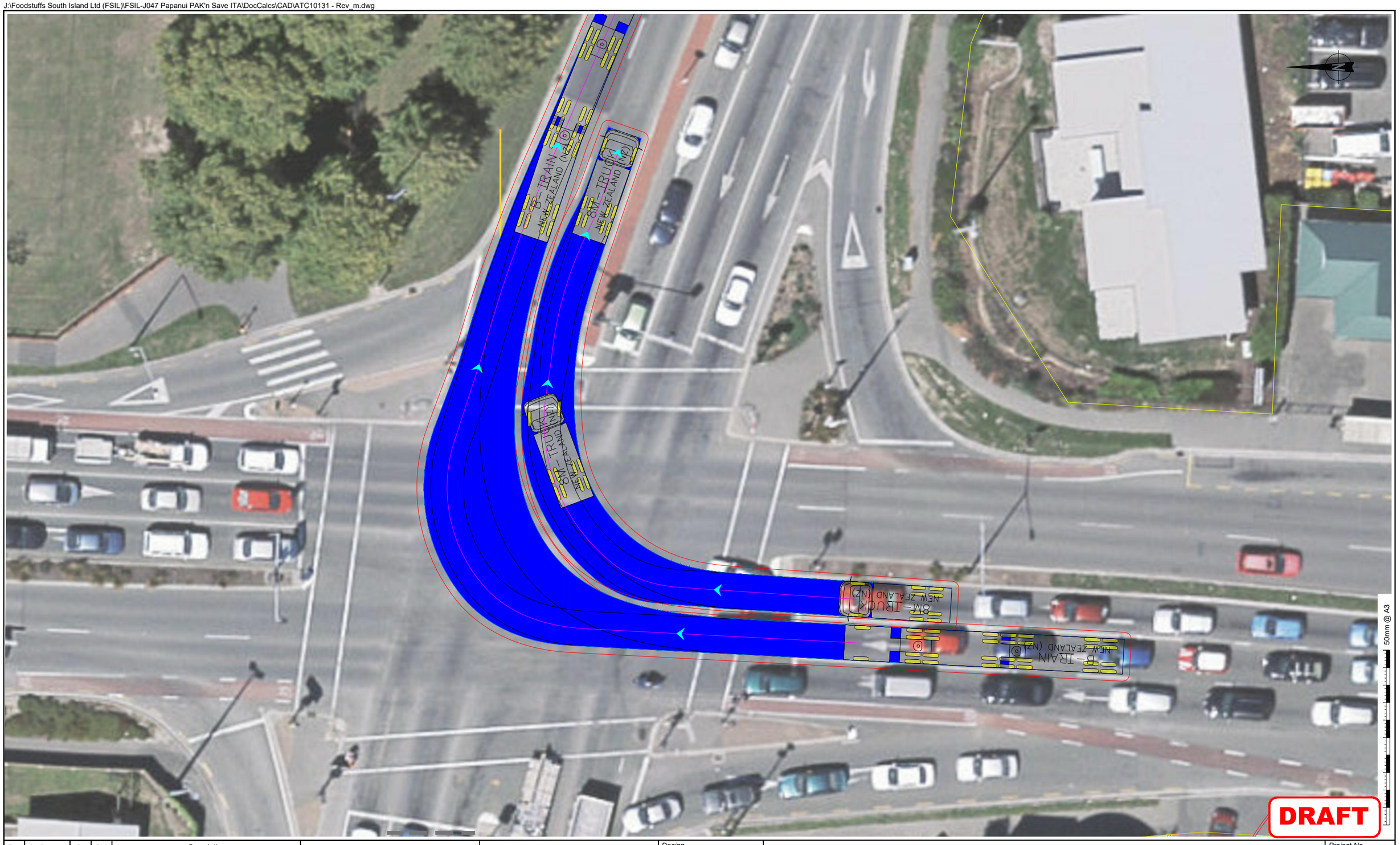
Design	AW/JB
Drawn	AW
Checked	JB/AMH
Issued	21/05/2019
Scale	Custom @ A3

FSIL PAK N SAVE Papanui

Proposed Site Layout
Vehicle Tracking
11.5m Large Rigid Truck

Project No.	FSIL-J047
Dwg #	ATC10131
Sheet	2
Revision	M

J:\Foodstuffs South Island Ltd (FSIL)\FSIL-J047 Papanui PAK'n Save ITA\DocCalcs\CAD\ATC10131 - Rev_m.dwg



Rev	Date	By	Chk	Description
F	01/06/2018	AW	JB	Realigned aisles and roundabout configuration
G	12/06/2018	AW	JB	Added FSIL Car park layout as provided
L	19/12/2018	GB	AMH	Free left turn added at signalised intersection
D	21/05/2018	AW	JB	Added access to FSIL HQ car park, northern site edits
E	28/05/2018	AW	JB	Modified Car Park and Access

Design	AW/JB
Drawn	AW
Checked	JB/AMH
Issued	21/05/2019
Scale	1:250 @ A3

FSIL PAK N SAVE Papanui

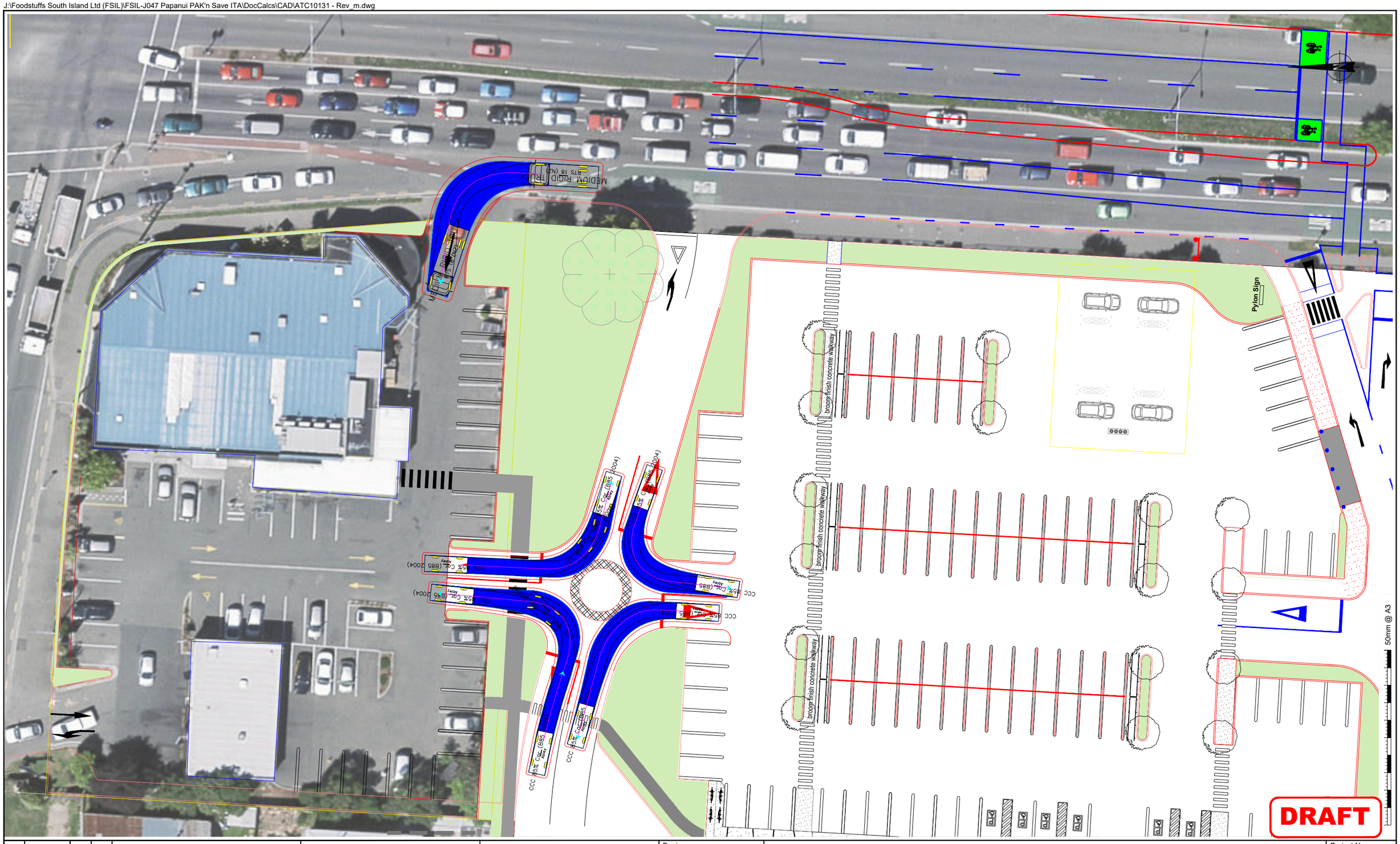
Proposed Site Layout

Vehicle Tracking

Medium Rigid Truck and B-Train Turning Simultaneously

Project No.	FSIL-J047
Dwg #	ATC10131
Sheet	3
Revision	M

J:\Foodstuffs South Island Ltd (FSIL)\FSIL-J047 Papanui PAK'n Save ITA\DocCalcs\CAD\ATC10131 - Rev_m.dwg



Rev	Date	By	Chk	Description
F	01/06/2018	AW	JB	Realigned aisles and roundabout configuration
G	12/06/2018	AW	JB	Added FSIL Car park layout as provided
L	19/12/2018	GB	AMH	Free left turn added at signalised intersection
D	21/05/2018	AW	JB	Added access to FSIL HQ car park, northern site edits
E	28/05/2018	AW	JB	Modified Car Park and Access

Design	AW/JB
Drawn	AW
Checked	JB/AMH
Issued	21/05/2019
Scale	1:400 @ A3

FSIL PAK N SAVE Papanui

Proposed Site Layout

Vehicle Tracking

CCC 85% Cars at Roundabout and 8m Truck Entry

Project No.	FSIL-J047
Dwg #	ATC10131
Sheet	4
Revision	M

50mm @ A3

Appendix C
Crash Reports

5 Year Crash History

Crash severity

Fatal Crash, Serious Crash, Minor Crash, Non-Injury Crash

Crash year

2014 — 2019

Saved sites

Main road V3

Road user type

Pedestrian, Cyclist

Plain English report

3 results from your query.

