CHRISTCHURCH NORTHERN CORRIDOR DOWNSTREAM EFFECTS MANAGEMENT PLAN (DEMP)

PREPARED FOR CHRISTCHURCH CITY COUNCIL

October 2018

Stantec

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Abbreviations

AC	Access to Commercial Centres
AP	Access to Parks
AS	Access to Schools
CAST	Christchurch Assignment and Simulation Traffic
CBD	Central Business District
CNC	Christchurch Northern Corridor
CPTED	Crime Prevention Through Environmental Design
CSU	Cranford Street Upgrade
CTSP	Christchurch Transport Strategic Plan
DEMP	Downstream Effects Management Plan
ECan	Environment Canterbury
HOV	High Occupancy Vehicle
LILO	Left-In and Left-Out
MCA	Multi Criteria Analysis
MR	Major Roads
NAE	Northern Arterial Extension
NoR	Notice of Requirement
ONRC	One Network Road Classification
QEII	Queen Elizabeth II Drive (State Highway 74)
SANF	Safety Audit and Network Functionality
SC	Safer Cycling routes
SSCA	Safe Speed Community Areas
TC	Traffic Calming
V/C	Volume over road Capacity

Christchurch City Council

Christchurch Northern Corridor Downstream Effects Management Plan (DEMP)

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Introduction

This Plan recommends a programme of work to reduce the downstream effects of the Christchurch Northern Corridor (CNC). It has been compiled to comply with the Notice of Requirement (NoR) ruling for the CNC for an independent traffic expert to develop a Downstream Effects Management Plan (the Plan). Where possible, it has been formulated to be consistent with national, regional, and local transport policy and to address transport concerns raised by stakeholders and the public during consultation. To minimise the impact of improvements on private land, the Plan has focused as far as possible on remedial treatments that can occur within the existing road reserve.

The Plan supports further travel demand management initiatives in northern Christchurch and beyond, to reduce the volume of vehicles with single occupants entering the urban road network. However, the focus of the Plan, as specified in the NoR decision, is to mitigate the impacts of the additional traffic that will enter the local network at Cranford Street. Even if travel demand management measures reduce future traffic volumes it is expected that most of the additional traffic as estimated from the transport models will still impact on this network and require various interventions.

Issue Identification

As specified in the NoR, the key focus of the Plan is to identify the preferred vehicle access routes for the additional traffic from the CNC, including trucks, that will occur on the downstream road network. To manage this traffic so that it uses the preferred routes and mitigate where possible adverse effects of the additional traffic, especially on local streets. A transport model has been used to assess the routes drivers are likely to take travelling from the CNC into the city centre in 2021 (opening year) and 2031 (design year). This modelling indicates that the preferred traffic routes, the arterials and collector streets, do not have adequate capacity to accommodate all the additional traffic (including trucks) and, without intervention, there would be a lot of rat-running traffic in local streets. The NoR specifies that when the rat-running traffic volumes on these local streets are 30% or greater than what would have been expected had the CNC not been built, then intervention is required to avoid, remedy, or mitigate these effects. The modelling shows that many local streets trigger this 30% increase, especially in 2031, if there is no intervention.

Whether on the main routes or local streets, the additional traffic from the CNC will adversely impact other road users, and specifically pedestrians and cyclists that use the roads affected. Of particular concern is how this traffic will impact on safety and access of less able pedestrians, such as school children, elderly, and those with a disability. The additional traffic will in some cases impact on local residents' ability to safely access various community facilities (e.g. schools, parks, and commercial centres) and their own properties by walking, cycling, and driving/parking. The Plan has considered how these impacts might be avoided, remedied, or mitigated. In most cases localised studies have been recommended to look at these matters and develop suitable interventions.

Option Development

Based on an understanding of the likely transport impacts of the additional CNC traffic, two option development stages were undertaken. The first stage of the option development focused on options that would encourage the additional vehicles from the CNC to primarily use arterial and collector routes, and not use local streets. The second stage then considers how the increased safety and access requirements of different road users can be improved on streets with additional traffic flows.

Stage 1: Major Route and Traffic Calming Upgrades

During the first stage of option development both arterial/collector upgrades and traffic calming options were developed to keep the extra traffic from the CNC on the main routes. In the first assessment we considered arterial/collector and traffic calming measures on their own. We then considered several options that looked at a combination of arterial upgrades and traffic calming measures. The arterial/collector road improvements were developed to address capacity constraints that were identified along these routes; both midblock and at intersections, using local experience and the transport modelling. The traffic calming measures were developed for local streets that are expected to have a significant amount of rat-running traffic (defined as greater than 30% increase in traffic) with or without arterial/collector upgrades. The full list of major upgrades considered are presented below.

- Do Nothing – this results in rat-running on a lot of local streets
- Option 1. Traffic Calming Only
- Option 2. Arterial Upgrades Only. This included three-laning of Barbadoes Street and Madras (Forfar) Street, Cranford Street Clearways and Berwick Street / Warrington Street capacity improvements)
- Option 3 (a). Traffic Calming and Arterial Upgrades. Arterial upgrades as per Option 2 except clearways on Barbadoes Street and Madras (Forfar) Street instead of permanent three-laning
- Option 3 (b). Traffic Calming and Arterial Upgrades. Arterial upgrades as per Option 2, so permanent three-laning of Barbadoes and Madras (Forfar) Streets
- Option 3 (c). Traffic Calming and Arterial Upgrades. Arterial upgrades as per Option 2 except extension of Barbadoes / Madras one-ways to Warrington Street.
- Option 4 (a). Traffic Calming and Clearways on Cranford / Sherborne Streets from Innes Road to Bealey Avenue
- Option 4 (b) Traffic Calming and permanent four-laning on Cranford / Sherborne Street (option included to allow comparison of options with a more major upgrade of arterial roads)
- Option 5. Traffic Calming plus combined Arterial Options (Options 3(a) and 4(a))

The analysis of these options was undertaken using the CAST (Christchurch Assignment and Simulation Traffic) transport model. This model indicated how successful the options were in keeping traffic on the main routes and discouraging rat-running in local streets.

A multi-criteria analysis (MCA) workshop was then undertaken of each option to determine the best performing options. This involved a number of transport specialists and an urban designer. The MCA looked at a number of factors, including impact on safety of different road users, whether the options met the objectives of the NoR, journey time benefits, timeframe to implement, construction costs, impacts on local businesses, social and amenity impacts, and environment impacts. The workshop participants, including the independent traffic expert, agreed the criterion and the weighting of each criteria and discussed and assessed the various options. The highest weighting went on community impacts (the last three criteria above). Journey time benefits only had a 10% weighting. The best performing options in order were 3 (c), 4(a) and 3 (a).

All three options have very similar upgrades on Cranford Street north of Berwick Street and along Berwick Street and Warrington Streets. They differ in the improvements south of Berwick Street on Cranford/Sherborne Streets, Forfar/Madras Streets and Barbadoes Street. Hence the Plan recommends that the improvements along Berwick and Warrington Streets and Cranford Street north are progressed to scheme design and the three options south of Berwick Street are further investigated and presented to the community for input before deciding on a preferred southern option (see Table 1 below). In addition to infrastructure changes, education, and enforcement aspects of the improvements, especially the peak period clearways, needs to be investigated and implemented.

A list of routes that are expected to require traffic calming has also been developed, based on the transport modelling. Careful monitoring of traffic volumes on local streets is required between 2020 and 2031 to assess the benefits of traffic calming measures and any streets that are adversely impacted by rat-running traffic as a result of drivers selecting alternative rat-running routes. Nine safe speed community areas are also proposed in the wider St Albans network to discourage rat-running.

Stage 2: Safe Access to Community Facilities

During the second option development phase, the impacts the additional traffic would have on all road users was considered, specifically those who live in or near the impacted road network and their ability to safely access various destinations within the local road network. The project has been split up into:

1. Safe access to School
2. Safer Cycling
3. Access to Parks
4. Access to Commercial Centres

Most of the issues raised by the public and stakeholders fit into one of these categories. One specific matter that does not is safe access into properties on arterial and collector roads with peak period clearways, like Cranford Street. The identification of issues with access and possible solutions to improve access will need to be assessed as part of the implementation of the clearways.

The key issues in terms of safe access to schools is access across Cranford Street for children walking to and from St Albans School. The children primarily use the Cranford Street /Westminster Street signalised intersection to access the school, but some also use the Berwick Street/Cranford Street signalised intersection. Due to several close (crash) misses, the school currently employees a cross warden at the Cranford Street /Westminster Street intersection to help children cross the road. With the proposed upgrades of this intersection (also Berwick Street /Cranford Street) the potential for a crash will increase if no safety improvements are made. As an interim measure it is proposed to lower the speed limit to 40km/h from north of Westminster Street to south of Berwick Street during school start and finish times, install a textured surface at the Westminster Street intersection and look at changes to the signals before the CNC opens. Further improvements need to be investigated and implemented within 3 years of the CNC opening.

The introduction of peak period clearways along Cranford Street down to Berwick Street and possibly other clearways further south makes such routes less safe for cycling, especially during the peak periods. It is not possible to rectify this without widening the road designation and purchasing additional land. Hence the recommended option is to direct cyclists onto other routes. The general increase in traffic across the network will also make it less safe to cycle on a number of other roads (e.g. Edgeware Road) without improved cycle facilities. To encourage local people to cycle and to direct them to use the Papanui Parallel cycleway (a separated north-south cycle path) on Rutland Street, Trafalgar Street, and Colombo street, it is proposed to develop three east-west secondary cycle routes (along McFaddens Road, Westminster/ Courtenay Streets and Edgeware Road). These will be feeder routes to the Papanui Parallel and will be a combination of on-road cycle lanes and off-road paths. It is also proposed that a secondary north-south cycle route be provided on the eastern side of Cranford Street to link cyclists that have origins and destinations on the eastern side of the main route to the city centre and St Albans Park.

The additional traffic generated by the CNC will also increase traffic volumes around St Albans Park, and to a lesser degree around Malvern Park. The three main roads around St Albans Park; Barbadoes Street, Forfar Street and Warrington Street, will have increased traffic flows making it more difficult to access the Park. The proposed traffic signals at Forfar Street /Warrington Street and Barbadoes Street /Warrington Street and the proposed new north-south cycleway to the east of Cranford Street will improve access to the north of the park. However, there are still challenges for pedestrians wanting to cross Forfar Street and Barbadoes Street further south. There have been a number of vulnerable road user crashes at the northern end of Barbadoes Street and the additional traffic from the CNC will exacerbate existing access issues. Hence, a study is proposed to look at access and safety issues for St Albans Park (and Malvern Park) and develop options to make access safer.

Local residents also need to have safe access to their local (shopping and eating) commercial centres. Christchurch City Council are keen to see local centres become more vibrant and for locals to walk and cycle to these centres. Access to these centres by vehicle, along with parking, is also required for some trips, especially those made by less able-bodied residents. A neighbourhood improvement plan has already been developed for the Edgeware Village and so a new plan for that centre is not proposed, although improvement options for cycling and walking along Edgeware Road will need to be integrated into that plan. It is recommended that transport studies are undertaken for the four local activity centres impacted by the CNC traffic; the Westminster Street /Cranford Street, Warrington Street /Barbadoes Street, Edgeware Road /Barbadoes Street and Rutland Street activity centres. Corridor assessments, along Edgeware Road and Westminster/Courtenay Streets are also required to look at enhancing access and amenity for pedestrians of all abilities. The improvements that are recommended in these studies should be implemented to offset the access and safety consequences of the additional traffic.

The key outcomes that are desired from all the proposed studies and improvements is a network of roads that are safer and 'healthier', even with the increased traffic volumes. Hence it is important that all designs go through a road safety and healthy streets review in order to maximise the benefits of such improvements. With respect to safety, in addition to traditional safety audits, it is recommended that all designs are assessed using the Austroads safe system assessment framework which targets crash risk that could lead to serious injury and fatal crashes. To achieve healthier streets, it is recommended that all street upgrades are assessed using the Heathy Streets framework that has been developed by Transport for London.

The Downstream Effects Management Plan

Table 1 shows a summary of the studies and improvement options that are proposed to avoid, remedy, or mitigate the impacts of the CNC. This is based on analysis and review of the transport issues using modelling and experience. A key element of the Plan is the ongoing monitoring of the transport flows (including pedestrian and cycle volumes), vehicles speeds, and environmental impacts (vehicle emissions, noise and vibration). Of particular importance will be how traffic flows through the downstream road network in the years following the opening of the CNC. While arterial and collector upgrades and traffic calming measures will be introduced to encourage drivers to use the major roads, it is highly likely that some drivers will choose to use local streets as rat-runs, and that they may behave in ways not predicted by the transport models. Hence the monitoring will identify issues that may require other changes to the road network such as traffic calming of additional streets and upgrades of signalised intersections. The monitoring is expected to have the greatest impact on the composition of the Stage 3 projects.

While ideally some of the Stage 2 projects are undertaken before the CNC opens, there is limited time to make all the changes and hence the most crucial changes to prevent excessive congestion and rat-running have been prioritised in Stage 1 (to be in place ideally before CNC opens), with other projects delayed. The impact of this maybe adverse transport effects in the short-term. Hence it is important that Council do act quickly to address the worst of any adverse transport effects (e.g. high levels of rat-running) once the CNC opens. We would recommend rapid implementation of projects, where this is practical, and other temporary measures to address the effects that are identified in the monitoring.

Table 1 – Lists of improvement projects and studies categorised by Stage (note some projects appear in two or more stages as they consist of more detailed studies and the implementation of improvements)

Stage 1 – Projects and studies to be undertaken before the CNC opens
Major Road (MR) Upgrades: **MR1 (Cranford Street Clearways)** – Peak Period Clearways along Cranford Street from Innes Road to Berwick Street. **MR2 (Westminster/Cranford Intersection)** – Upgrades to Westminster Street /Cranford Street Intersections. **MR3 (Berwick/Warrington Upgrades) –** Upgrading of Berwick Street /Cranford Street signalised intersection and signalisation of the Forfar Street /Warrington Street and Barbadoes Street /Warrington Street Intersections. **MR4 (South Berwick Upgrades)** –Downstream of Berwick Street arterial upgrade option that comes out of the scoping study. **MR5 (HOV lanes on Cranford-Sherborne)** – Investigate extending the southern HOV (high occupancy vehicle) lanes on the CNC through to Bealey Avenue and installing a northbound HOV lane. **Safe System Community Areas (SSCA):** **SSCA 1 to 9** – Introduce nine 30km/h (or 40km/h) reduced speed limit areas through the downstream local road network **Traffic Calming (TC) Measures:** Introduce traffic calming on **TC1 – Mersey Street (Innes to Forfar), TC2 – Knowles** Street**, TC 3 – Weston** Road**, TC 4 – McFaddens Road, TC7 – Malvern Street (LILO) and TC8 – Dee Street (LILO)** **Safe Access to Schools (AS):** **AS1 – Safe Access Across Cranford Street** – This study will look at a range of options, including a new mid-block signalised crossing across Cranford Street near the English Park Carpark entrance. **AS2 – Interim Improvements on Cranford Street** – As an interim measure it is suggested that as part of **MR1 (Cranford Clearways)** and **MR2 (Westminster** Street **/Cranford** Street **Intersection)** a 40km/h speed limit be introduced during school arrival and departure time on Cranford Street from approximately 50m north of Westminster Street to 50m south of Berwick Street, a coloured surfacing be installed at the Westminster Street /Cranford Street Intersection, and left turning red arrows be used as protection for crossing pedestrians.

Safe Cycling Routes (SC):

SC1 (Cycle Wayfinding Signage) – Development of and implementation of a wayfinding signage plan that directs cyclists at the northern end of Cranford Street (at McFaddens Road) and southern end of Cranford Street to safer cycling routes.

SC2 (McFaddens Road Secondary Cycle Corridor) – Undertake a route study of a cycling route both west (towards the Papanui Parallel) and east (towards new north south route) on McFaddens Road.

SC3 (Westminster/Courtenay Secondary Cycle Corridor) – Undertake a route study of a cycling route both west and east of Cranford Street.

SC4 (Edgeware Road Secondary Cycle Corridor) – Undertake a route study of a cycling route both west and east of Cranford Street.

SC5 (North-South Secondary Cycle Corridor) – Undertake a route study of an alternative north-south cycle route through traffic calmed streets to the east of Cranford Street.

Stage 2 – Projects and Studies that need to be undertaken within three years of CNC opening

Traffic Calming (TC) Measures:

Introduce traffic calming on **TC9 – Roosevelt Avenue, TC12 - Caledonian Road, TC13 - Edgware Road (Village), TC14 – Manchester Street and TC15 – Westminster** Street **/Courtenay** Street, where expected increases in traffic volumes are validated by the monitoring data.

Safe Access to Schools (AS):

AS1 – Safe Access Across Cranford Street – Implement any options identified in this study such as a new mid-block signalised crossing across Cranford Street near the English Park Carpark entrance.

Safe Cycling Routes (SC):

SC2 (McFaddens Road Secondary Cycle Corridor) – Construct a secondary cycling route both west (towards the Papanui Parallel) and east (towards new north south route) on McFaddens Road.

SC3 (Westminster/Courtenay Secondary Cycle Corridor) – Construct a secondary cycling route both west and east of Cranford Street.

SC4 (Edgeware Road Secondary Cycle Corridor) – Construct a secondary cycling route both west and east of Cranford Street.

Access to Parks (AP):

AP1 (St Albans Park Access Plan) – Development of a plan that will look at access to the park by pedestrians (of different abilities), cyclists, and motorists.

AP2 (Malvern/Rugby Park Access Plan) – Development of a plan that will look at access to the park by pedestrians (of different abilities), cyclists, and motorists.

Access to Commercial Centres (AC):

AC1 – Westminster/Cranford Local Activity Centre Transport Study. Undertake study that will consider safe access to this activity centre by pedestrians, cyclists, and motorists.

AC2 – Barbadoes/Warrington Local Activity Centre Transport Study. Undertake study that will consider safe access to this activity centre by pedestrians, cyclists, and motorists.

AC3 – Barbadoes/Edgeware Local Activity Centre Transport Study. Undertake study that will consider safe access to this activity centre by pedestrians, cyclists, and motorists.

AC3 – Rutland Street Local Activity Centre Transport Study. Undertake study that will consider safe access to this activity centre by pedestrians, cyclists, and motorists.

AC4 – Westminster/Courtenay Corridor Study (Rutland to Forfar) – Undertake this study which will focus on safe access by pedestrians along the route and crossing the route especially for vulnerable road users.

AC5 – Edgware Corridor Study (Springfield to Barbadoes) – Undertake this study which will focus on safe access by pedestrians along the route and crossing the route especially for vulnerable road users.

Stage 3 – Projects that could be undertaken any time between the opening of the CNC and 2031

Monitoring

Ongoing monitoring of traffic, pedestrians, and cycle volumes, crashes and vehicles speeds, emissions, noise, and vibration on major roads and some local streets is to occur annually, or when required more often, after the CNC opens to validate the plans and projects already identified in this document, and through the various studies that are specified.

It is expected that additional interventions will be required to avoid, remedy, or mitigate the effects of the additional CNC traffic, including the impact of trucks, that is identified in this monitoring. In terms of local streets, intervention is required if the traffic volumes increase by 30% above what might have been expected on the route if the CNC had not been built. In terms of other interventions (e.g. arterial upgrades) this will be the result of congestion or safety concerns with respect to all road users. Some improvement may also not be required (e.g. if local road traffic does not increase by 30%, as predicted by the modelling). Consultation on all proposed changes will be undertaken.

An indication of Stage 3 improvement projects is provided below. This list will need to be reviewed and where necessary revised once the actual impacts of the CNC traffic is known from the monitoring.

Traffic Calming (TC) Measures:

Introduce traffic calming only where monitoring indicates high levels of rat-running are occurring (may include additional streets): **TC – 5 McFadden Road, Knowles** Street**, Weston** Road **(east Cranford), TC6 – Jameson** Avenue**, TC10 – Forfar Street, TC11 – Flockton Street, TC16 – Severn Street, TC17 – Thames Street, TC 18 – Aylesford Street, TC19 – Kensington Avenue, TC 20 – Philpotts Road and TC 21- Francis SAvenue.**

Safe Cycling Routes (SC):

SC5 (North-South Secondary Cycle Corridor) – Construct an alternative north-south cycle route through traffic calmed streets to the east of Cranford Street.

Access to Parks (AP):

AP1 (St Albans Park Access Plan) – Implementation of the access plan as required to address access issues.

AP2 (Malvern/Rugby Park Access Plan) – Implementation of the access plan as required to address access issues.

Access to Commercial Centres (AC):

AC1 – Westminster/Cranford Local Activity Centre Transport Study. Implement study recommendations

AC2 – Barbadoes/Warrington Local Activity Centre Transport Study. Implement study recommendations.

AC3 – Barbadoes/Edgeware Local Activity Centre Transport Study. Implement study recommendations

AC3 – Rutland Street Local Activity Centre Transport Study. Implement study recommendations

AC4 – Westminster/Courtenay Corridor Study (Rutland to Forfar) – Implement study recommendations.

AC5 – Edgeware Corridor Study (Springfield to Barbadoes) – Implement study recommendations

1. Introduction and Background

Planning for a new arterial route from the Christchurch CBD (Four Avenues) to the northern suburbs of Christchurch and beyond has been ongoing for many decades. Over the last decade a preferred route has been identified and designed for the northern section of this route. This preferred route is called the Christchurch Northern Corridor (CNC) which, at the time of this report, is under construction with a planned completion date of mid-2020. The CNC will increase traffic volumes on the urban road network south of the project[1]. The Downstream Effects Management Plan (the Plan) considers the impact of this additional traffic and what changes are required to the network to minimise the impact of this additional traffic travelling from the CNC through to the CBD. The Plan has been compiled to satisfy the requirements of the Notice of Requirement (NoR) ruling for the CNC (Appendix A). The rest of this introduction provides background and history of the CNC (decades of transport planning on a northern route), that helps set the context of the Plan.

1.1 Christchurch Northern Corridor and Requirement for a Downstream Effects Management Plan

The Christchurch Northern Corridor (CNC) project is an alliance project currently being undertaken by the New Zealand Transport Agency (NZ Transport Agency), and Christchurch City Council[2]. As part of this project a new four-lane motorway will connect SH1 from just south of the Waimakariri Bridge with Cranford Street about 500m north of the McFaddens Road / Cranford Street Intersection (see Figure 1-1). The project also includes new pedestrian and cycle facilities[3].

Figure 1-1: Christchurch Northern Corridor (Source: https://www.nzta.govt.nz/assets/projects/christchurch-northern-corridor/CNC-Map-Poster.pdf)

A section of Cranford Street (the southern end of the CNC) will also increase from a two-lane road to four-lanes with a median. As part of the project the Innes Road / Cranford Street intersection will also be subject to works to enlarge its capacity. A representation of these changes, including active mode provisions, are shown in Appendix B.

In July 2015 Independent Hearings Commissioners heard the designation case for the CNC. The designation was approved subject to a number of conditions. A major concern raised by submitters was the downstream effects of the CNC, especially on local roads within St Albans and adjoining suburbs. To address this concern a condition was added that required Christchurch City Council to engage a suitably qualified independent traffic expert who would produce a Downstream[4] Effects Management Plan. Dr Shane Turner of Stantec was appointed to this role.

The Plan is the outcome of investigations on likely downstream effects of the CNC and recommends works that could be undertaken to address those effects. Given the uncertainty around the effects, which are

[1] Refer to Section 4.1.2.1

[2] Information on this project can be found at https://www.nzta.govt.nz/projects/christchurch-motorways/christchurch-northern-corridor/

[3] https://www.nzta.govt.nz/projects/christchurch-motorways/christchurch-northern-corridor/faqs/#1

[4] Downstream as defined by the Notice of Requirement means south of the Innes Road / Cranford Street intersection. For the purposes of the DEMP, 'south' of the CNC has been interpreted as including local and collector roads between Innes and McFaddens due to the interconnectivity of the local road network.

based on land use estimates and expected driver behaviour, a key aspect of the Plan is the monitoring of transport effects once the CNC opens, and comparing these with conditions prior to the CNC (minus expected network growth without the CNC). However, given the increase in traffic volume from day 1 some improvements do need to be in place before the CNC is opened (expected to be in 2020).

