Draft Cranford Regeneration Plan

Integrated Transport Assessment

Summary Document of Transport Modelling and Analysis

June 2017

1 Introduction

1.1 This report provides an assessment of the transport effects of the proposed rezoning of Cranford Basin to residential urban uses. The report also provides some commentary around the development of the Outline Development Plan (ODP) transport network and the reasons for the proposed transport links.

1.2 The ODP area comprises approximately 30 hectares of land bounded by Cranford Street, the Cranford Basin and Grassmere Street and existing residential properties. The land is located close to the Papanui/Northlands District Centre, other business areas and community infrastructure. There is also a small area of land to the north east of Cranford Street on the edge of the existing residential area[1] that is proposed to be rezoned for residential use that is discussed separately in Section 7 of this report.

1.3 There are several established transport links between the Cranford Basin and the Central City, including Cranford Street, the Northern Arterial (currently being constructed) and the strategic cycleway network. The area is well serviced by public passenger transport, with the majority of the land being within 500 metres of a bus route. There is a high frequency public transport route on the Main North / Papanui Road corridor and there are proposals being developed to provide further bus priority measures along this route. A major cycleway, the Papanui Parallel, is also currently being constructed providing direct access from this area to the Central City. There are several schools and recreation facilities located nearby and the area is well served by parks and playgrounds.

1.4 In preparing this assessment consideration has been given to the following reference material which is appended to this report:

A. Cranford Basin Proposed Rezoning Transport Assessment – 2 April 2015

B. Cranford Basin Submissions Transport Modelling and Access review Memorandum – 1 December 2015

C. Statement of evidence of Tim Wright before the Replacement Christchurch District Plan hearing – 10 December 2015

D. Statement of evidence of Andrew Carr before the Replacement Christchurch District Plan hearing – 15 December 2015

E. North-East Papanui Outline Development Plan Transport Assessment – 8 December 2016

F. North-East Papanui Outline Development Plan Transport Assessment – 18 January 2017

[1] Known as the Case and Crozier land

G. North-East Papanui Outline Development Plan Transport Assessment – May 2017

1.5 The above reports, dating from 2015 to 2017 include extensive traffic modelling of a number of alternative land use scenarios, including varying residential densities, commercial and industrial uses and various road layout options and treatments. The most recent supplementary modelling assesses the impacts of a more modest development scenario of between 200 and 370 households for the Grassmere block and is the focus of this summary report.

1.6 By way of further background, the current proposals for the Christchurch Northern Corridor (CNC) involve making changes to Cranford Street, providing four traffic lanes as far south as its intersection with Innes Road. The CNC proposals will result in greater volumes of traffic being on Cranford Street to the south of Innes Road, and some further changes to the road network will be necessary.

1.7 As a result, a condition was placed on the consent granted for the CNC that required Council to employ an "Independent Expert" to assess the impacts of the CNC on the road network at the southern end of the route, and recommend a series of improvements to the road network (known as The " Downstream Effects Management Plan"), which would seek to address any issues. These changes will be funded by CCC.

1.8 The "Independent Expert" has been appointed, and some preliminary traffic modelling work has been undertaken. However, this has been temporarily put "on hold" while a decision is made on whether a third southbound lane will be added to the Waimakariri River bridge (which could have some effect on traffic flows on Cranford Street). Once these deliberations are complete, work on the "Downstream Effects Management Plan" can continue, and a critical part of this process will be a community engagement/consultation process. The changes to the road network identified by the Downstream Effects Management Plan will be undertaken to coincide with the opening of the CNC.

2 Development of the ODP Transport Network

2.1 The zoning of the land within the ODP area, south of Cranford Street, could provide for the development of up to 370 residential units[2] with the majority of these located in the north-west quadrant due to constraints on the balance of the land.

2.2 The Outline Development Plan (ODP) for the North-East Papanui Area was developed as the most appropriate network to provide a:

1) fully interconnected local network that provides a high level of accessibility and safety for all forms of transport;

2) An extension to the existing residential areas to the north and west of the new development area;

3) A network that fits within the confines of the constraints imposed by the waterways and geotechnical conditions within the area;

4) Protection of the function of the Papanui Parallel major cycleway through design and the limiting of access onto Grassmere Street;

5) Links to the local Key Activity Centre and associated community facilities.

A fully interconnected transport network that provides a high level of accessibility and safety for all forms of transport

2.3 An inter-connected network of roads and paths provides an efficient transport system that is resilient to emergencies, such as earthquakes, by providing for alternative routes through and to the area. The network will cater for vehicle, pedestrian and cycle movements with connections to the arterial road network and the wider cycle network. There are a number of bus routes within walking distance of the site that run along Cranford Street and Main North Road.

An extension to the existing residential areas to the north and west The ODP transport network has been developed with north-south and east-west connections to ensure that the area integrates and has a high level of connection with the existing residential areas. Whilst this will result in extra traffic using these existing local roads the transport modelling indicates that the extra traffic generated will not create safety or efficiency issues on the wider network.

[2] This includes the land occupied by the Christchurch Top 10 Holiday Park who currently have no plans to redevelop the land for residential use.

It is acknowledged that there are likely to be effects on amenity for some residents due to the extra traffic particularly on Grants Road, Grassmere Street and to a lesser extent Blighs Road.

A network that fits within the confines of the constraints imposed by the waterways and geotechnical conditions within the area

2.4 Major constraints on the layout and density of the area is the hydro-geotechnical conditions of the land, presence of springs and limitations on the filling of flood prone areas. Therefore, to some extent the transport network is confined by these con constraints.

Protection of the function of the Papanui Parallel major cycleway through design and the limiting of access onto Grassmere Street

2.5 The route of the Papanui Parallel runs along Rutland Street, through a short section of reserve land and then along Grassmere Street to cross Main North Road at a set of pedestrian/cycle signals. The Papanui Parallel is one of 13 major cycleways.

Links to the local Key Activity Centre and associated community facilities

2.6 The Papanui commercial centre (including Northlands Mall) provides an employment centre and also a centre for shopping and services within easy walking distance of the proposed North-East Papanui ODP.

3 Transport Effects of ODP

Model Assumptions

3.1 The modelling work and consequent memoranda prepared for Council by QTP Limited between April 2015 to and May 2017[3] provided an assessment of the effects of the proposed increase in household numbers adjacent to existing residential areas. The later analysis quantified the effects of between 200 and 370 new households within the development block. While the total number of residential units provided for that part of the ODP area south of Cranford Street is now proposed up to a cap of 425 (including the holiday park), the effects of the additional quantum of 55 residential units is unlikely to change the conclusions reached from the modelling.

3.2 The change in land use has been modelled using the Christchurch Assignment and Simulation Traffic (CAST) model. The CAST model represents the whole of Christchurch city

[3] Memo May 2017 QTP to CCC North-East Papanui Outline Development Plan Transport Assessment

allowing the simulation of the wider effects of the proposed rezoning to be tested and issues identified.

3.3 The residential development of the land, based on commonly used generation rates[4], is calculated to generate approximately 2,300 trips per day, with a PM peak hour generation of approximately 236 vehicles per hour (vph), for a development scenario of 200 households to approximately 3,500 trips per day, with a PM peak hour generation of approximately 375vph, for a development scenario of 370 households. The key conclusion drawn from the 200hh scenario testing is that the reduced scale of development has (relatively) little effect on projected traffic volumes along what may be described as the most locally affected area of Grants Road. The preceding parts of this report subsequently refers only to the analysis associated with the 370hh scenario.

3.4 The assumption has also been made that all traffic generated is additional to the base-case generic CAST model. The base model has also been adjusted to reflect potential for development up to the densities now anticipated in the Replacement District Plan (RDP) in the adjacent, existing residential areas. The vehicle trip rates used within the model reflect historical residential trip rates with no adjustments made for potential changes in future travel behaviour encouraged through investment in public transport and active transport options.

Options Tested

3.5 Three main options for the internal road network for the proposed ODP area have been modelled[5] to ascertain the effects on the local and wider network of the proposed change in zoning of the land[6].

3.6 Option 1 – illustrated in **Figure 3.1** assumes a single roundabout controlled 3-way intersection[7] on Cranford Street with a less direct alignment through the site and splitting into two routes at a point approximately 1/3 of the distance across the site. It was also assumed that there would be traffic calming installed on the route to make it less desirable as a through route for externally generated traffic.

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[4] Sources include NZ Trips Database, NZTA Research Report RR453 and the RTA Guide to Traffic Generating Developments

[5] Note that 6 land use scenarios were originally tested for Option 1 as reported in Cranford Basin Proposed Rezoning Transport Assessment – 2 April 2015

[6] All modelled scenarios include narrowed of Grassmere Street to reflect the MCR infrastructure along this route.

[7] The final design of the intersection would be subject to further detailed investigation, with a signalled arrangement potentially providing higher safety benefits for pedestrians and cyclists.

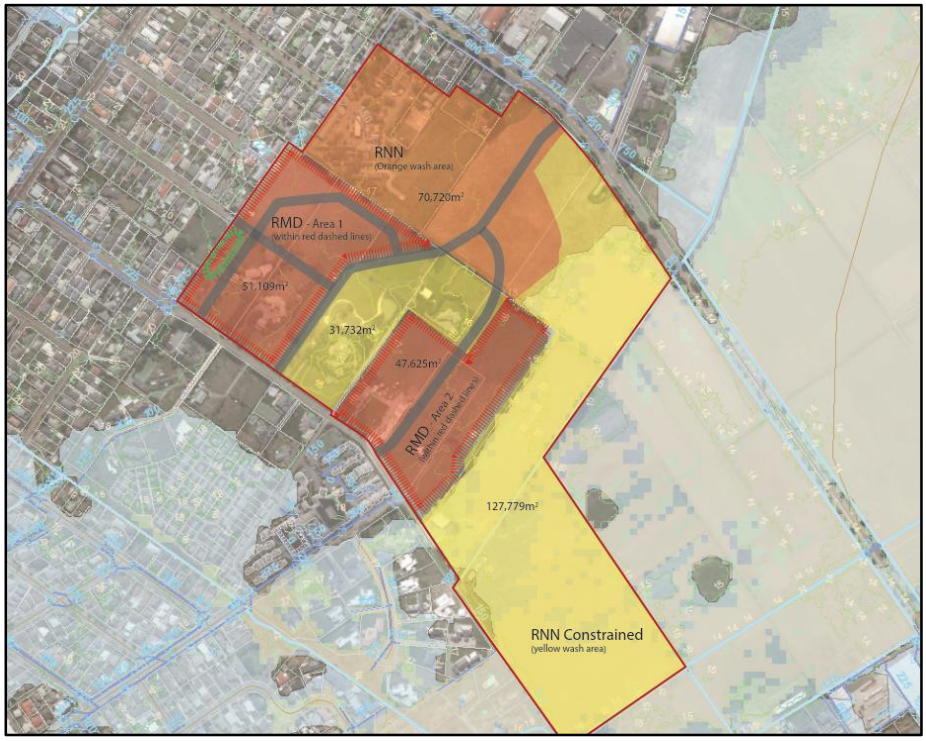

Figure 3.1 - Option 1 ODP Road Layout

3.7 Option 2 – illustrated in **Figure 3.2** splits the proposed development area into two disparate areas connected by pedestrian / cycle links that could be used by emergency vehicles if required. The option was modelled to test whether this layout would reduce the level of traffic on existing local roads without adversely impacting on the safety and efficiency of the wider network and the level of accessibility for residents living in the area.

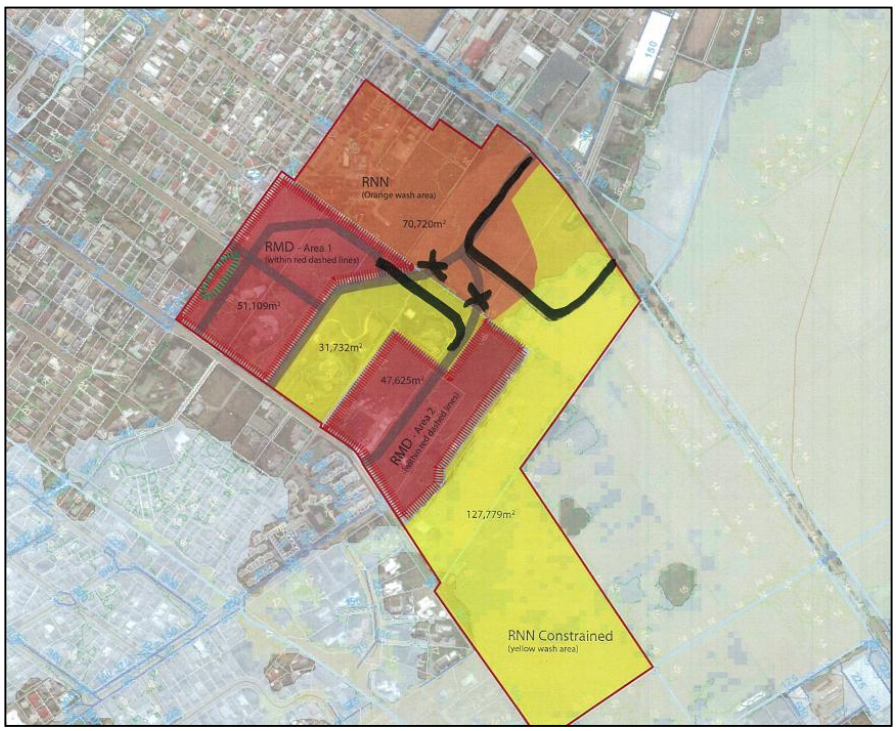

Figure 3.2 – Option 2 OPD Road Layout

3.8 Option 3 – not illustrated, consists of a single collector road through the area connecting from a single roundabout controlled 4-way intersection on Cranford Street to Grassmere Street at its intersection with Grants Road providing for a direct route through the area. The option delivers a network link that provides a mid-block connection between Cranford Street and Papanui Road for through traffic as well as locally generated trips.

3.9 A brief analysis of the pros and cons of the three options is included in **Table 1** below.

Option	Pros	Cons
Option 1 – Split ODP road network and offset from Grants Road	Lesser number of through trips relative to trips generated within the area cf the direct link. Single controlled connection at Cranford Street.	Still will have an effect on the local amenity, but less than for Option 3. Intersection location does not provide for potential future connection to area north of Cranford Street.
Option 2 – Separated road network with pedestrian/cycle connections	Stops external traffic routing through the area. Less traffic crossing Papanui Parallel.	Does not provide the connectivity with the wider network. Does not provide a route north for locally generated traffic.
Option 3 – Single Collector onto Grants Road	Provides a direct link through the block between Knowles Street and Main North Road. Single intersection point of conflict on Papanui Parallel. Single controlled connection at Cranford Street.	Large percentage of through routing traffic potentially doubling volumes and affecting the amenity of the residential area and safety of the Papanui Parallel MCR. Limited ability to implement traffic calming measures, if required on collector route.

Table 1 - Initial ODP road layout option assessment

3.10 Given the potential for significant volumes of traffic to route through the ODP area and local streets to the south-east, Option 3 has not been considered further in this assessment of effects of the proposed development of the ODP.

Connection to Cranford Street

3.11 Option 1 assumes the intersection of the ODP road with Cranford Street is controlled by a 3-legged roundabout. The modelling indicates that the roundabout would be approaching, or over, practical capacity[8] on several approaches for the ODP scenario in 2021 should the Northern Arterial projects not be completed by this time[9] On completion of the Northern Arterial projects, however the traffic volumes on Cranford Street reduce significantly and the roundabout is forecast to operate with modest delays in the AM and PM peak hours with full development of the ODP. This option therefore provides an appropriate level of service for the ODP area for access to the north of the site.

3.12 For Option 2, a crescent has been assumed with two intersections on Cranford Street assumed to be priority T-intersections with Cranford Street traffic having priority. The use of priority T's means that the potential impact on Cranford Street will be minimal.

Network Effects

3.13 The network effects of the proposed rezoning have been modelled for 2021 (assuming no Northern Arterial) and 2031 (assuming all Northern Arterial projects are completed) for Options 1 and 2. Whilst it is highly unlikely that this scenario will eventuate, with the Northern contract having been let (and completion scheduled for 2021), it does demonstrate how important these network improvements are to the successful development of the ODP area.

Option 1

3.14 The outputs of the modelling for Option 1 indicate that even at 2021 the effects of the rezoning on the network are potentially more than minor if the Northern Arterial projects are not completed and the ODP area is fully developed. The main impacts in terms of additional traffic forecast are the increase in traffic on Grants Road, Grassmere Street and Blighs Road. Whilst the volume increases will still be within the carrying capacity of the roads, the increases will be noticeable to the residents and is likely to impact on their amenity. This is particularly so for Grants Road where the relative increase in estimated traffic volumes with full development can be considered to be significant. Without the Northern projects in place the

[8] Peak Flow Ratio of 90%

[9] The current timetable for completion of the Northern is early 2021, assuming no significant delays occur.

level of service at the intersections reduces to the extent where the delays would be large enough to potentially create safety issues.

3.15 In 2031, the locations of potentially significant increases in delay do not occur, due to the relief to bottlenecks forecast due to the completion of the Northern Arterial projects. This is despite the additional demand generated by 10 years of general traffic growth. Notwithstanding the amenity effects of the increased traffic volumes forecast on Grants Road, Grassmere Street and (to a lesser extent) Blighs Road, the effects on the local network are modest in terms of operational capacity.

3.16 The long-term estimated changes in traffic along local roads are likely to be most acute along Grants Road with the estimated traffic volumes for this road typically found on the lower volume collector roads of today. By 2031, estimated traffic volumes along Grants Road of between 4000vpd-5000vpd can be compared to levels of traffic that can currently be found on roads such as Phillpotts Road, Tomes Road and Rutland Street.

3.17 Such levels of estimated traffic may suggest that Grants Road should be reclassified from a local to a Collector Road. However reclassifying Grants Road to a Collector Road would have undesirable effects in terms of physical changes necessary to accord with a Collector road standard including signalising Grants Road/ Papanui Road. Such changes would impact on the efficiency of the public transport corridor along Papanui Road and potentially attract higher volumes of traffic through Grants Road.

3.18 Alternatively, the introduction of traffic calming on the ODP roads that interface with Grassmere Street has also been tested and this does provide a reduction in predicted volumes on Grants Road of approximately 13% equating to a total of around 4,700vpd compared to around 5,400vpd without the measures. Treatment to the intersection of Grassmere Street/Main North Road in association with the Main North Road PT corridor improvements has the potential to further reduce traffic flows on Grassmere Street and to a lesser extent on Grants Road.

3.19 Maintaining Grants Road as a local road is therefore the best outcome for the local area noting that traffic increases significantly beyond that associated with 370hh are likely to tip the status of Grants Road towards a Collector road with adverse consequences for the local and wider community.

3.20 The design of the ODP road traffic calming features will need to achieve a balance between deterring a level of through traffic while delivering on the advantages of the ODP link road, including lower peak direction travel times on the Main North Road public transport corridor,

relief of pressure on Shearer Avenue and the higher accessibility and connectivity of the ODP development block to and from the surrounding road network.

Option 2

3.21 This option does not provide a vehicle connection through the ODP area, connecting Cranford Street to Grassmere Street and was modelled to test the effect of not enabling extraneous traffic to travel through the area, but still providing pedestrian and cycle connections. This necessarily also restricts the connectivity of the area to the surrounding transport network, not allowing for traffic (including local traffic) to travel to the north and west through the ODP area, providing a less efficient layout overall.

3.22 Without the connection, Grants Road is still forecast to carry around 3,500vpd under this scenario in 2021 without the Northern Arterial projects in place (if the ODP were fully developed), up from the current volume of about 1,600vpd.

3.23 With the Northern Arterial projects in place in 2031 and the ODP fully developed (370 hhs) Grants Road would be expected to carry around 3,300vpd as opposed to around 4,700[10] vpd in Option 1. However, there are also relative increases forecast on Main North Road, Shearer Avenue and some residential streets to the south-east of the ODP area. The lack of a through route hinders the ability for both local movements (including ODP and existing residential neighbourhoods) and traffic further afield to access either Cranford or Grassmere Streets and Grants Road.

3.24 This has a disproportionate adverse effect on delays for traffic exiting Grassmere and Shearer Street, particularly prior to the completion of the Northern Arterial projects. The forecast delays for right turns, in particular, are forecast to have delays that are likely to give rise to adverse safety issues, particularly with the full development of the ODP.

General

3.25 The modelling indicates that full development of the ODP site without the completion of the Northern Arterial projects would result in issues on the network that would be considered to be more than minor in terms of increased delays and the resultant potential for safety issues to occur.

Wider Network Issues

- The proposed development is highly compatible with the existing residential development surrounding the ODP.

[10] Option assumes some traffic calming implemented.

- The ODP, particularly the higher density development, is well located for local public transport, employment, shopping and recreational activities.

- The development potential for the site is limited by stormwater management and geohydrological constraints reducing the adverse traffic effects on the surrounding local road network.

- The model outputs as reported do not provide enough detail to reflect the positive network wide effect from developing land close to the city centre and also within walking and cycling distance of a large Key Activity Centre, rather than the development occurring in a more remote location with no servicing close by.

4 Public Transport

4.1 The area is generally well served by public transport with most of the proposed medium density residential within 500 metres (approximately 6 minute walk) and a significant proportion of the site within 800 metres (approximately 10 minutes) walk of the No 28, Blue Line and the Orbiter.

4.2 The Blue Line is a direct service with the Central City via Main North and Papanui Roads, which has a 10 minute frequency at peak times and 15 minutes during other times of the day. Route 28 (Papanui to Lyttelton and Rapaki via the Central City) travels along Cranford and operates with a frequency of 30 minutes for most of the day. The Orbiter has a frequency of 10 minutes during the day and provides access across the city. This service may be re-routed along Cranford Street from QEII Drive due to the changes to the network from the construction of the Northern Arterial and its extension to Cranford Street.

4.3 Completion of the Northern Arterial may also provide an opportunity to provide for bus priority measures along the Main North Papanui Road corridor. To date, no work has been undertaken to test what measures could be implemented in the future, but the City Council is proposing to investigate this issue and this could result in a more efficient and attractive service being developed along the corridor.

4.4 The Draft Regional Passenger Transport Plan (dRPTP) anticipates that some new routes may be introduced in the future to service new residential subdivisions. Given the limited area

proposed for residential development and the proximity to existing high frequency services, it is unlikely that there would be any new routes specifically serving this area.

4.5 The provision of a high level of safe and attractive pedestrian connections through the area providing access to Main North Road and Cranford Street is therefore essential to ensure that the residents of the area can take full advantage of the adjacent bus routes.

5 Cyclist Access

5.1 The rural zoning and private ownership of the land historically offers little opportunity to provide off-road links through the area, other than the shared path adjacent to the south west boundary between Rutland Street and Grassmere Street. The existing facilities in the wider area consist of the shared cycle/bus lane along Main North / Papanui Road, the railway cycleway along the Main North Line, the QEII Drive off-road shared path and the Innes Road cycle lanes.

5.2 Council are currently planning, designing and building a network comprising 13 Major Cycle Routes (MCR), one of which (the Papanui Parallel) will run along the south-west boundary of the site. The MCR's are designed to connect suburbs, shopping areas, businesses, schools and sporting destinations. The routes offer a level of service not seen before in Christchurch.

5.3 The Papanui Parallel is currently under construction with completion scheduled in 2017 and will provide a high level of safe access for cyclists, connecting the site with the Central City and the Northern Line Cycleway (also a MCR). The cycleway will also provide a high level of access to more local facilities, such as the Paparoa Street School and Papanui High School, via the signalised pedestrian / cycle crossing on Main North Road linking Grassmere Street to Sawyers Arms Road. The crossing will also provide easy access to the Papanui Key Activity Centre.

5.4 The development of the Northern Arterial Extension (NAE) will also see the construction of a shared path on the west side of the corridor which will cross Cranford Street via a set of pedestrian / cycle signals to link with a shared off-road path on the south-west side of Cranford Street. There is the opportunity to link the NAE cycleway across the site to join with the Papanui Parallel to provide access to the Central City.

5.5 The MCR's are designed to make cycling a safe, convenient and enjoyable experience to encourage new groups of people to try cycling and the route is designed to emphasise these features. Intersections and vehicle accesses are areas where conflict can occur and it is therefore essential that access to the North-East Papanui ODP area is designed to minimise the conflicts to maximise the safety of its users. This can be achieved through the

minimisation of crossing points and/or the design of these crossing points to ensure that visibility between users is maximised and vehicle speeds are kept low.

5.6 The limitation of four road access points along Grassmere Street will provide access to the ODP area, and the MCR crossings will need to be designed with input from Council to ensure they align with the overall design philosophy of the MCR's. The design is likely to include a level of traffic calming, which will also assist in reducing the level of through traffic in the area.

6 Pedestrian Access

6.1 The site is well located for pedestrian access to Main North Road and the development of the Papanui Parallel will also afford better access for pedestrians across Main North Road with the new signalised crossing point. This will provide convenient walking access to the high frequency bus routes and also to the employment, shopping and other services available within and around the Papanui/Northlands District Centre.

6.2 As with the cycle connections, the internal network should be designed to provide high-quality pedestrian connections from the site to the adjacent pedestrian areas, the major cycleway and to the signalised pedestrian crossing on Cranford Street.

7 Case and Crozier Land

7.1 The two lots of land to the north east of Cranford Street on the edge of the existing residential area, known as the Crozier and Case land, would provide for development of about 35 and 20 lots respectively. This level of traffic generation would be unnoticeable on a network wide basis and in my opinion would have a less than minor effect on the frontage roads used to access the land, providing well designed access points are used.

7.2 Current access to Crozier land is from Croziers Road which is a local road with a 13 metre wide formed carriageway. The road ends at the boundary of the residential zoning and it was obviously intended that the road would provide access to any future development of the land.

7.3 The extra residential development would generate approximately 350 vehicle trips per day (35 during peak hour) and whilst the increase in traffic would be noticeable to residents in the immediate proximity, it would not be enough to create safety issues. Given the adjacent development of the Council's stormwater area, the provision of a pedestrian/cycle connection to the area from the Crozier land should be incorporated as part of development.

7.4 The Case land currently has access via a right of way from Esperance Street with the main access for the business and residence from Cranford Street. The works associated with the Northern Arterial Extension will change the form of Cranford Street substantially, with the two lane road being widened to four lanes separated by a solid median. The solid median includes

a number of right-turn facilities to provide for access to adjacent land use, with a bay located immediately outside the Case property.

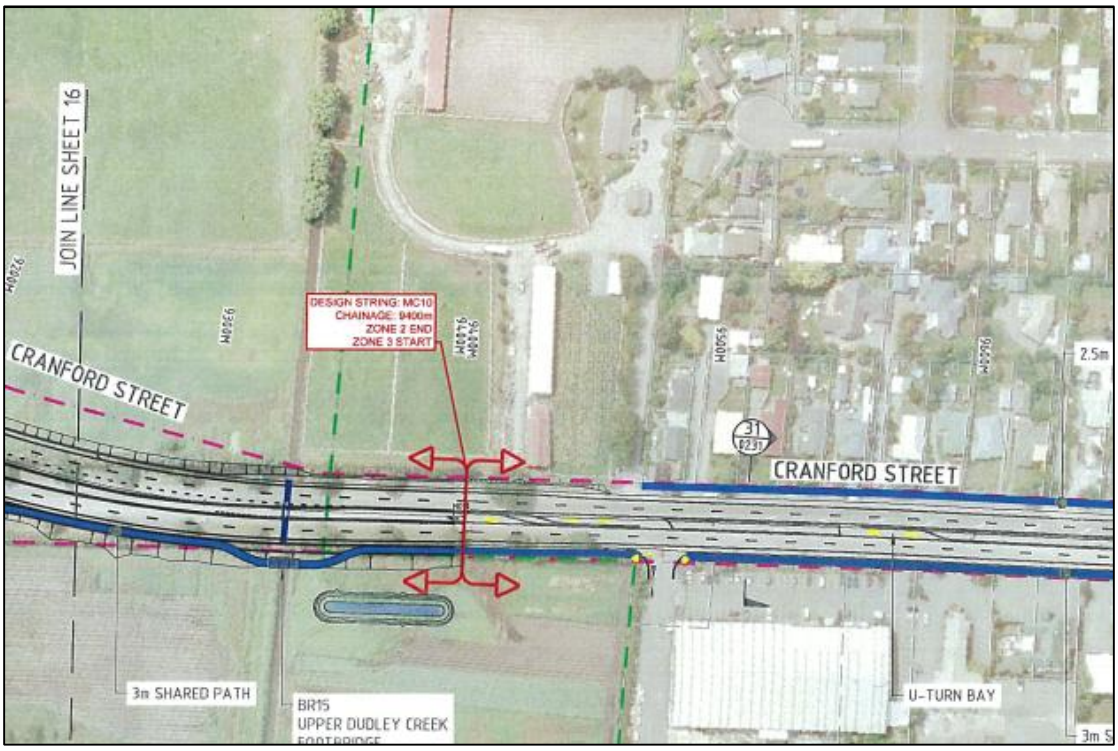

Figure 7.1 – Case Land – Cranford Road fronatge

7.5 The location of this turning bay has the potential to result in unsafe manoeuvres occurring from a future access from the Case land, depending on its final location. A left-in-left-out (LILO) arrangement has been tested from the Case Land to Cranford Street. In addition to impacting to some degree on the safety and efficiency of Cranford Street, a LILO arrangement enables vehicles from the Case land to cross two lanes of heavily trafficked southbound Cranford Street lanes in order to reach the turn bay and this movement is not without risk.

7.6 The level of risk can be equated to the extent of use of the LILO and the frequency of movements from the Case land. As such, a limit on the number of units to be accessed from any LILO arrangement should be imposed. Previous assessments of a LILO arrangement have been undertaken and when considered within the context of the safety impacts associated with the downstream effects of the Christchurch Northern Corridor, a limit of 6 units was considered to offer a reasonable level of intersection performance notwithstanding the efficiency effects on Cranford Street.

7.7 With use of the Frome Street right of way access being geometrically constrained to traffic associated with up to 8 units, access for any additional units associated with the Case land

should be established via a vehicle link through to the Crozier land and a limit specified for the number of residential units with direct access from Frome Place.

7.8 While a properly designed and located LILO arrangement from Cranford Street could provide a means of access to a limited number of units, access onto the local network would be a preferable solution with linkage to the Crozier land providing further benefits by reducing the use of both the LILO and the right of way to Frome Place.

8 Conclusions and Recommendations

8.1 Traffic modelling that has been undertaken for Council by QTP Limited assessing the potential effects on the transport network from three options for the development of the ODP. The modelling has highlighted a number of issues that need to be addressed to maintain the safety and efficiency of the network, particularly prior to the Northern Arterial projects being completed.

8.2 The issues raised pertain to the delays anticipated where local roads intersect with the arterial network and the extra delays created by the extra vehicle traffic generated by the ODP. Due to the safety implications associated with extended delays at intersections, it is recommended that access cannot be provided to Cranford Street from the ODP area south of Cranford Street prior to the completion of the Northern Arterial projects to minimise the adverse effects.

8.3 Council's preferred option for the development of the ODP area is Option 1, which includes a road link connecting Cranford Street to Grassmere Street. The option is preferred as it provides a high level of connection through the area, and improves connectivity and resilience by providing an alternative route through the block as an outlet to the north and west of the city for residents of the area.

8.4 The connection would also provide the opportunity to construct a controlled intersection with Cranford Street, either in the form of a roundabout or a signalised intersection, which would provide a safe and efficient link to the residential area.

8.5 The design of the ODP road traffic calming features will require to be such that it achieves a balance between deterring excessive through traffic while delivering on the advantages of the ODP link road such as lower peak direction travel times on the Main North Road public transport corridor, relief of pressure on Shearer Avenue and the higher accessibility and connectivity of the ODP development block to and from the surrounding road network.

8.6 While the potential amenity impacts on Grants Road are recognised, maintaining Grants Road as a local road provides the best transport outcome for the local area, noting that traffic

increases beyond that associated with 370hh are likely to tip the status of Grants Road towards a collector road with adverse consequences for the local and wider road network.

8.7 Where new roads cross the Papanui Parallel the intersections with the MCR will need to be designed to be compatible with the design treatments used along the route. Minimising the number of intersections and individual property accesses will limit the conflict points and enhance safety along this section of the cycleway. It is also important that any vehicle accesses provide for adequate visibility of the cycleway for residents entering or leaving their properties, through such devices as visibility splays.

8.8 The development of the Crozier and Case land can be accommodated on the transport network with less than minor effects on the safety and efficiency of the network, however the proximity of the Case land to turning bays being constructed on Cranford Street will require careful design and location of the access, or for primary access to be from the Crozier property.

8.9 The following italicised transport requirements are recommended for inclusion in the narrative for the NE Papanui ODP:

a) There shall be a fully interconnected local road network that achieves a high level of accessibility for walking, cycling and public transport that utilises the transport and open space network as defined on the ODP.

8.10 The road network and associated linkages need to be highly connected, to reflect the desire lines and destinations within (and outside) the area and also in surrounding neighbourhoods. This encourages people to walk or cycle where practicable, rather than using their car, particularly for shorter local trips. When this can be achieved, it results in energy savings and creates a safer and more efficient network.

b) There shall be a collector road from Cranford Street to Grassmere Street in accordance with the District Plan and Infrastructure Design Standard as part of any subdivision within the area identified for the collector road. There shall be no more than 99 residential units in Areas 1 – 4 prior to the Christchurch Northern Corridor being operational.

8.11 The collector road provides the spine road through the area onto the main arterial links to enable easy and safe access around the city. The modelling forecasts that the introduction of a controlled access onto Cranford Street prior to the Northern Arterial would adversely affect the operation of Cranford Street and during peak periods would be unlikely to have the capacity to cope with the traffic flows.

c) The intersection of Cranford Street and the collector road is to be designed to provide a Level of Service D (as defined in HCM 2010) or better for right turning vehicles

from the collector road onto Cranford Street during the peak hour. 'Peak hour' is defined as those hours between 7am to 9am and 3pm to 7pm on a weekday.

8.12 The Cranford Street/Collector road intersection is to be designed to provide an appropriate level of service (LOS) for people using the intersection. Level of Service criteria are frequently used for planning to provide an indication of congestion and associated levels of delay. Levels of service below D indicate the stage at which the network is reaching its practical capacity and where the intersection delays start to translate to unsafe manoeuvres. Modelling indicates that a roundabout or signals will offer a safe level of service.

d) Shearer Avenue shall be extended to connect to the Cranford Street to Grassmere Street collector road in conjunction with subdivision of Area 1.

8.13 The road network and associated linkages need to be highly connected, to reflect the desire lines and destinations within (and outside) the area and also in surrounding neighbourhoods.

e) An extension of the Northern Arterial strategic cycleway along the eastern boundary of the ODP area shall be provided through to Grassmere Street in conjunction with subdivision of the adjoining land.

8.14 The construction of the Northern Arterial will include a shared path along the western boundary of the transport corridor. This path will cross Cranford Street at a set of pedestrian/cycle signals and link into the Papanui Parallel major cycleway. To provide safe access the path needs to be overlooked from residential properties.

f) There shall be no more than four road access points onto Grassmere Street, to protect the functioning, safety and amenity of the Papanui Parallel major cycle route.

8.15 To provide a safe cycleway, it is important to minimise access across the cycleway, where possible, and where roads cross the facility ensure that there is adequate visibility available.

g) Grassmere Street to be widened on the north-east side to enable the construction of the Papanui Parallel cycleway.

8.16 The construction of a safe facility requires a corridor wide approach to ensure the path and a separation strip are provided, particularly with the additional traffic generated by the ODP

area. Sections of the legal corridor for Grassmere Street are narrow and will require widening to enable an appropriate facility to be constructed.

h) Within Area 5 there shall be no more than six residential units with direct vehicle access from Cranford Street. Vehicle access from Cranford Street shall be limited to one access from Cranford Street in the location of the existing access.

8.17 To maintain the safety and efficiency of Cranford Street, additional access to Cranford Street will need to be carefully managed and limited.

i) There shall be no more than two residential units with direct vehicle access from Frome Place.

8.18 Access constraints between the Case Lane and Frome Place result in a limitation of use of that access.

j) Other than provided for, all residential units within Area 5 shall be accessed and egressed from Croziers Road.

Appendix A – Cranford Basin Proposed Rezoning Transport Assessment – 2 April 2015

QTP
Quality Transport Planning

QTP Ltd
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Phone (+64) 03 379 2489

Memorandum

To:	Ivan Thomson
From:	Tim Wright
Subject:	Cranford Basin Proposed Rezoning Transport Assessment
Date:	Thursday 2nd April 2015
Copy:	Nilesh Redekar

Dear Ivan,

Thank you for asking QTP to assist with the transport assessment you require as an input to the Section 32 (of the RMA) Evaluation of the proposed rezoning of the Cranford Basin area for urban purposes as part of the proposed Replacement District Plan (pRDP).

As discussed at our meeting last week, the effects-based assessment has been informed by a significant amount of traffic modelling using Council's Christchurch Assignment and Simulation Traffic (CAST) model. Due to the short time-frame available for the analysis and reporting, at this stage, some aspects of the transport assessment are necessarily high-level and the reporting here-is highly summarised. This perhaps belies the degree of technical work that has been undertaken to develop a workable road network to service the area proposed for rezoning and to assess various iterations of this network for some 5 alternative urban development scenarios, for both AM and PM peak hours, both in the short-term (2021) and the medium-term (2031).

1 Scope of Assessment

1.1 Council have specified the Scope of the assessment as follows:

1) What are the effects on the local road network under the following rezoning scenarios ?:
   i. 200 households of similar density to the Residential Suburban Peat Constraint Zone (L1B in the Operative Plan;
   ii. 750 households of similar density to the Residential Suburban Zone (L1 in the Operative plan);
   iii. 1500 households of similar density to the Residential; Medium Density (L3 in the operative plan;
   iv. Assuming that the portion of the area identified for rezoning to the south-west of Cranford Street is zoned for general industrial purposes; and
   v. Assuming that part of the portion of the area identified for rezoning to the south-west of Cranford Street is zoned to accommodate a commercial area comprising 30,000m^2 GFA.
2) What upgrades would be needed, their timing and approximate cost ?

3) An assessment of the area in terms of public transport services, cycleways, and active transport
4) Where are the safest and most efficient access points into the site from the surrounding existing and potential network, and what is the most efficient internal layout ?

1.2 The extent of the area to accommodate the proposed urban zoning is illustrated within the following diagram (being the area indicated by white hatching).

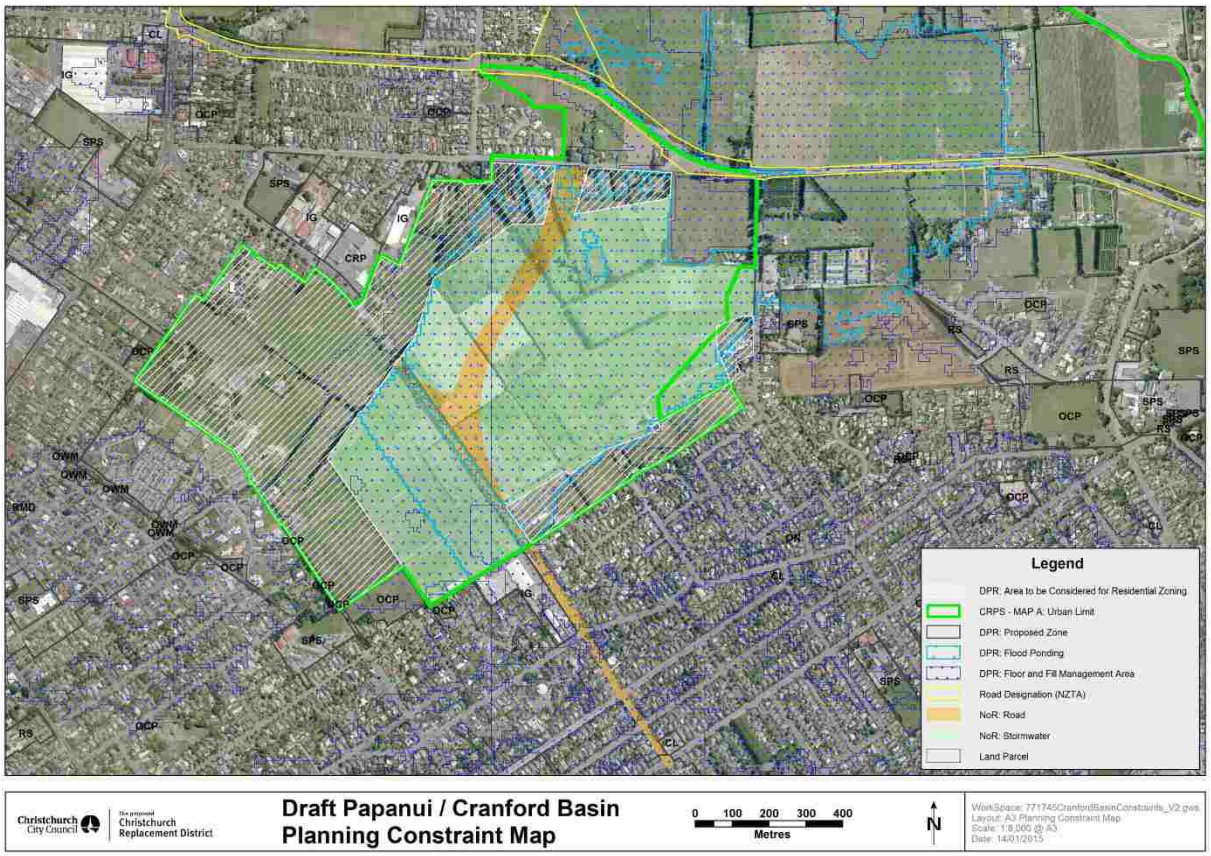

Figure 1.1: Draft Cranford Basin Planning Constraint Map

1.3 In relation to item 2) above, we have excluded from the scope any information regarding project costings given the time available for this assessment and that this is not QTP's area of expertise.

1.4 At this stage, neither a full Integrated Transport Assessment (ITA) is required, nor is the preparation of Expert Evidence on transport matters. The transport modelling methodology is also necessarily simplified to meet the required timescales as explained further next.

2 Methodology

2.1 As discussed at our meeting last week, given the time available to complete this analysis, modelling is to be undertaken using the CAST model only. This study involves the modelling of increased household numbers adjacent to existing residential areas. As such, the base model distribution of the trips of the residential areas subject to

potential residential zoning is considered a reasonable basis for the distribution of trips under increased traffic generation. It was therefore agreed, and considered appropriate, at the Scoping Stage, that the CAST model (alone) could be used at the basis of the assessment.

2.2 This study does, however, also consider alternative zoning of the site for industrial and commercial purposes. Ideally, the distribution of trips would be informed by first undertaking modelling using the regional CTM model. The CTM provides an estimate of trip distribution for different trip purposes by matching trip generation (typically the home-end of the trip) with attractions (the workplace, shops etc.). In this regard the CTM would provide a better estimate of potential trip distribution for the industrial and commercial land-uses than the more simplistic method adopted for this assessment, both for the site being considered and other areas of the city where trip patterns could be affected by the proposed rezoning.

2.3 However, in the time available to conduct this analysis it has not been possible to undertake CTM modelling of the various scenarios and then use the resulting demands as the basis of the more detailed assessment afforded by the CAST model. Given that the resolution of the CTM model is not sufficient to identify the effects of the proposed development on the road network (including 'Local' roads) in the vicinity of the site, it is preferable that modelling be undertaken with the CAST model. This has a much finer-grained representation of model demands and unlike the CTM includes all local roads with a significant through-traffic function. Unlike the CTM, the CAST model includes sophisticated simulation of intersections and their interactions and also simulates capacity constraints of the road network.

2.4 Whilst there are some limitations associated with the CAST modelling (only), it is considered a reasonable basis for informing the effects on the local (and wider) road network at this stage. The assignment and simulation model allows all trips to re-route to their optimal route under the modelled traffic conditions and in this regard is considerably more sophisticated than traditional techniques applied in undertaking Integrated Transport Assessments (ITAs) where trip distribution is estimated and new trips are simply superimposed on the base situation. Such analysis does not allow for the reassignment of traffic across the network and is often limited in scope (network coverage). Conversely, the CAST model represents the whole of Christchurch city in 'simulation' level of detail, allowing the wider effects of re-zoning to be identified.

3 Traffic Demands

3.1 The following table summarises the trip rates adopted for this assessment.

Landuse Scenario	No.	Unit	Type	AM		PM		AM	PM
				From	To	From	To	2-Way	2-Way
1	200	hh	L1B Low Density Res.	0.76	0.31	0.46	0.72	1.07	1.18
2	750	hh	L1 Low Density Res.	0.76	0.31	0.46	0.72	1.07	1.18
3	1,500	hh	L3 Med Density Res.	0.44	0.18	0.31	0.49	0.62	0.80
4	3,340	$100m^2$ site area	General Industrial	0.09	0.21	0.20	0.10	0.30	0.30
5	30,000	$100m^2$ GFA	Commercial (LFR)	0.59	0.76	2.02	0.98	1.35	3.00

Table 3.1: Adopted Trip Rates for Traffic Generation

3.2 The above trip rates translate to the following traffic generation:

Landuse Scenario	No.	Unit	Type	AM		PM		AM	PM
				From	To	From	To	2-Way	2-Way
1	200	hh	L1B Low Density Res.	152	62	92	144	214	236
2	750	hh	L1 Low Density Res.	570	233	345	540	803	885
3	1,500	hh	L3 Med Density Res.	660	270	465	735	930	1,200
4	33	$100m^2$ site area	Industrial + Res.	521	785	791	546	1,306	1,337
5	8	$100m^2$ GFA	Commercial + Res.	634	415	883	728	1,049	1,610

Table 3.2: Traffic Generation

3.3 In relation to traffic generation, the following points are noted:

- Rates are generally reflective of 'design' 85th %ile rates and draw on a number of sources including the New Zealand Trips Database, NZTA Research Report RR453, the RTA Guide to Traffic Generating Developments, rates adopted in Transport Assessments conducted by Council, QTP and third parties.
- For scenarios 4 (general industrial) and 5 (commercial) the rates apply to only part of the site south of Cranford Street. The remainder of the sites are assumed to be developed for low density residential under these scenarios.
- All traffic generation is assumed to be additional to the base case generic CAST models. No adjustment has been made to traffic generation in other locations in the future year models that might be anticipated under an assumed fixed population. In this regard, the assessment is considered robust in terms of assessed network operation. In practice, the effects of applying such adjustments on a model-wide basis are likely to be insignificant given the total traffic generation above equates to around 1% of total model demands.
- For the commercial development scenario, assuming Large Format Retail type development (LFR), no specific representation of pass-by or diverted trips has been made. However, the adopted trip rates are 20-40% lower than some trip rate sources for some LFR types and therefore constitutes a simplified approach to accounting for the fact that not all trips to/from the commercial element are likely to be entirely 'new' to the road network.

3.4 For the residential development, the distribution of trips is based on the aggregate distribution of trips to from the surrounding residential areas (or model zones). For the industrial development, the nearest model zone which contains predominantly industrial development is at Sheffield Crescent, Burnside. For the commercial development, the distribution of trips is based on the model zones comprising Northlands Mall.

3.5 The development area has been represented by four new zones coded into the model to the south of Cranford Street and a total of five zones to the north of Cranford Street (three new zones and two existing residential zones encompassing adjacent residential areas on the south-eastern extent of the proposed urban rezoning).

4 Initial Road Network

4.1 In consultation with Council, an initial road network was developed as the basis of the traffic modelling conducted to inform the assessment of effects. This is illustrated in the following diagram, overlaid on the planning constraints map, and including the road classification of the existing roads as per the pRDP.

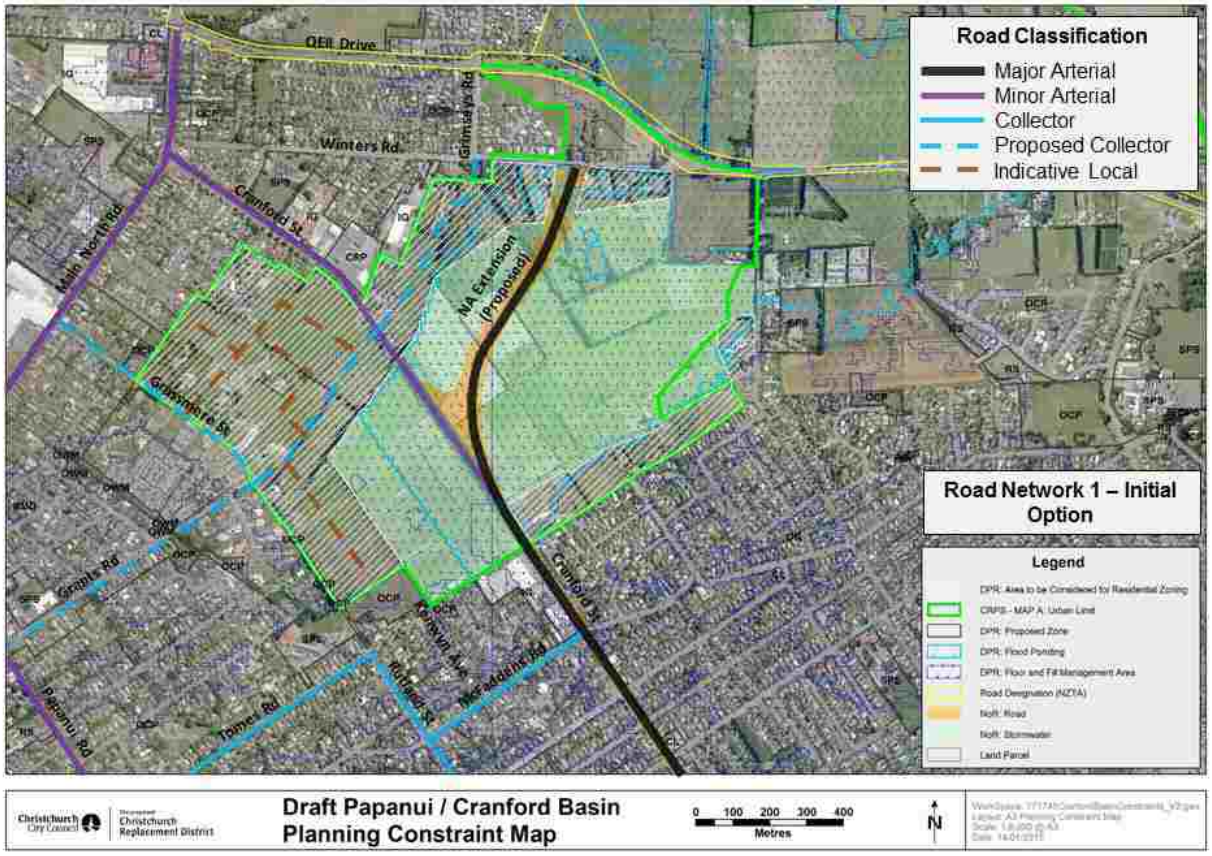

Figure 4.1: Initial Road Network

4.2 Key features of the above network are:

- Three access routes provided via Collector Roads serving the proposed urban zoning south of Cranford Street (and the surrounding residential area)
- A spine road serving the smaller proposed urban zoning north of Cranford Street, with connections to Cranford Street to the south and Winters Rd to the north
- Good access between the two urban areas afforded via the four-way intersection of the two Collector Rds and Cranford Street

4.3 Ideally, from a transport perspective, accessibility and overall network efficiency (through reduced vehicle.kilometres) would be improved with the provision of a fourth access route to the south-east, for example connecting with Rutland Street or Kenwyn Avenue. However, there are considerable constraints to such an option, including the zoning of Open Space (Rutland Reserve), the Paparoa Street School and the proposed 'Papanui Parallel' Major Cycleway that would connect Grassmere Street and Rutland

Street. Accordingly, in order to provide a pragmatic basis of assessment, a fourth corridor to the south-east of the proposed urban zoning (south of Cranford St) has not been assumed for general traffic, but is considered a vital component of a walking and cycling network.

5 Base Traffic Models (the Receiving Environment)

5.1 This Memo is focused on summarising the potential effects of the proposed rezoning. However, given the requirement to undertake traffic modelling at 2021 (with No Northern Arterial or Extension) and 2031 (with Northern Arterial and Extension), it is useful to first understand how traffic patterns may change in the future, irrespective of the proposed Cranford Basin rezoning.

5.2 The following diagrams provide an indication of modelled daily traffic volumes[1] in 2021 and 2031, with the third diagram illustrating the changes between the two scenarios (green bands indicating reductions and red bands increases, with the **width** of the bands (not the length) proportional to the traffic volumes illustrated in each diagram).

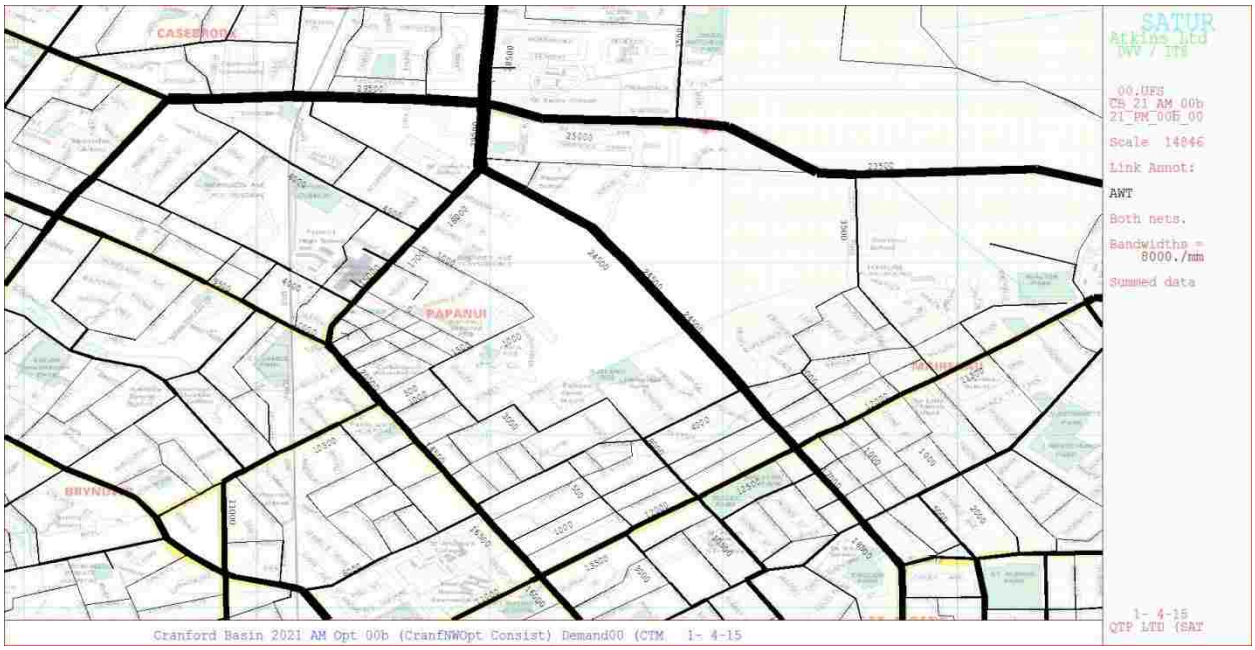

Figure 5.1: Modelled Daily Traffic Volumes 2021 (no Northern Arterial and Extension)

[1] Estimated from CAST AM and PM peak hour modelling

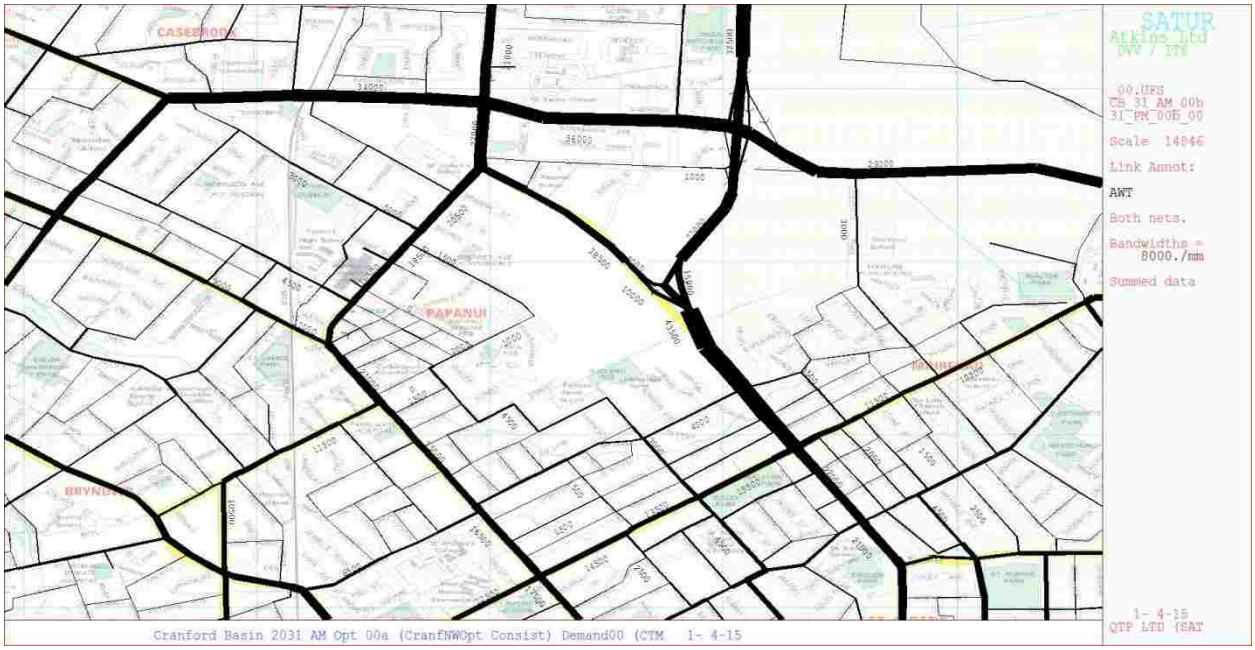

Figure 5.2: Modelled Daily Traffic Volumes 2031 (with Northern Arterial and Extension)

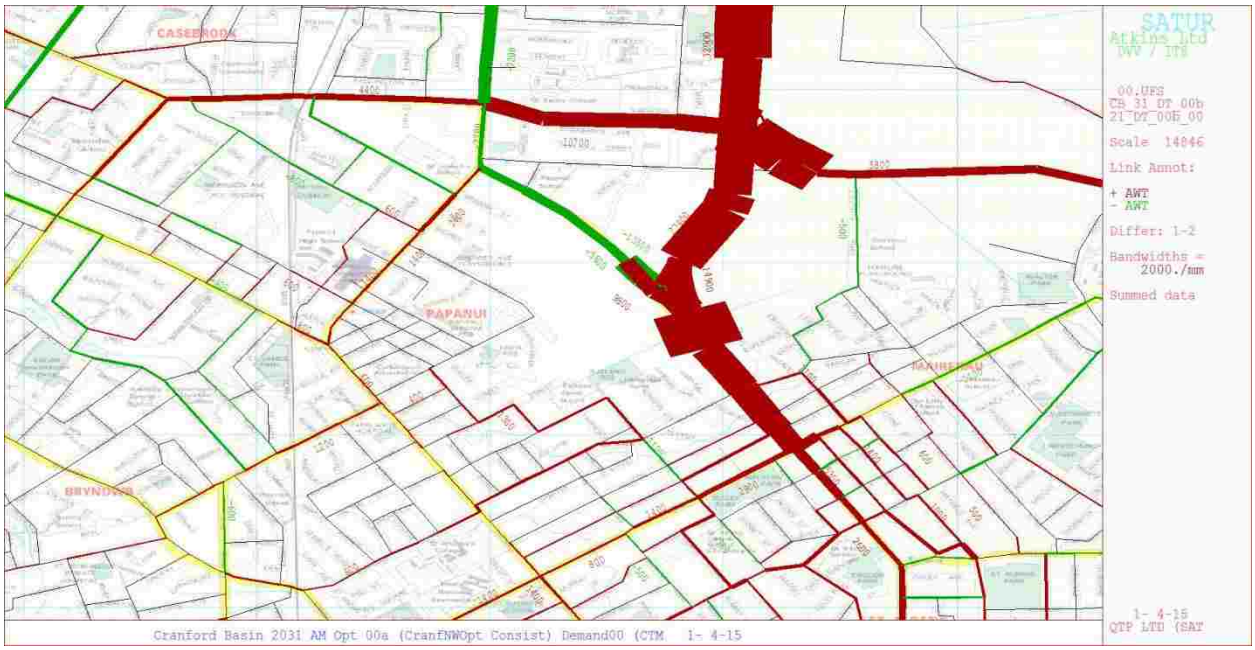

Figure 5.3: Modelled Change in Daily Traffic Volumes 2031 vs. 2021

5.3 The above diagrams illustrate:

- Significant increases in traffic volumes on Cranford Street to the south of the proposed roundabout at the intersection of the Northern Arterial Extension (NAX) and Cranford Street (an increase of 19,000 vpd and reducing as progressing southbound along Cranford Street);
- Reductions in traffic volumes on Cranford Street to the north of the NAX roundabout of around 6,000 vpd;
- Small increases on Main North Rd south of Cranford Street (around 2,000 vpd); and
- No significant change in traffic volumes on Papanui Rd.

6 Initial Traffic Modelling and Results

6.1 Initially, traffic modelling has assumed a single-lane four-arm roundabout at the intersection of the proposed Collector Rd serving the proposed rezoning and Cranford Street. This was to gauge the level of development that might be adequately served by the proposed intersection both in the short-term (2021) and in the medium-term (2031). In 2031, traffic volumes on the section of Cranford Street through the proposed rezoning are anticipated to reduce with the Northern Arterial (NA) and Northern Arterial Extension (NAX) assumed to be in place.

6.2 The modelling indicates that the roundabout would be over capacity on several approaches in all scenarios modelled in 2021. For 2031, with reduced traffic volumes on this section of Cranford Street, such a roundabout generally operates with modest delays for all scenarios in the AM peak hour. However, in the PM peak hour, large delays (>70 seconds, LoS F) are indicated for all scenarios modelled.

6.3 The following diagram illustrates the potential location of the proposed 4-way intersection in relation to the scheme plans developed for the NAX.

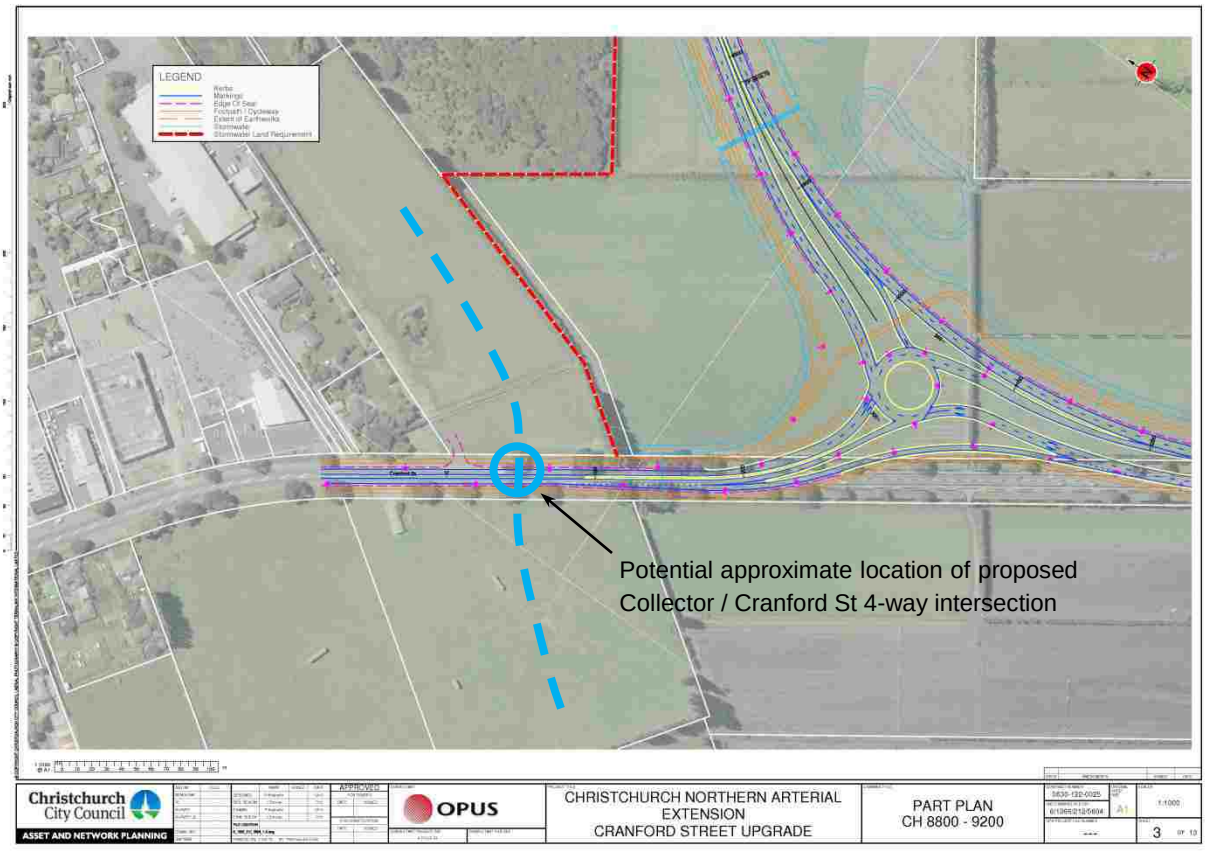

Figure 6.1: Location of Potential Cranford St Intersection Relative to NAX

6.4 Whilst it is around 250m between the intersections, the design incorporates a slip-lane for northbound traffic on Cranford Street. This requires a merge length from two lanes to a single lane, which terminates just on approach to the approximate roundabout location. It may be possible to modify the NAX roundabout design and the location of

the proposed roundabout to some degree, thus enabling an intersection with single approach lanes to be provided. However, assuming the NAX intersection design retains a slip-lane and merge length, it is considered most unlikely that a multi-lane intersection (roundabout or signals) could be safely accommodated at the proposed location. This is because this would create a 'weave' of vehicles between the NAX intersection exit lanes and the proposed intersection approach lanes over a very short length of road. Accordingly, this initial road network configuration has been modified.