1-3 of 3

Crash road	Distance	Direction	Side road	ID	Date	Day of week	Time	Description of events	Crash factors
CRANFORD ST		I	MAIN NORTH ROAD	201717761	18/09/2017	Mon	15:10	Car/Wagon1 WDB on Main North Rd lost control turning right	CAR/WAGON1, driver unfamiliar with vehicle/towing, inappropriate speed for road conditions, ENV: slippery road due to rain
MAIN NORTH ROAD	50m	S	NORTHCOTE ROAD	201416150	22/09/2014	Mon	15:55	Car/Wagon1 NDB on MAIN NORTH ROAD hit Pedestrian2 (Age 15) crossing road from left side	PEDESTRIAN2, pedestrian running across, heedless of traffic, stepping out from behind vehicle
MAIN NORTH ROAD	120m	N	WINTERS ROAD	201716460	26/07/2017	Wed	14:45	Cycle1 SDB on MAIN NORTH ROAD sideswiped by Car/Wagon2 SDB on MAIN NORTH ROAD turning left	CAR/WAGON2, failed to give way turning to non-turning traffic

1-3 of 3

5 Year Crash History

Crash severity

Fatal Crash, Serious Crash

Crash year

2014 — 2019

Saved sites

Main road V3

Plain English report

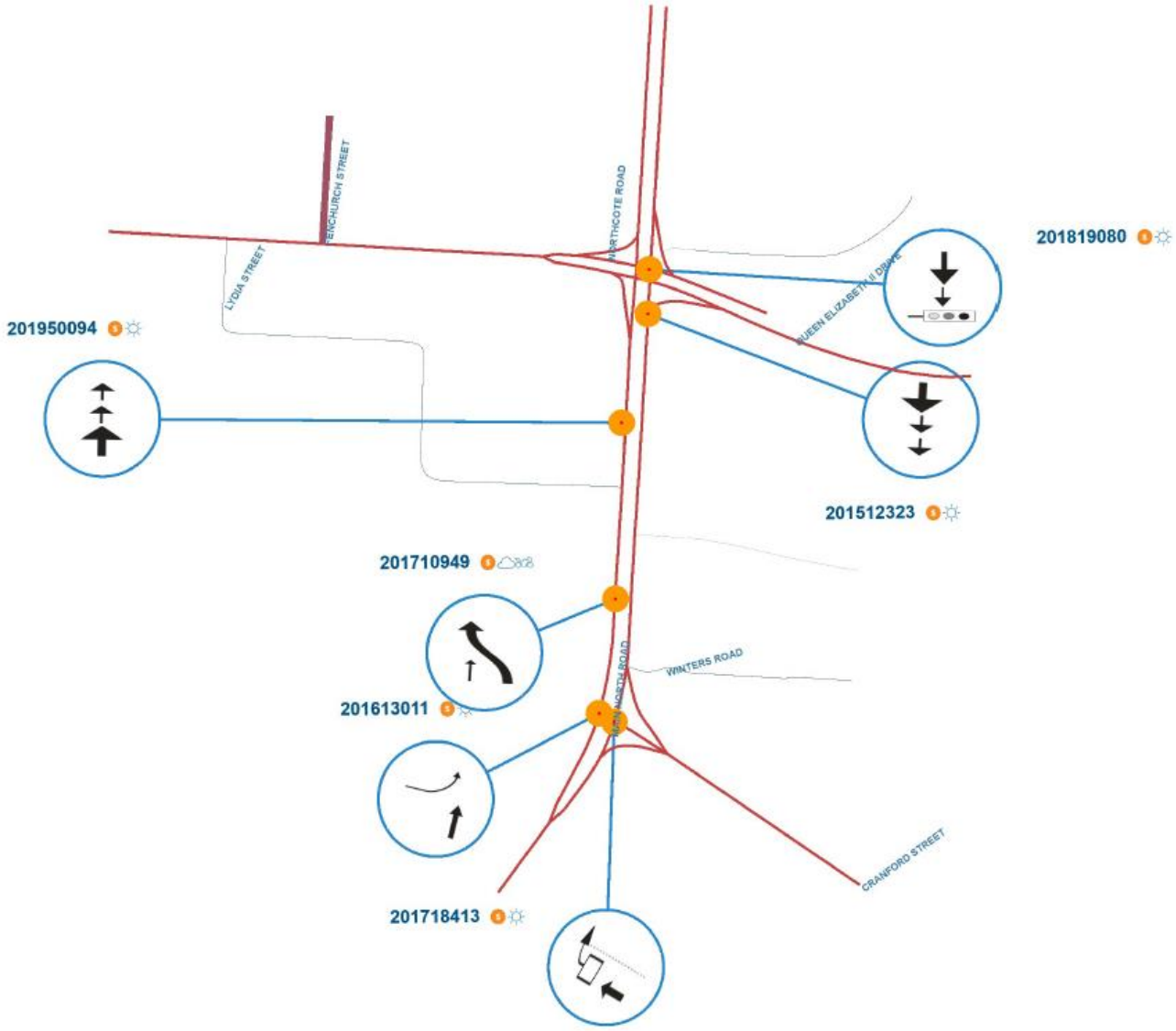
6 results from your query.

1-6 of 6

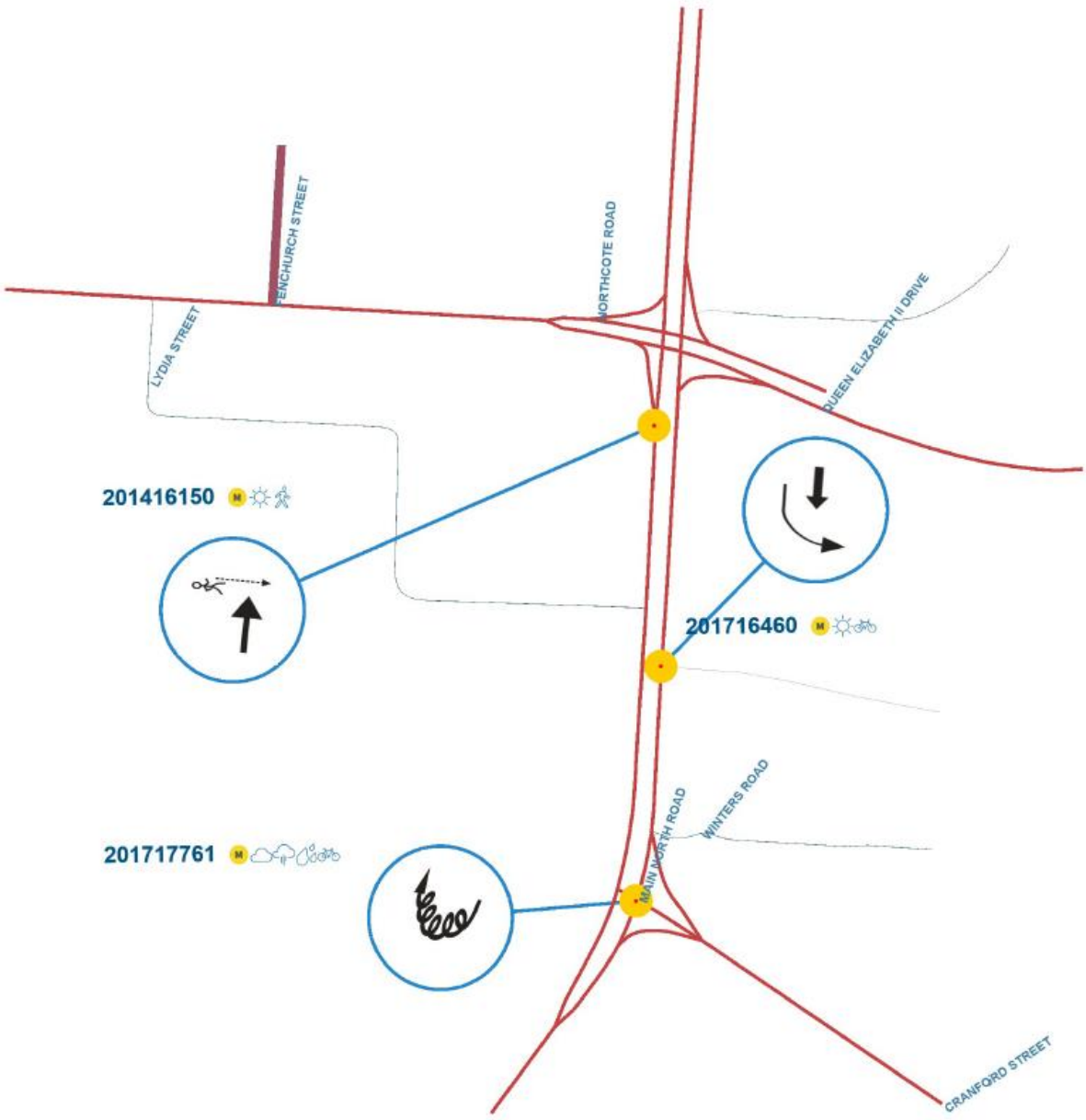
Crash road	Distance	Direction	Side road	ID	Date	Day of week	Time	Description of events	Crash factors
CRANFORD ST		I	MAIN NORTH ROAD	201718413	11/10/2017	Wed	17:37	Car/Wagon1 WDB on CRANFORD ST hit rear of Moped2 WDB on CRANFORD ST turning right from centre line	CAR/WAGON1, following too closely, intimidating driving
MAIN NORTH ROAD	15m	N	CRANFORD ST	201613011	13/04/2016	Wed	17:00	Moped1 NDB on MAIN NORTH ROAD hit Car/Wagon2 merging from the left	CAR/WAGON2, failed to give way when waved through by other dri MOPED1, motor vehicle in cycle lane, new driver/under instruction
MAIN NORTH ROAD	100m	N	CRANFORD ST	201710949	29/01/2017	Sun	15:30	Car/Wagon1 NDB on Main North Road changing lanes to left hit Motorcycle2	MOTORCYCLE2, speed on straight
MAIN NORTH ROAD	105m	S	NORTHCOTE ROAD	201950094	31/01/2019	Thu	10:25	Bus1 NDB on Main North Road hit rear end of Car/Wagon2 stop/slow for queue	CAR/WAGON2, alcohol test below limit BUS1, alcohol test below limit, failed to notice car slowing, stopping/stationary, other attention diverted
MAIN NORTH ROAD	20m	S	SH 74	201512323	15/02/2015	Sun	15:34	Car/Wagon1 SDB on MAIN NORTH ROAD hit rear end of Car/Wagon2 stop/slow for queue	CAR/WAGON1, attention diverted by other traffic, driver over-reacted, wrong pedal/foot slipped
SH 74		I	MAIN NORTH ROAD	201819080	26/10/2018	Fri	13:45	Van1 WDB on QE2 Drive hit rear end of Van2 stop/slow for signals	VAN1, following too closely, misjudged intentions of another party