1.2 History of the Christchurch Northern Arterial (now CNC)

Various traffic corridor plans have been conceived in planning for Christchurch since the 1950s. In 1962 the Christchurch Regional Planning Authority proposed the Northern Arterial Concept Route; roughly following the path of the current Northern Arterial however extending further south through St Albans. During the 2nd review of the plans the corridor was changed so that new arterial would extend to Bealey Avenue where it would connect with the one-way pair; Barbadoes and Madras Street. In 1989 the Northern Arterial Designation was narrowed in width at the Redwood/Belfast portion. Later, the St Albans portion of the designation was removed from the Christchurch City District Scheme.[5] The following excerpt is taken from Christchurch City Centre – 40 years of Change, and it explains some of the reasons why the network has been developed the way it has in Northern Christchurch:

> "During the 1980s...the Christchurch City Council made successive reductions to the proposed road network in suburban areas. These changes were in response to a combination of other factors including: slower population growth, economic downturn – less central employment, limited funding based on benefit/cost ratios, community acceptance of greater congestion, increasing opposition from affected residents, councillor opposition in the 70s and 80s. Subsequently in the agreed 1989 regional plan the road network and hierarchy of roads were generally retained but the motorways were deferred still further on the assumption that the arterial "at-grade" road network would suffice. This policy, together with the reliance on benefit/cost for national funding, supported the ongoing construction of major arterial all-purpose roads in the suburbs."[6] (Christchurch City Centre – 40 Years of Change, Traffic, Planning – 1959-1999, Malcom Douglass, Christchurch City Council, 2000 (p11)).

Clearly, there has been much discussion and investigation on the north – south transport connections in Northern Christchurch for at least the last 50 – 60 years. During that time larger motorway connections (passing through urban Christchurch) have been considered, planned, and eventually withdrawn. The history of these decisions has been important in the preparation of the Plan as it is not intended to re-litigate or reconsider past discarded options, or options of a similar nature and scale, which have shown to be out of favour.

Given the history and strong views of the local community, the Plan is focused on using existing roads to carry the additional traffic associated with the CNC. It also seeks to minimise the impact of any upgrades on private property and especially building structures within the urban area. Hence wherever possible the focus is on remaining within current road reserves.

An important part of the Plan is understanding the impact that the additional CNC traffic could have on the local community, and how this can be avoided, remedied or mitigated. This includes minimising the impact of the additional CNC traffic on safe access to parks, schools, businesses and housing. It is also important that the future transport network supports transport choice, and in particular walking, cycling, and public transport. A legacy of the Plan should also be improvements in amenity and urban design to streets within the community.

[5] https://www.nzta.govt.nz/assets/projects/northern-arterial/docs/nart-project-timeline.pdf

[6] Christchurch City Centre – 40 Years of Change, Traffic, Planning – 1959-1999, Malcom Douglass CCC, 2000 (p11)

2. Report Structure

The report begins (Section 3) by summarising the various national, regional, and local transport planning strategies that have been agreed and outlines the current road network and operating conditions for different road users, including any existing road safety issues.

The report then outlines the purpose and objectives of the study and the methodology that has been adopted to undertake the transport assessment (Section 4). It also specifies the 'balanced' transport planning approach that we have attempted to undertake that looks to minimise the impact of the additional traffic on local streets, but also provide for, and encourages, greater use of other transport modes, or at the very least, higher occupancy rates in motor vehicles.

Section 5 discusses the transport modelling that has been undertaken to understand the likely impacts of the additional traffic from CNC (currently expected to open in mid-2020) on the downstream road network in 2021 (represents opening year) and 2031 (design year) if no changes are made. The modelling assesses the impacts of the CNC against what is expected in terms of traffic growth on the wider network if the CNC was not built.

The consultation undertaken with stakeholders and the public is summarised in Section 6. Wherever possible the concerns raised by the public and various organisations have been addressed in the option development. However, not all issues raised can be addressed, as many fall outside the scope of this assessment, or are in conflict with other issues and options raised.

The option development phase is presented in Section 7. The first iteration of the option development focused on the local streets that had greater than a 30% increase in traffic and also capacity constraints on the urban arterial/collector network. The focus at this level being to minimise the number of local streets impacted by a combination of arterial/collector road upgrades (the carrot) and local road traffic calming and speed limit reductions (the stick). The second iteration of the option development looks at options to minimise the impact of the additional traffic on safe access to schools, safe cycling through the network, access to parks, and access to local and neighbourhood activity/community centres.

Section 8 and 9 present the recommended downstream improvement plan. It highlights improvements that need to be undertaken before the opening of the CNC to address impacts associated with the sudden increase in traffic as a result of the CNC opening. It then outlines improvements that should be undertaken shortly after the opening and through to approximately ten years after the opening (up to design year 2031). The Plan has a strong monitoring focus to assess the impact of traffic growth between opening and 2031. The timing of upgrades beyond the opening will be tied to the impacts observed in the monitoring. Some upgrade projects may be delayed, and other projects brought forward depending on the monitoring outcomes, and new projects may be identified based on traffic effects not predicted in the modelling (e.g. local street rat-running).

3. Background Review

This section outlines briefly the key national, regional, and local transport strategies that have been agreed by various organisations for transport planning activities within Christchurch. It then provides an overview of the existing transport network and how this operates. This includes bus and cycling routes, and road safety issues. There are a number of existing transport issues on the current road network but only some of these issues will be impacted by the CNC traffic, and need to be addressed in the Plan. More information on these issues is presented in Section 6.

3.1 National, Regional, and Local Strategies

Various national, regional, and local strategies exist which have guided the direction of the Plan. Their respective relevance to the Plan is that the options need to be conscious of, and aim to satisfy (where possible), the relevant objectives contained in those strategies.

3.1.1 National

The latest Government Policy Statement has four strategic directions; Safety, Access, Environment, and Value for Money. These strategic directions were considered during option conception and in the application of the multi-criteria analysis.

The Safer Journeys Strategy (2010-2020) guides how safety concerns will be addressed in New Zealand over the period 2010-2020[7]. It outlines the Safe System approach which recognises the vulnerability of road users, and the four pillars of safe roads and roadsides, safe speeds, safe vehicles, and safe road use, under which safety is to be addressed. In urban areas the safety of pedestrians (especially vulnerable pedestrians; young, and elderly) and cyclists needs to be considered alongside vehicle safety.

3.1.2 Regional

The Regional Land Transport Plan (2015-2025) outlines five regional objectives; 1) A land transport network that addresses current and future transport demand, 2) A land transport system that is increasingly free from death and serious injury, 3) The Canterbury earthquakes recovery is supported, 4) The land transport network is resilient and supports long-term sustainability, and 5) Investment in land transport infrastructure and services is efficient.

In addressing the downstream effects, the formation of the Plan has been particularly conscious of regional objectives 1, 2, and 5, as well as long-term sustainability mentioned in objective 4. Resilience was considered less of a priority due to the various routes available in Christchurch should, for example, Cranford Street becomes temporarily unavailable. It should be noted, however, that any implementation of works must also be conscious of earthquake recovery projects when they occur.

3.1.3 Local

The Christchurch Transport Strategic Plan (CTSP)has four goals; 1) Improve access and choice, 2) Create safe, healthy, and liveable communities, 3) Support economic vitality, and 4) Create opportunities for environmental enhancements. The Plan seeks to align with the CTSP[8]; namely to use the existing road network more efficiently. Therefore, the Plan has concentrated on low impact, at grade, treatments.

The Long-Term Plan (LTP) sets out Christchurch City Council's funding priorities for transport over the next 10 years (2018-2028). Their commitment to the CNC is outlined there, along with other key projects such as Accessible City, Major Cycle Routes, a local cycle network (connecting to major cycle routes), pedestrian improvements plan, and Public Transport Infrastructure. Achieving mode shift (including better mode choices) is one of the level of service targets for the active transport in the LTP. Indicative funding has also been allocated in the LTP for Down-stream Effects Management Plan projects in the period 2018/19 to 2023/24.

[7] http://www.saferjourneys.govt.nz/

[8] https://www.ccc.govt.nz/assets/Documents/The-Council/Plans-Strategies-Policies-Bylaws/Strategies/ChristchurchStrategyTransportPlan2012.pdf

3.2 Local Network Conditions & Description

This section of the report provides an overview of the existing down-streams urban transport network south of the CNC.

3.2.1 Route and Road User Hierarchy

Streets vary significantly in function. Some are used only for through movements (for example a motorway), while others are mainly used for access (a cul-de-sac). In response to this, the road network is categorised into hierarchy which enables planning and decisions to be made, some of which have wide effects. The route hierarchy in the vicinity of Cranford Street (which is relevant here) is presented in Figure 3-1 from Christchurch City Council's District Plan. A similar hierarchy is given in the CTSP.

Figure 3-1: Road Hierarchy (Source: http://www.proposeddistrictplan.ccc.govt.nz/Images/DistrictPlanImages/Chapter%207%20Transport/Operative/OperativeFig7.17a.jpg (note: some street names added))

A key objective of the Plan is to keep the majority of vehicles on principal routes (arterials, distributors, and collectors).

Cranford Street from the connection of the CNC to Innes Road is a major arterial, south from there it becomes a minor arterial[9] primarily as it moves through community centres like Westminster Street / Cranford Street, and Edgeware Village. Innes Road and Berwick Street / Warrington Street are also classified as minor arterials. Collector roads in the vicinity of Cranford Street include McFaddens Road, Rutland Street, Westminster Street / Courtenay Street / St Albans Street, Madras Street, and Barbadoes Street.

Based on this hierarchy the bulk of the north-south traffic from the CNC should be accommodated on Cranford, Berwick, Warrington, Madras, Barbadoes, and Sherborne Streets. While Rutland Street and Springfield Road are also collectors, Rutland Street now forms part of a major cycle route and hence it is desirable to keep traffic volumes on Rutland Street at lower levels.

NZ Transport Agency's One Network Road Classification (ONRC) system[10] also classifies Christchurch's urban roads. This system shows Madras Street and Barbadoes Street on an equivalent hierarchy to

[9] Definitions of the respective road hierarchies can be found in the Council's District Plan

[10] Details can be found here: https://www.nzta.govt.nz/roads-and-rail/road-efficiency-group/onrc/.

Cranford Street and Sherborne Street (arterials[11]), and also highlights the importance of Forfar Street, which is classified as a primary collector under the ONRC. Based on ONRC categories the study has assessed using Madras and Barbadoes for carrying additional north—south traffic and Forfar Street carrying more traffic than the majority of local streets in the area.

3.2.2 Active Modes and Public Transport

Christchurch City Council have been active in promoting active and public transport modes in the northern suburbs of Christchurch, by identifying and installing infrastructure to support these travel options. Christchurch City Council and Environment Canterbury (ECan) are planning to do more upgrades, and promotion, to support greater use of these modes. We support further initiatives to move people out of cars and into other transport modes.

Christchurch City Council are currently investing in the development of separated cycleways[12] as part of their Major Cycle Route (MCR) project, which will eventually deliver 13 major cycleways. The Papanui Parallel Cycleway was one of the first to be constructed, and its alignment through the subject area can been seen in Figure 3-2. Further cycleways are planned in the wider area including; the Northern Line, and the cycle trail along the CNC, as well as a network of secondary cycle routes connecting to the major cycleway network[13]. The CNC cycle trail will eventually allow cyclists to travel from the Waimakariri District to the Papanui Parallel and into the city. The CNC also includes a cycle track to the east along QEII Drive. Limited work has been undertaken to date around key secondary cycle route linkages to the Papanui Parallel. We do see the development of such routes being important as traffic volumes grow in this network.

Christchurch City Council have a project to create a link between the CNC and the Papanui Parallel, called the Grassmere Link. Council have allocated funding for this project in the 2020 to 2024 financial years. This project will be delivered as part of the CNC.

Figure 3-2: Cycle Network (Adapted from: https://www.ccc.govt.nz/assets/Documents/Transport/Cycling/map/Cycle-map.PDF)

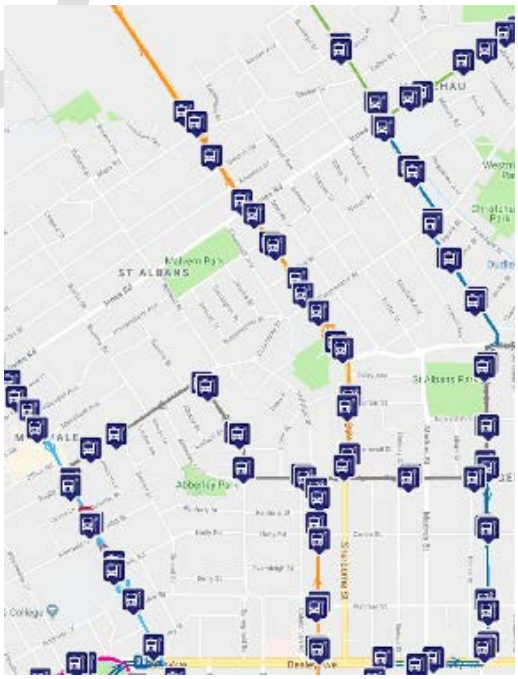

Figure 3-3: Bus Routes (Source: http://www.metroinfo.co.nz/map/)

[11] ONRC divides New Zealand's roads into categories based on how busy they are, whether they connect to important destinations, or are the only route available. Within this arterial is broadly defined as 'link regionally significant places and industries' (Source: https://www.nzta.govt.nz/assets/Road-Efficiency-Group/docs/ONRCPMsgeneralguide.pdf)

[12] https://ccc.govt.nz/transport/cycling/major-cycle-routes/about-cycle-routes/

[13] https://www.ccc.govt.nz/assets/Documents/The-Council/Plans-Strategies-Policies-Bylaws/Plans/Long-Term-Plan/draft2018/service-plans/Long-Term-Plan-2018-28-draft-Service-Plan-Active-Travel2.pdf

Bus routes in the vicinity of Cranford Street are shown in (Figure 3-3). The Orange Line bus route is located on Cranford Street. From the Christchurch Northern Corridor connection, the Orange Line continues down Cranford Street as far as Edgeware Road where it moves across to Colombo Street. Other nearby bus routes include '44 Shirley', '100 Wigram/The Palms', the Orbiter which turns right from Innes Road (east) onto Cranford Street under the new route, and the Blue Line which connects Rangiora to Christchurch City Centre via Papanui Road.

ECan have plans to increase the frequency of bus services (on the Orange Line) on Cranford Street. Further bus priority measures are currently being investigated on Main North Road leading into Papanui Road[14]. One benefit of the CNC is that it is expected to reduce traffic volumes on Main North Road and Papanui Road allowing better bus priority on this corridor.

ECan (and NZ Transport Agency) have also previously investigated Park N Ride facilities in northern Christchurch. Any facility needs to be located so that it benefits from the bus priority improvements on Main North Road and Papanui Road.

We support citywide initiatives that encourage more trips by bike, public transport, or walking. We also support initiatives to encourage car-pooling, including HOV lanes.

3.2.3 Existing Traffic Conditions and Crash Analysis

Historical crash data is available for the network south of the CNC but there are limited traffic counts available for the existing road network. The traffic counts that are available are shown in Appendix C. As part of the monitoring a lot more (baseline) traffic counts are being collected before the CNC opens.

The crash history shows that generally the majority of crashes (in the period 2012-2016) in the downstream network have occurred on higher volume roads such as Cranford Street, Innes Road, and Hills Road. In general, the data aligns with what would be expected relative to a typical network hierarchy; high volumes on arterials and collectors, and a relationship between traffic flow and crash incidence.

Of the death and serious injuries that have occurred during the 2012-2016 timespan, the majority have involved turning or crossing traffic mainly at intersections. Hence particular attention needs to be given to the design of intersections as traffic volumes increase.

Pedestrian crashes have occurred east of Cranford Street on Innes Road (near school crossing), and also around Edgeware Village and near St Albans Park. In total there were 11 pedestrian (including one mobility) crashes that occurred in the study area in the period of 2012-2016. Of these, two pedestrians were minors, and three were older than 65. The crashes resulted in two Deaths or Serious Injuries (DSI) (only 8% of the DSI) which is lower than the national average[15] for 2016 (10%).

There were three recorded bicyclist DSI in the study area (12.5% of the DSI), which is higher than the national average of 6.2% for 2016, but fairly typical of Christchurch where cycle numbers are higher. Cyclist crashes have generally occurred south of Westminster Street. Cranford Street has experienced a higher amount of motorcycle crashes than most other nearby streets.

Speed has also been a factor. Cranford Street performed relatively well compared with other major roads, except around the Westminster Street / Cranford Street intersection, and immediately south of the Berwick Street / Cranford Street intersection. Locations where speeds were a bigger factor include Barbadoes Street between Edgeware Road and Warrington Street, and Flockton Street. This may be a result of the current wide lanes on these roads and the unsignalised Barbadoes/ Warrington intersection.

More detail on current crash patterns is provided in Appendix C. The pre-CNC crash data will form an important baseline for monitoring the crash impacts on the network following the opening of the CNC.

[14] https://www.ccc.govt.nz/news-and-events/newsline/show/2047

4. Purpose of the Plan

4.1 CNC Notice of Requirement (NoR)

The primary purpose of the Plan, as specified in the NOR, is to identify downstream effects (from the southern end of the NAE/CSU[16]) of the CNC and develop a plan that addresses these effects. This requires identifying what needs to happen before the CNC has opened and what level of monitoring and interventions are required to mitigate adverse effects between 2020 (opening year) and 2031 (design year).

4.1.1 NoR Objectives

The objectives of the investigation, as stated in the Notice of Requirement (NoR), into the downstream effects are:

(a) To identify preferred vehicle access routes, particularly for trucks, between the end of the Christchurch Northern Corridor and the Central City (that is between the end of the NAE/CSU and the City centre); and

(b) To identify strategies to keep vehicles on preferred vehicle access routes; and

(c) To discourage vehicles away from public transport routes and walking or cycling routes such as Main North Road / Papanui Road and Rutland Street corridors respectively.

These objectives are limited in scope and are motor vehicle centric. While objective 3 may consider other modes, it does not cover improved infrastructure over the network for other modes to offset the additional traffic volumes. To be consistent with the various national, regional, and local transport strategies it is important that the Plan developed considers a number of other transport planning matters (e.g. safe access to schools), and especially the impacts of the additional CNC traffic on walking, cycling, and public transport on the downstream road network. Hence the Plan includes improvements that extend beyond these objectives.

4.1.2 NoR Effects Management

The NoR also states that: This Management Plan is to ensure downstream effects are appropriately managed and to:

(a) Assess the existence, nature, and extent of any increased traffic on streets adjacent to, or adjoining Cranford Street attributable to the NAE/CSU that might cause or contribute to a loss of service to any of these streets for up to 10 years after the opening date of the NAE/CSU;

(b) Implement measures to avoid, remedy or mitigate such effects, where these are more than minor, in a timely and cost-effective manner and where appropriate and practicable; and

(c) Monitor the efficacy of the measures for an appropriate period and implement further remedial action, if this is necessary and appropriate.

Here we have taken a broader view on the measures that need to be undertaken to avoid, remedy, or mitigate the traffic effects. It not just being a matter of keeping the traffic on main roads and discouraging them from using local streets and routes currently prioritised for public transport (Main North Road) and cycling (Rutland Street), but also mitigating the effects on other modes of the increased traffic. For example, the large increase in traffic on Cranford Street will impact 1) on safety of school children crossing the corridor to access St Albans School, 2) cyclists who use Cranford Street and 3) pedestrians and drivers who want to access the Westminster/Cranford local activity centre. Measures to mitigate these three risks have been considered in the Plan.

4.1.2.1 30% Traffic Growth Threshold

It was stipulated in the NoR that in order to be considered for treatment a street must have experienced in excess of 30% increase on the traffic volume that preceded the CNC. Additionally, underlying traffic growth was not to be included. It was also made clear that in the event of a street exceeding the threshold that works did not necessarily need to be undertaken to reduce the traffic volume.

[16] NAE refers to 'Northern Arterial Extension' (the connection between SH74 and Cranford Street), CSU refers to 'Cranford Street Upgrade'. Both form part of the greater Christchurch Northern Corridor (CNC) project.

This requirement is significantly more complex than it appears. Initially, when the CNC is completed and connected to the existing network, it will be relatively simple to deduce where a 30% increase has occurred exclusive of non-CNC related growth. The complexity of accurately making this calculation will concatenate the longer time passes from 2021.

While this threshold seems relevant for local streets, which carry modest volumes, the same cannot be said of arterial roads and some collector streets. Many of the arterials, and especially some of the intersections, would experience congestion well before they get a 30% increase in traffic. If changes are not made to the arterials to remove severe congestion, then it will be difficult to mitigate the 30% growth in traffic on some local streets. Hence our approach with arterials has been to look at where congestion is expected to occur and look at options to reduce congestion where this does reduce the number of local streets impacted by more than 30% additional traffic.

4.1.2.2 Monitoring the Threshold

The streets that are expected to get a 30% increase in traffic by 2031 or may get an increase (based on local knowledge) will be monitored from 2020 through to 2031. Baseline data from these streets is being collected in 2018. There are some challenges in monitoring local streets as the 30% growth threshold is the additional growth that has occurred beyond what might have been expected from natural traffic growth without the CNC.

There are many societal events which affect the number of trips undertaken on a network; land use changes, economic changes, and political changes to name a few. Given time, changes will occur, and these will need to be updated in a base model. There are also many specific changes that will occur on the network which will also need to be updated within the base model. These changes are relatively simple to take care of in a model. However, a much more difficult undertaking is to uncouple changes made to the downstream network in response to the CNC; changes which affect the traffic volume on various streets (increases and decreases) which may not have been undertaken had the CNC not been constructed, or at least not within the set timespan outlined in the NoR. Over time it will become increasingly difficult to separate the impact of these downstream treatments and the CNC itself in terms of their consequence to the network's performance. Section 8.1 discusses the monitoring method that we suggest being used to monitor traffic volume increases.

It is also proposed to monitor the vehicle emission, noise, and vibration impacts of the additional traffic on arterials and collector routes. This monitoring is in response to concerns raised by the community.

4.2 Methodology

The NoR set out the framework for the appointment and methodology of the Plan. Prior to the operating of the CNC, Christchurch City Council were to appoint a suitably qualified independent traffic engineering expert to investigate and design an appropriate methodology. To avoid doubt the NoR stated what was expected to be included in the methodology. The following headings outline the methodology we have adopted to respond to the various elements expected by the NoR.

4.2.1 Identify Affected Streets, specifically those by CNC

Streets affected by the CNC were primarily identified using the CAST Saturn Model. The model outputs highlighted midblock locations that exceeded the 30% growth requirement of the NoR in the AM Peak, PM Peak, and all-day. A model was used as the network size is too great to attempt to conceptualise the impact only through the experience of individuals. Notwithstanding, models are limited in their ability to reflect dynamic human choices, due to the many variables, and varying importance of variables, that can influence trip distribution. Therefore, the streets identified in the model were subjected to community consultation, expert knowledge of the network (and network management in general), and with other experts during the workshop.

The monitoring of streets between 2020 and 2031 will identify the actual streets impacted by the CNC by more than 30%, which may or may not align with that shown in the modelling. The local streets affected by the CNC (from modelling and local knowledge) if no arterial upgrades occur are shown in Section 5.4. The local streets expected to be impacted under the two arterial upgrade options are shown in Section 7.2.4.

4.2.2 Assess Current Vehicle Usage and Service

Various sources were available to assess the baseline traffic volumes for the Plan. The primary source is the CAST transport model (flow estimates are included in Appendix D1) and a small number of manual counts (Appendix C). Before the CNC is opened, traffic counts will be collected at over 50 locations in the road network to establish baseline traffic volumes which will be used as part of the ongoing monitoring of each

street in relation to the impact of the CNC. Monitoring screens have been developed and are presented in Appendix E. We are recommending ongoing annual or biannual monitoring of the streets that are expected to carry most of the additional traffic, while other streets only need to be monitored if adverse effects are reported (e.g. increase in rat-running or speeding). These counts will include the proportion of heavy vehicles. Separate baseline intersection counts will also collect pedestrian and bicycle traffic volumes.