7 Modified Road Network

7.1 The road network has been modified to provide two T-intersections on Cranford Street serving the proposed rezoning area as illustrated within the following diagram.

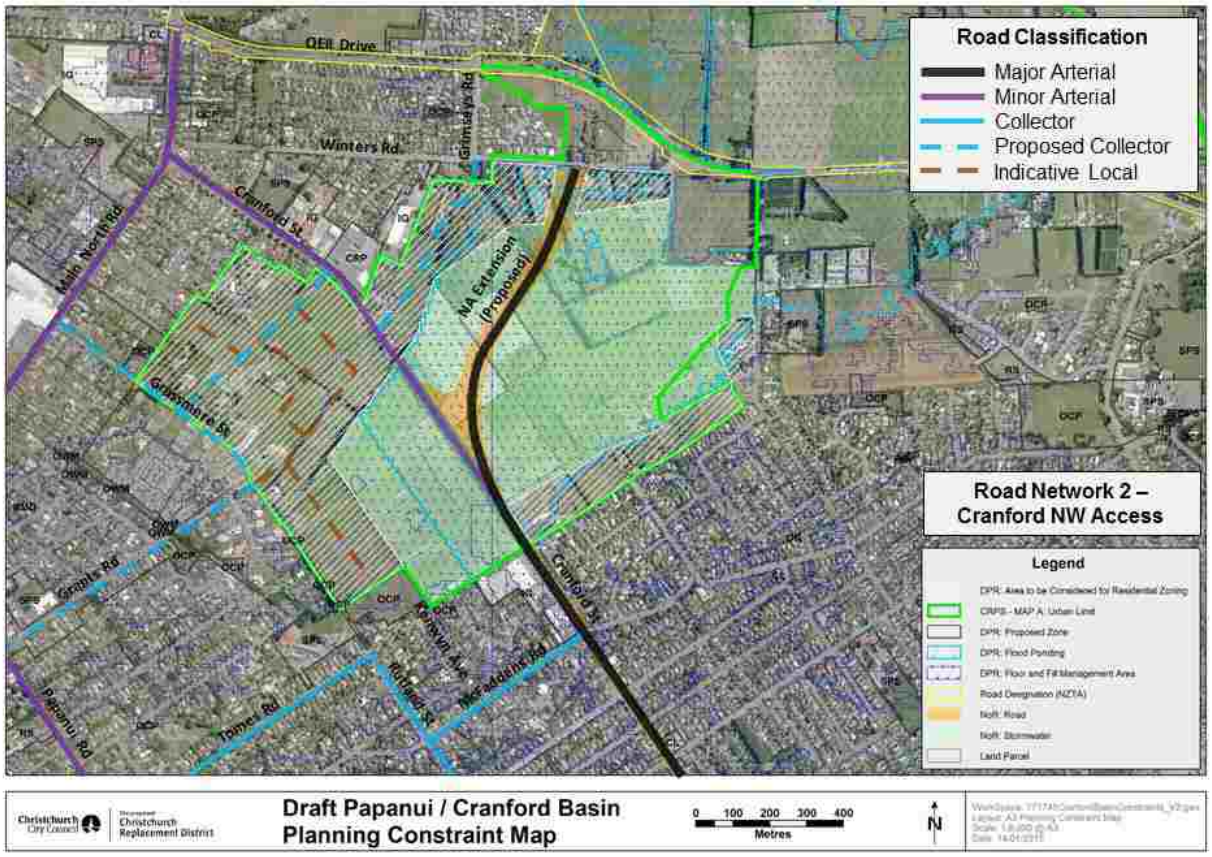

Figure 7.1: Modified Road Network

7.2 The road network does not provide the same level of accessibility between the proposed urban zoning north and south of Cranford Street. However, good accessibility for pedestrian and cyclists can be maintained through the provision of a suitably designed walking / cycling link in the southern section, connecting to the proposed Collector Road serving the northern section. The modelling has assumed the following:

- The proposed Cranford Street intersection serving the smaller (northern) portion of the proposed rezoning is assumed to be a Left-In, Left-Out (LILO) priority T-intersection. This design acknowledges the close proximity of the adjacent NAX

intersection and the resulting issues discussed above. Whilst this design represents a compromise in terms of accessibility to the northern area, the strongest vehicular demand between Cranford Street (to/from the central city) and the northern area is accommodated by means of the left-turn out movement and the proximity of the proposed roundabout to the north-west, that would accommodate a u-turning movement from the central city direction.

- The proposed Cranford Street intersection serving the larger (southern) portion of the proposed rezoning is assumed to be a two-lane roundabout. This has the potential to accommodate U-turns in accessing the northern section of the proposed rezoning. Testing of a single-lane roundabout indicated insufficient capacity for the lowest traffic generation scenario.

8 Modelled Effects of Rezoning

8.1 Modelling has been conducted for 5 demand scenarios, for 2 transport networks, for both the AM and PM peak hours, both at 2021 and 2031. This is some 40 model runs. Various graphical outputs have been extracted from the model for each model run both for the purpose of checking the sensibility of outputs and to inform the assessment of effects. Some 400 model plots have thus been generated.

8.2 It is not within the scope of this assessment to provide a full explanation of the assessed traffic volumes, delays and changes in volumes and delays for each model run. Thus selected model outputs have been chosen to illustrate the results of the assessment and a summary chapter provided at the end of this Memo.

8.3 Base Models

8.3.1 In order to provide some context to the assessment of effects, the following diagrams illustrate the modelled delays and CAST Level of Service (LoS) on the road network for the generic 2021 and 2031 CAST models for the AM and PM peak hours (without the effects of the proposed rezoning). The delays are at the intersection approach level and are colour-coded as follows:

- LOS A to C (green bands) = 0 to 30 seconds delay
- LOS D (orange bands) = 30-50 seconds delay
- LOS E (red bands) = 50-70 seconds
- LOS F (black bands) > 70 seconds

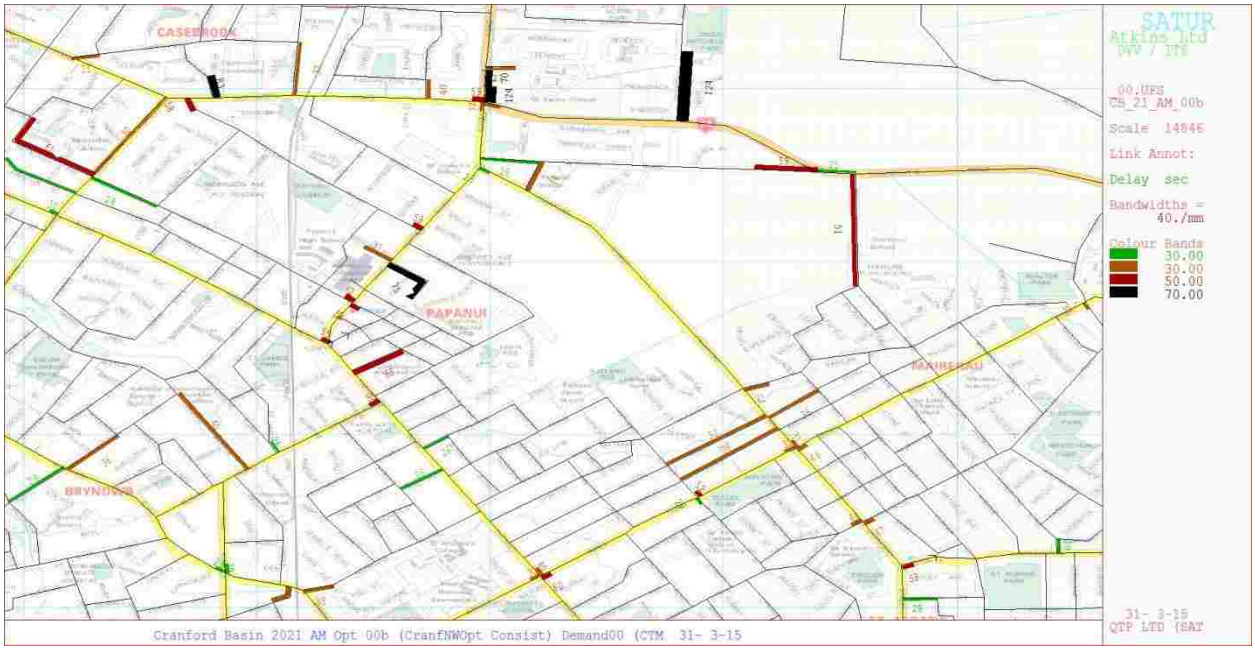

Figure 8.1: Link Delays and LoS, Base Model, 2021 AM Peak Hour

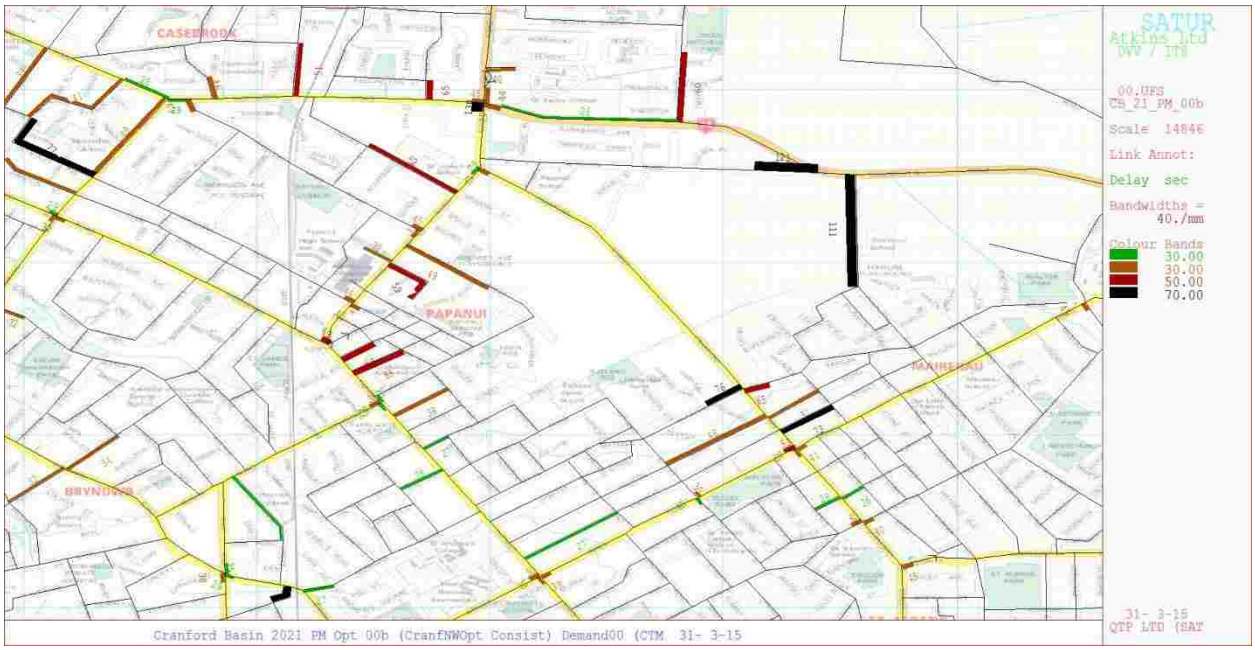

Figure 8.2: Link Delays and LoS, Base Model, 2021 PM Peak Hour

Figure 8.3: Link Delays and LoS, Base Model, 2031 AM Peak Hour

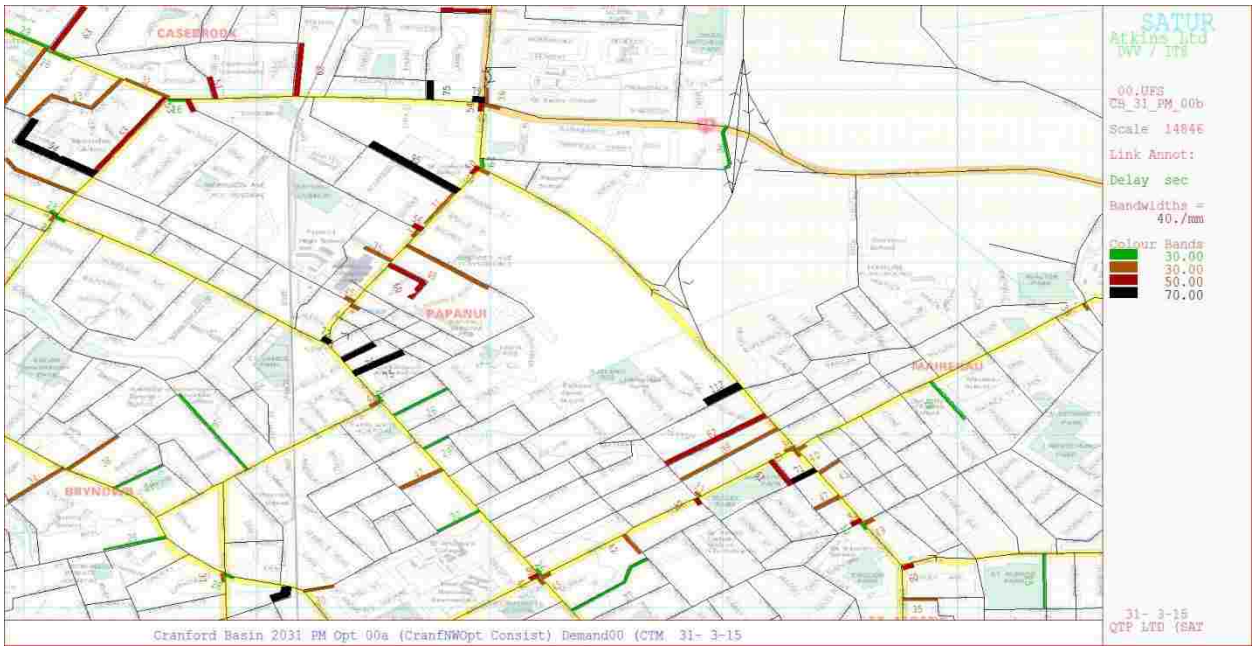

Figure 8.4: Link Delays and LoS, Base Model, 2031 PM Peak Hour

8.3.2 The following points are noted:

- A number of minor road approaches to Main North Rd and Papanui Rd have high delays with LoS E or F illustrated in both 2021 and 2031
- At 2031, with the NAX assumed to be in place, delays on the McFaddens Rd and Weston Rd approaches increase and are at LoS F and E respectively.

8.3.3 For modelled base year daily traffic volumes, refer Figure 5.1 and Figure 5.2 above.

8.4 Scenario 1: 200 Low Density Households

8.4.1 The following diagram illustrates the modest changes in daily traffic volumes resulting from this scenario (2021 illustrated).

Figure 8.5: Changes in Daily Traffic Volumes, Scenario 1: 200 Low Density Households, 2021

8.4.2 The following diagrams illustrate the resulting changes in delays as a consequence of the additional development traffic in the AM and PM peak hours at 2021.

Figure 8.6: Changes in Delays due to Scenario 1: 200 Low Density Households, AM Peak, 2021

Figure 8.7: Changes in Delays due to Scenario 1: 200 Low Density Households, PM Peak 2021

8.4.3 At 2021, the impacts are generally modest. Note that there are modest reductions in delays relative to the base model on some minor-arm approaches to Papanui, Main North Rd and Cranford Street. This is because the assumed intersection on Cranford Street provides some relief to delays faced by traffic from the surrounding residential area in accessing these arterial roads.

8.4.4 There are however some locations of notable increases in delays:

- Grimseys Rd southbound (approximately 20 seconds), AM Peak Hour
- Philpotts Rd northbound to QEII Drv (approximately 10 seconds), PM Peak Hour
- Knowles St southwestbound to Cranford St (approximately 20 seconds), PM Peak Hour

8.4.5 Because these locations are already operating at LoS E or F in the base model, these impacts are considered potentially significant, particularly as there are safety consequences of large delays on give-way approaches to intersections.

8.4.6 It is somewhat subjective as to whether such a scale of impacts are considered minor, or more than minor. At this stage, our recommendation would be not to allow for zoning that could exacerbate existing efficiency and associated safety issues on the road network at 2021 without either mitigating these effects or undertaking more detailed analysis to confirm these initial findings.

8.4.7 The following plots illustrate the modelled delay increases at 2031.

Figure 8.8: Changes in Delays due to Scenario 1: 200 Low Density Households, AM Peak, 2031

Figure 8.9: Changes in Delays due to Scenario 1: 200 Low Density Households, PM Peak 2031

8.4.8 At 2031, these locations of potentially significant delay **increase** as summarised above in 8.4.4 do not occur due to the relief to these bottlenecks brought by the NA & NAX.

8.4.9 Generally the effects on the road network are modest, and on balance slightly adverse in the morning peak hour (with more traffic from residential side-roads) but with generally positive benefits in the PM peak hour due to the relief provided to other routes as a consequence of the proposed Cranford Street intersection.

8.4.10 Whilst there are some locations of increased delay in the AM peak hour for traffic

approaching Papanui Rd, these are at locations where delays are modest, such that the resulting LoS is D or better.

8.5 Scenario 2: 750 Low Density Households

8.5.1 The following diagram illustrates the changes in daily traffic volumes resulting from this scenario (2021 illustrated).

Figure 8.10: Changes in Daily Traffic Volumes, Scenario 2: 750 Low Density Households, 2021

8.5.2 The increases in traffic volumes are noticeably higher than for Scenario 1. The following diagrams illustrate the resulting changes in delays as a consequence of the additional development traffic in the AM and PM peak hours at 2021.

Figure 8.11: Changes in Delays due to Scenario 2: 750 Low Density Households, AM Peak, 2021

Figure 8.12: Changes in Delays due to Scenario 2: 750 Low Density Households, PM Peak 2021

8.5.3 At 2021, the impacts of landuse Scenario 2 are generally modest. However, there are some locations of notable increases in delays, being somewhat higher than for landuse Scenario 1:

- Grimseys Rd southbound (approximately 60 seconds), AM Peak Hour
- Philpotts Rd northbound to QEII Drv (approximately 45 seconds), PM Peak Hour
- Knowles St southwestbound to Cranford St (approximately 45 seconds), PM Peak Hour

8.5.4 Because these locations are already operating at LoS E or F in the base model, these impacts are considered significant, particularly as there are safety consequences of large delays on give-way approaches to intersections.

8.5.5 We further note that the proposed Collector serving the northern portion of the area proposed for rezoning operates at LoS F (with a delay of 2 minutes) at 2021 on approach to Cranford Street, prior to the NA / NAX being completed. By contrast, this approach is modelled at operating at LoS E (with a delay of just under one minute), at the limit of acceptable performance under Scenario 1. The following diagrams highlight these locations of poor performance and significant impact at 2021.

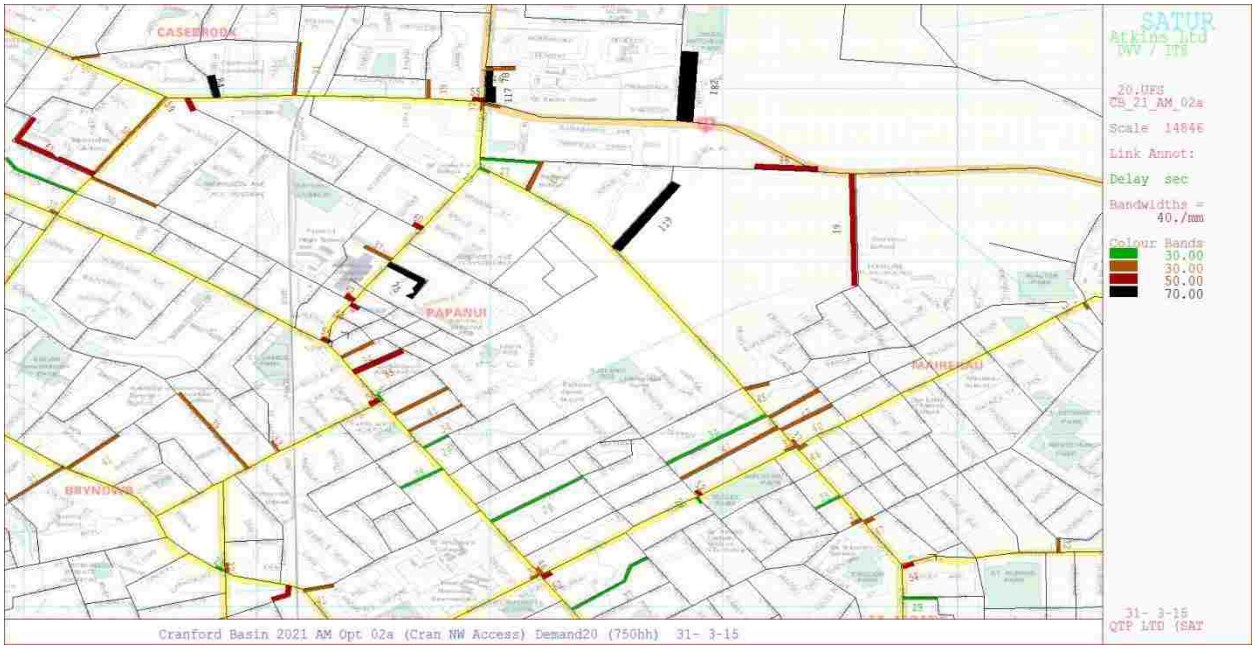

Figure 8.13: Link Delays and LoS, Scenario 2, 2021 AM Peak Hour

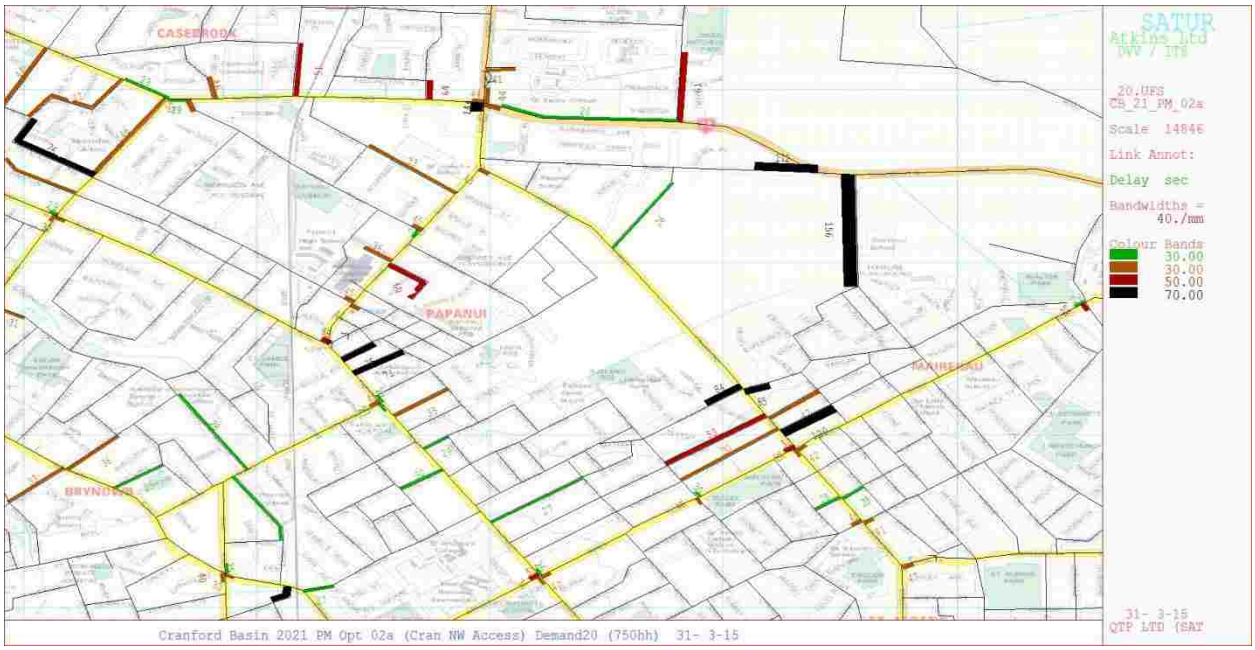

Figure 8.14: Link Delays and LoS, Scenario 2, 2021 PM Peak Hour

8.5.6 At 2031, these locations of significant delay **increase** as summarised above in 8.5.3 do not occur due to the relief to these bottlenecks brought by the NA & NAX, as illustrated in the following plots.

Figure 8.15: Changes in Delays due to Scenario 2: 750 Low Density Households, AM Peak, 2031

Figure 8.16: Changes in Delays due to Scenario 2: 750 Low Density Households, PM Peak 2031

8.5.7 Generally the effects on the road network are modest, and on balance slightly adverse in the morning peak hour (with more traffic from residential side-roads) but with generally positive benefits in the PM peak hour due to the relief provided to other routes as a consequence of the proposed Cranford Street intersection.

8.5.8 Whilst there are some locations of increased delay in the AM peak hour for traffic

approaching Papanui Rd, these are at locations where delays are modest, such that the resulting LoS is D or better.

8.6 Scenario 3: 1,500 Medium Density Households

8.6.1 The following diagram illustrates changes in daily traffic volumes resulting from this scenario (2031 illustrated).

Figure 8.17: Changes in Daily Traffic Volumes, Scenario 3: 1500 Med Density Households, 2031

8.6.2 Note that significant changes (over around 1,000 vpd two-way) are limited to the localised area bound by QEII Drive to the north, Main North Rd / Papanui Rd to west and Innes Rd to the south. Given the reporting for Scenario 2, with an overall smaller traffic generation, analysis at 2021 is not presented here as the effects were considered to be significant.

8.6.3 The following diagrams illustrate the impacts on delays on the surrounding network at 2031.

Figure 8.18: Changes in Delays due to Scenario 3: 1500 Medium Density Households, AM Peak, 2031

Figure 8.19: Changes in Delays due to Scenario 3: 1500 Medium Density Households, PM Peak 2031

8.6.4 As with Scenarios 1 and 2 at 2031, generally the effects on the road network are considered modest. The following diagrams illustrate the modelled delays / LoS for Scenario 3 in 2031.

Figure 8.20: Link Delays and LoS, Scenario 3, 2031 AM Peak Hour

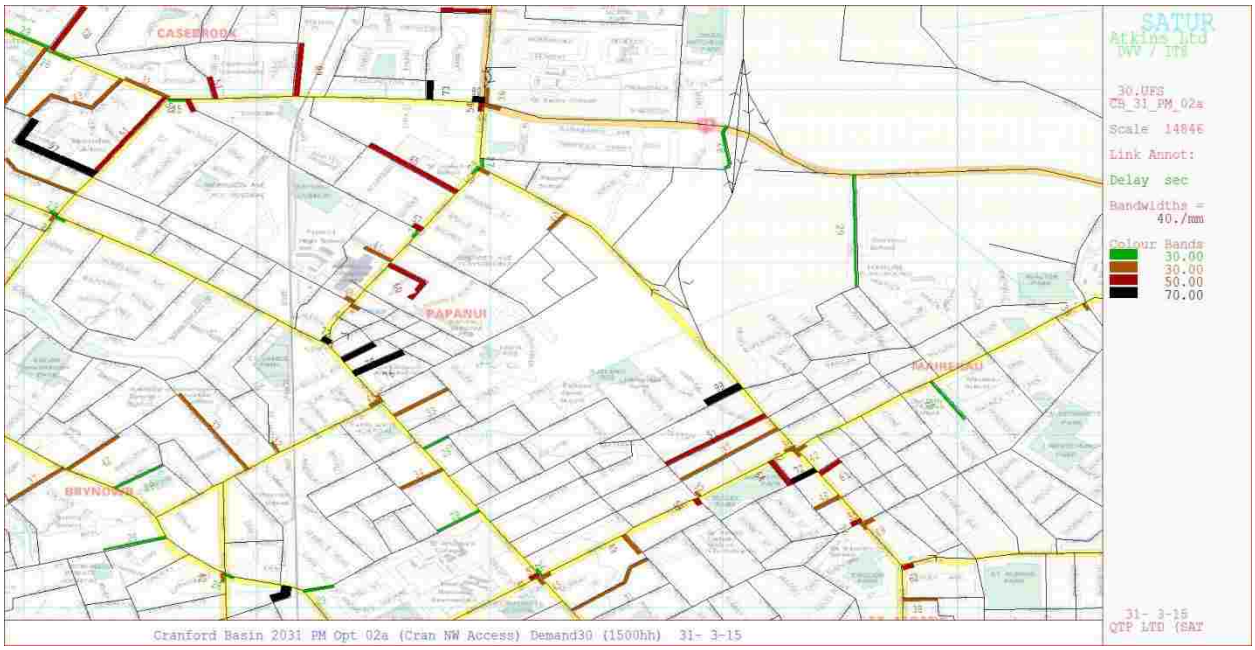

Figure 8.21: Link Delays and LoS, Scenario 3, 2031 PM Peak Hour

8.6.5 Cross-checking the locations of significant increases in delays (say, greater than 10 seconds) of the previous diagrams with the locations of poor performance (red and black bands indicating LoS E/F) suggests that Scenario 3 does not contribute significantly to poor network performance for the modelled road network (including access to/from Cranford Street).

8.6.6 However small increases in traffic volumes on Papanui Rd and on the give-way minor road approaches does lead to an increase in delays on the Wyndham St, Dormer St and Perry St approaches in the AM peak hour, all of which have 'borderline' LoS D performance. Discussion on possible mitigation measures is provided in the subsequent section on Scenario 4 traffic effects.

8.7 Scenario 4: General Industrial + Residential

8.7.1 This scenario assumes all the proposed area for urban rezoning to the south of Cranford Street is for industrial purposes. This constitutes some 33.4 ha. The area to the north of Cranford Street (around 20ha in total) is assumed to be low density residential as per Scenario 2, yielding some 284 hh. The total trip generation assessed is higher than for Scenario 3 (or 5), as shown in Table 3.2 above. Note, however that the predominant direction of travel is reversed from the residential scenarios with employment areas attracting more inbound trips than outbound in the morning peak hour and more outbound trips in the PM peak hour.

8.7.2 The following diagram illustrates changes in daily traffic volumes resulting from this scenario (2031 illustrated).

Figure 8.22: Changes in Daily Traffic Volumes, Scenario 4: General Industrial + Residential, 2031

8.7.3 Note that significant changes (over around 1,000 vpd two-way) extend beyond the area identified for Scenario 3, with some 2,500 trips to/from Blighs Rd and around 1,500 to/from Harewood Rd. Note the significant volume increases modelled on Grants Rd of up to 7,000 vpd.

8.7.4 The following diagrams illustrate the impacts on delays on the surrounding network at 2031.

Figure 8.23: Changes in Delays due to Scenario 4: Industrial + Residential, AM Peak, 2031

Figure 8.24: Changes in Delays due to Scenario 4: Industrial + Residential, PM Peak 2031

8.7.5 As with Scenarios 1 to 3, generally the effects on the road network are considered modest at 2031. The following diagrams illustrate the modelled delays / LoS for Scenario 4 in 2031.

Figure 8.25: Link Delays and LoS, Scenario 3, 2031 AM Peak Hour

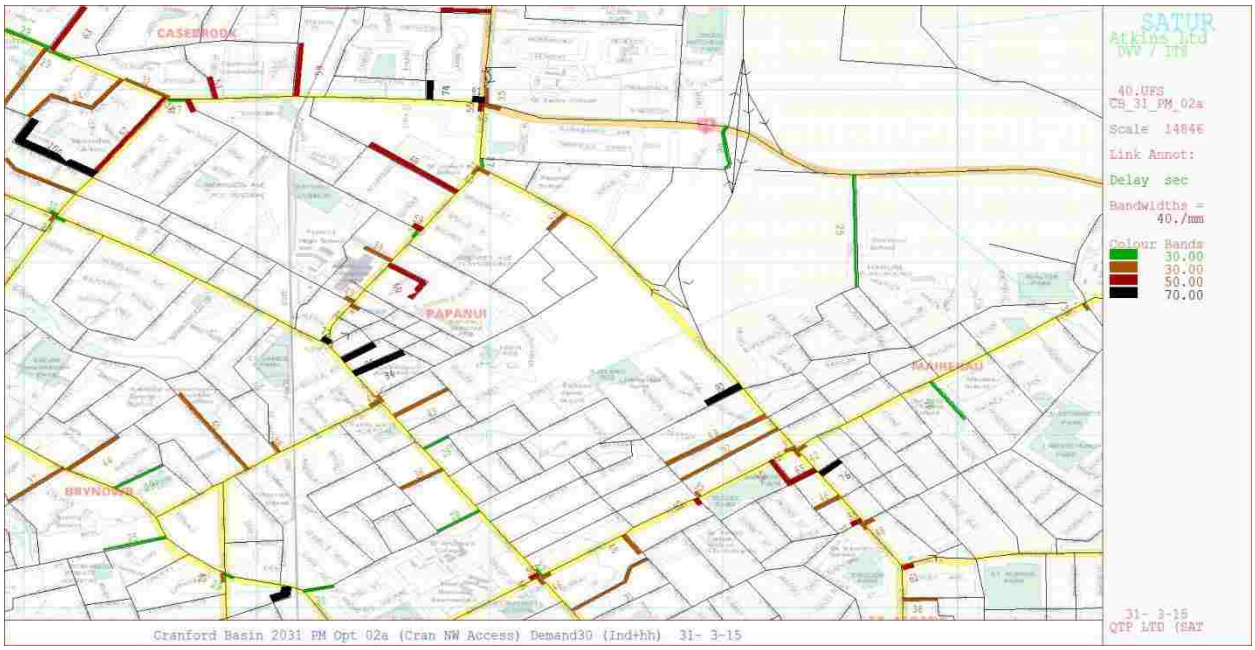

Figure 8.26: Link Delays and LoS, Base Scenario 3, 2031 PM Peak Hour

8.7.6 Cross-checking the locations of significant increases in delays (say, greater than 10 seconds) of the previous diagrams with the locations of poor performance (red and black bands indicating LoS E/F) suggests that Scenario 4 does contribute to increased delays in the AM peak hour on some approaches to Papanui Rd that have a poor LoS (notably the Wyndham Street approach). It is suggested that some form of mitigation by way of intersection upgrade(s) would be appropriate to mitigate these effects. For example, consideration could be given to signalisation of the intersection of Grants Rd with Papanui Rd or Grassmere St with Main North Rd. As illustrated within Figure 7.1, Grassmere Street and Grants Rd are considered to act as Collector Rds in serving the proposed urban area and existing hinterland. On this basis, it would be logical that delays and impacts on local streets be mitigated though promotion of the street

hierarchy with appropriate intersection upgrades. It is not, however, within Scope of this assessment to test the effectiveness of such solutions, at this stage.

8.8 Scenario 5: Commercial + Residential

8.8.1 This scenario assumes that part of the proposed area for urban rezoning to the south of Cranford Street is for commercial purposes. Trip generation has been based on Large Format Retail assuming that part of the site (30,000m^2 GFA) fronting Cranford Street (on its southern side) is zoned for commercial purposes. The total trip generation assessed is similar to Scenario 3 in the AM peak hour and considerably higher than any other scenario in the PM peak hour.

8.8.2 The following diagram illustrates changes in daily traffic volumes resulting from this scenario (2031 illustrated).

Figure 8.27: Changes in Daily Traffic Volumes, Scenario 3: Commercial + Residential, 2031

8.8.3 The following diagrams illustrate the impacts on delays on the surrounding network at 2031.

Figure 8.28: Changes in Delays due to Scenario 5: Commercial + Residential, AM Peak, 2031

Figure 8.29: Changes in Delays due to Scenario 5: Commercial + Residential, PM Peak 2031

8.8.4 As with Scenarios 1 to 4, generally the effects on the road network are considered modest at 2031. This is true of the PM peak hour, despite this scenario having the highest two-way traffic generation in this period. The following diagrams illustrate the modelled delays / LoS for Scenario 5 in 2031.

Figure 8.30: Link Delays and LoS, Scenario 5, 2031 AM Peak Hour

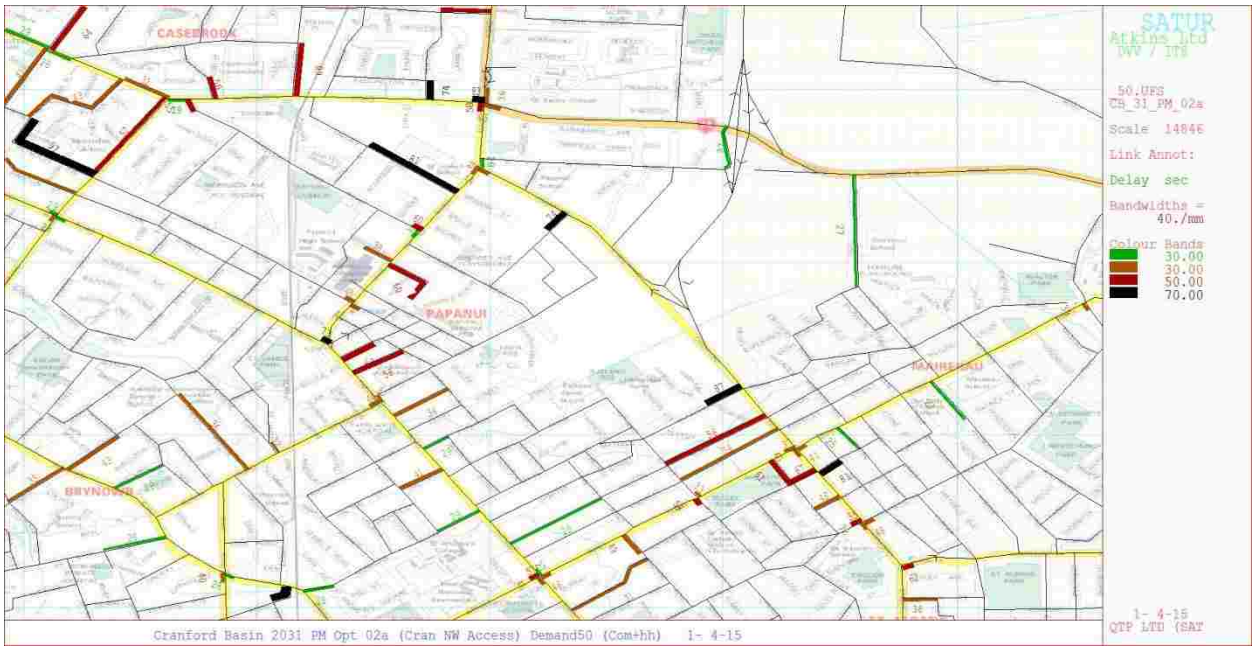

Figure 8.31: Link Delays and LoS, Scenario 5, 2031 PM Peak Hour

8.8.5 As with scenario 3, cross-checking the locations of significant increases in delays (say, greater than 10 seconds) of the previous diagrams with the locations of poor performance (red and black bands indicating LoS E/F) suggests that Scenario 5 does not contribute significantly to poor network performance for the modelled road network (including access to/from Cranford Street).

8.8.6 However, as also noted under Scenario 3, small increases in traffic volumes on Papanui Rd and on the give-way minor road approaches does lead to an increase in delays on the Wyndham St, Dormer St and Perry St approaches in the AM peak hour, all of which have 'borderline' LoS D performance.

8.8.7 Note also that the assumed roundabout providing access to the site from Cranford Street is at LoS F on the Collector Rd approach (with a delay of approximately 70 seconds). Modelling of a signalised intersection (with two-through lanes on Cranford Street) indicates better performance on the Collector Rd can be achieved, but with higher delays on the Cranford Street approaches (albeit still operating at LoS C in 2031).

9 Public Transport, Cycleways and Pedestrian Accessibility

9.1 Public Transport

9.1.1 The following diagram illustrates the relationship between the Cranford Basin proposed urban zoning area and the existing public transport routes. Walking distances to the Blue Line and No 28 bus services are illustrated at 500m (approximately a 6 minute walk) and 800m (approximately a 10 minute walk).

Figure 9.1: Bus Routes Serving Proposed Urban Zoning

9.1.2 The site is generally very well served by public transport. The Blue Line, a direct service to/from the Central City, routing via Main North Rd and Papanui Rd has a frequency of 10 minutes in the peak hours and typically 15 minutes at other times during the day.

9.1.3 The Orbiter (illustrated above in green) has a frequency of 10 minutes during the day.

9.1.4 Route 28 (Papanui to Lyttelton and Rapaki) via the City, routing via Cranford Street, operates with a frequency of around 30 minutes for most of the day.

9.1.5 The above diagram illustrates that nearly all of the proposed urban zoning is within around a 6-minute walk (500m) from Route 28. The majority of the site is also within a 10-minute walk (800m) from the high-frequency Blue Line service (and the Orbiter).

9.1.6 Ideally, all dwellings would be within a 5 to 10 minute walk of a direct, high-frequency bus service such as the Blue Line. However, in practice, there is a trade-off between walking distance to a route and the frequency and directness of services that can be provided (afforded) in serving the whole city. There is little value in providing infrequent, meandering bus routes in order to meet targets of proportions of dwellings within close proximity to bus routes. We consider a better outcome is achieved by focusing public transport services on arterial routes, of a high frequency, and generally directly to/from the Central City. In this regard, the relatively small area of the site not within a 5 to 10 minute walk of a high-frequency service is considered an acceptable trade-off, particularly as this portion of the site is within 500m of a 30-minute frequency route on Cranford Street.

9.1.7 In order to take full advantage of the adjacent bus routes, it is essential that an Outline Development Plan (ODP) is prepared that includes excellent pedestrian connections between the proposed urban zoning and Main North Rd and Cranford Street. Whilst pedestrian linkages would undoubtedly be available via Grassmere Street, it appears that accessibility to Main North Rd via Meadow Street and Apollo Place (refer above diagram) may not be possible due to the nature of the development that has occurred at the south-eastern end of these cul-de-sacs. At very least, pedestrian linkages should be pursued between the proposed urban zoning and Shearer Avenue. Under any redevelopment of the holiday park at the end of Meadow Street that occurs under the proposed zoning, Council should also seek to provide pedestrian (and cycle) linkage between the proposed urban area and Meadow Street to maximise accessibility to the high-frequency public transport service on Main North Rd.

9.1.8 The smaller proposed urban area to the north of Cranford Street also has excellent opportunities for good access to high quality public transport, being within a 600m walk of the Route 28 service on Cranford Street and around 800m from the high-frequency Orbiter service.

9.1.9 Finally, we note that the Draft Regional Passenger Transport Plan (dRPTP) anticipates that some new routes may be introduced in the future to service new residential subdivisions. Given the proximity of the proposed urban rezoning area to routes 28, The Blue Line and the Orbiter, we would not anticipate any new routes specifically serving the area. It is quite possible that Ecan may look in future to increase the frequency of Service 28 on Cranford Street in response to greater demand from the proposed rezoned area. Whilst this is highly desirable, this is not considered essential given the proximity to existing high-frequency services for the majority of the area.

9.2 Cycling

9.2.1 The site is presently rural and as such no cycle facilities exist within the proposed urban zoning area. The following diagram, illustrates CCC's cycle routes as at 2012, in the vicinity of the site.

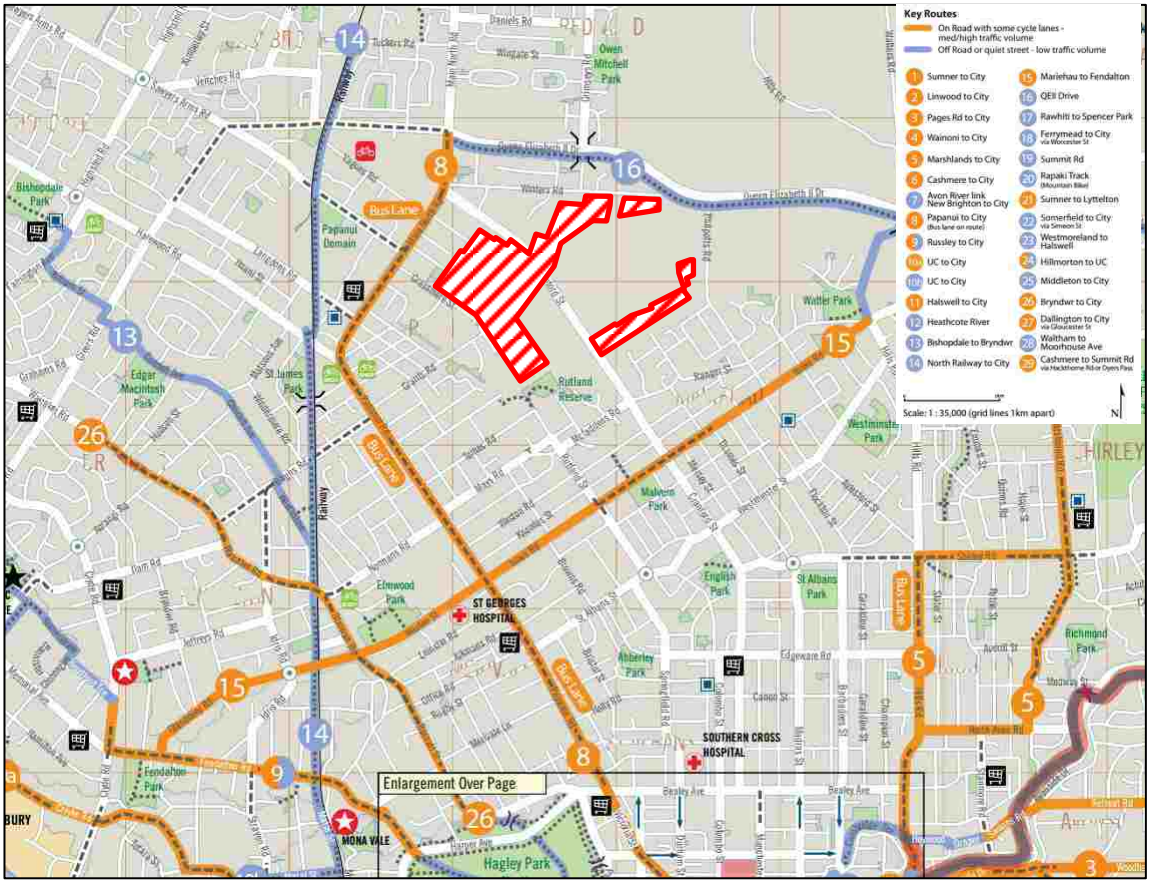

Figure 9.2: Existing (2012) Cycle Routes Network in Relation to Proposed Urban Zoning

9.2.2 The key existing facilities that would serve the site are:

- Papanui Rd / Main North Rd cycle lane shared with the bus lane;
- The North Railway to City off-road cycle path;
- The QEII Drive off-road cycle path; and
- The Innes Rd cycle lanes.

9.2.3 Council are currently planning, designing and implementing a network comprising 13 Major Cycle Routes (MCR). These are illustrated in the following diagram.

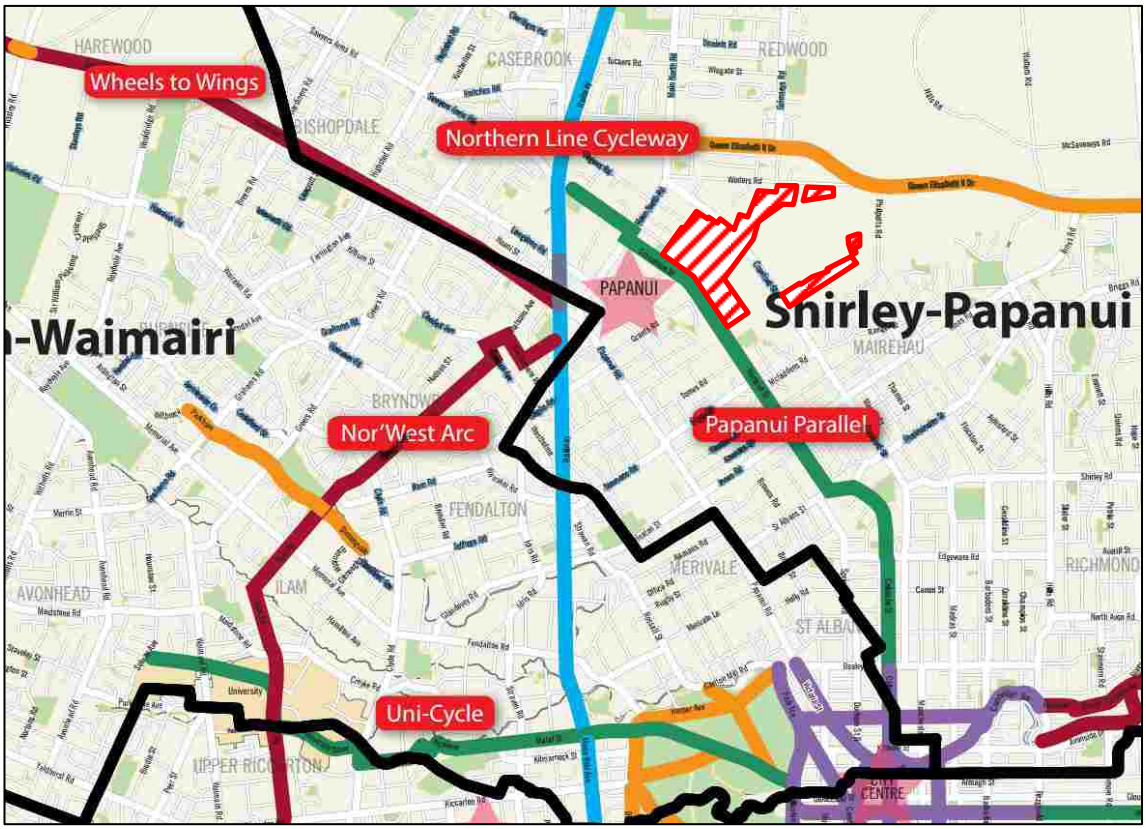

Figure 9.3: Major Cycle Routes Network in Relation to Proposed Urban Zoning

9.2.4 The Papanui Parallel route would provide highly convenient, direct access to the proposed urban zoning, connecting the site to the Central City. The Papanui Parallel is one of the first four routes to be built and Council's current programme is for this to be completed by 2017.

9.2.5 The Northern Line route would see an extension of the current north Railway route, north of Tuckers Rd and south to Blenheim Rd. Council have applied for funding for this project to be completed in the 2018/19 financial year.

9.2.6 We note that no cycle facilities exist or are planned on Cranford Street. It is therefore considered essential that a highly convenient crossing facility is provided of Cranford Street, connecting the northern and southern portions of the proposed urban zoning. Given the forecast traffic volumes on Cranford Street and the close proximity of such a crossing facility (connecting the northern and southern portions of the zoning) and the proximity to the proposed Cranford St / NAX intersection, our assessment at this high-level stage is that this should be grade-separated (an overpass or underpass).

9.2.7 The proposed Papanui Parallel MCR provides an excellent opportunity to provide good accessibility of the site to/from the surrounding residential areas to the south-east (and beyond) in the absence of a road connection. Naturally, the transport network for the site should be designed with frequent pedestrian and cycle access to this route and conversely minimise the number of vehicle conflicts with the route.

9.2.8 As noted above in relation to public transport accessibility, it is highly desirable that

improved cycle / pedestrian links are provided to the northwest of the site (e.g. Shearer Avenue and Meadow Street) in order to provide convenient access to Main North Rd with the employment, shopping and recreational trip opportunities that exist, particularly associated with Northlands Mall.

9.3 Walking

9.3.1 As illustrated within Figure 9.1 above, the site is well located for pedestrian access to Main North Rd to provide convenient access to a high-quality public transport corridor, but also for employment, shopping and other recreational purposes associated with Northlands Mall and the surrounding area.

9.3.2 As noted above under ‘Cycling’ the internal network should be designed to provide high-quality pedestrian linkages to the residential areas to the north-west and south-east of the site, the proposed Papanui Parallel to the south-west and the recommended pedestrian crossing of Cranford Street for access to/from the portion of the proposed urban zoning to the north of Cranford Street.

10 Wider Consideration of Transport Issue Affecting Landuse Choice

10.1 Chapter 8 has considered the effects of alternative land-uses on the operation of the surrounding road network, with Chapter 9 providing an assessment of the accessibility of the area in terms of public transport, cycling and walking. This Chapter briefly considers some of the wider transport-related issues and implications of the alternative land-uses assessed. For the sake of brevity, the issues and implications are bulleted for each land-use scenario.

10.2 Scenario 1: Low Density Residential 200 households

- Residential zoning is highly compatible with the existing surrounding residential land-uses in terms of traffic effects (minimal heavy vehicles and noise)
- Residential zoning is well located for local public transport, employment, shopping and recreational activities
- A relatively small number of households does not realise the full potential of the site for being serviced by, or having access to, high quality public transport or the MCRs
- In the longer-term, adverse traffic effects (congestion, emissions) for this location which is encompassed by existing urban areas are likely to be less than for residential development more remote from the Central City. More remote Greenfield Sites or locations within Selwyn or Waimakariri District will generally be less accessible to public transport and employment centres, resulting in a greater number of vehicle.kilometres travelled by private vehicles, with an associated economic, environmental and social cost.

10.3 Scenario 2: Low Density Residential 750 households

- Residential zoning is highly compatible with the existing surrounding residential land-uses in terms of traffic effects (minimal heavy vehicles and noise)
- Residential zoning is well located for local public transport, employment, shopping and recreational activities
- In the longer-term, adverse traffic effects (congestion, emissions) for this location which is encompassed by existing urban areas are likely to be less than for residential development more remote from the Central City. More remote Greenfield Sites or locations within Selwyn or Waimakariri District will generally be less accessible to public transport and employment centres, resulting in a greater number of vehicle.kilometres travelled by private vehicles, with an associated economic, environmental and social cost.

10.4 Scenario 3: Medium Density Residential 1500 households

- Residential zoning is highly compatible with the existing surrounding residential land-uses in terms of traffic effects (minimal heavy vehicles and noise)
- Residential zoning is well located for local public transport, employment, shopping and recreational activities
- A relatively large number of households realises the full potential of the site for being serviced by, or having access to, high quality public transport or the MCRs,

thereby gaining full advantage of investment in cycle and public transport services.

- In the longer-term, adverse traffic effects (congestion, emissions) for this location which is encompassed by existing urban areas are likely to be less than for residential development more remote from the Central City. More remote Greenfield Sites or locations within Selwyn or Waimakariri District will generally be less accessible to public transport and employment centres, resulting in a greater number of vehicle.kilometres travelled by private vehicles, with an associated economic, environmental and social cost.

10.5 Scenario 4: General Industrial + Low Density Residential

- Industrial zoning is not compatible with the existing surrounding residential land-uses in terms of traffic effects (Heavy vehicles and noise)
- Industrial zoning does provide further employment opportunities within close proximity to residential areas, maximising opportunities for walking and cycling
- However, analysis of employment capacity for land already zone for employment purposes in the Greater Christchurch area suggests that ample Greenfield Land has already been zoned, such that by 2041, Greenfield employment areas would only be at around 30% of their employment capacity.[2] An over-supply of land zoned for employment makes it difficult to effectively plan and manage the transport network due to the uncertainty regarding where development will actually occur. At the Greater Christchurch level, it does not provide a cost-effective basis for providing transport infrastructure (road upgrades, cycling, walking and public transport provision) with a dispersed pattern of trip making.
- Industrial zoning is well located for access by public transport services and proposed / existing cycling infrastructure
- In the longer-term, adverse traffic effects (congestion, emissions) for this location which is encompassed by existing urban areas are likely to be less than for industrial development more remote from the Central City. More remote Greenfield Sites or locations within Selwyn or Waimakariri District will generally be less accessible to public transport, cycling infrastructure and walking opportunities from surrounding residential areas, resulting in a greater number of vehicle.kilometres travelled by private vehicles, with an associated economic, environmental and social cost.

10.6 Scenario 5: Commercial + Low Density Residential

- The transport network associated with partial commercial zoning would need to be carefully managed to avoid adverse traffic effects on the remainder of the proposed residential zoning and surrounding existing residential community.
- Commercial zoning does provide further employment and shopping opportunities within close proximity to residential areas, maximising opportunities for walking and cycling

[2] Source: CAST Integration with CTM: Derivation of Landuse Inputs, May 2012. Table 8-6 and Figure 8-12.

- Commercial zoning is well located for access by public transport services and proposed / existing cycling infrastructure
- Similar to the concerns provided above regarding the over-supply of land for employment purposes, we are concerned that this argument could also apply to commercial premises. We have not, however, been involved in the assessment of the capacity of land supply specifically for commercial purposes. Due to the potential agglomeration benefits of the location of appropriate business types together in a central location, such as the Central City, from a sustainable transport perspective, it is recommended that consideration be given to adopting Plan Change rules to limit the degree of office-related development at this urban fringe location, which is considered to be better suited to residential activities.

11 Summary and Conclusions

11.1 This Memo sets out the rationale in developing a draft transport network for the proposed Cranford Basin urban zoning, the likely effects on the traffic network of five alternative land-use assumptions and a high-level assessment of the area in terms of public transport, cycling and walking. Due to the time constraints for this assessment, it does not constitute a full Integrated Transport Assessment and there are some limitations in the modelling methodologies applied.

11.2 An initial road network was identified that provided direct linkage via a Collector Rd between the portions of the proposed urban zoning either side of Cranford Street. Initial modelling and further consideration of the implications of the new intersection proposed at the Cranford Street / Northern Arterial Extension would suggest that this direct general-traffic linkage, via a four-way intersection, is not workable on safety and efficiency grounds.

11.3 Accordingly, a second road network has been developed, effectively with staggered T-intersections on Cranford Street serving the northern and southern portions of the proposed urban rezoning. This has formed the basis of the main 'effects'-based assessment of the five alternative land-use scenarios modelled and reported here.

11.4 The five alternative land-use scenarios assessed are summarised as follows:

1) 200 low-density households
2) 750 low-density households
3) 1500 medium-density households
4) The southern portion as Industrial (the smaller northern portion as low density residential)
5) Part of the southern portion as 30,000m^2 GFA Commercial (Large Format Retail assumed), the remainder of the southern portion and the northern portion as low density residential)

11.5 Traffic modelling has been conducted using Council's CAST traffic model for the horizon years of 2021 (pre-Northern Arterial and Extension) and 2031 (with Northern Arterial and Extension) for the AM and PM peak hours.

11.5.1 At 2021, for Scenario 1 (200 hh), there are measurable impacts at a number of locations on the surrounding road network for which no simple mitigation measures have been identified. Because these locations are already operating at LoS E or F in the base model, these impacts are considered potentially significant, particularly as there are safety consequences of large delays on give-way approaches to intersections. It is somewhat subjective as to whether the scale of impacts is considered minor, or more than minor. At this stage, our recommendation would be not to allow for zoning that could exacerbate existing efficiency and associated safety issues on the road network at 2021 without either mitigating these effects or undertaking more detailed analysis to confirm these initial findings.

11.5.2 At 2021, for Scenario 2 (750hh), the scale of the impacts at a number of locations on the local road network is considered significant (more than minor). Scenarios 2 to 5 all have a large traffic generation potential and it is recommended that in the absence of more detailed analysis that zoning rules are implemented that constrain the amount of development that could occur prior to the Northern Arterial (NA) and Extension (NAX) being implemented.

11.5.3 At 2031, the locations of significant delay increases for Scenarios 1 and 2 do not occur due to the relief to these bottlenecks brought by the NA & NAX. The modelling would suggest that the effects of Scenarios 1 and 2 on the surrounding road network are minor.

11.6 At 2031, the traffic effects for Scenario 3 (1500 hh) are also generally minor. The modelling does however indicate some potentially significant increases in delays and border-line performance of some minor road approached to Papanui Rd.

11.7 For Scenario 4 (with industrial zoning south of Cranford Street) projected traffic volume increases on Grants Rd are large at up to 7,000 vpd. Whilst modelled network impacts are generally minor, the modelling does suggest that some form of local area traffic management and intersection upgrades would be required to mitigate potential impacts on the minor road approaches to Papanui Rd (e.g. Wyndham St, Dormer St and Perry St).

11.8 Scenario 5 (some commercial zoning south of Cranford Street) has projected traffic volume increases on Grants Rd of up to 6,000 vpd at 2031. As with Scenario 4, the modelling does suggest that some form of local area traffic management and intersection upgrades would be required to mitigate potential impacts on the minor road approaches to Papanui Rd (Wyndham St, Dormer St and Perry St). The main access to the commercial / residential development on the south side of Cranford Street was assumed to be a roundabout in all options. This roundabout works in tandem with the assumed Left-In, Left-Out intersection serving the northern portion of the proposed urban zoning by accommodating U-turning movements. Under Scenario 5, the assumed two-circulating roundabout is at LoS F on the Collector Rd approach in the PM peak hour. An alternative configuration assuming a large signalised intersection indicates satisfactory performance but may not accommodate U-turners satisfactorily.

11.9 Assessment of the site in terms of public transport, cycling and walking accessibility indicates that it is well located to take advantage of existing and proposed investment in high quality Public Transport (PT) services and cycling infrastructure. Further development of an ODP should include extensive cycling and walking linkages to capitalise on the high quality PT and cycling routes and to provide good accessibility to the neighbouring residential areas to the north-west and south-east of the site where accessibility by road corridors is otherwise poor.

11.9.1 We note that no cycle facilities exist or are planned on Cranford Street. It is therefore considered essential that a highly convenient crossing facility is provided of Cranford Street, connecting the northern and southern portions of the proposed urban zoning.

Given the forecast traffic volumes on Cranford Street and the close proximity of such a crossing facility (connecting the northern and southern portions of the zoning) and the proximity to the proposed Cranford St / NAX intersection, our assessment at this high-level stage is that this should be grade-separated (an overpass or underpass).

11.9.2 Our overall assessment of the transport implications of alternative land-use scenarios is that a high number of residential households (Scenario 3) would be the preferable use of the proposed urban zoning. Residential zoning is highly compatible with the existing surrounding residential land-uses in terms of traffic effects (minimal heavy vehicles and noise compared to industrial and commercial uses).

11.9.3 Residential zoning is well located for local public transport, employment, shopping and recreational activities. A relatively large number of households realises the full potential of the site for being serviced by, or having access to, high quality public transport or the Major Cycle Routes, thereby gaining full advantage of investment in cycle infrastructure and public transport services.

11.9.4 In the longer-term, adverse traffic effects (congestion, emissions) for this location which is encompassed by existing urban areas are likely to be less than for residential development more remote from the Central City. More remote Greenfield Sites or locations within Selwyn or Waimakariri District will generally be less accessible to public transport and employment centres, resulting in a greater number of vehicle.kilometres travelled by private vehicles, with an associated economic, environmental and social cost.