1-6 of 6

C1 Serious and Fatal Injury Crashes



C2 Pedestrian and Cyclist Crashes



Appendix D
Road Safety Audit and Responses

Main North Road Pak and Save traffic signals

Foodstuffs South Island Ltd

Concept Stage

Safety Audit Report

Date: 11 March 2019

Contents

1. Background

1.1. Safety Audit Procedure

A road safety audit is a term used internationally to describe an independent review of a future road project to identify any safety concerns that may affect the safety performance. The audit team considers the safety of all road users and qualitatively reports on road safety issues or opportunities for safety improvement.

A road safety audit is therefore a formal examination of a road project, or any type of project which affects road users (including cyclists, pedestrians, mobility impaired etc), carried out by an independent competent team who identify and document road safety concerns.

A road safety audit is intended to help deliver a safe road system and is not a review of compliance with standards.

The primary objective of a road safety audit is to deliver a project that achieves an outcome consistent with Safer Journeys and the Safe System approach, that is, minimisation of death and serious injury. The road safety audit is a safety review used to identify all areas of a project that are inconsistent with a safe system and bring those concerns to the attention of the client in order that the client can make a value judgement as to appropriate action(s) based on the risk guidance provided by the safety audit team.

The key objective of a road safety audit is summarised as:

> *To deliver completed projects that contribute towards a safe road system that is increasingly free of death and serious injury by identifying and ranking potential safety concerns for all road users and others affected by a road project*.

A road safety audit should desirably be undertaken at project milestones such as:

- Concept Stage (part of Business Case);
- Scheme or Preliminary Design Stage (part of Pre-Implementation);
- Detailed Design Stage (Pre-implementation / Implementation); and
- Pre-Opening / Post-Construction Stage (Implementation / Post-Implementation).

A road safety audit is not intended as a technical or financial audit and does not substitute for a design check on standards or guidelines. Any recommended treatment of an identified safety concern is intended to be indicative only, and to focus the designer on the type of improvements that might be appropriate. It is not intended to be prescriptive and other ways of improving the road safety or operational problems identified should also be considered.

In accordance with the procedures set down in the *"NZTA Road Safety Audit Procedures for Projects Guidelines - Interim release May 2013"* the audit report should be submitted to the client who will instruct the designer to respond. The designer should consider the report and comment to the client on each of any concerns identified, including their cost implications where appropriate, and make a recommendation to either accept or reject the audit report recommendation.

For each audit team recommendation that is accepted, the client shall make the final decision and brief the designer to make the necessary changes and/or additions. As a result of this instruction the designer shall action the approved amendments. The client may involve a safety engineer to provide commentary to aid with the decision.

Decision tracking is an important part of the road safety audit process. A decision tracking table is embedded into the report format at the end of each set of recommendations to be completed by the designer, safety engineer and client for each issue documenting the designer response, client decision (and asset manager's comments in the case where the client and asset manager are not one and the same) and action taken.

A copy of the report including the designer's response to the client and the client's decision on each recommendation shall be given to the road safety audit team leader as part of the important feedback loop. The road safety audit team leader will disseminate this to team members.

1.2. The Safety Audit Team

The road safety audit was carried out in accordance with the "*NZTA Road Safety Audit Procedure for Projects Guidelines - Interim release May 2013"*, by:

- Antoni Facey, Director/Traffic Engineer, Avanzar Consulting Ltd
- David Wanty, Director/Principal, Wanty Transportation Consultancy Ltd

The Safety Audit Team (SAT) met to review the drawings on 26/2/2019. A site visit was undertaken on 26/2/2019.

An exit meeting was not held.

1.3. Report Format

The potential road safety problems identified have been ranked as follows:-

The expected crash frequency is qualitatively assessed on the basis of expected exposure (how many road users will be exposed to a safety issue) and the likelihood of a crash resulting from the presence of the issue. The severity of a crash outcome is qualitatively assessed on the basis of factors such as expected speeds, type of collision, and type of vehicle involved.

Reference to historic crash rates or other research for similar elements of projects, or projects as a whole, have been drawn on where appropriate to assist in understanding the likely crash types, frequency and likely severity that may result from a particular concern.

The frequency and severity ratings are used together to develop a combined qualitative risk ranking for each safety issue using the Concern Assessment Rating Matrix in Table 1 below. The qualitative assessment requires professional judgement and a wide range of experience in projects of all sizes and locations.

Severity (likelihood of death or serious injury)	Frequency (probability of a crash)			
	Frequent	**Common**	**Occasional**	**Infrequent**
Very likely	Serious	Serious	Significant	Moderate
Likely	Serious	Significant	Moderate	Moderate
Unlikely	Significant	Moderate	Minor	Minor
Very unlikely	Moderate	Minor	Minor	Minor

Table 1: Concern Assessment Rating Matrix

While all safety concerns should be considered for action, the client or nominated project manager will make the decision as to what course of action will be adopted based on the guidance given in this ranking process with consideration to factors other than safety alone. As a guide a suggested action for each concern category is given in Table 2 below.

RISK	Suggested Action
Serious	A major safety concern that must be addressed and requires changes to avoid serious safety consequences.
Significant	Significant concern that should be addressed and requires changes to avoid serious safety consequences.
Moderate	Moderate concern that should be addressed to improve safety
Minor	Minor concern that should be addressed where practical to improve safety.

Table 2: Concern Categories

In addition to the ranked safety issues it is appropriate for the safety audit team to provide additional comments with respect to items that may have a safety implication but lie outside the scope of the safety audit. A comment may include items where the safety implications are not yet clear due to insufficient detail for the stage of project, items outside the scope of the audit such as existing issues not impacted by the project or an opportunity for improved safety but not necessarily linked to the project itself. While typically comments do not require a specific recommendation, in some instances, suggestions may be given by the auditors.

1.4. Scope of Audit

This audit is a design stage safety audit of the proposed traffic signals at the Foodstuffs site on Main North Road. The audit includes the on site traffic issues and other site accesses on both Main North Road and Northcote Road.

1.5. Documents Provided

The SAT has been provided with the following documents for this audit:

- Site layout plans, Project FSIL-J047, Drawing ATC10131, sheets 1 to 4, revision L.
- Correspondence regarding traffic volumes and queue lengths.
- Emailed response to auditors initial questions regarding modelling.

1.6. Disclaimer

The findings and recommendations in this report are based on an examination of available relevant plans, the specified road and its environs, and the opinions of the SAT. However, it must be recognised that eliminating safety concerns cannot be guaranteed since no road can be regarded as absolutely safe and no warranty is implied that all safety issues have been identified in this report. Safety audits do not constitute a design review nor an assessment of standards with respect to engineering or planning documents.

Readers are urged to seek specific technical advice on matters raised and not rely solely on the report.

While every effort has been made to ensure the accuracy of the report, it is made available on the basis that anyone relying on it does so at their own risk without any liability to the safety audit team or their organisations.

1.7. Project Description

The proposed traffic signals are intended to provide access to and from the proposed new Pak N Save supermarket that is yet to be consented. The supermarket will replace a number of industrial buildings.

The signals are intended to provide access to other existing commercial offices on the site as well as a small general retail unit (ex Mad Butcher) and Oil Changers vehicle repair site.

An unmanned petrol station is proposed on site.

2. Safety Audit Findings

2.1. Traffic modelling

Concern Assessment Rating **Comment**

The team were not presented with details of the traffic modelling for the project, only a movement performance summary for the AM and PM peak without assumptions other than that the saturated flow rates were adjusted to match another (simulation) model and a cycle time of 85 seconds was specified (and a pedestrian crossing time was also given based on a relatively fast pedestrian crossing time). No details of linking with or the operation of the existing signals at Northcote Road/Queen Elizabeth II Drive or at Cranford Street were given. It is understood that the modelling is in the process of being agreed with the CCC Engineers.