4.2.3 Consideration of the Effects of Increased Traffic Flows

The effects on all transport modes as a result of the increased CNC traffic flows have been assessed based on community issues raised during consultation, expert knowledge of the network, and advice from transport engineers and an urban designer during three issue and option development workshops. These methods are limited insofar that they require a reliance on the predicted affected streets from the CAST model. The monitoring programme is therefore required to help ascertain and confirm exactly where and to what level the transport effects actually manifest. This may identify that streets not shown in the transport modelling are impacted.

4.2.4 Recommendation of Appropriate Mitigation Measures

At this stage a workshop process was undertaken with other experts. The feedback from the community consultation was used extensively during this phase to help identify potential problems on the network and also as a gauge on community response to options. This information was then used to identify a range of options that best addressed the issues. A multi-criteria analysis framework was developed and agreed upon, and the options were rated against different pre-agreed outcome measurements. The results were triangulated against local expert knowledge.

Once the type and scope of the arterial upgrades were settled upon a second iteration of mitigation measures took place which concentrated on measures that could mitigate the effects on access to schools, parks, commercial centres, and cycling in light of the arterial upgrades.

This process identified issues and options that need to be addressed before the CNC opens and depending on monitoring outcomes following the CNC opening, up to 2031.

4.2.5 Recommendation of Further Remedial Steps

While the Plan outlines the issues and upgrade options that may need to be actioned in the few years following the opening of the CNC and through to 2031, what needs to be done will depend on the outcome of transport monitoring. It is possible that new issues arise as a result of the CNC that are not reflected in the transport modelling undertaken or in the crash history. The routes expected to be affected may not be affected as predicted and thus not need to be upgraded. Through the ten years following the CNC opening, Christchurch City Council will need to regularly monitor traffic flows, crash records, and environmental impacts (emissions, noise, and vibration) and intervene to address such issues, to mitigate the ongoing effects of the CNC.

4.3 Balanced Transport Planning Approach

Wherever possible, we have taken a balanced transport planning approach to the development of the Plan that looks to mitigate the impact of the additional traffic on arterial roads and local streets and other transport modes with minimal impact on private property.

As cities grow they are faced with growth in land transport trips. It is not suitable to accommodate all such trips in single occupancy vehicles. NZ Transport Agency and Christchurch City Council have actively looked to provide transport options for these trips in Northern Christchurch[17]. This includes the provision and promotion of bus, cycle, and car-pooling initiatives, along with infrastructure upgrades to ease congestion and reduce the proportion of people in single occupancy vehicles. We are supportive of more investment and promotion in this area, but are conscious that such initiatives, particularly in the short term, will have limited impact on the number of vehicles that will enter Cranford Street when the CNC opens.

To achieve a balanced transport planning outcome, which encourages use of other transport options, we have not considered options that provide an expressway (e.g. permanent four-lane route) through St Albans to the City Centre via widening the road reserve of current arterials or on a new arterial alignment. Only a small number of people who participated in the consultation favoured such an approach. The support for a balanced approach to transport planning and the promotion of alternative transport modes

[17] https://www.nzta.govt.nz/projects/christchurch-motorways/northern-corridor-congestion/

and car-pooling was promoted by many stakeholders and the general public in the consultation. This is consistent with the findings of a number of consultation processes managed by Christchurch City Council citywide (e.g. Share an Idea campaign) in northern Christchurch. Hence, in our view highly car-centric options south of the CNC would not be acceptable to the majority of the local community and therefore are not being promoted.

However, the CNC is currently being constructed, and it is clear from the transport modelling that this will significantly increase vehicle flows on Cranford Street (south of Innes) in 2020 and through to 2031. While one option is to do nothing and allow congestion to occur, there are consequences of severe congestion that are undesirable to the community in terms of pollution and road safety. Hence to address severe congestion and discourage use of local streets by commuter traffic, a measured plan of arterial upgrades and traffic calming of local and collector roads is proposed. Wherever possible the upgrades are being achieved within the current road reserve. Given this constraint, there will still be congestion on the arterial/collector roads, especially at the Berwick Street /Cranford Street and Westminster Street /Cranford Street intersections as traffic volumes grow towards 2031.

The Plan also includes a number of transport improvements that are expected to encourage more walking and cycling in the community. Where possible this includes mitigating the adverse impacts of the additional CNC traffic. While this is not possible on all routes, this is to a degree offset with other transport improvements in the local road network e.g. improved bicycle routes running parallel with and crossing Cranford Street.

The Plan gives limited attention to travel demand management measures to move people out of cars, other than improving transport facilities to support use of other transport modes (e.g. walking and cycling). Travel demand management is typically an intervention considered strategically for a wide area; such as the Greater Christchurch urban area or the northern part of Christchurch and Waimakariri District. Any demand management interventions specific to this project would shift or create issues across the network if not coordinated with other projects. Therefore, the Plan does not closely look at hard[18] mode shift interventions or other wider demand management strategies for treating rises in traffic volumes. We do strongly support Christchurch City Council's investigations and plans to introduce more travel demand management measures in Northern Christchurch that focus on reducing congestion and travel in single occupancy vehicles on the Northern Corridor[19]. Such measures include improvements to bus services, possible HOV lanes on Cranford and Sherborne Streets, schemes that promote carpooling, and implementing park and ride (and park and bike) facilities.

Another key aspect of the project scope is that only problems that arise directly and significantly as a result of the CNC are being addressed as part of this project. All other network issues are to be addressed via other funding arms of the relevant transport authority. The NoR outlined that a 30% increase of vehicle movements on top of those expected to have occurred if the CNC had not been constructed are to be addressed in the Plan. Hence transport impacts created by general traffic growth in Northern Christchurch, and not by the CNC, will not necessarily be addressed by the Plan.

[18] Measures such as price tolling, or land zoning changes.

[19] https://www.nzta.govt.nz/projects/christchurch-motorways/northern-corridor-congestion/

5. Transport Modelling

Transport modelling forms an important part of the analysis that informs problem identification and option analysis. Modelling has been used as the effects of the project are yet to be experienced, and in many instances will be significant enough to warrant treatment prior to the opening of the CNC. For example, this is likely to be the case on arterial routes and at busy intersections where a sudden influx of traffic will make upgrades after the CNC more disruptive.

The important outputs required from the modelling were to estimate which local roads were likely to experience a 30% increase of traffic volume (either during the morning or evening peak, or daily) on top of what would have been expected at the same point of time in a scenario where the CNC was not constructed.

Therefore, the transport modellers were requested to model[20]:

a) The downstream network in 2021 and 2031 without the CNC

b) The downstream network in 2021 and 2031 with the CNC

c) The downstream network in 2021 and 2031 with the CNC and various downstream treatment packages (as outlined below)

These were to be modelled during the weekday AM Peak and PM Peak, and all (week) day.

No modelling of weekend traffic flows was undertaken as there is no current CAST weekend model. Weekend traffic volumes peaks can be relatively high but are not tidal like weekday peaks, so do not generally cause the same level of congestion. It will be important to monitor traffic volumes after CNC opens in the weekends to identify any capacity issues during the weekends.

The 2021 model represents the open year of the CNC (currently expected to open in September 2020). The 2031 model represents the design year. The expected effects beyond 2031 have not been assessed in this report as per the requirements of the NoR.

Modelling was undertaken for this study by Jacobs (a modelling consultant). This modelling included the roading changes associated with the Papanui Parallel cycleway that makes Rutland Street and Trafalgar Street less attractive for through traffic. The model also assumed the latest version on the CNC design, including a third motorway lane southbound on the Waimakariri River and southbound HOV lanes south of this extending to north of the QEII Drive interchange. The most recent land-use forecasts (at the time the modelling commenced) for Northern Christchurch and the Waimakariri District were used in the modelling. A summary of the modelling undertaken by Jacobs has been prepared for Christchurch City Council.

5.1 Limitations of Modelling

Modelling a network requires a series of assumptions to estimate trip patterns. These include assumptions relating to land use, population, and the propensity of people to choose particular modes given the attraction of trip generators. All of these (and others not mentioned here) have varying degrees of certainty. The assumptions can become erroneous following events such as policy changes, land developments, and economic changes. They can also be erroneous in how they predict the movements of vehicles which are controlled by individual humans who can (and do) employ dynamic decision making, rather than decisions made with rigid logic.

Models, like CAST, do not highlight the effects of intersection delay well. In this instance, given the amount and complexity of the network with many intersections (varying significantly in delay), intersection delay will be a factor in where drivers decide to make their trips in reality.

Christchurch has a grid like network (owing to primarily to its topography), where drivers have many route choices. In such circumstance larger models (as is the case here) may struggle to replicate actual behaviour due to 'all or nothing assignment' by the modelling algorithms. These issues become more pronounced when assessing the effects on local streets. It is fair (at least relatively) to assume drivers will use direct arterial routes if the level of service is acceptable to the driver. When the arterial becomes less desirable, exactly which local streets, and to what magnitude, will be affected is more difficult to estimate using transport modelling.

[20] More details available in Appendix D

Underlying assumptions, such as traffic growth, will also likely change in response to changes in land-use and different levels of land-use growth. Indeed land-use projections regularly change in response to market forces and planning rules.

As such, as discussed in Sections 4.1.2.1, and 4.1.2.2, the model will be more accurate in 2021 than in 2031, therefore monitoring to track growth following 2021 is critical to validating the model findings.

Nonetheless, even with the limitations, modelling is the best tool we have to estimate what may occur in the future.

5.2 Expected Transport Impacts Caused by CNC Traffic

In order to understand impacts caused by the CNC, it is important to first understand what level of growth on roads in Northern Christchurch would have occurred if the CNC had not been built. The pattern of travel would be impacted by the ability of the transport network to accommodate additional traffic. The modelling then considers how the CNC will concentrate traffic where it links to the arterial network at QEII Drive and Cranford Street. The pattern of travel is then influenced by the future road networks ability to accommodate this traffic. Upgrades to roads will influence which roads the traffic will use. This includes both capacity upgrades on arterials/collectors and at intersections and discouraging traffic through using traffic calming. Even small changes will impact on the routes drivers take to travel through Northern Christchurch.

5.2.1 Expected Traffic Growth Without CNC

Initial modelling has been undertaken (using CAST (Saturn) model) to identify the level and location of expected network traffic growth and traffic congestion if CNC had not been built, refer to Figure 5-1. Note that 'V/C' stands for volume over road capacity.

Areas of the network in excess of 80% experience congestion, as traffic volumes approach capacity (V/C = 1) and unstable flow conditions occur. This results in slower moving vehicles and smaller, and less frequent, gaps for vehicles to enter traffic flow from side streets. This in turn results in queuing on side streets, and risk taking when selecting gaps to enter.

Marshland Road and Main North Road are two important arterial routes in Northern Christchurch, and without the CNC additional congestion would have occurred on these routes by 2021 and be worse in 2031 due to growth in traffic flows from Northern Christchurch suburbs and Waimakariri District (dark red and red sections). But, as the maps shows, there are other congestion areas further south on Cranford Street and Hills Road. Barbadoes Street, especially closer to the intersection with Bealey Avenue, is also affected. All of these areas have been circled on the maps.

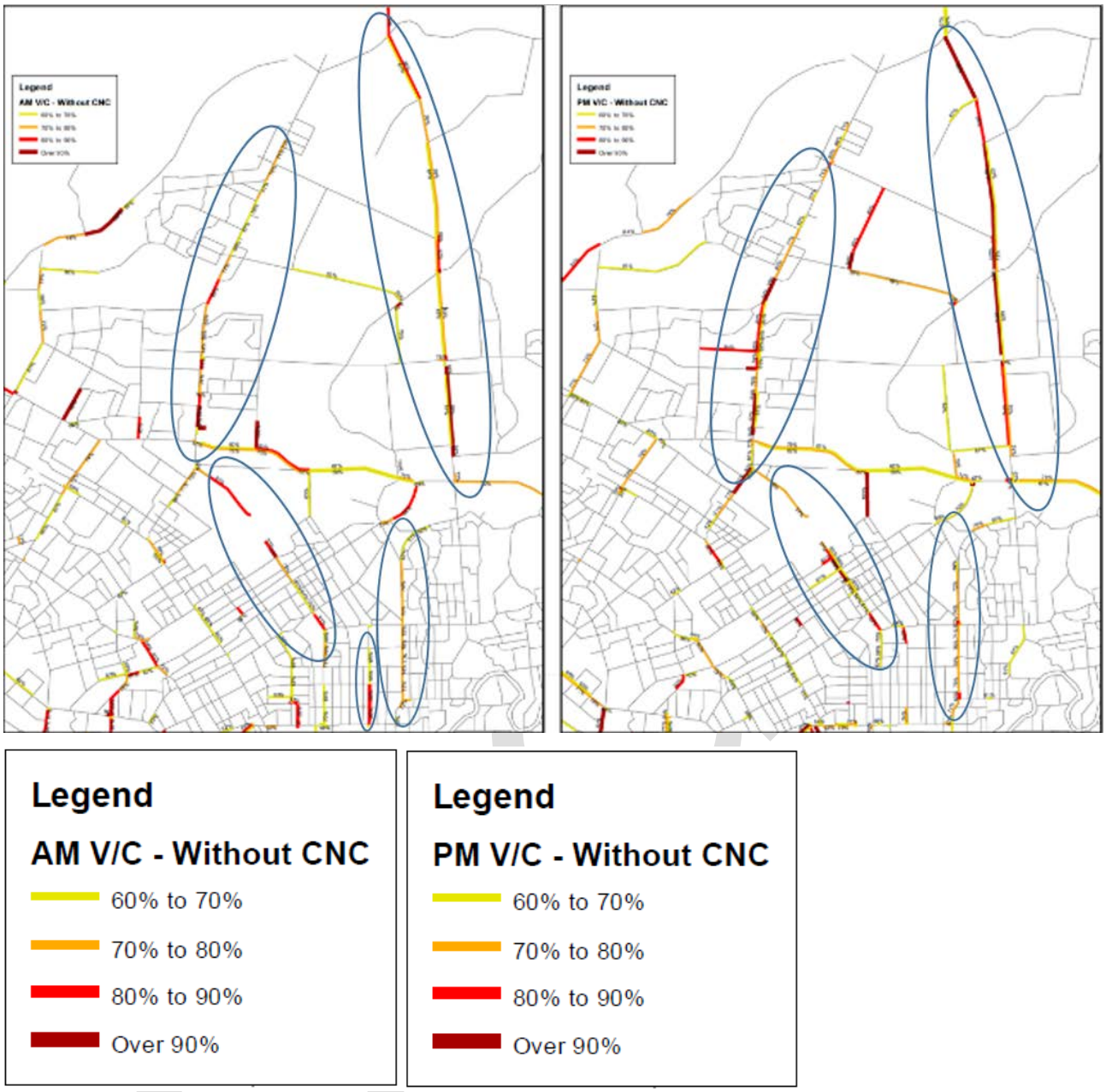

Figure 5-1: Expected Underlying Growth 2031 (Without CNC) (Left AM, right PM)

5.2.2 Additional Traffic Growth Across Local Network as a Result Of CNC

Modelling has been undertaken to assess the growth of traffic in the network overall and around the southern end of the CNC following the completion of the CNC (less the underlying expected growth if CNC had not been built). Streets (arterials, collectors, and local streets) that are likely to have an increase of 30% more traffic in peak periods by 2031 compared to 2021 without the CNC have been highlighted in the following figures. Figure 5.2 shows the larger picture and how traffic will divert from Marshland Road, Main North Road and Johns Road (blue lines) to the CNC and downstream routes (red lines).

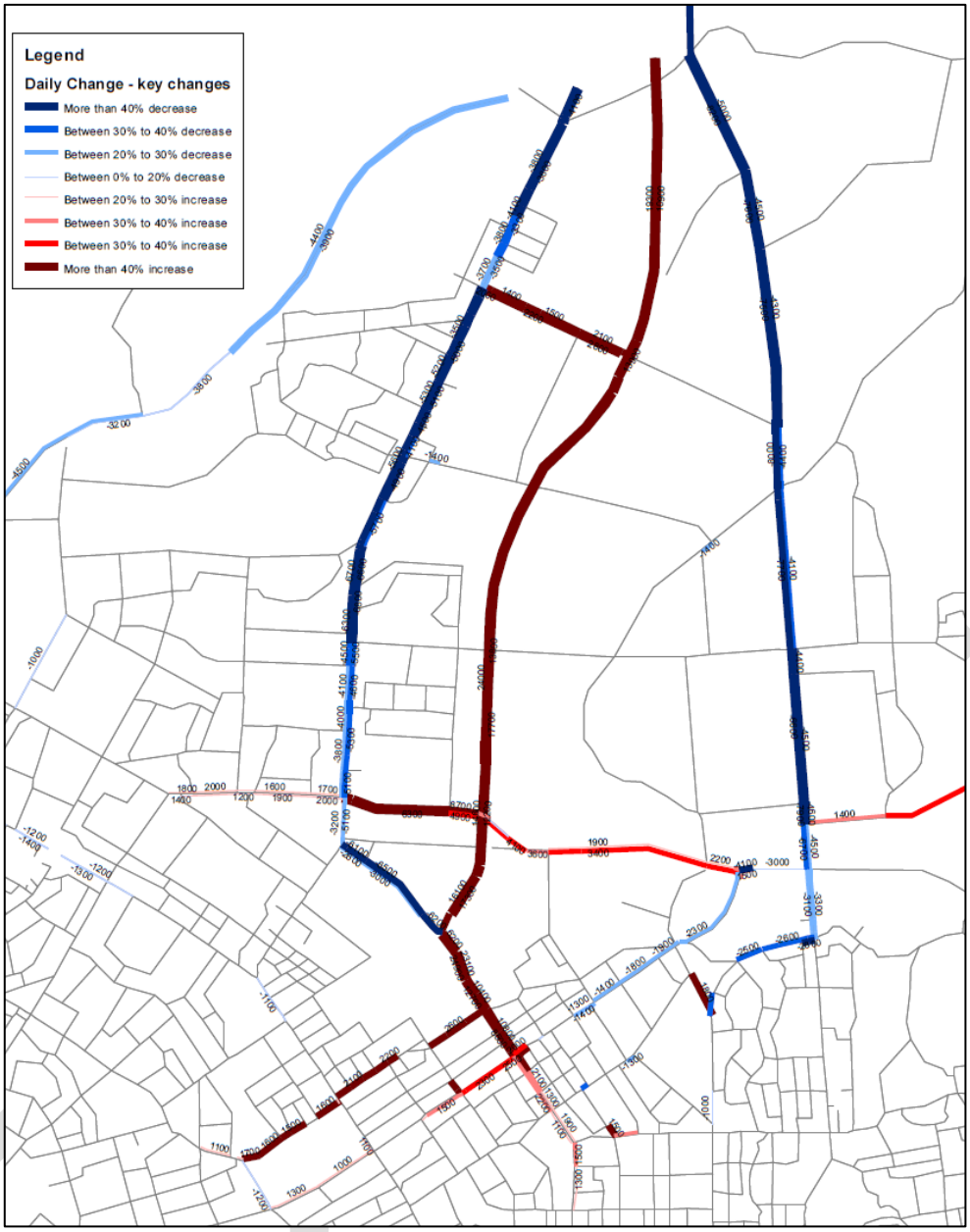

Figure 5-2: Major changes in traffic volumes as a result of CNC (compared with no CNC) in 2031

At a more localised level the impact of CNC on traffic volumes in the AM Peak, PM Peak, and all day in 2021 and 2031 are shown in Figure 5-3 to 5-8. Those streets which are expected to have a greater than 30% increase in traffic are shown in black (arterials) and orange (local roads).

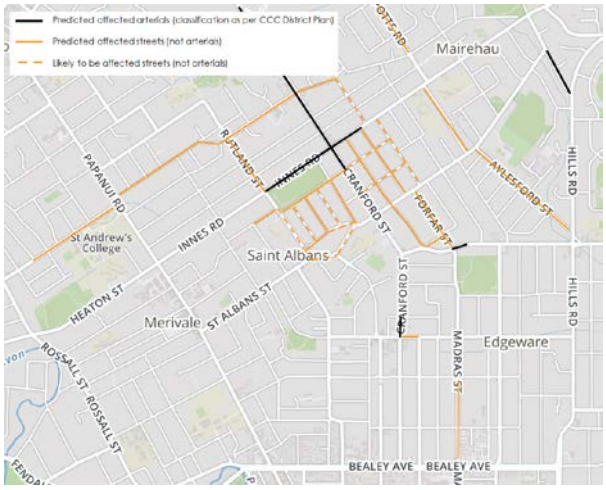

Figure 5-3: Streets expected to be affected by more than 30% in AM Peak, 2021

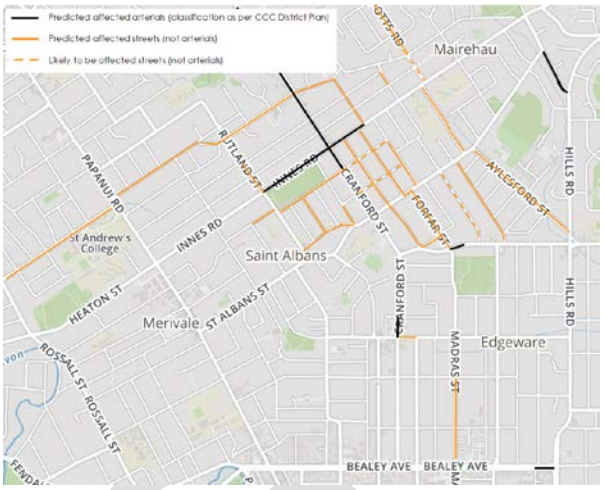

Figure 5-4: Streets expected to be affected by more than 30% in AM Peak, 2031

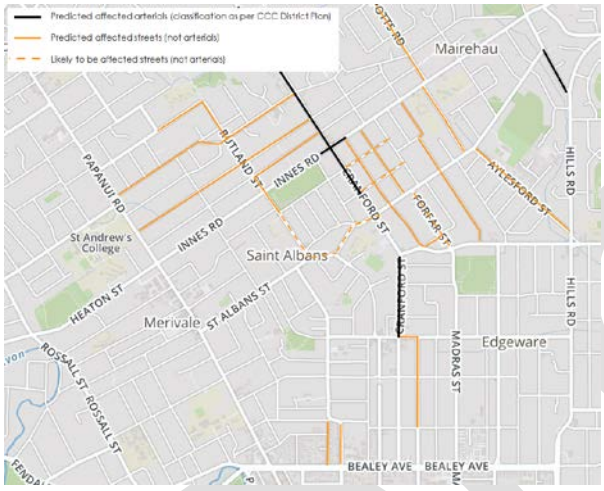

Figure 5-5: Streets expected to be affected by more than 30% in PM Peak, 2021

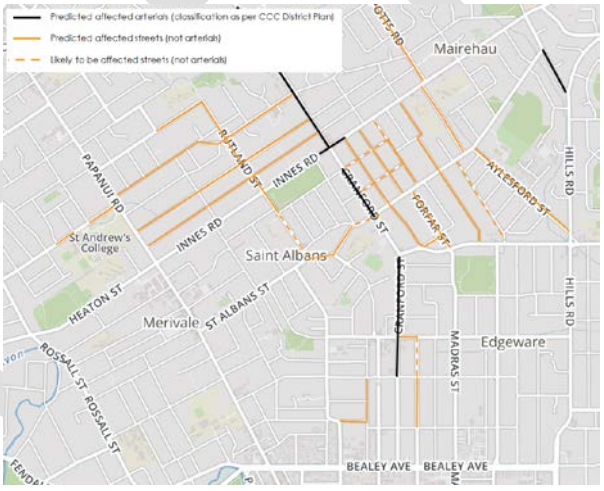

Figure 5-6: Streets expected to be affected by more than 30% in PM Peak, 2031

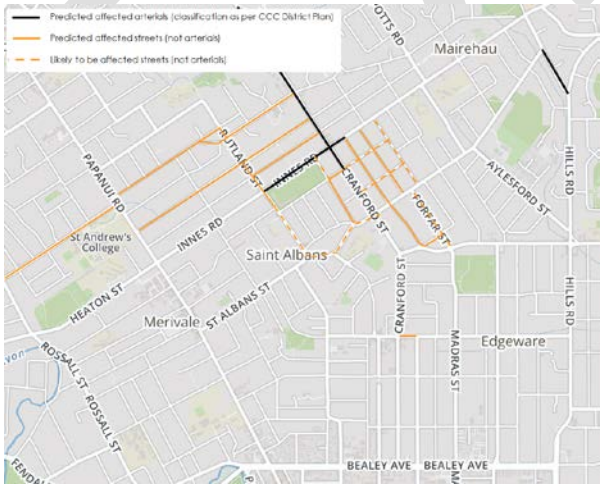

Figure 5-7: Streets expected to be affected by more than 30% all day, 2021

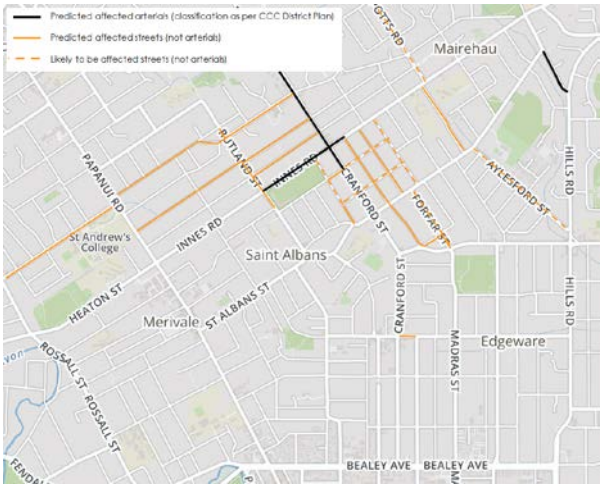

Figure 5-8: Streets expected to be affected by more than 30% all day, 2031

These figures show a significant number of local streets are expected to have at least a 30% increase in traffic volumes due to rat-running traffic. The effect is more pronounced in 2031, although the majority of streets are also impacted in 2020/21. If no arterial/collector upgrades progress, then a lot of streets need to be traffic clamed before the CNC opens. However, with the level of congestion expected on Cranford Street it will be challenging to design and construct traffic calming that deters rat-runners.