11.9.5 An over-supply of land zoned for employment (as implied by analysis previously conducted by QTP in the preparation of landuse inputs for the regional CTM transport model) makes it difficult to effectively plan and manage the transport network due to the uncertainty regarding where development will actually occur. At the Greater Christchurch level, it does not provide a cost-effective basis for providing transport infrastructure (road upgrades, cycling, walking and public transport provision) with a dispersed pattern of trip making.

Appendix B - Cranford Basin Submissions Transport Modelling and Access review Memorandum – 1 December 2015

QTP
Quality Transport Planning

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PO Box 106 • Christchurch 8140 • New Zealand
Phone (+64) 03 379 2489

Memorandum

To:	Ivan Thomson
From:	Tim Wright
Subject:	Cranford Basin Submissions Transport Modelling and Access Review
Date:	Tuesday 1st December 2015
Copy:	

Dear Ivan,

Thank you for asking QTP to undertake further traffic modelling in relation to submissions received on the proposed zoning of the Cranford Basin area within the proposed Replacement District Plan (pRDP).

At your request, QTP prepared an initial transport assessment required as an input to the Section 32 (of the RMA) Evaluation of the proposed rezoning. This was reported in the QTP Memorandum dated 2nd April 2015. The assessment included extensive traffic modelling of a number of alternative land-use scenarios, including varying residential densities, commercial and industrial uses.

The supplementary modelling that you recently requested is to better reflect the submissions received that propose Residential Suburban for parts of the Cranford Basin area, as opposed to the Rural Urban Fringe zoning indicated in the pRDP Stage 3 Planning Maps.

Accordingly this Memorandum summarises the assumptions and results of the supplementary modelling. It does not repeat the detail of the modelling methodology presented in the April Memorandum, nor does it repeat the results of the modelling or the other matters discussed with regard to public transport provision, walking and cycling and the wider consideration of transport issues affecting landuse choice.

1 Scope of Assessment

1.1 Council have specified the Scope of the assessment as follows:

1) What are the effects on the local road network under the following rezoning assumptions ?
   i. The Grassmere Street area (approximately 33ha) zoned for Residential Suburban; and
   ii. The Case and Crozier submission areas (approximately 4.6ha in total) zoned for Residential Suburban (approximately 60 households); and
   iii. The road network for the Grassmere Street area reflects that of the draft Outline Development Plan (ODP) supplied by Council; and
   iv. Unlike the earlier modelling, no rezoning (from Rural) is to be assumed at the northern extent of the area indicated within the draft ODP supplied.

1.2 The draft ODP supplied, annotated in relation to the submissions received and the assumptions adopted for the traffic modelling, is illustrated within the following diagram.

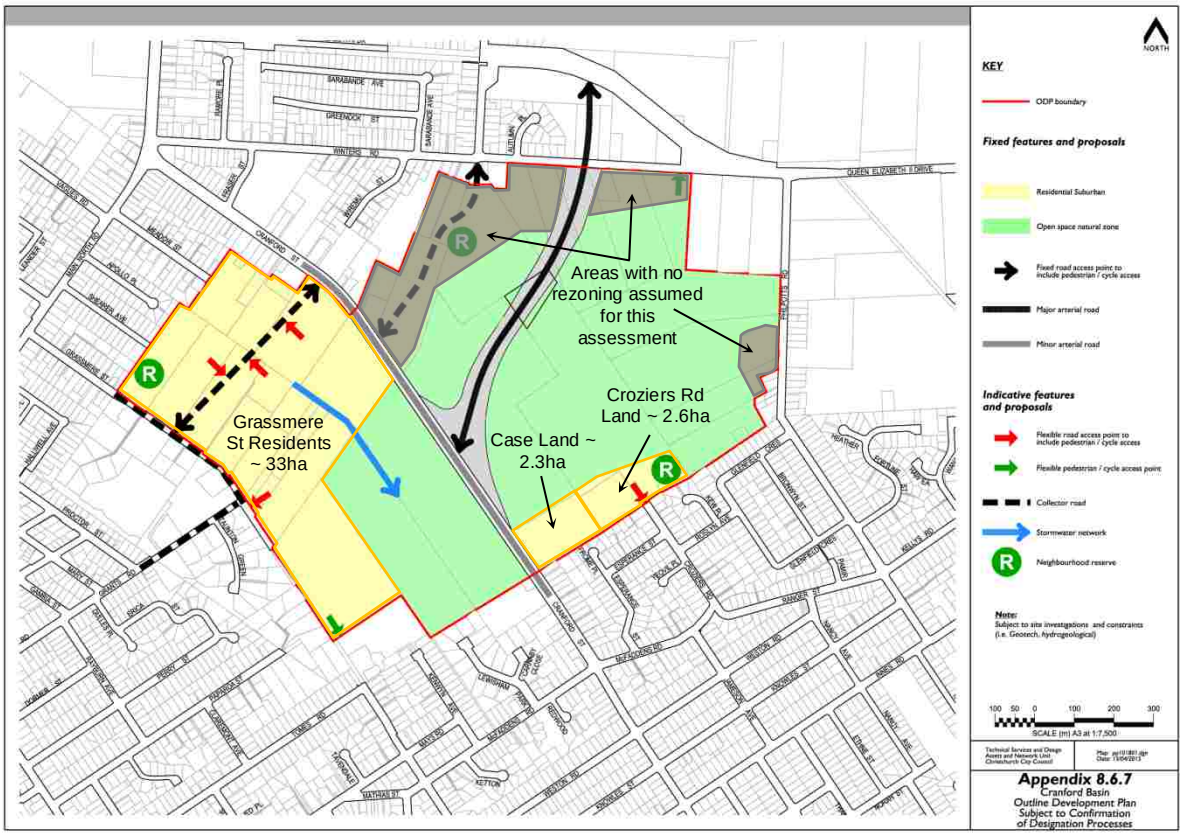

Figure 1.1: Draft Cranford Basin ODP Provided

1.3 Note that the draft ODP above generally reflects the road network developed for the Section 32 modelling in the Grassmere Street area, but that no Collector Road (or development) is assumed at the northern extent of the indicated ODP boundary. The road network adopted in this supplementary modelling has been modified accordingly.

1.4 In common with the modelling previously conducted, the proposed Cranford Street intersection serving the larger (southern) portion of the proposed rezoning is assumed to be a two-lane roundabout. Previous testing of a single-lane roundabout indicated insufficient capacity for the lowest traffic generation scenario. Further modelling would be required to assess the effects of alternative intersection forms at this location (signals or a give-way intersection).

2 Methodology

2.1 Refer to the April Memorandum for a description of the modelling methodology adopted. In summary, analysis has been conducted using Council's Christchurch Assignment and Simulation Traffic model (CAST). CAST includes all local roads with any significant through-traffic function. It allows all trips to re-route to their optimal route under the modelled traffic conditions for a particular scenario (the assumed road network and travel demands). In this regard is considerably more sophisticated than traditional techniques applied in undertaking Integrated Transport Assessments (ITAs)

where trip distribution is estimated and new trips are simply superimposed on the base situation. Such analysis does not allow for the reassignment of traffic across the network and is often limited in scope (network coverage). Conversely, the CAST model represents the whole of Christchurch city in 'simulation' level of detail, allowing the wider effects of the re-zoning to be identified.

3 Traffic Demands

3.1 In terms of modelling anticipated traffic demands to/from the submissions areas, the adjacent Case land and Croziers Road areas have been considered together[1] (totalling 4.8ha). The following table summarises the number of households adopted for the assessment of the wider network traffic effects of the submissions, based on an assumed density of 15hh/ha. An allowance of 15% of the gross site area has been assumed for roading, stormwater and reserves. CCC have advised that in practice, net developable areas maybe somewhat less than this due to the characteristics of the Cranford Basin area. However, the adoption of higher household yields, as summarised below, should provide a robust basis of assessment.

Site	Area (ha) Gross	Area (ha) Net	HH yield	HH Adopted
Grassmere	33.4	28.4	426	425
Case/Crozier	4.8	4.1	62	60
Total				**485**

Table 3.1: Development Assumptions

3.2 The following table summarises the trip rates adopted for this assessment, being the 6th landuse scenario tested. For the purpose of comparison, the trip rate table and resulting traffic generation within the subsequent table retain the assumptions for the five landuse scenarios previously assessed (as reported within the April Memorandum).

Landuse Scenario	No.	Unit	Type	AM		PM		AM	PM
				From	To	From	To	2-Way	2-Way
1	200	hh	L1B Low Density Res.	0.76	0.31	0.46	0.72	1.07	1.18
2	750	hh	L1 Low Density Res.	0.76	0.31	0.46	0.72	1.07	1.18
3	1,500	hh	L3 Med Density Res.	0.44	0.18	0.31	0.49	0.62	0.80
4	3,340	100m^2 site area	General Industrial	0.09	0.21	0.20	0.10	0.30	0.30
5	30,000	100m^2 GFA	Commercial (LFR)	0.59	0.76	2.02	0.98	1.35	3.00
6	485	hh	Residential Suburban	0.76	0.31	0.46	0.72	1.07	1.18

Table 3.2: Adopted Trip Rates for Traffic Generation

3.3 The above trip rates translate to the following peak hour traffic generation:

[1] The likely housing yield of the Case land and Croziers Road sites are relatively small compared to the Grassmere Street site. The purpose of the CAST traffic modelling is to assess the scale of effects on the wider road network. Whilst the Case and Croziers sites could have different access arrangements, this makes little difference to the assessment of wider network traffic impacts. Issues relating to access to each of the sites are discussed in section 0.

Landuse Scenario	No.	Unit	Type	AM		PM		AM	PM
				From	To	From	To	2-Way	2-Way
1	200	hh	L1B Low Density Res.	152	62	92	144	214	236
2	750	hh	L1 Low Density Res.	570	233	345	540	803	885
3	1,500	hh	L3 Med Density Res.	660	270	465	735	930	1,200
4	33	$100m^2$ site area	Industrial + Res.	521	785	791	546	1,306	1,337
5	8	$100m^2$ GFA	Commercial + Res.	634	415	883	728	1,049	1,610
6	485	hh	Residential Suburban	369	150	223	349	519	572

Table 3.3: Traffic Generation

4 Modelled Effects of Submissions

4.1 Introduction

4.1.1 The modelling reported here is for a single demand scenario, assuming all three submissions areas are developed.

4.1.2 Modelling has been conducted for both the AM and PM peak hours, both at 2021 and 2031. Various graphical outputs have been extracted from the model for each model run both for the purpose of checking the sensibility of outputs and to inform the assessment of effects.

4.1.3 Selected model outputs have been chosen to illustrate the results of the assessment and a summary chapter provided at the end of this Memo.

4.2 Base Traffic Models (the Receiving Environment)

4.2.1 This Memo is focused on summarising the potential effects of the proposed rezoning. However, given the proposed significant changes to the road network in the vicinity of the site, it is useful to first understand how traffic patterns may change in the future, irrespective of the proposed Cranford Basin rezoning. Modelling has been undertaken for the following appraisal years with the following changes to the road network noted:

- 2021 **without** Northern Arterial (NA) or Extension (NAE) or Cranford Street Upgrade (CSU)
- 2031 with the NA, NAE and CSU assumed to be in place.

4.2.2 The following diagrams provide an indication of modelled daily traffic volumes[2] in 2021 and 2031, with the third diagram illustrating the changes between the two scenarios (green bands indicating reductions and red bands increases, with the **width** of the bands (not the length) proportional to the traffic volumes illustrated in each diagram).

[2] Estimated from CAST AM and PM peak hour modelling

Figure 4.1: Modelled Daily Traffic Volumes 2021 (no Northern Arterial and Extension)

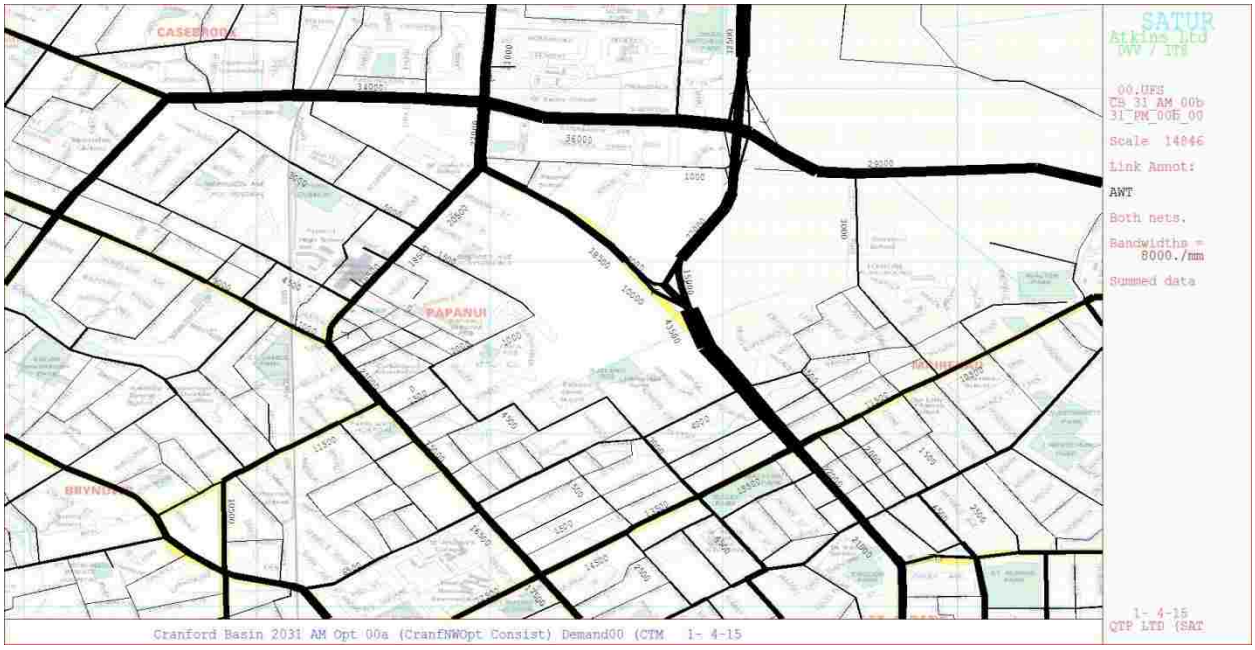

Figure 4.2: Modelled Daily Traffic Volumes 2031 (with Northern Arterial and Extension)

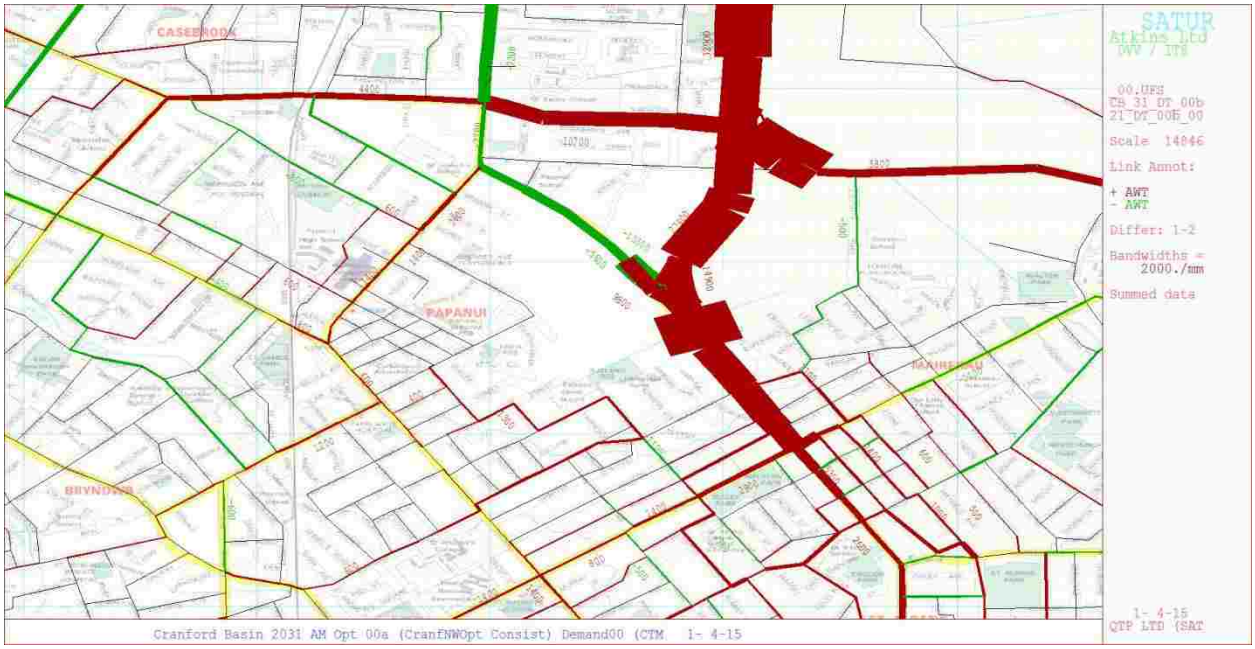

Figure 4.3: Modelled Change in Daily Traffic Volumes 2031 vs. 2021

4.2.3 The above diagrams illustrate:

- Significant increases in traffic volumes on Cranford Street to the south of the proposed roundabout at the intersection of the Northern Arterial Extension (NAX) and Cranford Street (an increase of 19,000 vpd and reducing as progressing southbound along Cranford Street);
- Reductions in traffic volumes on Cranford Street to the north of the NAX roundabout of around 6,000 vpd;
- Small increases on Main North Road south of Cranford Street (around 2,000 vpd); and
- No significant change in traffic volumes on Papanui Road.

4.2.4 In order to provide some context to the assessment of effects, the following diagrams illustrate the modelled delays and CAST Level of Service (LoS) on the road network for the generic 2021 and 2031 CAST models for the AM and PM peak hours (without the effects of the proposed rezoning). The delays are at the intersection approach level and are colour-coded as follows:

- LOS A to C (green bands) = 0 to 30 seconds delay
- LOS D (orange bands) = 30-50 seconds delay
- LOS E (red bands) = 50-70 seconds
- LOS F (black bands) > 70 seconds

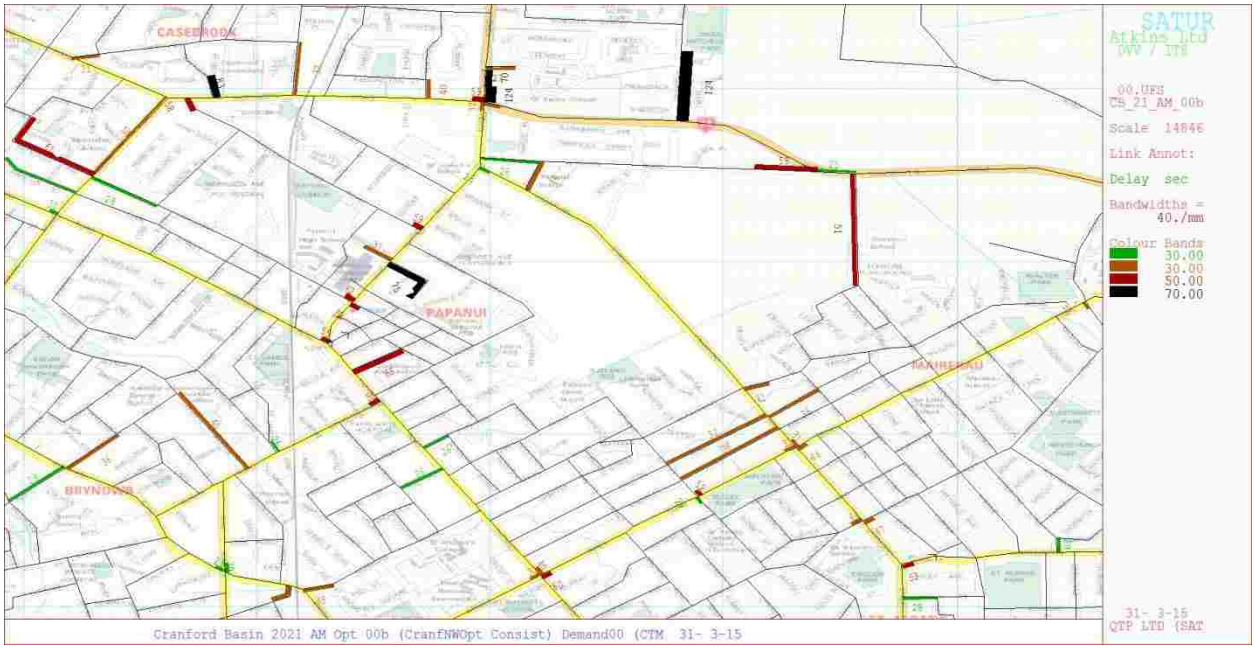

Figure 4.4: Link Delays and LoS, Base Model, 2021 AM Peak Hour

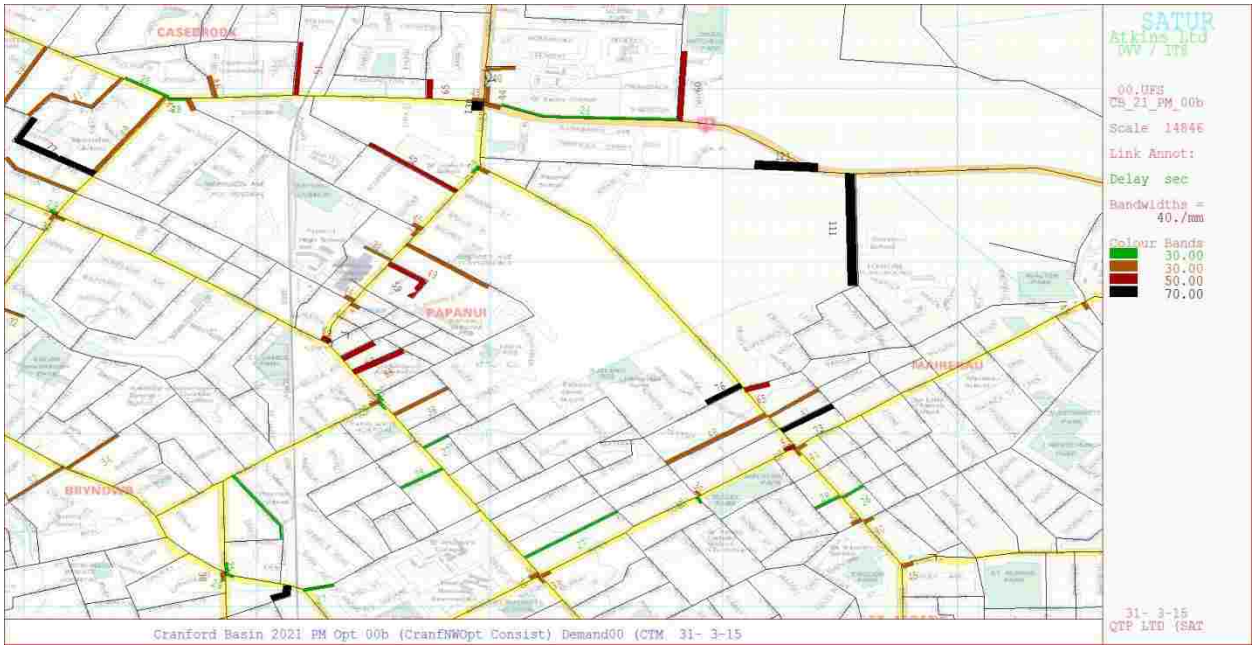

Figure 4.5: Link Delays and LoS, Base Model, 2021 PM Peak Hour

Figure 4.6: Link Delays and LoS, Base Model, 2031 AM Peak Hour

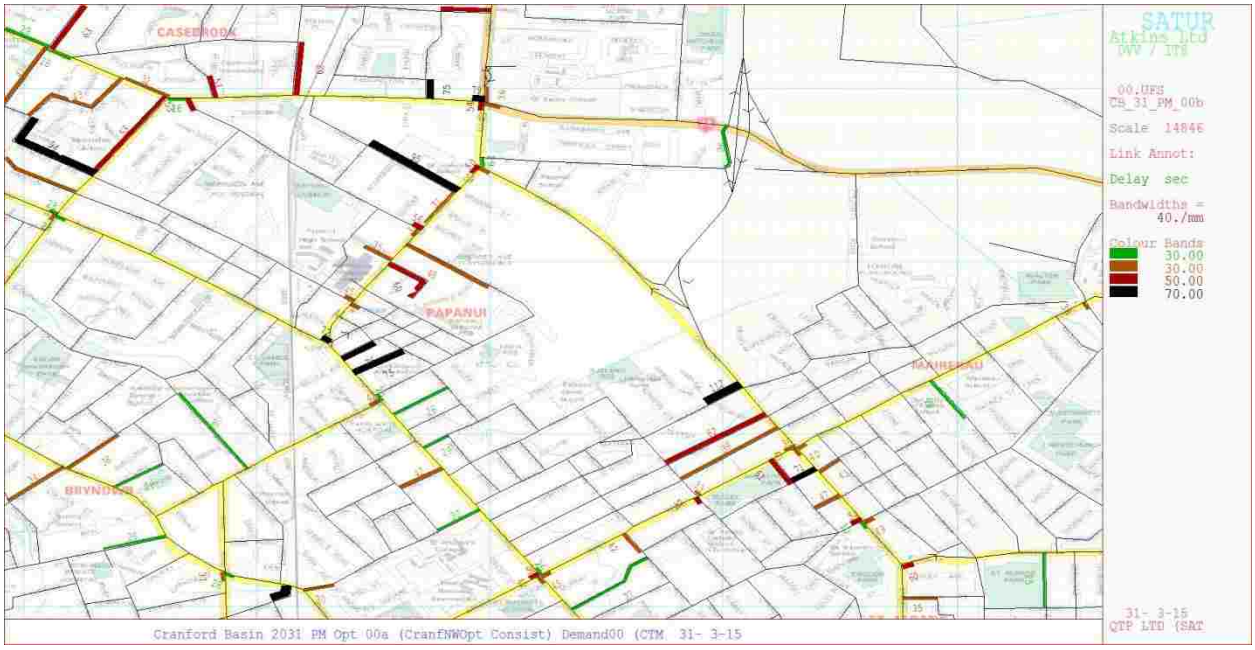

Figure 4.7: Link Delays and LoS, Base Model, 2031 PM Peak Hour

4.2.5 The following points are noted:

- A number of minor road approaches to Main North Road and Papanui Road have high delays with LoS E or F illustrated in both 2021 and 2031
- At 2031, with the NAX assumed to be in place, delays on the McFaddens Road and Weston Road approaches increase and are at LoS F and E respectively.

4.3 Effects of Submissions at 2021 (Without NA, NAE and CSU)

4.3.1 The following diagram illustrates the changes in modelled daily traffic volumes with the addition of traffic attributed to the submissions land. Volumes are two-way, with volume changes lower than 400 vehicles per day (vpd) not illustrated.

Figure 4.8: Changes in Daily Traffic Volumes (Two-Way) with Submission Areas, 2021

4.3.2 The above diagram illustrates how traffic from the Grassmere Street area disperses across the three access routes proposed (Cranford Street via a new link road, Main North Road via Grassmere Street and Papanui Road via Grants Road). The greatest proportion of trips (around 5,000 vpd) access the road network at Cranford Street and just under 1,000 vpd at Main North Road. Around 2,500vpd route via Grants Road to the southeast, with these traffic volumes dissipating across a number of streets in gaining access to Papanui Road.

4.3.3 The following diagrams illustrate the modelled changes in peak hour traffic volumes in 2021. Volumes are illustrated on a directional basis, with volume changes lower than 40 vehicles per hour (vph) not illustrated.

Figure 4.9: Changes in AM Peak Hour Traffic Volumes (Directional) with Submission Areas, 2021

Figure 4.10: Changes in PM Peak Hour Traffic Volumes (Directional) with Submission Areas, 2021

4.3.4 The following diagrams illustrate the resulting changes in delays as a consequence of the addition of traffic attributed to the submissions areas in the AM and PM peak hours at 2021.

Figure 4.11: Changes in Delays due to Submission Areas, AM Peak, 2021

Figure 4.12: Changes in Delays due to Submission Areas, PM Peak, 2021

4.3.5 At 2021, the impacts are generally modest. Note that there are modest reductions in delays relative to the base model on some minor-arm approaches to Main North Road. This is because the assumed new intersection on Cranford Street provides some relief to delays faced by traffic from the surrounding residential area in accessing the surrounding arterial roads. Conversely, some increase in delay is modelled on the Dormer Street and Perry Street approaches to Papanui Road (up to 20 seconds).

4.3.6 There are however some locations of notable increases in delays:

- Grimseys Road southbound (approximately 20 seconds), AM Peak Hour
- Philpotts Road northbound to QEII Drv (approximately 35 seconds), PM Peak Hour

- Knowles Street southwestbound to Cranford Street (approximately 20 seconds), PM Peak Hour

4.3.7 Because these locations are already operating at LoS E or F in the base model, these impacts are considered potentially significant, particularly as there are safety consequences of large delays on give-way approaches to intersections.

4.3.8 It is somewhat subjective as to whether such a scale of impacts is considered minor, or more than minor. At this stage, my recommendation would be not to allow for zoning that could exacerbate existing efficiency and associated safety issues on the road network at 2021 without some form of mitigation and undertaking further analysis to confirm the effectiveness of any such mitigation.

4.3.9 The following plots illustrate the modelled delays and LoS with the submissions, confirming that the above listed locations of significant delay impact are operating with poor performance at 2021.

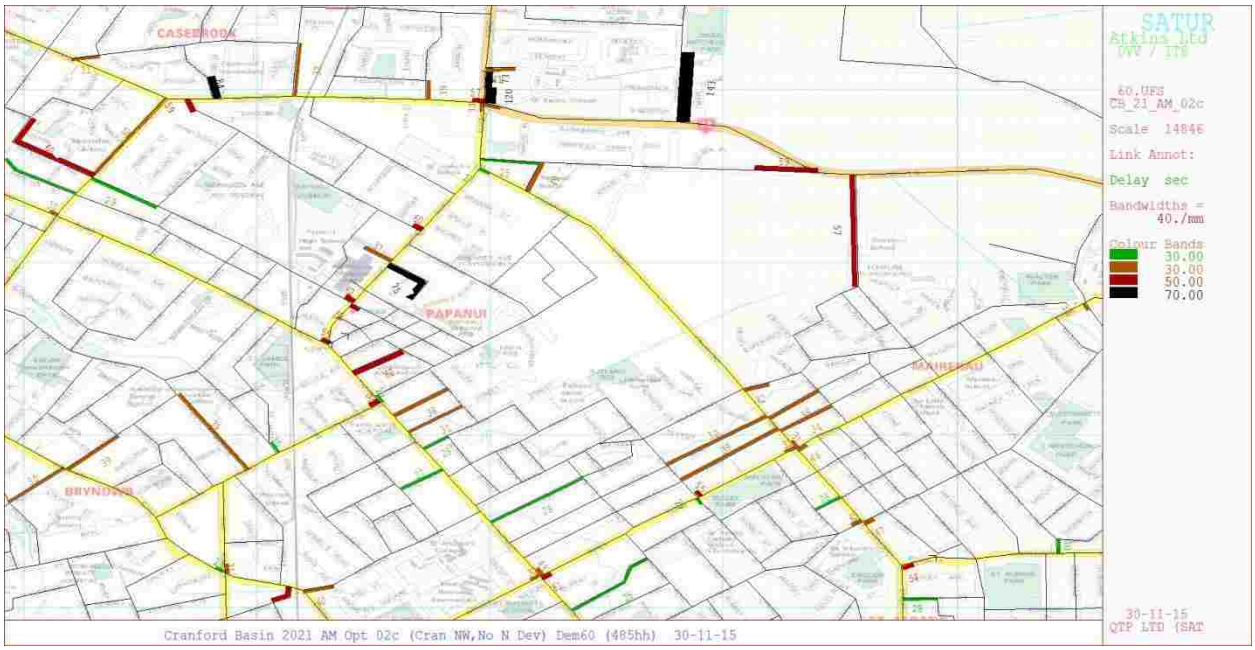

Figure 4.13: Link Delays and LoS, With Submission Areas, 2021 AM Peak Hour

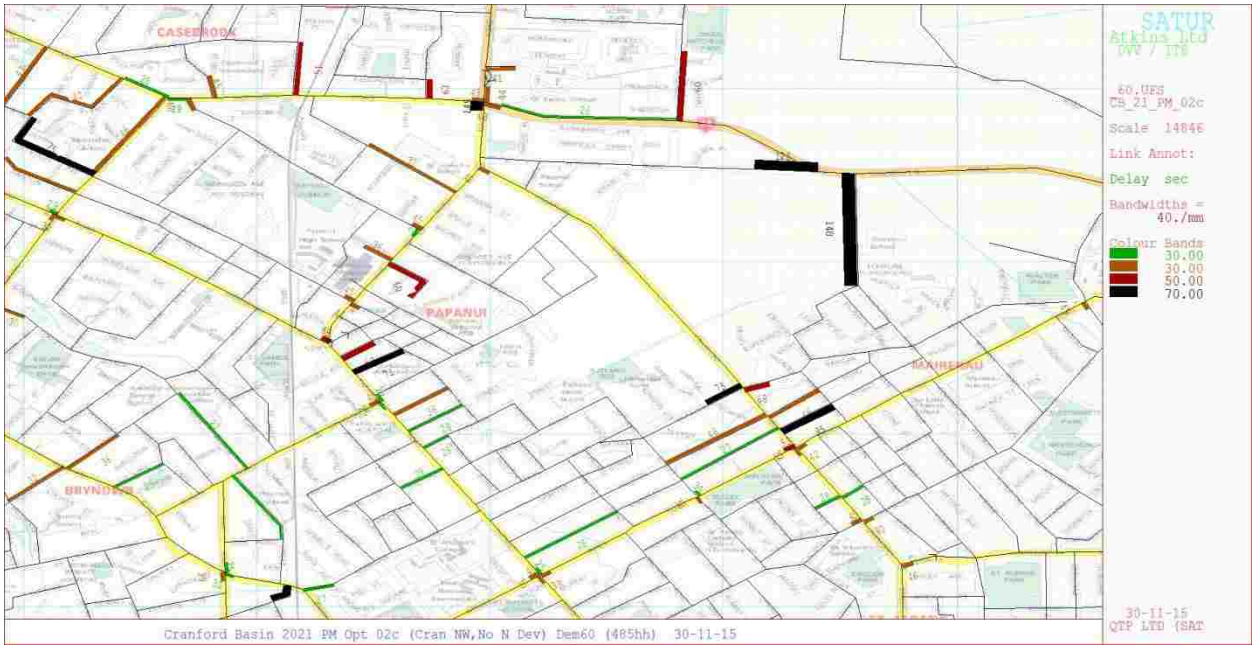

Figure 4.14: Link Delays and LoS, With Submission Areas, 2021 PM Peak Hour

4.4 Effects of Submissions at 2031 (With NA, NAE and CSU)

4.4.1 The following diagram illustrates the changes in modelled daily traffic volumes with the addition of traffic attributed to the submissions land and the proposed access strategy. Volumes are two-way, with volumes lower than 400 vehicles per day (vpd) not illustrated.

Figure 4.15: Changes in Daily Traffic Volumes (Two-Way) with Submissions Areas, 2031

4.4.2 The above diagram illustrates how traffic from the Grassmere area disperses across the three access routes proposed (Cranford Street via a new Collector road, Main North Road via Grassmere Street and Papanui Road via Grants Road). Unlike the 2021 analysis, the NAE is assumed to be in place. This results in some traffic from the

surrounding residential area of Papanui routing via the proposed Collector road to/from the NAE, as opposed to routing around the periphery of the residential area on Main North Road and Cranford Street.

4.4.3 The net changes in traffic volumes on the key roads providing access to the Grassmere Street submission area are:

- Around 8,000 vpd on the new Collector road to/from Cranford Street
- Up to around 5,000 vpd on Grants Road (but less than 1,000 vpd south of Rayburn Avenue)
- Around 1,500 vpd on Grassmere Street to/from Main North Road

4.4.4 The following diagrams illustrate the modelled changes in peak hour traffic volumes in 2031. Volumes are illustrated on a directional basis, with volume changes lower than 40 vehicles per hour (vph) not illustrated.

Figure 4.16: Changes in AM Peak Hour Traffic Volumes (Directional) with Submissions Areas, 2031

Figure 4.17: Changes in PM Peak Hour Traffic Volumes (Directional) with Submissions Areas, 2031

4.4.5 The above plots indicate generally higher changes in peak traffic volumes on the roads providing access to the Grassmere Street submission area than in 2021. For the purposes of this assessment, 'full' development of the submissions areas is assumed in both years. The higher differences in traffic volumes in 2031 are attributable to trips being made from the surrounding residential areas via the new Collector road providing access to Cranford Street and on to the NAE.

4.4.6 The following diagrams show the result of Selected Link Analysis (or SLA) which shows the modelled routes of all traffic predicted to use the proposed Collector road, just south of Cranford Street.

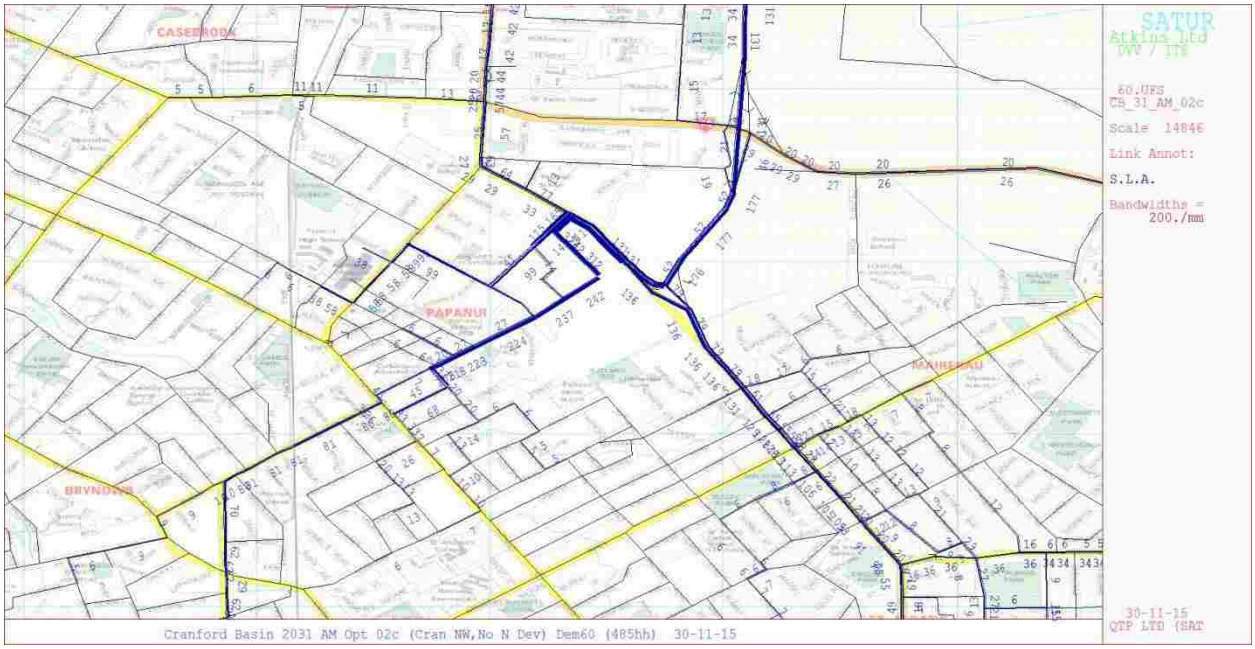

Figure 4.18: SLA Showing the Route of All Traffic Using the Proposed Collector Rd, South of Cranford Street, 2031 AM Peak Hour

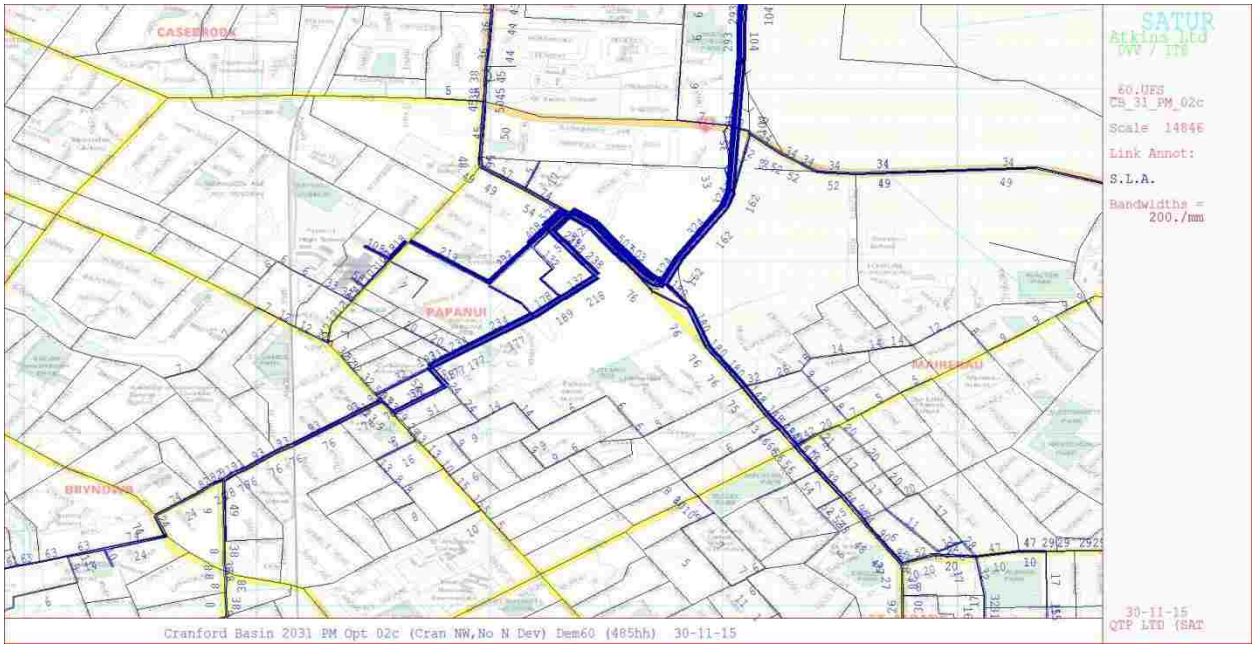

Figure 4.19: SLA Showing the Route of All Traffic Using the Proposed Collector Rd, South of Cranford Street, 2031 PM Peak Hour

4.4.7 The above plots show that the proposed Collector road does attract a significant proportion of traffic from beyond the local area bound by Papanui Road, Main North Road, Cranford Street and Innes Road. For example, in the PM peak hour, of nearly 600 vph northeastbound on the proposed road approaching Cranford Street, around 200 are from locations to the west of Main North Road (via Grassmere Street) and a similar number are from locations to the west of Papanui Road, via Grants Road.

4.4.8 In practice, the actual volume of traffic that would use the proposed Collector road would depend to some degree on its design in terms of the speed environment and the

location and nature of its intersections with Grassmere Street and Cranford Street.

4.4.9 The following diagrams illustrate the resulting changes in delays as a consequence of the changes in traffic volumes attributed to the rezoning sought by the submissions in the AM and PM peak hours at 2031.

Figure 4.20: Changes in Delays due to Submission Areas, AM Peak, 2031

Figure 4.21: Changes in Delays due to Submission Areas, PM Peak, 2031

4.4.10 At 2031, the locations of potentially significant delay **increase** at 2021 as summarised above in 4.3.6 do not occur due to the relief to these bottlenecks brought by the NA & NAX.

4.4.11 Generally the effects on the road network are modest, and on balance slightly adverse

in the morning peak hour (with more traffic from residential side-roads) but with generally positive benefits in the PM peak hour due to the relief provided to other routes as a consequence of the proposed Collector providing access via Cranford Street.

4.4.12 Whilst there are some locations of increased delay in the AM peak hour for traffic approaching Papanui Road, these are at locations where delays are modest, such that the resulting LoS is D or better, as illustrated within the following diagrams.

Figure 4.22: Link Delays and LoS, With Submissions, 2031 AM Peak Hour

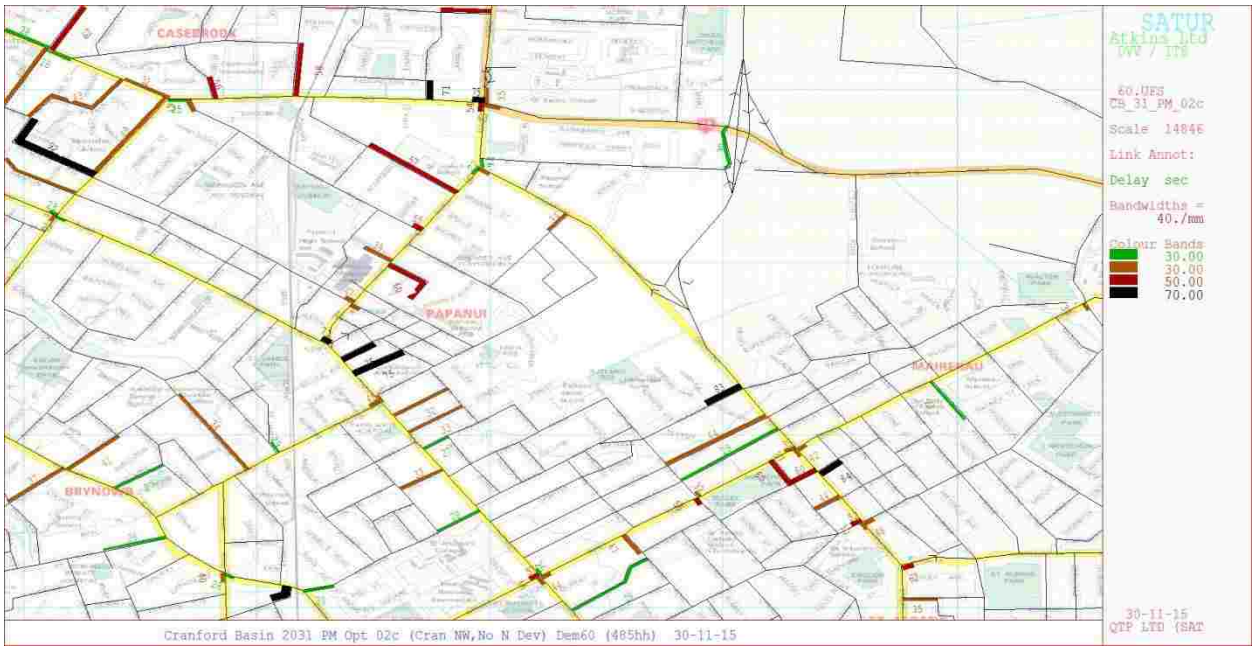

Figure 4.23: Link Delays and LoS, With Submissions, 2031 PM Peak Hour

5 Site Access

5.1 Submission 646: Grassmere Street Area

5.1.1 For the Grassmere Street submission area there are relatively few constraints in considering how access to the dwellings within the submission area itself could be provided. The proposed Collector Roads and indicative Local road locations allow the hierarchical approach to transport planning, as described within the pRDP, to be adhered to. The Local roads will provide for access to each property, with the proposed Collector Roads providing a balance in function between access to properties and their distribution function in connecting with the Arterial road network. In this way, access to the surrounding Arterial road network is managed, the adverse effects of access are minimised, allowing the Arterials to fulfil their function in moving larger volumes of traffic around the city in a safe and efficient manner.

5.2 Submission 324: Croziers Road

5.2.1 Submission 646 for land accessed from Croziers Road has no major constraints that affect the ability of the site to be accessed in a safe and efficient manner. One significant issue with the indicative site layout provided within the submission is that there is only a single point of access to the proposed subdivision comprising 30 households. In terms of accessibility, it would be preferable to provide a pedestrian/cycle linkage to the adjacent Case site also proposed for rezoning to Residential Suburban.

5.2.2 It would also be preferable to have a second point of access for general traffic, reducing route vulnerability and providing a second point of access for emergency services. However, the opportunities for providing a second point of access are limited and would require careful design in order to avoid adverse effects on existing residences (for example, on the properties bordering the narrow driveway at the end of Frome Place).

5.2.3 The pRDP recognises these issues relating to accessibility and route vulnerability. The New Neighbourhood Zone Standards (8.4.2.5) limit the lengths of cul-de-sacs to 150m where a pedestrian connection is provided to an adjacent street, or 75m in other cases. The proposed subdivision does not comply with this standard, although I understand that this standard is only applicable to areas specifically zoned New Neighbourhood Zones, and therefore are not standards that the pRDP requires for all residential zones. The New Neighbourhood Zone has been introduced in the pRDP for new greenfield residential development. In my view, the standards in relation to new greenfield residential development should be equally applicable to the submissions areas.

5.2.4 The subdivision layout may not comply with all the pRDP rules in relation to access and new road standards (8.6.2 and 8.6.3). It would be appropriate to review the proposed subdivision layout in relation to the pRDP provisions at the consenting stage.

5.3 Submission 3280: Case Site

5.3.1 The submission includes two Concept Plans, one allowing for the division of the land into 9 approximately equal slices of land (each of around 2,300m^2), the other with 8 smaller allotments (varying between 500m^2 and 1,170m^2) at the eastern corner of the site. Pertinently, both plans assume access is to be provided from Cranford Street at the location of the existing driveway providing access to 340 Cranford Street and numbers 11 and 11a Frome Place. Both plans also indicate a second, narrower, point of access from Frome Place.

5.3.2 Cranford Street is classified as a Major Arterial in the pRDP. This is the class of road with the highest movement function category (with Local roads providing the highest access function and the lowest movement function). Major Arterial status is applied to State Highways and selected key roads, including Cranford Street. Major Arterials are managed to minimise adverse effects from access on network efficiency.

5.3.3 Cranford Street is to be subject to physical changes (the Cranford Street Upgrade or CSU) as part of the Northern Arterial Extension project which will provide a direct extension of the proposed Northern Arterial into the City. The Northern Arterial is one of the Government's Roads of National Significance (RoNS), with construction anticipated to commence next year (mid 2016).

5.3.4 The NA, NAE and CSU will significant affect traffic volumes on the Cranford Street corridor. Traffic volumes in the vicinity of the site are anticipated to increase from around 20,000 vpd (2012 count data) to around 40,000 vpd (refer Figure 4.2, above).

5.3.5 The scheme plans submitted as part of the Notice of Requirement (NOR) indicate that Cranford Street is to become a four-lane, median divided road to the north of McFaddens Road. A new roundabout is to be located at the intersection of Cranford Street and the NAE, approximately 400m to the north of the proposed access to the Case site.

5.3.6 The joint Hearings into the NA projects included submission and consideration of u-turn facilities in the vicinity of the proposed access from Cranford Street. However, The Joint Recommendation / Decision of the Commissioners is for the proposed additional u-turn facilities not to be included as part of the scheme due to the safety implications of uncontrolled turns.

5.3.7 Thus access across the median, between McFaddens Road and the proposed roundabout to the north, is restricted to a right-turn into the Placemakers site (practically opposite the proposed access to the Case site) and a southbound u-turn facility near 293 Cranford Street (just north of McFaddens Road). Whilst an additional u-turn facility for northbound traffic to the south of Placemakers was considered appropriate, it was to be left to the detailed design and safety processes to confirm its acceptability.

5.3.8 The following diagrams, extracted from the NOR Scheme Assessment Report, provide

the context and detail of access proposals in the vicinity of the Case site.

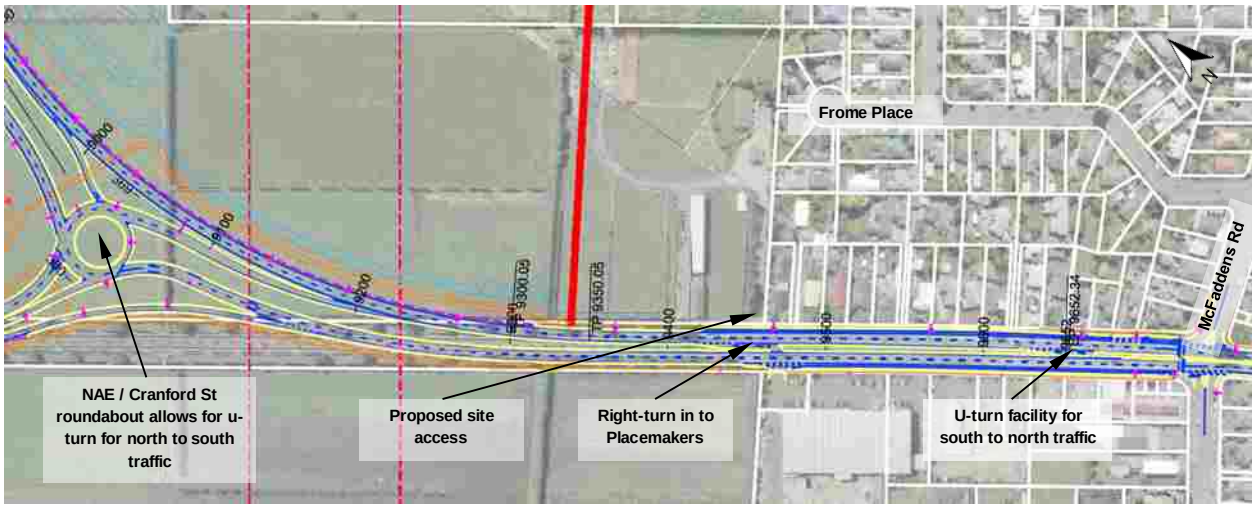

Figure 5.1: Context of Cranford Street Access Strategy

Figure 5.2: Detail of CSU Scheme in Vicinity of Case Site

5.3.9 The proposed access would inevitably result in some impact on the efficiency and safety of Cranford Street. Even if movements were limited to Left-In and Left-Out (LILO), the slowing of vehicles to turn left into the site and the acceleration of vehicles turning left from the site will impede traffic on Cranford Street to some degree. If the site were to be developed for 8 households, then a typical rough-order estimate of daily trip making would be for 80 movements per day. Thus, on a daily basis, the proposed access has the potential to impede platoons of traffic on Cranford Street up to 80 times a day. When vehicles on multi-lane roads with high traffic volumes are impeded, there is an increased number of breaking and lane-changing manoeuvres which carries a corresponding increase in the risk of vehicle collision.

5.3.10 Given Council's approach of establishing a road classification system (Transport Policy 1) and the intent to minimise adverse effects from access on network efficiency (Appendix 7.12), I do not support the proposal to provide direct access to the site from the Major Arterial (Cranford Street) when alternative options exist. In isolation, it is somewhat subjective as to whether the effects of such a proposal are considered less than minor, minor, or more than minor. In my opinion, I would suggest the proposal

would have a minor effect on the efficiency and safety of the road network. However, in terms of cumulative effects on the road network, should Council policy not be upheld in this regard, then in my opinion such decisions would result in more than minor effects on the efficiency and safety of the road network.

5.3.11 The ability of Arterial roads to provide relatively efficient and safe routes for motorists directly effects the environment on Collector and Local Roads through our residential neighbourhoods. If access and road intersections on Arterial roads are frequent, then their efficiency is reduced, thereby reducing their attractiveness relative to routes through more sensitive residential areas. Thus in addition to localised efficiency and safety impacts, I consider it important that network efficiency is preserved on Arterial routes in order to fulfil their function in moving large volumes of traffic, in preference to the use of Collector and Local Roads through our neighbourhoods.

5.3.12 For the Case submission area, I consider a better outcome in terms of network efficiency, safety and overall community impacts would be achieved through providing access to the land via the adjacent Croziers Road submission area. If Frome Place were to be retained / designed for pedestrian and cycle access only, this would also assist with the accessibility issue raised above for the Croziers Road site (refer 5.2).

5.3.13 A further alternative option is for access to be provided via Frome Place only. The current driveway provides access to 11 and 11a Frome Place, which actually comprise the majority of the subdivision area (being the four larger property titles) indicated with the second concept plan within the Case submission. The driveway is narrow at around 3.0m and has a legal width of 3.5m.

5.3.14 The pRDP standards for private ways and vehicle access allow up to eight residential units to be served from a road with a minimum width of 3.0m and a minimum legal width of 3.6m. Thus, the existing driveway is very close to being compliant with these requirements (but has a legal width of 3.5m versus 3.6m required).

5.3.15 For a residential activity of nine or more residences, the pRDP standards are for a minimum legal width of 5.0m plus a further 1.5m for pedestrians/cyclists. Whilst Frome Place as a single point of access is very close to being compliant with the pRDP standards, it is somewhat subjective as to how many houses might be appropriately served by a single driveway of approximately 3.0m width. The issue of the frequency of vehicles moving in opposite directions having to let each other pass is predominantly one of convenience, and in my opinion of secondary importance to the safe provision of road space for pedestrians, including children, in our neighbourhoods. I would not recommend that access via such a narrow driveway without a dedicated place for pedestrians is provided for more than five houses.

5.3.16 It should also be recognised that the increased vehicular use of the Frome Street driveway will have a noise and amenity impact on the residences bordering the driveway at 9 and 10 Frome Place. In this regard, the access strategy to the Case and Croziers sites should seek to minimise the increased vehicular use of this driveway.

5.3.17 Whilst access via Frome Place only for the proposed subdivision (of 8 or 9 households) is, on balance, preferable to providing direct access via Cranford Street, I consider this option very much inferior to an access strategy that provides the main vehicular access to both sites from Croziers Road (including provision for pedestrians) and includes a secondary access from Frome Place for pedestrian and cycle access.

6 Summary and Conclusions

6.1 This Memo sets out the results of the traffic modelling conducted to inform the assessment of the potential impact of three submissions received for the rezoning of land in the Cranford Basin area from Rural (Urban Fringe) to Residential (Suburban). It also considers access matters in relation to the submissions land.

6.2 Modelling has been based on an assumed net density of 15 households per hectare, yielding around 500hh in total across the three submissions areas. Traffic modelling has been conducted using Council's CAST traffic model for the horizon years of 2021 (pre-Northern Arterial and Extension) and 2031 (with Northern Arterial and Extension) for the AM and PM peak hours.

6.3 At 2021, there are measurable impacts at a number of locations on the surrounding road network for which no simple mitigation measures have been identified. Because these locations are already operating at LoS E or F in the base model reflecting the receiving environment, these impacts are considered potentially significant, particularly as there are safety consequences of large delays on give-way approaches to intersections. I would recommend that that zoning rules are included that limit the amount of development that could occur prior to these planned road improvement schemes being completed. I note that a consent duration of some 13 years for the construction phase of these projects has been sought (as of 27 July 2015).

6.4 At 2031, the locations of significant delay increases modelled at 2021 do not occur due to the relief to these bottlenecks brought by the NA & NAX. The modelling would suggest that the effects of the rezoning sought by the submissions on the surrounding road network are minor.

6.5 The modelling assumes that rezoning of the Grassmere Area includes connections to Papanui Road, Main North Road and a new connection to Cranford Street. I consider such road connections necessary in order to minimise network impacts and provide good accessibility.

6.6 For submission 324, the Croziers Road site, I consider it highly preferable to pursue an access strategy that provides a second point of access, at least for pedestrians and cyclists. This could be achieved through linkages to be provided with the adjacent submission 3280 Case site.

6.7 For submission 3280, the Case site, I do not support the proposed access to the site from Cranford Street. Cranford Street is classified as a Major Arterial in the pRDP and Council policy is to manage such roads to minimise adverse effects from access on

network efficiency. With the proposed Northern Arterial, Northern Arterial Extension and Cranford Street Upgrades, traffic modelling indicates that traffic volumes will likely double from around 20,000 vehicles per day in 2012 to around 40,000 in 2031. The proposed access has the potential to impede platoons of traffic on Cranford Street up to 80 times a day. When vehicles on multi-lane roads with high traffic volumes are impeded, there is an increased number of breaking and lane-changing manoeuvres which carries a corresponding increase in the risk of vehicle collision.

6.8 When considered in isolation, I would suggest the proposed access would have a minor effect on the efficiency and safety of the road network. However, in terms of cumulative effects on the road network, should Council policy not be upheld in this regard, then in my opinion such decisions would result in more than minor effects on the efficiency and safety of the road network. In addition to localised efficiency and safety impacts, I consider it important that network efficiency is preserved on arterial routes in order to fulfil their function in moving large volumes of traffic, in preference to the use of Collector and Local Roads through our neighbourhoods.

6.9 For the Case submission area, I consider a better outcome in terms of network efficiency, safety and overall community impacts would be achieved through providing access to the land via the adjacent Croziers Road submission area. If Frome Place were to be retained / designed for pedestrian and cycle access only, this would also assist with the accessibility issue raised above for the Croziers Road site (refer 6.6).

6.10 A third option is for access to be provided to the Case land via the existing narrow driveway from Frome Place only. Whilst this option is very close to being compliant with pRDP standards for vehicle access, it has potentially poor outcomes with regards to provision of safe pedestrian access and on amenity impact on the neighbouring residences. Whilst access via Frome Place only for the proposed subdivision (of 8 or 9 households) is, on balance, preferable to providing direct access via Cranford Street, I consider this option very much inferior to an access strategy that provides the main vehicular access to both sites from Croziers Road (including provision for pedestrians) and includes a secondary access from Frome Place for pedestrian and cycle access.

Appendix C - Statement of evidence of Tim Wright before the Replacement Christchurch District Plan hearing – 10 December 2015

BEFORE THE CHRISTCHURCH REPLACEMENT DISTRICT PLAN INDEPENDENT HEARINGS PANEL

IN THE MATTER of the Resource Management Act 1991 and the Canterbury Earthquake (Christchurch Replacement District Plan) Order 2014

AND

IN THE MATTER of the hearing on the Rural zoning for land within the Cranford Basin (Stage 3)

STATEMENT OF EVIDENCE OF TIMOTHY JOHN WRIGHT ON BEHALF OF CHRISTCHURCH CITY COUNCIL

TRANSPORT

10 DECEMBER 2015

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1. INTRODUCTION

1.1 My full name is Timothy John Wright. I am a director of QTP Limited and have held this position since April 2009.

1.2 My qualifications include a Masters Degree in Civil Engineering from the University of Nottingham, UK (1995, class 2:1). I am a Chartered Professional Engineer (CPEng) and registered under the Chartered Professional Engineers New Zealand Act 2002. I am a Member of the Institution of Professional Engineers New Zealand (MIPENZ), the Chartered Institution of Highways and Transportation (MCIHT), the IPENZ Transportation Group, and the New Zealand Transport Modelling User Group (a sub-group of the IPENZ Transportation Group).

1.3 I have been professionally engaged in transport planning, transport modelling and traffic engineering for 18 years, predominantly in the private sector. During my career I have prepared and reviewed many transport assessments including resource consents, plan changes, area plans, transport modelling and strategic studies.

1.4 I have been engaged by the Christchurch City Council (**Council**) to provide evidence on transport issues in relation to site specific rezoning submissions on Stage 3 of the Rural Chapter of the proposed Replacement District Plan (**pRDP**), that are located within the Cranford Basin.

1.5 I have been providing the Council with my expertise in relation to the rezoning of the land within the Cranford Basin since March 2015. I have also provided transport advice to Council in the past (around 2009) in relation to resource consent applications received for proposed development within the Cranford Basin. On Tuesday 17 November 2015 I visited the three sites that are the subject of the site specific submissions.

1.6 Of particular relevance to this hearing is my experience and expertise in relation to the traffic modelling used to inform my assessment of transport effects of the submissions. In 2010, I led the development

of Council's traffic model[1] of Christchurch and have been involved in all updates to the model for Council since. In March 2015 I applied the model for Council to test a range of alternative Cranford Basin zoning options and have since applied the model to assess a scenario relating to the three submissions received.

1.7 In the Commercial (part) and Industrial (part) hearings in Stage 2 I provided technical analysis and a will-say statement, but because of availability issues the evidence was ultimately provided by Mr Andrew Milne for the Council.

1.8 In addition, I have been appointed by Council to undertake the traffic modelling to inform the effects of the Residential Medium Density zone (Residential Stage 1, at 14.3 of the pRDP), the Meadowlands new neighbourhood (exemplar housing area – North Halswell, Chapter 14.1.6A of the RDP) and to inform Council's response to other submissions received on the Commercial and Industrial chapters.

1.9 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2014 and that I agree to comply with it. I confirm that I have considered all the material facts that I am aware of that might alter or detract from the opinions that I express, and that this evidence is within my area of expertise, except where I state that I am relying on the evidence of another person.