The SAT considers that accurate modelling of the traffic generated by the site will be critical to the success of this project. The outputs presented to the SAT suggest that the intersection will perform at or close to its limits and that any errors or wrong assumptions in the modelling may cause the intersection to operate beyond its limits with consequent safety implications, not only for this intersection but also for those related traffic signal controlled intersections north and south.

For the purposes of this safety audit, the SAT has assumed the outputs as presented are unsubstantiated and cannot be presumed to be reliable. The SAT recommends strongly that the model should be independently peer reviewed to ensure that the model is robust and the inputs and outputs are supportable and the effects of the development are consistent with the parameters already calculated. Sensitivity testing should be conducted and modelling for the Saturday peak period provided.

The model should also include the effects of the proposed traffic signals on the intersections to the north and south, particularly in peak periods such as December and when the northern arterial is completed which will potentially change the traffic patterns at the Main North Road/QEII/Northcote Road intersection significantly.

Recommendations:

Ensure that the model is robust and consistent with the results already presented and extended to include consideration of the linked signal controlled intersections to the north and south.

Provide results for the Saturday peak period for different future years and undertake sensitivity testing.

Consider using observed saturation flow rates at the nearby signals rather than rely on those applied or inferred from another model.

Frequency Rating:		***Severity Rating:***	
Crashes are likely to be	**N/A**	*Death or serious injury is*	**N/A**

Designer Response:	The design team have been working closely with the CCC modelling team to agree on the choice of modelling platform, option assessed, future year assumptions, periods modelled and other modelling assumptions. Response to Safety Engineer Comment: The SIDRA models used to draw conclusions on the queuing at the new signalised intersection have been provided to council as part of the revised ITA.
Safety Engineer:	Intersection model in SIDRA or LinSig should be made available ensure issues raised are addressed. These have not been sighted by the safety engineer.
Client Decision:	Agree with designer.
Action Taken:	No changes to design required.

2.2. Lydia Street roundabout

Concern Assessment Rating **Minor**

The plans show a roundabout is proposed at the Lydia Street access to the site shown below.

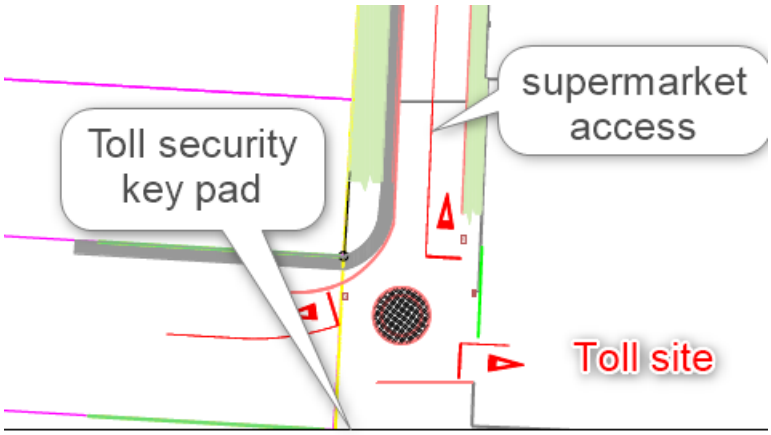


Figure 1: Lydia Street Roundabout proposal.

The team do not consider this to be a feasible option given the current users of the intersection and its layout. B trains were seen on the Toll site and they had come through the intersection. This is the only access to the Toll site. Similarly, there was a small industrial site to the west of the intersection.

The Toll site had security access that truck drivers need to be beside to gain access to the site as shown in Photograph 1 below. This would require drivers to bypass the roundabout.

It is also not clear that a truck could enter the Toll site by correctly negotiating the roundabout.

The SAT consider that the roundabout should not be constructed.

Further, given the complex existing access arrangements to the Toll site and the adjacent site to the west, it would be unwise to open the intersection to additional traffic generated by the supermarket. The plans show that Lydia Street would be connected to the supermarket and regular customers would learn that Lydia Street would be an alternative access to the supermarket. The team considers that the supermarket should not have any physical public connection to Lydia Street.

Photograph 1: Toll site security access.

Recommendation:

Do not construct the Lydia Street roundabout.

Do not allow any connection between Lydia Street and the supermarket for customers.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occasional**	*Death or serious injury is* **Unlikely**

Designer Response:	The connection between Lydia Street and the supermarket is an easement and all adjacent activities have right-of-way for access to Main North Road. The Lydia Street roundabout will be designed to be mountable for heavy vehicles. Response to Safety Engineer Comment: The subject gate is located on land that is not owned by the applicant. The site is currently leased by Toll NZ and we understand the lease expires in 2021,

	which is most likely to be prior to the opening of the PAK'nSAVE. Therefore, the existing arrangement is unlikely to operate in conjunction with the supermarket. It is also worth noting that the lease has not been renewed as the ownership of the land has changed and alternative development plans are expected. It is anticipated that any future development will address the issue raised.
Safety Engineer:	No Consideration in the layout of the roundabout has been given to how and where trucks wait to access the gated area. Trucks requiring access will block the road. Consideration needs to be given to indenting the gated access so that a waiting truck can wait in a location that doesn't block to roundabout.
Client Decision:	Agree with designer.
Action Taken:	No changes to design required.

2.3. Oil Changers access to Northcote Road

Concern Assessment Rating **Significant**

The SAT is concerned that the car park at the Oil Changers site is being linked to the supermarket carpark and this will generate more traffic to use the Northcote Road access. The access is some 55 metres from the traffic signals limit line.

The SAT considers that there is already confusion amongst drivers when a vehicle is turning into the site from Northcote Road that they may be expecting the driver to be turning at the Main North Road intersection. Turning right from the site is difficult with the merge from two lanes to one lane westbound still occurring at the Oil Changers access. It is understood that the traffic volumes on Northcote Road will increase with the northern arterial which will further complicate this area.

The SAT recommends that the raised median island on Northcote Road should be extended to prevent right turn access to and from the Oil Changers carpark.

Recommendation:

Extend the raised median on Northcote Road to prevent right turns to and from the Oil Changers carpark.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Common**	*Death or serious injury is* **Unlikely**

Designer Response:	Agree. The raised median will be extended to prevent right turn movements. The site plan is updated to reflect this. Response to Safety Engineer Comment: It should be noted that the current assessment rating is inconsistent with the severity and frequency ratings applied. Regardless, the raised median will eliminate the safety concern hence downgrading the assessment rating to "Minor".
Safety Engineer:	No addition comments.
Client Decision:	Agree with designer.
Action Taken:	No changes to design required.

2.4. Pedestrians

2.4.1. Oil Changers carpark

Concern Assessment Rating **Minor**

There is no route shown for pedestrians to access the supermarket from Northcote Road through the Oil Changers carpark. A pedestrian path is shown leading to the carpark from the supermarket but it appears to terminate at a car parking space in the Oil Changers carpark. From here, it is unclear how pedestrians would walk safely through the Oil Changers carpark. This is an obvious pedestrian desire line and a clear path should be defined.

Recommendation:

Define a safe path for pedestrians from Northcote Road to the supermarket through the Oil Changers carpark.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occasional**	*Death or serious injury is* **Unlikely**

Designer Response:	Agreed. A pedestrian path is now included in the site plan.

Safety Engineer:	No addition comments.
Client Decision:	Agree with designer.
Action Taken:	No changes to design required.

2.4.2. Pedestrian access to the supermarket

Concern Assessment Rating **Minor**

A pedestrian access route from Main North Road to the supermarket is shown on the plans in the extract below. The team is unclear where the main pedestrian access to the supermarket is proposed to be but it would appear to be further south than where the pedestrians will be deposited. It is also unclear if there is a pedestrian path along the front (eastern side) of the supermarket, and whether the two bicycle parking areas will be covered.

The SAT consider that a better location for the pedestrian route through the site to access the supermarket would be near the traffic signals where a safe crossing point can be constructed across Main North Road. Other internal pedestrian paths from the carparking spaces to the supermarket main access should be developed.

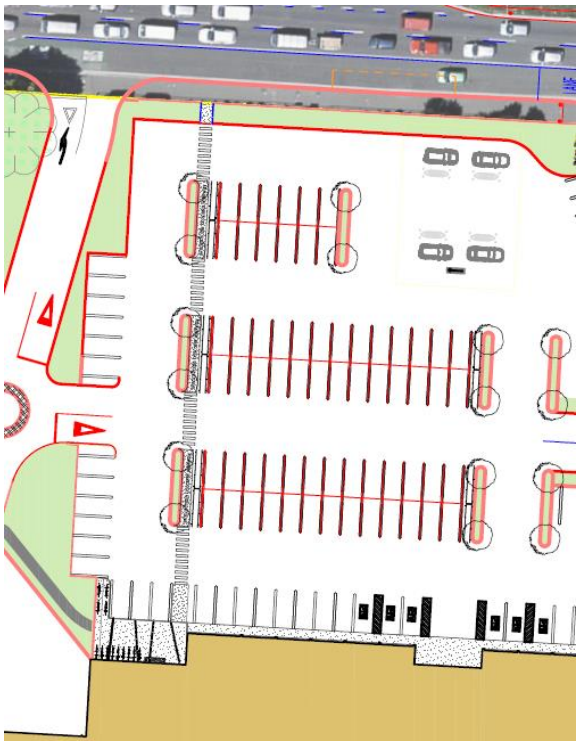


Figure 2: Pedestrian path through the carpark.