5.3 Modelling of Improvement Options

The initial modelling excluded any change to downstream routes and intersections. This was done subsequent to options being developed and is presented in the following sections, and Appendix D.

5.4 Impacts of Additional Traffic

The main impacts of the additional traffic are road safety, access to shops, parks, school and housing, air pollution, pavement deterioration, and amenity (urban design).

There is a known relationship between traffic volume and crash risk. This means streets with an increase in traffic volume (particularly if not treated) tend to experience more crashes if not treated. Deterring vehicles, especially heavy vehicles away from local streets (for example by traffic calming) and onto better designed arterial routes will reduce the safety impact of the CNC traffic. Lower operating speeds (<40km/h, or even 30km/h) on local roads will also reduce both the number and severity of crashes. On arterial and some collector (distributer) streets where traffic volumes will increase significantly, a combination of route upgrades and temporary speed limit reductions (for example school zones) can be used to address crash risk. As traffic volumes increase, the headway between vehicles decreases and consequently the ability for drivers to enter and exit the traffic flow (via accesses, or intersections) reduces.

Road pavement tends to wear out faster with higher traffic volumes; however, this is more dependent on the relative volume of heavy vehicles, rather than necessarily the total traffic volume.

The Plan looks to address as many of these impacts of the CNC traffic as possible, acknowledging that some issues cannot be easily addressed. The intention of the Plan being to minimise rather than fully eliminate the effects of the additional traffic volumes as a result of the CNC.

6. Community and Stakeholder Concerns

6.1 Purpose and Outcomes of Early Community Engagement

Consultation with the public and key stakeholders has and will continue to be an important part of the development and advancement of the Plan. The St Albans community, in particular, have been very active in expressing their views on the various northern arterial scenarios that have been presented by Christchurch City Council and the Crown over the last 50 plus years, including the Christchurch Northern Corridor (CNC). The major concern expressed during consultation on the CNC, is how the additional traffic from the arterial will impact on the St Albans and surrounding communities, and how this can be mitigated. Concerns that were expressed at the CNC NoR hearing led to the requirement to produce a DEMP (the Plan).

In order to involve the public and key stakeholder in the process as required by the NoR and Christchurch City Council's own internal processes, a consultation strategy was developed by Christchurch City Council. The first step of the strategy focused on capturing all the issues and concerns of the general public, key stakeholders, and politicians (community board and Christchurch City Council). In order to achieve an independent perspective (from Christchurch City Council) on the issues and concerns, the independent expert participated in the majority of the consultation meetings.

Subsequent phases will involve consultation on the Plan and each of the improvement projects within the Plan. The NoR has some specific requirements around consultation which are stated below. Most of these matters apply to consultation on the options that are developed in the Plan.

> 4.5. Where traffic calming work is recommended, Christchurch City Council will consult with:
>
> 4.5.1. Residents of the streets where traffic calming measures are proposed to be taken;
>
> 4.5.2. Canterbury District Health Board;
>
> 4.5.3. Mairehau Primary School, Our Lady of Fatima School[21], Paparoa Street Primary School, St Albans Catholic Primary School, and St Albans School;
>
> 4.5.4. St Albans Residents Association and Mairehau Community Trust; and
>
> 4.5.5. Cyclists through Spokes;
>
> 4.6. Consultation shall include the distribution of a newsletter including feedback form prior to the review.

Section 5 of the NoR also provided guidance on the process for consultation prior to implementation of the Plan.

> 5.2 Owners and occupiers of properties on streets identified by the independent traffic expert as requiring mitigation measures shall be:
>
> 5.2.1 Advised of the recommendations of the independent traffic expert under clause 3, including proposed mitigation measures, within 30 working days following the provision of the recommendation to Christchurch City Council;
>
> 5.2.2 Provided a period of 20 working days to comment on the proposed mitigation measures; and
>
> 5.2.3 Advised by Christchurch City Council of the final mitigation measures to be implemented, at least 20 workings days prior to commencement of any works.

The initial phase of stakeholder and public consultation was focused on identifying all the existing and potential future transport issues associated with the CNC traffic on the downstream transport network. To

[21] Now known as St Francis of Assisi School

help the public in assessing the potential effects of the CNC, transport modelling outputs of the likely impacts of the CNC were provided. More specifically, this identified the streets that are expected to have more than 30% additional (rat-running) traffic in 2031. In order for the public to consider how changes to the arterial and collector roads may reduce the amount of traffic using local streets, the benefits of a potential arterial upgrade options were provided. This preliminary option included clearways on Cranford Street, upgrades to three intersections on Berwick and Warrington Street and three-laning of Madras/Forfar and Barbadoes Streets from Bealey Avenue to Warrington Street in the higher flow direction.

The initial consultation process consisted of the following steps:

1. One-on-one meetings with 20 key stakeholders, which included the parties specified in the NoR (e.g. the local schools) and other stakeholders such as shop owners expected to be impacted.
2. Four public open days attended by 123 members of the community at which plans were presented of the impacted area and a potential arterial upgrade option.
3. Distribution of a newsletter to approximately 12,000 households and businesses in the affected road network (Appendix F). This included a submission form. Over 400 submissions were received from the community.
4. Several meetings with the Papanui-Innes community board and Infrastructure, Transport and Environment (ITE) Council committee to discuss the process being used in consultation and the issues identified in the transport modelling.
5. A half day consultation hearing of submissions from stakeholder and the public that was chaired by the community board.

The feedback from the public and stakeholders was compiled into common themes for consideration at future stages of the project. The key topics raised from consultation are as follows[22] (Christchurch City Council have prepared a report that provides more detail on each submission);

Clearway comments (mostly Cranford Street, but also in general)

• Take the clearway through to Bealey Avenue	• Ongoing monitoring/policing	• Loss of parking
• Pedestrian safety – upgrades required and design concerns	• Improved facilities for public transport / park and ride	• Provision of safe cycling facilities
• Access to English Park	• Impact on Cranford Street properties	• Impact on businesses
• Impact on side streets	• Impact on driveway safety	• Consider HOV lanes

Intersection changes comments

• Parking concerns	• Impact on businesses	• Leave as is and monitor traffic impact first
• Forfar Street roundabout doesn't need to change, and safety concerns	• Impact on St Albans Park	• Pedestrian safety – both concern for increasing pedestrian risk and also support for changes
• Cycling safety – both concern for increasing cyclist risk and also support for changes	• Barbadoes / Warrington needs lights	• Berwick Street – pinchpoint and congestion

[22] The Council summary of submissions can be found here: https://www.ccc.govt.nz/assets/Documents/Consultation/2018/July/Cranford-Street-Feedback-Summary.pdf

• Traffic light phasing	• Two new sets of lights could cause short cutting through side streets	• Flockton Street issue – will vehicle and bus manoeuvres be possible due to proximity to traffic signals

Three laning – Madras Street and Barbadoes Street

• Prefer clearway	• Loss of parking undesirable	• Bus blocking inside lane during clearway operation
• Leave as is and monitor	• Pedestrian safety	• Impact on businesses
• Improve public transport options	• Cyclist safety	• Impact on St Albans Park users
• Impact on residents	• Increase in truck movements undesirable – vibration and noise	• Continuation of the one-way system all the way through

Cranford / Westminster, Cranford / Berwick, Madras / Edgeware, and Barbadoes / Edgeware

• Safety – driver behaviour and vehicle speed concerns, pedestrian safety (especially children), and also desire to leave as is.	• Turning arrows or separate turning lanes	• Lower the speed
• Leave intersection(s) as is	• Have red light camera at intersection	• Pedestrian and cycle focus
• Parking – provision for shops/businesses and increase P15 to P30.	• Impact on businesses and residents	• Widen road – do not narrow

The feedback from consultation provided good insight into the community's thoughts and concerns on the project. The results were considered during the issue and options workshops which led into option development, and the multi-criteria analysis of different options. Refer to Section 7.2.4 and 7.4 for discussion on how the consultation outputs informed option analysis.

Many of the issues with the options can be mitigated, or possibly resolved, during the later design phases of this project, however others may be more challenging. On-going dialogue and consultation will therefore be crucial to try to achieve the best upgrade options for the community.

As per the requirements of Section 5.2 of the NoR, and Christchurch City Council's own processes, further consultation will occur on the Plan and each of the projects that are recommended in the Plan. This phase of consultation will inherently be more detail specific on the individual treatment selection (say speed platform vs carriageway narrowing); however, it is important that the resultant decisions remain holistic to the network. A treatment decision on one street may result in a significant impact on another; perhaps even acting as a catalyst for another street exceeding the 30% threshold. Consequently, decisions cannot be made in isolation, or without consideration of their wider impact. The monitoring regime will be an important part of monitoring the impacts of various interventions and identifying any knock-on effects of such changes to other parts of the transport network.

6.2 Changes in Transport Modelling

Since the initial transport modelling was undertaken, that informed the consultation material, further modelling has been undertaken of the downstream effects. The latest transport modelling has changed some of the streets that are expected to be impacted by greater than 30% traffic in 2031 and also looked

at the impacts in 2021. One major change to the modelling that impacts on routes impacted downstream is the proposed layout of the Innes Road/Cranford Street intersection, which is being upgraded as part of the CNC project. Other changes that have been made include restricting a number of side-roads on major routes to left-in and left-out (LILO). For example, Malvern Street and Dee street intersections on Cranford Street. These network changes have impacted on traffic flows on Mersey Street (which now carries more traffic) and Malvern Street (which carries less traffic).

6.3 Changes to the Plan following second round of Engagement

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7. Issues and Option Development

This section of the report outlines the expected transport issues that will result from the CNC, along with associated improvement options (as identified during the stakeholder and public consultation), transport modelling, and review of the network by the independent expert. The Plan presents various options that have been developed to avoid, remedy or mitigate the expected transport issues and fulfil the objectives stated in the NoR conditions. In many cases it also recommends further studies to look at option development. As with any area-wide transport plan, it is also important that the options are as consistent as possible with the objectives of local, regional, and national strategies. As outlined in the CTSP and the national Government Policy Statement (GPS) on transport, road safety, and access for all road users is a high priority.

Section 7.1 outlines the issue and option development process that has been adopted for the Plan. Given the focus on keeping upgrades within the existing road reserve wherever possible (e.g. not looking at any new arterials or major arterial upgrades), there are a limited number of options available for increasing road capacity and mitigating the impact of the additional traffic on various road users (e.g. cyclists and pedestrians) and the local community.

7.1 Issues and Option Development Process

The first step in developing options was to clearly set out all of the issues that may be experienced on the network following the opening of the CNC. These included existing issues that may be exacerbated, and new issues. Compiling the issues was done by using the data available on the network (such as crash data), outputs from the model (such as where congestion might occur), feedback from the public, and expert knowledge of the network. A knowledge of the issues (or at least likely issues) was important so that the subsequent options considered would be focused on addressing these issues.

The option development has been separated into two development stages. Stage One involved developing options to encourage the additional traffic that will come down the CNC, when it opens and through to 2031, to stay primarily on the arterials and collector routes and off the local streets. This can be achieved by using a combined 'carrot' and 'stick' approach. The carrot being to upgrade some of the arterial and main collector routes. The stick being to traffic calm a number of local streets to push traffic back onto the arterial and collector routes. In addition to the traffic calming, up to 9 'safe speed community areas (SSCA)' are proposed in the study area to deter rat-running traffic on local streets and to reduce the risk of serious and fatal crashes from any traffic.

We acknowledge that the community wants to also see travel demand management measures that reduce the volume of vehicles coming down the CNC and into the St Albans road network. We have suggested that Christchurch City Council and NZ Transport Agency investigate measures that encourage alternative modes and more car-pooling. While such measures would reduce traffic volumes, the impact on traffic volumes coming off the CNC, at least initially, is likely to be relatively small (effective measures might result in up to 10% reduction in traffic volumes) and so the focus of this study has been dealing with a significant increase in traffic through the network when the CNC opens and out to 2031.

The second development stage focuses on improvements that need to be made on several roads to mitigate the impact of the additional traffic from the CNC on all road users and the community. Of particular importance is a network of roads that supports and promotes use of transport options other than the single occupancy motor vehicle, which retains or improves access to key community facilities (parks, schools, and shops) and, where possible, addresses the safety impacts of the additional traffic. The second stage of option development includes projects in the following four categories:

- Safe Access to Schools
- Safe Cycling Routes
- Access to Parks
- Access to Commercial Centres

Two over-arching principles are promoted in the development of the options; delivering healthier streets and a safer (transport) system. With the growing understanding that streets have a vital role to play in developing vibrant and healthy communities, the Plan includes a requirement to develop street improvements that lead to healthier streets wherever possible. We propose doing baseline (before treatment) and design assessments of each impacted route using the Healthy Streets framework developed by Transport for London (see Guide to the Healthy Streets Indicators). The ten key healthy street indicators are shown in Figure 7-1 below. Preference should be given to options that lead to more healthy

streets or, where this is not possible due to increasing traffic volumes, that minimise the impact on the health of a street.

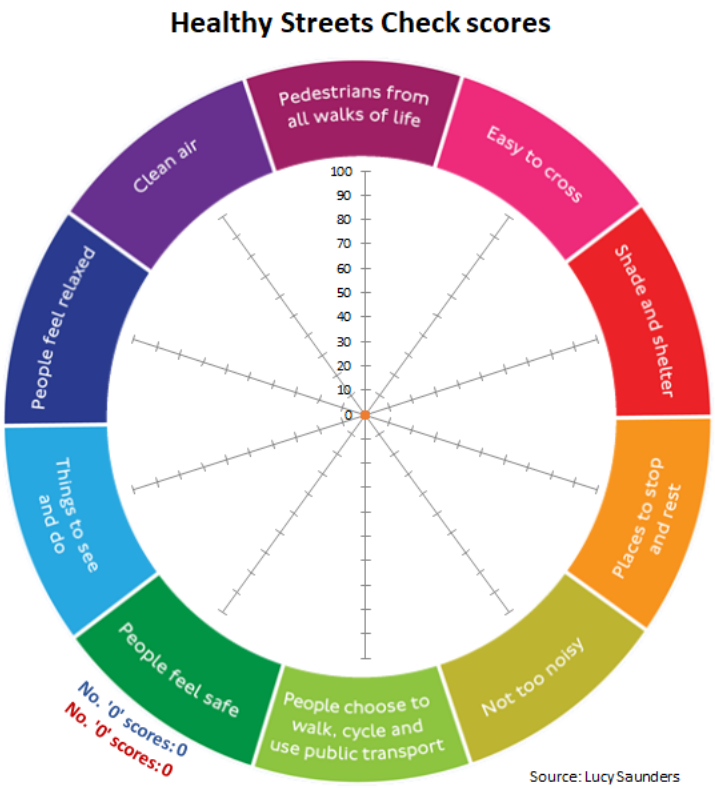


Figure 7-1: Healthy Street Framework

In terms of improving road safety and moving towards a safer transport system the Austroads safe system assessment framework should be used, in addition to safety auditing, to evaluate all infrastructure improvement options. The safe system framework breaks the risk of fatal and serious injury crashes into three components: exposure, likelihood, and severity. The exposure is typically the volume of transport users (pedestrians, cyclists, and motorists) on the street. With the increase in traffic volumes on many routes in the network as a result of the CNC, the crash risk will increase if no improvements are made. To compensate for this increase in crash risk we propose that both the 'likelihood' and 'severity' of crashes must go down. To achieve a reduction in 'likelihood' the facilities for road users, especially pedestrians and cyclists, in urban areas must improve. For example, the introduction of traffic signals, the greater use of pedestrians crossing aids (islands) and shorter crossing distances, and introduction of cycle lanes and paths. Crash severity is influenced by operating speeds which are related to speed limits and road design. Hence improvements that reduce operating speeds and lower speed limits reduces crash severity. In this network this will be achieved on local roads through introduction of the safe speed areas.

The Plan does not include many changes to support public transport, although it does support further investigation of improvement options that benefits public transport (i.e., HOV lanes). While this may be the case, one of the key outcomes of the CNC is to reduce traffic on Main North Road and Papanui Road which is the key public transport corridor for Northern Christchurch. In terms of the study area, the needs of public transport should be considered in the more detailed designs, including location of bus stops, bus shelters, and reducing delays on routes, especially at traffic signals.

The next five sections talk in more detail about the issues and options in the Plan.

7.2 Arterial/Collector Capacity Issues

7.2.1 Context

One of the main issues identified for the arterial and collector roads was that they would be under greater strain (in terms of vehicle flows) than before the CNC during peak periods. When a road becomes severely congested vehicle movements slow and gap selection becomes more difficult and dangerous leading to greater queuing on local streets. It also becomes more dangerous to cross the road; especially before vehicle speeds drop due to congestion. To a degree, arterial/collector congestion is to be expected, especially during peak hours. However, the modelling outputs indicate that congestion will rise (especially during weekday peak hours) to a point where drivers will be more likely to choose to use local roads impacting on safety and amenity in primarily residential areas. Therefore, the issue identified was that the key arterial roads will likely be unable to cater for the increased vehicle demands, resulting in a redistribution of movements to local roads. The key arterial and collector capacity constraints have been identified for the current network in the transport modelling (during weekday peaks periods) and are as follows (noting that an extensive number of plots have been used to identify these issue):

1. The merge south of the Cranford Street / Innes Road intersection when the CNC opens. Two through lanes north and through the intersection become one lane southbound. The modelling in the AM Peak indicates that the V/C (expected volume to road capacity) ratio in 2021 would be 0.97 and in 2031 would be 0.98 (noting that anything over 0.8 is poor and will lead to disruptive traffic flows). Modelling indicates a lot of rat-running, especially onto Mersey Street if this matter is not addressed.
2. The through lane capacity at the Westminster Street /Cranford Street Intersection. The current intersection has a shared through and right lane and through and left lane with a short merge lane, especially northbound (due to parking for the shops). With right turning demand there is effectively only a single through lane at the intersection, which severely constrains the capacity of intersection in both north and southbound directions. Queues already form heading northbound in PM Peak period.
3. Northbound and southbound through lane capacity at the Berwick Street /Cranford Street intersection. Currently only one through lane and a short right turn lane is provided heading north through the intersection. With CNC flows, the northbound through movement has a V/C of 0.85 in 2021. There is currently one through and one short left turn lane heading southbound. With CNC flows and the clearways on Cranford to Berwick the V/C is 0.91 in 2021. Both constraints would cause peak period delays.
4. Right turn capacity turning right from Berwick Street into Cranford Street. The single right turn lane is a major capacity constraint for traffic heading north on Madras Street /Forfar Street wishing to turn into Cranford Street. The impact of this constraint in isolation is difficult to assess given upstream capacity constraints. Option modelling has shown that with a double right turn in 2021, this route will have a V/C 0.74. From this we can imply that a single right turn will have a much poorer V/C.
5. The single-lane Forfar Street /Warrington Street roundabout is also a capacity constraint. In 2021 the North bound Forfar Street approach will be 0.81 in the PM Peak and this deteriorates further in 2031. The impact of this has again been assessed using the option modelling because of upstream capacity constraints. The option modelling includes traffic signals with a double left turn from Forfar Street into Berwick Street. This movement has a V/C is 0.62 in the PM Peak. A single left, as provided with the roundabout, would have a V/C well over 0.8. In the AM Peak the single through lane V/C from Berwick Street into Warrington Street at a signalised intersection would be 0.87. This indicates that two through lanes (or both a through and through and right turn lane) are required which can-not be accommodated at the current roundabout. In addition, roundabouts often experience safety problems when they operate near capacity due to risk taking as drivers pick smaller gaps. We expect crash numbers to increase if roundabout is not upgraded.
6. Capacity constraints at Barbadoes Street /Warrington Street priority T-intersection. Right turn movements out of Barbadoes Street will become increasingly difficult due to increased traffic volumes during peak periods. At the priority intersection the V/C for the right turn out of Barbadoes Street is 0.82 in the evening peak in 2021. We have already observed considerable delays for this movement in the evening peak, in the absence of CNC traffic.
7. Edgeware Road intersections at Cranford Street /Sherborne Street, Madras Street, and Barbadoes Street can only effectively accommodate a single through lane, like Westminster Street /Cranford Street, due to right turners sharing the lane with through vehicles, and short shared left and through lanes.

8. Southbound capacity constraint at Barbadoes Street /Bealey Street intersection. The single lane through movement on the mid-block approach to the intersection (there are two through lanes at the intersection itself) already causes congestion in the AM Peak, which the models predict to increase going forward, especially if more traffic from the CNC is pushed down this route.
9. Northbound capacity constraint at Madras Street /Bealey Street intersection. In the PM Peak the two through lanes have to merge quickly on the exit of the intersection due to a short merge to accommodate kerbside parking. This creates safety issues for motor vehicles and especially cyclists as the motor vehicles are often travelling at higher speeds having come off the one-way system with traffic signal coordination.
10. Southbound capacity constraint at the Sherborne Street /Bealey Avenue intersection. The single lane right-turn at this intersection into Bealey Avenue and single through lane approach up Sherborne Street causes queuing especially in the AM Peak, mainly to right turners but also to left turners stuck in the queue. The modelling of clearways down Sherborne Street indicates V/C of 0.91 in 2021 and 0.95 in 2031 for right turn into Bealey Avenue if this intersection is not upgraded.
11. While the Innes Road /Cranford Street intersection is being upgraded as part of the CNC we are aware that the left turn from the west into Cranford Street has only a short lane and hence drivers travelling north on Rutland Street may choose to travel through on Rutland Street and use Knowles Street, Weston Road, or McFaddens Road to access Cranford Street instead of Innes Road.
12. The installation of traffic signals at St Albans Street /Rutland Street intersection and limited right turn phase time from Rutland Street into Innes Road at the St Albans Street /Rutland Street intersection as part of the cycleway upgrade has reduced the traffic volumes on this route (a good outcome given cycle safety considerations), and also the influenced how drivers heading north access Cranford Street, as in 11.