1.10 The key documents I have used, or referred to, in forming my view while preparing this brief of evidence are:

(a) QTP Memo to Council dated 2 April 2015 – 'Cranford Basin Rezoning Transport Assessment' (**Attachment A**);
(b) QTP Memo to Council dated 1 December 2015 – 'Cranford Basin Submissions and Access Review' (**Attachment B**);
(c) The pRDP, in particular Chapter 7, Transport; and
(d) The plans for the Northern Arterial Extension (**NAE**) and Cranford Street Upgrade (**CSU**) project, as contained within

1 Christchurch Assignment and Simulation Traffic model (**CAST**).

the Scheme Assessment Report (Dated October 2013) forming Appendix 2 of Council's Application for land to be designated for roading purposes (RMA92024074) and the subsequent decision on the NAE and CSU.

2. SCOPE

2.1 My evidence addresses the transport issues arising from the individual site specific submissions that seek a rezoning in the Cranford Basin Rural Urban Fringe (**RuUF**) zone. I have taken a view on each of the individual site specific submissions on whether the relief sought in terms of transport effects should be rejected or whether I do not oppose it.

2.2 The three relevant submissions are:

(a) Grassmere St Residents Group & Grants Rd Holdings (**Grassmere Block**) **#3193**;
(b) G, M and M Case (**Case**) **#3280**; and
(c) R J and L T Crozier (**Crozier**) **#3268**.

3. EXECUTIVE SUMMARY

3.1 The analysis I have conducted indicates that a net density of 15 households per hectare (**hh/ha**), being reflective of Residential Suburban (**RS**) zoning, as sought in the three rezoning submissions and theoretically yielding around 500 households in total, can be accommodated with minor impacts on the wider road network.

3.2 I note that based on the modelling conducted, some larger impacts (more than minor effects) on the operation of the road network would be anticipated **if** significant development of the Grassmere Block were to occur prior to the planned Northern Arterial (**NA**), NAE and CSU projects being completed. I recommend that rules are included in relation to the Grassmere Block that limit the amount of development that could occur prior to these planned road improvement schemes being completed. I note that a consent

duration of some 13 years for the construction phase of the NA/NAE/CSU roading projects has been sought (as of 27 July 2015).

3.3 In principle, I do not oppose the relief sought through the proposed rezoning within the three submissions. However, there are particular factors that need to be taken into account in relation to access to each of the submission areas, including:

(a) The planned NAE and CSU;
(b) The status of Cranford Street in the Replacement District Plan (**RDP**) as a Major Arterial;[2] and
(c) Existing capacity and congestion issues affecting Papanui Road and Main North Road.

3.4 In my opinion, the rezoning of the Grassmere Block requires road connections to Papanui Rd, Main North Rd and a new connection to Cranford Street. This is in order to minimise network impacts and provide good accessibility.

3.5 I do not consider access to the Case site via Cranford Street to be appropriate on efficiency and safety grounds given the anticipated traffic volumes and function of Cranford Street as a Major Arterial. In this regard, access would be better served via the adjacent local roads, thereby better reflecting several RDP objectives and policies that seek to promote integrated transport planning and to manage Major Arterial roads to minimise adverse effects from access on network efficiency.

3.6 The RDP and pRDP include policies and objectives that seek to ensure that new neighbourhoods are comprehensively planned and designed with transport networks (vehicular, pedestrian and cycle) that fully integrate with existing adjacent communities and enable connectivity with other undeveloped areas. In this regard, and in relation to my recommendation for the Case site, I recommend a rule be adopted that ensures the site is developed to enable a continuation of the main access road through to the adjacent Case site.

2 As confirmed in the Panel's decision on the Stage 1 Transport Proposal.

3.7 When both of the adjoining Case and Crozier sites are developed, I recommend that they both have vehicular access from Croziers Road and that the Frome Place driveway reverts to a pedestrian / cycle access serving both sites.

4. BACKGROUND

4.1 I was appointed by Council in March 2015 to undertake a transport assessment of five alternative rezoning scenarios for land within the Cranford Basin and to develop multi-modal access strategies for each scenario, in order to inform the Council's Section 32 Evaluation. The assessment was informed by extensive traffic modelling using Council's CAST model. The work included an assessment of the area in terms of public transport services, cycleways and active transport, in addition to identifying an access strategy for rezoning scenarios.

4.2 Owing to the short time available for the reporting of the results of the assessment, I provided this by way of a QTP Memo to Council dated 2 April 2015 – 'Cranford Basin Rezoning Transport Assessment' (**Attachment A**).

4.3 I was subsequently engaged in November 2015 as the Council's expert witness on transport implications of rezoning parts of the Cranford Basin from RuUF to RS. Under this engagement, I have undertaken further traffic modelling to better reflect the traffic effects of the rezoning sought by the three submissions and to provide further advice in relation to access to each of the submission sites. The results of the assessment are set out in my QTP Memo to Council dated 1 December 2015 – 'Cranford Basin Submissions Transport Modelling and Access Review' (**Attachment B**).

4.4 **Attachments A and B** set out the assumptions and methodology adopted within the wider network traffic modelling for testing the appropriateness of the zoning sought by the submissions.

4.5 In summary, analysis of the wider network traffic impacts of the rezoning sought by the three submissions has been conducted using Council's CAST model. CAST includes all local roads with any significant through-traffic function. It allows all trips to re-route to their optimal route under the modelled traffic conditions for a particular scenario (the assumed road network and travel demands). In this regard, the modelling is considerably more sophisticated than traditional techniques applied in undertaking Integrated Transport Assessments (**ITAs**) where trip distribution is estimated and new trips are simply superimposed on the base situation. Such analysis does not allow for the reassignment of traffic across the network and is often limited in scope (network coverage). Conversely, the CAST model represents the whole of Christchurch city in 'simulation' level of detail, allowing the wider effects of the re-zoning on the road network to be identified.

4.6 In addition to identifying the wider traffic effects of the rezoning sought by the submissions, I have reviewed the access proposals in relation to the relevant provisions of the pRDP. I have also undertaken isolated intersection modelling of the intersection sought on Cranford Street within the Case submission to provide access to their site. I have provided my opinion on the likely traffic efficiency and safety effects of the submissions informed by this review of the pRDP/RDP provisions and the traffic modelling conducted.

5. OUTCOMES OF MEDIATION / CAUCUSING

5.1 I participated in Expert Conferencing in relation to the Case submission on Wednesday 23 November 2015 with their transport expert, Mr Andy Carr. The Conferencing Statement is **Attachment C** to this evidence which sets out in detail what was agreed and our respective views on disagreed matters. In terms of what was agreed:

(a) there would be no perceptible change in traffic volumes on Cranford Street as a result of the development of the Case land;

(b) eight or fewer properties could be served via the single-lane Right of Way (**RoW**) onto the cul-de-sac head of Frome Street, as per the pRDP rules.

5.2 The key area of disagreement is in relation to the use of Cranford Street as an appropriate means of providing access to the Case site:[3]

> *Mr Wright considers that any increased use of the Case access onto Cranford Street (over and above that which is presently permitted) would have efficiency and safety implications for the operation of Cranford Street. He considers that these effects would be minor. He considers that instead, access should be provided onto the local roads towards the south and east, as the overall effects on the efficiency and safety of the road network would be less. In his view, this better achieves relevant Objectives and Policies in the District Plan with regard to the hierarchical approach to management of the road network.*
>
> *Mr Carr considers that no direct access to residences (ie driveways) should be provided between the Case land and Cranford Street, but considers that a properly formed access road (onto which the residential lots would gain access) would not be inconsistent with the replacement District Plan rules.*

6. MERITS OF REZONING SOUGHT

6.1 The residential zoning sought within the submissions is highly compatible with the existing surrounding residential land-uses in terms of traffic effects (minimal heavy vehicles and noise compared to industrial and commercial uses).

6.2 Residential zoning is well located for local public transport, employment, shopping and recreational activities. Allowing residential development realises some of the potential of the area for being serviced by, or having access to, high quality public transport

3 Joint Statement of Transport Expert Witnesses (Cranford Basin) dated 23 November 2015, at section 4.2.1.

and the Major Cycle Routes, thereby taking advantage of investment in public transport services and cycle infrastructure.

6.3 In the longer-term, I consider the adverse traffic effects (congestion and emissions) for residential development at this location, which is encompassed by existing urban areas, are likely to be less than for residential development located further from the Central City. The alternative development (for residential purposes) of more remote Greenfield Sites within Christchurch City, or locations within Selwyn or Waimakariri Districts, will generally be less accessible to public transport and employment centres. This results in a greater number of vehicle kilometres travelled by private vehicles, with an associated economic, environmental and social cost.

6.4 The analysis I have conducted indicates that a net density of 15 hh/ha, being reflective of RS zoning and theoretically yielding around 500 hh in total, can be accommodated with minor impacts on the road network.

6.5 In principle, based on these merits of residential zoning and the results of the analysis conducted I do not oppose the rezoning sought. However, there are particular factors that need to be taken into account in relation to access to each of the submission areas, including:

(a) The planned NAE and CSU;
(b) The status of Cranford Street in the Replacement District Plan as a Major Arterial and the relatively high traffic volumes carried by the road; and
(c) Existing capacity and congestion issues affecting Papanui Road and Main North Road.

6.6 Thus whilst in principal I do not oppose the rezoning sought, I consider that there are potential issues from a transport perspective associated with each of the three submissions. Therefore, in order to avoid potential adverse transport effects, I consider there are certain requirements for each of the sites that may best be met through the specification of rules within the pRDP.

7. INTEGRATED TRANSPORT PLANNING

7.1 The Case site immediately adjoins the Crozier site.

7.2 The RDP and pRDP contain objectives and policies which seek to ensure that new neighbourhoods are comprehensively planned and designed with transport networks (vehicular, pedestrian and cycle) that fully integrate with existing adjacent communities and enable connectivity with other undeveloped areas. Particularly relevant provisions are (with my emphasis in bold):[4]

> *Chapter 8 Subdivision and Earthworks Policy 8.1.2.6 – Integration and connectivity*
>
> *a.* *Ensure well integrated places, infrastructure, movement networks and activity.*
>
> *b.* ***Provide efficient and safe, high quality, barrier free, multimodal connections within a development, to surrounding areas, and to local facilities and services, with emphasis at a local level placed on walking, cycling and public transport.***
>
> *…*
>
> *Chapter 8 Subdivision and Earthworks Objective 8.1.3 – Infrastructure and transport*
>
> *a.* *Subdivision design and development promotes efficient provision and use of infrastructure and transport networks*
>
> *b.* *A legible,* ***well-connected, highly walkable****, and comprehensive movement network for all transport modes is provided.*
>
> *c.* *Land is set aside for services which can also be used for other activities, such as pedestrian or cycle ways.*
>
> *Chapter 8 Subdivision and Earthworks Policy 8.1.3.2 – Transport and access*
>
> a. *Provide a legible,* ***well- connected, highly walkable****, and comprehensive movement network for all transport modes that enables people of all ages and physical abilities to access public open space facilities, public transport, suburban centres, and community facilities, and to move between neighbourhoods and the wider urban area*.

4 Closing Submissions for Christchurch City Council; Proposal 8 – Subdivision (part) (Stage 2) dated 23 November 2015 at Appendix B.

7.3 Given the above objectives and policies, both the Case and Crozier sites should be designed and developed in an integrated manner. Thus my consideration of potential issues at both sites considers the above policies for integrated development. Further, the measures that I have identified to avoid, remedy or mitigate potential issues have been developed in the context of the above policies and objectives.

8. G, M AND M CASE #3280 – 340 CRANFORD STREET

8.1 Submission #3280 seeks the rezoning of 340 Cranford Street as RS rather than the notified RuUF. The property area is 2.27 ha. The submission includes attachments showing concept plans for the site layout. Concept plan #2 in the submission shows a yield of nine lots if the whole property was developed. Concept plan #5 (labelled as Attachment 4) shows a yield of eight lots if the part of the property that is outside the Flood Ponding Management Area (as notified in Stage 3) was developed.

8.2 Both plans indicate that access is to be provided via a proposed RoW providing access from Cranford Street and a secondary access via the relatively narrow (approximately 3.0m) driveway from the head of the Frome Place cul-de-sac, which presently provides a secondary access to the existing dwelling on the subject site.

Summary

8.1 In summary, for the Case site, I do not oppose the rezoning (in relation to transport considerations) in principle.

8.2 There are however potential efficiency and safety effects of the proposed intersection on Cranford Street should this be implemented prior to the NAE and CSU projects being completed. Once the CSU has been completed, involving four-laning of Cranford Street, a Left in, Left out (**LILO**) intersection is likely to operate with moderate delays for left turning vehicles from the site. There are however likely to be some efficiency and safety effects as vehicles to/from the site impede traffic on the Major Arterial. Whilst I consider that these

effects are likely to be minor, I consider that access would be better served via the adjacent local roads, thereby better reflecting several pRDP objectives and policies that seek to promote integrated transport planning and to manage Major Arterial roads to minimise adverse effects from access on network efficiency.

8.3 For this reason, I recommend that rules are adopted that specify that primary vehicle access be provided via Croziers Road and therefore the adjacent Crozier submission site. As an interim solution, access could be provided via Frome Place, should the development sought by the Crozier submission take longer to eventuate than that of the Case Site. When both sites are developed, I recommend that both sites have access from Croziers Road and that the Frome Place driveway reverts to a pedestrian / cycle access serving both sites.

8.4 I set out my reasons for these views, in more detail below.

8.5 Since the expert conferencing, I provided my assessment of the site access issues associated with the Case site within the memorandum dated 1 December 2015 (refer Attachment B, section 5.3). Considerations are complicated to some degree by the consented NAE and CSU road schemes that will alter the form of Cranford Street and significantly increase traffic volumes, once the works are completed (construction of the works has not yet commenced).

8.6 Subsequent to providing my assessment within the Memorandum, I have also undertaken further traffic modelling, specifically of the proposed RoW / Cranford Street intersection in order to inform my opinion of the likely operation of the intersection both with and without the proposed NAE and CSU schemes in place.

Cranford Street in context

8.7 The Christchurch Transport Strategic Plan (**CTSP**) reflects Christchurch's transport policy in relation to relevant statutory plans, in particular the Canterbury Regional Land Transport Strategy, Canterbury Regional Policy Statement, Greater Christchurch Urban Development Strategy and Regional Public Transport Plan. It

identifies Cranford Street, north of Innes Road, as a Major or District Arterial, part of the strategic road network:

> *"Identified strategic roads will improve journey reliability and efficiency; and reduce conflict with adjacent land use."*
>
> *"The network of major arterial routes will be planned, designed and managed to maximise journey efficiency and reliability while supporting the land uses that surround the network."*

8.8 Cranford Street is classified as a Major Arterial in the RDP. This is the class of road with the highest movement function category (with Local roads providing the highest access function and the lowest movement function). Major Arterial status is applied to State Highways and selected key roads, including Cranford Street. Major Arterials are managed to minimise adverse effects from access on network efficiency.

8.9 Cranford Street is to be subject to physical changes as part of the CSU project (which forms part of the NAE project and will provide a direct extension of the proposed NA into the City). The NA is one of the Government's Roads of National Significance, with construction anticipated to commence next year (mid 2016).

8.10 The NA, NAE and CSU will significantly affect traffic volumes on the Cranford Street corridor. Traffic volumes in the vicinity of the site are anticipated to increase from around 20,000 vehicles per day (**vpd**) (2012 count data) to around 40,000 vpd (refer **Attachment B**, Figure 4.2).

8.11 The scheme plans submitted as part of the Notice of Requirement (**NoR**) indicate that Cranford Street is to become a four-lane, median divided road to the north of McFaddens Road. A new roundabout is to be located at the intersection of Cranford Street and the NAE, approximately 400m to the north-west of the proposed access to the Case site.

8.12 Appeals have been received on the NAE/CSU Notices of Requirement, although neither challenge the projects as a whole. There is some uncertainty around timescales for the project given Council's decision not to identify funding for the project in its Long Term Plan.[5] A consent duration of some 13 years for the construction phase of these projects was sought (as of 27 July 2015), but completion could occur well before this date.

8.13 Due to the uncertainty surrounding the timing of the NAE and CSU, my assessment of transport effects considers scenarios both with and without completion of the schemes. Whilst traffic volumes on Cranford Street with the scheme are anticipated to increase significantly, the four-laning of the road and the provision of a central median would affect how access to the Case site would be formed. Thus the assumed intersection configuration and traffic volumes will be different in both cases and the anticipated operation of the intersection could similarly differ.

An appropriate access strategy

8.14 Given the principles of integrated transport planning as supported by the Chapter 7 RDP provisions, the Council's current position on the Chapter 8 pRDP provisions highlighted above and the context of Cranford Street as a Major Arterial within the RDP and as part of the strategic road network within the CTSP, the access strategy for the Case site should prioritise access from the local road network and avoid access from the arterial road network.

8.15 The Cranford Street intersection would inevitably result in some impact on the efficiency and safety of Cranford Street. Even if movements were limited to LILO, the slowing of vehicles to turn left into the site and the acceleration of vehicles turning left from the site will impede traffic on Cranford Street to some degree. If the site were to be developed for 8 households, then a typical rough-order estimate of daily trip making would be for 80 movements per day. Thus, on a daily basis, the proposed access has the potential to impede platoons of traffic on Cranford Street up to 80 times a day. When vehicles on

5 I note the Council's LTP has allocated annual funding for the stormwater basin until 2025, starting this financial year.

multi-lane roads with high traffic volumes are impeded, there is an increased number of breaking and lane-changing manoeuvres which carries a corresponding increase in the risk of vehicle collision.

8.16 Given Council's approach of establishing a road classification system (RDP Transport Policy 1) and the intent to minimise adverse effects from access on network efficiency (RDP Appendix 7.12), I do not support the proposal to provide access to the site from the Major Arterial (Cranford Street) when alternative options exist. In isolation, it is somewhat subjective as to whether the effects of such a proposal are considered less than minor, minor, or more than minor. In my opinion, I would suggest the proposal would have a minor effect on the efficiency and safety of the road network. However, in terms of cumulative effects on the road network, should the Policy not be upheld in this regard in practice, then in my opinion such decisions would collectively result in more than minor effects on the efficiency and safety of the road network.

8.17 The ability of Arterial roads to provide relatively efficient and safe routes for motorists directly effects the environment on Collector and Local Roads through our residential neighbourhoods. If intersections on Arterial roads are frequent, then their efficiency is reduced, thereby reducing their attractiveness relative to routes through more sensitive residential areas. Thus in addition to localised efficiency and safety impacts, I consider it important that network efficiency is preserved on Arterial routes in order to fulfil their function in moving large volumes of traffic. This is in preference to the use of Collector and Local roads through our neighbourhoods.

8.18 For the Case land, I consider a better outcome in terms of network efficiency, safety and overall community impacts would be achieved through providing access to the land via Croziers Road and therefore the adjacent Crozier submission site. If Frome Place were to be retained / designed for pedestrian and cycle access only, this would also assist with the accessibility issue raised in relation to the Crozier site (refer 9.2, below).

8.19 A further alternative option is for access to be provided via Frome Place only. The current driveway provides access to 11 and 11a Frome Place, which actually comprise the majority of the proposed subdivision area, being the four larger property titles identified within Attachment 4 to submission #3280. The driveway is narrow at around 3.0m and has a legal width of 3.5m.

8.20 The RDP standards for private ways and vehicle access allow up to eight residential units to be served from a road with a minimum width of 3.0m and a minimum legal width of 3.6m. Thus, the existing driveway is very close to being compliant with these requirements (but has a legal width of 3.5m versus 3.6m required).

8.21 For a residential activity of nine or more residences, the RDP standards are for a minimum legal width of 5.0m plus a further 1.5m for pedestrians/cyclists. Whilst Frome Place is a single point of access that is very close to being compliant with the RDP standards, it is somewhat subjective as to how many houses might be appropriately served by a single driveway of approximately 3.0m width.

8.22 The issue of the frequency of vehicles moving in opposite directions having to let each other pass is predominantly one of convenience, and in my opinion of secondary importance to the safe provision of road space for pedestrians, including children, in our neighbourhoods. I would not support access via such a narrow driveway without a dedicated place for pedestrians for more than five houses.

8.23 It should also be recognised that the increased vehicular use of the Frome Place driveway will have a noise and amenity impact on the residences bordering the driveway at 9 and 10 Frome Place. In this regard, the access strategy to both the Case and Crozier sites should seek to minimise the increased vehicular use of this driveway.

8.24 Whilst access via Frome Place only for subdivision of the Case site (of 8 or 9 households) is, on balance, preferable to providing direct access via Cranford Street, I consider this option very much inferior to an access strategy that provides the main vehicular access to both

sites from Croziers Road (including provision for pedestrians) and includes a secondary access from Frome Place for pedestrian and cyclists.

Cranford Street intersection operation

8.25 Notwithstanding my views provided above in relation to an appropriate access strategy for the Case (and Crozier) sites, I have been asked by the Council to assess the likely operation of the proposed Cranford Street intersection serving the Case site.

8.26 The wider network traffic modelling presented within **Attachments A and B** assumes that the traffic movements associated with both the Case and Crozier sites would access the local road network (in the Croziers Road / McFaddens Road area).

8.27 Modelling of the proposed Cranford Street access intersection has been conducted using SIDRA intersection software. This more detailed model allows the specific characteristics of the proposed intersection to be modelled. I refer **Attachment D**, which is a QTP File Note dated 9 December 2015 – 'Cranford Basin Rural Zoning Transport Evidence – Cranford Street / Case Access Intersection Modelling', for further commentary on the modelling methodology and results.

8.28 In summary, the modelling of the proposed access prior to the NAE and CSU being completed indicates long delays (several minutes) in the peak hours on the access approach if all turns were permitted. This has safety implications. Implementing a LILO intersection would require significant abortive physical works when the CSU (involving four-laning) is constructed.

8.29 Once the CSU has been completed, involving four-laning of Cranford Street, a LILO intersection is likely to operate with moderate delays for left turning vehicles from the site. There are however likely to be some efficiency and safety effects as vehicles to/from the site impede traffic on the Major Arterial. Whilst I consider that these effects are likely to be minor, I consider that access would be better served via

the adjacent local roads. This will better reflect several pRDP objectives and policies that seek to promote integrated transport planning and to manage Major Arterial roads to minimise adverse effects from access on network efficiency.

9. R J and L T CROZIER #3268 – 60 CROZIERS ROAD

9.1 Submission #3268 seeks the rezoning of part (2.56 ha) of 60 Croziers Road as RS rather than the notified RuUF. Attachment A to the submission states that thirty lots could be developed, and the Spiire 'possible subdivision plan' referred to in Attachment A of #3268 can be found in the Crozier's Stage 1 submission, #324.

9.2 A significant issue with the indicative site layout (referring to Figure 2 on page 3 of the Eliot Sinclair report in Attachment B of the submission) is that there is only a single point of access to the proposed subdivision comprising 30 households. In terms of accessibility, it would be highly preferable to provide a pedestrian/cycle linkage to the adjacent Case site also proposed for rezoning to RS.

9.3 Paragraph 7.2 above sets out the relevant RDP policies and objectives that seek to ensure that new neighbourhoods are comprehensively planned and designed with transport networks (vehicular, pedestrian and cycle) that fully integrate with existing adjacent communities and enable connectivity with other undeveloped areas. In this regard, and in relation to my recommendation for the Case site at paragraph 8.1 above, I recommend a rule be adopted that ensures the site is developed to enable a continuation of the main access road through to the adjacent Case site.

9.4 In theory, it would also be preferable to have a second point of access for vehicular traffic, reducing route vulnerability and providing a second point of access for emergency services. However, in practice the opportunities for providing a second point of vehicular access are limited and would require careful design in order to avoid

adverse effects on existing residences (for example, on the properties bordering the narrow driveway at the end of Frome Place).

10. GRASSMERE ST RESIDENTS GROUP & GRANTS ROAD HOLDINGS #3193 – 471 AND 503 CRANFORD STREET

10.1 Submission #3193 seeks the rezoning of 471 and 503 Cranford Street, and 31, 41, 43, 45, 45A, 57, 59, 63 and 69 Grassmere Street as RS rather than the notified RuUF. The total property area is 29 ha.

10.2 Such a scale of development (up to approximately 400 households, dependent on areas required for roading, stormwater and reserves), has the potential to cause significant traffic impact.

10.3 For this reason, I was engaged by Council to undertake a transport assessment in March 2015, including extensive traffic modelling using Council's Christchurch Assignment and Simulation Traffic model (CAST) and to identify an access strategy. The transport assessment is included as **Attachment A**.

10.4 More recently, I was asked to undertake further traffic modelling to better reflect the traffic effects of the rezoning sought by the three submissions, including that of the Grassmere Street Residents Group & Grants Road Holdings, herein referred to as the Grassmere Street site. The results of the updated assessment are set out in **Attachment B** to this evidence.

10.5 Note that my assessment on this rezoning as set out in **Attachment B** was based on an initial sketch plan that identified some 33.4ha[6] for rezoning to RS, rather than the 29ha identified within submission #3193. In this regard, the modelling undertaken that identified the potential scale of effects can be considered as robust (ie, conservative) as it relates to a housing yield of 427 households, whereas Council's Planning Expert, Mr Ivan Thompson, refers within his evidence to a total yield of 250 – 300 sections.

6 The initial sketch plan included the sections of land comprising the Christchurch Top 10 Holiday Park

10.6 At 2021, without the NA, NAE and CSU projects assumed to be in place, the traffic modelling indicates measurable impacts at a number of locations on the surrounding road network for which no simple mitigation measures have been identified. Because these locations are already operating at Level of Service E or F in the base model,[7] reflecting the receiving environment, these impacts are considered potentially significant, particularly as there are safety consequences of large delays on give-way approaches to intersections. I would recommend that zoning rules are included that limit the amount of development that could occur prior to the planned road improvement projects being completed. I note that a consent duration of some 13 years for the construction phase of these projects has been sought (as of 27 July 2015).

10.7 At 2031, the locations of significant delay impacts modelled at 2021 do not occur due to the relief to these bottlenecks brought by the NA and NAE. The modelling would suggest that the effects of the rezoning sought by the Grassmere Street site submission on the surrounding road network are minor.

10.8 The modelling assumes that rezoning of the Grassmere Street site includes connections to Papanui Road, Main North Road and a new connection to Cranford Street. I consider such road connections, as illustrated within the draft Outline Development Plan (**ODP**) (refer **Attachment B**, Figure 1.1) necessary in order to minimise network impacts and provide good accessibility.

10.9 For the Grassmere Block site there are relatively few constraints in considering how access to the dwellings within the submission area itself could be provided. The proposed Collector Roads and indicative Local road locations allow the hierarchical approach to transport planning, as described within the RDP (Transport Policy 1 and Appendix 7.12), to be adhered to. The Local roads will provide for access to each property, with the proposed Collector Roads providing a balance in function between access to properties and their distribution function in connecting with the Arterial road network. In this way, access to the surrounding Arterial road network is

7 Refer to my **Attachment B** at page 10, section 8.3.1.

managed, the adverse effects of access are minimised, allowing the Arterials to fulfil their function in moving larger volumes of traffic around the city in a safe and efficient manner.

Timothy John Wright
10 December 2015

ATTACHMENT A

QTP MEMO TO COUNCIL DATED 2 APRIL 2015
'CRANFORD BASIN REZONING TRANSPORT ASSESSMENT'

ATTACHMENT B

QTP MEMO TO COUNCIL DATED 1 DECEMBER 2015
'CRANFORD BASIN SUBMISSIONS AND ACCESS REVIEW'

ATTACHMENT C

JOINT STATEMENT OF TRANSPORT EXPERT WITNESSES

ATTACHMENT D

QTP FILE NOTE ON CRANFORD STREET / CASE ACCESS INTERSECTION MODELLING

Independent Hearings Panel

Christchurch Replacement District Plan

Te paepae motuhake o te mahere whakahou a rohe o Ōtautahi

In the Matter of the Canterbury Earthquake (Christchurch Replacement District Plan) Order 2014 and Resource Management Act 1991

And

In the Matter of Directions by the Independent Hearings Panel pursuant to cl 9 of Schedule 3 of the Order

JOINT STATEMENT OF TRANSPORT EXPERT WITNESSES

CRANFORD BASIN: CHAPTERS 7 / 14 (PART)

Wednesday 23 November 2015

1. INTRODUCTION

This document sets out the discussions that took place in unfacilitated expert witness conferencing of the transport experts, on Wednesday 23 November 2015, at the Hearings Venue, 348 Manchester Street, Christchurch.

2. PARTICIPANTS

Name	Representing
Tim Wright	Christchurch City Council #3723
Andy Carr	Case Family #3280

3. CODE OF CONDUCT

At the outset it was acknowledged that this expert witness conference is proceeding under the Code of Conduct.

4. ISSUES DISCUSSED

4.1 Traffic Volumes

The experts agreed that there would be no perceptible change in traffic volumes on Cranford Street as a result of development of the Case land.

4.2 Appropriate Means of Gaining Access to the Case Land

4.2.1 Use of Cranford Street

Mr Wright considers that any increased use of the Case access onto Cranford Street (over and above that which is presently permitted) would have efficiency and safety implications for the operation of Cranford Street. He considers that these effects would be minor. He considers that instead, access should be provided onto the local roads towards the south and east, as the overall effects on the efficiency and safety of the road network would be less. In his view, this better achieves relevant Objectives and Policies in the District Plan with regard to the hierarchical approach to management of the road network.

Mr Carr considers that no direct access to residences (ie driveways) should be provided between the Case land and Cranford Street, but considers that a properly formed access road (onto which the residential lots would gain access) would not be inconsistent with the replacement District Plan rules.

4.2.2 Use of Frome Street Right of Way

Mr Wright considers that up to 8 residential properties on the Case land could be served via the short, single-lane Right of Way onto the cul-de-sac head of Frome Street, as per the replacement District Plan rules. Any additional residential lots would require an additional/alternative point of access which could be provided via Croziers Road, but he acknowledges that this requires access over third party land (this land is subject to a separate submission to the District Plan review, #324).

Mr Carr agrees that the single-lane Right of Way onto the cul-de-sac head of Frome Street is capable of serving up to 8 residential properties.

The experts agree that if 8 or fewer residential properties were served via the Right of Way, the safety and efficiency effects on the local roading network would be negligible.

4.3 Access onto Cranford Street

Noting the difference in opinions about the desirability of such as access, the experts agreed to constructively discuss the design issues ***if*** an access was to be provided onto Cranford Street. For clarity, the views of the experts remain as set out above in paragraph 4.2.

The experts agree that any access intersection must be appropriately designed. This will include consideration of whether extended deceleration and acceleration lanes should be provided.

4.3.1 If Cranford Street is Upgraded

If Cranford Street is upgraded as part of the Northern Arterial Extension in accordance with the latest plans, the experts agree that:

- there should be no ability for vehicles to turn right out of the access. This is due to the likely adverse safety effects of turning across four lanes of traffic on Cranford Street and the

anticipated volumes to be carried by the road. Instead, vehicles should turn left out of the site and then undertake a u-turn movement at the gap in the raised median on Cranford Street approximately 200m towards the south;

- there should be no ability for vehicles to turn right into the access. This is due to the proximity of the right-turn lane into the Placemakers site opposite. Instead, vehicles should undertake a u-turn movement either at the gap in the raised median on Cranford Street approximately 100m towards the north or at the roundabout further north, and then turn left into the site; and
- vehicles should only be permitted to only turn left into and left out of the site access.

Mr Wright considers that this arrangement of permitted/prohibited turns, while being preferred to permitting all turning movements, will still introduce safety and efficiency effects although these will be minor. Mr Carr considers that in view of the traffic volumes already forecast on Cranford Street, the effects on safety and efficiency will be unnoticeable.

4.3.2 If Cranford Street is Not Upgraded

If Cranford Street is ***not*** upgraded, the experts agree that there are no formal locations where vehicles could undertake a u-turn movement.

In such a case, the experts consider that the existing flush median on Cranford Street should be extended to enable vehicles to turn right into the site, and this is likely to require the Cranford Street carriageway to be widened.

Mr Carr considers that further assessment is required before determining whether a right turn out of the site could be supported. Mr Wright considers that vehicles turning right out of the site will increase the potential for adverse safety and efficiency effects on Cranford Street, and thus access via Frome Street becomes more preferable in that case.

Mr Wright considers that the movement of vehicles turning left out of the site and left into the site will introduce safety and efficiency effects but these will be minor. Mr Carr considers that in view of the traffic volumes already forecast on Cranford Street, the effects of these movements on safety and efficiency will be unnoticeable.

We confirm that this Statement is a true and accurate record of the expert witness conferencing on 23 November 2015

Signed:

Name	**Signature**
Andy Carr	
Tim Wright	

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File Note

By:	Tim Wright
Subject:	Cranford Basin Rural Zoning Transport Evidence – Cranford Street / Case Access Intersection Modelling
Date:	Wednesday 9th December 2015

1 Overview

1.1 I have been asked by the Council to assess the likely operation of the proposed Cranford Street intersection serving the Case site.

1.2 The wider network traffic modelling presented within QTP memoranda of 2nd April and 1st December 2015 assumes that the traffic movements associated with both the Case and Crozier sites would access the local road network (in the Croziers Road / Mc Faddens Road area).

1.3 Modelling of the proposed Cranford Street access intersection has been conducted using SIDRA intersection software. This more detailed model allows the specific characteristics of the proposed intersection to be modelled. Traffic volumes for Cranford Street in the peak hours have been based on those of the CAST model for the 2021 (without NAE and CSU) and 2031 (with NAE and CSU) scenarios. Trip rate assumptions for the assumed 8 household site are as per those reported for the wider network modelling. Trip distribution, determining the left and right turning proportions at the intersection, has been based on the area wide modelling forecast traffic volumes and trip distribution.

2 2021 Without NAE and CSU

2.1 Presently, Cranford Street is two lanes (one in each direction) with a painted flush median extending to around the location of the existing Case residence access, being the location of the proposed RoW providing access to the site. The intersection is almost opposite the Placemakers northernmost entrance, being around 15 metres further to the northwest of the proposed Case site access. The flush median is tapering at this location, being around two metres wide at the Placemakers entrance (and just able to accommodate vehicles waiting to turn right into Placemakers). The presence of the Placemakers' entrance does have safety implications for accommodating the right turns into the Case site. Effectively, right-turners into both sites would need to use the same section of flush median and are directly in conflict with each other.

2.2 It is my understanding from the Expert Conferencing that if Cranford Street were not upgraded prior to development commencing at the Case site, that Mr Carr suggests

access would be gained from a new RoW located further to the northwest of the existing driveway and the Placemakers entrance (Refer to the Joint Witness Statement, 4.3.2). Under such a scenario, localised road widening would be required in order to accommodate a flush median for vehicles turning right into the Case site.

2.3 For a standard give-way T-intersection (with a single approach lane on the Case Access and a flush median on Cranford Street) SIDRA Intersection modelling indicates very high delays for any right turners from the site in the AM peak hour (around 5 minutes) and in the PM peak hour (around 10 minutes). This is because the probability of sufficiently long gaps occurring in both directions on Cranford Street is very low. The actual number of right-turners assumed in the modelling is very low, being just 1 vehicle in each period. However, the point is that delays for any right-turners from the site would be very high and potentially block left turners. Modelled delays for right-turners into the site are relatively low, being greatest in the AM peak hour, at around 30 seconds per vehicle.

2.4 Sidra Intersection 6.1 software includes an option to reflect the fact that as drivers become more delayed, they tend to take greater risks and accept smaller gaps in the mainline traffic streams. This option is not invoked by default. However, it does, in my opinion, provide a more realistic estimate of traffic delays in more congested conditions. However, any resulting significant reduction in modelled delays directly reflects the increased risk-taking behaviour of drivers in accepting smaller gaps. The acceptance of smaller gaps results in more severe breaking of drivers on the main road, with a corresponding increase in the likelihood of collisions and a reduction in the efficiency of the Arterial road network.

2.5 Invoking a medium 'level of gap reduction with opposing flow rate' results in delays of around 2 minutes forecast for right-turners from the site in the morning peak hour and around 3 minutes in the PM peak hour. This level of delay is not considered acceptable and would likely result in greater risk-taking as frustrated drivers seek to take smaller gaps in the mainline flow.

2.6 In theory, an intersection layout that prohibits right-turns from the site but enables right-turns to the site should operate with acceptable delays for vehicles to/from the Case site. However, this would require further engineering works to provide physical medians on both the main carriageway and the site access, both shaped to prohibit the right-turn from the site. Such works would need to be removed when the CSU is constructed.

2.7 A more common arrangement than prohibiting only the right-turn on to an Arterial road is to ban both the right-turn into site and the right-turn out. This is relatively easily achieved though the implementation of a narrow physical median in the centre of the main carriageway. Modelling of such a Left-In, Left-Out (LILO) configuration indicates modest delays of around 20 seconds for left-turners from the site in the morning peak hour. Under such a scenario, vehicles wishing to make a right-turn to/from the site would instead need to use the McFaddens Rd intersection and use the secondary

Frome Place access. As noted above, such physical works required to enforce a LILO operation would need to be removed when the CSU is constructed.

2.8 By way of a sensibility check, the traffic volumes adopted for the 2021 assessment from the wide area traffic modelling using the CAST model have been compared to available data with the CCC count database between 2009 and 2012 (volume and intersection counts). Counts for citybound traffic in the AM peak hour range between 1030 PCUs[1] and 1210 PCUs, with the modelled volume at 2021 being 1350. In the reverse direction (from the city) counts range from 590 to 790 with the modelled volume at 2021 being 770. Thus the modelled volumes appear to be a sensible basis of assessment, particularly given likely continued increases in traffic demands with further development occurring in Waimakariri District.

3 2031 With NAE and CSU

3.1 With the NAE and CSU upgrade assumed to be in place, access would be via a LILO intersection. Vehicles wishing to turn right into the site would perform a U-turn at the proposed NAE / Cranford Street roundabout. Vehicles wishing to turn right from the site would need to first turn left and then perform a U-turn at the location proposed within the NAE and CSU scheme plans (refer Figures 5.1 and 5.2 of the QTP memorandum of 1st December 2015).

3.2 Under the default SIDRA intersection modelling parameters for the assumed LILO intersection form, with traffic volumes on Cranford Street based on the wide area CAST modelling, delays of around 50 seconds are modelled for the left-turn out of the site in the critical AM peak period. This is at Level of Service (**LoS**), and at around the limit of what I consider to be a reasonable delay for side-road traffic in the peak hours. With delays of around a minute or more, side-road traffic is more likely to take greater risks in accepting smaller gaps in the mainline traffic.

3.3 Assuming that drivers do take smaller gaps due to the high opposing flows and the delays that they would otherwise face, invoking a medium 'level of gap reduction with opposing flow rate' results in delays of around 30 seconds (LoS D) forecast. Whilst this is reasonable in terms of a LoS for side road traffic, it confirms my view that the proposed intersection will have an impact on the efficiency and safety of Cranford Street, albeit minor.

3.4 Thus whilst in theory the modelling indicates that, with the NAE and CSU in place, for the scale of development proposed at the Case site (around 8 households) a reasonable level of intersection performance can be anticipated, it will result in some disruption to flows on Cranford Street, due to the anticipated high traffic volumes and the correspondingly small gaps that side-road traffic will likely accept. This will lead to a corresponding increase in breaking manoeuvres on Cranford Street, with platoons of

[1] PCUs are Passenger Car Units. This is the unit of traffic flow used in the CAST wide area traffic modelling. It equates Heavy Vehicles, including buses, to equivalent Car Units, for the purpose of capacity assessment.

vehicles slowing as side road traffic joins the main carriageway, increasing the risk of nose-to-tail collisions. In the multi-lane situation proposed, this will also likely result in an increased incidence of lane changing behaviour to avoid slower drivers and / or breaking manoeuvres, further increasing the risk of collisions and reducing the efficiency of the Major Arterial.

3.5 It is somewhat subjective as to whether the effects of such a proposal are considered less than minor, minor, or more than minor. Due to the relative infrequency with which such interruptions to vehicle flow on Cranford Street may occur (up to 80 times a day for 8 households), I would suggest the proposal would have a minor effect on the efficiency and safety of the road network. However, in terms of cumulative effects on the road network, should adopted Council policy not be upheld in this regard in practice at other similar locations, then in my opinion, such decisions would collectively result in more than minor effects on the efficiency and safety of the road network.

Appendix D - Statement of evidence of Andrew Carr before the Replacement Christchurch District Plan hearing – 15 December 2015

BEFORE THE HEARINGS PANEL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of the Christchurch Replacement District Plan Chapters 14 and 17 (Part) as they relate to Cranford Basin
SUBMITTERS	Gavin Frederick Case, Margaret Mary Case, and Michael Gavin Maurice Case (#3280)

STATEMENT OF EVIDENCE OF ANDREW DAVID CARR

15 DECEMBER 2015

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1. INTRODUCTION

Qualifications and Experience

1.1 My full name is Andrew (Andy) David Carr.

1.2 I am a Chartered Professional Engineer, an International Professional Engineer (New Zealand section of the register) and an Associate Member of the New Zealand Planning Institute. I hold a Masters degree in Transport Engineering and Operations and also a Masters degree in Business Administration.

1.3 I have more than 26 years' experience in traffic engineering, over which time I have been responsible for investigating and evaluating the traffic and transportation impacts of a wide range of land use developments, both in New Zealand and the United Kingdom. I am presently a member of the national committee of the Resource Management Law Association and the immediate past Chair of the Canterbury branch. I have previously served on the Canterbury branch committee of the New Zealand Planning Institute.

1.4 I am presently a director of Carriageway Consulting Ltd, a specialist traffic engineering and transport planning consultancy which I founded in early 2014. My role primarily involves undertaking and reviewing traffic analyses for both resource consent applications and proposed plan changes for a variety of different development types, for both local authorities and private organisations. I am also a Hearings Commissioner and have acted in that role for Greater Wellington Regional Council, Ashburton District Council, Waimakariri District Council and Christchurch City Council.

1.5 Prior to forming Carriageway Consulting Ltd I was employed in senior positions by two other leading specialist consulting traffic engineering companies, and my role included undertaking and managing commissions throughout the South Island.

1.6 I have previously carried out a number of commissions which have involved providing traffic and transportation advice relating to the development of residential subdivisions. These have ranged from the major Prestons and West Kaiapoi subdivisions (2,500 and 1,100 sections respectively), to numerous much smaller proposals involving

10-20 residences. As a result, I am very familiar with the traffic-generating characteristics of residential development.

1.7 I have read the Environment Court's Code of Conduct for expert witnesses contained in the Environment Court Practice Note (2014), and I agree to comply with it. My qualifications as an expert are set out above. I confirm that the issues addressed in this statement of evidence are within my area of expertise except where I state I am relying on what I have been told by another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope of Evidence

1.8 In this matter, I have been asked by submitters Gavin, Margaret and Michael Case to provide advice in respect of the traffic and transportation implications of their submission (#3280) to the proposed Replacement District Plan ("*pRDP*") that land at 340 Cranford Street should be rezoned as Residential Suburban.

1.9 For clarity, I did not assist in the preparation of the submission and was engaged after the submission was lodged.

1.10 The documents I have used, or referred to, in forming my views while preparing this brief of evidence are:

a. Hearing Panel Decision 7 "Transport (Part) and Relevant Definitions", which I understand is now operative;

b. Opus Drawing 'Part Plan CH 9200 – McFaddens Rd' dated 18/02/2015; and

c. The evidence of Mr Tim Wright and Mr Ivan Thomson for the Christchurch City Council ('*City Council*').

Conferencing

1.11 I attended expert witness conferencing on 25 November 2015 with Mr Tim Wright, the City Council's consultant transport planner, which resulted in a Joint Witness Statement. The conferencing narrowed the matters in contention to just one, which relates to the desirability of

serving the site via Cranford Street rather than via local roads. My evidence therefore focusses on this issue.

2. SUMMARY OF EVIDENCE

2.1 In my view, serving a small residential subdivision of the scale proposed by the submitters via either individual private driveways, or one consolidated access directly onto Cranford Street under its current configuration, would not be consistent with the relevant pRDP Objectives and Policies.

2.2 However, I consider that serving such a subdivision via one consolidated access directly onto Cranford Street under the configuration anticipated by the currently-proposed improvement scheme would be consistent with the relevant pRDP Objectives and Policies.

3. BACKGROUND

Cranford Street

3.1 This section of Cranford Street is classified in the roading hierarchy of the pRDP as a Major Arterial Road. Table 7.17 of Appendix 7.12 of the pRDP explains that this means "*caters especially for longer trips. Major Arterial Roads are the dominant elements of the roading network which connect the major localities of the region, both within and beyond the main urban area, and link to the most important external localities. Some major arterials, particularly some state highways, serve an important bypass function within Christchurch District, directing traffic through it to areas beyond. They are managed to minimise adverse effects from access on network efficiency.*"[1]

3.2 A major roading improvement scheme is proposed for Cranford Street in future, as it becomes the continuation of the Northern Arterial further towards the northwest. I attach the most recent scheme layout of which I am aware (Attachment A, with an expanded view of the relevant section in Attachment B), which shows that a solid median is

[1] Table 7.17, pRDP Hearing Panel Decision 7 "*Transport (Part) and Relevant Definitions*"

proposed for the section of Cranford Street adjacent to the submitters' land. Since the median means that each existing access is restricted to left-in and left-out turning movements only, formal turning facilities are proposed through the median to enable vehicles to undertake u-turn and right-turn movements as well as at the proposed roundabout further north.

3.3 I understand that the Cranford Street improvement scheme is not presently funded.

Case Submission

3.4 The Case submission includes two indicative subdivision layouts showing up to nine residential lots being formed. This scale of development will significantly limit any potential adverse transportation effects, as it means that in the weekday peak hours the site will generate just 9 vehicle movements (7-8 outgoing and 1-2 incoming in the morning peak hour, and 3-4 outgoing and 5-6 incoming in the evening peak hour). My assessment is based upon traffic volumes of this scale.

Objectives and Policies

3.5 I consider that one Objective and two Policies are relevant to considering whether it is appropriate for Cranford Street to serve residential development on the submitters' land:

Objective 1 – Integrated transport system for Christchurch District

a. An integrated transport system for Christchurch District:

i. that is safe and efficient for all transport modes;

ii. that is responsive to the current recovery needs, future needs, and enables economic development;

iii. that supports safe, healthy and liveable communities by maximising integration with land use;

iv. that reduces dependency on private motor vehicles and promotes the use of public and active transport;

v. that is managed using the one network approach.

Policy 1 – Establishment of a road classification system

a. Identify a road network that connects people and places and recognises different access and movement functions for all people and transport modes, whilst:

i. supporting the safe and efficient operation of the transport network;

ii. providing for public places in accordance with the function of the road to enable community activities including opportunities for people to interact and spend time,

iii. providing space for utility services;

iv. reflecting neighbourhood identity and amenity;

v. recognising cross-boundary connections with adjoining districts, and

vi. providing for the efficient and effective functioning of the strategic transport network, including for freight.

Policy 3 – Vehicle access and manoeuvring

Provide vehicle access and manoeuvring, including for emergency service vehicles, compatible with the road classification, which ensures safety, and the efficiency of the transport system.

4. ROAD SAFETY ISSUES (ASSUMING CRANFORD STREET IMPROVEMENTS IN PLACE)

4.1 To evaluate the potential road safety effects of serving the submitters' land from Cranford Street I have firstly reviewed the type and number of reported crashes on the road using the NZTA Crash Analysis System. Over the past ten years, there have been 19 crashes on the section of Cranford Street between the submitters land and McFaddens Road of which 5 have involved drivers entering or exiting private accesses. In this regard, I note that there are already approximately 20 residential allotments which have direct access onto the northern side Cranford Street between the southern boundary of the submitters' land and McFaddens Road further south.

4.2 I have reviewed the five crashes recorded over the past ten years associated with private accesses in more detail.

a. Three crashes occurred when drivers emerged from driveways to turn right and struck other vehicles that were within the central flush median, also with the intention of turning right;

b. One crash occurred when a driver was waiting to turn right from the central flush median and was struck from behind by another vehicle; and

c. One crash occurred when a driver emerged from a private driveway to turn right, and was struck by a vehicle travelling within the southbound traffic lane of Cranford Street.

4.3 I note that four of these five accidents related to a right-turning movement out of a private driveway, whereas the presence of the proposed raised median on Cranford Street effectively prevents such a movement from taking place. The provision of formal turning bays within the median will also assist drivers in distinguishing vehicles that are turning from those that are travelling straight ahead and thus remove a significant contributing factor from the fifth reported accidents. Accordingly, I consider that the implementation of the Cranford Street improvement scheme will considerably reduce any road safety risk through removing the major contributing factors to the historic crashes on the road.

4.4 With regard to any additional vehicles undertaking u-turn movements within Cranford Street, the road will be designed in a manner which makes specific provision for such manoeuvres, and thus I anticipate that all relevant safety standards will be met. Moreover, the small scale of development of the submitters' land will generate very few additional movements even at the peak times.

4.5 As a result, from a solely road safety point of view I do not consider that there would be any noticeable increase in risk if residential development on the submitters' land had direct access onto Cranford Street and if the road improvement scheme was in place. This is because the improvement scheme removes major contributing factors

from the historic crashes, and the geometry of the improved road will meet current standards.

5. ROAD EFFICIENCY ISSUES (ASSUMING CRANFORD STREET IMPROVEMENTS IN PLACE)

5.1 If the submitters' land was developed in an arrangement whereby each lot had its own access onto Cranford Street, one necessary outcome of this would be that there would be multiple locations at which a vehicle could turn from Cranford Street into the appropriate lot, and similarly, multiple locations at which a vehicle could emerge onto Cranford Street. This would provide a consistent environment with that already in place further south.

5.2 However, I consider that there is likely to be an effect on the efficiency of the road under such an arrangement. In particular, through traffic is likely be delayed due to vehicles slowing within the southbound traffic lane before turning into residential lots, and also may need to slow to accommodate vehicles that have emerged from the land. In my view introducing delays in this manner would be contrary to Objective 1a(i), Policy 1a(i) and Policy 3.

5.3 To avoid this scenario, it would be possible to consolidate the accesses to each lot onto one access road, and this in turn would connect to Cranford Street. This then means that a suitable acceleration and deceleration lane or splay for traffic turning from and to the access road can be provided, thereby eliminating the potential for delays to through traffic.

5.4 Any vehicles travelling to or from the submitters' land that could undertake u-turn movements within Cranford Street would be required to 'give-way' to through traffic and will therefore not impede it. The small scale of development of the submitters' land means that it is extremely unlikely that any queues of turning vehicles would extend back into the through traffic lanes.

5.5 Accordingly, subject to the provision of one access road with suitable acceleration and deceleration lanes or splays, I do not consider that there would be any discernible change in the efficiency of Cranford

Street due to traffic associated with development of the submitters' land.

6. ROAD SAFETY AND EFFICIENCY ISSUES (ASSUMING NO CRANFORD STREET IMPROVEMENTS IN PLACE)

6.1 If the Cranford Street improvement scheme did not progress, drivers would be able to undertake right-turn movements out of the submitters' land. Based on the prevailing accident record, I do not consider that this would foster road safety on this part of the roading network and I therefore do not support such an arrangement.

6.2 Rather, in my view, to avoid safety issues arising a raised median would need to be provided to physically prevent right-turn movements out of the site. This then means that emerging drivers wishing to travel north would be required to undertake a u-turn movement, yet no formal facilities would be available. It would therefore be necessary to make such provision.

6.3 With regard to vehicles turning right into the site, I consider that the existing flush median on Cranford Street could be extended to form an auxiliary right-turn lane. However, this is likely to require the Cranford Street carriageway to be widened.

6.4 As is the case for the scenario where the improvement scheme is put in place, I consider that there would still be a requirement for suitable deceleration and acceleration lanes or splays at the site access to ensure that through traffic was not impeded.

6.5 Overall then, in my view, **if** the Cranford Street improvement scheme does not progress **and** the current road layout remains, then in my view, Objective 1 and Policies 1 and 3 of the pRDP are better met by serving the submitters' land via local roads as set out in the Joint Expert Witness Statement.

6.6 Conversely, constructing measures on Cranford Street such as a raised median and associated u-turn facilities, plus a right-turn lane into the site, together with widening of the carriageway and providing suitable acceleration and deceleration lanes or splays at the site

access itself, would result in the arrangement meeting the relevant Objectives and Policies.

7. REVIEW OF CHRISTCHURCH CITY COUNCIL EVIDENCE

Tim Wright, Council Consultant Transport Planner

7.1 Mr Wright notes that in his view, serving the submitters' land via an access onto Cranford Street would create "*some*" minor efficiency and safety effects on the road due to turning vehicles impeding through traffic, and so access should be via local roads. He considers that this better achieves "*several*" relevant pRDP Objectives and Policies[2], although he does not set out which nor explain the detail of his concerns.

7.2 Mr Wright also suggests that the Objectives and Policies seek to manage Major Arterial roads to minimise adverse effects from access on network efficiency[3]. I note though that this particular wording is not part of any of the Objectives and Policies, but rather is included within an explanation of the road function under Table 7.17 of Appendix 7.12 of the pRDP. I have set out my assessment of the actual Objectives and Policies previously in this statement.

7.3 Irrespective, in my view, the wording of "*minimise*" rather than the more prescriptive "*avoid*" does not preclude an access being formed between the submitters' land and Cranford Street. There are access options (such as each residential lot having a private driveway onto Cranford Street) that certainly do not achieve the intent of Appendix 7.12 of the pRDP and where the effects would demonstrably not be minimised. However, in my view a single access to serve the land, served by a left-in/left-out arrangement with suitable deceleration and acceleration lanes or splays, would minimise any adverse access effects.

7.4 I also note that Mr Wright then proposes that any access strategy for the submitters land should "*avoid*" access from the arterial road

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[2] Wright Evidence paragraph 8.2
[3] Wright Evidence paragraph 8.2

network[4]. In my view, this is a step beyond what is required under the pRDP.

7.5 Mr Wright highlights that alternative access arrangements are possible via the Crozier land[5]. However this necessarily then means that development of the submitters' land is contingent on the development of another site. In my experience, making access to a site reliant on a third party is very unusual.

7.6 He also describes how it is important to recognise that if access and road intersections on Arterial Roads are frequent, then their efficiency is reduced, thereby potentially displacing traffic onto Collector and Local Roads through neighbourhoods. While acknowledging that this this is often the case, I do not believe that this is a risk here. In the first instance, there are already more than 20 private driveways on Cranford Street just south of the submitters' land. If the Council had concerns about the effects of these on the function of Cranford Street, I would expect that this would be addressed through the proposed improvement scheme but rather, the existing access arrangements have been retained.

7.7 In this regard, Mr Wright sets out that he considers that the potential direct access from the submitters' land onto Cranford Street could impede platoons of traffic up to 80 times a day[6]. Applying the same calculation to the existing driveways on Cranford Street, I note that between the submitters land and McFadden Way traffic on Cranford Street will already be impeded more than 200 times a day at multiple accesses where vehicles potentially have to reverse onto the road. I consider it is highly doubtful whether a properly designed access to serve the submitters' land would demonstrably exacerbate this situation.

7.8 In my view it is also unlikely that rivers would reassign onto other roads even if there was to be some minor impedance on Cranford Street as a result of vehicles associated with the existing properties (with or without development of the submitters' land), because there are few alternative routes. Mr Wright appears to acknowledge this to

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[4] Wright Evidence paragraph 8.14
[5] Wright Evidence Attachment D, paragraph 5.3.12
[6] Wright Evidence Attachment D, paragraph 5.3.9

be the case, setting out that "*whilst the Case and Croziers sites could have different access arrangements, this makes little difference to the assessment of wider network traffic impacts*"[7].

7.9 With regard to the use of Frome Place, Mr Wright notes that he does not recommend that this is used for access for more than five houses without improvement[8] and that increased vehicular use of this access should be minimised[9] . This is contrary to the Joint Witness Statement, where it was agreed that the access was suitable for up to eight residential properties[10].

Ivan Thomson, Council Planner

7.10 Mr Thomson sets out that in his view, serving the submitters' land through the adjacent Crozier property would give rise to considerable cost and uncertainty and if possible the property should be accessed independently[11]. He then suggests that it would be acceptable for four or five properties to gain access from Cranford Street[12]. This is contrary to Mr Wright's position, that no access should be allowed.

7.11 This indicates that the Council's view is that it would be an acceptable outcome for 25 residences (20 to the south of the submitter's land plus 5 new residences on the submitters' land) to have access onto Cranford Street. Using Mr Wright's methodology, this equates to 250 times per day where through traffic could be impeded. However it would appear to be unacceptable for 29-30 residences to have access, equating to 290-300 potential impedance movements. No analysis is presented to justify this, and I have therefore been unable to explore in detail why the Council holds this view. Rather, I consider that the differences between the safety and efficiency aspects of the two scenarios is negligible.

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[7] Wright Evidence Attachment D, paragraph 3.1 footnote
[8] Wright Evidence Attachment D, paragraph 5.3.15
[9] Wright Evidence Attachment D, paragraph 5.3.16
[10] Joint Statement of Transport Expert Witnesses, paragraph 4.2.2
[11] Thomson Evidence paragraph 9.15
[12] Thomson Evidence paragraph 9.17

8. SUMMARY AND CONCLUSIONS

8.1 Overall I consider that serving the submitters land from Cranford Street would be consistent with Objective 1 and Policies 1 and 3 of the pRDP provided that:

a. the layout of Cranford Street is upgraded in the manner anticipated by the currently-proposed improvement scheme for the road corridor, or similar upgrades are put in place; **and**

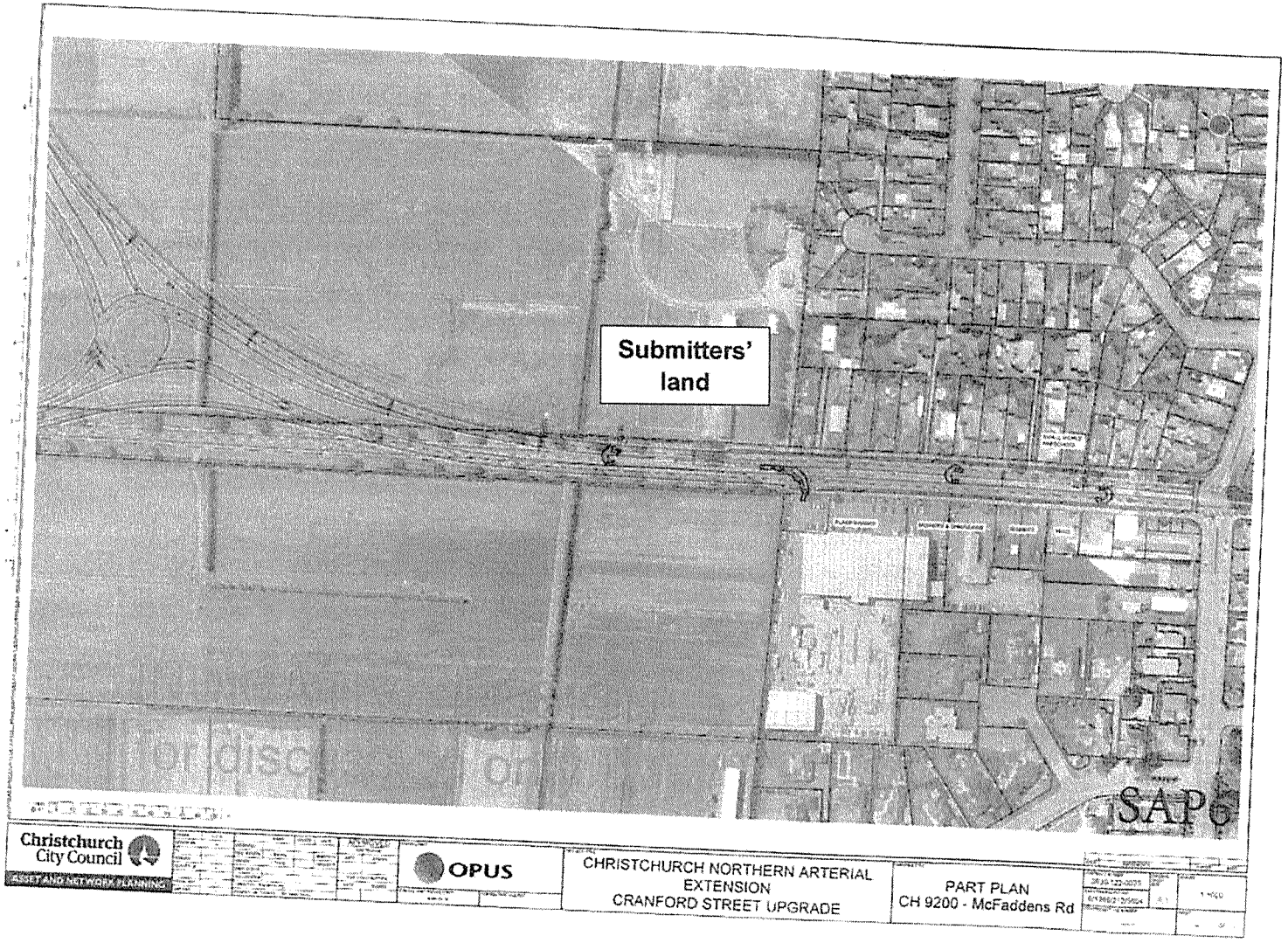
b. only one access is permitted from Cranford Street; **and**

c. the site access has suitable acceleration and deceleration lanes or splays.

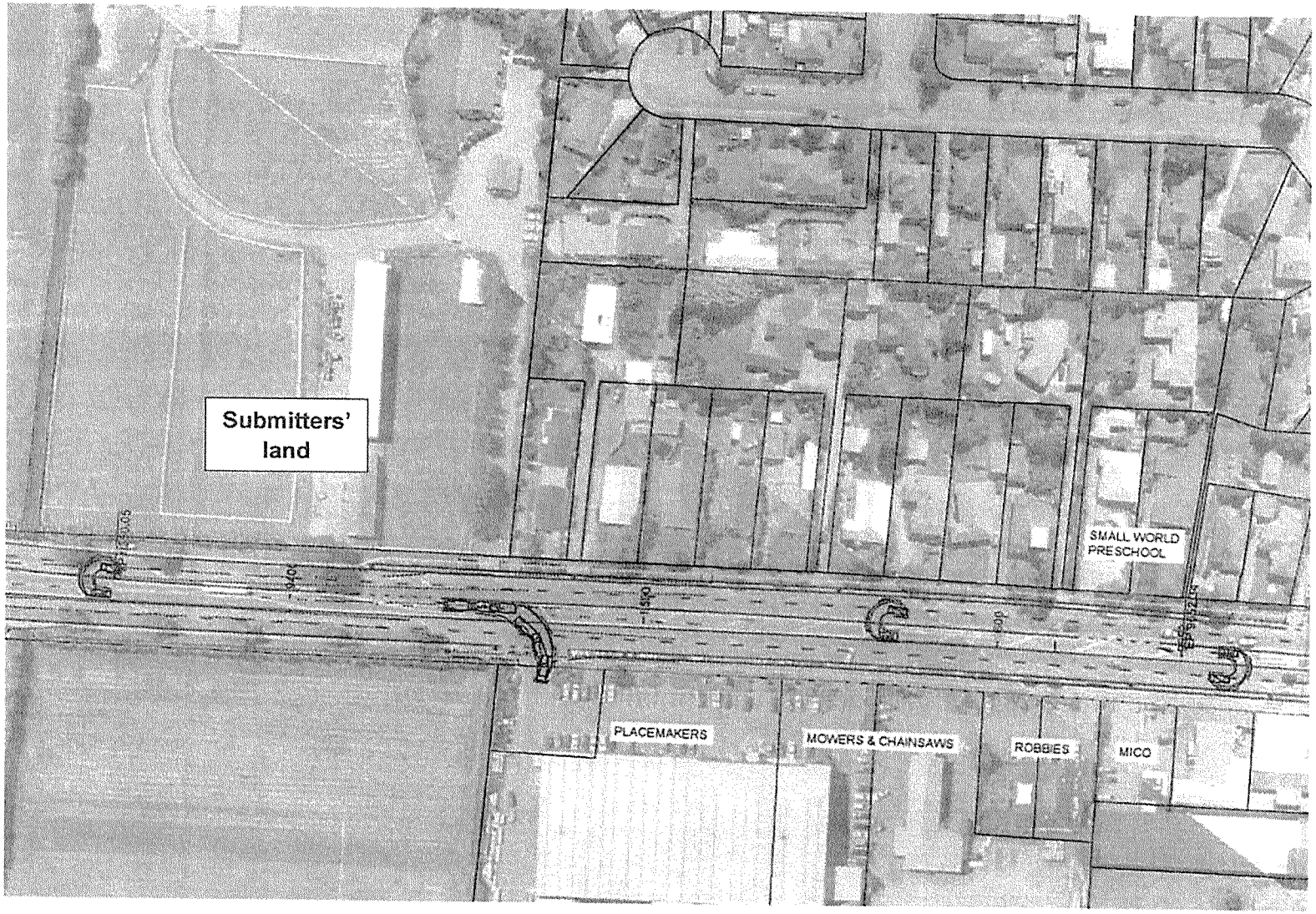
8.2 If the submitters' land is served from local roads, I also consider that this would be consistent with Objective 1 and Policies 1 and 3 of the pRDP.