Recommendation:

Reconsider the pedestrian access to Main North Road through the car park as currently shown.

Develop internal pedestrian routes from the various carparking areas to the main supermarket access, including along the front of the supermarket.

Provide cover for the proposed bicycle parking areas.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occasional**	*Death or serious injury is* **Unlikely**

Designer Response:	There is a second safe pedestrian facility extending to Main North on the eastern side of the car park. This connects directly to a walkway along the front of the supermarket.
Safety Engineer:	The proposed paths provide reasonable pedestrian linkages to and from the supermarket.
Client Decision:	Agree with designer.
Action Taken:	No changes to design required.

2.4.3. Right of way access

Concern Assessment Rating **Minor**

There is currently a shared right of way access between numbers 153 and 159 Main North Road. This is currently the most direct access into the large car parking area south of the Foodstuffs building. The access is shared by vehicles in both directions and pedestrians. The access is wide enough that some drivers may attempt to use it as a two lane road.

The SAT is concerned that this is a potentially dangerous situation for pedestrians. Internally there appears that a pedestrian path had once been provided between the ROW and the zebra crossing but it is now replaced with shrubs alongside the #161 property fence.

The team considers that with the new access to the carpark north of number 161 Main North Road, the access could be modified so it is clearly one lane only and a proper unencumbered footpath constructed on one side (presumably southern side as at present). It is suggested that the access becomes entry only (existing signs show that exiting traffic has to give way to entering traffic).

Alternatively, this access could be abandoned as a ROW and handed over to the other owner of the ROW and all carpark access directed to the new entrance.

Figure 3: Shared ROW between 153 and 159 Main North Road.

Photograph 2: Vehicle entering the ROW with an opposing vehicle waiting to enter.

Photograph 3: Other ROW user and initial pedestrian guidance through the site.

Photograph 4: Lack of pedestrian guidance once in the site.

Recommendation:

Review the use and need for the ROW access between numbers 153 and 159 Main North Road.

Create a safe pedestrian path within the car park between the ROW access and the site building(s) if the ROW remains.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Infrequent**	*Death or serious injury is* **Unlikely**

Designer Response:	The property at 155 Main North Road has been purchased by FSIL therefore the ROW is no longer required. This ROW is proposed to be used as an afterhours entry/exit. Details will be available at the resource consent stage of any changes to the site. Response to Safety Engineer Comment: The subject ROW access will operate in its current form however access will be restricted to after-hours vehicle entry/exit to the FSIL headquarters only, fully noting that 155 Main North Road will cease to operate as a dwelling. The ROW will be gated and pedestrians will be directed to alternative pedestrian connections located to the north of this ROW. Considering that the volume of traffic using the access is reduced and the pedestrian desire line is removed the raised safety concern is eliminated.
Safety Engineer:	Details of any proposals to this access should be made available to the audit team and to CCC transport engineers to enable a full assessment of the safety implications. Additional comments, 17/07/19 – the measures proposed in terms of how the access will operate, will aid in mitigating the concerns raised.
Client Decision:	Agree with designer.
Action Taken:	No changes to design required.

2.5. Internal roundabout

Concern Assessment Rating **Moderate**

The internal roundabout for access to the traffic signals is acknowledged by the modellers to be blocked during peak periods. As can be seen on the plan below, there is little capacity available for queuing vehicles before the left turn lane is blocked and all vehicles will queue into the internal roundabout. It is unlikely that signs and markings would prevent the roundabout from being blocked. This will lead to vehicles entering the site queueing back towards Main North Road and potentially onto Main North Road.

The SAT considers that the roundabout should not be constructed and the staff carpark to the south not have access to the traffic signals but use the new high standard uncontrolled access beside number 161 Main North Road. This would be no different to the existing situation.

To prevent staff from performing U turns at the proposed traffic signals, a U turn facility could potentially be incorporated into the median south of the traffic signals.

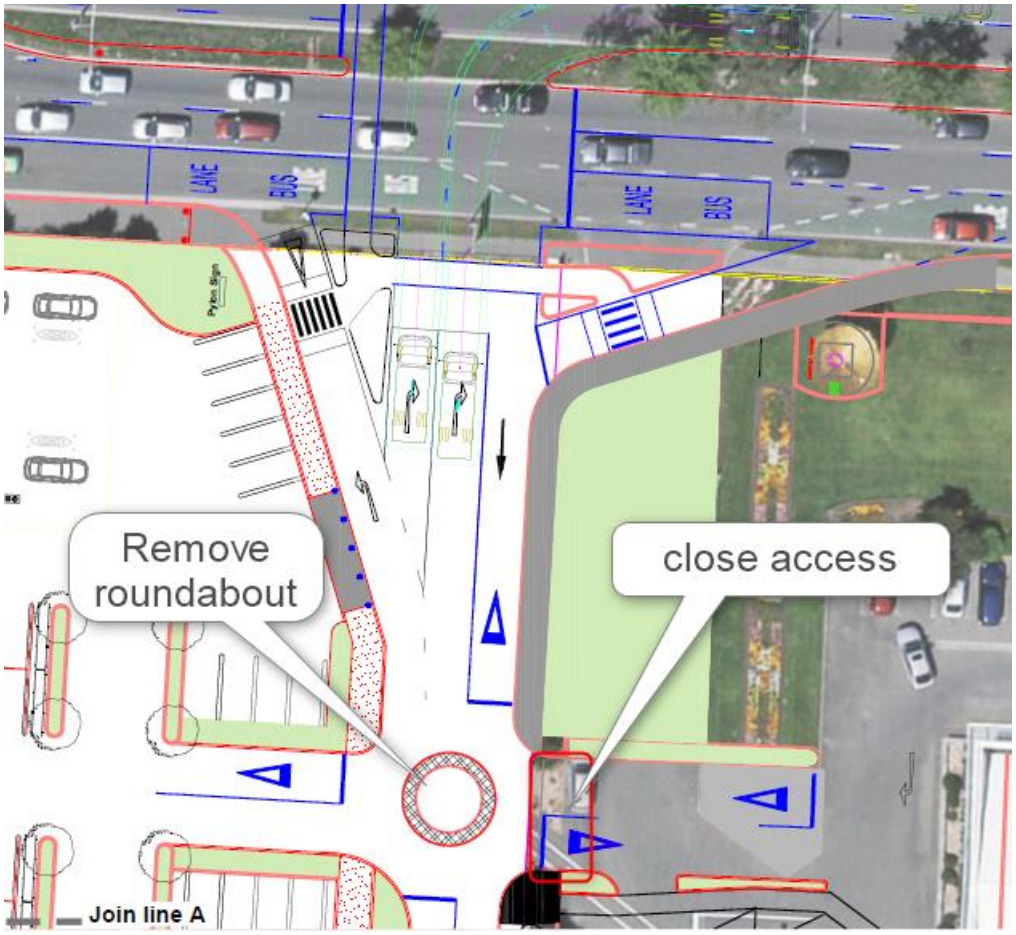


Figure 4: Internal roundabout with limited queueing.

Recommendation:

Do not construct the internal roundabout and prevent staff from the existing carpark accessing the traffic signals directly.

Open a U turn facility south of the proposed traffic signals.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occasional**	*Death or serious injury is* **Very likely**

Designer Response:	The applicant agrees that management controls can be applied to prevent staff from the head office from accessing the roundabout and adjacent traffic signals. Monitoring is proposed to establish the conditions and/or timing under

	which these controls should be implemented. This reduces the conflicts at the roundabout which significantly reduces the likelihood that vehicles will block the roundabout resulting in queuing back onto Main North Road. The microsimulation traffic modelling supporting the application has been updated to remove vehicles from using this approach during the evening peak when Head Office traffic is released (4:30pm-5:30pm). The modelling demonstrates that the roundabout operates satisfactorily. The ITA has been updated accordingly. The design team does not agree with providing a U-turn facility in the Main North Road median to the south of the proposed signals, due to the short weaving length for traffic exiting the head office exit and the potential for U-turning traffic to block northbound through traffic in the median lane. Traffic will instead be directed to use the exit on Lydia Street if travelling south or continue north until a safe U-turn manoeuvre is feasible, when the management controls are in place. Response to Safety Engineer Comment: U-Turns will be prohibited on all approaches at the new signalised intersection. Traffic modelling has demonstrated that the queues from the roundabout will not extend to the signalised intersection as motorists approaching the roundabout from this approach have priority over other approaches and not be impeded by vehicles circulating at the roundabout. Yellow hatching will be used to ensure motorists do not block the circulating lane of the roundabout. Due to the above reasons the risk rating should be downgraded to “Moderate”. Furthermore, the applicant is agreeable to a monitoring condition which indicates that a suitably qualified traffic engineer will observe the operation of the roundabout and advise FSIL to either close the south approach or not. The south approach can be closed as a swing gate will be installed as shown in the landscape master plan (Landscape and Urban Design Report, page 23).
Safety Engineer:	U turns should be prohibited at the signals due to the potential phasing of the pedestrian signals. From a safety perspective it is unreasonable to rely on management to prevent staff exiting the car park at certain times of day. If the roundabout blocks back to the intersection, more stacking will be needed and consideration should be given to moving the roundabout further west. Additional comments, 17/07/19 – a monitoring clause needs to be included within the consent conditions. This will help deal with any issues should they occur in the future.
Client Decision:	Agree with designer.

Action Taken:	A consent condition related to monitoring will be presented to council.