Arterial upgrades typically involve increasing the capacity of transport corridors to attract trips from local roads to arterials and collectors during peak flow periods. The idea is that if arterials/collector routes have adequate capacity then drivers are less inclined to use local roads which tend to be designed more for accessing adjacent residential land uses rather than for movement of vehicles.

There is a range of ways in which the capacity of a road can be increased, such as physically creating more capacity (more lanes) at intersections and mid-blocks. Time controlled additional capacity is another treatment such as 'clearways' where part of the carriageway can be used as an additional lane during heavier traffic flows but returns to parking at other times of the day, so it can be used for other purposes i.e., parking. Applying right turning bans at intersections can also increase road capacity.

Other treatments are also possible which increase the productivity of a corridor (number of people carried in each lane). Improvements of this kind can be in the form of high occupancy vehicle lanes (HOV) and bus lanes. HOV lanes require vehicles using those lanes to have a minimum number of people (typically two or three per vehicle) which over time allows more people to pass through the existing corridor. Buses can use HOV lanes, as can electric vehicles and bicycles. Bus-only lanes tend to be used on high frequency bus routes. HOV lanes are an option for clearways in the study area while bus-only lanes are not recommended due to the relatively low frequency of buses. A study would be required to confirm that HOV lanes can operate along the proposed clearways

Bealey Avenue, as a key arterial, forms a southern boundary of this project. Bealey Avenue runs approximately west to east and provides connections with the one-way pair box, and four avenues. There are several arterials and collectors located south of the CNC and north of Bealey Avenue that will carry additional traffic from the CNC. The key ones being Cranford Street, Sherborne Street, Berwick/Warrington Street, Barbadoes Street, Madras Street, and the Innes, Rutland/Springfield corridor. The extent to which each street will carry the extra traffic depends on the capacity that is added to these streets at intersections and to midblock. Early on in the study, modelling was undertaken to assess whether improvements to the QEII Drive/Innes roundabout, Innes Road, and Hills Road might move some of the traffic expected down Cranford Street onto Hills Road. The modelling indicated that even with higher cost improvements along this route very few drivers would divert to the Hills Road route.

As with all capacity improvement projects, there is a risk that adding capacity can simply shift the location of congestion; for example, by relieving pressure at one location traffic will flow freely until encountering the next constriction. However, if there is too much congestion on arterial roads then drivers will be more inclined to 'rat-run' using local roads. Hence the Plan, therefore balances these issues by providing some additional arterial capacity, while calming local streets. While capacity is being added to arterial and collector roads there will still be some peak period congestion. The actual traffic effects after CNC is opened will be monitored to see whether more arterial capacity, and/or local road traffic calming is required.

7.2.2 North of Berwick Street Issues and Options

North of Berwick Street there are only two existing arterial and collector route options available to drivers coming down from the CNC. One option is the Rutland Street /Springfield Road corridor. As discussed previously, with the improvement made to the corridor as part of the Papanui Parallel separated cycleway (on Rutland Street), and being less direct, this corridor is less attractive than the main route option of Cranford Street.

The split of extra traffic between the routes is approximately 550vpd (vehicles per day) on Rutland Street and 4,100vpd on Cranford Street south of Innes Road when the CNC opens in 2020 (without any improvements). This increases to around 900vpd on Rutland Street and 5,000vpd on Cranford Street by 2031. While there is an increase in traffic on Rutland Street, it is minimal given the total increase in traffic from CNC and will have minimal adverse effects on the Papanui Parallel cycleway. Further details on traffic volumes on various routes are provided in Appendix D2.

As identified earlier, the main issues on this route are the capacity constraints as traffic heads south in the morning and north in the evening, via one single through lane south of Innes Road. The other constraint is right turning vehicles blocking the through lane at side roads and at the English Park carpark. While this will occur at other accessways along the route, the intersections and the carpark are the major traffic generators of right turning movements. Other issues, such as the safety of school children crossing Cranford Street, are covered in later sections.

While no changes are proposed to Rutland Street, additional capacity is required on Cranford Street from Innes Road to Berwick Street to accommodate the increase in traffic from the CNC. The two main options that can be accommodated in the current road reserve are four-laning and peak period clearways. The latter is preferred because it allows parking on Cranford Street near the Westminster Street /Cranford Street local commercial centre outside peak periods. Changes are also proposed at the Westminster Street /Cranford Street intersection (see Figure 7.2). Right turn bans will apply at this intersection during peak periods, to provide two through lanes. Given the increased traffic volumes through the intersection, to accommodate cyclists (via cycle lane) and to address safety concerns with drivers hitting the signal pole (westbound) along Westminster Street, widening of the western approach is proposed (more on this later). Right turn bans will be installed permanently at the Dee Street and Malvern Street approaches on both sides of Cranford Street using throat islands. We also propose that the English Park carpark access be redesigned and right turns in and out of this carpark be banned.

Figure 7-2: Proposed Arterial Upgrades North of Berwick Street

7.2.3 South of Berwick Street Issues and Options

South of Berwick Street there are three routes that can carry the additional traffic from the CNC through to Bealey Avenue, being Cranford Street /Sherborne Street, Forfar Street /Madras Street, and Barbadoes Street. The extent to which each route carries this additional traffic depends on the capacity improvements undertaken to address the constraints listed above. The key capacity issues are at the nine intersections in the network that are on these routes intersecting with Berwick Street /Warrington Street, Edgeware Road, and Bealey Avenue. The key intersection constraints are along Berwick and Warrington streets. The issues being lack of right turn capacity (from a single right turn lane) from Berwick into Cranford, and the capacity and safety of the Forfar Street/Warrington Street roundabout and Barbadoes Street /Warrington Street priority-controlled intersection with the increase in traffic volumes. The other six intersections capacity issues can be addressed by banning right turn and/or adding approach lane capacity.

In terms of a continuous route connecting Cranford Street (clearway) and Bealey Avenue, there are two main options with several sub-options for one of the options proposed. Both options involve upgrading the Cranford Street /Berwick Street, Forfar Street /Warrington Street, and Barbadoes Street /Warrington Street intersections along with some capacity improvements to Berwick and Warrington Streets to provide approach-lane capacity. Option A involves adding clearways to Cranford and Sherborne Streets and Option B involves upgrading the capacity of Barbadoes and Madras/Forfar Streets (two sub-options being clearways or extending one-ways). In addition, there are a number of intersection upgrades required. More on each of these options and analysis is given later on in this report.

Figure 7-3: Proposed Arterial Upgrade South of Berwick Street

7.2.4 Local Streets Affected by Traffic following Arterials Improvements

Transport modelling was undertaken to assess how effective the arterial upgrades would be in reducing the number of local streets that have a greater than 30% increase in traffic in 2021 and 2031. This analysis effectively repeated that undertaken early on in the study for no network changes (as presented in section 5.4) but this time including the two arterial upgrade options. Both options looked at the clearway from Innes Road to Berwick Street, improvements to the Cranford Street / Westminster Street intersections and upgrades to capacity along Berwick and Warrington Streets. The two options south of Berwick were A (Cranford/Sherborne clearways) and B (Madras Street /Forfar Street and Barbadoes Street clearways) as shown in Figure 7-3.

Figures 7-4 to 7-9 shows the local streets that will trigger the 30% increase in AM Peak, PM Peak and all-day in 2021 and 2031 for Option A. Figures 7-10 to 7-15 show the same plots but for Option B. These figures were produced using the change flow maps from the transport modelling, as presented in Appendix D4. These figures show the streets that are expected to trigger a 30% increase in traffic compared with what might have occurred if the CNC had not been built.

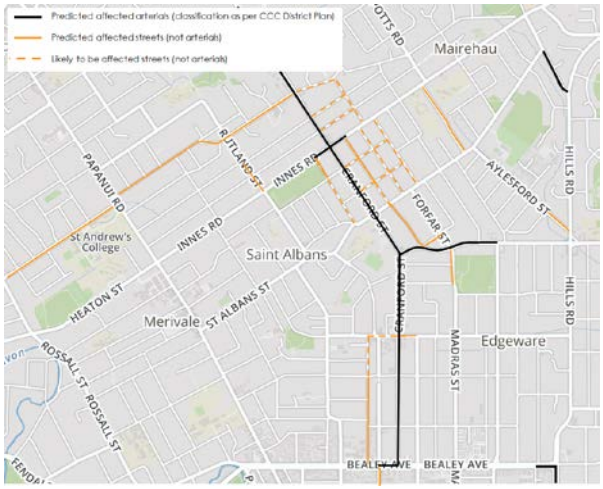


Figure 7-4: Streets expected to be affected by more than 30% in AM Peak, 2021, Option A

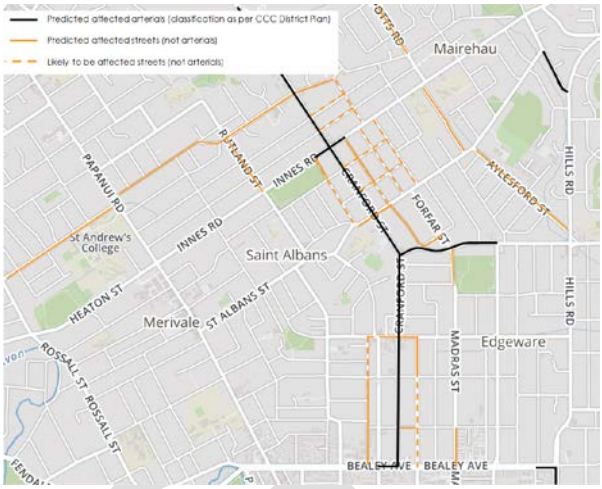


Figure 7-5: Streets expected to be affected by more than 30% in AM Peak, 2031, Option A

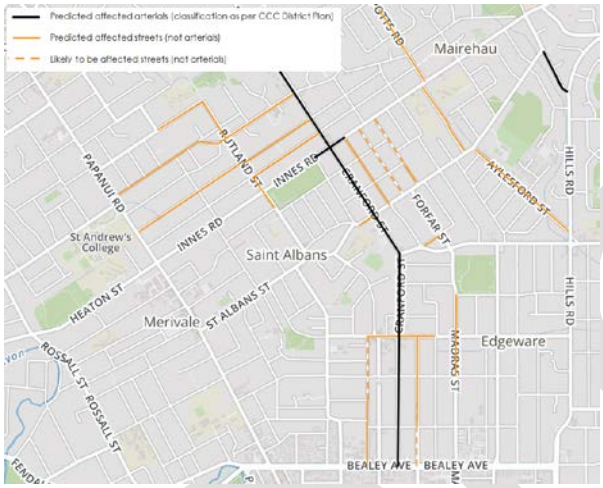


Figure 7-6: Streets expected to be affected by more than 30% in PM Peak, 2021, Option A

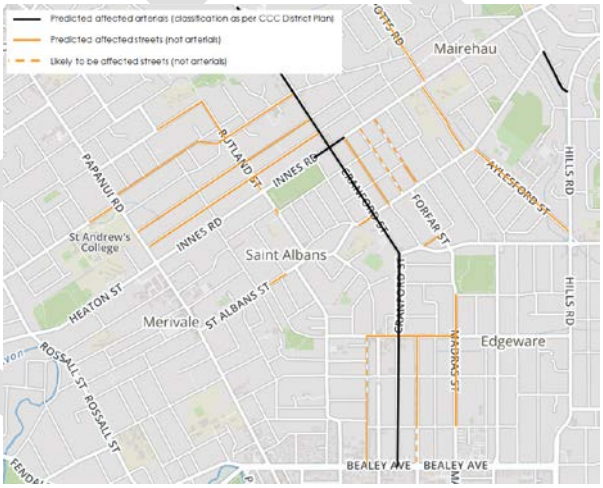


Figure 7-7: Streets expected to be affected by more than 30% in PM Peak, 2031, Option A

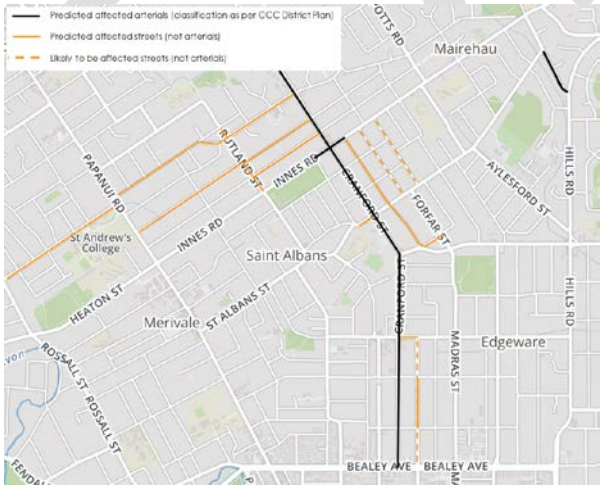


Figure 7-8: Streets expected to be affected by more than 30% all day, 2021, Option A

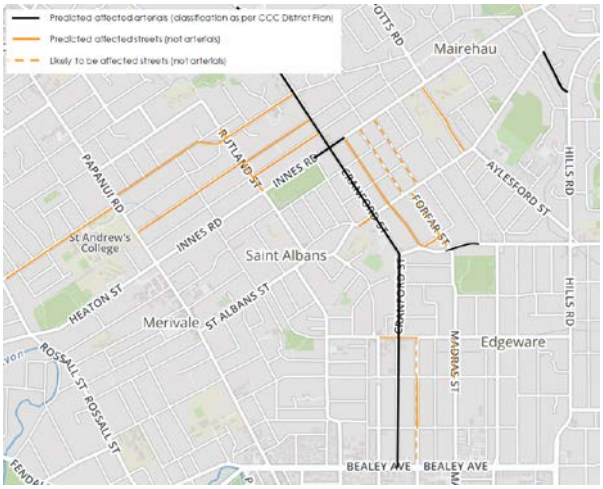


Figure 7-9: Streets expected to be affected by more than 30% all day, 2031, Option A

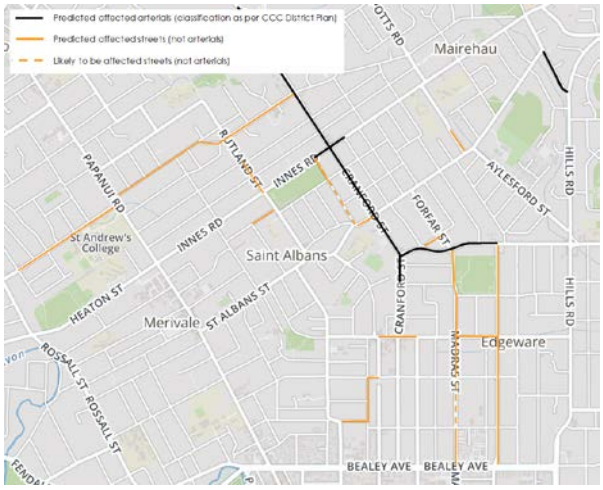


Figure 7-10: Streets expected to be affected by more than 30% in AM Peak, 2021, Option B

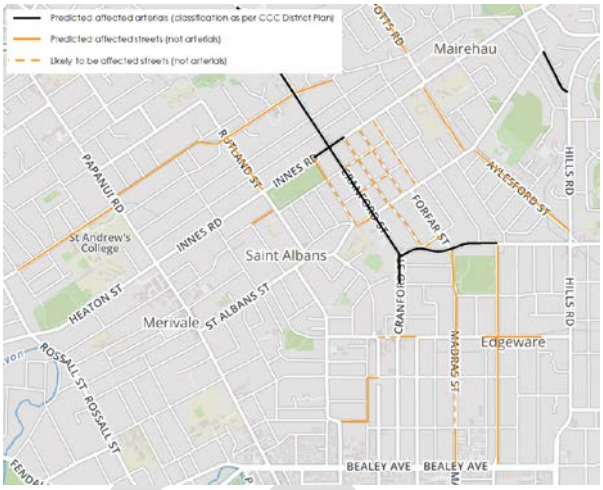


Figure 7-11: Streets expected to be affected by more than 30% in AM Peak, 2031, Option B

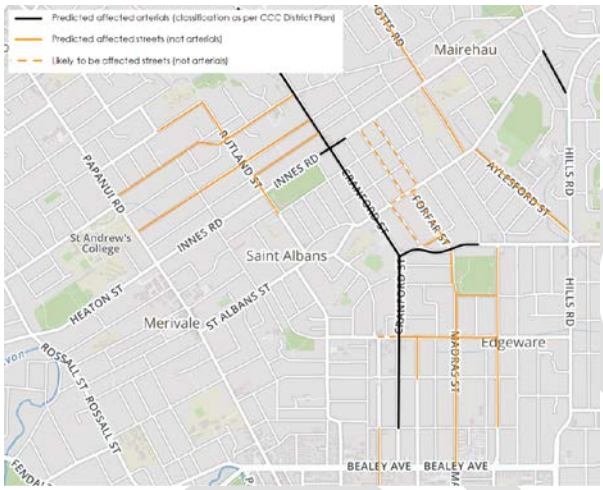


Figure 7-12: Streets expected to be affected by more than 30% in PM Peak, 2021, Option B

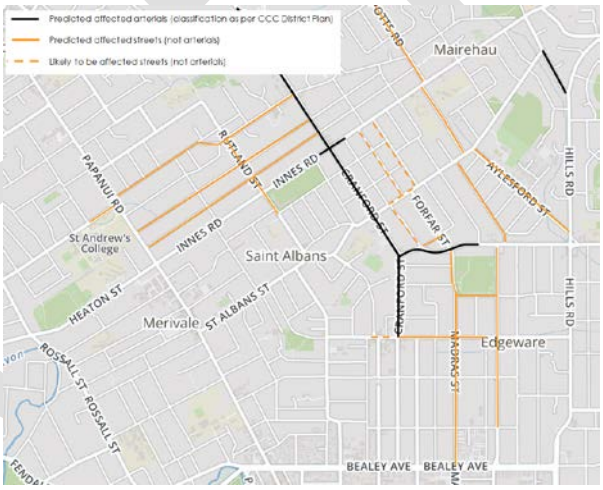


Figure 7-13: Streets expected to be affected by more than 30% in PM Peak, 2031, Option B

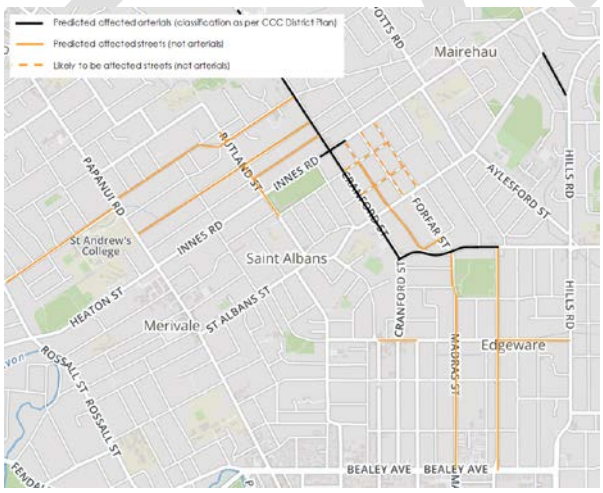


Figure 7-14: Streets expected to be affected by more than 30% all day, 2021, Option B

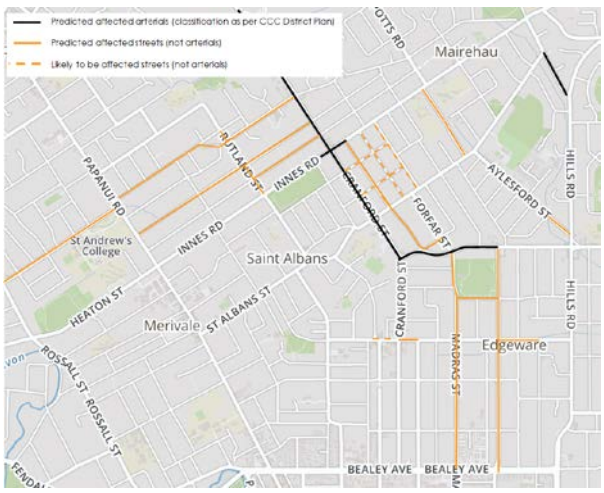


Figure 7-15: Streets expected to be affected by more than 30% all day, 2031, Option B

Care needs to be taken in interpreting these plots as there is considerable uncertainty in how much these streets will be impacted by the CNC traffic, due to the limitation in transport modelling. What it does indicate is streets that need to be treated before the opening of the CNC or shortly after. For the other streets (those not impacted by additional traffic in 2021), the traffic monitoring will identify the actual increase and determine whether traffic calming changes are required to these streets.

The outcome of this analysis informs the streets that are likely to need traffic calming when the CNC is opened or shortly after (e.g. Mersey Street). These are streets that are shown to be impacted in most scenarios, and those that can be monitored and treated at a later date (e.g. – Forfar Street). Figures 7-4 to 7-9 show the additional rat-running streets south of Berwick Street, including Edgeware Road, Manchester Street, and Caledonian Road (the last two are wide local streets) that are impacted by Option A, extending clear-ways down Sherborne Street. A detailed list of streets that need to be (or may need to be) treated are provided in Chapter 8. Details on the types of traffic calming that should be provided, along with supporting speed limit restrictions, are provided in Section 7.5. Specific traffic calming treatments need to be developed and discussed with affected parties and the public for each street.

7.3 Options Considered to Address Issues

During the first stage (iteration) of option development, the study team looked at project options that used a combination of traffic calming of local streets and capacity upgrades of arterial and collector routes to attract the extra vehicles from the CNC to the arterial and collector routes. The intention of each of the options is to encourage the additional CNC traffic to use the preferred arterial and collector roads and reduce rat-running on local roads. The Stage 1 options were compiled following consultation with stakeholders and the public. The consultation feedback was used at this stage to ensure the options considered were fairly representative.

As already discussed, additional options were developed as comments from the public and stakeholders were received. This included greater use of clearways, rather than permanent three-laning, the option of extending the Barbadoes Street /Madras Street one-way system north to Warrington Street, and using clearways down the Cranford Street /Sherborne Street corridor south of Berwick Street. The full list of options was discussed and evaluated during several issue and option workshops and meetings.

The main options considered in Stage 1 are summarised as follows (see Appendix G for option diagrams).

- Do Nothing – this results in rat-running in a lot of local streets.
- Option 1. Traffic Calming Only.
- Option 2. Arterial Upgrades Only. The option used was three-laning of Barbadoes Street and Madras (Forfar) Street, Cranford Street Clearways and Berwick Street / Warrington Street capacity improvements).
- Option 3 (a). Traffic Calming and Arterial Upgrades. Arterial upgrades as in Option 2 except clearways on Barbadoes Street and Madras (Forfar) Street instead of permanent three-laning.
- Option 3 (b). Traffic Calming and Arterial Upgrades. Arterial upgrades as in Option 2, so permanent three-laning of Barbadoes and Madras (Forfar) Streets.
- Option 3 (c). Traffic Calming and Arterial Upgrades. Arterial upgrades as in Option 2 except extension of Barbadoes Street /Madras Street one-ways to Warrington Street.
- Option 4 (a). Traffic Calming and Clearways on Cranford Street / Sherborne Street from Innes Road to Bealey Avenue plus Berwick Street and Warrington Street Improvements.
- Option 4 (b) Traffic Calming and permanent four-laning on Cranford Street / Sherborne Street (option included to allow comparison of options with a more major upgrade of arterial roads)
- Option 5. Traffic Calming plus combined Arterial Options of all three routes (Options 3(a) and 4(a)).

Most of the options include right turn bans at intersections, including traffic signals (e.g. Cranford Street / Westminster Street). The traffic signal right turn bans only operate when the clearways are operating.