Andrew D Carr
15 December 2015

Attachment A: Proposed Improvement Scheme for Cranford Street



Attachment B: Expanded View of Proposed Improvement Scheme for Cranford Street



Appendix E - North-East Papanui Outline Development Plan Transport Assessment – 8 December 2016

QTP
Quality Transport Planning

QTP Ltd
Level 1 • Cowlishaw Mews • 48 Worcester Boulevard
PO Box 106 • Christchurch 8140 • New Zealand
Phone (+64) 03 379 2489

Memorandum

To:	Mike Calvert
From:	Paul Roberts
Subject:	North-East Papanui Outline Development Plan Transport Assessment
Date:	Friday 8th December 2016
Copy:	Sarah Oliver

Dear Mike,

Thank you for asking QTP to assist with the transport assessment you require as an input to the Outline Development Plan (**ODP**) for North-East Papanui, currently being developed by Christchurch City Council (**CCC**). The ODP seeks to integrate the various facets of a proposed residential development, in accordance with the proposed Replacement District Plan (**pRDP**) and the Regional Policy Statement.

This assessment provides a technical basis for input into the ODP development. In particular it seeks to ensure a comprehensive, fully connected road network that can serve the North-East Papanui area is ultimately enabled and whose design has been supported through testing and consideration of various road network options.

This assessment is also required to demonstrate whether any adverse traffic effects on the local (and wider) network of the draft ODP and proposed residential densities are no more than minor. Should modelling demonstrate otherwise, then mitigation measures should be suggested. These might include (but are not limited to): maximum household numbers; less residentially zoned land; lower densities; or limits on development before the Northern Arterial (or other network improvements) is completed. A short discussion on the positive effects of the location of the proposed residential zoning relative to the Key Activity Centre (**KAC**), high frequency bus routes and major cycleway is also to be provided.

Investigations into potential road network options for the Residential area have previously been considered in reports provided to CCC by QTP. These being:

- Cranford Basin Proposed Rezoning Transport Assessment – 2 April 2015
- Cranford Basin Submissions Transport Modelling and Access Review Memorandum – 1 December 2015
- Statement of evidence of Tim Wright before the Replacement Christchurch District Plan Hearings Panel – 10 December 2015

Whilst these previous (transport) investigations do provide a good starting point from which to demonstrate a high-level consideration of the transport effects of the zoning now proposed, it is noted that Council have since further developed their thoughts on what may be the most-appropriate road network and land use (type and density) for the area, based not only on the previous transport advice but a wider range of relevant urban planning considerations.

This investigation therefore uses the latest design changes as the starting point for its updated assessment. Specifically, it should be noted that the issues previously raised around the Case and Croziers land and other land to the north of Cranford Street do not need to be addressed in this commission.

1 Scope of Assessment

1.1 The draft ODP landuse and network provided as the basis for this updated assessment is shown in Figure 1-1.

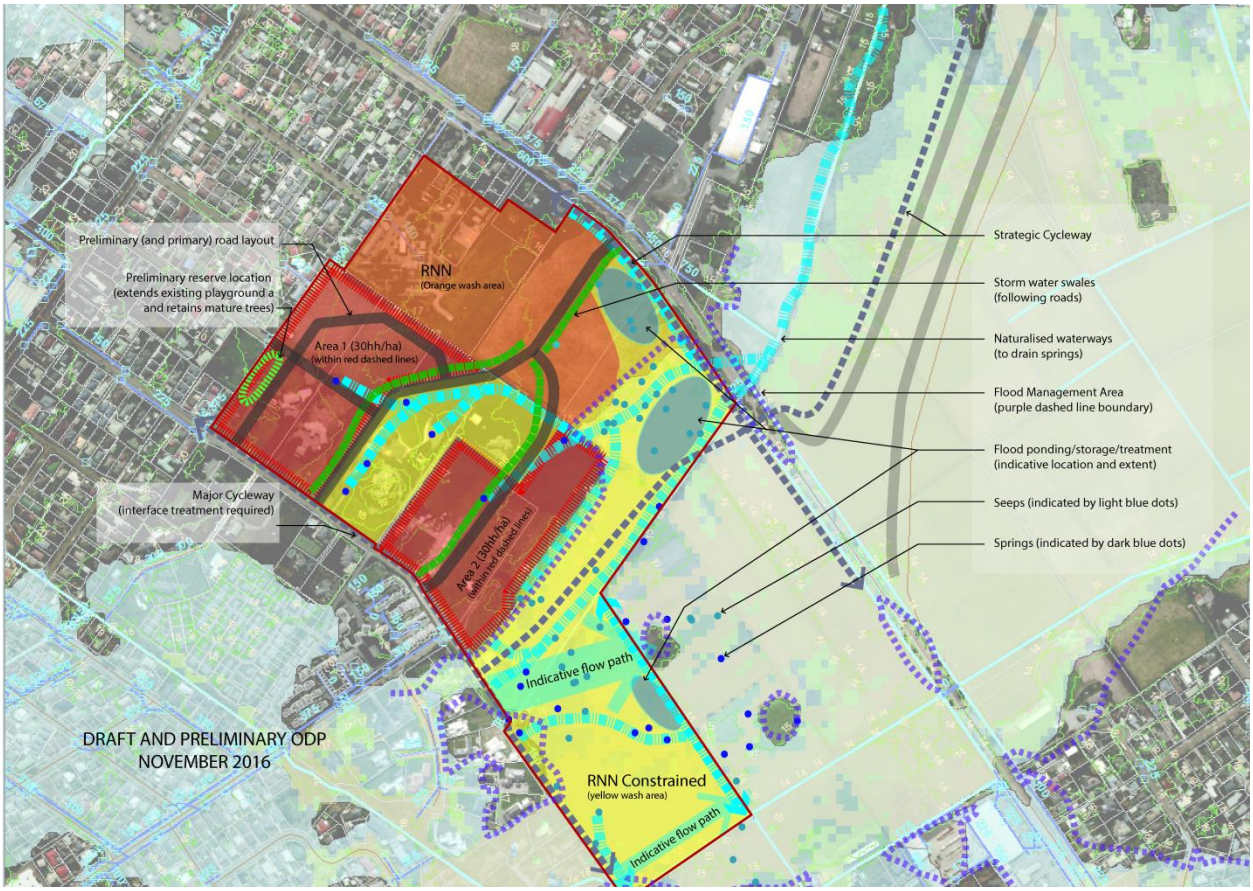


Figure 1-1: Draft North-East Papanui Outline Development Plan landuse.

1.2 The specific requirements of this assessment are to:

- Refine base and do something networks for the draft ODP (using 2016 network with 2021 demands to indicate potential effects prior to the Northern Arterial (**NA**) / Northern Arterial Extension (**NAE**) and the 2031 model to assess longer-term effects (with NA/NAE);
- Estimate the traffic demands for the proposed development;
- Analyse the effects and identify mitigation measures (if necessary);
- Include high level accessibility, multi-modal and integrated transport considerations (as canvassed in the April 2015 assessment); and
- Provide a short Technical Report (this memo) summarising the assumptions, methodology and findings.

1.3 As with the previously-reported assessments, the traffic modelling conducted to inform this assessment has used Council's Christchurch Assignment and Simulation Traffic (**CAST**) model. Since the previous assessments however, this model has undergone a comprehensive update, in terms of both networks and future land use assumptions. This study therefore both makes use of the latest version of the model (**v16a**) as the basis for assessment, as well as reflecting the land use and transport network design changes within the draft ODP illustrated above.

2 Methodology

2.1 As for the previous assessments, this study has involved modelling the transport (traffic) impacts of increased household numbers adjacent to existing residential areas.

2.2 The CAST model is considered a reasonable basis for identifying the (principal) potential effects on the local (and wider) road network. This assignment and simulation traffic model allows all trips to re-route to their optimal route under the modelled traffic conditions and in this regard is considerably more sophisticated than traditional techniques applied in undertaking Integrated Transport Assessments (ITAs), where trip distribution is estimated and new trips are simply superimposed on the base situation. Such analysis does not allow for the reassignment of traffic across the network and is often limited in scope (network coverage). Conversely, the CAST model represents the whole of Christchurch city in 'simulation' level of detail, allowing the wider effects of re-zoning to be identified.

2.3 Our assessment has been conducted for the weekday morning and evening peak hours, these being 07:30-08:30 and 16:30-17:30 respectively. Assessments have been conducted for these periods at both a potential 'short-term' (2021) and the 'medium-term' (2031) horizons.

2.4 The basis for the potential 'short-term' (2021) horizon is however the existing (2016) v16a CAST network model, to which forecast (v16a) 2021 traffic demands have been applied.

2.5 The rationale behind this is the use of the 2016 road network provides a suitable base by which to assess the potential impact of the proposed ODP area *prior* to completion of the Northern Arterial, Northern Arterial Extension (**NAE**) and Cranford Street Upgrade (**CSU**), which together are hereafter referred to collectively as the Christchurch Northern Connections (**CNC**).

2.6 This network thus provides the basis to consider the potential land use scenarios (with and without the ODP) either:

- should the implementation of the CNC schemes be deferred beyond the currently-anticipated timeframes; and/or
- whether and of what scale any limitations might be appropriate on ODP development, prior to their completion: The existing (v16a) 2021 network model assumes that all of these major infrastructure schemes *will* be completed by 2021 and removal of the schemes from this network (to reflect a potential 'pre-Northern

Connections' network') would have been much less-expedient than adoption of the existing 2016 network as a base for an appropriate network.

2.7 Consistent with our previous assessments, the base model distribution of the trips of residential areas surrounding the ODP area is considered a reasonable basis for the distribution of ODP residential trips under increased traffic generation.

3 Traffic Demands

3.1 The draft ODP now contemplates development that differs from the six potential land use scenarios assessed through previously-reported transport investigations. Thus the current draft ODP landuse is reported upon here as a single additional (landuse) scenario ('Scenario 7').

3.2 The trip rates adopted to determine traffic demands for this scenario are however consistent with those applied for previous assessments. These are shown, along with the revised assumed potential residential household (**hh**) yields, in Table 3.1.

ODP Area	Gross Area (ha)	Net Area (ha)	Density (hh/ha)	HH Yield	Rate	Trip Rates (VPH/hh)					
						AM		PM		AM	PM
						From	To	From	To	2-Way	2-Way
Area 1 (RMD)	5.1	3.6	30	107	Med	0.44	0.18	0.31	0.49	0.62	0.80
Area 2 (RMD)	4.8	3.3	30	100	Med	0.44	0.18	0.31	0.49	0.62	0.80
Area 3 (RNN)	7.1	5.0	15	74	Low	0.76	0.31	0.46	0.72	1.07	1.18
Area 4 (RNN Constrained)	16.0	11.2	8	89	Low	0.76	0.31	0.46	0.72	1.07	1.18
Total ODP Area	**32.9**	**23.0**	**16.1**	**370**		**0.62**	**0.25**	**0.39**	**0.62**	**0.87**	**1.01**

Table 3.1: Adopted Yields and Trip Rates for Traffic Generation

3.3 The above yields and trip rates translate to the anticipated traffic generation shown in Table 3.2.

ODP Area	HH Yield	Vehicle Trips (VPH)					
		AM		PM		AM	PM
		From	To	From	To	2-Way	2-Way
Area 1 (RMD)	107	81	33	49	77	114	126
Area 2 (RMD)	100	76	31	46	72	107	118
Area 3 (RNN)	74	33	13	23	36	46	59
Area 4 (RNN Constrained)	89	39	16	28	44	55	71
Total ODP Area	**370**	**229**	**94**	**146**	**229**	**323**	**375**

Table 3.2: ODP Traffic Generation

3.4 We note that the total generation now anticipated thus falls towards the lower-end of the spectrum of the 6 scenarios previously assessed. These ranged from a total yield of 200hh (exclusively residential), with estimated PM peak hour traffic generation of 236vph, up to a potential commercial and residential scenario (over a wider area), which was anticipated to potentially generate up to 1,610vph.

3.5 As with the previous assessments:

- Adopted rates are generally reflective of 'design' 85th %ile rates and draw on a number of sources including the New Zealand Trips Database, NZTA Research Report RR453, the RTA Guide to Traffic Generating Developments, rates adopted in Transport Assessments conducted by Council, QTP and third parties.

- All traffic generation is assumed to be additional to the adjusted base-case[1] generic CAST models. No adjustment has been made to traffic generation in other locations in the future year models that might be anticipated under an assumed fixed population. In this regard, the assessment is considered robust in terms of assessed network operation. In practice, the effects of applying such adjustments on a model-wide basis are likely to be insignificant given the total traffic generation above equates to around 1% of total model demands.

3.6 The development area has been represented by four new zones coded into the model to the south of Cranford Street, representing each of the areas identified in Figure 1-1 and the tables above. The distribution of trips to these areas is based on the aggregate distribution of trips to and from surrounding residential areas (or model zones).

3.7 In addition to the potential traffic generated by development within the ODP area, a further zone (#3068) has also been added, to more precisely reflect the *existing* development (within zone #3061) serviced *only* by Shearer Avenue: Given that the outline ODP draft primary road network now proposes a connection to this street, this model modification thus allows any potential increase in demand, given the ODP, to be identified and reported upon.

3.8 Finally, the base (v16a) demands have been slightly modified in selected areas[2] surrounding the ODP, to reflect the potential for development up to the densities now anticipated in the pRDP and in particular the 'RMD' areas to the south-west. These modifications have been applied to provide an updated base for assessment of the incremental effect of the potential residential development within the ODP alone.

[1] The generic CAST models have been adjusted (in terms of both network and demand) to form an appropriate evaluation base ('without-ODP') for this ODP assessment, as explained below.

[2] CAST zones #3051, 3052, 3063, 3074, 3075 & 4411.

4 Road Networks Assessed

4.1 As shown in Figure 1-1, the Council have provided an initial conceptual primary road network which has been used as the basis of the traffic modelling conducted to inform the assessment of effects reported here. The model networks adopted, given implementation of the ODP are illustrated in the following diagrams.

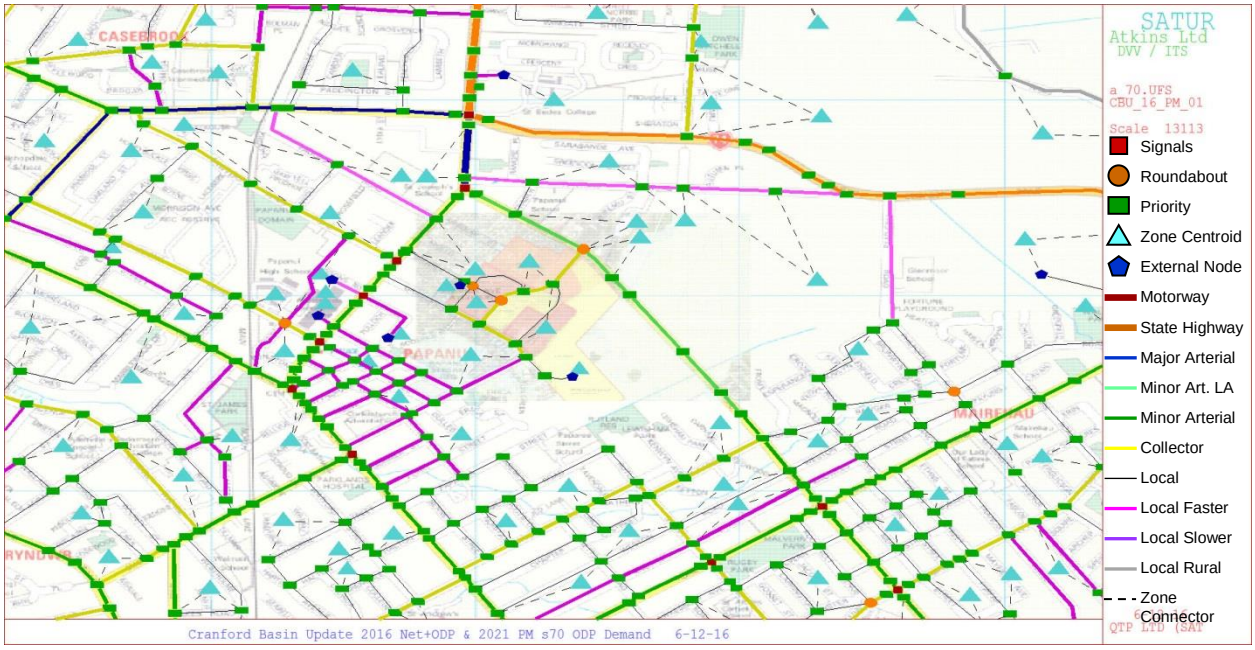


Figure 4-1: Initial Road Network ('2021' with ODP – No CNC)

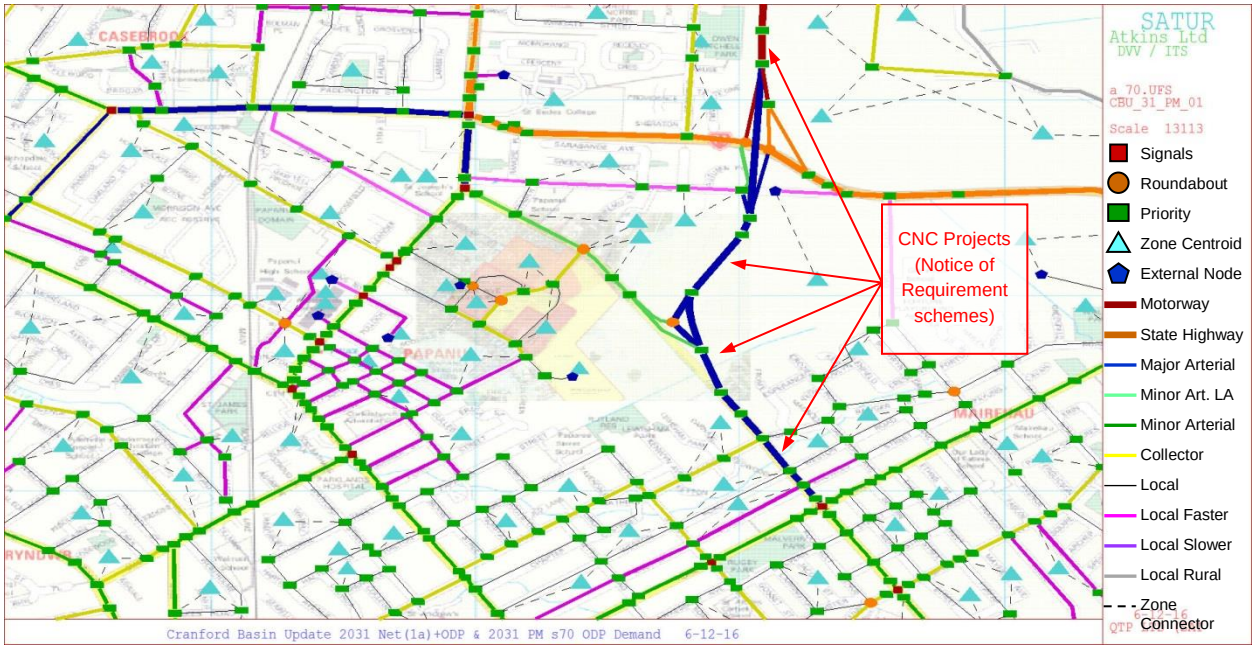


Figure 4-2: Initial Road Network (2031 with ODP – CNC in place)

4.2 It might be noted from both the above two diagrams (which illustrate the initial 'with-ODP' networks used for this assessment), that:

- The starting point is the 'generic' (official v16a release) CAST networks, being the 2016 (used for assessment under 2021 demands) and 2031 networks.

- To form a modified base for this assessment (the 'without-ODP' scenarios), the v16a-version generic networks have been modified with respect to:
  - Disaggregation (splitting) of zones within and adjacent to the ODP area, as noted in paragraph 3.7.
  - Addition of Shearer Avenue (given the potential with-ODP connection);
  - Addition of the westbound-eastbound U-turn proposed on QEII Drive east of Main North Road (given CNC proposed Outline Plan changes described further below);
  - Addition of a signal crossing between Grassmere Street and Sawyers Arms Road planned as part of the Papanui Parallel Major Cycle route (**MCR**), (given this scheme is presently under construction); and
  - Addition of the nodes where the 'with-ODP' network would intersect with the base network, in order to allow consistent illustration of differences between 'with-ODP' and 'without-ODP' scenarios.
- For the 'with-ODP' networks, priority intersections have (initially) been assumed at the interface between all connections between the primary ODP network and Grassmere Street, whilst a roundabout intersection has been assumed with the single connection assumed with Cranford Street. These initial assumptions reflect potentially-appropriate forms, given the anticipated demands on the respective roads.
- The layout on the wider road network shown in Figure 4-2 reflects the CNC schemes which were considered when the Notice of Requirements (**NoR**) for both the Northern Arterial and NAE were considered and approved following hearings in 2015. It is the NoR proposals which are reflected within the current v16a CAST generic future models (v16a) and which form the starting point for this updated assessment.

4.3 More recently however, the NZ Transport Agency and CCC have submitted Outline Plans for the CNC works which reflect modified arrangements (compared with those presented within the respective NoRs). These are currently being processed under s176A of the Resource Management Act and no decisions have yet been made to the Requiring Authorities, as to whether and what modifications to their Outline Plans may be recommended.

4.4 The principal CNC Outline Plan changes within the vicinity of the ODP now proposed by the Requiring Authorities are illustrated within Figure 4-3. Those with the greatest potential to affect traffic flows around (and through) the ODP area are:

- The proposed removal of a southbound right-turn option from the NAE to Cranford Street (north) at the proposed roundabout;
- Removal of the northbound slip lane bypassing the Cranford/NAE roundabout; and
- The proposed removal of a southbound traffic lane from the western NA/QEII Drive Roundabout to Winters Road; this being substituted by the proposed opening of a Left In/Left Out (LILO) intersection at the intersection of QEII Drive and Grimseys Road (south).

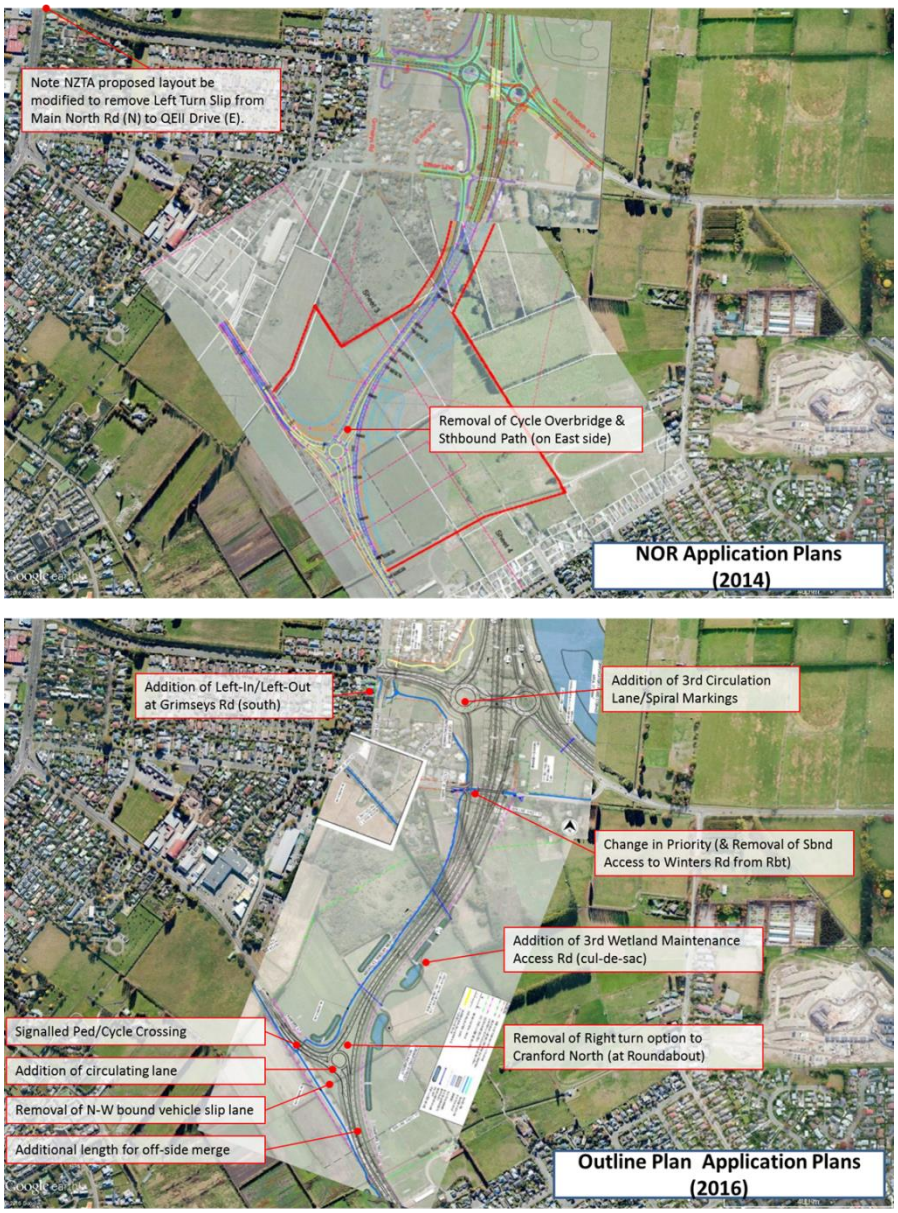


Figure 4-3: Local Changes Proposed within CNC Project Outline Plans (cf NoR)

4.5 These changes have therefore been examined through further network model runs, to illustrate the potential impact of these changes with and without the ODP (in 2031 only) – and indicate any changes which may be of significance for the ODP assessment, which is the focus of this investigation.

4.6 Finally, the 'with-ODP' networks have been (briefly) examined to illustrate whether and to what extent additional traffic–calming measures might limit any 'extraneous' (non-ODP) traffic that could be attracted to travel through the ODP area (with the potential to affect the amenity of both the ODP and surrounding residential areas). These measures have been reflected (notionally[3]), through the addition of further roundabout intersections, at the ODP interface with Grassmere Street, illustrated by the model

[3] Potential traffic-calming measures could be more extensive, if required but examination of multiple options is beyond the scope of the current study.

network diagram shown in Figure 4-4.

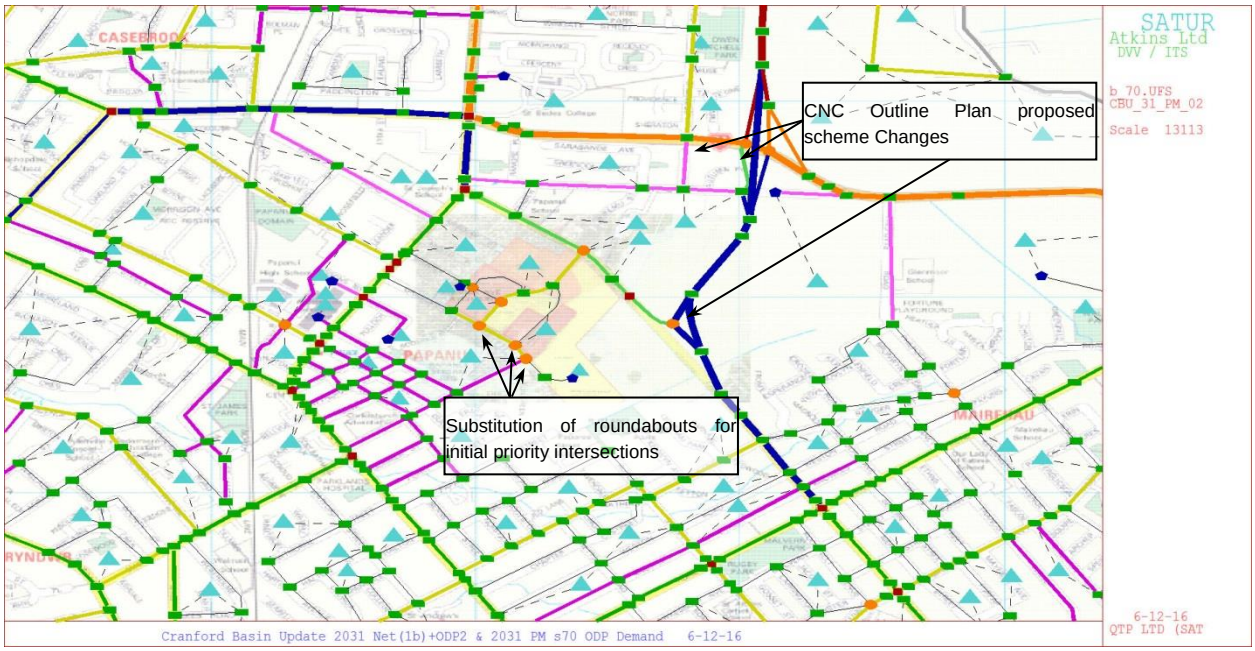


Figure 4-4: Modelled Network showing CNC Outline Plan Changes and modified ODP Intersections

4.7 A summary of all demand/network scenarios assessed (each being modelled for both AM and PM peak hours in the relevant years) is presented, together with the relevant network file references in Table 4.1.

Demand Scenario	Without ODP	With ODP
2021	No CNC	No CNC
	*CBU_16_**_00a_00*	*CBU_16_**_01a_70*
		No CNC, Grassmere Rbts
		*CBU_16_**_02a_70*
2031	With CNC (NoR Schemes)	With CNC (NoR Schemes)
	*CBU_31_**_00a_00*	*CBU_31_**_01a_70*
	With CNC (OP Schemes)	With CNC (OP Schemes)
	*CBU_31_**_00b_00*	*CBU_31_**_01b_70*
		With CNC (OP Schemes) + Grassmere Rbts
		*CBU_31_**_02b_70*
** refers to the time period modelled ('AM' or 'PM' Peak hour)		

Table 4.1: Summary of Modelled Assessment Scenarios (*Network references in italics*)

5 Base Traffic Models (the Receiving Environment)

5.1 This Memo is focused on summarising the potential effects of the proposed rezoning. However, given the requirement to undertake traffic modelling at 2021 (with No Northern Arterial or Extension) and 2031 (with Northern Arterial and Extension), it is useful to first understand how traffic patterns may change in the future, irrespective of the proposed ODP rezoning.

5.2 The following diagrams provide an indication of modelled daily traffic volumes[4] in 2021 and 2031, with the third diagram illustrating the changes between the two scenarios (green bands indicating reductions and red bands increases, with the **width** of the bands (not the length) proportional to the traffic volumes illustrated in each diagram).

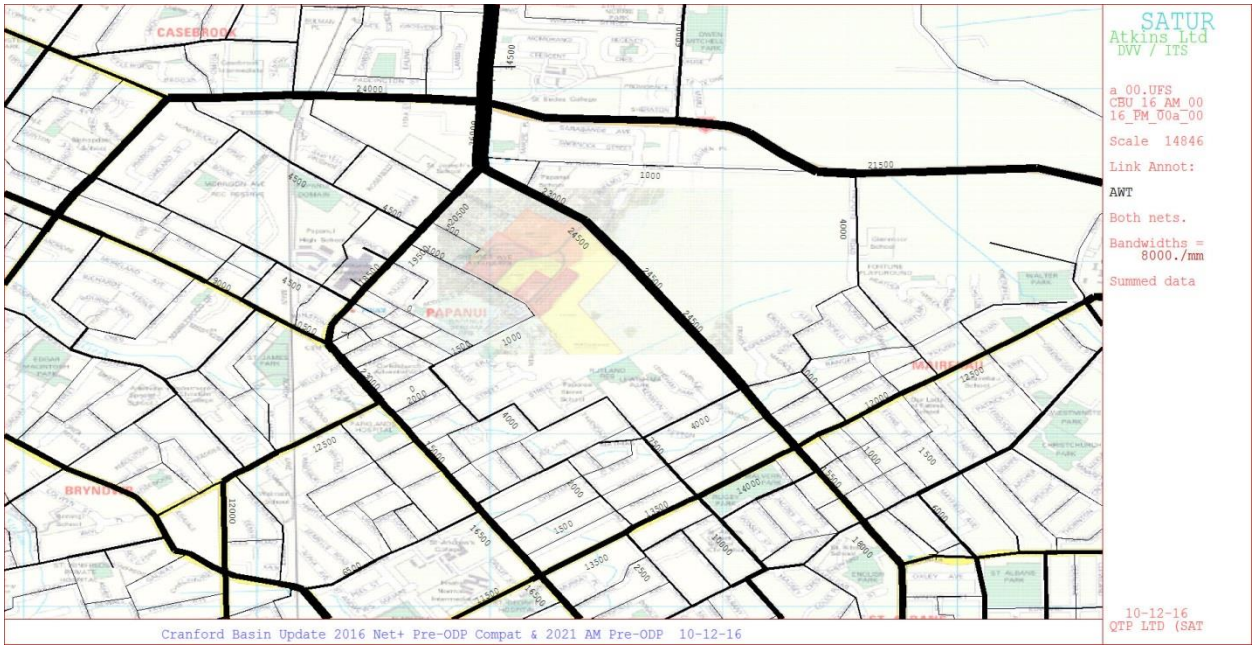


Figure 5-1: Modelled Daily Traffic Volumes 2021 (no Northern Arterial and Extension)

[4] Estimated from CAST AM and PM peak hour modelling

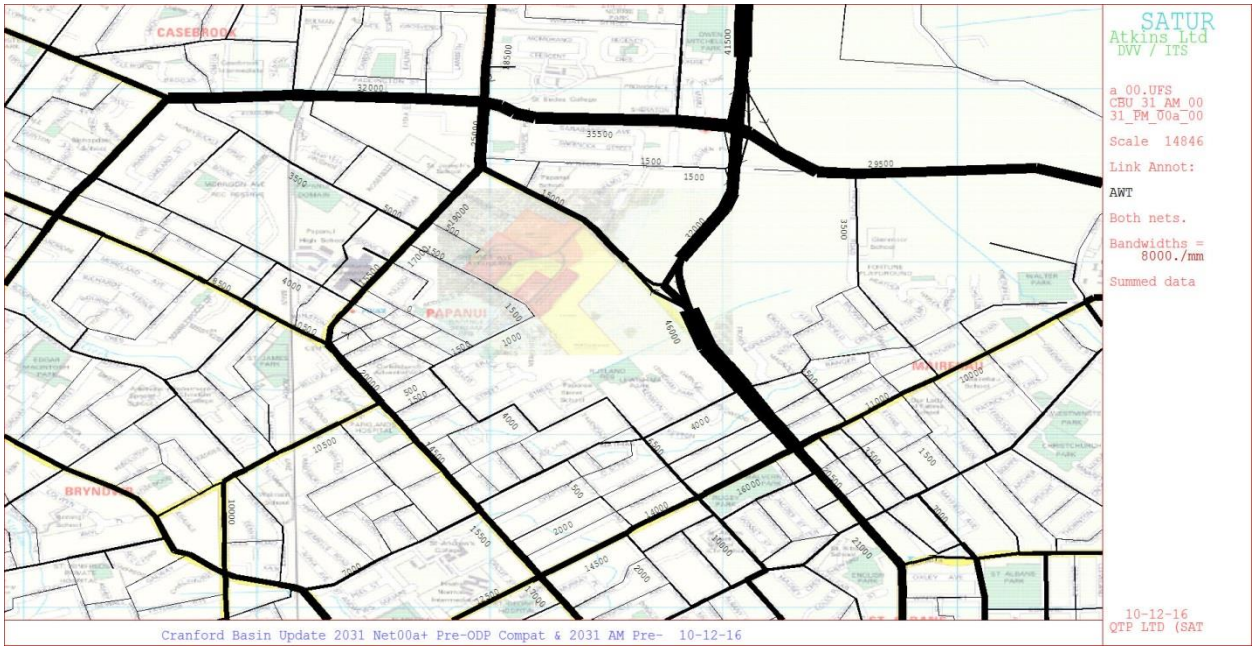


Figure 5-2: Modelled Daily Traffic Volumes 2031 (with CNC - NoR Schemes)

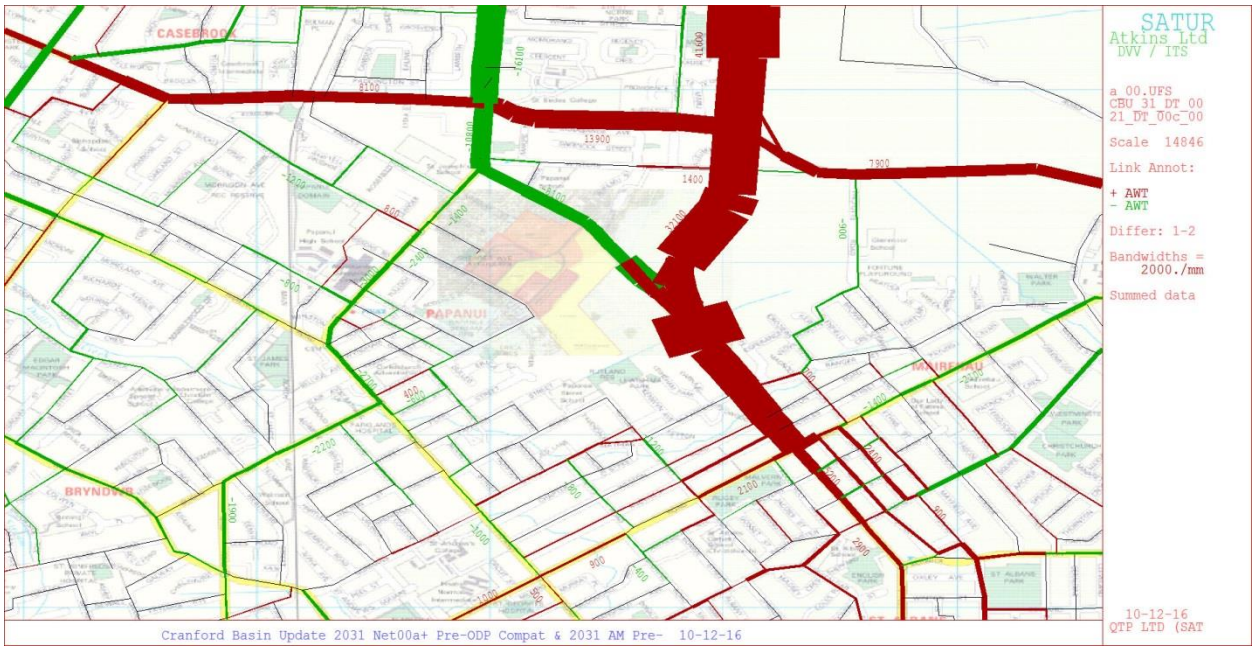


Figure 5-3: Modelled Change in Daily Traffic Volumes 2031 vs. 2021

5.3 The above diagrams illustrate:

- Significant increases in traffic volumes on Cranford Street to the south of the proposed roundabout at the intersection of the NAE and Cranford Street (an increase of 21,500 vpd and reducing as progressing southbound along Cranford Street);
- Reductions in traffic volumes on Cranford Street to the north of the NAE roundabout of around 8,000 vpd;
- Decreases on Main North Rd south of Cranford Street (around 1.5-3,000 vpd); and
- No significant change in traffic volumes on Papanui Rd, south of Blighs Road.

6 Principal Connection to Cranford Street

6.1 This traffic modelling has assumed a single-lane (3-arm) roundabout would provide the intersection of the proposed Collector Rd serving the proposed ODP and Cranford St.

6.2 The modelling indicates that the roundabout would be approaching practical capacity[5] on several approaches for the updated ODP scenario modelled in 2021 - should the CNC projects not be implemented by this time, but the ODP were to be fully-developed ahead of this, to now-proposed densities. However, on completion of the CNC projects, with reduced traffic volumes on this section of Cranford Street, such a roundabout is forecast to operate (in 2031) with modest delays, in both (AM and PM) peak hours.

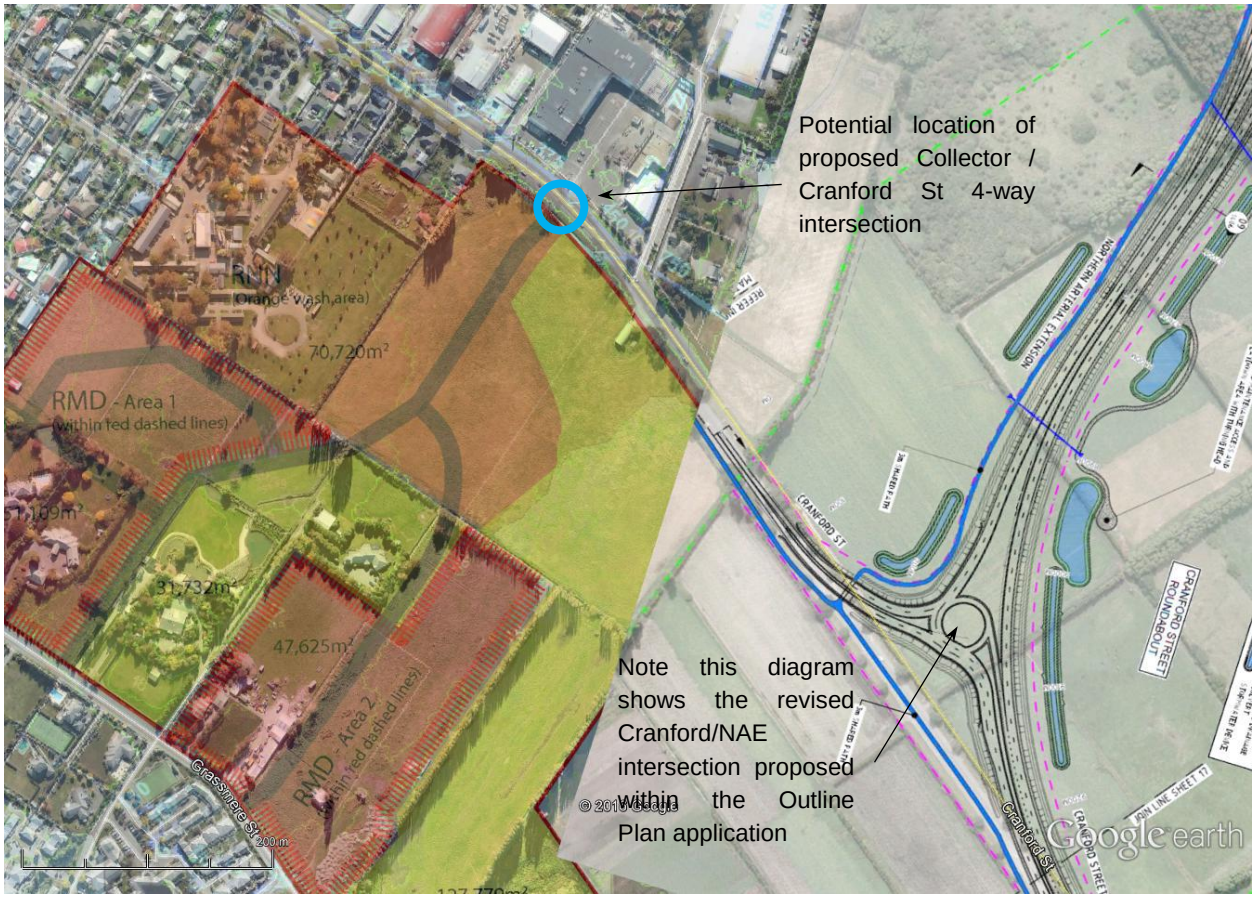


Figure 6-1: Location of Potential Cranford St/ODP Intersection Relative to the NAE

6.3 We note that the roundabout location has been shifted north under the updated draft ODP, such that it is now located around 400m north of a proposed (signalled) cycle/pedestrian crossing, to be located west of the Cranford/NAE roundabout[6].

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5 With peak ratio of flow to capacity of around 90%, resulting in average approach delays of around 32 seconds/veh.

6 Note that the previous potential roundabout location afforded the opportunity for a four-way intersection with a connecting link north to serve potential future development between the CRP zone and NAE. This created issues given the proximity to the potential merge from the northbound slip lane within the NoR NAE scheme, which has since been removed from the recently-submitted Outline Plan scheme.

6.4 This location (along with the revisions proposed to the NAE Outline Plan configuration) will remove the issues raised within our 2015 assessment regarding the potential weave between the NAE/Cranford roundabout and this principal ODP access, in the network adopted for the initial network assessed previously.

6.5 However, it should also be noted that within this round of modelling, we have not attempted to identify and specifically locate the demands from the Commercial Centre as the potential fourth arm of the Cranford/ODP roundabout - such demand being loaded to adjacent sections of Cranford St, as in the v16a base models. Therefore, for explicit recognition of the potential impacts of the ODP on access to and from this site (and confirmation of this preliminary modelling which indicates that a roundabout could form a suitable intersection form), we suggest that further detailed investigation is likely to be warranted at some point in the future, to confirm any detailed intersection design.

6.6 A further difference to the networks considered in previous modelling (which considered an ODP over a wider area than that which is now being contemplated), is that the potential link between Grimseys Road and Cranford Street assumed for that assessment now no longer forms part of the ODP area, nor thus the networks modelled to indicate the impact of the revised ODP. However, omission of this link does provide a suitable base, by which to assess the (reduced) accessibility that a more limited external connection network for the ODP may have.

6.7 The previous ODP assessments suggested that such a direct local network link between Cranford Street and QEII Drive may also have provided a conduit through which ‘external’ traffic (i.e. that not generated by the ODP land itself) may travel between QEII Drive and areas to the south and west of the ODP area - making use of the ODP road network. The revised CNC proposals (whereby a LILO intersection is now proposed to directly access QEII Drive to and from Grimseys Road south) may also have been expected to increase the potential for such ‘rat-running’ traffic further. Thus the omission of this link (from the network assumed), whilst it can be expected to reduce the accessibility to the ODP, is also likely to reduce the potential for additional traffic to be attracted to the network to the south and west of the ODP site.

7 Modelled Effects of Rezoning

7.1 As noted above, modelling for this updated assessment has been conducted for a single revised ‘with-ODP’ demand scenario, However, together with the ‘without-ODP’ demand scenarios, the modelling for 2021 and 2031 and various network configurations has resulted in a requirement for some 16 model runs. Various graphical outputs have been extracted from the model for each model run both for the purpose of checking the sensibility of outputs and to inform the assessment of effects. Some 80 model plots have thus been generated.

7.2 It is not within the scope of this assessment to provide a full explanation of the assessed traffic volumes, delays and changes in volumes and delays for each model run. Thus only selected model outputs have been chosen to illustrate the results of the assessment and a summary chapter provided at the end of this Memo.

7.3 Base ('Without-ODP') Models

7.3.1 To provide some context to the assessment of effects, the following diagrams illustrate the modelled delays and CAST Level of Service (LoS) on the road network for the 2021 and 2031 base models for the AM and PM peak hours (I,e. without the effects of the proposed rezoning). The approach-level delays are colour-coded as follows:

- LOS A to C (green bands) = 0 to 30 seconds delay
- LOS D (orange bands) = 30-50 seconds delay
- LOS E (red bands) = 50-70 seconds
- LOS F (black bands) > 70 seconds

Figure 7-1: Link Delays and LoS, Base Model, 2021 AM Peak Hour

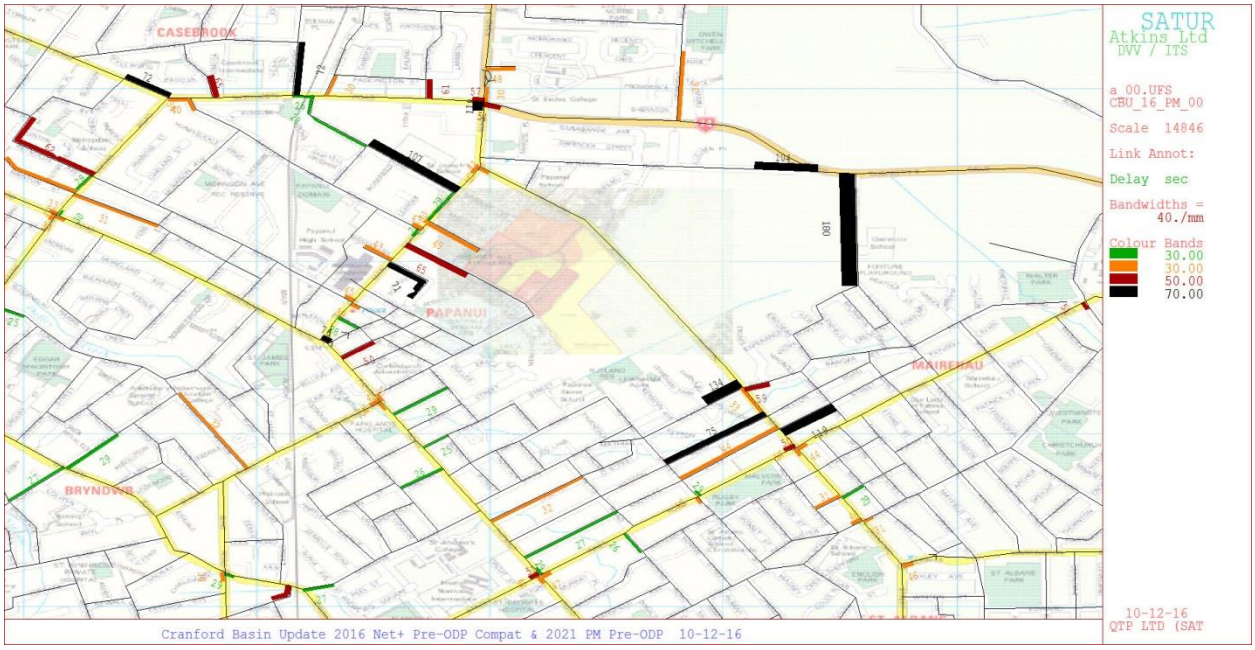

Figure 7-2: Link Delays and LoS, Base Model, 2021 PM Peak Hour

Figure 7-3: Link Delays and LoS, Base Model, 2031 AM Peak Hour

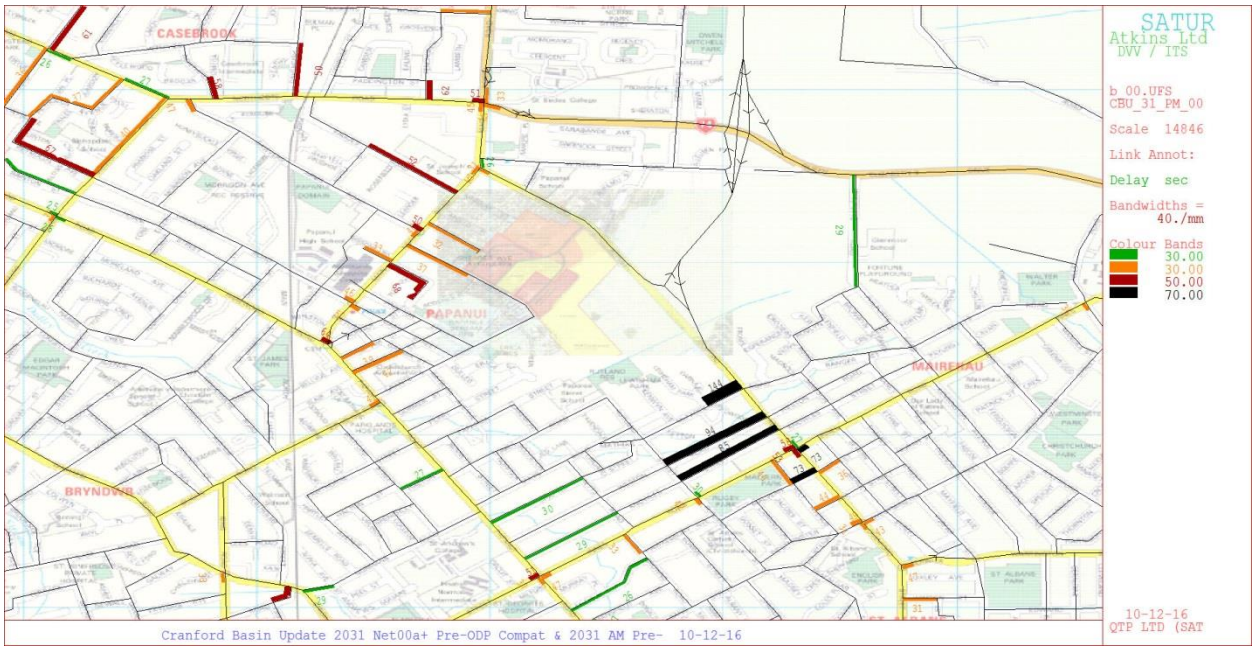

Figure 7-4: Link Delays and LoS, Base Model, 2031 PM Peak Hour

7.3.2 The following points are noted:

- A number of minor road approaches to Main North Rd and Papanui Rd have high delays with LoS E or F illustrated in both 2021 and 2031;
- The modelled delays at Halliwell Avenue/Main North Road are forecast to be particularly severe, in the morning peak - even following the completion of the CNC projects. This arises due to a) higher demands within the v16a forecast matrices (compared to the previous ODP assessment base) of the area (model zone) served by Halliwell Avenue and Tulloch Place and b) The potential increase then applied to these, to allow for potential development of this area up to anticipated (RMD)

densities (30hh/ha, potentially yielding 190hh, compared with the v16 future model assumptions of around 130hh and a 2013 Census total of 115hh. Whether the assumed density and thus demand would ever eventuate is of course unknown, but such delays could be relatively easily addressed through signal phasing changes - albeit at some cost to delays from wither the Main North Road approaches (or the Northlands Mall access).

- Compared to previously-reported assessments there are also higher delays (at LoS F) forecast on the local road connections to Cranford Street between McFaddens Road and Innes Road, with the CNC in place.

7.3.3 For modelled base year daily traffic volumes, refer Figure 5-1 and Figure 5-2 above.

7.4 Scenario 7 (Draft ODP at 370 Households) – Prior to Completion of CNC Projects

7.4.1 The following diagram illustrates the potential changes in daily traffic volumes resulting from this scenario (2021, *without* completion of the CNC projects).

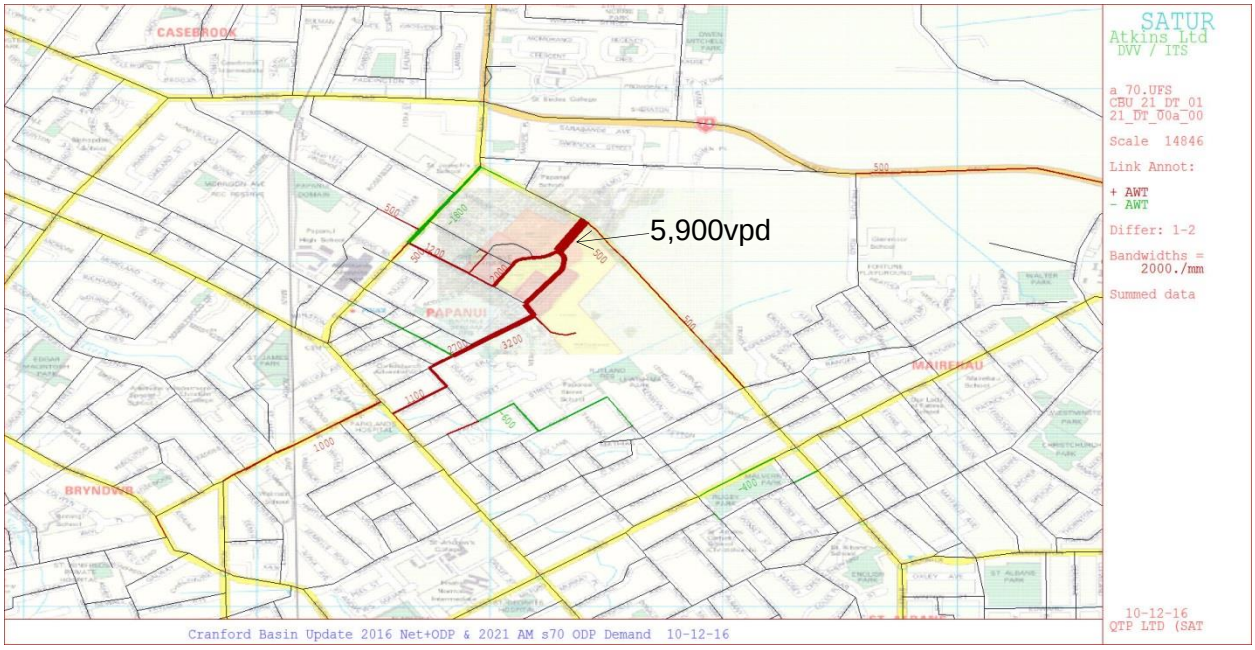

Figure 7-5: Changes in Daily Traffic Volumes, Draft ODP Scenario, 2021 (No CNC)

7.4.2 It may be seen that the forecast impacts, in terms of volume changes, are generally modest in extent. The additional traffic forecast on the local road network is greatest on Grants Road, east of Rayburn Ave. Existing volumes on this road rise up to around 1,600vpd (towards the eastern end) and these are in line with its current Local Road status. Given the full development of the draft ODP (by 2021, but without the CNC projects), this volume could rise up to around 4,400vpd. This is above a desirable volume for a Local Road – albeit being not untypical of many existing local roads in Christchurch, particularly those that serve a Collector Road function, even if they are not currently designated as such. Whilst such a volume is well within the carrying capacity of the road, the degree of increase is considered likely to be perceived by some residents as representing a significant impact. More detailed investigation would be required however, to determine whether such a volume would result in a more-than minor impact, in

practice, in terms of traffic safety and amenity, given the particular nature and crash record for this street.

7.4.3 It is also notable that the existing form of the intersection between Grants Road and Papanui Road as a LILO intersection (which serves to limit the traffic volumes carried, particularly at the western end of Grants Rd) does not currently reflect the full connectivity that might be expected at the intersection of a Minor Arterial (Papanui Road) and what might be anticipated as the potential status of Grants Rd (as a Collector rather than a Local Road), given development of the ODP. Modelling of the impacts of further network improvement scenarios, such as might be considered at the intersection, is beyond the limitations of the current study. We do note however that such improvements may have the potential to reduce the ODP impacts forecast in this study through the residential areas north and south of Grants Road as these result, in part, through this lack of direct (full) connectivity at Grants/Papanui.

7.4.4 Grassmere Street currently (2016) carries volumes of around 1,200vpd and this volume might be expected to rise to approaching 2,400vpd, given full development of the ODP (by 2021). Whilst a substantial *relative* impact, the resulting volume would still be (just) within the volumes expected to be carried by a typical Local Road[7].

7.4.5 Further afield the most significant traffic volume increase is forecast to be on Blighs Road. This Collector Road currently carries around 12,600vpd and this is expected to rise to around 13,600vpd (about 8%), given development of the draft ODP area.

7.4.6 The following diagrams illustrate the resulting changes in delays as a consequence of the additional development traffic in the AM and PM peak hours at 2021.

[7] Note that these are likely to be 'worst-case' estimates: Whilst the signal crossing of Main North Road east of Grassmere Street proposed as part of the Papanui Parallel MCR has been incorporated within all modelling, a potential associated change of the Grassmere St/Main North Rd intersection to allow only LILO movements has not: It is understood that this is still being considered and no decisions have yet been made. Retention of the existing 'full' movements at this intersection therefore provides maximum accessibility to the ODP and wider area and thus results in higher traffic volumes (on Grassmere Street) than would be expected with a LILO configuration. Conversely however, a LILO configuration, without the ODP, can be expected to increase impacts at the intersection of Main North Rd/Mary St to the south-west. Despite the added traffic generation, the ODP network with its connection to Cranford St has the potential to *reduce* the resulting adverse effects that might otherwise occur to the south-west, should Grassmere/Main North be made LILO.

Figure 7-6: Changes in Delays due to Draft ODP Scenario, AM Peak, 2021 (No CNC)

Figure 7-7: Changes in Delays due to Draft ODP Scenario, PM Peak, 2021 (No CNC)

7.4.7 It may be seen that there are forecast to be substantial reductions in delays relative to the base model on some minor-arm approaches to Main North Rd and Cranford Street. This is primarily because the alternative route enabled through the ODP area would provide some relief to delays faced by traffic from the surrounding residential areas in accessing these arterial roads.

7.4.8 There are however some locations of notable increases in delays forecast:

- westbound to Papanui Rd at Frank St through to Perry St (up to 30 seconds), AM Peak Hour; and
- westbound to Papanui Rd at Frank St (around 30 seconds), PM Peak Hour

7.4.9 Because these locations are already operating at a reasonable level of service (LoS C or D) in the base model, these impacts may be considered potentially significant, particularly as there are safety consequences of large delays on give-way approaches to intersections. The delays are exacerbated because of the lack of (full) connectivity between Grants Road and Papanui Road, noted above.

7.4.10 It is somewhat subjective as to whether such a scale of impacts are considered minor, or more than minor. At this stage, our recommendation would be not to allow for zoning that could exacerbate existing efficiency and associated safety issues on the road network at 2021 without either mitigating these effects or undertaking more detailed analysis to confirm these initial findings.

7.4.11 Whilst it might be considered that an appropriate way to mitigate the potential (adverse) traffic effects (whilst still providing for the ODP) would be to defer the ODP zoning until implementation of the CNC projects has been achieved, it is noted that the impacts (in terms of additional traffic forecast on Grants Rd, Grassmere St and Blighs Rd only) are very similar, whether or not the CNC projects are in place, as demonstrated below.

7.5 Scenario 7 (Draft ODP at 370 Households) – 2031 (with CNC Projects)

7.5.1 The following plot illustrates the modelled volume increases at 2031, given the additional traffic generated by the ODP. (Note that the network shown for this example assumes that the Outline Plan changes submitted for the CNC projects would proceed, as submitted by the respective Requiring Authorities).

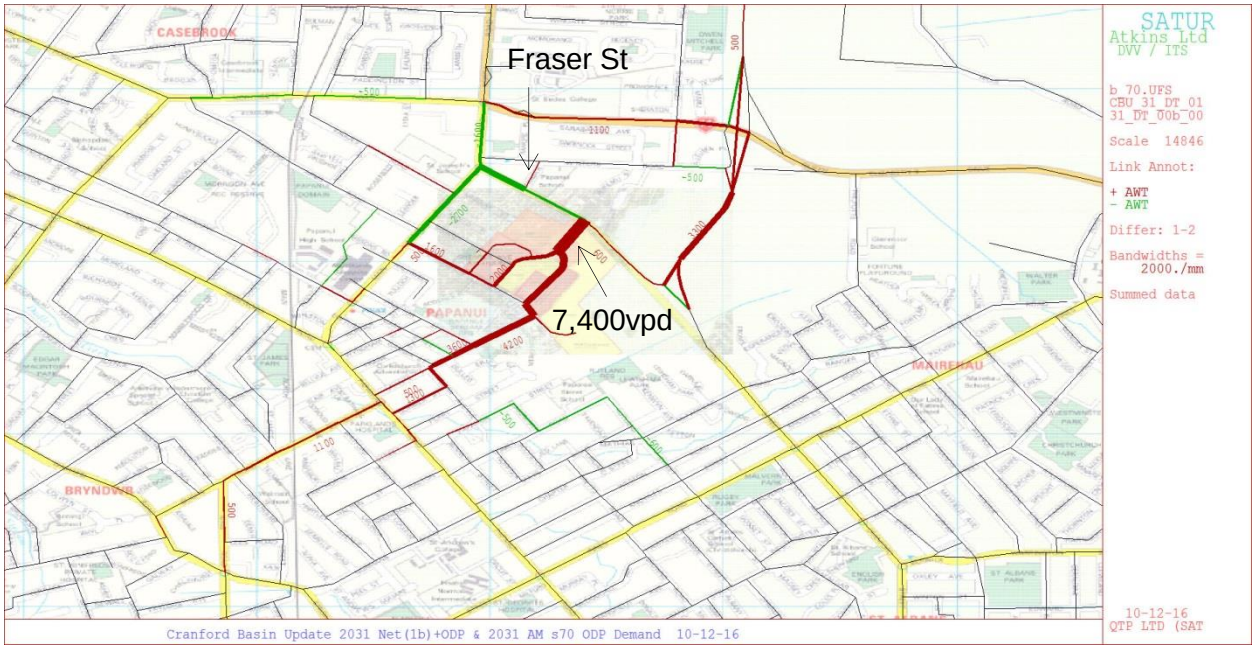

Figure 7-8: Changes in Daily Traffic Volumes, Draft ODP Scenario, 2031 (With CNC)

7.5.2 As may be seen through comparison with Figure 7-5, the forecast traffic volume increases on Grants Rd, Grassmere St and Blighs Rd are of a similar magnitude to those forecast for 2021 (without the CNC projects in place).