2.6. Bus lane

Concern Assessment Rating **Minor**

The SAT considers that the northbound bus lane could terminate at the proposed new signals and a bus gateway formed for northbound buses. There is no bus lane north of the QEII intersection and it would assist buses to enter the northbound traffic flow if they do not need to stop at the bus stop just north of the proposed traffic signals. The traffic effects of this would need to be modelled to determine the effect on the traffic signals and queue lengths to the south of the proposed traffic signals.

Recommendation:

Consider a northbound bus gateway (bus pre-emption) at the proposed traffic signals.

Check the width of the bus lane which has been dimensioned as 4.5 m but which the SAT considers is a typo and should be 4.2 m (existing measured width).

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occasional**	*Death or serious injury is* **Unlikely**

Designer Response:	Bus pre-emption is available at the proposed traffic signals for northbound buses. We have engaged with Environment Canterbury to discuss opportunities for bus pre-emption for northbound buses. Response to Safety Engineer Comment: The ability to provide bus pre-emption is a positive effect of the application and it is agreed that this is feasible. The details of the specific operation of the bus pre-emption will be agreed with Council at detailed design stage.
Safety Engineer:	Agree with auditors comments, consideration should be given to terminating the bus lane at the new signals and an assessment should be made to determine what benefit the bus lane north of the new signals actually provides. Proposed bus pre-emption details need to be made available to the auditors and CCC transport engineers to enable the assessment of any road safety impacts.

	Additional comments, 17/07/19 – this needs to be dealt with at detailed design to ensure issue is mitigated.
Client Decision:	Agree with designer.
Action Taken:	Issue to be resolved at detailed design stage.

2.7. Private access to the traffic signals

Concern Assessment Rating **Moderate**

The SAT observed a vehicle reversing from the dentist site at 186 Main North Road into the area that will be controlled by the traffic signals. The vehicle access will be in the middle of the intersection. The dentist currently employs 4 dentists on site.

The designer intends to provide signs and markings that would advise drivers not to turn right out when leaving the site. However, the SAT considers that while this may be adequate for residential properties which are also near the proposed traffic signals, it is not adequate for a commercial business. Residents are regular users and can be educated specifically about how to use the traffic signals and recognise the various phases. This is not possible with commercial sites where drivers will be occasional users and may have difficulty recognising the phasing.

The SAT considers that the exit from the dentist site should be controlled by the traffic signals and could include a right turn exit from the dentist.

Some drivers will be tempted to turn right into the dentist through the traffic signals or to undertake a U turn. This will need to be addressed with signs.

Other residential properties near the intersection would need to have an appropriate consultation plan prepared to advise them how to use the intersection.

Recommendation:

Incorporate the dentist site exit in the traffic signal phasing.

Develop a consultation plan for residents living close to the intersection.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occasional**	*Death or serious injury is* **Likely**

Designer Response:	We do not recommend that the dentist exit be included in the traffic signal phasing. However, delineation is proposed to be included between the southbound bus lane and traffic lane through the intersection to prevent vehicles reversing from the dentist access from conflicting with intersection through traffic. Agree that a consultation plan for residents is appropriate. Response to Safety Engineer Comment: Surveys undertaken on the morning of 16th July recorded 11 (TBA) vehicle movements in and a further eight (TBA) out in a two-hour period (10am – 12 noon) using this vehicle crossing. It is impractical to signalise the access for this low level of demand and noting that it is a two-way one lane vehicle crossing. Only one vehicle was observed reversing out of the access onto Main North Road. Signage would be required at the dentist entrance to alert customers that the access is left out only (as existing). Right turns and U-turns from Main North Road southern approach will be banned, and this will be clear to northbound motorists through the installation of signage.
Safety Engineer:	The safest solution would be to signalise the access. Additional comments, 17/07/19 – consideration should be given to agreeing usage of parts of the supermarket car park for customers of the dentist. This would help mitigate the issue.
Client Decision:	Agree with designer.
Action Taken:	No changes to design required.

2.8. Traffic Signals

2.8.1. Signal phasing

Concern Assessment Rating **Minor**

The SAT is unclear why the slip lanes are required at the proposed traffic signals. The effective operation of these phases should be investigated through the modelling review to determine if these can be brought under signal control. For example, access to the left turn from the site may often be blocked by vehicles turning right out of the site. A controlled left turn is

typically safer for pedestrians than a free left turn. Given the minimum green time required associated with the full crossing, the need for the short additional right turn bay is questionable, particularly when it results in a reasonably narrow entry lane.

The slip left turn into the site through the bus lane presents conflict with both cyclists and pedestrians. The desire line for pedestrians is affected by both the slip lanes with increased risk which would not be entirely mitigated by the proposed "Wombat crossing".

Recommendations:

Consider bringing the left turns into the traffic signal control (and retaining the existing northbound bus stop location).

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occasional**	*Death or serious injury is* **Unlikely**

Designer Response:	The design team propose to include a raised platform to restrict vehicle speeds on the free left turns and enable safe pedestrian movement. The design team has concerns that if the signals were fully controlled with traffic signals there is the potential for more queuing on site and on the northbound left turn into the site. Response to Safety Engineer Comment: The zebra crossings will be removed and slip lane crossings will be maintained as raised courtesy crossings. The applicant agrees to install the ducting and necessary infrastructure to signalise the slip lane crossing. Post-opening pedestrian volumes will be monitored along the corridor to understand whether the volume warrants signalisation of the slip lane.
Safety Engineer:	Agree with the auditors. Slip lanes in this environment provide a poor safety provision for pedestrians, pedestrian numbers should be determined to establish whether the crossings needs to be signalised or whether the left turn lanes need to be incorporated into the signalised intersection. Block back into the site is not a concern unless it blocks traffic entering the site, which is partially mitigated through point 2.5. Zebra crossings as marked on the plans will introduce another level of uncertainty to all users and should not be used.

	Additional comments, 17/07/19 – the additional proposals will help mitigate the issues raised. Due to the short length of the slip lanes they may not offer much benefit form a delay point of view.
Client Decision:	Agree with designer.
Action Taken:	No changes to design required.

2.8.2. Cyclists

Concern Assessment Rating **Minor**

No specific cycle facilities have been provided for the signal controlled intersection. The team considers that advanced cycle stop boxes should be provided as appropriate.

Recommendation:

Provide cycle advance boxes as appropriate.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Infrequent**	*Death or serious injury is* **Unlikely**

Designer Response:	Agree. These have been included as per best practice.
Safety Engineer:	No further comments.
Client Decision:	Agree with designer.
Action Taken:	No changes to design required.

2.8.3. Right turn in to the site

Concern Assessment Rating **Serious**

The team notes from the modelling produced to date that the level of service for the right turn into the site from the north is level of service D in both the AM and PM peaks. The modelling suggests that there will be an overflow queue from the right turn bay 25% of the time. The SAT considers this to be an excessive frequency for an overflow queue that will impact on the safe functioning of the intersection and without any other details or sensitivity testing is likely to be an underestimate at times. Southbound drivers on Main North Road will often be confronted by right turning vehicles queueing in the traffic lane as they are accelerating away from the QEII intersection creating safety concerns as well as reducing efficiency with the flow on effects that inefficient traffic flows have on driver frustration and safety at other intersections. This will cause sudden decisions to change lanes in a congested traffic environment as well as lane underutilisation.

The SAT considers that the right turn bay must be able to accommodate at least the 95%ile right turning queue for the design year hour for all periods including the Saturday peak. Given that the LOS is currently calculated to be D, the movement is on the edge of becoming unsustainable and the assumptions used in the model are critical.

Recommendation:

Ensure that the right turn bay into the site will contain the 95%ile traffic queues.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Frequent**	*Death or serious injury is* **Likely**

Designer Response:	Additional modelling has been undertaken to determine the appropriate length of the right turn bay. The design team propose to extend this to 40 metres to enable 95%ile queue lengths during the evening peak to be accommodated. The increase to 40 metres reduces the length of the right turn bay on the Main North Road south approach to the Main North Road/QEII/Northcote Road signals. The lane configuration on the southern approach to the Main North Road/QEII/Northcote Road signals is proposed to be reconfigured to an exclusive through, shared through-right and exclusive right turn lane. The future traffic volumes after the opening of the CNC show an increase in right turn demand and reduction in through demand on the southern approach. The change in configuration and phasing to enable this configuration results in an improvement in intersection performance at both 2021 and 2031 and enables the right turn bay on the southern approach to be reduced by approximately 15 metres (that is to offset the increase in length of the Main North Road supermarket access right turn bay). The intersection design and ITA are updated to reflect the changes required and reports on the subsequent intersection and wider network performance.

	Response to Safety Engineer Comment: The conversion of a through lane to a shared through/ right turn lane of the Main North Road south approach has reduced the right turn bay queue length. Subsequently, the right turn bay at the proposed signalised intersection has been extended to ensure 95% queues do not block through traffic. Therefore, the assessment rating for this safety issue could be downgraded to "Moderate" due to the reduced frequency. Vehicle tracking attached as Appendix 3 of the ITA indicates that a B-double truck and 8m truck could simultaneously turn however minor alterations at the pedestrian island and slip lane (Main North Road North approach) could improve manoeuvrability. It is proposed that this issue is addressed at detailed design stage of the project and the applicant is agreeable to a condition of consent to ensure that vehicle tracking is satisfactorily addressed.
Safety Engineer:	Confirmation is sought to determine queue lengths in both right turn lanes, right turners should be accommodated within the space provided for the supermarket access and for Main North Road / QEII. Right turning traffic should not block other traffic lanes. The tracking provided of a b train and an 8m vehicle making the double right turn shows the vehicle paths crossing and also shows them to overhang road side infrastructure, hence this movement doesn't cater for these vehicles to turn simultaneously. Additional comments, 17/07/19 - the vehicle tracking could be acceptable should additional works be proposed though detailed design, including carriageway widening and works to islands etc.
Client Decision:	Agree with designer.
Action Taken:	No changes to design required. Additional works at the QEII/ Main North Road intersection to be investigated at detailed design stage.