Some of the stakeholders have also suggested use of high occupancy vehicle (HOV) clearway lanes. These lanes encourage people to car-pool and/or use the bus. Currently HOV lanes are proposed on part of the CNC; in southbound direction but ending before the QEII interchange. This project has not looked at HOV lanes in detail as such lanes need to be considered over the full corridor, including the CNC. We would support Christchurch City Council and NZ Transport Agency undertaking an HOV lane study of the northern corridor (Waimakariri Bridge to Bealey Avenue) and looking at whether the clearways on

Cranford Street and other routes can be HOV lanes, as such an option should reduce the number of single occupancy vehicles coming from the north, which is consistent with a number of transport strategies, including the CTSP.

7.4 Multi-Criteria Analysis of Options

Before commencing the MCA assessment, an MCA facilitator developed a number of criteria for evaluating the options based on previous assessments of this type he had undertaken and based on the strategic transport documents that were relevant for this study area. During the first issues and options workshop the criterion and weightings for each criterion were discussed and agreed. The attendees at the workshops were selected by the Independent Expert to cover various transport and other relevant disciplines, including urban design. The attendees intentionally wanted limited weighting placed on journey time and more on community impacts to reflect the outcomes from the consultation, which wanted a focus on community impacts.

During the second and third workshops, participants gave ratings to the various options listed above. This involved robust discussion over each of the ratings. Feedback from the consultation process was used during discussion (such as exactly where safety or environmental concerns were) which allowed for more specific rating analysis. The ratings of each option (considering the positive and negative consequences) are compared with the transport network in 2020 immediately before the CNC becomes operational; the baseline option. Hence, the sum of rankings for all options do have a negative value as they include CNC traffic, while the baseline option does not. To provide a relative score between the options each option has been compared with the do-nothing option and, in this case, most of the options have a positive score. The results of the MCA are presented in Table 7-1.

Table 7-1: Multi-Criteria Analysis Results

Criteria	Weighting	Do Nothing	Option 1	Option 2	Option 3a	Option 3b	Option 3c	Option 4a	Option 4b	Option 5
			Traffic Calming (only)	Arterial Upgrades (only)	Arterial Upgrade (clearways)	Arterial Upgrade (3 laning)	Arterial Upgrade (Extend one-ways)	Cranford / Sherborne Clearways	Cranford / Sherborne 4 laning	Combined Arterial Upgrades
Safety	20%									
Safety for pedestrians										
Safety for vulnerable users										
Safety for cyclists										
Safety for motorists										
Strategic Context	20%									
Keep vehicles on preferred vehicle access routes										
Encourage mode change										
Alignment with local and national transport strategies										
Journey Time (End to End)	10%									
Delay for motor vehicles on arterial roads										
Retain or improve PT travel times and reliability										
Main Considerations	40%									
Impact to local businesses and economic develo	10%									
Social and amenity impact	20%									
Environmental impacts	10%									
Implementability	10%									
Timeframe										
Construction and on-going costs										
Grand total										

Scale	Significant positive	Moderate positive	Minor positive	Neutral (no noticable change from pre-CNC conditions)	Minor negative	Moderate negative	Signficant negative	Serious negative	Fatal flaw

The MCA indicates that option 3(c), which involves extending the one-way pair of Madras (Forfar) Street and Barbadoes Street, along with clearways on Cranford Street to Berwick and capacity upgrades including new signals on Warrington Street and traffic calming of local streets has the best overall (score) ranking.

However, two other options also rank relatively well being option 3(a) which is similar to option 3(c) but has clearways on Madras (Forfar) Street and Barbadoes Street rather than converting them to one-way streets. The other high ranked option is 4(a) which includes clearways on Cranford Street /Sherborne Street through to Bealey Avenue, with traffic signals at Forfar Street /Warrington and Barbadoes Street /Warrington Street. While option 3(b) also has a similar scoring overall it did score more poorly in terms of 'main considerations', with permanent three-laning impacting more on business and residential kerb-side car parking. Given that additional capacity is only required in peak periods, the peak period clearway option (3a) is preferable as a two-way configuration, and so it has not been carried forward.

Option 5 provides both sets of upgrades. It is unlikely by 2031 that both upgrade Options (3(a) and 4(a)) will be required. Indeed, capacity constraints on Cranford Street north of Berwick Street will limit need for all upgrades. Hence this option is not preferred.

7.4.1 Preferred Option Discussion

Option 3(a) includes upgrades to Berwick Street and Warrington Street, as does Option 3(c). However, instead of extending the one-way streets it proposes peak period clearways on Madras (Forfar) Street and

Barbadoes Streets south of Warrington Street. A key reason this option is not scoring as well as the one-way extension is the additional lane during peak periods would impact on the following: 1) Kerbside parking (for business and residents), 2) Difficulty accommodating cycle facilities (due to clearway), and 3) Much wider crossing distance across Forfar Street and Barbadoes Street to St Albans Park. The main negatives with the one-way extension is extra travel distance for some trips to Madras Street and Barbadoes Street businesses and residents (this is minimal in this case due to the grid network of roads), and a potential increase in speeds if road does not get suitable narrowing.

Option 4(a) includes extending clearways further south on Cranford Street and along Sherborne Street. This option has slightly better travel time savings compared to Options 3(a) and 3(c). But, as can be seen in the MCA analysis, travel time has a relatively low weighting overall (at 10%) compared to many other matters assessed. Negative impacts include poor provision for cyclists when clearway is in operation, right turn ban at Berwick Street (from Cranford Street), additional traffic through Edgeware Village, and removal of parking on Sherborne Street from Bealey Avenue to Purchase Street permanently as part of upgrading the Bealey Avenue/Sherborne Street intersection. The main advantage of this option is that change will not need to be made to most of Madras (Forfar) Street and Barbadoes Street. However, this is also a negative as these routes, especially Madras (Forfar) Street, will experience traffic growth which will impact on safe access to St Albans Park as there will be additional traffic that pedestrians have to give-way to.

7.4.2 Development of a Preferred Option

All three options would provide the additional traffic capacity required to minimise rat-running on local streets. All three include peak period clearways on Cranford Street to Berwick Street and improvements to the Westminster Street /Cranford Street and Berwick Street /Cranford Street intersections. The modelling indicates that Madras Street would have significant additional traffic using it with all three options and that the Warrington Street /Forfar Street intersection needs to be signalised, along with associated upgrades to Berwick and Warrington Streets. We would also highly recommend upgrading the Barbadoes Street Warrington Street intersection, which already experiences considerable delays and has safety concerns, especially for crossing pedestrians and buses.

For the three highest ranking options, the capacity upgrades required on Berwick Street /Warrington Street and north of Berwick Street (Cranford clearways) are very similar and hence these elements of the options are included as part of the proposed Plan (some differences in intersection layouts at new traffic signals). However, south of Berwick Street there are three options, with one, Sherborne Street clearways, appearing to be quite different to the other two that utilised Barbadoes Street and Madras Street to carry the additional CNC traffic. However, all three routes, Sherborne Street /Cranford Street, Madras Street /Forfar Street, and Barbadoes Street already have a role in distributing traffic from Cranford North to Bealey Avenue and further south, and vice versa. Drivers tend to choose the route that best positions them to use Bealey Avenue and access the two sets of one-way pairs (Madras Street /Barbadoes Street and Durham Street /Montreal Street), depending on their destination (or origin). Drivers will still have both choices following the opening of the CNC but will distribute themselves depending on the level of congestion on each route.

Modelling to date on this study has been undertaken with the CAST model. This model is useful for looking at preferred route choice at a network level. In our view it is not sensitive enough to assess the more detailed operation of the road network at an intersection and individual road link level. We are also conscious that the stakeholders and the public are keen to see more detail on what each upgrade option would look like, and the detailed effects. These effects include removal of parking outside residences and business, rat-running through several local routes, such as Edgeware Road through the village. Hence the Plan suggests all three options are progressed to a scoping study. This scoping study would look in more detail at the design of each route and the nine main intersections from Warrington Street to Bealey Avenue, involve more detailed modelling of each option to look at how the options might be staged (e.g. where are clearways required in 2020, compared with 2031), and seek further community and stakeholder input on the proposed upgrades. It is possible that the preferred option may involve some upgrades to all three routes.

In all three cases the upgrades would connect into the Berwick Street /Warrington Street capacity improvements which we suggest progresses to detail design and construction ideally ahead of the CNC opening.

7.5 Traffic Calming and Safe Speed Community Areas

7.5.1 Development of Traffic Calming Measures

Local streets have a primary function of providing access to adjoining land-use and lack some of the safe design features of arterial and, to a lesser degree, collector routes. While many of the streets in the St Albans area are narrow or have been narrowed to reduce vehicle speeds, there are a number of local streets in the study area that are very wide and may attract fast moving rat-running traffic, including larger trucks. Speeding issues if not treated, can increase the risk of crashes involving serious injuries and deaths. A range of treatments exist which can limit, dissuade, or mitigate vehicle movements through parts of the transport network where these movements are less desired, or unexpected. Most of these treatments are categorised as 'traffic calming' and should also reduce vehicle speeds and discourage access by larger vehicles (except on bus routes). Treatments typically include[23];

- **Vertical deflection** - watts profile speed humps, raised platforms (mid-block and intersection), raised pavements, and wombat crossings (raised pedestrian crossings).
- **Horizontal deflection** – lane narrowing/kerb extensions, slow points, centre blister islands, driveway links, median treatments, and roundabouts.
- **Diversion devices** – full road closure, half road closure, diagonal road closure, modified T-intersection, left-in/left out islands.
- **Signs, line marking, and other treatments** – speed limit signs and indication devices, prohibited traffic movement signs, one-way street signs, give-way signs, stop signs, shared zones, school zones, threshold treatments, tactile surface treatments, bicycle facilities, and bus facilities.

The traffic calming measures range in severity. Some completely close off available movements, such as converting a street that had multiple vehicle entries to a cul-de-sac. A treatment such as this would remove all through movements from the street. Other treatments are less severe, allowing for full access but reducing vehicle speeds and making the street less comfortable to negotiate. In the Plan we have generally selected less severe traffic calming measures to start, as these are typically more acceptable to the public prior to high levels of rat-running being observed on streets.

If traffic monitoring indicates this is not effective, more severe traffic calming, such as banning movements or partially, or fully closing streets, may be necessary. While there is a focus on the less severe traffic calming to start, there are some obvious more severe traffic calming measures (e.g. restricting arms of intersections to entry or exit only) that could be made for relatively low cost, compared to traffic calming an entire street. Such options should be discussed with local residents and if supported progressed.

Another beneficial side effect of traffic calming streets is that it can improve the level of service for cyclists and pedestrians. This can be achieved by treatments such as kerb protrusions that reduce the crossing distance for pedestrians, or by reducing speeds so cyclists feel more comfortable cycling in the traffic lane.

The Plan identifies the streets that are expected to have a greater than 30% increase in traffic volumes as a result of the CNC in the AM or PM peak periods (in some cases in both) or all day by 2031. The modelling indicates some of these streets may need to be treated before or shortly after the CNC opens. The monitoring programme will pick up changes in traffic volumes and speeds and indicate which streets need to traffic calmed later on; between 2021 and 2031.

7.5.2 Safe Speed Community Areas (SSCA)

In addition to physical changes to streets it is proposed to create up to 9 safe speed (community) areas either side of Cranford and Sherborne Streets as shown in Figure 7-16.

In addition to reducing travel speeds on local streets and reducing crash risk, the SSCA also signal to drivers that they are entering lower volume and lower speed streets where they should be more alert as children and elderly people may be on or crossing the road; hence the reason for including 'safe' in the signage. Ideally SSCA should have a 30km/h speed limit, as that is the 'safe speed' where collisions with pedestrians and cyclists have a very low likelihood of causing fatal or severe injuries.

We recommend that all traffic calmed local streets be designed to operate at around 30km/h. However, some of the streets within these areas will remain untreated and so a 40km/h speed limit may be more appropriate until such time as all the streets in an area are treated and have operating speeds between

[23] Adapted from Austroads Guide to Traffic Management Part 8 Local Area Traffic Management. p121

30 and 40km/h. The 40km/h speed limit is also more consistent with what has already been applied to other residential streets in the city. In either case, a drop in the speed limit and the associated signage is expected to reduce the number of crashes and the severity of any crashes which do occur.

Note that it is not essential to lower the speeds in area 2B, as these are not through routes, although as part of the changes we would strongly recommend these routes have lower speed limits.

Figure 7-16: Safe Speed (Community) Areas

7.6 2nd Stage of Option Development

The additional CNC traffic coming into Cranford Street causes a number of transport, social, and environment effects on the downstream (primarily St Albans) community. The proposed arterial/collector street upgrades (and associated traffic calming and speed management) address some of these effects, but do not address others, and in some cases create new traffic effects. The Stage 2 option development needs to consider these other effects. We have divided these other issues and associated improvement options into five categories;

1) Safe access to schools,

2) Safer cycle facilities,

3) Access to parks,

4) Access to commercial activity centres, and

5) Other effects.

The other effects include issues like access to properties along the arterial routes.

Few infrastructure improvement options are proposed at this stage. Instead a number of studies are proposed to look at the specific impacts of the additional traffic on each focus area and how these impacts can be mitigated. These studies are included in the Plan. An outcome of these studies will be a number of improvement options, some of which need to be implemented soon after the CNC is opened,

and others which can be made later in ten-year monitoring period (known as the commissioning period). The ongoing monitoring may also indicate that additional improvement options are required in these categories to address specific issues. As mentioned earlier, the healthy streets and the safe system framework methods are proposed, alongside traditional safety auditing, to maximise the safety and amenity benefits of route and intersection upgrades.

The next few sections outline some of the issues that need to be addressed by these improvement options.

7.6.1 Safe Access to Schools

Increased traffic volumes in the area will impact on safe access to key destinations in the local area, and specifically schools, parks, and commercial activity centres, and especially for those walking to these locations. Of particular concerns is access to these locations by the young (e.g. school children), elderly (which there are increasing numbers of), and those with disabilities, such as those with a mobility or visual impairment. Increased risk of crashes is a direct result of the additional traffic from the CNC, especially on arterial and collector roads. Hence improvements need to be made including infrastructure improvements and speed limit changes.

There are a number of primary schools in the study area and consideration needs to be given to how the additional traffic from the CNC may impact on the safety of school children that are walking around the network and especially crossing the road. Typically, it is older primary school children (year 5 and 6) that are walking unaccompanied by adults. There may also be a small number of primary school pupils that cycle to school. While there are also a number of preschools in the area, children of this age will in almost all cases be accompanied by an adult.

The main school impacted by the CNC downstream traffic is St Albans Primary School. Some of the school children need to cross Cranford Street to walk to the school. Children also cross Westminster Street (west of Cranford) and Courtenay Street. While signalised intersection crossings are provided at the Westminster Street and Berwick Street intersections, there have been a number of near misses, particularly at the former, between crossing children and turning traffic (typically turning when the signal has gone red, often due to traffic congestion and no turning arrows). St Albans School currently employees a cross-guard at this intersection before and after school to guide pupils across the road. Traffic calming has already been introduced on Westminster Street both sides of Courtenay Street, including a pedestrian refuge and road narrowing, to slow down traffic and aid crossing of the route by school children.

The additional traffic on Cranford Street, as a result of the CNC, will increase the risk of crashes involving pedestrians, including school children, if no changes are made. There are several improvements that can be made on Cranford Street to address this safety risk including a temporary speed limit before and after the school north of Westminster to south of Berwick, putting the Westminster Street / Cranford Street intersection on a platform or using a textured surface, and introducing smarter signals phasing as part of widening the western approach of the intersection. The latter being part of a proposed upgrade of Westminster Street and Courtenay Street to improve amenity and accommodate cycling infrastructure. Banning of right turns into Westminster Street in the AM peak (and PM commuter peak) will also reducing the risk of turning crashes involving pedestrians crossing Westminster Street. Additional enforcement be it a red-light running camera, or increased Police presence, is also recommended.

Another option that should be considered is a mid-block crossing outside the English (ASB) Park carpark, approximately mid-way between the two intersections (Berwick and Westminster). An at-grade mid-block crossing would have the advantage of no turning movements. As raised by submitters, a grade separated crossing (sub-way or overbridge) would remove the conflict with vehicles altogether. However, there are a number of issues with such an option, with the key issue being the lack of room to accommodate the overbridge within the current road reserve. It would be difficult based on the number of daily users to justify the cost of such a structure and there are major visual impacts associated with installing an overbridge in this location.

The banning of right turn vehicles from Cranford Street into Westminster Street in the morning peak will also help reduce this risk.

Another safety issue identified during the consultation was the school crossings on Innes Road outside Mairehau Primary School and Our Lady of Fatima School[24]. While there are zebra crossings outside each school, many drivers are not stopping, especially at the Mairehau Primary School, crossings. A signalised crossing would be more effective, perhaps located at the Mairehau school crossing. Although the traffic volumes on Innes Road are not expected to increase significantly (and not above 30%) when the CNC is

[24] Now known as St Francis of Assisi School

opened we would strongly recommend Christchurch City Council signalise one of the crossings as part of its safer routes to school programme.

There are also incidents on Rutland Street outside St Albans Catholic School between school children and cyclists on the cycleway. Christchurch City Council have been looking into these issues as part of the major cycleway programme and hence the Plan does not consider this matter further, other than raising it as an issue that needs to be monitored going forward. It is possible that the increased traffic flows on Rutland Street as a result of the CNC may impact on the safety of crossing school children. Options to address any concerns may need to be considered as a Stage 3 project.

It is important that through the 'safe routes to school programme' that there is additional education of pupils, teachers, and parents, especially associated with safe crossing behaviour in and around each school, leading up to the opening of the CNC.

7.6.2 Safer Cycle Facilities

A key impact of the additional CNC traffic and the need for peak period clearways on Cranford Street and other routes is a deterioration in the facilities provided for cyclists on these routes. Not only is there additional traffic on the clearway routes, there is not adequate room to provide cycle lanes or adequate room for cyclists when clearways are in use. The 3.7m wide kerbside lane is not adequate for a truck or bus to safely pass a cyclist. When parking is occurring in the clearway lanes then cyclists have some space between the parked car and main traffic lane. Such a facility is only suitable for confident cyclists and not the new cyclists that Christchurch City Council want to encourage into cycling. It is also a poorer option than the cycle paths that are provided down the CNC and on Cranford Street down to McFaddens Road. The option of a shared path on the berm is not considered suitable due to safety concern associated with backing vehicles from residential properties. Because of issues associated with visibility from backing vehicles, narrowing the berm and widening the carriageway to accommodate cycle lanes is also not considered a safe option.

With the Papanui Parallel nearby and with the provision of additional infrastructure and suitable wayfinding (at each end of clearway sections), the majority of cyclists can be accommodated on alternative routes. Some cyclists will choose to cycle on Cranford Street anyway, mostly the confident cyclists that will use the space when available or cycle in the traffic lane. Others with origins or destinations on routes like Cranford Street will most likely ride on the footpath or cycle in the traffic. If the Government do pass a law allowing footpath cycling like some Australian States and other countries, then we would recommend that Christchurch City Council consider applying this to these routes. With footpath riding, speeds are tempered by the width of the footpath (as compared with allowing a footpath cyclist on this route as a shared path) and the users who are typically less confident or younger riders.

To provide suitable facilities for cyclists coming from the north (to and from the city) and the local community we are recommending investigation of one further north-south cycleway and at least three east-west cycle links to the Papanui Parallel and the new north-south cycleway, which needs to be on the eastern side of Cranford Street. The need for the new north-south route, especially north of Westminster Street, is that the deviation to the Papanui Parallel will be too great for some cyclist's trips, especially from cyclists that originate from Mairehau, which is to the east of Cranford Street. Wayfinding needs to be provided at the McFaddens Road/Cranford Street intersection to the north. In the south, cyclists heading north from the city should be encouraged to use the Colombo Street cycleway or the Manchester Street cycle lanes.

The new north-south link should start on the eastern side of Cranford Street at the McFaddens Road / Cranford Street intersection. The preferred route needs to go through a routes selection process and Safety Audit and Network Functionality (SANF) assessment (see Appendix H for details). One potential route that utilises streets that need to be traffic calmed, is shown in Figure 7-17. The route follows McFaddens Road, Jameson Avenue, Severn Street, Forfar Street, then alongside Madras Street and through St Albans Park, Allard Street, Packe Street, Purchas Street, and then onto Manchester Street. The route would be a combination of quiet streets and shared paths. Suitable crossings would need to be provided across Innes Road, Westminster Street, and Edgeware Road.

The key east-west links are McFaddens Road, Westminster/Courtenay Street and Edgeware Road. The McFaddens Road cycle connection would be considered as part of the traffic calming of this route on both sides of Cranford Street. The Westminster Street/Courtenay Street and Edgeware Road cycle facilities would be included in two corridor studies that are recommended for these routes, with the extent of these studies shown in Purple in Figure 7-17. This will be a combination of on-road cycle lanes and shared facilities. Extension of the Manchester Street cycle lanes from Bealey Avenue to Edgeware Road is also recommended.

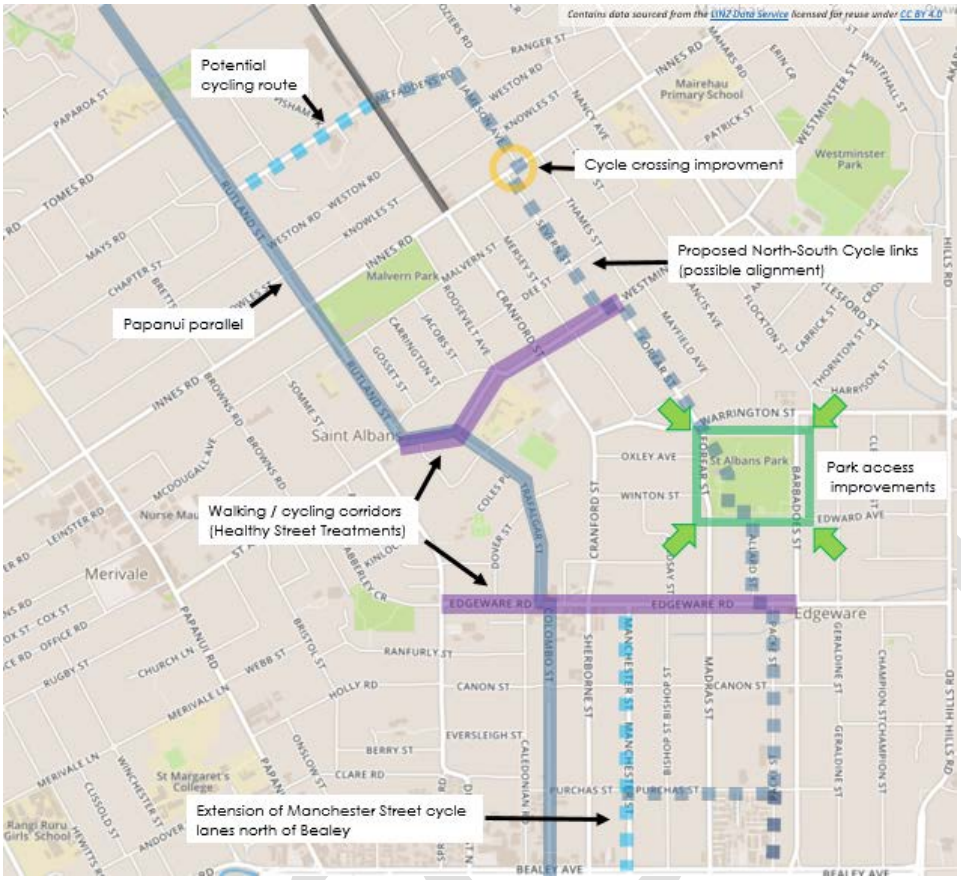


Figure 7-17: Suggested new cycle routes

7.6.3 Safe Access to Parks

The additional traffic from the CNC will potentially impact on traffic flows around at least two of the parks, St Albans Park and to a lesser degree Malvern/Rugby Park. Given St Albans Park is surrounded by three main routes that are likely to have an increased traffic volume, being Warrington Street, Barbadoes Street, and Forfar (Madras) Street, it is the most affected by additional traffic. Current pedestrian (and cycle) access to the park is not ideal with the wide carriageway on Forfar Street and Barbadoes Street, and a roundabout and only pedestrian crossing aids at Forfar/ Warrington and Barbadoes Street /Warrington Street respectively. Cycle access to the north is provided by these main roads. With the relatively lower traffic volumes the impact on access and safety has been limited. With the increased traffic it will be difficult in peak periods to access the Park.