7.5.3 It may be noted that the increases shown for Grimseys Rd (south), Winters Rd and

Fraser St, as a result of development of the ODP, are not anticipated to be particularly 'significant' (although in proportional terms they are, at between +17-23%). As illustrated by the following results for Fraser Street, the changes resulting from the CNC Outline Plan changes (e.g. opening of a LILO intersection at Grimseys/QEII Drive are forecast to be more significant than the forecast to occur as a result of draft ODP.

CNC Scheme	Land Use	ADT
As NoR	Without ODP	1360
	With ODP	1590
	Increase	*230*
As Outline Plan	Without ODP	2170
	With ODP	2670
	Increase	*500*

Table 7.1: Weekday Daily Traffic Volumes, 2031, on Fraser Street (N Cranford)

7.5.4 Clearly the CNC Outline Plan proposals to open Grimseys south to QE2 and remove the (direct) right turn from the NAE into Cranford St (north) is somewhat less-desirable in 'strategic' terms, compared to the CNC NoR proposals, in terms of accommodating ODP and other traffic on the arterial rather than the local road network[8]. It might also be argued that, if the CNC projects are implemented according to the CNC Outline Plan schemes (rather than the CNC NoR proposals), then the draft ODP anticipated development would take this connection (just) above a threshold that might be considered reasonable for a Local Road. However, although the recommendations on the proposed CNC Outline Plan have yet to be made and considered, we are relatively comfortable in suggesting that the impacts (of the ODP) on the roads north of QEII Drive may be judged to be 'minor', whether the CNC projects are ultimately implemented according to either of the scheme layouts assessed.

7.5.5 There are however more substantial volume reductions forecast, on Main North Rd (N Grassmere St) and Cranford St (N of the proposed ODP principal access), by virtue of the enhanced connectivity and use made of the ODP principal road network, to access the CNC projects.

7.5.6 The following plots illustrate the modelled delay increases at 2031 given the additional traffic generated by the ODP (Note that these diagrams area for the same network as above i.e. with the CNC Outline Plan configuration).

[8] There may also be some potential issues with respect to a potential for increased crash risk at the NAE roundabout - but this is a matter of detail beyond the direct potential implications for the ODP.

Figure 7-9: Changes in Delays due to Draft ODP Scenario, AM Peak, 2031 (With CNC)

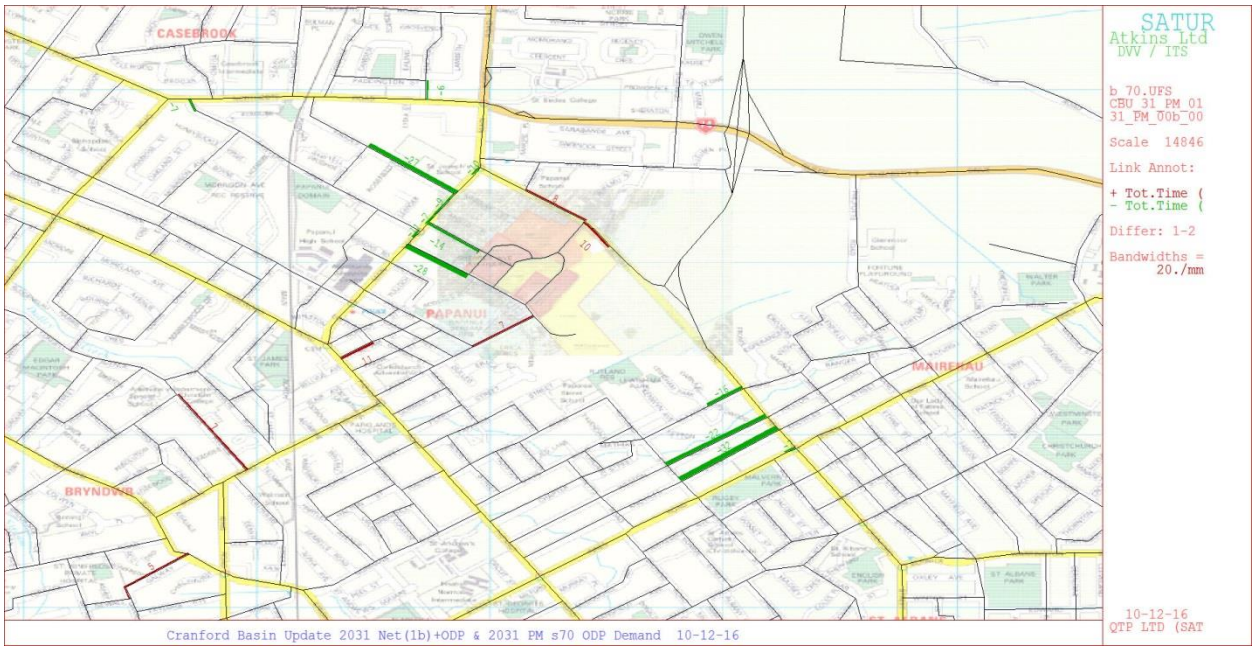

Figure 7-10: Changes in Delays due to Draft ODP Scenario, PM Peak, 2031 (With CNC)

7.5.7 At 2031, the locations of potentially significant delay **increase** summarised above in 7.4.8 do not occur, due to the relief to these bottlenecks that is forecast to be brought about by the CNC projects. This is despite that demand from 10 years more of general traffic growth, as well as that generated by the draft ODP, is being accommodated.

7.5.8 Generally, notwithstanding the increased traffic volumes forecast on Grants Rd, Grassmere St and Blighs Rd, the potential effects on the immediately surrounding are modest. Indeed, on balance there are generally positive benefits, due to the relief provided to other routes as a consequence of the proposed route created through the ODP area and the access this affords to Cranford St.

7.5.9 The above conclusions hold for the 'base' (ODP) networks assessed for this study, which assume priority intersections at the interface with Grassmere St. However, we have also briefly examined whether and to what extent additional traffic–calming measures might limit any 'extraneous' (non-ODP) traffic that could be attracted to travel through the ODP area (with the potential to affect the amenity of both the ODP and surrounding residential areas), these measures being reflected through the addition of further roundabout intersections, at the ODP interface with Grassmere Street (refer Figure 4-4). The diagram below indicates the difference in daily traffic volumes that is predicted to occur as a result of these additions:

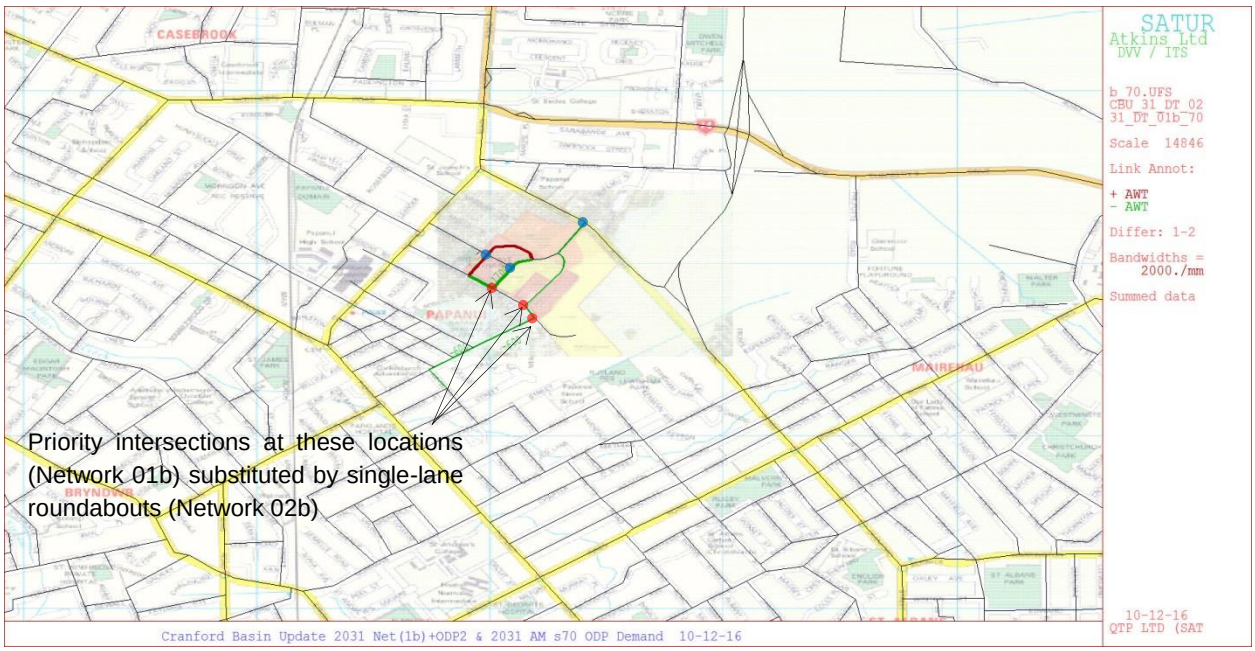

Figure 7-11: Changes in Daily Traffic due to additional traffic-calming only (Draft ODP Scenario, 2031 (With CNC)

7.5.10 It may be seen that the measures assumed have a relatively modest, but positive effect in terms of reducing traffic volumes on Grants Rd: As detailed in Table 7.2 below, given full-development of the ODP and adoption of the Outline Plan changes proposed for the CNC projects, with the additional traffic-calming volumes on Grants Rd could be reduced to total around 4,700vpd, compared to around 5,400vpd without the measures (assumed).

CNC Scheme	Land Use	ADT
As NoR	Without ODP	1630
	With ODP	4360
	Increase	*2730*
As Outline Plan	Without ODP	1700
	With ODP	5280
	Increase	*3570*
	With ODP (Rbts)	4670
	Increase	*2960*

Table 7.2: Weekday Daily Traffic Volumes, 2031, on Grants Road (E Proctor)

7.5.11 While the predicted benefits of relief from additional traffic appear to be negligible for Grassmere Street, it is however also worth noting the reassignment predicted on the internal ODP network, through the addition of the roundabout at the intersection of the main road through the ODP site (anticipated to fulfil a Collector function) and Grassmere St. The modelling suggests that this may induce some drivers to use the alternative internal route to the north, which is unlikely to be desired. This could be potentially reduced by further amending intersections along this route – but modelling of the detailed potential effects of such further options is beyond the scope of the present study.

7.5.12 Furthermore, as noted in section 3.5, all traffic generation is assumed to be *additional* to the adjusted base-case[9] generic CAST models for the purposes of this study, with no adjustment being made to traffic generation in other locations in the future year models that might be anticipated under an assumed fixed population. In this regard, the assessment is considered robust in terms of assessed network operation. It will however not fully reflect the 'true' overall benefits that will accrue from development in this location, compared to others in more remote and less-accessible sites through the greater Christchurch area.

[9] The generic CAST models have been adjusted (in terms of both network and demand) to form an appropriate evaluation base ('without-ODP') for this ODP assessment, as explained below.

8 Public Transport, Cycleways and Pedestrian Accessibility

8.1 Public Transport

8.1.1 The following diagram illustrates the relationship between the draft ODP area and the existing public transport routes. Walking distances to the Blue Line and No 28 bus services are illustrated at 500m (approximately a 6 minute walk) and 800m (approximately a 10 minute walk).

Figure 8-1: Bus Routes Serving Proposed Urban Zoning

8.1.2 The site is generally very well served by public transport. The Blue Line, a direct service to/from the Central City, routing via Main North Rd and Papanui Rd has a frequency of 10 minutes in the peak hours and typically 15 minutes at other times during the day.

8.1.3 The Orbiter (illustrated above in green) has a frequency of 10 minutes during the day.

8.1.4 Route 28 (Papanui to Lyttelton and Rapaki) via the City, routing via Cranford Street, operates with a frequency of around 30 minutes for most of the day.

8.1.5 The above diagram illustrates that nearly all of the draft ODP area is within around a 6-minute walk (500m) from Route 28. The majority of the site is also within a 10-minute walk (800m) from the high-frequency Blue Line service (and the Orbiter).

8.1.6 Ideally, all dwellings would be within a 5 to 10 minute walk of a direct, high-frequency bus service such as the Blue Line. However, in practice, there is a trade-off between walking distance to a route and the frequency and directness of services that can be provided

(afforded) in serving the whole city. There is little value in providing infrequent, meandering bus routes in order to meet targets of proportions of dwellings within close proximity to bus routes. We consider a better outcome is achieved by focusing public transport services on arterial routes, of a high frequency, and generally directly to/from the Central City. In this regard, the relatively small area of the site not within a 5 to 10 minute walk of a high-frequency service is considered an acceptable trade-off, particularly as this portion of the site is within 500m of a 30-minute frequency route on Cranford Street.

8.1.7 In order to take full advantage of the adjacent bus routes, it is essential that the ODP is prepared that includes excellent pedestrian connections between the proposed urban zoning and Main North Rd and Cranford Street. Under the draft ODP layout, pedestrian linkages to Main North Rd would be available via Grassmere Street and Shearer Avenue.

8.1.8 It appears that accessibility via Apollo Place (which lies between Shearer Avenue and Meadow Place on above diagram) may not be possible due to the nature of the development that has occurred at the south-eastern end of this cul-de-sac. However, the Top 10 holiday park (which covers some 3.8ha or 50% of the area signalled as RNN - Area 3) currently enjoys access from both Meadow Place and Cranford Street and Council should therefore seek to provide pedestrian (and cycle) linkage between the proposed ODP area and Meadow Street to maximise accessibility to the high-frequency public transport service on Main North Rd[10].

8.1.9 We note that the routeing of the Orbiter service shown on the above diagram will likely be amended on completion of the CNC projects: Given the proposals for the Northern Arterial and associated four-laning of QEII Drive, with the latter including the conversion of the Philpotts Rd intersection at QEII Drive to a LILO configuration, this would prevent the existing 'clockwise' service from using the existing route. It is therefore possible that the Orbiter may be rerouted (in both directions) to travel via Cranford St rather than QEII Drive, bringing this high-frequency service still closer to the proposed ODP area.

8.1.10 Finally, we note that the Draft Regional Passenger Transport Plan (dRPTP) anticipates that some new routes may be introduced in the future to service new residential subdivisions. Given the proximity of the proposed urban rezoning area to routes 28, The Blue Line and the Orbiter, we would not anticipate any new routes specifically serving the area. It is however possible that Ecan may look in future to increase the frequency of Service 28 on Cranford Street in response to greater demand from the proposed rezoned area. Whilst this is highly desirable, this is not considered essential given the proximity to existing high-frequency services for the majority of the area.

[10] Note that the traffic modelling reported above reflects the provided primary road network plan and therefore has not considered a (secondary) potential vehicle linkage to Meadow Street that may be possible to the RNN area, given the current holiday park access at this point.

8.2 Cycling

8.2.1 The site is presently rural and as such no cycle facilities exist within the proposed ODP area. The following diagram, illustrates CCC's cycle routes as at 2012, in the vicinity of the site.

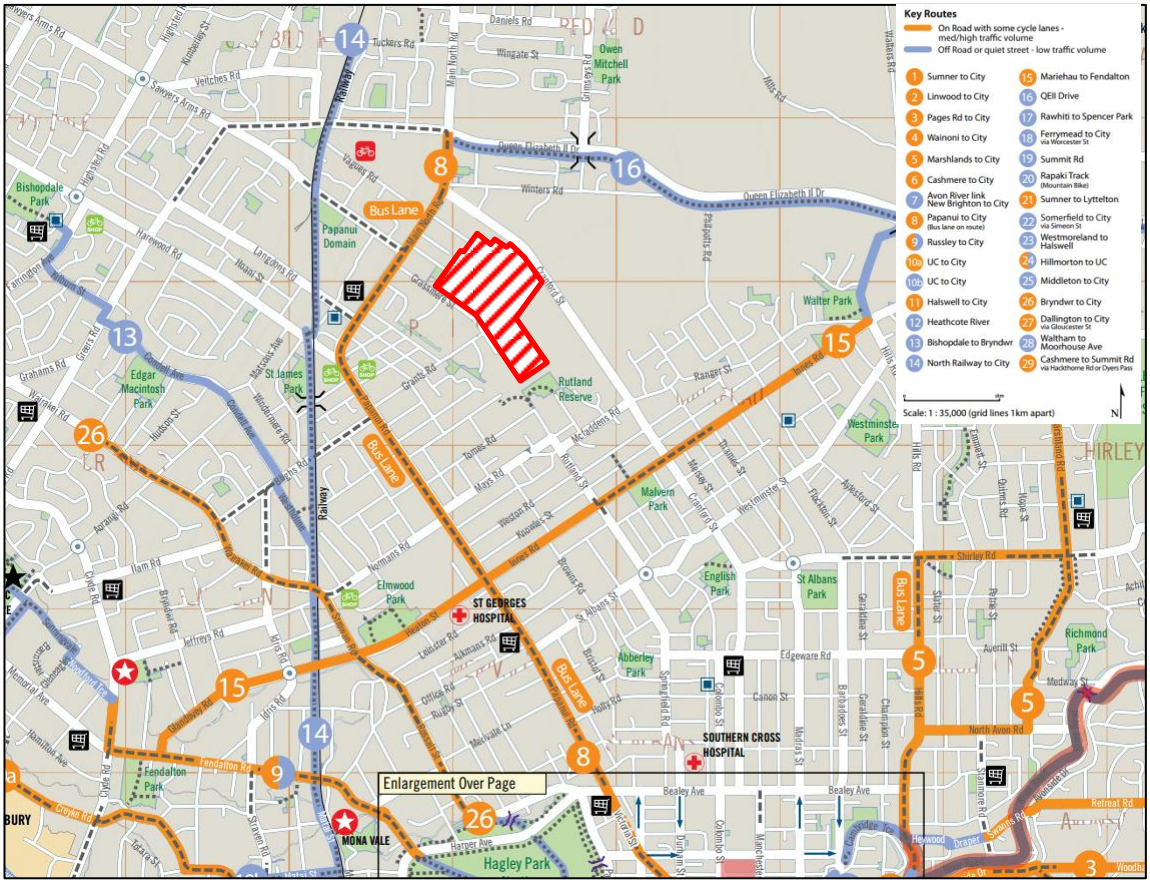

Figure 8-2: Existing (2012) Cycle Routes Network in Relation to draft ODP area.

8.2.2 The key existing facilities that would serve the site are:

- Papanui Rd / Main North Rd cycle lane shared with the bus lane;
- The North Railway to City off-road cycle path;
- The QEII Drive off-road cycle path; and
- The Innes Rd cycle lanes.

8.2.3 Council are currently planning, designing and implementing a network comprising 13 Major Cycle Routes (MCR). These are illustrated in the following diagram.

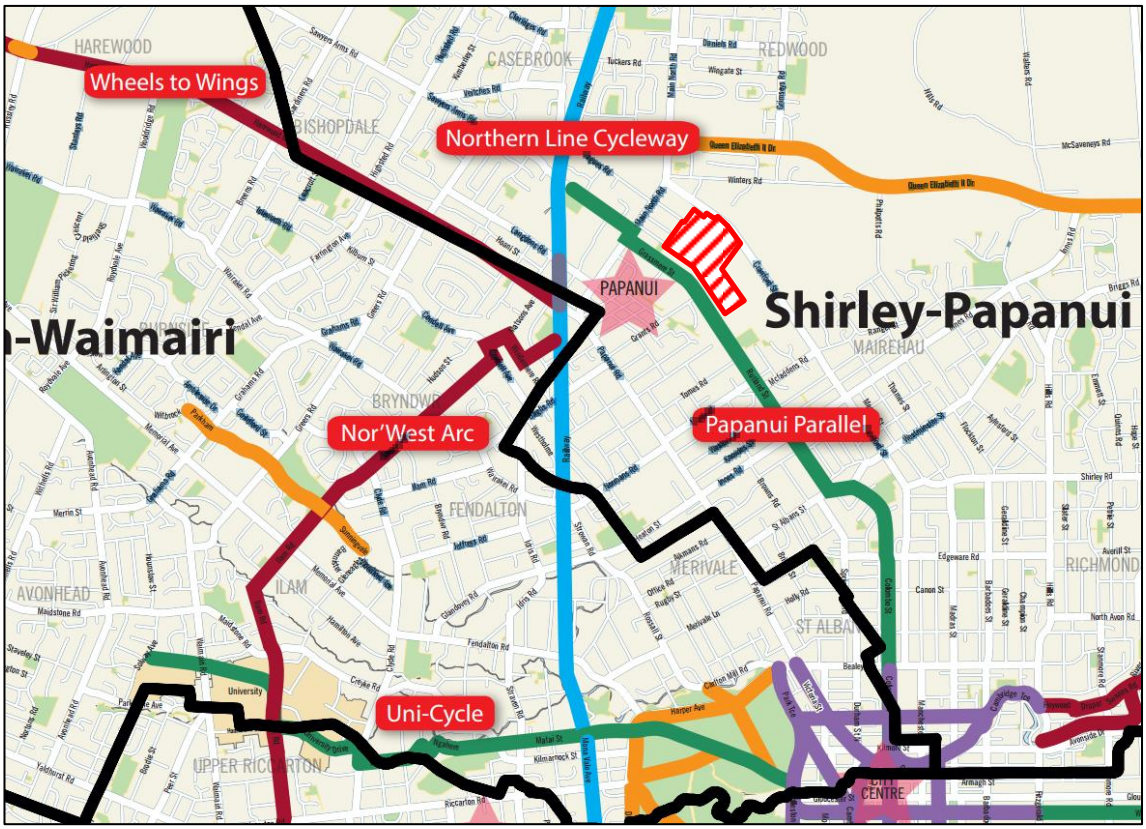

Figure 8-3: Major Cycle Routes Network in Relation to draft ODP area.

8.2.4 The Papanui Parallel route, which is currently under construction and scheduled for completion in 2017, will provide highly convenient, direct access to the proposed ODP area, connecting the site to the Central City. The Northern Line route would see an extension of the current north Railway route, north of Tuckers Rd and south to Blenheim Rd. This route is currently programmed for completion in 2019.

8.2.5 On a more local basis, the diagram below shows the current Council and NZTA proposals for cycleway improvements in the immediate area of the ODP, together with a potential strategic cycle route connection through the ODP area that would connect with the shared path proposed on the west side of the NAE and Cranford St as part of the CNC works (submitted Outline Plan schemes).

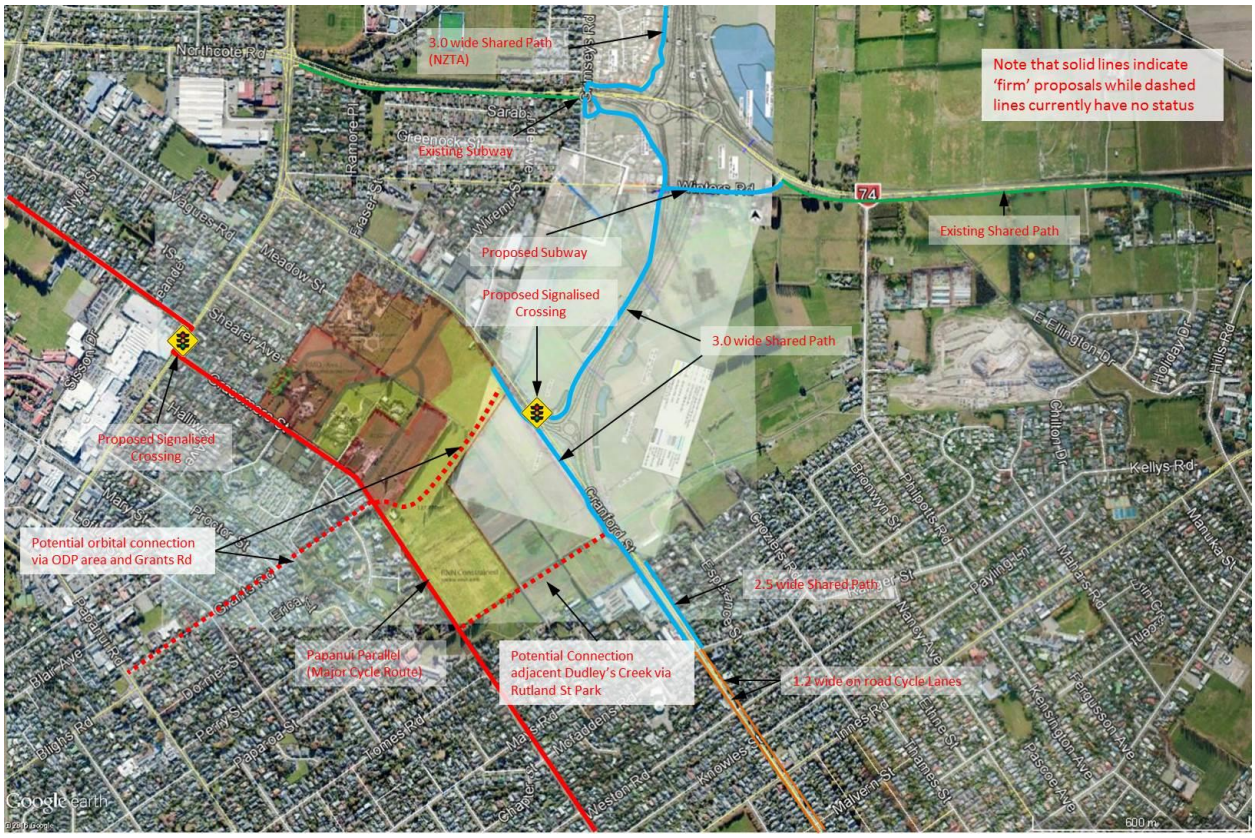

Figure 8-4: Current/Potential Cycle Infrastructure Proposals in vicinity of ODP area

8.2.6 It may be noted that such a connection formed part of the future network assumed for the MCR 'package' assessment and its function to facilitate 'orbital' connectivity between the proposed NZTA Northern Arterial cycleway and the Papanui Parallel MCR may be seen of the modelled cycle demand diagram below, where the width of the bands indicates the modelled cycle demand in 2031 (given completion of the full MCR programme and associated routes assumed).

8.2.7 It may be noted however that the direct connection assumed for this network (between the existing Grimseys Rd/QEII Drive underpass does **not** form a part of any current programmed works – but may be facilitated through incorporation within the Cranford Stormwater basin works. Without this more-direct link to the assumed potential route through the draft ODP area, the demand through the ODP area is likely to be less than shown, as the route between the planned Northern Arterial and Papanui Parallel cycleways will be less-attractive if it is *only* facilitated by less-direct route afforded via the shared path proposed to the immediate west of the NAE.

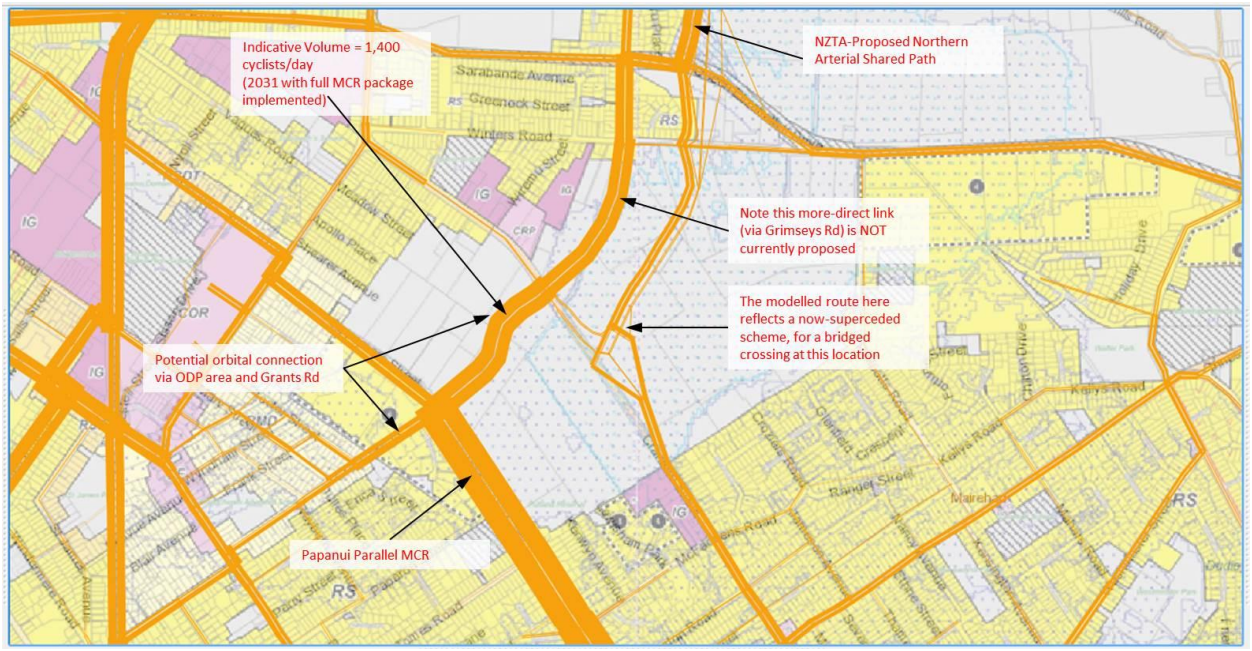

Figure 8-5: Potential Cycle Demand Around and Through the Draft ODP Area

8.2.8 Notwithstanding that it lies outside the draft ODP area, we therefore strongly recommend that Council should seek to achieve (or at least safeguard) a more direct route between the ODP area and Grimseys Rd, through the Cranford Basin.

8.2.9 Irrespective of linkages to the north, the proposed Papanui Parallel MCR will provide an excellent opportunity to provide good accessibility of the site to/from the surrounding residential areas to the south-east (and beyond) in the absence of a road connection. Naturally, the transport network for the site should be designed with frequent pedestrian and cycle access to this route and conversely minimise the number of vehicle conflicts with the route.

8.2.10 As noted above in relation to public transport accessibility, it is highly desirable that improved cycle / pedestrian links are provided to the northwest of the site in order to provide convenient access to Main North Rd with the employment, shopping and recreational trip opportunities that exist, particularly associated with Northlands Mall.

8.3 Walking

8.3.1 As illustrated within Figure 8-1 above, the site is well located for pedestrian access to Main North Rd to provide convenient access to a high-quality public transport corridor, but also for employment, shopping and other recreational purposes associated with Northlands Mall and the surrounding area.

8.3.2 As noted above under ‘Cycling’ the internal network should be designed to provide high-quality pedestrian linkages to the residential areas to the north-west and south-east of the site, the proposed Papanui Parallel to the south-west and the recommended pedestrian crossing of Cranford Street for access to/from the portion of the proposed urban zoning to the north of Cranford Street.

9 Wider Consideration of Transport Issues

9.1 Section 7 has considered the effects of the draft ODP on the operation of the surrounding road network, with Section 8 providing an assessment of the accessibility of the area in terms of public transport, cycling and walking. In line with our brief, the bullet points below provide only brief commentary on some of the wider transport-related issues and implications of the draft ODP

- The proposed residential zoning is highly compatible with the existing surrounding residential land-uses in terms of traffic effects (minimal heavy vehicles and noise);
- The proposed residential zoning is well-located for local public transport, employment, shopping and recreational activities;
- Arguably, the relatively small number of households (370) does not realise the full potential of the site for being serviced by, or having access to, high quality public transport or the MCRs, but there are naturally other considerations for the site that in practical terms will limit this, not least being constraints (and opportunities) presented by stormwater management; and
- In the longer-term, adverse traffic effects (congestion, emissions) for this location which is encompassed by existing urban areas are likely to be less than for residential development more remote from the Central City. More remote Greenfield Sites or locations within Selwyn or Waimakariri District will generally be less accessible to public transport and employment centres, resulting in a greater number of vehicle.kilometres travelled by private vehicles, with an associated economic, environmental and social cost.

10 Summary and Conclusions

10.1 This Memo has considered the potential transport effects of the draft ODP, which provides for development of around 370 households within the Cranford Basin area.

10.2 Traffic modelling has been conducted using Council's CAST traffic model for the horizon years of 2021 (but reflecting a scenario if the ODP were to be developed ahead of completion of the Christchurch Northern Connections (**CNC**) projects[11]) and 2031 (reflecting implementation of these projects). Modelling has considered both the CNC schemes identified within the Notice of Requirements for these projects, as well as updated Outline Plans which include changes that will affect access around the ODP..

10.3 All ODP traffic generation is assumed to be additional to the 'no-ODP' models for the purposes of this study, with no adjustment being made to traffic generation in other locations that might be anticipated under an assumed fixed population. In this regard, the assessment is considered robust in terms of assessed network operation.

10.4 An initial primary road network to serve the ODP has been identified by Council. It includes a direct linkage between Cranford and Grassmere Sts. Initial modelling of the new intersection formed between this road and Cranford St would suggest that if formed as a roundabout, this is likely to operate without undue delay.

10.5 Prior to completion of the CNC projects, the forecast impacts in terms of volume changes, are forecast (at 2021) to generally be modest in extent. The additional traffic forecast on the local road network is greatest on Grants Road, east of Rayburn Ave.

10.6 At 2031, assuming completion of the CNC projects, the level of impact, in terms of additional traffic forecast on Grants Rd and Grassmere St are very similar to those identified for 2021 (without the CNC projects in place). The volumes of Grassmere St are forecast to remain within those typically expected of Local Roads. On Grants Rd however, volumes are expected to rise by a significant degree (compared to the existing 1,000-1,600vpd), but at up to around 5,300vpd (with the CNC proposed outline Plan scheme changes), this would be within the levels expected of a Collector Road.

10.7 Generally, notwithstanding the increased traffic volumes forecast on Grants Rd, Grassmere St (and Blighs Rd), the potential effects on the immediately surrounding are modest. Indeed, on balance there are generally positive benefits, due to the relief provided to other routes as a consequence of the proposed route created through the ODP area and the access this affords to Cranford St..

10.8 We suggest that the impacts (of the ODP) on the roads north of QEII Drive may be judged to be 'minor', whether the CNC projects are ultimately implemented according to either of the scheme layouts (NoR or Outline Plan) assessed.

10.9 Additional traffic-calming of the ODP road network has the potential to reduce use of

[11] Northern Arterial, Northern Arterial Extension and Cranford Street Upgrade.

local roads by extraneous traffic, to a modest degree – albeit reducing the potential for wider relief (of delays) identified above.

10.10 Assessment of the site in terms of public transport, cycling and walking accessibility indicates that it is well located to take advantage of existing and proposed investment in high quality Public Transport (PT) services and cycling infrastructure. Further development of an ODP should include extensive cycling and walking linkages to capitalise on the high quality PT and cycling routes and to provide good accessibility to the neighbouring residential areas to the north-west and south-east of the site where accessibility by road corridors is otherwise poor.

10.11 The ODP should seek to achieve a high-quality cycle connection between Cranford Street and the Papanui Parallel MCR, as well as facilities to provide permeability for cyclists and pedestrians through, to and from the wider ODP area). Notwithstanding that it lies outside the draft ODP area, we also strongly recommend that Council should investigate a direct cycle/pedestrian route between the ODP area and Grimseys Rd, (that is in addition to the current Outline Plan NAE proposal).

10.12 Our overall assessment is that the:

- Notwithstanding some potential for imposing increased traffic on surrounding roads (most notably Grants Rd), the proposed residential zoning is generally highly-compatible with the surrounding residential land-uses in terms of traffic effects and indeed is much more so than potential (e.g. industrial and commercial) alternatives.
- The ODP is well located for local public transport, employment, shopping and recreational activities.
- In the longer-term, any adverse traffic effects (congestion, emissions) for this location which is encompassed by existing urban areas are likely to be less than for residential development more remote from the Central City.
- Although the judgement is ‘marginal’, and it would defer the potential to achieve transport benefits on the surrounding network should the ODP be implemented, on balance we consider that the most efficient way to mitigate potential adverse effects, prior to completion of the CNC projects is to recommend that (development of) the ODP land be deferred until the CNC projects have been implemented. This will reduce the potential for adverse traffic effects (increased delay and reduced safety) that are otherwise predicted to occur at the intersections of local roads north and south of Grants Rd with Papanui Rd.
- Once the CNC projects are implemented, we consider that the transport effects of the ODP proposed are on balance likely to be positive overall. Where the potential for adverse effects does exist, it is likely that these will be generally of a minor or less-than-minor scale.
- That being said, there is the opportunity to mitigate the potential for adverse effects on Grants Rd through careful design in detail of the ODP network and its interface with existing roads. Further more-detailed investigation would be required to confirm the efficacy of such measures – and indeed whether and what further measures may be warranted on Grants Rd and/or intersecting streets.

Appendix F - North-East Papanui Outline Development Plan Transport Assessment – 18 January 2017

QTP
Quality Transport Planning

QTP Ltd
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PO Box 106 • Christchurch 8140 • New Zealand
Phone (+64) 03 379 2489

Memorandum

To:	Mike Calvert
From:	Paul Roberts
Subject:	North-East Papanui Outline Development Plan Transport Assessment
Date:	Tuesday 18th January 2017
Copy:	

Dear Mike,

Following on from our memorandum dated 8th December 2016, you have requested that QTP provide further assistance with the transport assessment you are preparing for the Outline Development Plan (**ODP**) for North-East Papanui, in respect of modelling the traffic impacts of an additional ODP road network option to that outlined in our earlier memo.

1 Further Option Modelled

1.1 The further option reported here (showing the principal road network only) is shown, overlaid upon the option used as the basis for our original assessment, in Figure 1-1.

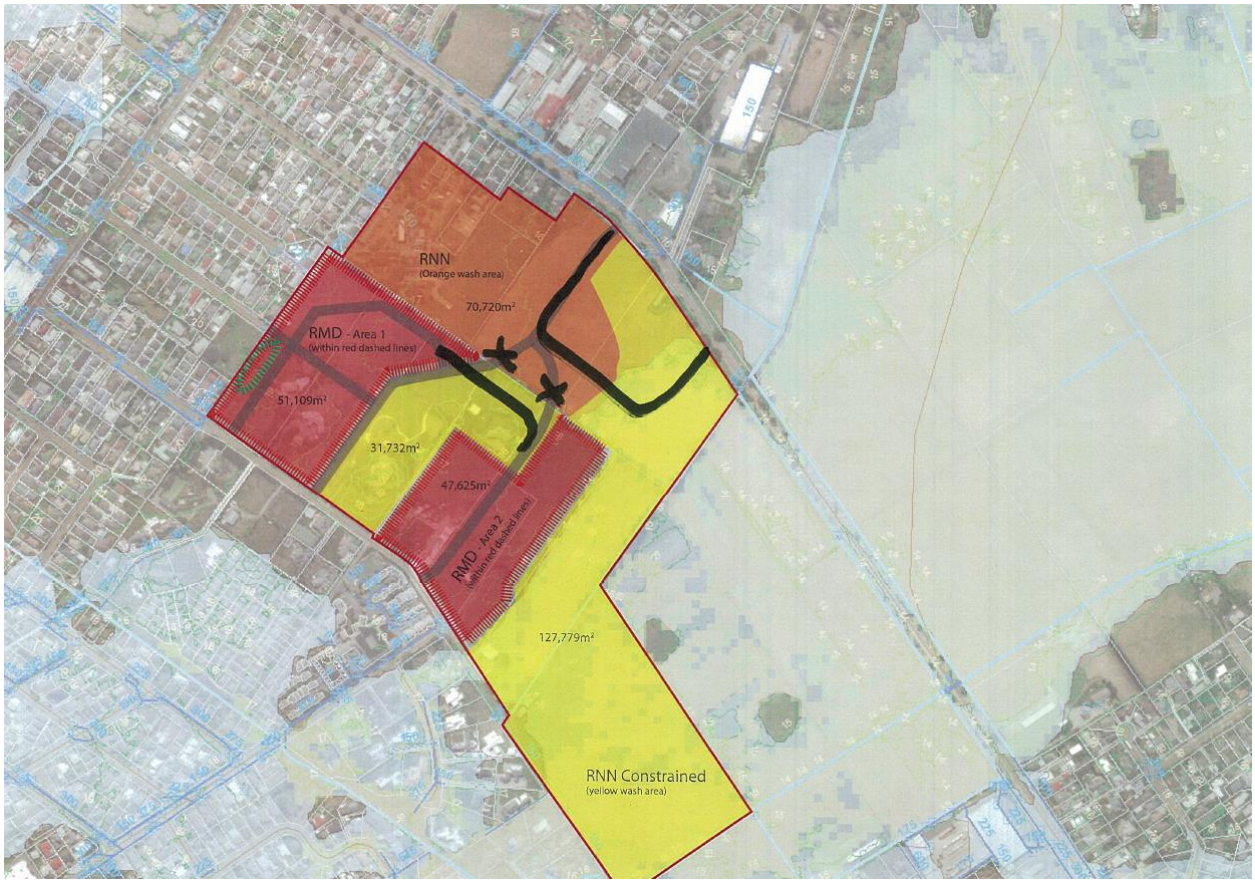


Figure 1-1: Draft North-East Papanui Outline Development Plan landuse.

1.2 Essentially therefore, this additional option would provide for no (vehicle) route connections through the ODP area between Cranford and Grassmere Streets, as a potential means of mitigating the traffic impacts of extraneous (or rather additional traffic, from any location) on Grassmere Street and its connecting residential streets to the south-east of the ODP area.

1.3 Although not shown on the above schematic, we would anticipate however that such an option would provide for cycle and pedestrian connectivity to maximise accessibility for these modes both to, from and through the entire ODP and wider neighbourhood.

2 Methodology

2.1 Consistent with the previous assessment, the additional option has been assessed using the v16a version of Council's Christchurch Assignment and Simulation Traffic (**CAST**) model. Likewise, our assessment has been conducted for the weekday morning and evening peak hours[1], and for both 2021, representing a potential 'short-term' prior to completion of the Christchurch Northern Connections (**CNC**). and for a 'medium-term' (2031 – with CNC) horizons.

2.2 For the sake of clarification, we also note that the modelling of the additional option is consistent with those previously-reported, insofar as it reflects CCC's current plan to retain the existing right turn movement out of Grassmere Street at Main North Road, despite the relative proximity to the new pedestrian and cycle crossing to be implemented as part of the Papanui Parallel Major cycle route (**MCR**). Given that the additional option may load up the right turn movement, safety issues may arise that would need to be addressed e.g. ban the right turns again. Therefore you have sought particular comment on this aspect in this summary reporting.

2.3 For the sake of expediency, we have however restricted the 2031 medium-term assessment of the additional option, to reflect only a scenario whereby the wider network reflects the CNC schemes presented in the Outline Plans submitted by the requiring Authorities (NZ Transport Agency and CCC) - rather than also assessing the impacts against both these schemes *and* those presented within the Notices of Requirement (these reflecting the approved Designations). The wider network impacts of the additional 'No Through-Route ODP Option' have thus been compared here to the equivalent scenario for the 'Through-Route ODP Option' described in our December 2016 memo.

[1] 07:30-08:30 and 16:30-17:30 respectively.

3 Modelled Effects of Additional ODP Network Option ('No Through-Route')

3.1 As with the previous assessment only selected model outputs have been chosen to illustrate here the results of the further assessment, with a summary section being provided at the end of this Memo.

3.2 Prior to Completion of CNC Projects

3.2.1 The following diagram illustrates the forecast daily traffic volumes resulting from this scenario (2021, *without* completion of the CNC projects).

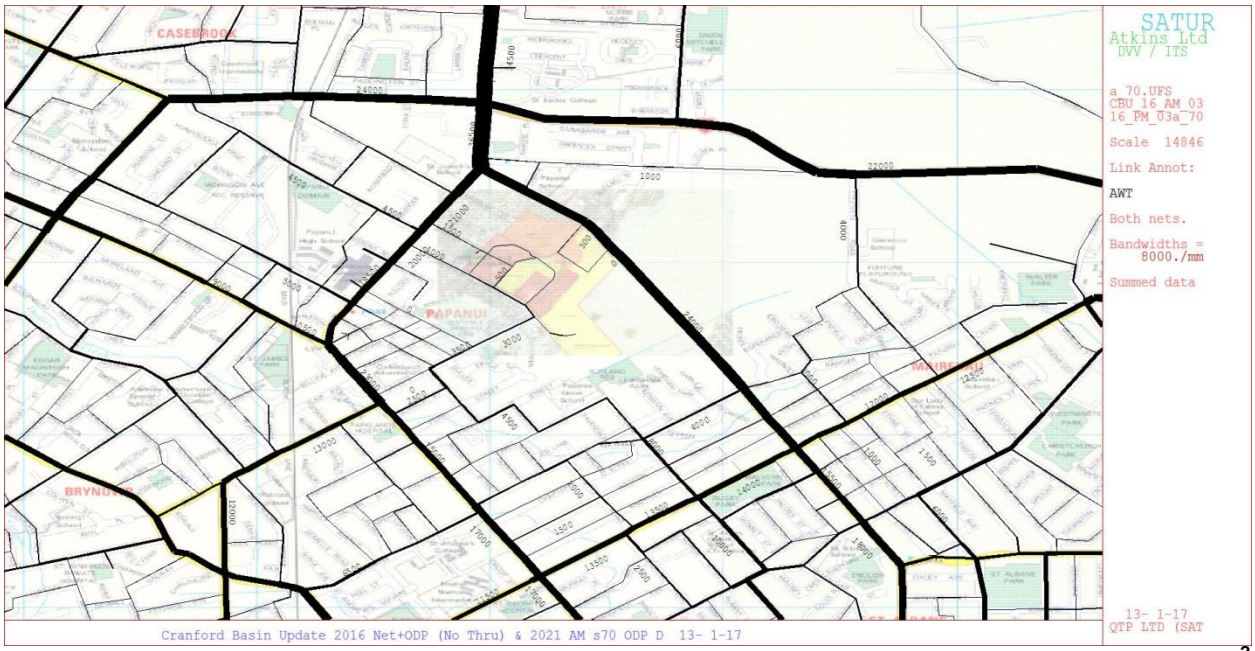


Figure 3-1: Daily Traffic Volumes forecast with No Through-Route Option, 2021 (No CNC)[2]

3.2.2 It may be seen that on Grants Rd is still forecast to carry around 3,500vpd under this scenario, up from around 1,600vpd (without the ODP), but lower than the approx. 4,400vpd forecast with the draft ODP (Through-Route) network, prior to completion of the CNC projects.

[2] Figures are shown rounded to the nearest 500vpd. As a matter of further relative detail, with respect to the link volumes shown *within* the ODP, please note that in practice these are likely to be somewhat higher than shown: In SATURN (the software platform used by CAST), it is standard practice that traffic in the simulation area 'loads' to / from zones directly to/from the model links, but via the nodes at either end of a link. Link traffic volumes do not, therefore, include zonal demands loading to the link, i.e. traffic leaving the link (at node A) or entering the link (at node B). This reflects that fact that in practice, traffic generally enters and leaves links at numerous locations, for example at driveways or to use on-street parking. The consequence of this is that where such zone loading occurs in the model (as within the ODP), illustrated link volumes are generally somewhat lower than actual volumes. This is not usually a significant issue because:

- ALL trips to / from zones are modelled at the nodes (usually representing intersections) at either end of the link. The modelling of intersections is the important aspect of accurately simulating the operation of urban networks.

- Zonal demands should typically be such that they are relatively small compared to the through-traffic using any particular link. (Where large traffic generation exists at specific locations (for example, at car parks) the precise location of zone loading can be modelled using 'spigot' nodes and links.

3.2.3 The differences between the draft ODP (Through-Route) network option and the No-Through Route option are perhaps illustrated more clearly in the diagram below:

Figure 3-2: Changes in Daily Traffic Volumes, between No Through-Route and Through-Route Options (Draft ODP Scenario, 2021, No CNC) [3]

3.2.4 Figure 3-2 shows that the forecast traffic volume increases on Grants Rd would be reduced by around 1-1,300vpd, compared to the ODP Through-Route Option, or about 25-30%. There are however relative *increases* forecast on Main North Road, Shearer Ave and some residential streets to the South-east of the ODP area. This arises because the lack of a through-route hinders the ability for both local (ODP and surrounding residential neighbourhoods) and traffic further afield to use a through vehicle route to access either Cranford or Grassmere Streets and Grants Rd (depending on their origin and/or destination).

3.2.5 This is also apparent when the changes in delays (between No Through-Route and Through-Route Options are considered, as shown below (PM only for illustration). The reduced permeability of the No Through Route Option, for both local and non-local traffic results in increased use of Main North Rd in particular, and this has a disproportionate (adverse) effect on delays for traffic exiting Grassmere St and Shearer Ave.

[3] Note that in this diagram the green bars represent a reduction (decrease) in traffic and red bars represents an increase (despite the red being annotated as negative). The changes should therefore be interpreted as absolute values, based on the colour.

Figure 3-3: Net Change in Link Delays from Draft ODP Concept Plan (Through Route) to No Through-Route Option (2021 PM Peak Hour, No CNC)

3.2.6 We noted previously that it was somewhat subjective whether the forecast impacts (in terms of forecast changes in volumes on the local road network surrounding the ODP area) should be considered minor, or more than minor, with our recommendation being **not** to allow for zoning that could exacerbate existing efficiency and associated safety issues on the road network at 2021, without either mitigating these effects or undertaking more detailed analysis to confirm our initial findings. This opinion would be stronger should a 'No Through-Route Option' be adopted for the ODP, as particularly prior to completion of the CNC projects, the forecast delays at both Grassmere St and Shearer Ave *are* likely to give rise to adverse safety issues, given full development of the ODP.

3.3 With Completion of CNC Projects

3.3.1 The following diagram illustrates the forecast daily traffic volumes resulting from this scenario (2031, *with* completion of the CNC projects per the Outline Plan Schemes).

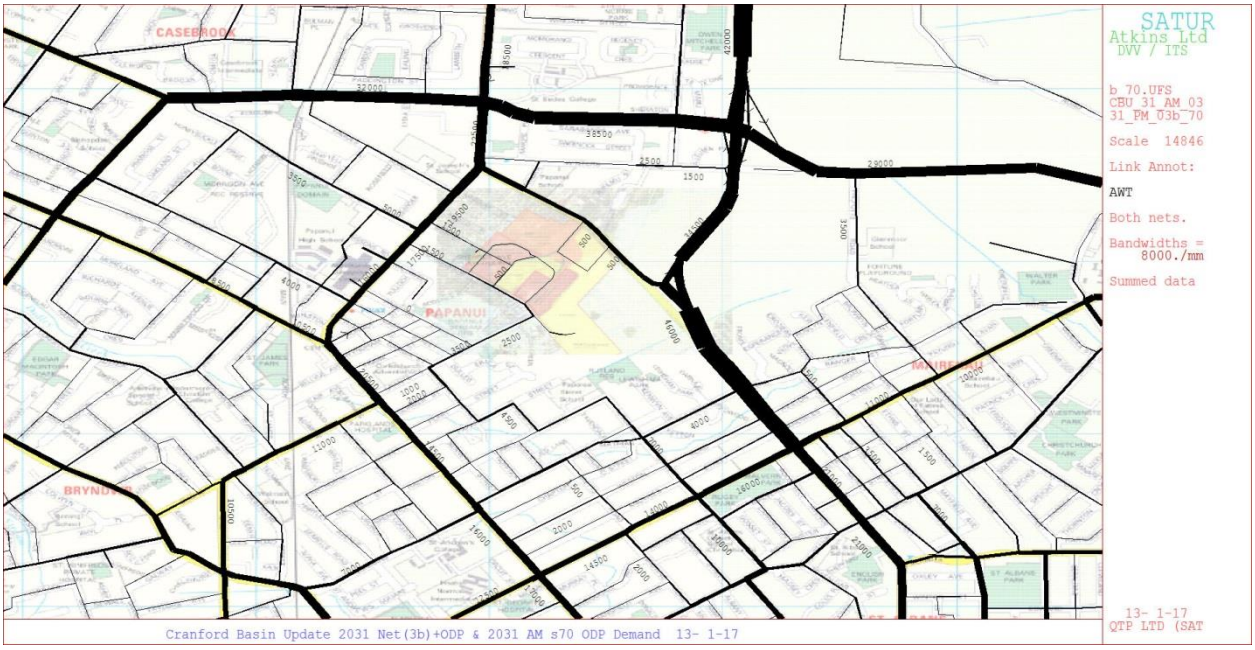


Figure 3-4: Daily Traffic Volumes forecast with No Through-Route Option, 2031 (With CNC)[4]

3.3.2 It may be seen that on Grants Rd is still forecast to carry around 3,300vpd under this scenario, up from around 1,700vpd (without the ODP) - but around 2,000vpd lower than the approx. 5,300vpd forecast with the draft ODP (Through-Route) network.

3.3.3 The differences between the draft ODP (Through-Route) network option and the No-Through Route option are illustrated more clearly below.

[4] See Footnote 2.

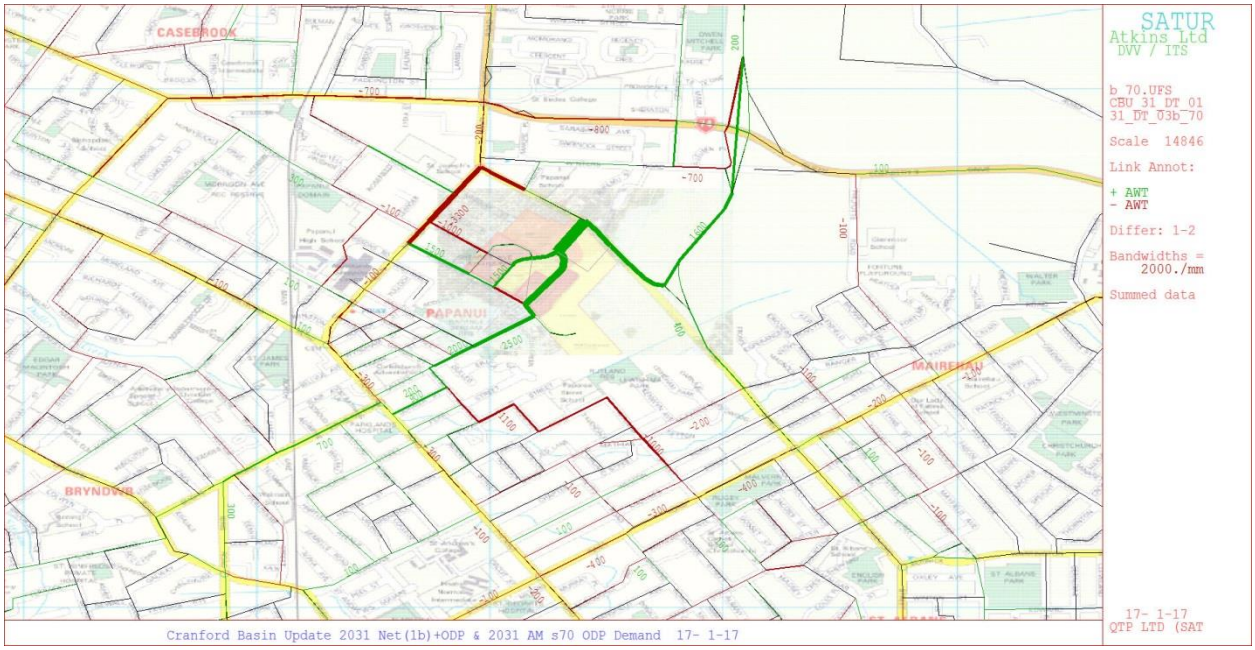


Figure 3-5: Changes in Daily Traffic Volumes, between No Through-Route and Through-Route Options (Draft ODP Scenario, 2031, With CNC)[5]

3.3.4 Figure 3-5 shows that the forecast traffic volume increases on Grants Rd would be reduced by around 2-2,500vpd, compared to the ODP Through-Route Option. There are however forecast to be relative *increases* forecast on Main North Road, Shearer Ave and residential streets to the South-east of the ODP area. This arises because the lack of a through-route affects the ability for both local (ODP and surrounding residential neighbourhoods) and traffic further afield to use a through vehicle route to access either Cranford or Grassmere Streets and Grants Rd (depending on their origin and/or destination).

3.3.5 In a similar manner to Figure 3-3, the changes in delays (between No Through-Route and Through-Route Options have been considered for this 2021 'With CNC' scenario, as shown below (PM only for illustration).

5 Note that in this diagram green represents a reduction (decrease) in traffic and red an increase (despite the red being annotated as negative. The changes should therefore be interpreted as absolute values, based on the colour).

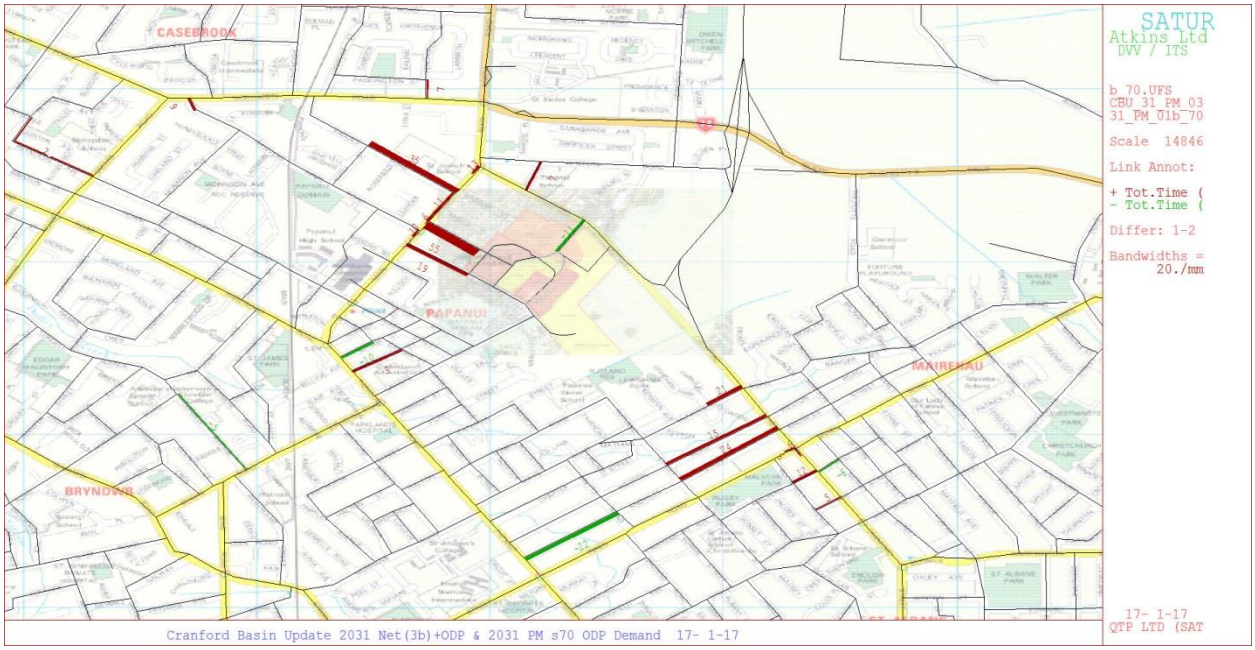


Figure 3-6: Net Change in Link Delays from Draft ODP Concept Plan (Through Route) to No Through-Route Option (2031 PM Peak Hour, With CNC)

3.3.6 These comparisons thus reveal a similar story to that shown by Figure 3-2 and Figure 3-3, with the benefits (of a reduced traffic volume on Grants Road) being countered by increased traffic volumes and delays elsewhere (compared to the 'Through-Route ODP network).

3.3.7 The (adverse) effects of reduced permeability are therefore still predicted to apply, despite the presence of the CNC projects. While the latter do serve to reduce somewhat the adverse effects of a No Through-Route Option (relative to the Through Route Option this analysis suggests that safety issues are still likely to arise at Grassmere St and Shearer Av intersections, should a No Through Route Option for the ODP be pursued.

4 Summary and Conclusions

4.1 This Memo has considered the potential transport effects of a further network option for the draft ODP, being one that does not provide a (vehicle) route through the ODP area.

4.2 Overall this assessment confirms that such an option does have the potential to reduce (additional) traffic forecast to otherwise occur on Grants Rd (with the ODP and the Through Route Option previously examined).

- In the absence of the CNC projects, if the ODP area were to be fully developed by 2021, this reduction would be around 900vpd (meaning Grants Rd might be expected to carry around 3,500vpd as opposed to around 4,400vpd with the Through-Route Option).
- With the CNC projects, with the ODP fully developed, by 2031 this reduction would be around 2-2,500vpd (meaning Grants Rd might be expected to carry around 3,300vpd as opposed to around 5,300vpd with the Through-Route Option).

4.3 However, there are also relative increases forecast on Main North Road, Shearer Ave and some residential streets to the South-east of the ODP area, because the lack of a through-route hinders the ability for both local (ODP and surrounding residential neighbourhoods) and traffic further afield to use a through vehicle route to access either Cranford or Grassmere Streets and Grants Rd (depending on their origin and/or destination).

4.4 This has a disproportionate (adverse) effect on delays for traffic exiting Grassmere St and Shearer Ave. Particularly prior to completion of the CNC projects, the forecast delays at both Grassmere St and Shearer Ave are likely to give rise to adverse safety issues, given full development of the ODP.

Appendix G - North-East Papanui Outline Development Plan Transport Assessment – May 2017

Memorandum

To:	Andy Milne
From:	Paul Roberts
Subject:	North-East Papanui Outline Development Plan Transport Assessment
Date:	Monday 22nd May 2017
Copy:	Mike Calvert, Gemma Dioni

Dear Andy,

Further to your instructions, we report below on the further analysis requested for additional options considered for the Outline Development Plan (**ODP**) for North-East Papanui. This further analysis supplements earlier advice:

- Memo dated Friday 8th December (whereby initial options for a 370hh residential development with a Through-Route ODP collector road system were examined); and
- Memo dated Tuesday 18th January (whereby a further option for a 370hh residential development with a No Through-Route ODP road system was examined);

1 Further Options Modelled

1.1 The principal focus of the additional analysis requested is three-fold[1], with respect to identification of the potential impact of alternative ODP densities and road networks (including Grassmere/MNR configurations) on:

- **Bus travel times:** MNR is defined as a Core Public Transport Route within the Christchurch Transport Strategic Plan (CTSP). One of the key CTSP goals is to improve access and choice and a key action to achieve this is through provision of a (more) attractive and efficient public transport system, ensuring journey reliability and good connectivity with other modes. To this end, the Council is currently investigating the provision of further infrastructure along this section of MNR (including bus lanes), to enhance bus reliability and complement the recent addition of services along this corridor by Environment Canterbury;
- **General Traffic travel times:** In terms of general traffic movement function, MNR is classified as a Minor Arterial within the City Plan. Whilst such roads do not have the strategic importance of Major Arterials and are expected to fulfil more of an access function, they are nevertheless important for trips throughout the city, providing the connections between major arterial roads and collector roads and linking major rural, suburban and industrial areas and commercial centre;

[1] Other potential analysis, such as on the relative accessibility of the ODP and/or surrounding existing residential suburbs is possible but as this is time-consuming, has not been included within this initial assessment (but may be considered for selected options/scenarios)

- **Traffic Volumes on Surrounding Roads.** In addition to the potential impacts on Main North Road, you have requested us to identify the forecast traffic volumes on selected surrounding roads, including Grassmere St, Grants Rd, Rayburn Avenue and Gambia Streets, given alternative ODP land use and road network scenarios.

1.2 This additional analysis has been undertaken for a variety of potential control options for the Grassmere Road/Main North Road (**MNR**) intersection, which are being considered both as part of the ODP development and the Council's current project to examine options to enhance bus priority along Main North Road. Each of these options has also been examined with respect to a potential reduction in the net residential density within the ODP area, which would effect an (assumed) total of around 200hh, as well as the previous density assumptions (yielding a total of 370hh). These combinations have all been assessed for a 'short-term' scenario, prior to completion of the Christchurch Northern Corridor (**CNC**) projects ('2021') and for a 'medium-term' scenario, assuming completion of the CNC projects (2031).