2.8.4. Pedestrian phase

Concern Assessment Rating **Moderate**

The SAT note that the pedestrian phase used in the analysis to date to cross Main North Road is unlikely to be long enough to allow pedestrians to clear the carriageway completely. This was acknowledged by the designer.

To allow the pedestrians to cross Main North Road safely, the pedestrian phase will need to be extended to accommodate the full width crossing or a stagger could be introduced to allow the pedestrian phase to be broken with pedestrians waiting on the median. Note that the stagger would have a detrimental effect on the right turn bay length.

A pedestrian crossing (with late start) could also be considered on the southern side of the signals or a linked mid-block staggered signalised pedestrian crossing provided to the south.

Recommendation:

Review the options for the pedestrian crossing phase across Main North Road.

Provide Pedestrian Countdown timers and install a camera for safety and performance monitoring purposes (standard Council practice).

Consider providing an additional signalised (staggered) pedestrian crossing at the signals or to the south.

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occasional**	*Death or serious injury is* **Likely**

Designer Response:	The intersection design has been modified to enable a 2.4 metre median which can be used to provide a staggered pedestrian crossing such that pedestrians can safely cross Main North Road in two-stages. Pedestrian countdown timers and a camera can be provided as required. An additional signalised pedestrian crossing across the Main North Road south approach could be included if required but is not expected to be a strong pedestrian desire line. It is recommended that monitoring be undertaken to ensure that the Main North Road pedestrian crossing facilities are appropriate. The traffic modelling assessment simulates the proposed staggered pedestrian crossing by ensuring the phase times are sufficient for pedestrians to safely cross Main North Road. The introduction of the staggered pedestrian crossing is expected to downgrade the assessment rating from Moderate to Minor.
Safety Engineer:	The inclusion of a staggered crossing will help mitigate pedestrian safety concerns. This will need to be included within the modelling to confirm that there are no adverse effects. U turn will also need to be prohibited.
Client Decision:	Agree with designer.
Action Taken:	No changes to design required.

2.8.5. Median islands

Concern Assessment Rating **Minor**

There is no separation between the opposing traffic lanes on the supermarket approach to the traffic signals. A median island should be constructed to separate the opposing traffic flows at the intersection.

The Main North Road median is narrowed to 1.4 m with a 2.8 m wide right turn bay, which is achieved by narrowing the southbound bus lane from 4.2 to 3.7 m (the minimum desirable width recommended by AUSTROADS for an on-road part time bus/cycle lane with parallel on-street parking). The median width is less than the desirable width and the SAT consider that some pedestrians (with strollers or even trollies) might cross one direction and wait in the centre (particularly if cycle times increase resulting in a relatively poor pedestrian level of service - already stated as LoS D - with delay approximately equal to half their red time). See also 2.8.4 above.

Recommendation:

Construct a median island on the supermarket approach to the traffic signals.

Increase the Main North Road median width beside the right turn bay by potentially narrowing the northbound bus lane (with adjustment for the approach lanes south of the signals).

Frequency Rating:	***Severity Rating:***
Crashes are likely to be **Occasional**	*Death or serious injury is* **Unlikely**

Designer Response:	Agreed. A splitter island has been added to the traffic signal design. The Main North Road median has been increased to 2.4m as noted in 2.8.4.
Safety Engineer:	No further comments.
Client Decision:	Agree with designer.
Action Taken:	No changes to design required.

3. Audit Statement

We certify that we have used the available plans, and have examined the specified roads and their environment, to identify features of the project we have been asked to look at that could be changed, removed or modified in order to improve safety. The problems identified have been noted in this report.

Signed: Date: 11/3/2019

Antoni Facey, Traffic Engineer
Director, Avanzar Consulting Ltd

Signed: Date: 11/3/2019

David Wanty, BE/ME Civil, MSc Transport Planning & Eng.; CPEng, IntPE (NZ)
Director / Principal, Wanty Transportation Consultancy Ltd

Designer:

Signed: Date: 01/4/2019

Jay Baththana**,** Senior Traffic Engineer
Abley Ltd

Safety Engineer: *Name: Stephen Wright* *Position: CCC Safety Engineer*

Signature: *Date: 08/07/2019*

Project Manager: *Name: Rebecca Parish* *Position: Prop. Dev, Manager, FSIL*

Signature: *Date:* 17/7/2019.

Action Completed: *Name: Rebecca Parish* *Position: Prop. Dev, Manager, FSIL*

Signature: *Date:* 17/7/2019.

Project Manager to distribute audit report incorporating decision to designer, Safety Audit Team Leader, Safety Engineer and project file.

Date: 17/07/19

Appendix E
Site Access Sidra Model

Insightful solutions. Empowering advice.

Papanui Pak N Save - Site Access Sidra Model

Prepared for:	Christchurch City Council
Job Number:	FSIL-J047
Revision:	A
Issue Date:	1 May 2019
Prepared by:	Ravindu Fernando, Transportation Engineer
Reviewed by	Dave Smith, Technical Director

1. Introduction

Abley Limited (Abley) has been commissioned by Foodstuffs South Island Limited (FSIL) to provide transport advice with regard to establishing and operating a PAK'nSAVE supermarket at 171 Main North Road in Papanui, Christchurch.

This technical note has been prepared as an addendum to the Integrated Transport Assessment (ITA) prepared by Abley and intends to provide an overview of the SIDRA model undertaken to assess the site access performance. It is noted that a detailed microsimulation model has been developed using s-Paramics by Abley to assess the wider transport network effects of the proposal including the signalised site access.

The SIDRA model has been prepared in response to some issues raised in the safety audit of the intersection design and further refine the s-Paramics modelling assessment using specialist intersection modelling software which includes:

- Incorporating pedestrian movements and demands,
- substantiating the effects of heavy vehicle movements, and
- objectively determine and assess the queuing lengths.

This technical note should be read in conjunction with the ITA.

2. Sidra Analysis Methodology

The following key points are noted regarding the methodology of setting up the SIDRA model.

- Traffic flow volumes have been obtained directly from the corresponding s-Paramics model scenarios.
- Pedestrian crossings include a staged crossing on the northern approach of the intersection and a single stage crossing on the access (western) approach with no pedestrian facility on the southern approach.
- The same signal phasing times and cycle time from the S-Paramics model has been used and these are consistent with the phase and cycle times currently used at adjacent signalised intersections on the Main North Road corridor.
- Signal coordination along the Main North Road corridor for northbound traffic in the PM peak has been incorporated into the model.
- Saturation flows at the site access has been adjusted to reflect downstream effects of congestion as observed in the S-Paramics model. Basic saturation flow has been reduced to 1800 through car units per hour (tcu/h) from the SIDRA default value of 1950 tcu/h for the peak flow directions during both AM and PM peak periods (i.e. for southbound traffic during the AM peak and northbound traffic during the PM peak). Default saturation flow value has been retained for the opposite directions (non-peak direction). It is noted that the reduced saturation flow worsens the performance of the intersection as it approaches saturation as it essentially caps the throughput.
- Bus priority lanes and a bus priority signal phase have been appropriately incorporated into the model as is consistent with the proposed intersection design. Bus volumes during the peak hours have been calculated based on the current bus operations along the Main North Road corridor.

T +64 9 486 0898 (Akld)
T +64 3 377 4703 (Chch)
E admin@abley.com

Auckland
Level 8, 57 Fort Street
PO Box 911336
Auckland 1142
New Zealand

Christchurch
Level 1, 137 Victoria Street
PO Box 25350
Christchurch 8144
New Zealand

www.abley.com

3. Sidra Analysis Outputs

The SIDRA modelling outputs for the site access during the 2021 AM (8-9am) and PM (5-6pm) peak hours including the proposed supermarket development are summarised in **Table 3.1** and **Table 3.2** respectively. The same modelling outputs for the 2031 future scenario are outlined in **Table 3.3** and **Table 3.4**. Complete movement summaries of all aforementioned modelling outputs are shown in ***Appendix A***.