The installation of traffic signals at Forfar Street /Warrington Street and Barbadoes Street /Warrington Street as part of the major road improvement (MR3) will improve access and safety considerably to pedestrians and cyclists even with the increasing traffic volumes. The new north-south cycle facility (SC5) in conjunction with east-west links (SC3 and SC4) will also improve cycle access to the park. The remaining issues are mid-block crossings across Forfar Street /Madras Street and Barbadoes Street. The new design of these routes needs to consider how both routes can be narrowed alongside the park so that pedestrians have shorter crossing distance and speeds are managed to lower levels. This is particularly an issue for the mobility impaired and also caregivers with prams.

In terms of Malvern Park, rat-running traffic on Roosevelt Avenue and Malvern Street would impact on access to the park. Traffic calming measures will be required to manage traffic volumes and speeds around the park. Access across Innes Road to Malvern Park will also become more difficult due increasing traffic volumes. There is an alleyway provided between Innes Road and Knowles Street /Weston Road which includes a refuge island on Innes Road. With increased traffic flows on Innes Road, the mid-block crossing will be more difficult.

7.6.4 Safe Access to Commercial Centres

There are a number of commercial centres that are likely to be impacted by the downstream traffic generated from the CNC. This includes the Edgeware Village Neighbourhood Centre and four local commercial centres, being Westminster/Cranford shops, Barbadoes/Warrington shops, Barbadoes/ Edgeware shops, and the Rutland Street shops.

Recent changes on Rutland Street have provided improved access to these shops by bicycle (Papanui Parallel) and pedestrians (crossing aids). Parking has also been considered in the new design. However, there are concerns from businesses that there is not enough short-term parking nearby. This is a matter that needs to be monitored by Christchurch City Council and addressed as needed.

The Edgeware Village has been the subject of several recent studies, including the Edgeware Village masterplan. This has resulted in improved north-south cycle facilities (Papanui Parallel) and a signalised pedestrian crossing of Edgeware Road. Modelling indicates that traffic volumes may increase on Edgeware Road, both to west (and east) of Cranford Street and on Cranford Street /Sherborne Street. This is likely to impact on cycle access to the village and the Papanui Parallel, especially from the east. The corridor plan recommended for Edgeware Road (in Figure 7-17) should consider how cyclists can move through the Village east to west and vice-versa. Any option development through the village needs to be developed in conjunction with refinement of the Edgeware Village masterplan.

The centre most impacted by the extra CNC traffic is the Cranford Street /Westminster Street local centre. Since the earthquakes this centre has become more vibrant with several new businesses setting up in this area. The current pedestrian and cycle connections around the centre are not good, although there is a signalised intersection to get across Cranford Street. With Christchurch City Council wanting to promote walking and cycling, and encourage people to use these local centres, in addition to the increasing traffic through the centre we recommend that a plan be prepared for the centre in conjunction with the corridor study of Westminster (and Courtenay) Streets. The plan should look at cycle and pedestrian linkages to the centre. This will require widening of the western approach to the traffic signals and new footpaths. The plan should also consider parking requirements and options to provide additional parking, especially off-road parking.

The Warrington Street /Barbadoes Street local centre also has relatively poor pedestrian and cycle facilities. Access to the north will be improved with the proposed traffic signals. A plan should also be prepared that looks at opportunities to improve pedestrian facilities, especially to the park/west side of Barbadoes Street. The study should also look at parking requirements, as parking demand is high from residents and the café customers who are not able to use the off-road car-park, with the clearway option impacting on parking availability. Special consideration needs to be given to the Audiology business on west side of Barbadoes Street (sensitive to noise, including construction) and also the location of the bus stop outside the café (can this be moved to allow short stay parking for the café).

The Barbadoes Street /Edgeware Road local centre has poor cycle facilities but reasonable pedestrian access via the traffic signals. Again, a plan should be prepared for this centre. Cycle facilities should be provided on Edgeware Road as part of the Edgeware corridor study. Parking requirements should be considered given the potential for the clearway to limit parking in the morning peak period.

8. Recommendations (Management Plan)

The overall downstream effects plan will be implemented over approximately a 10-year period. Some network changes need to be in place before the CNC is opened in mid-2020 due to the expected jump in traffic volumes on Cranford Street from traffic diverting from other routes. While the focus is on routes that are expected to be impacted by traffic growth of 30% or more by 2031 as result of the CNC, the timing of upgrades is dependent on a number of factors, such as increased crash risk, overall increase in rat-running, level of congestion on arterial roads and impacts of construction after CNC opens.

The following sections outline the recommended improvements and further studies that are proposed to avoid, remedy and mitigate the traffic impacts of the CNC on the downstream road network. This builds on the option development process discussed above. First, we discuss the staging of the upgrades and monitoring requirements before presenting the options across the seven option (and study) categories.

8.1 Monitoring and Project Staging

8.1.1 Introduction

The Plan presented in this report is based on traffic modelling, which is based on land-use projections and drivers' behaviours. There is no certainty of how much traffic will use the CNC and downstream roads, especially by 2031. However, there is an expectation that there will be an initial increase in traffic due to drivers diverting to the CNC from Marshlands Road and Main North Road, and hence the Plan looks to address the impact of this increase and then monitoring will be used to confirm transport impacts between 2021 and 2031 and what needs to be addressed.

Some parts of the network may be initially more sensitive to the impact of the CNC than others, and once drivers become more accustomed to the new layout, driving behaviours will become more obvious. We are particularly conscious that drivers' rat-running behaviours are difficult to predict using a transport model and so we expect some behaviour to be different to what has been modelled.

The capacity interventions, particularly on Cranford Street and Berwick Street, appear more pressing than others, and do need to be in place before the CNC becomes operational. There were some suggestions during consultation that no works should be undertaken prior to the CNC opening, and to see how the network performs. This approach has merit on parts of the network, however if universally adopted it is likely to result in major traffic impacts on a large number of (rat-running) routes after the CNC is opened and severe congestion on arterial roads. Making changes following the opening of the CNC may also be very disruptive on commuters and the community once the network is already heavily congested.

8.1.2 Proposed Monitoring

As previously stated, the Plan is focused on parts of the network that experience a 30% increase in vehicles (minus underlying traffic growth). In order to ascertain whether a part of the network has exceeded the 30% threshold, the simplest approach would be interpolate between the growth expected on 2021 and 2031 with the volume recording at any given time. However, there are a number of limitations in using this approach as outlined below.

There are many societal events which affect the number of trips undertaken on a network; land-use changes, economic changes, and political changes to name a few. Given time, changes will occur, and these will need to be updated in a base model. There are also many specific changes that will occur on the network which will also need to be updated within the base model. These changes are relatively simple to take care of in a model. However, a much more difficult undertaking is to uncouple changes made to the downstream network in response to the CNC; changes which affect the traffic volume on various streets (increases and decreases) which may not have been undertaken had the CNC not been constructed, or at least not within the set timespan outlined in the NoR. One example of this is the provision of additional capacity on (any) arterial corridor in order to relieve traffic from local streets. Any expansion of capacity on the network will likely illicit a redistribution of vehicle movements, but the net effect may on balance be the most desirable. Consequently, there may be scenarios where Christchurch City Council are best to increase the traffic flow on some arterial or collector roads (perhaps even in excess of the 30% threshold). Over time it will become increasingly difficult to separate the impact of these downstream treatments and the CNC itself in terms of their consequence to the network's performance.

The easiest method, therefore, is to gather baseline data from the monitoring sites, and apply an assumed base growth rate on the network to these streets as representing growth that would have occurred if the CNC was not build. Then traffic volumes can be monitored and, when a site increases beyond a 30% growth above this standard level of growth, the next step of investigation can begin. In our view, a 30%

downstream wide blanket threshold is a relatively blunt approach to network management of this magnitude. It fails to acknowledge fundamental network differences, and the interrelationship between hierarchy elements. Networks vary in where it can, and cannot, accommodate growth, or indeed what exactly might be considered acceptable or unacceptable growth. The relationship between effects of traffic, and volume of traffic, is also not strictly linear. Some effects respond differently to the volume of traffic, and effects also vary depending by road environment.

A time unit for the traffic volume increase was not stipulated in the NoR (for example 30% increase on the number of vehicles per day). The tidal nature of the commuter flow in Northern Christchurch means that the greatest effects is usually experienced during the morning peak, and to a lesser extent the evening peak. Therefore, for the purposes of the Plan, the assumed time unit for the 30% threshold includes the daily count, AM peak count, or the PM peak count.

A decision tree conceptualisation of the process outlined in the NoR is shown below:

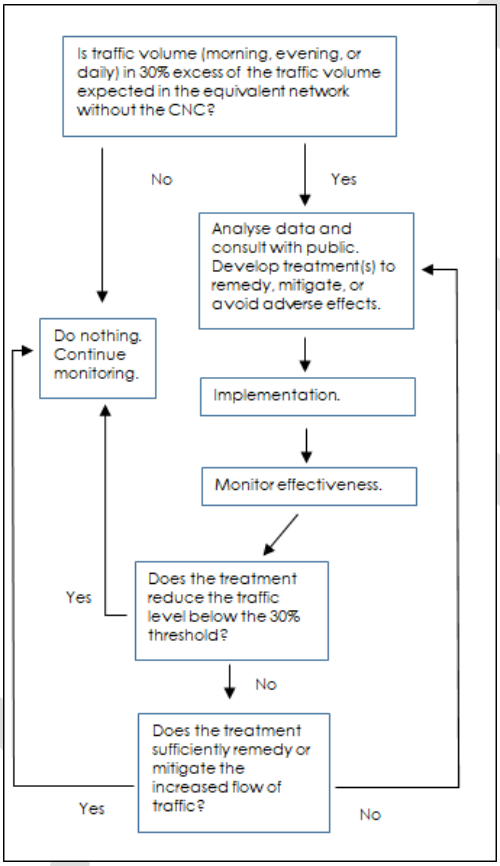


Figure 8-1: Decision Tree for NoR Monitoring of Traffic Volumes

The monitoring programme will involve the collection of daily traffic volumes and vehicle speeds (over a minimum of three 24hour days – normally seven days). The baseline data (pre-CNC) is being collected in 2018 at over 50 sites/streets in the downstream road network. The locations of the counts are shown on the screen lines in Appendix E. Following the opening of the CNC, Christchurch City Council will typically collect counts annually or biennially on the routes that are most likely to impacted by rat-running traffic, as indicated by the transport modelling. A number of the streets included in the baseline counts are not expected to be impacted, but counts are being collected in case rat-running does occur so there can be a comparison made of traffic conditions before the CNC opened. For these streets, and also the regularly monitored streets out of sequence, special counts may be collected if rat-running does appear to be an issue. It may also be necessary to monitor adjoining streets after traffic calming is applied if traffic just diverts across to these other streets.

It is also proposed to monitor the vehicle emission, noise, and vibration impacts of the additional traffic on the main roads (arterials and collector routes). This monitoring is in response to concerns raised by the community. Baseline data will be collected along with annual or biennial measurements through to 2031. The arterial sites being monitored include:

- Cranford Street north of McFaddens Road

- Cranford Street north of Berwick Street
- Berwick Street immediately east of Cranford Street
- Madras Street north of Edgeware Road
- Barbadoes Street north of Edgeware Road

The intention being to collect air pollution levels using detectors installed at each of these locations, so data can be extracted whenever required through to at least the end of 2031. Christchurch City Council will investigate suitable technology for this monitoring.

Noise and vibration measurements will also be collected at sites along these routes. The monitoring will consider those most effected by vibration and noise (houses and businesses close to the vibration and noise source), and the typical impact on houses and businesses along each section of road. The source of noise and vibration will be identified using video (CCTV) cameras. Based on the monitoring, Christchurch City Council will consider whether there are suitable options to address any adverse effects found by this monitoring.

8.1.3 Staging of Improvements

The proposed improvements and associated studies have been grouped into three time periods. Stage 1 upgrades are those upgrades that need to be in place before the CNC is opened, to address severe traffic congestion and excessive rat-running in local streets. Stage 2 upgrades are those improvements that will reduce other traffic effects of the CNC opening traffic flows, including additional traffic calming schemes, safe cycling, and safe access to schools, parks, and commercial areas. These improvements should be implemented within three years of the opening of the CNC. It is recommended that the studies into the issues and options for these upgrades commence before the CNC opens. While these improvements should ideally also be in place before the CNC opens, it is acknowledged that it will take time to develop and implement these options. Stage 3 upgrades are those improvements that the modelling indicates will be required between 2021 and 2031. This includes traffic calming and some additional safe cycling improvements. The timing of these upgrades will depend on the outcomes from the monitoring.

8.2 Proposed Improvement Options

This section outlines the various improvement options and associated studies that are recommended to address the expected impacts of the CNC traffic that will flow into the downstream road network. The options have been split into Stage 1, 2, and 3 depending on when the upgrades should be implemented. The improvements options have been grouped into the following categories:

1. Major Roads (MR Options)
2. Traffic Calming (TC Options) and Safe Speed Community Areas (SSCA Options)
3. Safe Access to Schools (AS Options)
4. Safe Cycling Routes (SC Options)
5. Access to Parks (AP Options)
6. Access to Commercial Centres (AC Options)

Each of the options are presented in the following sections and have been developed in-line with the processes outlined previously.

8.2.1 Major Roads (MR Options)

All of the major road upgrade options need to be in place before the CNC opens. So, all options are in Stage 1.

The major road options have been separated into those north and south of Berwick Street, and on Berwick Street / Warrington Street. The options proposed north of Berwick Street include the following:

MR1 (Cranford Clearways) – Peak Period Clearways along Cranford Street – to extend from Innes Road through to Berwick Street. To include right turn restrictions at Dee Street and Malvern Street and at English Park Carpark. This option will also include a study of the accesses along the route and how drivers will be able to manoeuvre in and out of each driveway (the same to be applied to other clearway options further south). A plan will also need to be produced on how to enforce the clearways.

MR2 (Westminster/Cranford Intersection) – Upgrades to Westminster Street /Cranford Street Intersection. This is to include banning right turns into Westminster Street in peak period, widening of the western approach and include cycle lanes on Westminster Street. It should also include other changes to improve safety for crossing school children as discussed later on.

Along Berwick Street and Warrington Street the following option is proposed. This should be undertaken as a single option given the close proximity of the intersections and associated road widening between each.

MR3 (Berwick/Warrington Upgrades) – Upgrading of Berwick Street /Cranford Street intersection to include double right turn into Cranford Street and signalisation of the Forfar Street /Warrington Street and Barbadoes Street Warrington Street Intersections, plus any road widening between these intersections. Simulation modelling will be required to assess what extra lanes are required.

South of Berwick Street there are several upgrade options possible on the three arterial/collector routes (as specified earlier, i.e. options 3(a), 3(c) or 4(a)) and a scoping study needs to be undertaken, using a simulation model to develop these options further and determine what needs to be in place by 2021 and then through to 2031. Consideration needs to be given to high kerbside parking demands on Madras Street and Barbadoes Street due to medium density developments in this area in the development of options. A parking survey needs to be undertaken as part of the scoping study. The access requirements of the proposed St Albans Shopping Centre on Madras Street also need to be considered in option development. It is suggested up to three options should then go to the public for feedback before finalising the option. This may delay the project construction until after the CNC opens, but, ideally these changes are made before the CNC opens. The MR 1, 2, and 3 options above are the more critical projects that need to be in place when the CNC opens.

MR4 (South Berwick Upgrades)– Preferred downstream of Berwick Street arterial upgrade option that comes out of the scoping study of Options 3(a), 3(c) and 4(a) and any sub-options of these.

We also strongly recommend that Christchurch City Council work with NZ Transport Agency to do a study extending the High Occupancy Vehicle (HOV) lanes on the CNC in the southbound direction from north of QEII down through the arterial road network and along Cranford and Sherborne Streets. In addition, an HOV lane could be provided northbound from Bealey Avenue though to the CNC roundabout on Cranford Street. The use of HOV lanes would promote car-pooling and bus use, and reduce the number of single occupancy vehicles, which is a desirable travel demand management outcome. The HOV lanes would utilise the extra lane created by the peak period clearways. This study is specified below as MR5 and the HOV lanes, if suitable, should ideally be implemented as a Stage 1 improvement, but could also be implemented as a Stage 2 improvement.

MR5 (HOV lanes on Cranford Sherborne) – Investigate with the NZ Transport Agency extending the southern HOV lanes on the CNC through to Bealey Avenue and installing a northbound HOV lane.

No other major road upgrade options are proposed.

8.2.2 Local Roads: Traffic Calming of Local Streets (TC Options) and Safe Speed Community Areas (SSCA Options)

As mentioned in Section 7.5, it is proposed that nine safe speed community areas (**SSCA 1 to 9**) are introduced in the downstream road network making up most of the local streets. A speed limit of 30km/h is recommended, but a 40km/h speed limit is also an option. The location of these areas on each side of Cranford Street and Sherborne Street are shown in Figure 8-1 and listed below.

- **SSCA1 – Ranger Street**
- **SSCA2 – Knowles Street**
- **SSCA3 – Thames Street**
- **SSCA4 – Roosevelt Avenue**
- **SSCA5 – Flockton Street**
- **SSCA6 – Trafalgar Street**
- **SSCA7 – Oxley Ave**
- **SSCA8 - Caledonian Road**
- **SSCA9 – Bishop Street**

It is recommended that the SSCA areas all be in place before the opening of the CNC, as a deterrent for rat-running. It is recommended over time that all the streets in these areas are traffic calmed so that the reduced speed limit is self-explaining on each street.

The modelling has identified the streets that are likely to require traffic calming through to 2031. As specified previously, some of these streets need to be traffic calmed in Stage 1 or 2, while others can wait until the CNC opens and following monitoring (Stage 3 options). It is also possible the monitoring will identify rat-running streets not identified in the transport modelling. Table 8-1 shows the streets that are expected to have an increase in traffic volumes through to 2031 even with the arterial upgrades and the proposed staging of these options, based on the expected timing of rat-running on these routes. Potential rat-running routes west of Rutland Street have been excluded from assessment (Christchurch City Council will monitor and treat these routes if required separate from the Plan).

Table 8-1: Traffic Calming Routes and Their Staging

Street	Start and Finish	Staging
TC1 - Mersey Street	Innes Road to Berwick Street	Stage 1
TC2 - Knowles street	Rutland Street to Cranford Street	Stage 2
TC3 – Weston Road	Rutland Street to Cranford Street	Stage 2
TC4 – McFaddens Road	Rutland Street to Cranford Street	Stage 2
TC5 – McFaddens Road	Cranford Street to Ranger Street	Stage 2
TC6 – Jameson Avenue	McFaddens Road to Innes Road	Stage 2
TC7 – Malvern Street	Rutland Street to Cranford Street	Stage 1[#]
TC8 – Dee Street	Roosevelt Avenue to Cranford Street	Stage 1[#]
TC9 – Roosevelt Avenue	Innes Road to Westminster Street	Stage 2
TC10 – Forfar Street	Westminster Street to Warrington Street	Stage 3
TC11 – Flockton Street	Westminster Street to Warrington Street	Stage 3
TC12 – Caledonian Road	Bealey Avenue to Edgeware Road	Stage 3
TC13 – Edgeware Road	Caledonian Road to Manchester Street	Stage 3
TC 14 – Manchester Street	Bealey Avenue to Edgeware Road	Stage 3

[#] As part of the Cranford Street Clearways Project (MR1) these streets will become left-in and left-out only which effectively works as traffic calming.

8.2.3 Safe Access to Schools (AS)

The main school impacted by the CNC downstream traffic is St Albans Primary School. Some of the school children need to cross Cranford Street to walk to the school. Given the range of options that are possible to address this risk it is recommended that a study be undertaken to identify the preferred option(s). This study is to be undertaken as part of the Stage 1 improvements and implemented as a Stage 2 improvement.

AS1 – Safe Access across Cranford Street – This study will look at a range of options, including a new mid-block signalised crossing across Cranford Street near the English Park Carpark entrance.

AS2 – Interim Improvements on Cranford Street - As an interim measure it is suggested that, as part of **MR1 (Cranford Clearways)** and **MR2 (Westminster/Cranford Intersection),** a 40km/h speed limit be introduced during school arrival and departure time on Cranford Street from north of Westminster Street, a coloured surfacing be installed at the Westminster Street /Cranford Street Intersection, and left turning red arrows be

used as protection for crossing pedestrians. As with MR1 and MR2 these changes should be undertaken as a Stage 1 improvement.

8.2.4 Safer Cycling Routes (SC Options)

One of the new transport effects of the CNC, is that there will be poor facilities for cyclists on Cranford Street, especially when the clearway is in operation. Given the future traffic volumes down Cranford Street, this is not ideal. A number of options to provide better cyclist facilities on Cranford Street were investigated (e.g. shared pedestrian and cyclist path) and none are suitable within the current road reserve. Widening the road reserve would be expensive and very intrusive for those who live on the street. Hence the preferred option is to accommodate cyclists on alternative routes. While the Papanui Parallel does provide an alternative route, this is not considered sufficient on its own to redirect cyclists and accommodate all diverted and local area cyclists and hence other network changes are proposed. Hence, we propose a number of studies to identify suitable secondary cycle routes and look at wayfinding signage.

We would strongly recommend that Christchurch City Council use the SANF process to refine the options (as specified in Appendix H). The preferred eastern north-south route should also be selected using a multi-criteria analysis of different potential routes (as also specified in Appendix H).

The proposed five cycle facility upgrades are as follows:

SC1 (Cycle Wayfinding Signage) – Development of a wayfinding signage plan that directs cyclists at the northern end of Cranford Street (at McFaddens Road) and southern end of Cranford Street to safer cycling routes. This should be a Stage 1 improvement and coincide with introduction of the peak period clearways.

SC2 (McFaddens Road Secondary Cycle Corridor) – Development of a safe cycling route both west (towards the Papanui Parallel) and east (towards new north south route) on McFaddens Road of ideally slow streets or off-road routes. Route study to occur in Stage 1 and be implemented in Stage 2.

SC3 (Westminster/Courtenay Secondary Cycle Corridor) – Development of a safe cycling route both west and east of Cranford Street. May consist of on-road and off-road cycling facilities, or just on-road facilities. Route study to occur in Stage 1 and be implemented in Stage 2.

SC4 (Edgeware Road Secondary Cycle Corridor) - Development of a safe cycling route both west and east of Cranford Street. To consist of mainly on-road cycling facilities. Route study to occur in Stage 1 and be implemented in Stage 2.

SC5 (North-South Secondary Cycle Corridor) – Development of an alternative north-south cycle route through traffic calmed streets to the east of Cranford Street. To consist of bicycle greenways and off-road routes. A key cycle linkage to St Albans Park from the north and south. Route study to occur in Stage 1 and be implemented in Stage 3.

These Westminster Street /Courtenay Street and Edgeware Road corridors are also key accesses routes for pedestrians to the Westminster Street /Cranford Street local activity centre and the Edgeware Village, as specified in section 8.2.6.

8.2.5 Access to Parks (AP Options)

Two studies are proposed to look at safe access to these parks and what improvements could be made to improve safety around the parks.

AP1 (St Albans Park Access Plan) – This plan will look at access to the park by pedestrians (of different abilities), cyclists, and motorists. It will consider carparking requirements, given the proposed upgrades to Forfar Street and Barbadoes Street, and parking requirements of cyclists. The study should occur during Stage 2 and any recommendations be implemented during Stage 3.

AP2 (Malvern/Rugby Park Access Plan) – This plan will look at access to the park by pedestrians (of different abilities), cyclists, and motorists. It will consider carparking requirements of Malvern Park and also what traffic calming may be required to reduce traffic speeds on Malvern Street and Roosevelt Avenue to create safer crossing places. The study should occur during Stage 2 and any recommendations be implemented during Stage 3.