1.3 The forms of control examined for the Grassmere/MNR intersection include:

i. Full Priority Control (i.e. no restrictions on turning movements): This is the control option recently implemented as part of the approved Papanui Parallel Major Cycle Route (MCR) scheme);

ii. Right-in, Left Out (RILO) Priority Control: Whilst this option was proposed within the initial Papanui Parallel MCR consultation, ultimately it was not the preferred configuration to support that scheme. Nevertheless, we have included it as a potential control option for this exercise, to ensure the impacts of a range of potential accessibility options is reflected.

iii. Left-in, Left-out (LILO)) Priority Control; This is an option being considered for Council's MNR Bus Priority Project, as it would enable a northbound bus lane and bus gate to be installed on the approach to the signalled crossing north-east of Grassmere St; and

iv. Full Signalisation. Whilst the provision of full signals at an intersection of a Local Road with an Arterial is contrary to the hierarchy of treatments set out in the Council's Infrastructure Design Standard[2], as an intersection of a 'Minor Arterial' (MNR) and a 'Local Road' (Grassmere St) would not normally be considered for signalisation, such an option is not without precedent (e.g. MNR/Richill St) and has been tested here to ensure a full range of options has been considered.

1.4 Each of the priority control options (i-iii) have been assessed with the recent implementation of a signalised cycle/pedestrian crossing to the north-east of the intersection[3], whilst this crossing movement has been incorporated within the fully-signalised option (and thus the separate crossing signals removed).

[2] https://www.ccc.govt.nz/assets/Documents/Consents-and-Licences/construction-requirements/IDS/IDS-Part-08-Roading-V3-September-2016.PDF

[3] For the short-term scenario (based on the 'existing' network) scenarios reflecting the existing (2016) network without this crossing were also examined to determine the impact of this crossing in isolation.

1.5 Given the number of combinations of network and ODP development scale (and the fact that each is examined for both AM and PM peaks), this has yielded a total of 90 scenarios (only 12 of which had previously been assessed)[4]. Because of this number, only key analysis results have been included here, with interpretation of these heavily summarised in the following sections.

2 Key Points of Interpretation for Bus Travel Time Analysis (Appendix A):

2.1 This table looks at the journey times for all buses passing through the Grassmere/Main North Rd Intersection and the difference between these given different intersection control and ODP Land Use or Network Options.

2.2 The recent installation of crossing signals can be expected to add on average around 7-10 seconds to travel times for buses using this section of Main North Road; However, this amounts to no more than 0.3% of the total moving travel time of those services (noting that the modelling excludes time spent by those services at stops).

2.3 Prior to completion of the CNC projects (i.e. the '2021' scenarios presented in the table), if no development occurred within the ODP area, either restricted-movement priority control option considered for Grassmere/Main North[5] would have a relatively-benign impact on average bus travel times, with changes between -1 second/bus (AM peak, LILO) and +5seconds/bus (PM peak, LILO), compared to the situation given a full-movement priority intersection *with* the signalled-crossing to the north-east. These are the average changes over all buses passing through the intersection (i.e. in both directions).

2.4 Installation of a (full-movement) traffic signal intersection, replacing the recently-installed separate pedestrian/cycle crossing with its own phase on the north-east arm (in a similar manner to e.g. Kilmarnock/Deans but in this case being assumed to operate at half-the signal cycle time of adjacent signals in order to keep crossing delays to an acceptable level), would have the most-significant effect in the AM peak, increasing bus travel times by around 10 seconds/bus. As can be seen however, this still amounts to no more than 0.3% of the total moving travel time of those services(compared to the full-movement priority with traffic signals). In other words, it could be expected to have a similar (additional) impact to the recent installation of crossing signals.

2.5 Given development of the ODP (prior to completion of the CNC projects), then any of the alternative control options examined for Grassmere/Main North Road would not have a particularly significant effect on bus travel times, with the largest forecast increase (comparing the control options for same land-use scenario) being if full traffic signals were installed with the 370hh ODP, No Through-Route option. This amounts to an average of

[4] Note also that all these scenarios now reflect the CNC Outline Plan schemes (rather than the earlier 'NOR' schemes that previously provided for a right-turn connection from the Northern Arterial Extension to Cranford Street (North). The latter is removed in the Outline Plan schemes.

[5] 'RILO' = 'Right-in, Left-out' (as initially proposed during the 2015 Papanui Parallel Consultation scheme); 'LILO' = 'Left-in, Left-out', as currently being considered.

around +10s/bus in the AM peak.

2.6 With a 370hh ODP and No Through-Route, then full traffic signals could be expected to add around +19 seconds to each bus journey (AM peak), compared to if no development were to occur within the ODP area. With a Through-Route however, this increase would reduce to around +8seconds/bus. Given a lower level of development within the ODP area (e.g. the 200hh scenario examined), these increases would be lower (+16seconds/bus with no through-route and +4 seconds/bus with a through-route).

2.7 Given completion of the CNC proposals (and background traffic growth expected to 2031), full signalisation of Grassmere/Main North could be expected to have a less significant effect on the operation of buses using Main North Road, given the traffic relief forecast on this route: Absent of any ODP development, they could be expected to add around +7 seconds to average AM peak hour bus journeys (+2 seconds in the PM peak), when compared to a (full-movement) priority. By contrast however, a LILO option (with the recently-installed signalled crossing to the north-east maintained) could be expected to have small savings, of around -1 seconds/bus.

2.8 If ODP development proceeds however, full signalisation would have relatively-little additional impact, with this being no more than +8 seconds/bus (compared to a full-movement priority and crossing signals), given 370hh (and no through-route)[6]. As with the 'pre-CNC' (2021) scenarios, the presence of a through-route in the ODP area serves to reduce the additional Main North Road delay due to full-signalisation.

2.9 This may be seen particularly when the results for the 370hh with through-route scenario are compared to the no ODP scenario (and existing control) for the restricted priority options: Even with this level of development, either the RILO or LILO options actually generate small savings (around -12 seconds/bus), because of the additional relief (on top of that enabled by the CNC projects), afforded by a route through the ODP area, whereas with no through-route there could be expected to be a (small) increase in travel times (e.g. +3 to +4 seconds/bus, for a LILO option).

2.10 The impacts on bus travel times described in this section could be further mitigated by addition of bus lanes (and/or bus gates at signal stoplines) that have not formed part of the assumptions for this analysis : For example, northbound bus delays predicted under the LILO option could be reduced further by a northbound bus lane/bus gate. Under a fully-signalised option, southbound bus delays could be further mitigated by formation of a southbound bus lane/bus gate. Whilst such an option could be time-limited, it would require removal of the current indented parking between Sawyers Arms Rd and Grassmere St during periods of operation.

6 When compared to the performance given the existing layout (full-movement priority with crossing signals) and NO ODP, a fully-signalised Grassmere/Main North intersection with 370hh and no through-route would add around +13 seconds/bus to average travel times (2031 AM peak).

3 Key Points of Interpretation for General Traffic Journey Time Analysis (Appendix B):

3.1 This table and the associated graphed data looks at peak period journey times for cars along Main North Rd in both directions, between north of QE2 Drive and just south of Blighs Rd (for southbound trips), with the reverse for northbound trips.

3.2 The travel times (shown in seconds) for this 2.1km journey are presented for different intersection layouts at Grassmere/Main North and alternative ODP Land Use or Network Options.

3.3 It can be seen that (regardless of the option for Grassmere/Main North or the ODP itself), substantial relief (e.g. around 1.5 minutes in the AM peak hour) to peak direction travel times (southbound in the AM Peak, northbound in the PM Peak) is expected to be created by 2031, notwithstanding the expected wider traffic growth. This arises, principally, because of the assumption of the CNC projects in these later scenarios.

3.4 For all scenarios, peak direction travel times on Main North Rd would be higher for general traffic if a No Through-Route Option is pursued for the ODP network, compared to if a Through-Route is provided. These differences appear to be much more substantial than the differences between potential Grassmere/Main North control options.

3.5 Minimal differences are however made to general traffic journey times by a lower level of development within the ODP (200hh compared to 370hh scenarios) for a given network configuration (e.g. No Through-Route or Through-Route or between any of the control options for Grassmere/Main North).

3.6 While a fully-signalised intersection at Grassmere/Main North does add to southbound AM Peak general traffic journey times, compared to other control options (for a given development scenario), the additional travel times are not substantial (typically adding between +9 to +18 seconds to the average southbound journey - amounting to not more than +4% for the section examined).

3.7 For the northbound PM peak journey, a fully-signalised intersection at Grassmere/Main North is actually predicted to offer slightly faster journey times than a LILO option (with separate signalised crossing) – but again, differences are for the most part marginal (the differences being up to around 9 seconds).

3.8 If a Through-Route Option were pursued for the ODP however, then the analysis suggests that a LILO (plus separate signalised crossing) would actually perform slightly less well than full-movement signals at Grassmere/Main North (for northbound PM peak travel), because of the wider impacts of traffic reassignment.

3.9 The impacts described in this section may be expected to be only slightly worse in terms of limited additional delay to general traffic, should additional bus priority measures (such as those described above in paragraph 2.10) be considered warranted on Main North Road, given its status as a Core Public Transport Route.

4 Key Points of Interpretation for Traffic Flow (Appendix C):

4.1 Appendix C summarises the predicted traffic volumes on key surrounding roads. The tabulated volumes may be compared by reference to the associated graphs for each location:

- Appendix C – Location 1: Main North (S Grassmere)
- Appendix C – Location 2: Main North (N Sawyers Arms)
- Appendix C – Location 3: Grants (S Proctor)
- Appendix C – Location 4: Grassmere (S Main North)
- Appendix C – Location 5: Shearer (S Main North)
- Appendix C – Location 6: Grassmere + Shearer (S Main North)
- Appendix C – Location 7: Rayburn (S Grants)
- Appendix C – Location 8: Gambia (N Grants)
- Appendix C – Location 9: Claremont (S Paparoa)

4.2 In addition to these graphs (for which more detailed points of interpretation are offered below), a series of plots have been generated to indicate the differences in anticipated volumes under key scenarios:

4.3 **Figure 4-1** overleaf shows the difference in daily traffic (given a 370hh Through-Route ODP) with LILO control of the Grassmere/Main North intersection, compared to the previous full-movement priority control. It shows that the restricted turning movements serve to reduce traffic through (and from) the ODP using the Through-Route and Grassmere Street (the latter by a fairly-significant 1,800vpd). There is, however, minimal reduction anticipated on Grants Road and negligible reduction effected further to the south. Relatively small increases would occur on Shearer Avenue, but these are minimised by the Through-Route which offers a preferable way to the north for most traffic originating from the ODP (and other residential areas to the SE).

4.4 **Figure 4-2** overleaf shows the difference in daily traffic (given a 370hh Through-Route ODP) with signal control of the Grassmere/Main North intersection, compared to the previous full-movement priority control. It shows that whilst volumes are reduced on Grassmere St, the less-restricted turning movements (compared to a LILO) means the scale of reduction is less. (The slight additional delays on Main North Road also cause some re-routeing of non-ODP traffic, for example offering greater encouragement for the use of Sissons Drive to ‘cut-through’ to Langdons Rd).

Figure 4-1: Difference in Daily Traffic (Grassmere LILO vs Full Movement Priority, Through-Route ODP with 370hh for both)[7]

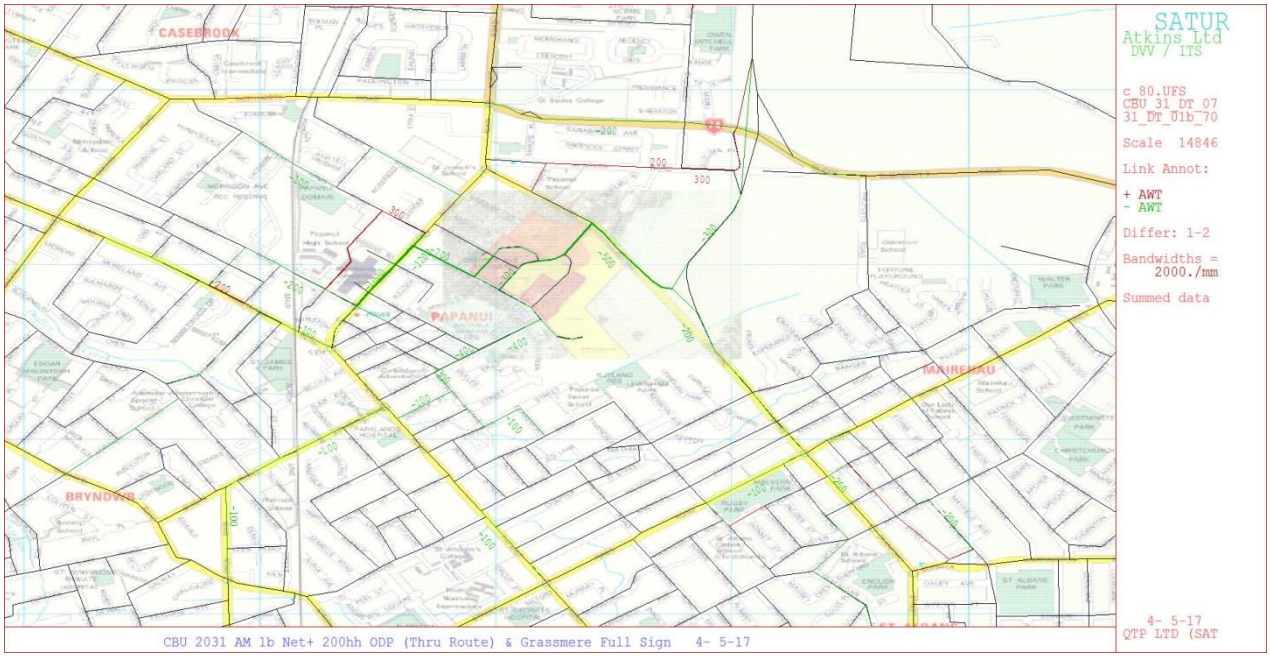
Figure 4-2: Difference in Daily Traffic (Grassmere Signals vs Full Movement Priority, Through-Route ODP with 370hh for both)[7]

[7] Note that only differences of 100vpd are shown (and are rounded to the nearest 100vpd)

4.5 **Figure 4-3** shows the difference in daily traffic given LILO control of the Grassmere/Main North intersection and a 200hh ODP, compared to the previous full-movement priority and a 370hh ODP. Whilst this shows a fairly similar pattern **Figure 4-1**, it may be seen that more extensive reductions are anticipated to the SE, and in particular on Grants Rd. However, at -600vpd, this amounts to around -11% and may not be perceived as significant. Traffic signals would effect a smaller reduction for the same comparison, of around -400vpd (**Figure 4-4**).

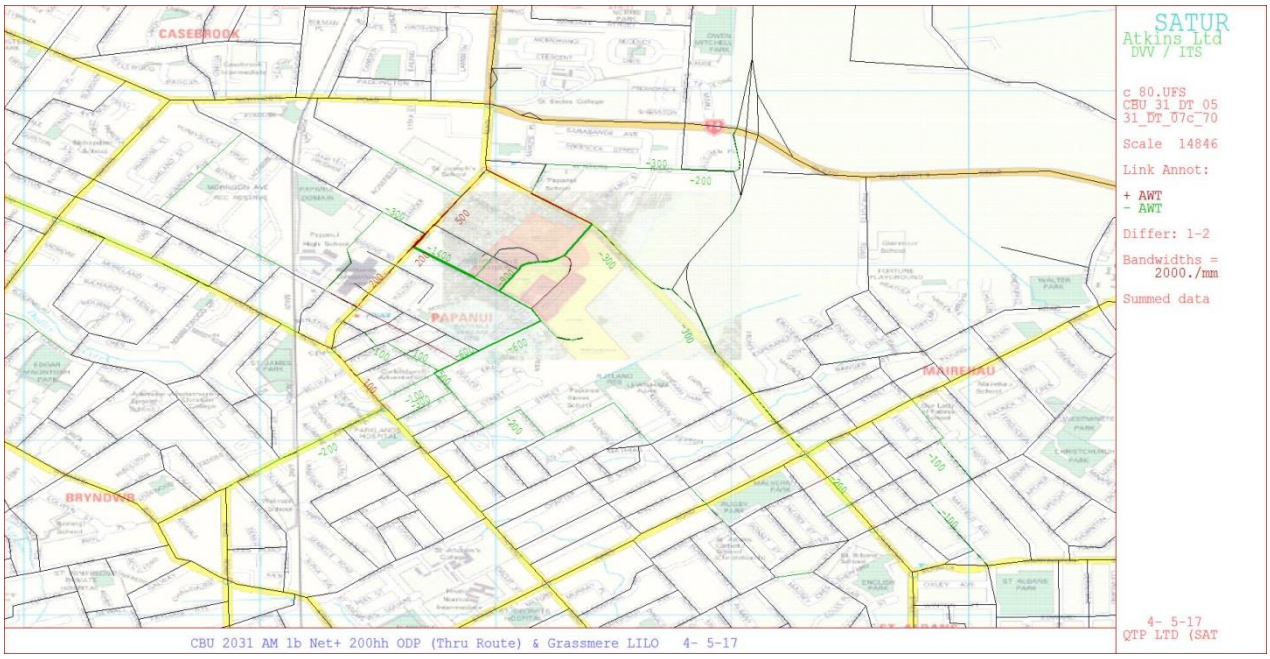
Figure 4-3: Difference in Daily Traffic (Grassmere LILO with 200hh ODP vs Full Movement Priority with 370hh) [7]

Figure 4-4: Difference in Daily Traffic (Grassmere Signals with 200hh ODP vs Full Movement Priority with 370hh) [7]



4.6 **Figure 4-5** below shows the difference in daily traffic given LILO control of the Grassmere/Main North intersection and a 200hh ODP - but compared to adoption of full-movement signals at the intersection *and* a 370hh ODP. As might be expected ,this exhibits a fairly similar pattern to Figure 4-3, generating around a 10% reduction in traffic on Grants Rd. However, more significant reductions are shown on Grassmere Street (where -1400vpd would be equivalent to around 50% of the 2,400vpd otherwise expected given full signalisation and a 370hh ODP (with Through-Route). That said, a traffic flow of 2,400vpd is, in our view, still well within the typical flows that might be expected for Local Roads.

Figure 4-5: Difference in Daily Traffic (Grassmere LILO with 200hh ODP vs Full Movement Signals with 370hh) [7]



4.7 **(Refer Appendix C1 Locations 1 & 2):** Main North Road volumes are affected by the alternative ODP and Grassmere scenarios, with the biggest (positive) impact coming from the Through-Route vs No Through-Route. As noted above, additional delays from full signalisation of Grassmere/Main North do have the potential to encourage some re-routing of traffic to non-arterial routes (e.g. to Sissons Drive), compared to more-restrictive forms of control (e.g. LILO).

4.8 **(Refer Appendix C1 Location 3):** Grants Road volumes are also affected much more significantly by a ‘’No Through-Route’ Option vs a Through-Route Option, than by any form of alternative control at Grassmere/Main North – or indeed by a potential reduction in ODP development from 370hh to 200hh. As noted above, (given a Through-Route) a reduced scale of development has (relatively) little effect on projected Grants Road volumes.

4.9 **(Refer Appendix C1 Location 4):** Likewise, Grassmere Road volumes are also affected much more significantly by a ‘’No Through-Route’ Option vs a Through-Route Option. However, in contrast to Grants Road, they are then most significantly affected by the

restrictive control afforded under a LILO arrangement compared to, e.g., traffic signals – *and much less affected by a reduction from 370hh to 200hh*. Notwithstanding this, in our opinion, the volumes projected for any scenario (including 370hh) are not of a scale that should be of concern and thus (as noted above) the choice of control should come down more to other considerations, such as safety and accessibility.

4.10 **(Refer Appendix C1 Location 5):** The potential reductions in traffic on Grassmere Street should also be considered in conjunction with the effects on Shearer Avenue, as the ODP is anticipated to provide for a direct connection to the latter and thus it offers an alternative route to (and from Main North Road). Thus for those options that are more restrictive in terms of accessibility to and from Grassmere Street, increased pressure can be expected to be placed upon Shearer Avenue(although this is significantly mitigated by the presence of a Through-Route). The combined total volumes of both Grassmere Street and Shearer Avenue are presented in Appendix C1 Location 6).

4.11 **(Refer Appendix C1 Location 7):** For Rayburn Avenue, traffic volumes may be expected to be substantially reduced in future, on completion of the CNC projects[8]. A reduction in ODP density to 200hh is however projected to have only a fairly modest impact on traffic volumes at the 2031 horizon compared to a 370hh ODP. (e.g. around -6% for a signalled Grassmere with Through-Route).

4.12 **(Refer Appendix C1 Location 8):** For Gambia Street, traffic volumes are not expected to be substantially affected (in absolute terms) by any of the options examined for the ODP, with minimal change expected should the ODP be reduced from 370hh to 200hh.

4.13 **(Refer Appendix C1 Location 9):** More remotely from the ODP, e.g. on Claremont Avenue, this is only affected to a noticeable degree by the Through-Route/No Through-Route: A reduction to 200hhh from 370hh is predicted to have negligible effect, e.g. reducing projected daily traffic by around -100vph (-3%) at 2031 for a signalled Grassmere (Through-Route ODP) scenario.

[8] Note that the model predictions of traffic volumes on these roads are affected by local model zone connections and should be treated as indicative only of differences between scenarios (rather than absolute scale). In particular, the (2021) base model predictions for Rayburn Avenue are substantially higher than the last-available CCC observed count (albeit that this is from 2010).

5 Summary:

5.1 In terms of overall network performance, this additional analysis appears to offer strong support for a Through-Route option for the ODP collector road network – notwithstanding such an option has the potential for more significant increases in traffic volumes on Grants Road.

5.2 A reduction in ODP density to 200hh from 370hh does not appear to have the potential to reduce expected traffic volumes on most surrounding roads to a significant degree. For example, given traffic signals at Grassmere/Main North, volumes on Grants Road would only be reduced by around -400vpd (6%).

5.3 In terms of overall general traffic impacts on the network, full-movement traffic signals at Grassmere/Main North have the potential for (small) savings in overall travel *distance* compared to a LILO option for both peak periods, reflecting the greater accessibility afforded by a full-movement signalised option. Whilst within the morning peak (only) there is projected to be a (very small) increase in overall network travel *time* for signals compared to a LILO, this is not the case in the evening peak, whereby the signals are projected to offer slight savings (as the reduced travel costs from increased accessibility outweigh the small penalties at the intersection itself).

5.4 Given ODP development (with a Through-Route) there are thus *not* substantial benefits forecast to be achieved for a LILO at Grassmere/Main North (plus separate signalised crossing), compared to a fully-signalised intersection. However, given the status of MNR as a Core Public Transport Route, it is notable that a fully-signalised option is predicted to increase average bus delays by around +9 seconds/bus compared to a LILO option in the critical AM peak period, without further mitigation.

5.5 Whilst MNR bus delays could be further mitigated for *either* a LILO or fully-signalised intersection by formation of bus lanes/gates (e.g. northbound for a LILO and north and/or southbound for signals), we note that a southbound bus lane for a full-signals option would require removal of the current indented parking between Sawyers Arms Rd and Grassmere St, during periods of operation.

5.6 In summary however, the analysis reported here suggests that bus and general traffic travel time differences between LILO or fully-signalised options for Grassmere/MNR do not appear to be significant in an overall context: The choice between either option is, in our view, likely to be governed more by safety, accessibility and amenity considerations.

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Appendix A – Bus Impacts

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Forecast Impact of Network and Land Use Options on Bus Travel Times on Main North Road

(Note that the statistics in this analysis relates to *all buses passing through Grassmere/Main North intersection* only)

Year	Land Use /ODP Network	Main North Rd		Model reference		AM Peak Hour						PM Peak Hour					
		Grassmere/ Main North	Signalled Cycle Crossing	AM	PM	Time (Bus hrs)	Distance (Bus-km)	Speed (kph)	Total Change (s)	[Buses/Hr] Change (Secs/Bus)	% Change (Total JT)	Time (Bus hrs)	Distance (Bus-km)	Speed (kph)	Total Change (s)	[Buses/Hr] Secs/Bus	% Change (Total JT)
2021*	No ODP	Full Priority*	✗	CBU_21_AM_00c_00	CBU_21_PM_00c_00	41.00	1305.66	31.8	-321	-7	-0.2%	43.50	1265.26	29.1	-458	-10	-0.3%
		Full Priority	✓	CBU_21_AM_04c_00	CBU_21_PM_04c_00	41.09	1305.66	31.8		[47]		43.63	1265.26	29.0		[48]	
		RILO	✓	CBU_21_AM_06c_00	CBU_21_PM_06c_00	41.09	1305.66	31.8	14	0	+0.0%	43.65	1265.26	29.0	91	2	+0.1%
		LILO	✓	CBU_21_AM_05c_00	CBU_21_PM_05c_00	41.07	1305.66	31.8	-46	-1	-0.0%	43.69	1265.26	29.0	247	5	+0.2%
		Signals	✓	CBU_21_AM_07c_00	CBU_21_PM_07c_00	41.27	1305.66	31.6	653	14	+0.4%	43.71	1265.26	28.9	315	7	+0.2%
	ODP with No Through Route (370hh)	Full Priority*	✗	CBU_21_AM_00c_71	CBU_21_PM_00c_71	41.13	1305.61	31.7	-250	-5	-0.2%	43.69	1265.21	29.0	-422	-9	-0.3%
		Full Priority	✓	CBU_21_AM_04c_71	CBU_21_PM_04c_71	41.20	1305.61	31.7		[47]		43.81	1265.21	28.9		[48]	
		RILO	✓	CBU_21_AM_06c_71	CBU_21_PM_06c_71	41.20	1305.61	31.7	2	0	+0.0%	43.78	1265.21	28.9	-89	-2	-0.1%
		LILO	✓	CBU_21_AM_05c_71	CBU_21_PM_05c_71	41.18	1305.61	31.7	-69	-1	-0.0%	43.83	1265.21	28.9	88	2	+0.1%
		Signals	✓	CBU_21_AM_07c_71	CBU_21_PM_07c_71	41.33	1305.61	31.6	469	10	+0.3%	43.83	1265.21	28.9	73	2	+0.0%
	ODP with Through Route (370hh)	Full Priority*	✗	CBU_21_AM_00c_70	CBU_21_PM_00c_70	41.01	1305.61	31.8	-207	-4	-0.1%	43.41	1265.21	29.1	-235	-5	-0.1%
		Full Priority	✓	CBU_21_AM_04c_70	CBU_21_PM_04c_70	41.07	1305.61	31.8		[47]		43.47	1265.21	29.1		[48]	
		RILO	✓	CBU_21_AM_06c_70	CBU_21_PM_06c_70	41.07	1305.61	31.8	6	0	+0.0%	43.50	1265.21	29.1	83	2	+0.1%
		LILO	✓	CBU_21_AM_05c_70	CBU_21_PM_05c_70	41.07	1305.61	31.8	-6	0	-0.0%	43.54	1265.21	29.1	226	5	+0.1%
		Signals	✓	CBU_21_AM_07c_70	CBU_21_PM_07c_70	41.19	1305.61	31.7	428	9	+0.3%	43.50	1265.21	29.1	97	2	+0.1%
	ODP with No Through Route (200hh)	Full Priority*	✗	CBU_21_AM_00c_81	CBU_21_PM_00c_81	41.07	1305.61	31.8	-295	-6	-0.2%	43.62	1265.21	29.0	-361	-8	-0.2%
		Full Priority	✓	CBU_21_AM_04c_81	CBU_21_PM_04c_81	41.15	1305.61	31.7		[47]		43.72	1265.21	28.9		[48]	
		RILO	✓	CBU_21_AM_06c_81	CBU_21_PM_06c_81	41.13	1305.61	31.7	-76	-2	-0.1%	43.72	1265.21	28.9	-17	0	-0.0%
		LILO	✓	CBU_21_AM_05c_81	CBU_21_PM_05c_81	41.14	1305.61	31.7	-55	-1	-0.0%	43.73	1265.21	28.9	46	1	+0.0%
		Signals	✓	CBU_21_AM_07c_81	CBU_21_PM_07c_81	41.30	1305.61	31.6	517	11	+0.3%	43.76	1265.21	28.9	137	3	+0.1%
	ODP with Through Route (200hh)	Full Priority*	✗	CBU_21_AM_00c_80	CBU_21_PM_00c_80	40.98	1305.61	31.9	-214	-5	-0.1%	43.33	1265.21	29.2	-339	-7	-0.2%
		Full Priority	✓	CBU_21_AM_04c_80	CBU_21_PM_04c_80	41.04	1305.61	31.8		[47]		43.43	1265.21	29.1		[48]	
		RILO	✓	CBU_21_AM_06c_80	CBU_21_PM_06c_80	41.04	1305.61	31.8	0	0	+0.0%	43.42	1265.21	29.1	-31	-1	-0.0%
		LILO	✓	CBU_21_AM_05c_80	CBU_21_PM_05c_80	41.05	1305.61	31.8	24	1	+0.0%	43.47	1265.21	29.1	154	3	+0.1%
		Signals	✓	CBU_21_AM_07c_80	CBU_21_PM_07c_80	41.13	1305.61	31.7	337	7	+0.2%	43.45	1265.21	29.1	92	2	+0.1%
2031	No ODP	Full Priority	✓	CBU_31_AM_00b_00	CBU_31_PM_00b_00	41.21	1267.20	30.8		[48]		42.77	1231.88	28.8		[47]	
		RILO	✓	CBU_31_AM_06c_00	CBU_31_PM_06c_00	41.19	1267.20	30.8	-49	-1	-0.0%	42.78	1231.88	28.8	25	1	+0.0%
		LILO	✓	CBU_31_AM_05c_00	CBU_31_PM_05c_00	41.19	1267.20	30.8	-58	-1	-0.0%	42.76	1231.88	28.8	-13	0	-0.0%
		Signals	✓	CBU_31_AM_07c_00	CBU_31_PM_07c_00	41.30	1267.20	30.7	329	7	+0.2%	42.79	1231.88	28.8	82	2	+0.1%
	ODP with No Through Route (370hh)	Full Priority	✓	CBU_31_AM_00c_71	CBU_31_PM_00c_71	41.27	1267.20	30.7		[48]		42.87	1231.88	28.7		[47]	
		RILO	✓	CBU_31_AM_06c_71	CBU_31_PM_06c_71	41.30	1267.20	30.7	92	2	+0.1%	42.85	1231.88	28.8	-81	-2	-0.1%
		LILO	✓	CBU_31_AM_05c_71	CBU_31_PM_05c_71	41.26	1267.20	30.7	-31	-1	-0.0%	42.86	1231.88	28.7	-40	-1	-0.0%
		Signals	✓	CBU_31_AM_07c_71	CBU_31_PM_07c_71	41.38	1267.20	30.6	385	8	+0.3%	42.87	1231.88	28.7	-5	0	-0.0%
	ODP with Through Route (370hh)	Full Priority	✓	CBU_31_AM_01b_70	CBU_31_PM_01b_70	41.07	1267.20	30.9		[48]		42.54	1231.88	29.0		[47]	
		RILO	✓	CBU_31_AM_06c_70	CBU_31_PM_06c_70	41.07	1267.20	30.9	-6	0	-0.0%	42.51	1231.88	29.0	-85	-2	-0.1%
		LILO	✓	CBU_31_AM_05c_70	CBU_31_PM_05c_70	41.05	1267.20	30.9	-54	-1	-0.0%	42.58	1231.88	28.9	164	3	+0.1%
		Signals	✓	CBU_31_AM_07c_70	CBU_31_PM_07c_70	41.15	1267.20	30.8	281	6	+0.2%	42.57	1231.88	28.9	117	2	+0.1%
	ODP with No Through Route (200hh)	Full Priority	✓	CBU_31_AM_00c_81	CBU_31_PM_00c_81	41.24	1267.20	30.7		[48]		42.80	1231.88	28.8		[47]	
		RILO	✓	CBU_31_AM_06c_81	CBU_31_PM_06c_81	41.26	1267.20	30.7	74	2	+0.1%	42.80	1231.88	28.8	-5	0	-0.0%
		LILO	✓	CBU_31_AM_05c_81	CBU_31_PM_05c_81	41.25	1267.20	30.7	38	1	+0.0%	42.79	1231.88	28.8	-30	-1	-0.0%
		Signals	✓	CBU_31_AM_07c_81	CBU_31_PM_07c_81	41.34	1267.20	30.7	367	8	+0.2%	42.82	1231.88	28.8	70	1	+0.0%
	ODP with Through Route (200hh)	Full Priority	✓	CBU_31_AM_01b_80	CBU_31_PM_01b_80	41.03	1267.20	30.9		[48]		42.49	1231.88	29.0		[47]	
		RILO	✓	CBU_31_AM_06c_80	CBU_31_PM_06c_80	41.05	1267.20	30.9	46	1	+0.0%	42.50	1231.88	29.0	7	0	+0.0%
		LILO	✓	CBU_31_AM_05c_80	CBU_31_PM_05c_80	41.04	1267.20	30.9	29	1	+0.0%	42.53	1231.88	29.0	130	3	+0.1%
		Signals	✓	CBU_31_AM_07c_80	CBU_31_PM_07c_80	41.11	1267.20	30.8	263	5	+0.2%	42.53	1231.88	29.0	114	2	+0.1%

* Note that the '2021' scenarios use the anticipated demands in 2021 but the current (2016) network, as an indicator of potential 'pre-CNC' changes. It will be noted that use of the 'existing' layout assumptions for Main North means that the 'Full Priority' network for this year (deliberately) omits the recently-installed signalled cycle crossing to the north-east of the intersection **for this scenario only.**

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Appendix B – General Traffic Journey Time Impacts

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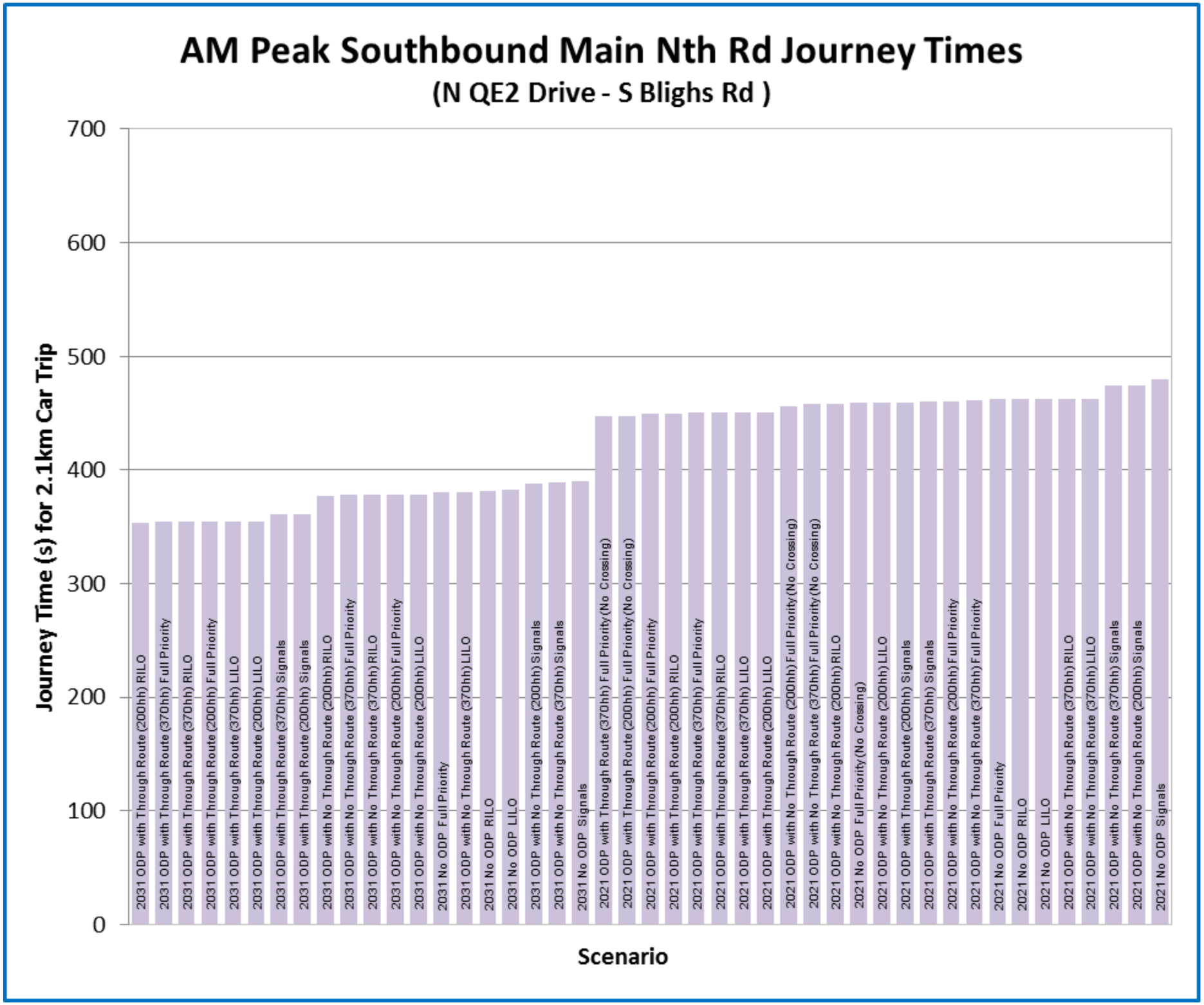
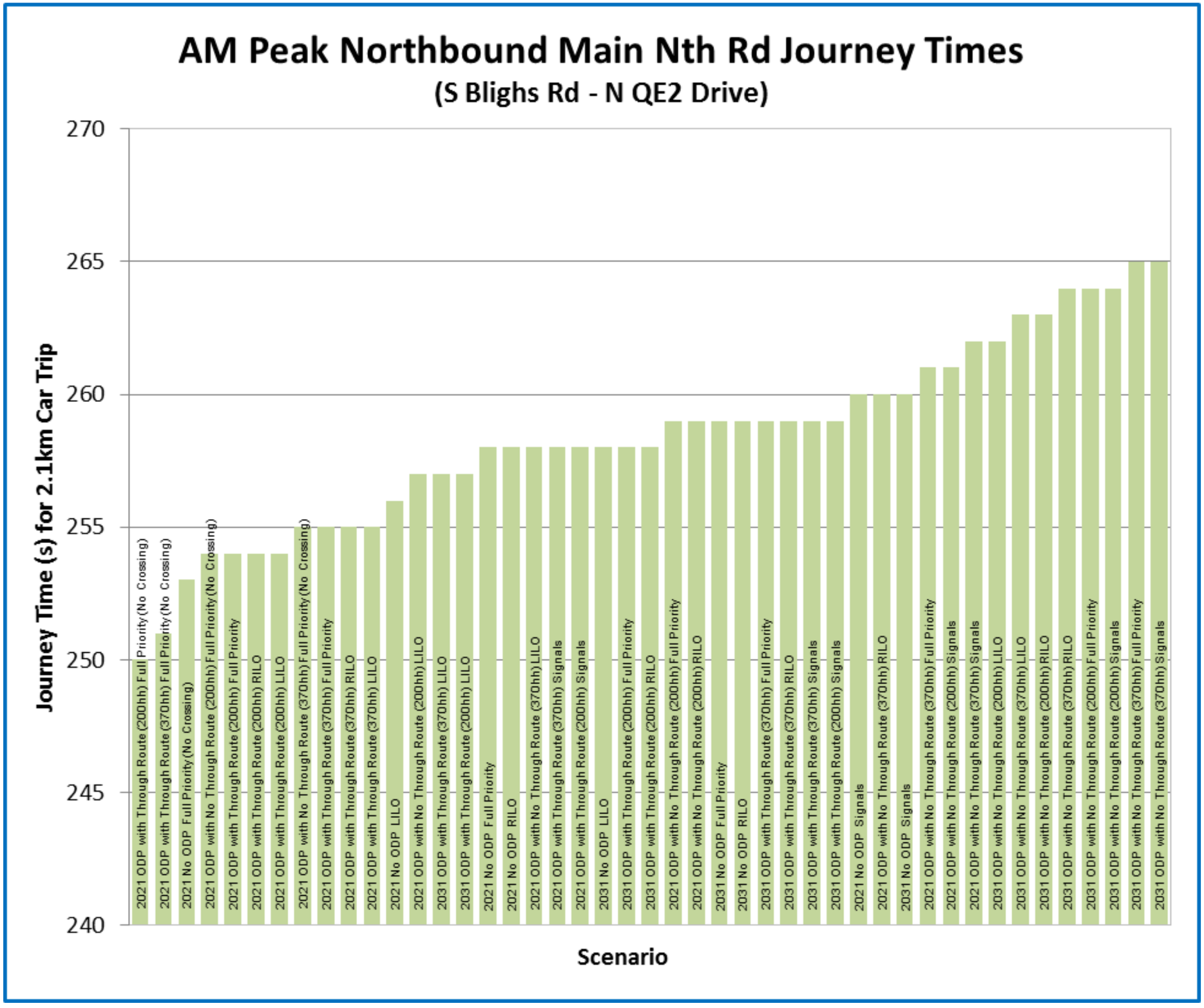
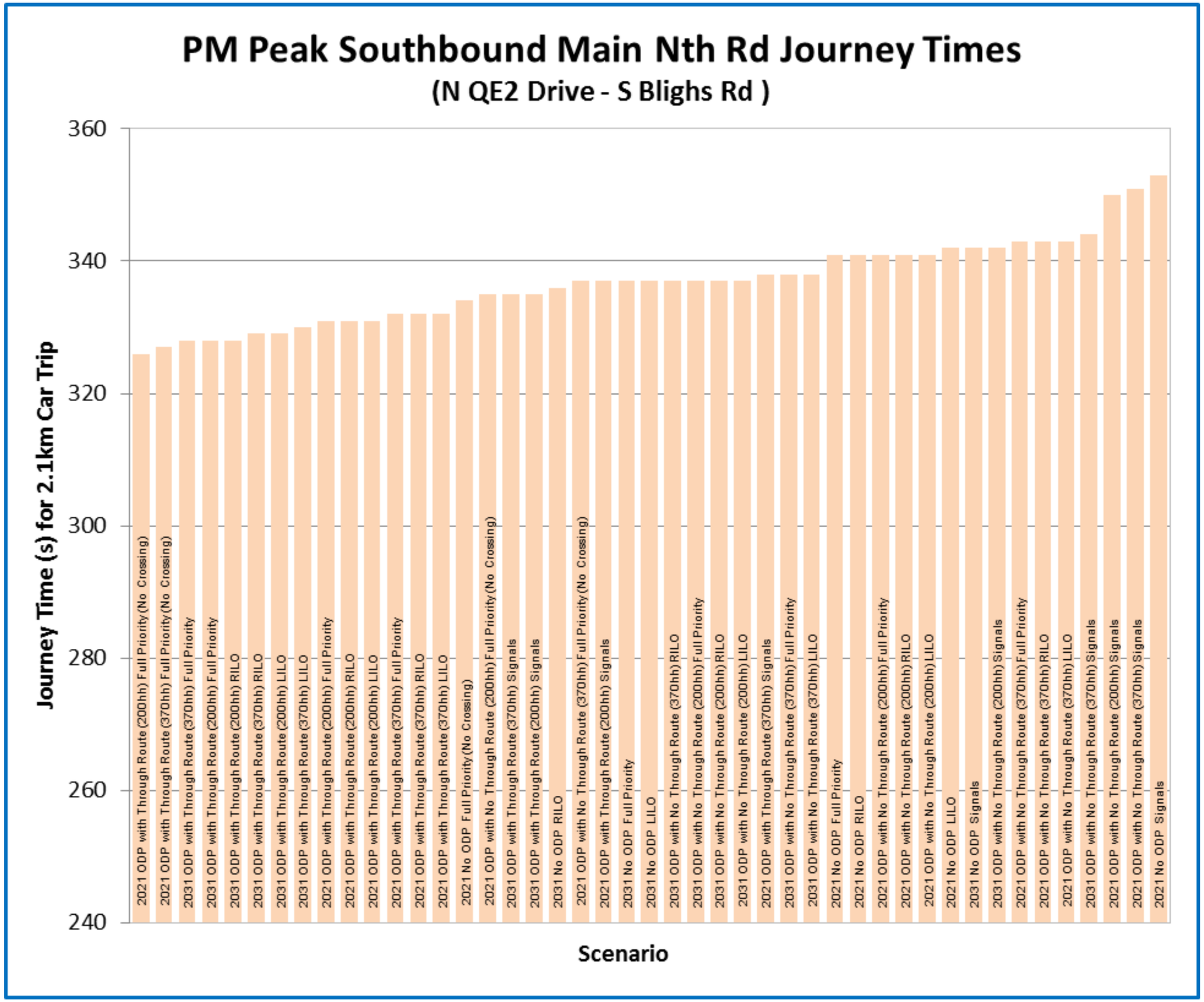
Forecast Impact of Network and Land Use Options on General Traffic Travel Times on Main North Road

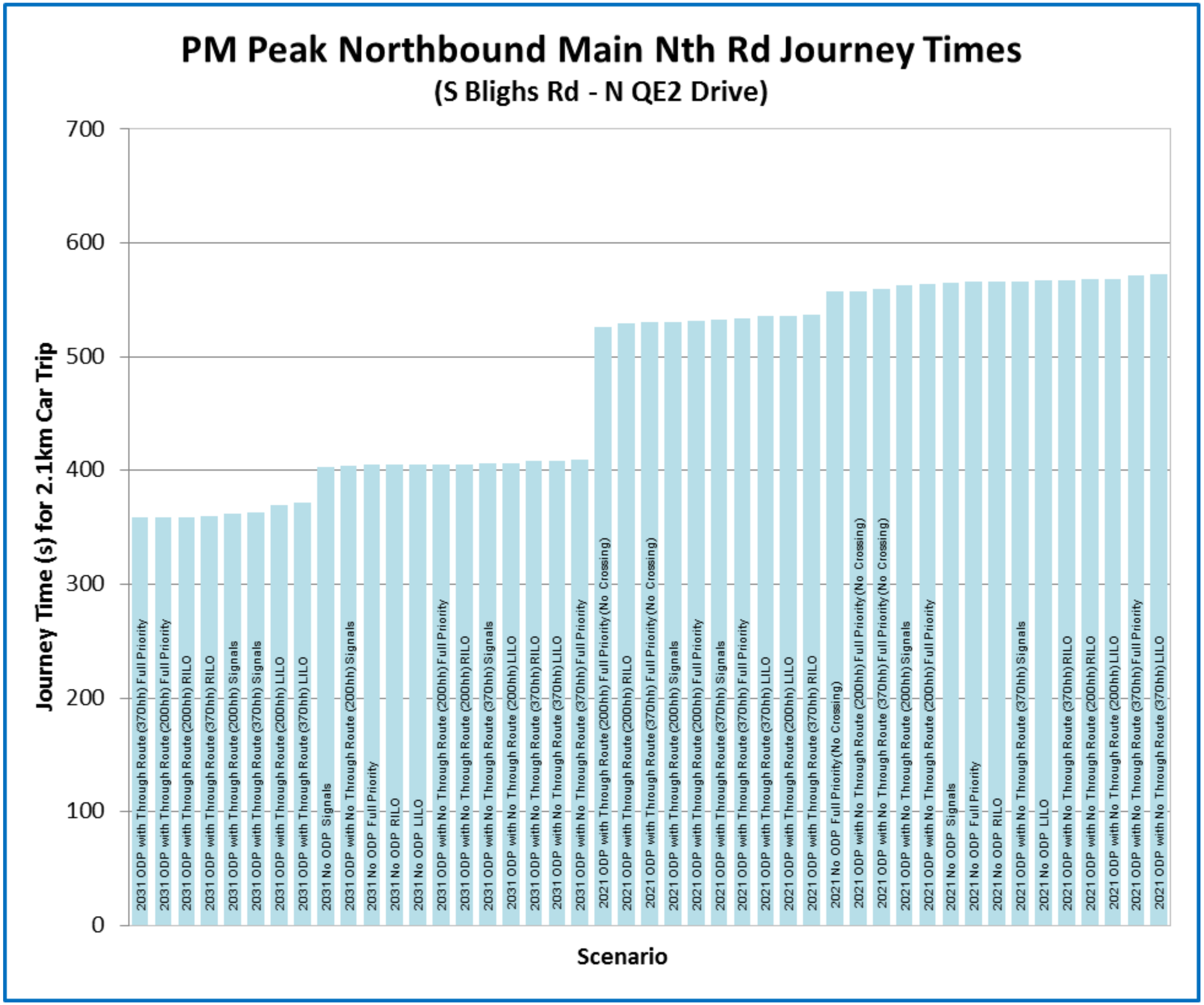
Year	Land Use /ODP Network	Main North Rd		Model reference		AM Peak Hour						PM Peak Hour					
		Grassmere/ Main North	Signalled Cycle Crossing	AM	PM	Nbnd Time (s)	Sbnd Time (s)	Nbnd Change	Sbnd Change	Nbnd % Change	Sbnd % Change	Nbnd Time (s)	Sbnd Time (s)	Nbnd Change	Sbnd Change	Nbnd % Change	Sbnd % Change
2021*	No ODP	Full Priority*	✗	CBU_21_AM_00c_00	CBU_21_PM_00c_00	253	459	-5	-3	-1.9%	-0.6%	557	334	-9	-7	-1.6%	-2.1%
		Full Priority	✓	CBU_21_AM_04c_00	CBU_21_PM_04c_00	258	462					566	341				
		RILO	✓	CBU_21_AM_06c_00	CBU_21_PM_06c_00	258	462	+0	+0	+0.0%	+0.0%	566	341	+0	+0	+0.0%	+0.0%
		LILO	✓	CBU_21_AM_05c_00	CBU_21_PM_05c_00	256	462	-2	+0	-0.8%	+0.0%	567	342	+1	+1	+0.2%	+0.3%
		Signals	✓	CBU_21_AM_07c_00	CBU_21_PM_07c_00	260	480	+2	+18	+0.8%	+3.9%	565	353	-1	+12	-0.2%	+3.5%
	ODP with No Through Route (370hh)	Full Priority*	✗	CBU_21_AM_00c_71	CBU_21_PM_00c_71	255	458	-6	-3	-2.3%	-0.7%	560	337	-11	-6	-1.9%	-1.7%
		Full Priority	✓	CBU_21_AM_04c_71	CBU_21_PM_04c_71	261	461					571	343				
		RILO	✓	CBU_21_AM_06c_71	CBU_21_PM_06c_71	260	462	-1	+1	-0.4%	+0.2%	567	343	-4	+0	-0.7%	+0.0%
		LILO	✓	CBU_21_AM_05c_71	CBU_21_PM_05c_71	258	462	-3	+1	-1.1%	+0.2%	572	343	+1	+0	+0.2%	+0.0%
		Signals	✓	CBU_21_AM_07c_71	CBU_21_PM_07c_71	262	474	+1	+13	+0.4%	+2.8%	566	351	-5	+8	-0.9%	+2.3%
	ODP with Through Route (370hh)	Full Priority*	✗	CBU_21_AM_00c_70	CBU_21_PM_00c_70	251	447	-4	-4	-1.6%	-0.9%	530	327	-4	-5	-0.7%	-1.5%
		Full Priority	✓	CBU_21_AM_04c_70	CBU_21_PM_04c_70	255	451					534	332				
		RILO	✓	CBU_21_AM_06c_70	CBU_21_PM_06c_70	255	451	+0	+0	+0.0%	+0.0%	537	332	+3	+0	+0.6%	+0.0%
		LILO	✓	CBU_21_AM_05c_70	CBU_21_PM_05c_70	255	451	+0	+0	+0.0%	+0.0%	536	332	+2	+0	+0.4%	+0.0%
		Signals	✓	CBU_21_AM_07c_70	CBU_21_PM_07c_70	258	460	+3	+9	+1.2%	+2.0%	533	338	-1	+6	-0.2%	+1.8%
	ODP with No Through Route (200hh)	Full Priority*	✗	CBU_21_AM_00c_81	CBU_21_PM_00c_81	254	456	-5	-4	-1.9%	-0.9%	557	335	-7	-6	-1.2%	-1.8%
		Full Priority	✓	CBU_21_AM_04c_81	CBU_21_PM_04c_81	259	460					564	341				
		RILO	✓	CBU_21_AM_06c_81	CBU_21_PM_06c_81	259	458	+0	-2	+0.0%	-0.4%	568	341	+4	+0	+0.7%	+0.0%
		LILO	✓	CBU_21_AM_05c_81	CBU_21_PM_05c_81	257	459	-2	-1	-0.8%	-0.2%	568	341	+4	+0	+0.7%	+0.0%
		Signals	✓	CBU_21_AM_07c_81	CBU_21_PM_07c_81	261	474	+2	+14	+0.8%	+3.0%	563	350	-1	+9	-0.2%	+2.6%
	ODP with Through Route (200hh)	Full Priority*	✗	CBU_21_AM_00c_80	CBU_21_PM_00c_80	250	447	-4	-2	-1.6%	-0.4%	526	326	-6	-5	-1.1%	-1.5%
		Full Priority	✓	CBU_21_AM_04c_80	CBU_21_PM_04c_80	254	449					532	331				
		RILO	✓	CBU_21_AM_06c_80	CBU_21_PM_06c_80	254	450	+0	+1	+0.0%	+0.2%	529	331	-3	+0	-0.6%	+0.0%
		LILO	✓	CBU_21_AM_05c_80	CBU_21_PM_05c_80	254	451	+0	+2	+0.0%	+0.4%	536	331	+4	+0	+0.8%	+0.0%
		Signals	✓	CBU_21_AM_07c_80	CBU_21_PM_07c_80	258	459	+4	+10	+1.6%	+2.2%	530	337	-2	+6	-0.4%	+1.8%
2031	No ODP	Full Priority	✓	CBU_31_AM_00b_00	CBU_31_PM_00b_00	259	380					405	337				
		RILO	✓	CBU_31_AM_06c_00	CBU_31_PM_06c_00	259	381	+0	+1	+0.0%	+0.3%	405	336	+0	-1	+0.0%	-0.3%
		LILO	✓	CBU_31_AM_05c_00	CBU_31_PM_05c_00	258	382	-1	+2	-0.4%	+0.5%	405	337	+0	+0	+0.0%	+0.0%
		Signals	✓	CBU_31_AM_07c_00	CBU_31_PM_07c_00	260	390	+1	+10	+0.4%	+2.6%	403	342	-2	+5	-0.5%	+1.5%
	ODP with No Through Route (370hh)	Full Priority	✓	CBU_31_AM_00c_71	CBU_31_PM_00c_71	265	378					409	338				
		RILO	✓	CBU_31_AM_06c_71	CBU_31_PM_06c_71	264	378	-1	+0	-0.4%	+0.0%	408	337	-1	-1	-0.2%	-0.3%
		LILO	✓	CBU_31_AM_05c_71	CBU_31_PM_05c_71	263	380	-2	+2	-0.8%	+0.5%	408	338	-1	+0	-0.2%	+0.0%
		Signals	✓	CBU_31_AM_07c_71	CBU_31_PM_07c_71	265	389	+0	+11	+0.0%	+2.9%	406	344	-3	+6	-0.7%	+1.8%
	ODP with Through Route (370hh)	Full Priority	✓	CBU_31_AM_01b_70	CBU_31_PM_01b_70	259	354					359	328				
		RILO	✓	CBU_31_AM_06c_70	CBU_31_PM_06c_70	259	354	+0	+0	+0.0%	+0.0%	360	329	+1	+1	+0.3%	+0.3%
		LILO	✓	CBU_31_AM_05c_70	CBU_31_PM_05c_70	257	355	-2	+1	-0.8%	+0.3%	372	330	+13	+2	+3.6%	+0.6%
		Signals	✓	CBU_31_AM_07c_70	CBU_31_PM_07c_70	259	361	+0	+7	+0.0%	+2.0%	363	335	+4	+7	+1.1%	+2.1%
	ODP with No Through Route (200hh)	Full Priority	✓	CBU_31_AM_00c_81	CBU_31_PM_00c_81	264	378					405	337				
		RILO	✓	CBU_31_AM_06c_81	CBU_31_PM_06c_81	263	377	-1	-1	-0.4%	-0.3%	405	337	+0	+0	+0.0%	+0.0%
		LILO	✓	CBU_31_AM_05c_81	CBU_31_PM_05c_81	262	378	-2	+0	-0.8%	+0.0%	406	337	+1	+0	+0.2%	+0.0%
		Signals	✓	CBU_31_AM_07c_81	CBU_31_PM_07c_81	264	388	+0	+10	+0.0%	+2.6%	404	342	-1	+5	-0.2%	+1.5%
	ODP with Through Route (200hh)	Full Priority	✓	CBU_31_AM_01b_80	CBU_31_PM_01b_80	258	354					359	328				
		RILO	✓	CBU_31_AM_06c_80	CBU_31_PM_06c_80	258	353	+0	-1	+0.0%	-0.3%	359	328	+0	+0	+0.0%	+0.0%
		LILO	✓	CBU_31_AM_05c_80	CBU_31_PM_05c_80	257	355	-1	+1	-0.4%	+0.3%	370	329	+11	+1	+3.1%	+0.3%
		Signals	✓	CBU_31_AM_07c_80	CBU_31_PM_07c_80	259	361	+1	+7	+0.4%	+2.0%	362	335	+3	+7	+0.8%	+2.1%

* Note that the '2021' scenarios use the anticipated demands in 2021 but the current (2016) network, as an indicator of potential 'pre-CNC' changes. It will be noted that use of the 'existing' layout assumptions for Main North means that the 'Full Priority' network for this scenario (deliberately) omits a potential signalled cycle crossing to the north-east of the intersection.