Table 3.1 Performance of the signalised site access on Main North Road – 2021 AM Peak Hour

Approach	Movement	Flow	Average Delay (sec)	Level of Service	95% Queue	
					Vehicles	*Distance (m)*
Main North Road (South)	Left	65	14	LOS B	1.9	17.4
	Through	751	14.9	LOS B	9.5	72.2
Main North Road (North)	Through	1222	5.4	LOS A	10.6	75.8
	Right	57	47.1	LOS D	2.4	17.2
Site Access	Left	67	8.1	LOS A	0.8	5.6
	Right	136	39.8	LOS D	2.6	18.1

Table 3.2 Performance of the signalised site access on Main North Road – 2021 PM Peak Hour

Approach	Movement	Flow	Average Delay (sec)	Level of Service	95% Queue	
					Vehicles	*Distance (m)*
Main North Road (South)	Left	265	13.0	LOS B	4.5	35.1
	Through	1139	16.1	LOS B	15.6	114.8
Main North Road (North)	Through	727	4.8	LOS A	5.3	38.2
	Right	123	49.0	LOS D	5.4	38.6
Site Access	Left	254	12.6	LOS B	5.1	35.7
	Right	224	39.8	LOS D	5.1	35.7

Table 3.3 Performance of the signalised site access on Main North Road – 2031 AM Peak Hour

Approach	Movement	Flow	Average Delay (sec)	Level of Service	95% Queue	
					Vehicles	*Distance (m)*
Main North Road (South)	Left	57	14.0	LOS B	1.7	16.2
	Through	839	15.4	LOS B	11.0	82.8
Main North Road (North)	Through	1215	1.0	LOS A	1.9	13.9
	Right	48	46.8	LOS D	2.0	14.7
Site Access	Left	64	8.7	LOS A	0.8	5.8
	Right	125	39.6	LOS D	2.4	16.7

Table 3.4 Performance of the signalised site access on Main North Road – 2031 PM Peak Hour

Approach	Movement	Flow	Average Delay (sec)	Level of Service	95% Queue	
					Vehicles	*Distance (m)*
Main North Road (South)	Left	282	13.1	LOS B	4.9	37.4
	Through	1297	21.0	LOS C	23.4	171.3
Main North Road (North)	Through	635	4.6	LOS A	4.4	32.4
	Right	112	47.9	LOS D	4.8	34.4
Site Access	Left	236	16.1	LOS B	5.6	39.2
	Right	263	40.3	LOS D	6.3	44.2

These outputs clearly show that the site access will operate satisfactorily. It is of particular note that the queue of right turning vehicles into the site can be accommodated within the specified right turn lane which is approximately 40m in length. It is further noted that the pedestrian crossings are working efficiently in all scenarios with sufficient crosswalk times available and an average modelled pedestrian delay of 37 seconds. Default pedestrian demands of 50 vehicles per hour on each crosswalk have been assumed in the analysis in lieu of any survey data as the intersection is not currently formed.

4. Conclusion

Overall, the detailed intersection modelling including pedestrian movements has confirmed that the intersection design at the supermarket site will operate with good Level of Service and provides sufficient length turning bays to accommodate right turners.

Appendix A –Site Access Movement Summaries

MOVEMENT SUMMARY

Site: 101 [PAK'nSAVE Site Access - AM 2021]

PAK"nSAVE Site Access and Main North Road Intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 85 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Main North Road												
4	L2	65	3.2	0.117	14.0	LOS B	1.9	17.4	0.50	0.53	0.50	42.9
5	T1	751	13.5	0.404	14.9	LOS B	9.5	72.2	0.68	0.59	0.68	41.5
Approach		816	12.6	0.404	14.8	LOS B	9.5	72.2	0.66	0.59	0.66	41.6
North: Main North Road												
11	T1	1222	4.0	0.474	5.4	LOS A	10.6	75.8	0.46	0.41	0.46	46.5
12	R2	57	3.7	0.381	47.1	LOS D	2.4	17.2	0.99	0.75	0.99	30.4
Approach		1279	4.0	0.474	7.3	LOS A	10.6	75.8	0.48	0.43	0.48	45.5
West: PAK'nSAVE Site Access												
1	L2	67	3.1	0.082	8.1	LOS A	0.8	5.6	0.37	0.60	0.37	45.1
3	R2	136	1.6	0.242	39.8	LOS D	2.6	18.1	0.92	0.75	0.92	32.2
Approach		203	2.1	0.242	29.3	LOS C	2.6	18.1	0.74	0.70	0.74	35.6
All Vehicles		2298	6.9	0.474	11.9	LOS B	10.6	75.8	0.57	0.51	0.57	43.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P41	North Stage 1	53	36.8	LOS D	0.1	0.1	0.93	0.93
P42	North Stage 2	53	36.8	LOS D	0.1	0.1	0.93	0.93
P1	West Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	36.8	LOS D			0.93	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: ABLEY TRANSPORTATION CONSULTANTS LIMITED | Processed: Tuesday, 30 April 2019 3:32:58 p.m.
Project: J:\Foodstuffs South Island Ltd (FSIL)\FSIL-J047 Papanui PAK'n Save ITA\Models\SIDRA for Safety Audit\PAK'nSAVE access updated layout Apr 29 V2.sip8

MOVEMENT SUMMARY

Site: 101 [PAK'nSAVE Site Access - PM 2021]

PAK"nSAVE Site Access and Main North Road Intersection
Site Category: (None)
Signals - Fixed Time Coordinated Cycle Time = 85 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Main North Road												
4	L2	265	0.8	0.325	13.0	LOS B	4.5	35.1	0.39	0.58	0.39	42.8
5	T1	1139	8.9	0.696	16.1	LOS B	15.6	114.8	0.72	0.65	0.72	40.9
Approach		1404	7.3	0.696	15.4	LOS B	15.6	114.8	0.66	0.63	0.66	41.3
North: Main North Road												
11	T1	727	6.7	0.266	4.8	LOS A	5.3	38.2	0.39	0.34	0.39	46.9
12	R2	123	1.7	0.713	49.0	LOS D	5.4	38.6	1.00	0.87	1.17	30.0
Approach		851	5.9	0.713	11.2	LOS B	5.4	38.6	0.47	0.41	0.50	43.4
West: PAK'nSAVE Site Access												
1	L2	254	0.8	0.378	12.6	LOS B	5.1	35.7	0.58	0.71	0.58	42.8
3	R2	224	0.9	0.431	39.8	LOS D	5.1	35.7	0.93	0.77	0.93	32.2
Approach		478	0.9	0.431	25.3	LOS C	5.1	35.7	0.75	0.74	0.75	37.1
All Vehicles		2733	5.8	0.713	15.9	LOS B	15.6	114.8	0.62	0.58	0.62	41.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P41	North Stage 1	53	36.8	LOS D	0.1	0.1	0.93	0.93
P42	North Stage 2	53	36.8	LOS D	0.1	0.1	0.93	0.93
P1	West Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	36.8	LOS D			0.93	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PAK'nSAVE Site Access - AM 2031]

PAK"nSAVE Site Access and Main North Road Intersection
Site Category: (None)
Signals - Fixed Time Coordinated Cycle Time = 85 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Main North Road												
4	L2	57	3.7	0.108	14.0	LOS B	1.7	16.2	0.49	0.51	0.49	43.0
5	T1	839	12.0	0.451	15.4	LOS B	11.0	82.8	0.70	0.61	0.70	41.3
Approach		896	11.5	0.451	15.2	LOS B	11.0	82.8	0.69	0.61	0.69	41.4
North: Main North Road												
11	T1	1215	4.0	0.472	1.0	LOS A	1.9	13.9	0.08	0.08	0.08	49.4
12	R2	48	4.3	0.326	46.8	LOS D	2.0	14.7	0.98	0.74	0.98	30.5
Approach		1263	4.0	0.472	2.7	LOS A	2.0	14.7	0.12	0.10	0.12	48.2
West: PAK'nSAVE Site Access												
1	L2	64	3.3	0.082	8.7	LOS A	0.8	5.8	0.39	0.61	0.39	44.8
3	R2	125	1.7	0.223	39.6	LOS D	2.4	16.7	0.91	0.74	0.91	32.2
Approach		189	2.2	0.223	29.2	LOS C	2.4	16.7	0.74	0.70	0.74	35.6
All Vehicles		2348	6.7	0.472	9.7	LOS A	11.0	82.8	0.39	0.34	0.39	44.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P41	North Stage 1	53	36.8	LOS D	0.1	0.1	0.93	0.93
P42	North Stage 2	53	36.8	LOS D	0.1	0.1	0.93	0.93
P1	West Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	36.8	LOS D			0.93	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [PAK'nSAVE Site Access - PM 2031]

PAK"nSAVE Site Access and Main North Road Intersection
Site Category: (None)
Signals - Fixed Time Coordinated Cycle Time = 85 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Main North Road												
4	L2	282	0.7	0.342	13.1	LOS B	4.9	37.4	0.40	0.59	0.40	42.8
5	T1	1297	7.8	0.822	21.0	LOS C	23.4	171.3	0.80	0.79	0.88	38.8
Approach		1579	6.5	0.822	19.5	LOS B	23.4	171.3	0.73	0.75	0.80	39.5
North: Main North Road												
11	T1	635	7.6	0.232	4.6	LOS A	4.4	32.4	0.37	0.32	0.37	47.0
12	R2	112	1.9	0.647	47.9	LOS D	4.8	34.4	1.00	0.83	1.10	30.2
Approach		746	6.8	0.647	11.1	LOS B	4.8	34.4	0.47	0.40	0.48	43.4
West: PAK'nSAVE Site Access												
1	L2	236	0.9	0.382	16.1	LOS B	5.6	39.2	0.67	0.73	0.67	41.1
3	R2	263	0.8	0.525	40.3	LOS D	6.3	44.2	0.95	0.78	0.95	32.1
Approach		499	0.8	0.525	28.9	LOS C	6.3	44.2	0.82	0.76	0.82	35.8
All Vehicles		2824	5.6	0.822	19.0	LOS B	23.4	171.3	0.68	0.66	0.72	39.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P41	North Stage 1	53	36.8	LOS D	0.1	0.1	0.93	0.93
P42	North Stage 2	53	36.8	LOS D	0.1	0.1	0.93	0.93
P1	West Full Crossing	53	36.8	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	36.8	LOS D			0.93	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

T +64 9 486 0898 (Akld)
T +64 3 377 4703 (Chch)
F +64 3 377 4700
E office@abley.com

Auckland
Level 8, 57 Fort Street
PO Box 911336
Auckland 1142
New Zealand

Christchurch
Level 1, 137 Victoria Street
PO Box 25350
Christchurch 8144
New Zealand

www.abley.com