AM Peak Southbound Main Nth Rd Journey Times
(N QE2 Drive - S Bligh Rd)
Journey Time (s) for 2.1km Car Trip
700
600
500
400
300
200
100
0
2031 ODP with Through Route (200hh) RILO
2031 ODP with Through Route (370hh) Full Priority
2031 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (200hh) Full Priority
2031 ODP with Through Route (370hh) LILO
2031 ODP with Through Route (200hh) LILO
2031 ODP with Through Route (370hh) Signals
2031 ODP with Through Route (200hh) Signals
2031 ODP with No Through Route (200hh) RILO
2031 ODP with No Through Route (370hh) Full Priority
2031 ODP with No Through Route (370hh) RILO
2031 ODP with No Through Route (200hh) Full Priority
2031 ODP with No Through Route (200hh) LILO
2031 No ODP Full Priority
2031 ODP with No Through Route (370hh) LILO
2031 No ODP RILO
2031 No ODP LILO
2031 ODP with No Through Route (200hh) Signals
2031 ODP with No Through Route (370hh) Signals
2031 No ODP Signals
2021 ODP with Through Route (370hh) Full Priority (No Crossing)
2021 ODP with Through Route (200hh) Full Priority (No Crossing)
2021 ODP with Through Route (200hh) Full Priority
2021 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (370hh) Full Priority
2021 ODP with Through Route (370hh) RILO
2021 ODP with Through Route (370hh) LILO
2021 ODP with Through Route (200hh) LILO
2021 ODP with No Through Route (200hh) Full Priority (No Crossing)
2021 ODP with No Through Route (370hh) Full Priority (No Crossing)
2021 ODP with No Through Route (200hh) RILO
2021 No ODP Full Priority (No Crossing)
2021 ODP with No Through Route (200hh) LILO
2021 ODP with No Through Route (200hh) Signals
2021 ODP with No Through Route (370hh) Signals
2021 ODP with No Through Route (200hh) Full Priority
2021 ODP with No Through Route (370hh) Full Priority
2021 No ODP Full Priority
2021 No ODP RILO
2021 No ODP LILO
2021 ODP with No Through Route (370hh) RILO
2021 ODP with No Through Route (370hh) LILO
2021 ODP with No Through Route (370hh) Signals
2021 ODP with No Through Route (200hh) Signals
2021 No ODP Signals
Scenario


AM Peak Northbound Main Nth Rd Journey Times
(S Bighs Rd - N QE2 Drive)
Journey Time (s) for 2.1km Car Trip
270
265
260
255
250
245
240
2021 ODP with Through Route (200hh) Full Priority (No Crossing)
2021 ODP with Through Route (370hh) Full Priority (No Crossing)
2021 No ODP Full Priority (No Crossing)
2021 ODP with No Through Route (200hh) Full Priority (No Crossing)
2021 ODP with Through Route (200hh) Full Priority
2021 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (200hh) LILO
2021 ODP with No Through Route (370hh) Full Priority (No Crossing)
2021 ODP with Through Route (370hh) Full Priority
2021 ODP with Through Route (370hh) RILO
2021 ODP with Through Route (370hh) LILO
2021 No ODP LILO
2021 ODP with No Through Route (200hh) LILO
2031 ODP with Through Route (370hh) LILO
2031 ODP with Through Route (200hh) LILO
2021 No ODP Full Priority
2021 No ODP RILO
2021 ODP with No Through Route (370hh) LILO
2021 ODP with Through Route (370hh) Signals
2021 ODP with Through Route (200hh) Signals
2031 No ODP LILO
2031 ODP with Through Route (200hh) Full Priority
2031 ODP with Through Route (200hh) RILO
2021 ODP with No Through Route (200hh) Full Priority
2021 ODP with No Through Route (200hh) RILO
2031 No ODP Full Priority
2031 No ODP RILO
2031 ODP with Through Route (370hh) Full Priority
2031 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (370hh) Signals
2031 ODP with Through Route (200hh) Signals
2021 No ODP Signals
2021 ODP with No Through Route (370hh) RILO
2031 No ODP Signals
2021 ODP with No Through Route (370hh) Full Priority
2021 ODP with No Through Route (200hh) Signals
2021 ODP with No Through Route (370hh) Signals
2031 ODP with No Through Route (370hh) LILO
2031 ODP with No Through Route (200hh) RILO
2031 ODP with No Through Route (370hh) RILO
2031 ODP with No Through Route (200hh) Full Priority
2031 ODP with No Through Route (200hh) Signals
2031 ODP with No Through Route (370hh) Full Priority
2031 ODP with No Through Route (370hh) Signals
Scenario


PM Peak Southbound Main Nth Rd Journey Times
(N QE2 Drive - S Bligh Rd)
Journey Time (s) for 2.1km Car Trip
360
340
320
300
280
260
240
Scenario
2021 ODP with Through Route (200hh) Full Priority (No Crossing)
2021 ODP with Through Route (370hh) Full Priority (No Crossing)
2031 ODP with Through Route (370hh) Full Priority
2031 ODP with Through Route (200hh) Full Priority
2031 ODP with Through Route (200hh) RILO
2031 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (200hh) LILO
2031 ODP with Through Route (370hh) LILO
2021 ODP with Through Route (200hh) Full Priority
2021 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (200hh) LILO
2021 ODP with Through Route (370hh) Full Priority
2021 ODP with Through Route (370hh) RILO
2021 ODP with Through Route (370hh) LILO
2021 No ODP Full Priority (No Crossing)
2021 ODP with No Through Route (200hh) Full Priority (No Crossing)
2031 ODP with Through Route (370hh) Signals
2031 ODP with Through Route (200hh) Signals
2031 No ODP RILO
2021 ODP with No Through Route (370hh) Full Priority (No Crossing)
2021 ODP with Through Route (200hh) Signals
2031 No ODP Full Priority
2031 No ODP LILO
2031 ODP with No Through Route (370hh) RILO
2031 ODP with No Through Route (200hh) Full Priority
2031 ODP with No Through Route (200hh) RILO
2031 ODP with No Through Route (200hh) LILO
2021 ODP with Through Route (370hh) Signals
2031 ODP with No Through Route (370hh) Full Priority
2031 ODP with No Through Route (370hh) LILO
2021 No ODP Full Priority
2021 No ODP RILO
2021 ODP with No Through Route (200hh) Full Priority
2021 ODP with No Through Route (200hh) RILO
2021 ODP with No Through Route (200hh) LILO
2021 No ODP LILO
2031 No ODP Signals
2031 ODP with No Through Route (200hh) Signals
2021 ODP with No Through Route (370hh) Full Priority
2021 ODP with No Through Route (370hh) RILO
2021 ODP with No Through Route (370hh) LILO
2031 ODP with No Through Route (370hh) Signals
2021 ODP with No Through Route (200hh) Signals
2021 ODP with No Through Route (370hh) Signals
2021 No ODP Signals


PM Peak Northbound Main Nth Rd Journey Times
(S Bligh Rd - N QE2 Drive)
Journey Time (s) for 2.1km Car Trip
700
600
500
400
300
200
100
0
2031 ODP with Through Route (370hh) Full Priority
2031 ODP with Through Route (200hh) Full Priority
2031 ODP with Through Route (200hh) RILO
2031 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (200hh) Signals
2031 ODP with Through Route (370hh) Signals
2031 ODP with Through Route (200hh) LILO
2031 ODP with Through Route (370hh) LILO
2031 No ODP Signals
2031 ODP with No Through Route (200hh) Signals
2031 No ODP Full Priority
2031 No ODP RILO
2031 No ODP LILO
2031 ODP with No Through Route (200hh) Full Priority
2031 ODP with No Through Route (200hh) RILO
2031 ODP with No Through Route (370hh) Signals
2031 ODP with No Through Route (200hh) LILO
2031 ODP with No Through Route (370hh) RILO
2031 ODP with No Through Route (370hh) LILO
2031 ODP with No Through Route (370hh) Full Priority
2021 ODP with Through Route (200hh) Full Priority (No Crossing)
2021 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (370hh) Full Priority (No Crossing)
2021 ODP with Through Route (200hh) Signals
2021 ODP with Through Route (200hh) Full Priority
2021 ODP with Through Route (370hh) Signals
2021 ODP with Through Route (370hh) Full Priority
2021 ODP with Through Route (370hh) LILO
2021 ODP with Through Route (200hh) LILO
2021 ODP with Through Route (370hh) RILO
2021 No ODP Full Priority (No Crossing)
2021 ODP with No Through Route (200hh) Full Priority (No Crossing)
2021 ODP with No Through Route (370hh) Full Priority (No Crossing)
2021 ODP with No Through Route (200hh) Signals
2021 No ODP Signals
2021 No ODP Full Priority
2021 No ODP RILO
2021 ODP with No Through Route (370hh) Signals
2021 No ODP LILO
2021 ODP with No Through Route (370hh) RILO
2021 ODP with No Through Route (200hh) RILO
2021 ODP with No Through Route (200hh) LILO
2021 ODP with No Through Route (370hh) Full Priority
2021 ODP with No Through Route (370hh) LILO
Scenario

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Appendix C –Traffic Flow Impacts

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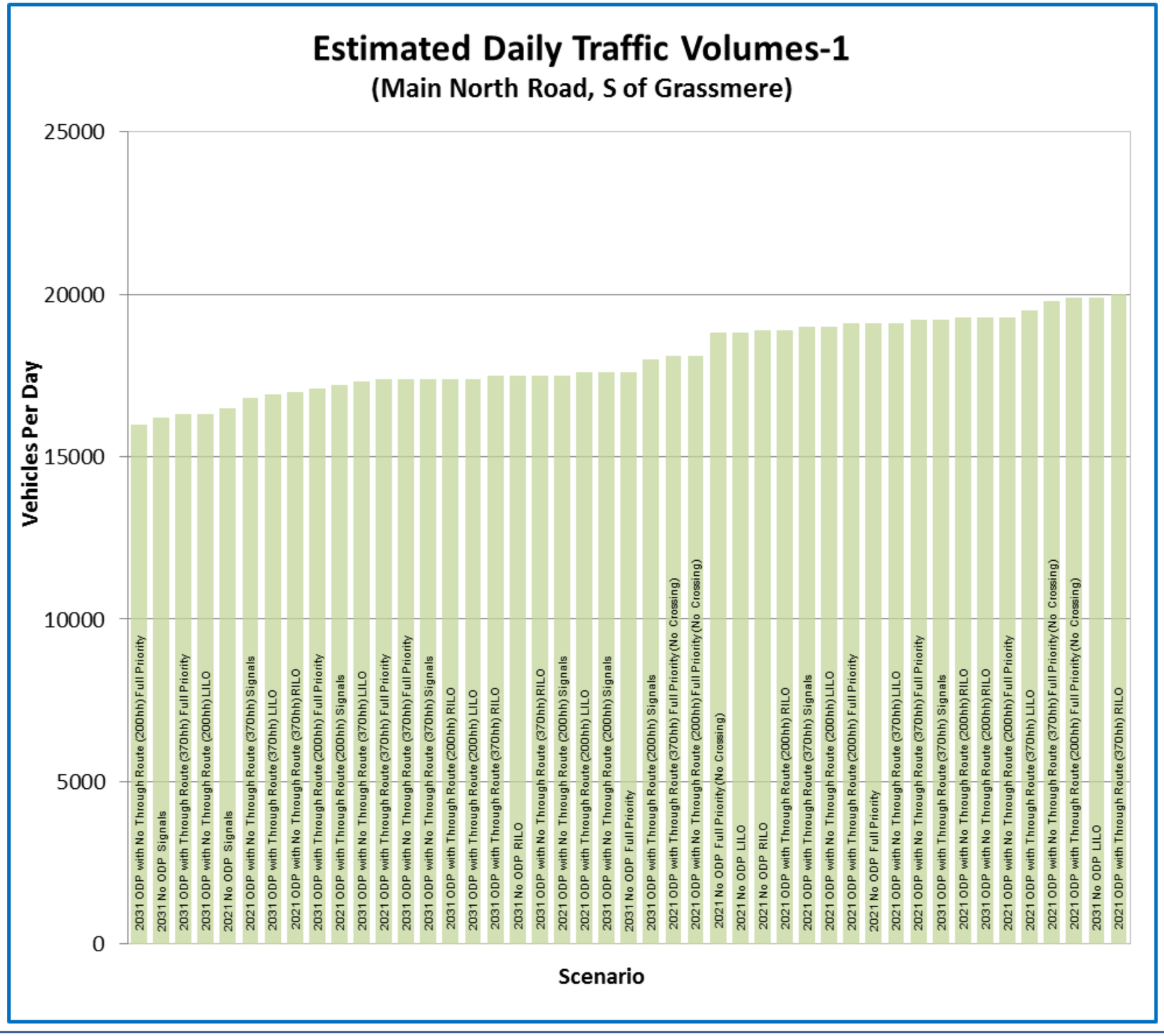
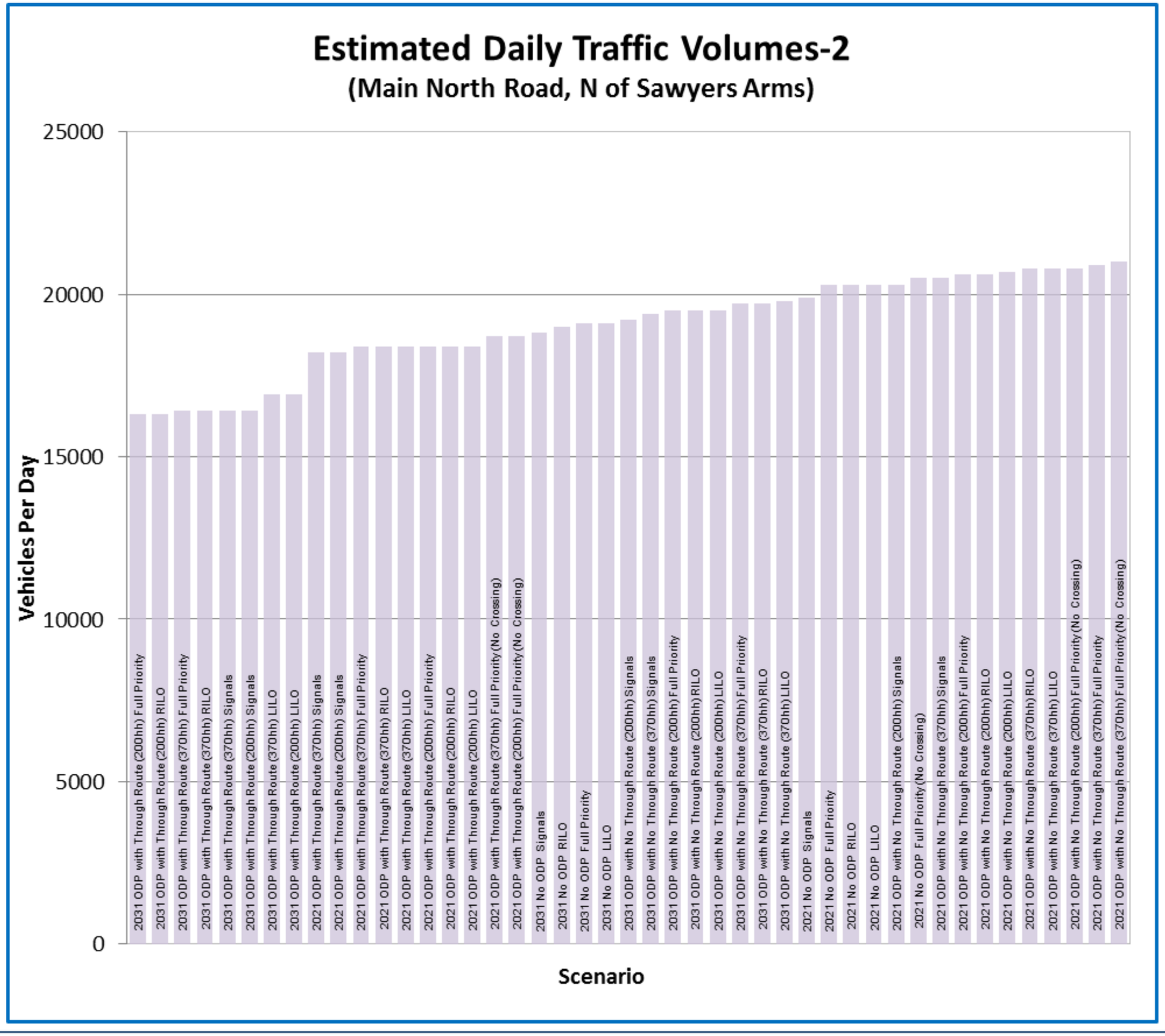
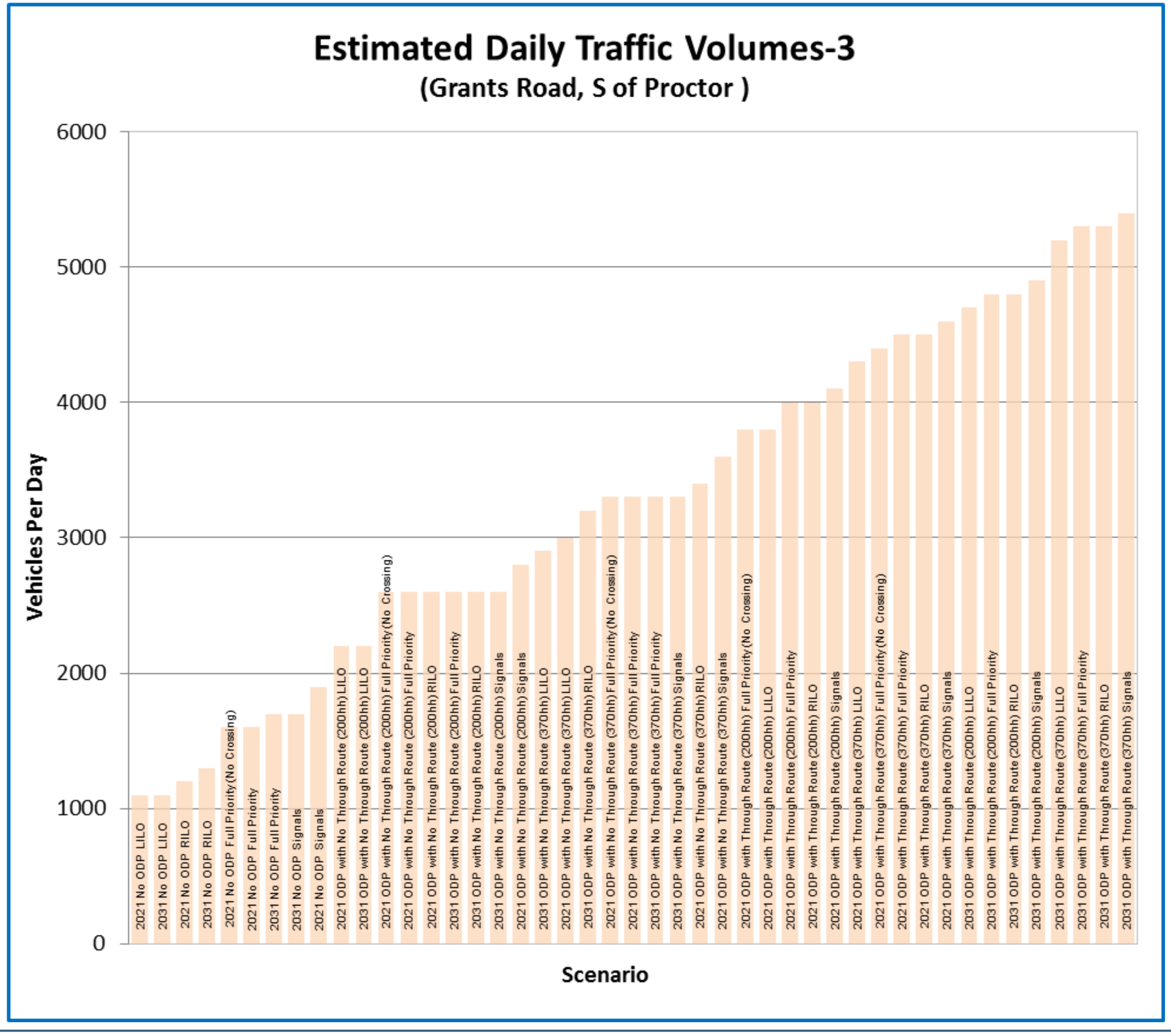
Forecast Impact of Network and Land Use Options on General Traffic Travel Times on Main North Road

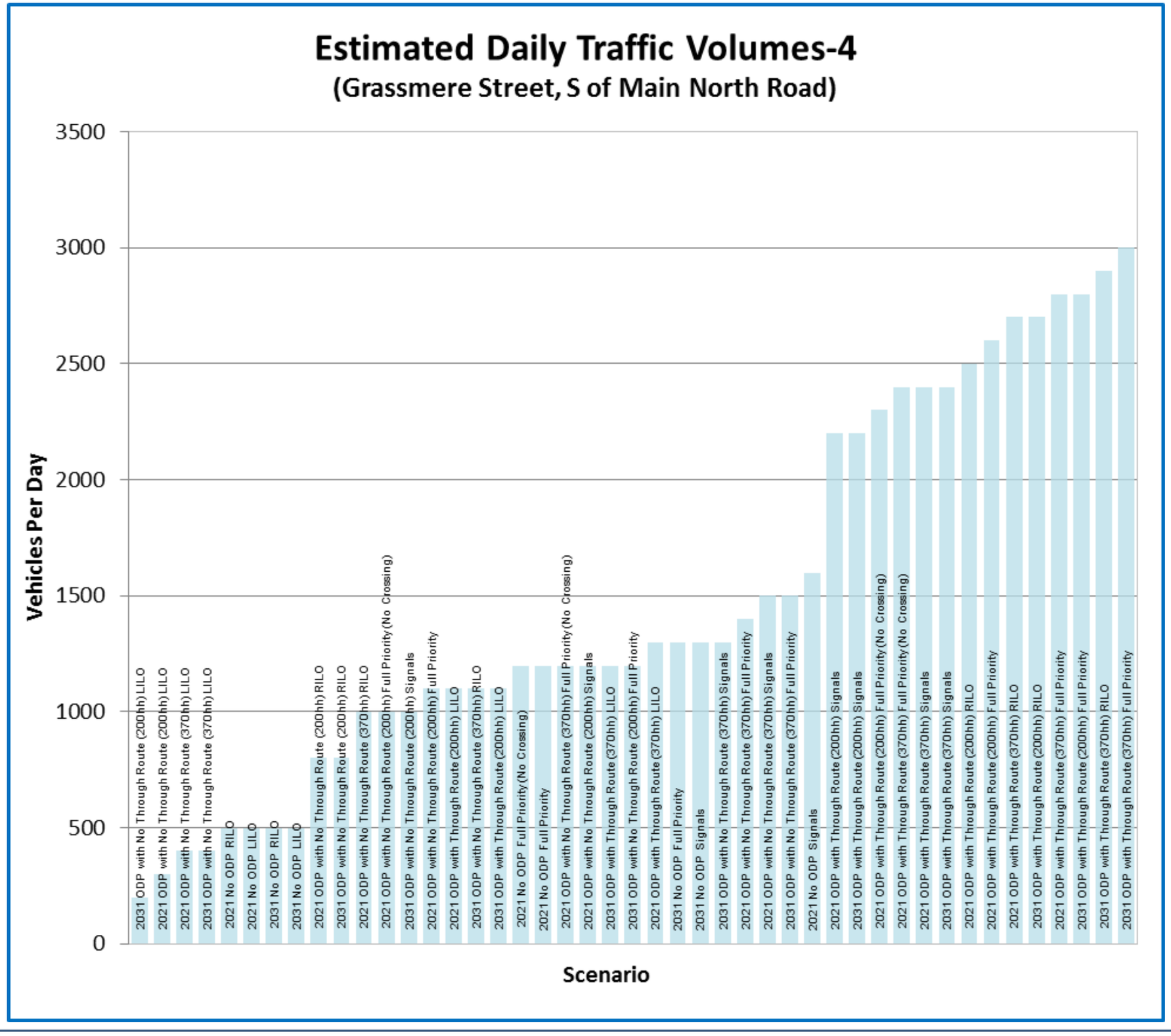
Year	Land Use /ODP Network	Main North Rd		Model reference		Daily Traffic (rounded to nearest 100)							
		Grassmere/ Main North	Signalled Cycle Crossing	AM	PM	Main North (S Grassmere)	Main North (N Sawyers)	Grants (S Proctor)	Grassmere (S Main North)	Shearer (S Main North)	Rayburn (S Grants)	Gambia (N Grants)	Claremont (S Paparoa)
2021*	**No ODP**	Full Priority*	✗	CBU_21_AM_00c_00	CBU_21_PM_00c_00	19,500	20,500	1,600	1,200	500	5,500	800	3,800
		Full Priority	✓	CBU_21_AM_04c_00	CBU_21_PM_04c_00	18,800	20,300	1,600	1,200	500	5,500	800	3,800
		RILO	✓	CBU_21_AM_06c_00	CBU_21_PM_06c_00	19,300	20,300	1,200	500	500	5,400	800	3,700
		LILO	✓	CBU_21_AM_05c_00	CBU_21_PM_05c_00	18,100	20,300	1,100	500	500	5,100	800	3,600
		Signals	✓	CBU_21_AM_07c_00	CBU_21_PM_07c_00	17,000	19,900	1,900	1,600	500	5,300	700	3,700
	ODP with No Through Route (370hh)	Full Priority*	✗	CBU_21_AM_00c_71	CBU_21_PM_00c_71	19,900	21,000	3,300	1,200	1,400	7,000	1,100	4,400
		Full Priority	✓	CBU_21_AM_04c_71	CBU_21_PM_04c_71	19,200	20,900	3,300	1,400	1,300	7,000	1,100	4,400
		RILO	✓	CBU_21_AM_06c_71	CBU_21_PM_06c_71	19,200	20,800	3,400	1,000	1,600	7,000	1,100	4,400
		LILO	✓	CBU_21_AM_05c_71	CBU_21_PM_05c_71	19,000	20,800	3,000	400	1,800	6,800	1,100	4,300
		Signals	✓	CBU_21_AM_07c_71	CBU_21_PM_07c_71	17,600	20,500	3,600	1,500	1,500	6,800	1,000	4,300
	ODP with Through Route (370hh)	Full Priority*	✗	CBU_21_AM_00c_70	CBU_21_PM_00c_70	20,000	18,700	4,400	2,400	600	6,800	1,200	3,200
		Full Priority	✓	CBU_21_AM_04c_70	CBU_21_PM_04c_70	19,300	18,400	4,500	2,800	500	6,800	1,100	3,100
		RILO	✓	CBU_21_AM_06c_70	CBU_21_PM_06c_70	19,300	18,400	4,500	2,700	600	6,800	1,100	3,100
		LILO	✓	CBU_21_AM_05c_70	CBU_21_PM_05c_70	18,900	18,400	4,300	1,300	1,300	6,700	1,200	3,100
		Signals	✓	CBU_21_AM_07c_70	CBU_21_PM_07c_70	18,100	18,200	4,600	2,400	600	6,900	1,200	3,100
	ODP with No Through Route (200hh)	Full Priority*	✗	CBU_21_AM_00c_81	CBU_21_PM_00c_81	19,800	20,800	2,600	1,000	1,100	6,400	1,000	4,100
		Full Priority	✓	CBU_21_AM_04c_81	CBU_21_PM_04c_81	19,000	20,600	2,600	1,100	1,100	6,400	1,000	4,100
		RILO	✓	CBU_21_AM_06c_81	CBU_21_PM_06c_81	19,100	20,600	2,600	800	1,300	6,400	1,000	4,100
		LILO	✓	CBU_21_AM_05c_81	CBU_21_PM_05c_81	18,900	20,700	2,200	300	1,400	6,100	1,000	4,000
		Signals	✓	CBU_21_AM_07c_81	CBU_21_PM_07c_81	17,400	20,300	2,800	1,200	1,200	6,200	900	4,100
	ODP with Through Route (200hh)	Full Priority*	✗	CBU_21_AM_00c_80	CBU_21_PM_00c_80	19,900	18,700	3,800	2,300	400	6,400	1,200	3,100
		Full Priority	✓	CBU_21_AM_04c_80	CBU_21_PM_04c_80	19,100	18,400	4,000	2,600	400	6,400	1,100	3,100
		RILO	✓	CBU_21_AM_06c_80	CBU_21_PM_06c_80	19,100	18,400	4,000	2,500	500	6,400	1,100	3,000
		LILO	✓	CBU_21_AM_05c_80	CBU_21_PM_05c_80	18,800	18,400	3,800	1,100	1,100	6,300	1,200	3,100
		Signals	✓	CBU_21_AM_07c_80	CBU_21_PM_07c_80	18,000	18,200	4,100	2,200	500	6,500	1,200	3,100
2031	**No ODP**	Full Priority	✓	CBU_31_AM_00b_00	CBU_31_PM_00b_00	17,100	19,100	1,700	1,300	500	4,300	600	3,800
		RILO	✓	CBU_31_AM_06c_00	CBU_31_PM_06c_00	17,600	19,000	1,300	500	500	4,300	800	3,800
		LILO	✓	CBU_31_AM_05c_00	CBU_31_PM_05c_00	17,200	19,100	1,100	500	500	3,900	700	3,700
		Signals	✓	CBU_31_AM_07c_00	CBU_31_PM_07c_00	16,000	18,800	1,700	1,300	500	4,200	700	3,800
	ODP with No Through Route (370hh)	Full Priority	✓	CBU_31_AM_00c_71	CBU_31_PM_00c_71	17,500	19,700	3,300	1,500	1,500	5,500	700	4,400
		RILO	✓	CBU_31_AM_06c_71	CBU_31_PM_06c_71	17,600	19,700	3,200	1,100	1,800	5,500	800	4,400
		LILO	✓	CBU_31_AM_05c_71	CBU_31_PM_05c_71	17,400	19,800	2,900	400	1,900	5,300	700	4,300
		Signals	✓	CBU_31_AM_07c_71	CBU_31_PM_07c_71	16,300	19,400	3,300	1,300	1,600	5,300	800	4,400
	ODP with Through Route (370hh)	Full Priority	✓	CBU_31_AM_01b_70	CBU_31_PM_01b_70	17,500	16,400	5,300	3,000	500	6,100	900	3,300
		RILO	✓	CBU_31_AM_06c_70	CBU_31_PM_06c_70	17,500	16,400	5,300	2,900	500	6,200	900	3,300
		LILO	✓	CBU_31_AM_05c_70	CBU_31_PM_05c_70	16,900	16,900	5,200	1,200	700	6,200	800	3,200
		Signals	✓	CBU_31_AM_07c_70	CBU_31_PM_07c_70	16,500	16,400	5,400	2,400	400	6,300	900	3,300
	ODP with No Through Route (200hh)	Full Priority	✓	CBU_31_AM_00c_81	CBU_31_PM_00c_81	17,400	19,500	2,600	1,200	1,200	4,900	700	4,100
		RILO	✓	CBU_31_AM_06c_81	CBU_31_PM_06c_81	17,500	19,500	2,600	800	1,400	4,900	800	4,100
		LILO	✓	CBU_31_AM_05c_81	CBU_31_PM_05c_81	17,300	19,500	2,200	200	1,500	4,700	700	4,000
		Signals	✓	CBU_31_AM_07c_81	CBU_31_PM_07c_81	16,200	19,200	2,600	1,000	1,300	4,900	700	4,100
	ODP with Through Route (200hh)	Full Priority	✓	CBU_31_AM_01b_80	CBU_31_PM_01b_80	17,400	16,300	4,800	2,800	300	5,800	900	3,200
		RILO	✓	CBU_31_AM_06c_80	CBU_31_PM_06c_80	17,400	16,300	4,800	2,700	400	5,800	900	3,200
		LILO	✓	CBU_31_AM_05c_80	CBU_31_PM_05c_80	16,800	16,900	4,700	1,100	500	5,800	800	3,100
		Signals	✓	CBU_31_AM_07c_80	CBU_31_PM_07c_80	16,300	16,400	4,900	2,200	400	5,900	900	3,200
NB Model context: Available Counts					ADT (Weekday)	25,500	25,500	1,600	1,400	n/a	3,200	n/a	2,500
					Year/Location	(2012, N Halliwell)	(2012, N Halliwell)	(2008, N Proctor)	(2007, S Main Nth)		(2010, S Grants)		(2010, S Paparoa)

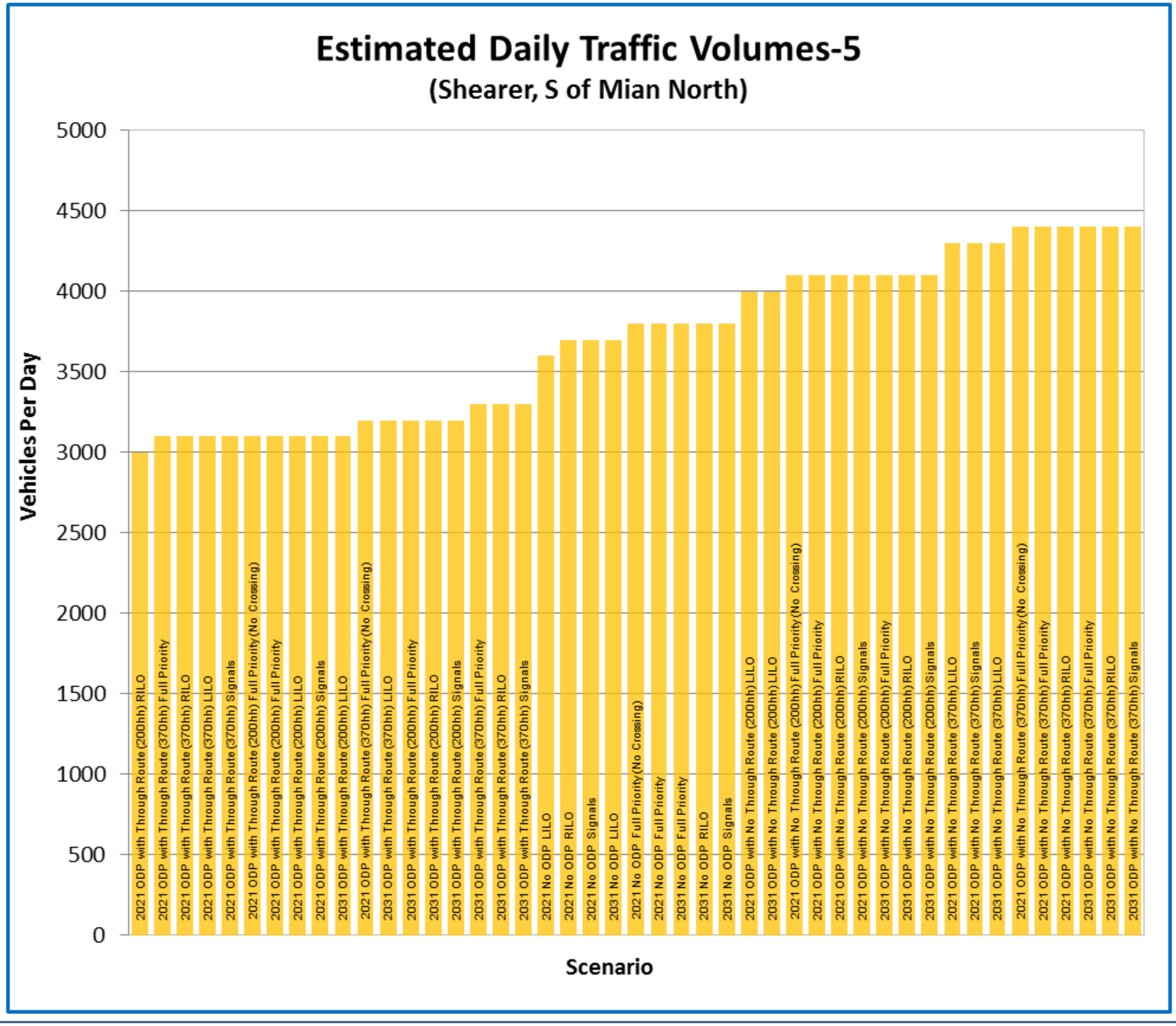
* Note that the '2021' scenarios use the anticipated demands in 2021 but the current (2016) network, as an indicator of potential 'pre-CNC' changes. It will be noted that use of the 'existing' layout assumptions for Main North means that the 'Full Priority' network for this scenario (deliberately) omits a potential signalled cycle crossing to the north-east of the intersection.

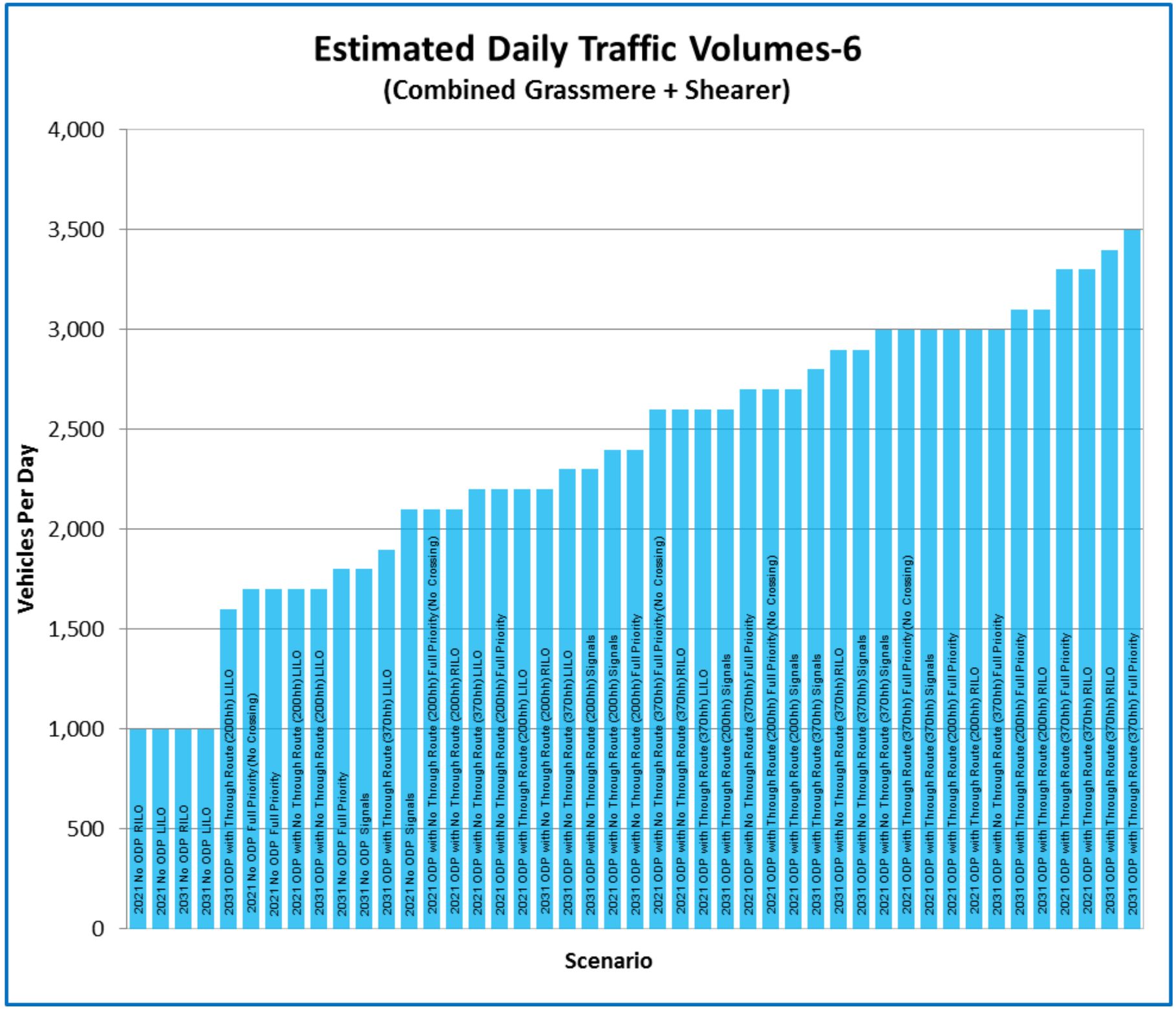

Estimated Daily Traffic Volumes-1
(Main North Road, S of Grassmere)
Vehicles Per Day
25000
20000
15000
10000
5000
0
Scenario
2031 ODP with No Through Route (200hh) Full Priority
2031 No ODP Signals
2031 ODP with Through Route (370hh) Full Priority
2031 ODP with No Through Route (200hh) LILO
2021 No ODP Signals
2021 ODP with No Through Route (370hh) Signals
2031 ODP with Through Route (370hh) LILO
2021 ODP with No Through Route (370hh) RILO
2031 ODP with Through Route (200hh) Full Priority
2021 ODP with Through Route (200hh) Signals
2031 ODP with No Through Route (370hh) LILO
2021 ODP with Through Route (370hh) Full Priority
2031 ODP with No Through Route (370hh) Full Priority
2031 ODP with No Through Route (370hh) Signals
2031 ODP with Through Route (200hh) RILO
2031 ODP with Through Route (200hh) LILO
2031 ODP with Through Route (370hh) RILO
2031 No ODP RILO
2031 ODP with No Through Route (370hh) RILO
2021 ODP with No Through Route (200hh) Signals
2031 ODP with No Through Route (200hh) LILO
2031 ODP with No Through Route (200hh) Signals
2031 No ODP Full Priority
2031 ODP with Through Route (200hh) Signals
2021 ODP with Through Route (370hh) Full Priority (No Crossing)
2021 ODP with No Through Route (200hh) Full Priority (No Crossing)
2021 No ODP Full Priority (No Crossing)
2021 No ODP LILO
2021 No ODP RILO
2021 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (370hh) Signals
2021 ODP with No Through Route (200hh) LILO
2021 ODP with Through Route (200hh) Full Priority
2021 No ODP Full Priority
2021 ODP with No Through Route (370hh) LILO
2021 ODP with No Through Route (370hh) Full Priority
2031 ODP with Through Route (370hh) Signals
2021 ODP with No Through Route (200hh) RILO
2021 ODP with No Through Route (200hh) RILO
2021 ODP with No Through Route (200hh) Full Priority
2021 ODP with Through Route (370hh) LILO
2021 ODP with No Through Route (370hh) Full Priority (No Crossing)
2021 ODP with Through Route (200hh) Full Priority (No Crossing)
2031 No ODP LILO
2021 ODP with Through Route (370hh) RILO

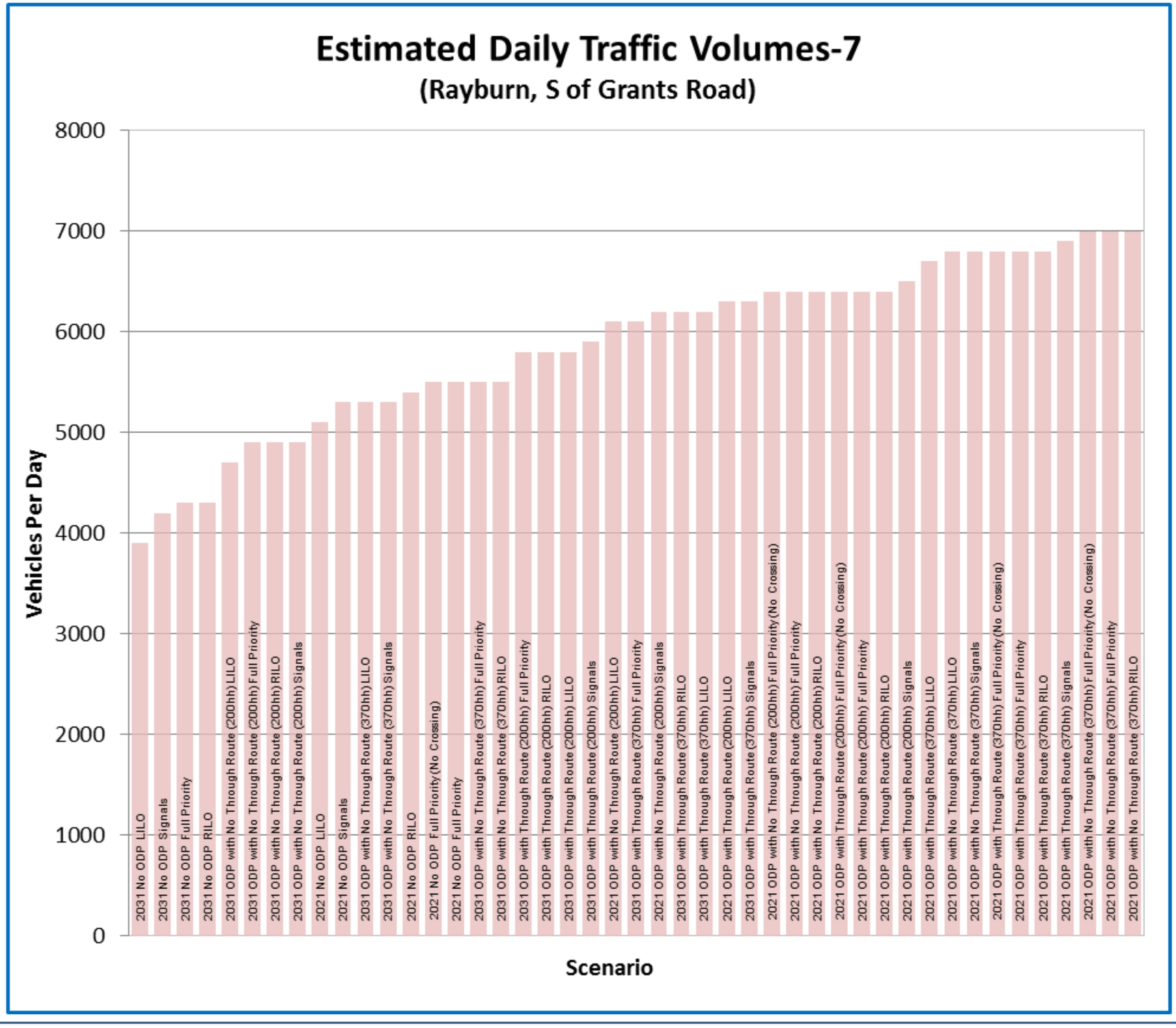

Estimated Daily Traffic Volumes-2
(Main North Road, N of Sawyers Arms)
Vehicles Per Day
25000
20000
15000
10000
5000
0
Scenario
2031 ODP with Through Route (200hh) Full Priority
2031 ODP with Through Route (200hh) RILO
2031 ODP with Through Route (370hh) Full Priority
2031 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (370hh) Signals
2031 ODP with Through Route (200hh) Signals
2031 ODP with Through Route (370hh) LILO
2031 ODP with Through Route (200hh) LILO
2021 ODP with Through Route (370hh) Signals
2021 ODP with Through Route (200hh) Signals
2021 ODP with Through Route (370hh) Full Priority
2021 ODP with Through Route (370hh) RILO
2021 ODP with Through Route (370hh) LILO
2021 ODP with Through Route (200hh) Full Priority
2021 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (200hh) LILO
2021 ODP with Through Route (370hh) Full Priority(No Crossing)
2021 ODP with Through Route (200hh) Full Priority(No Crossing)
2031 No ODP Signals
2031 No ODP RILO
2031 No ODP Full Priority
2031 No ODP LILO
2031 ODP with No Through Route (200hh) Signals
2031 ODP with No Through Route (370hh) Signals
2031 ODP with No Through Route (200hh) Full Priority
2031 ODP with No Through Route (200hh) RILO
2031 ODP with No Through Route (200hh) LILO
2031 ODP with No Through Route (370hh) Full Priority
2031 ODP with No Through Route (370hh) RILO
2031 ODP with No Through Route (370hh) LILO
2021 No ODP Signals
2021 No ODP Full Priority
2021 No ODP RILO
2021 No ODP LILO
2021 ODP with No Through Route (200hh) Signals
2021 No ODP Full Priority(No Crossing)
2021 ODP with No Through Route (370hh) Signals
2021 ODP with No Through Route (200hh) Full Priority
2021 ODP with No Through Route (200hh) RILO
2021 ODP with No Through Route (200hh) LILO
2021 ODP with No Through Route (370hh) RILO
2021 ODP with No Through Route (370hh) LILO
2021 ODP with No Through Route (200hh) Full Priority(No Crossing)
2021 ODP with No Through Route (370hh) Full Priority
2021 ODP with No Through Route (370hh) Full Priority(No Crossing)

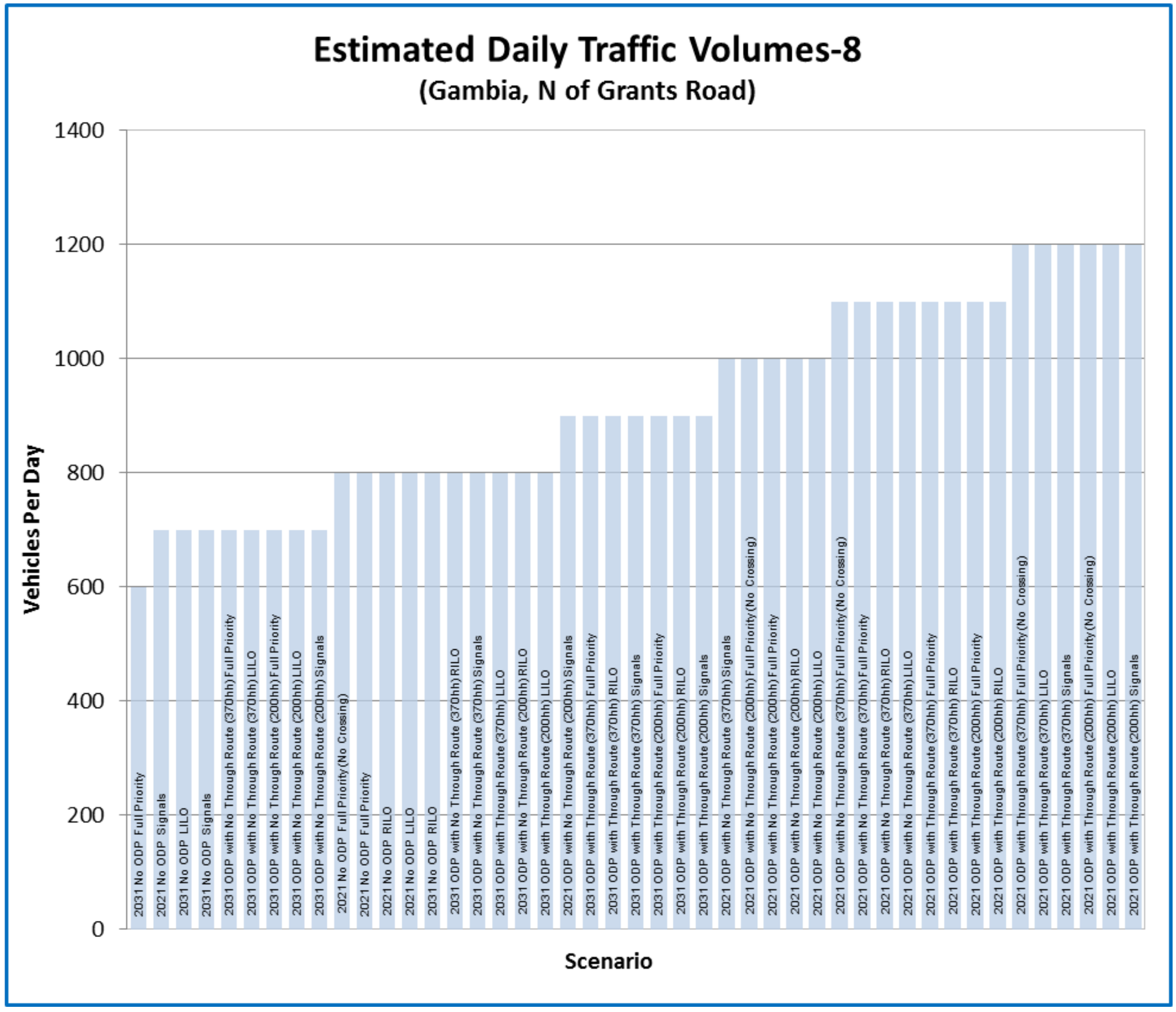

Estimated Daily Traffic Volumes-3
(Grants Road, S of Proctor)
Vehicles Per Day
6000
5000
4000
3000
2000
1000
0
Scenario
2021 No ODP LILO
2031 No ODP LILO
2021 No ODP RILO
2031 No ODP RILO
2021 No ODP Full Priority(No Crossing)
2021 No ODP Full Priority
2031 No ODP Full Priority
2031 No ODP Signals
2021 No ODP Signals
2021 ODP with No Through Route (200hh) LILO
2031 ODP with No Through Route (200hh) LILO
2021 ODP with No Through Route (200hh) Full Priority(No Crossing)
2021 ODP with No Through Route (200hh) Full Priority
2021 ODP with No Through Route (200hh) RILO
2031 ODP with No Through Route (200hh) Full Priority
2031 ODP with No Through Route (200hh) RILO
2031 ODP with No Through Route (200hh) Signals
2021 ODP with No Through Route (200hh) Signals
2031 ODP with No Through Route (370hh) LILO
2021 ODP with No Through Route (370hh) LILO
2031 ODP with No Through Route (370hh) RILO
2021 ODP with No Through Route (370hh) Full Priority(No Crossing)
2021 ODP with No Through Route (370hh) Full Priority
2031 ODP with No Through Route (370hh) Full Priority
2031 ODP with No Through Route (370hh) Signals
2021 ODP with No Through Route (370hh) RILO
2021 ODP with No Through Route (370hh) Signals
2021 ODP with Through Route (200hh) Full Priority(No Crossing)
2021 ODP with Through Route (200hh) LILO
2021 ODP with Through Route (200hh) Full Priority
2021 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (200hh) Signals
2031 ODP with Through Route (370hh) LILO
2021 ODP with Through Route (370hh) Full Priority(No Crossing)
2021 ODP with Through Route (370hh) Full Priority
2021 ODP with Through Route (370hh) RILO
2021 ODP with Through Route (370hh) Signals
2021 ODP with Through Route (200hh) RILO
2031 ODP with Through Route (200hh) Signals
2031 ODP with Through Route (370hh) LILO
2031 ODP with Through Route (370hh) Full Priority
2031 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (370hh) Signals

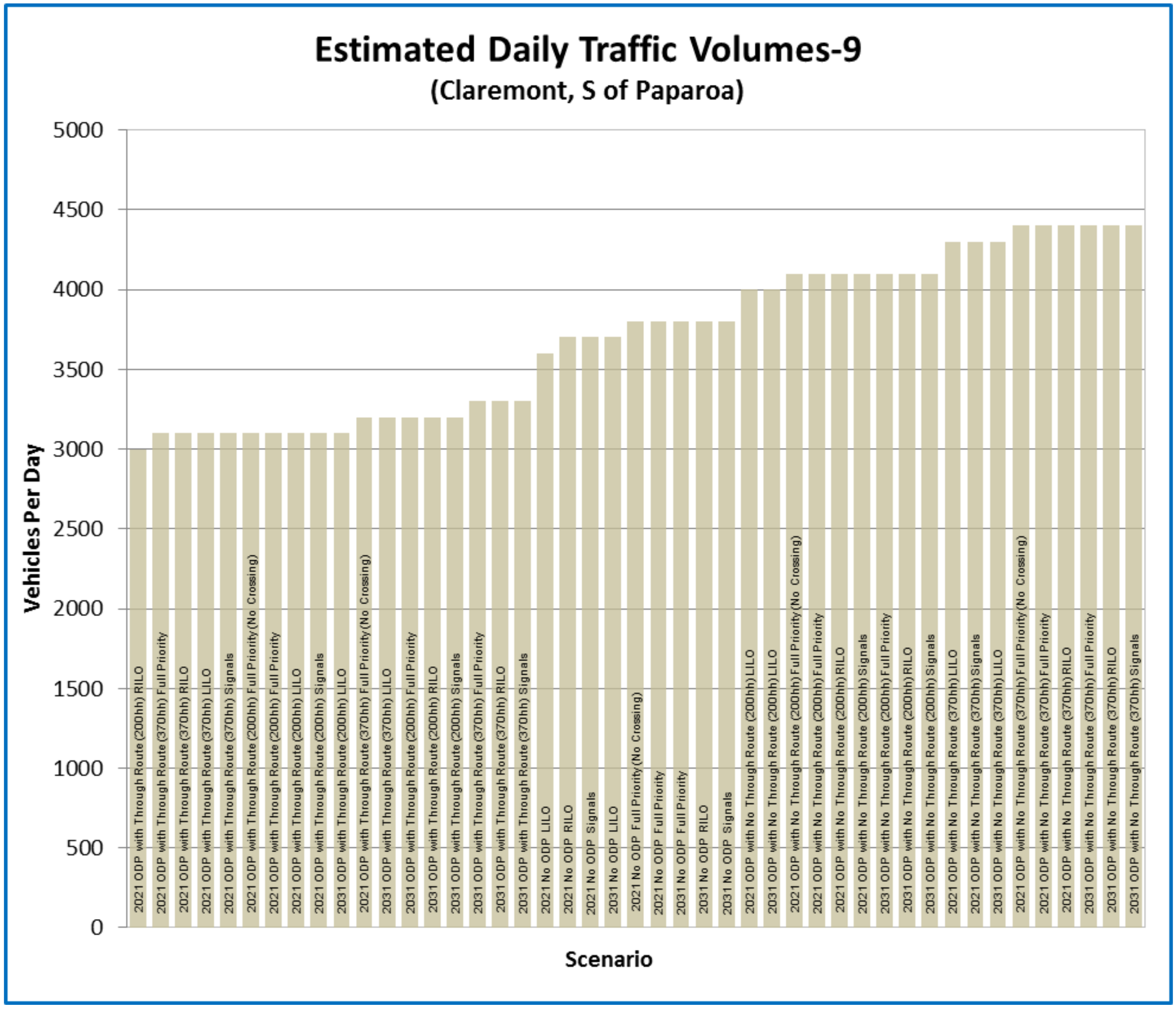

Estimated Daily Traffic Volumes-4
(Grassmere Street, S of Main North Road)
Vehicles Per Day
3500
3000
2500
2000
1500
1000
500
0
Scenario
2031 ODP with No Through Route (200hh) LILO
2021 ODP with No Through Route (200hh) LILO
2021 ODP with No Through Route (370hh) LILO
2031 ODP with No Through Route (370hh) LILO
2021 No ODP RILO
2021 No ODP LILO
2031 No ODP RILO
2031 No ODP LILO
2021 ODP with No Through Route (200hh) RILO
2031 ODP with No Through Route (200hh) RILO
2021 ODP with No Through Route (370hh) RILO
2021 ODP with No Through Route (200hh) Full Priority (No Crossing)
2031 ODP with No Through Route (200hh) Signals
2021 ODP with No Through Route (200hh) Full Priority
2021 ODP with Through Route (200hh) LILO
2031 ODP with No Through Route (370hh) RILO
2031 ODP with Through Route (200hh) LILO
2021 No ODP Full Priority (No Crossing)
2021 No ODP Full Priority
2021 ODP with No Through Route (370hh) Full Priority (No Crossing)
2021 ODP with No Through Route (200hh) Signals
2031 ODP with Through Route (370hh) LILO
2031 ODP with No Through Route (200hh) Full Priority
2021 ODP with Through Route (370hh) LILO
2031 No ODP Full Priority
2031 No ODP Signals
2031 ODP with No Through Route (370hh) Signals
2021 ODP with No Through Route (370hh) Full Priority
2021 ODP with No Through Route (370hh) Signals
2031 ODP with No Through Route (370hh) Full Priority
2021 No ODP Signals
2021 ODP with Through Route (200hh) Signals
2031 ODP with Through Route (200hh) Signals
2021 ODP with Through Route (200hh) Full Priority (No Crossing)
2021 ODP with Through Route (370hh) Full Priority (No Crossing)
2021 ODP with Through Route (370hh) Signals
2031 ODP with Through Route (370hh) Signals
2021 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (200hh) Full Priority
2021 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (370hh) Full Priority
2031 ODP with Through Route (200hh) Full Priority
2031 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (370hh) Full Priority


Estimated Daily Traffic Volumes-5
(Shearer, S of Mian North)
Vehicles Per Day
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2021 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (370hh) Full Priority
2021 ODP with Through Route (370hh) RILO
2021 ODP with Through Route (370hh) LILO
2021 ODP with Through Route (370hh) Signals
2021 ODP with Through Route (200hh) Full Priority(No Crossing)
2021 ODP with Through Route (200hh) Full Priority
2021 ODP with Through Route (200hh) LILO
2021 ODP with Through Route (200hh) Signals
2031 ODP with Through Route (200hh) LILO
2021 ODP with Through Route (370hh) Full Priority(No Crossing)
2031 ODP with Through Route (370hh) LILO
2031 ODP with Through Route (200hh) Full Priority
2031 ODP with Through Route (200hh) RILO
2031 ODP with Through Route (200hh) Signals
2031 ODP with Through Route (370hh) Full Priority
2031 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (370hh) Signals
2021 No ODP LILO
2021 No ODP RILO
2021 No ODP Signals
2031 No ODP LILO
2021 No ODP Full Priority(No Crossing)
2021 No ODP Full Priority
2031 No ODP Full Priority
2031 No ODP RILO
2031 No ODP Signals
2021 ODP with No Through Route (200hh) LILO
2031 ODP with No Through Route (200hh) LILO
2021 ODP with No Through Route (200hh) Full Priority(No Crossing)
2021 ODP with No Through Route (200hh) Full Priority
2021 ODP with No Through Route (200hh) RILO
2021 ODP with No Through Route (200hh) Signals
2031 ODP with No Through Route (200hh) Full Priority
2031 ODP with No Through Route (200hh) RILO
2031 ODP with No Through Route (200hh) Signals
2021 ODP with No Through Route (370hh) LILO
2021 ODP with No Through Route (370hh) Full Priority(No Crossing)
2021 ODP with No Through Route (370hh) Full Priority
2021 ODP with No Through Route (370hh) RILO
2031 ODP with No Through Route (370hh) Full Priority
2031 ODP with No Through Route (370hh) RILO
2031 ODP with No Through Route (370hh) Signals
Scenario


Estimated Daily Traffic Volumes-6
(Combined Grassmere + Shearer)
Vehicles Per Day
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2021 No ODP RILO
2021 No ODP LILO
2031 No ODP RILO
2031 No ODP LILO
2031 ODP with Through Route (200hh) LILO
2021 No ODP Full Priority(No Crossing)
2021 No ODP Full Priority
2021 ODP with No Through Route (200hh) LILO
2031 ODP with No Through Route (200hh) LILO
2031 No ODP Full Priority
2031 No ODP Signals
2031 ODP with Through Route (370hh) LILO
2021 No ODP Signals
2021 ODP with No Through Route (200hh) Full Priority(No Crossing)
2021 ODP with No Through Route (200hh) RILO
2021 ODP with No Through Route (370hh) LILO
2021 ODP with No Through Route (200hh) Full Priority
2021 ODP with Through Route (200hh) LILO
2031 ODP with No Through Route (200hh) RILO
2031 ODP with No Through Route (370hh) LILO
2031 ODP with No Through Route (200hh) Signals
2021 ODP with No Through Route (200hh) Signals
2031 ODP with No Through Route (200hh) Full Priority
2021 ODP with No Through Route (370hh) Full Priority(No Crossing)
2021 ODP with No Through Route (370hh) RILO
2021 ODP with Through Route (370hh) LILO
2031 ODP with Through Route (200hh) Signals
2021 ODP with No Through Route (370hh) Full Priority
2021 ODP with Through Route (200hh) Full Priority(No Crossing)
2021 ODP with Through Route (200hh) Signals
2031 ODP with Through Route (370hh) Signals
2031 ODP with No Through Route (370hh) RILO
2031 ODP with No Through Route (370hh) Signals
2021 ODP with No Through Route (370hh) Signals
2021 ODP with Through Route (370hh) Full Priority(No Crossing)
2021 ODP with Through Route (370hh) Signals
2021 ODP with Through Route (200hh) Full Priority
2031 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (370hh) Full Priority
2021 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (370hh) Full Priority
Scenario


Estimated Daily Traffic Volumes-7
(Rayburn, S of Grants Road)
Vehicles Per Day
8000
7000
6000
5000
4000
3000
2000
1000
0
2031 No ODP LILO
2031 No ODP Signals
2031 No ODP Full Priority
2031 No ODP RILO
2031 ODP with No Through Route (200hh) LILO
2031 ODP with No Through Route (200hh) Full Priority
2031 ODP with No Through Route (200hh) RILO
2031 ODP with No Through Route (200hh) Signals
2021 No ODP LILO
2021 No ODP Signals
2031 ODP with No Through Route (370hh) LILO
2031 ODP with No Through Route (370hh) Signals
2021 No ODP RILO
2021 No ODP Full Priority(No Crossing)
2021 No ODP Full Priority
2031 ODP with No Through Route (370hh) Full Priority
2031 ODP with No Through Route (370hh) RILO
2031 ODP with No Through Route (200hh) Full Priority
2031 ODP with Through Route (200hh) RILO
2031 ODP with Through Route (200hh) LILO
2031 ODP with Through Route (200hh) Signals
2021 ODP with No Through Route (200hh) LILO
2031 ODP with Through Route (370hh) Full Priority
2021 ODP with No Through Route (200hh) Signals
2031 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (370hh) LILO
2021 ODP with Through Route (200hh) LILO
2031 ODP with Through Route (370hh) Signals
2021 ODP with No Through Route (200hh) Full Priority(No Crossing)
2021 ODP with No Through Route (200hh) Full Priority
2021 ODP with No Through Route (200hh) RILO
2021 ODP with Through Route (200hh) Full Priority(No Crossing)
2021 ODP with Through Route (200hh) Full Priority
2021 ODP with No Through Route (200hh) RILO
2021 ODP with Through Route (200hh) Signals
2021 ODP with Through Route (370hh) LILO
2021 ODP with No Through Route (370hh) LILO
2021 ODP with No Through Route (370hh) Signals
2021 ODP with Through Route (370hh) Full Priority(No Crossing)
2021 ODP with Through Route (370hh) Full Priority
2021 ODP with Through Route (370hh) RILO
2021 ODP with Through Route (370hh) Signals
2021 ODP with No Through Route (370hh) Full Priority(No Crossing)
2021 ODP with No Through Route (370hh) Full Priority
2021 ODP with No Through Route (370hh) RILO
Scenario


Estimated Daily Traffic Volumes-8
(Gambia, N of Grants Road)
Vehicles Per Day
1400
1200
1000
800
600
400
200
0
Scenario
2031 No ODP Full Priority
2021 No ODP Signals
2031 No ODP LILO
2031 No ODP Signals
2031 ODP with No Through Route (370hh) Full Priority
2031 ODP with No Through Route (370hh) LILO
2031 ODP with No Through Route (200hh) Full Priority
2031 ODP with No Through Route (200hh) LILO
2031 ODP with No Through Route (200hh) Signals
2021 No ODP Full Priority(No Crossing)
2021 No ODP Full Priority
2021 No ODP RILO
2021 No ODP LILO
2031 No ODP RILO
2031 ODP with No Through Route (370hh) RILO
2031 ODP with No Through Route (370hh) Signals
2031 ODP with Through Route (370hh) LILO
2031 ODP with No Through Route (200hh) RILO
2031 ODP with Through Route (200hh) LILO
2021 ODP with No Through Route (200hh) Signals
2031 ODP with Through Route (370hh) Full Priority
2031 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (370hh) Signals
2031 ODP with Through Route (200hh) Full Priority
2031 ODP with Through Route (200hh) RILO
2031 ODP with Through Route (200hh) Signals
2021 ODP with No Through Route (200hh) Full Priority(No Crossing)
2021 ODP with No Through Route (200hh) Full Priority
2021 ODP with No Through Route (200hh) RILO
2021 ODP with No Through Route (200hh) LILO
2021 ODP with No Through Route (370hh) Full Priority(No Crossing)
2021 ODP with No Through Route (370hh) Full Priority
2021 ODP with No Through Route (370hh) RILO
2021 ODP with No Through Route (370hh) LILO
2021 ODP with Through Route (370hh) Full Priority
2021 ODP with Through Route (370hh) RILO
2021 ODP with Through Route (200hh) Full Priority
2021 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (370hh) Full Priority(No Crossing)
2021 ODP with Through Route (370hh) LILO
2021 ODP with Through Route (370hh) Signals
2021 ODP with Through Route (200hh) Full Priority(No Crossing)
2021 ODP with Through Route (200hh) LILO
2021 ODP with Through Route (200hh) Signals


Estimated Daily Traffic Volumes-9
(Claremont, S of Paparoa)
Vehicles Per Day
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2021 ODP with Through Route (200hh) RILO
2021 ODP with Through Route (370hh) Full Priority
2021 ODP with Through Route (370hh) RILO
2021 ODP with Through Route (370hh) LILO
2021 ODP with Through Route (370hh) Signals
2021 ODP with Through Route (200hh) Full Priority(No Crossing)
2021 ODP with Through Route (200hh) Full Priority
2021 ODP with Through Route (200hh) LILO
2021 ODP with Through Route (200hh) Signals
2031 ODP with Through Route (200hh) LILO
2021 ODP with Through Route (370hh) Full Priority(No Crossing)
2031 ODP with Through Route (370hh) LILO
2031 ODP with Through Route (200hh) Full Priority
2031 ODP with Through Route (200hh) RILO
2031 ODP with Through Route (200hh) Signals
2031 ODP with Through Route (370hh) Full Priority
2031 ODP with Through Route (370hh) RILO
2031 ODP with Through Route (370hh) Signals
2021 No ODP LILO
2021 No ODP RILO
2021 No ODP Signals
2031 No ODP LILO
2021 No ODP Full Priority(No Crossing)
2021 No ODP Full Priority
2031 No ODP Full Priority
2031 No ODP RILO
2031 No ODP Signals
2021 ODP with No Through Route (200hh) LILO
2031 ODP with No Through Route (200hh) LILO
2021 ODP with No Through Route (200hh) Full Priority(No Crossing)
2021 ODP with No Through Route (200hh) Full Priority
2021 ODP with No Through Route (200hh) RILO
2021 ODP with No Through Route (200hh) Signals
2031 ODP with No Through Route (200hh) Full Priority
2031 ODP with No Through Route (200hh) RILO
2031 ODP with No Through Route (370hh) Signals
2021 ODP with No Through Route (370hh) LILO
2021 ODP with No Through Route (370hh) Signals
2031 ODP with No Through Route (370hh) LILO
2021 ODP with No Through Route (370hh) Full Priority(No Crossing)
2021 ODP with No Through Route (370hh) Full Priority
2021 ODP with No Through Route (370hh) RILO
2031 ODP with No Through Route (370hh) Full Priority
2031 ODP with No Through Route (370hh) RILO
2031 ODP with No Through Route (370hh) Signals
Scenario