8.2.6 Access to Commercial (Activity) Centres (AC options)

It is recommended that four activity centre transport studies and two corridor studies be undertaken during Stage 2 and implemented during Stage 3 of the process, as outlined below. With a development plan having already been prepared for the Edgeware village it not proposed to do a further study of that

centre. There are some overlaps between these studies and the safer cycling route studies, so this will need careful coordination to get the best outcomes.

AC1 – Westminster/Cranford Local Activity Centre Transport Study. This study will consider safe access to this activity centre by pedestrians, cyclists, and motorists. It will consider amenity improvements that can be made to the centre. A key focus will be on improving access along Westminster Street and Courtenay Street in the associated corridor study and across the intersection as part of MR2.

AC2 – Barbadoes/Warrington Local Activity Centre Transport Study. This study will consider safe access to this activity centre by pedestrians, cyclists, and motorists. It will consider amenity improvements that can be made to the centre. A key change at this location will be the installation of traffic signals at the Barbadoes Street /Warrington Street intersection to improve walking access to the north. High kerbside parking demands and the noise sensitive audiology centre are key matters that need to be considered.

AC3 – Barbadoes/Edgeware Local Activity Centre Transport Study. This study will consider safe access to this activity centre by pedestrians, cyclists, and motorists. It will consider amenity improvements that can be made to the centre.

AC3 – Rutland Street Local Activity Centre Transport Study. This study will consider safe access to this activity centre by pedestrians, cyclists, and motorists. It will consider amenity improvements that can be made to the centre. Given that there have been several changes outside these shops with the new cycleways, major changes are not likely to be required at this activity centre.

AC4 – Westminster/Courtenay Corridor Study (Rutland to Forfar) – This study will be a companion study to the cycle corridor study (SC3) but focus on safe access by pedestrians along the route and crossing the route, especially for vulnerable road users.

AC5 – Edgware Corridor Study (Springfield to Barbadoes) – This study will be a companion study to the cycle corridor study (SC4) but focus on safe access by pedestrians along the route and crossing the route especially for vulnerable road users.

9. Summary

Table 9-1 summarises the improvements and studies that are proposed before the CNC opens (Stage 1 improvements and studies) and those options that should be implemented within three years of the opening (Stage 2 - less critical but expected to be actioned early in the ten-year monitoring period). Given the big increase in traffic volumes on Cranford Street expected when the CNC opens some work needs to be undertaken before it opens to avoid excessive congestion and rat-running in the down-streams network.

While some of the Stage 2 projects should ideally be in place before the CNC opens there is limited time to progress all the studies and projects identified before it opens and hence the more crucial projects have been prioritised in Stage 1 and the rest moved to Stage 2. Some of the Stage 2 projects, especially some of the traffic calming, may also not be required, depending on the monitoring results. The impact of delaying some projects to Stage 2 (up to three years after the CNC opens) is that there may be adverse transport effects in the short term. Council will need to prioritise the worst of these transport effects, as identified in the monitoring, for early intervention, including rapid implementation projects where practical.

Other projects, those in Stage 3, can be implemented after the CNC opens. The traffic monitoring will show the actual transport impacts of the CNC and allow the projects developed in Stage 3 (and studies and projects in Stage 2) to be refined and changes made to the streets treated and options implemented in response to the observed traffic volumes, and other outcomes (e.g. increase in crash risk).

Table 9-1: Lists of improvement projects and studies categorised by Stage (note some projects appear in two or more stages consisting of the studies and the implementation of improvements)

Stage 1 – Projects and studies to be undertaken before the CNC opens
Major Road (MR) Upgrades: **MR1 (Cranford Street Clearways)** – Peak Period Clearways along Cranford Street from Innes Road to Berwick Street. **MR2 (Westminster/Cranford Intersection)** – Upgrades to Westminster Street /Cranford Street Intersections. **MR3 (Berwick/Warrington Upgrades) –** Upgrading of Berwick Street /Cranford Street signalised intersection and signalisation of the Forfar Street /Warrington Street and Barbadoes Street /Warrington Street Intersections. **MR4 (South Berwick Upgrades)** –Downstream of Berwick Street arterial upgrade option that comes out of the scoping study. **MR5 (HOV lanes on Cranford-Sherborne)** – Investigate extending the southern HOV (high occupancy vehicle) lanes on the CNC through to Bealey Avenue and installing a northbound HOV lane. **Safe System Community Areas (SSCA):** **SSCA 1 to 9** – Introduce nine 30km/h (or 40km/h) reduced speed limit areas through the downstream local road network **Traffic Calming (TC) Measures:** Introduce traffic calming on **TC1 – Mersey Street (Innes Road to Forfar** Street**), TC2 – Knowles** Street**, TC 3 – Weston** Road**, TC 4 – McFaddens Road, TC7 – Malvern Street (LILO) and TC8 – Dee Street (LILO)** **Safe Access to Schools (AS):** **AS1 – Safe Access Across Cranford Street** – This study will look at a range of options, including a new mid-block signalised crossing across Cranford Street near the English Park Carpark entrance. **AS2 – Interim Improvements on Cranford Street** – As an interim measure it is suggested that as part of **MR1 (Cranford Clearways)** and **MR2 (Westminster/Cranford Intersection)** a 40km/h speed limit be introduced during school arrival and departure time on Cranford Street from approximately 50m north of Westminster Street to 50m south of Berwick Street, a coloured surfacing be installed at the Westminster/Cranford Intersection, and left turning red arrows be used as protection for crossing pedestrians.

Safe Cycling Routes (SC):

SC1 (Cycle Wayfinding Signage) – Development of and implementation of a wayfinding signage plan that directs cyclists at the northern end of Cranford Street (at McFaddens Road) and southern end of Cranford Street to safer cycling routes.

SC2 (McFaddens Road Secondary Cycle Corridor) – Undertake a route study of a cycling route both west (towards the Papanui Parallel) and east (towards new north south route) on McFaddens Road.

SC3 (Westminster/Courtenay Secondary Cycle Corridor) – Undertake a route study of a cycling route both west and east of Cranford Street.

SC4 (Edgeware Road Secondary Cycle Corridor) – Undertake a route study of a cycling route both west and east of Cranford Street.

SC5 (North-South Secondary Cycle Corridor) – Undertake a route study of an alternative north-south cycle route through traffic calmed streets to the east of Cranford Street.

Stage 2 – Projects and Studies that need to be undertaken within three years of CNC opening

Traffic Calming (TC) Measures:

Introduce traffic calming on **TC9 – Roosevelt Avenue, TC12 - Caledonian Road, TC13 - Edgware Road (Village), TC14 – Manchester Street and TC15 - Westminster** Street **/Courtenay** Street, where expected increases in traffic volumes are validated by the monitoring data.

Safe Access to Schools (AS):

AS1 – Safe Access Across Cranford Street – Implement any options identified in this study such as a new mid-block signalised crossing across Cranford Street near the English Park Carpark entrance.

Safe Cycling Routes (SC):

SC2 (McFaddens Road Secondary Cycle Corridor) – Construct a secondary cycling route both west (towards the Papanui Parallel) and east (towards new north south route) on McFaddens Road.

SC3 (Westminster/Courtenay Secondary Cycle Corridor) – Construct a secondary cycling route both west and east of Cranford Street.

SC4 (Edgeware Road Secondary Cycle Corridor) – Construct a secondary cycling route both west and east of Cranford Street.

Access to Parks (AP):

AP1 (St Albans Park Access Plan) – Development of a plan that will look at access to the park by pedestrians (of different abilities), cyclists, and motorists.

AP2 (Malvern/Rugby Park Access Plan) – Development of a plan that will look at access to the park by pedestrians (of different abilities), cyclists, and motorists.

Access to Commercial Centres (AC):

AC1 – Westminster/Cranford Local Activity Centre Transport Study. Undertake study that will consider safe access to this activity centre by pedestrians, cyclists, and motorists.

AC2 – Barbadoes/Warrington Local Activity Centre Transport Study. Undertake study that will consider safe access to this activity centre by pedestrians, cyclists, and motorists.

AC3 – Barbadoes/Edgeware Local Activity Centre Transport Study. Undertake study that will consider safe access to this activity centre by pedestrians, cyclists, and motorists.

AC3 – Rutland Street Local Activity Centre Transport Study. Undertake study that will consider safe access to this activity centre by pedestrians, cyclists, and motorists.

AC4 – Westminster/Courtenay Corridor Study (Rutland to Forfar) – Undertake this study which will focus on safe access by pedestrians along the route and crossing the route especially for vulnerable road users.

AC5 – Edgware Corridor Study (Springfield to Barbadoes) – Undertake this study which will focus on safe access by pedestrians along the route and crossing the route especially for vulnerable road users.

Stage 3 – Projects that could be undertaken any time between the opening of the CNC and 2031

Monitoring

Ongoing monitoring of traffic, pedestrians and cycle volumes, crashes and vehicles speeds, emissions, noise and vibration on major roads and some local streets is to occur annually, or when required more often, after the CNC opens to validate the plans and projects already identified in this document, and through the various studies that are specified.

It is expected that additional interventions will be required to avoid, remedy or mitigate the effects of the additional CNC traffic, including the impact of trucks, that is identified in this monitoring. In terms of local streets, intervention is required if the traffic volumes increase by 30% above what might have been expected on the route if the CNC had not been built. In terms of other interventions (e.g. arterial upgrades) this will be the result of congestion or safety concerns with respect to all road users. Some improvement may also not be required (e.g. if local road traffic does not increase by 30%, as predicted by the modelling). Consultation on all proposed changes will be undertaken.

An indication of Stage 3 improvement projects is provided below. This list will need to be reviews and where necessary revised once the actual impacts of the CNC traffic is known from the monitoring.

Traffic Calming (TC) Measures:

Introduce traffic calming only where monitoring indicates high levels of rat-running are occurring (may include additional streets): **TC – 5 McFadden, Knowles, Weston (east Cranford), TC6 – Jameson, TC10 – Forfar Street, TC11 – Flockton Street, TC16 – Severn Street, TC17 – Thames Street, TC 18 – Aylesford Street, TC19 – Kensington Avenue, TC 20 – Philpotts Road and TC 21- Francis Avenue.**

Safe Cycling Routes (SC):

SC5 (North-South Secondary Cycle Corridor) – Construct an alternative north-south cycle route through traffic calmed streets to the east of Cranford Street.

Access to Parks (AP):

AP1 (St Albans Park Access Plan) – Implementation of the access plan as required to address access issues.

AP2 (Malvern/Rugby Park Access Plan) – Implementation of the access plan as required to address access issues.

Access to Commercial Centres (AC):

AC1 – Westminster/Cranford Local Activity Centre Transport Study. Implement study recommendations

AC2 – Barbadoes/Warrington Local Activity Centre Transport Study. Implement study recommendations.

AC3 – Barbadoes/Edgeware Local Activity Centre Transport Study. Implement study recommendations

AC3 – Rutland Street Local Activity Centre Transport Study. Implement study recommendations

AC4 – Westminster/Courtenay Corridor Study (Rutland to Forfar) – Implement study recommendations.

AC5 – Edgeware Corridor Study (Springfield to Barbadoes) – Implement study recommendations

Appendices

Appendix A Downstream Effects and Property Traffic Management Plan

1. Introduction and Purpose

1.1. Christchurch City Council (**Council**) lodged an application for a Notice of Requirement (**NoR**) for the Northern Arterial Extension and Cranford Street Upgrade (**NAE/CSU**) in October 2013. As part of that application, on 3 November 2014, the Council lodged a report: Northern Arterial Extension and Cranford Street Upgrade Transport Assessment Addendum (**TAA**).

1.2. The TAA reported on the Christchurch Northern Corridor and included an assessment that, at the city end of that corridor, more traffic is expected to use Cranford Street than would be the case without the Project. The principal reason for this anticipated increase in use is re-routing traffic within the Christchurch Northern Corridor to benefit from the improved travel conditions provided by the NZ Transport Agency's Northern Arterial, and the Council's NAE/CSU.

1.3. While the project, and the full Christchurch Northern Corridor is considered by the Council to be necessary to deliver a wide range of outcomes for the urban form, shape and growth for northern Christchurch and Waimakariri District, additional traffic may have potential adverse effects on residences and businesses in the immediate area around the southern end of the NAE/CSU (referred to as "**downstream effects**" in this Management Plan). In particular, more vehicles may travel on adjacent or nearby roads which were not the subject of any improvement or upgrading as part of the NoR application.

1.4. The modelling used for the NoR predicts what will happen at 2031 so long as the modelled assumptions are borne out. The TAA recommends continued investigation of the downstream effects of the Christchurch Northern Corridor (i.e. NAE/CSU) with the following objectives:

(a) To identify preferred vehicle access routes, particularly for trucks, between the end of the Christchurch Northern Corridor and the Central City (that is between the end of the NAE/CSU and the City centre); and
(b) To identify strategies to keep vehicles on preferred vehicle access routes; and
(c) To discourage vehicles away from public transport routes and walking or cycling routes such as the Main North Road / Papanui Road and Rutland Street corridors respectively.

1.5. This Management Plan is to ensure downstream effects are appropriately managed and to:

(a) Assess the existence, nature and extent of any increased traffic on streets adjacent to, or adjoining Cranford Street attributable to the NAE/CSU that might cause or contribute to a loss of service to any of these streets for up to 10 years after the opening date of the NAE/CSU;
(b) Implement measures to avoid, remedy or mitigate such effects, where these are more than minor, in a timely and cost-effective manner and where appropriate and practicable; and
(c) Monitor the efficacy of the measures for an appropriate period and implement further remedial action, if this is necessary and appropriate.

1.6. Some traffic increase can be expected if development to the north of Christchurch continues to grow or exceeds present expectations, whether or not the NAE/CSU project proceeds. For the avoidance of doubt, this Management Plan is to identify any adverse traffic effects that arise between the commissioning date of the NAE/CSU (expected to be approximately 2021) and up to ten years after that opening date (referred to in this Management Plan as the "**Commissioning Period**"). If any adverse effects are identified, a response to appropriately-manage these adverse effects, within this Commissioning Period will be considered and implemented.

1.7. The precise areas to be covered under this Management Plan will be established as part of the methodology referred to below. The methodology will assess the existence, nature and extent of any increased traffic attributable to the NAE/CSU on a number of streets at the southern end of the NAE/CSU including, but not limited to Mersey Street, Malvern Street, Roosevelt Avenue, Severn Street, Dee Street, Weston Road, Knowles Street and McFaddens Road (**potentially adversely affected streets**).

1.8. For the avoidance of doubt, while these listed streets are described as potentially adversely affected streets, this Management Plan is not confined to those streets, nor does it mean all of these listed streets will be adversely affected.

2. Appointment and Methodology

2.1. Prior to operating the NAE/CSU the Council will appoint an independent expert who is a suitably qualified traffic engineer to investigate and design an appropriate methodology to identify the potential impacts (if any) on those streets at the end of the Christchurch Northern Corridor which may be potentially affected as a result of the operation of the NAE/CSU.

2.2. That methodology is to apply commonly accepted professional standards to assess traffic-related effects and, for the avoidance of doubt, will include procedures to:

(a) Identify and confirm all streets adjacent to or adjoining Cranford Street affected by the operation of the NAE/CSU;

(b) Assess the current level of vehicle usage and service of each of the potentially adversely affected streets in proximity to the southern end of the NAE/CSU;

(c) Include modelling where appropriate to identify the anticipated future increase in the use of potentially affected streets that may be caused by, or attributable to, the operation of the NAE/CSU;

(d) Consider the extent of and effects (if any) arising from such growth in traffic flows, on those potentially affected streets that are reasonably attributable to the operation of the NAE/CSU;

(e) Recommend appropriate mitigation measures (where an increase in traffic-related effects within potentially adversely affected streets, is caused by or contributed to by the NAE/CSU) to Council and, where required, the local community board (if the community board holds the requisite delegation for Council for any of the traffic calming works required) as soon as practicable, and institute monitoring procedures to verify the outcome of the mitigation measures; and

(f) Recommend further remedial steps to Council and, where required, the local community board (if the community board holds the requisite delegation for Council for any of the traffic calming works required) (under 3.1 below) if monitoring confirms a continued increase in adverse traffic-related effects on the affected streets that is more than minor.

2.3 Any appropriate mitigation measures may be delivered on an iterative basis that is by first assessing the efficacy of an initial stage of mitigation measures before undertaking a further stage or stages of mitigation measures.

2.4 Where monitoring is required that monitoring must be completed within six months from the completion of the mitigation works.

2.6 The independent expert will support and where necessary, assist Council with consultation and/or the communication required as part of this management Plan.

3. Recommendation to Council

3.1. The independent traffic expert recommendation to Council must include appropriate remedial steps to be taken to avoid, remedy or mitigate any increase in adverse traffic-related effects where such effects are more than minor, identified under the methodology as being caused by or attributable to the operation of the NAE/CSU. This may include but is not limited to:

(a) Measures to improve the operation of Cranford Street and Sherborne Street, including capacity measures such as peak hour clearways;

(b) The introduction of speed restrictions in some or all affected streets;

(c) The introduction of chicanes in some or all affected streets;

(d) The introduction of speed bumps in some or all affected streets;

(e) Any other suitable traffic calming mechanisms, including those identified within the Council's Infrastructure Design Standard.

3.2 The remedial steps may include a programmed series of measures to be delivered over time, with the intention that any recommended remedial steps must be taken as soon as reasonably practicable after that recommendation is made. All remedial steps must be completed within the Commissioning Period.

4. Work to be Carried Out by Council

4.1. If the independent traffic expert determines that the increase in traffic to be experienced prior to the expiry of the Commissioning Period that is caused by or attributable to the operation of the NAE/CSU, is likely to raise or has raised the level of vehicle movements on any of the potentially affected streets by more than 30 per cent above the traffic level that would have occurred without the operation of the NAE/CSU then measures to improve the operation of Cranford Street and Sherborne Street and/or calming work will be undertaken by the Council as recommended.

4.2. Any calming work may be undertaken iteratively, (that is by first assessing the efficacy of an initial stage of calming work before undertaking a further stage or stages of calming work). In such a situation the monitoring previously undertaken must be repeated within six months of each stage of calming work being completed. This further monitoring is to assess whether further or other calming work is needed.

4.3. For the avoidance of doubt no calming work will need to be investigated or carried out unless the NAE/CSU has raised the level of vehicle movements by more than 30 per cent above the traffic level that would have occurred without the operation of the NAE/CSU. Further, the purpose of any calming work undertaken is to mitigate (effects from) any increased traffic movement to an acceptable level but does not mean a requirement to reduce traffic movements or their effects to the levels occurring prior to the opening date of the NAE/CSU.

4.4. The desired outcome of this Management Plan is to, within the Commissioning Period, avoid, remedy or mitigate downstream traffic effects, such that they are no more than minor. The Council shall take all practicable steps to ensure any works reasonably-necessary to achieve this outcome are completed within that time.

4.5. Where traffic calming work is recommended Council will consult with:

4.5.1. Residents of the streets where traffic calming measures are proposed to be taken;

4.5.2. Canterbury District Health Board;

4.5.3. Mairehau Primary School, Our Lady of Fatima School, Paparoa Street Primary School, St Albans Catholic Primary School and St Albans School;

4.5.4. St Albans Residents Association and Mairehau Community Trust; and

4.5.5. Cyclists through Spokes;

4.6. Consultation shall include the distribution of a newsletter including feedback form prior to the review.

5. Communication with Residents

5.1. Prior to operating the NAE/CSU, the Council shall prepare and implement a Communication Plan that sets out procedures detailing how the public and stakeholders will be communicated with throughout the Commissioning Period. As a minimum, the Communication Plan shall include:

5.1.1. Details of a public liaison person including contact details;

5.1.2. Methods to inform and to communicate details to property owners and occupiers within potentially affected streets of the recommendations from the independent traffic expert and any proposed mitigation measures to be carried out by Council;

5.1.3. Methods to deal with any concerns raised by property owners or occupiers; and

5.1.4. Monitoring and review procedures for the Communication Plan.

5.2 Owners and occupiers of properties on streets identified by the independent traffic expert as requiring mitigation measures shall be:

5.2.1 Advised of the recommendations of the independent traffic expert under clause 3, including proposed mitigation measures, within 30 working days following the provision of the recommendation to the Council;

5.2.2 Provided a period of 20 working days to comment on the proposed mitigation measures; and

5.2.3 Advised by Council of the final mitigation measures to be implemented, at least 20 workings days prior to commencement of any works.

Appendix B

Cranford Street (north of Innes Road) Details

Figure B-1: Cranford Street Changes (Source: https://www.nzta.govt.nz/assets/projects/christchurch-northern-corridor/CNC-Project-Update-Cranford-Street-August-2017.pdf)

Appendix C Existing Traffic Flow and Crash Record

There is currently in excess of 20,000 vehicles per day on Cranford Street north of Berwick Street (2017). Warrington Street (2013) and Berwick Street (2014) have traffic counts of 10,790 and 12,326 vehicles per day respectively. Madras Street and Barbadoes Street have traffic counts of 8,274, and 8,191 vehicles per day (in 2016). The counts presented here are reasonably recent. Older counts are also available however become less useful over time.

Crash Record

Given the large area impacted by traffic from the CNC we have referred to aggregated crash maps from Urban KiwiRAP (New Zealand Road Assessment Programme). Urban KiwiRAP uses estimate death and serious injury equivalents along with distance (risk per kilometre for collective risk). It is a useful tool to examine safety risks comparative to the rest of the transport network, including other cities in New Zealand. Sections with high and medium-high risk are the key areas of focus.

An interrogation of Urban KiwiRAP data highlighted corridors that currently experience high numbers of crashes; either by kilometre (collective risk), or by number of vehicles (personal risk) in the study area.

Figure C-1: Collector Risk Map (Source: https://roadsafetyrisk.co.nz/maps/collective-risk#Canterbury)

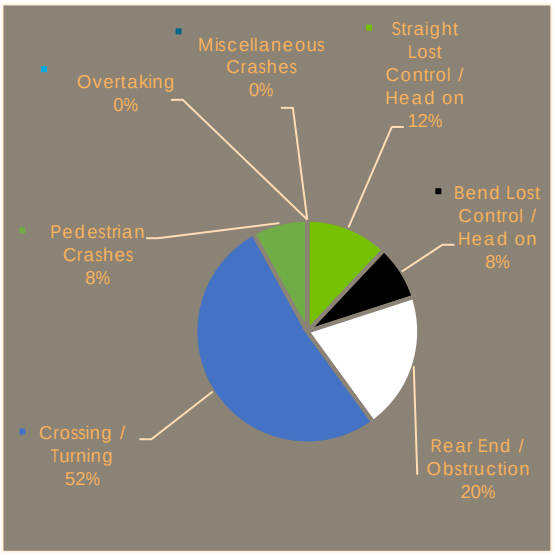


Figure C-2: Death and Serious Injury by Movement Type (2013-2017)

The Collective Crash Risk[25] in the vicinity of Cranford Street for 2012-2016 is shown in Figure C-2 (note the maps have been filtered so that only the High and Medium-High risk corridors are shown). The streets with the highest risk[26] that relate most directly to the potential downstream effects are Cranford Street (to Edgeware Road), Innes Road, and Madras Street. It is typical that the highest volume routes have the greatest concentration of crashes, and so this is to be expected.

For the period 2012-2016 there are few routes in the study area with a high Personal Risk (this is the risk per vehicle going down each street). The only routes that have medium-high crash risks are Malvern Street, Westminster Street (west of Cranford) and Edgeware Road through and either side of the Edgeware village. Improvements to these routes should consider local safety risks.

[25] The highest collective risks are often located on streets with the higher traffic volumes

[26] Note that the maps present a risk that aggregates the crash history over the length of the road section selected, and that these sections have not been created to only constitute streets directly affected by CNC. For example, the Madras Street section length extends from Warrington Road to Gloucester Street.

Figure C-2 shows the existing incidence of crashes and DSI within the project area. The majority of DSI crashes involved turning or crossing traffic mainly at intersections. Hence particular attention needs to be given to the design of intersections.

Crash heat maps for the period of 2012-2016 period are shown in Figures C-3 to C-6.

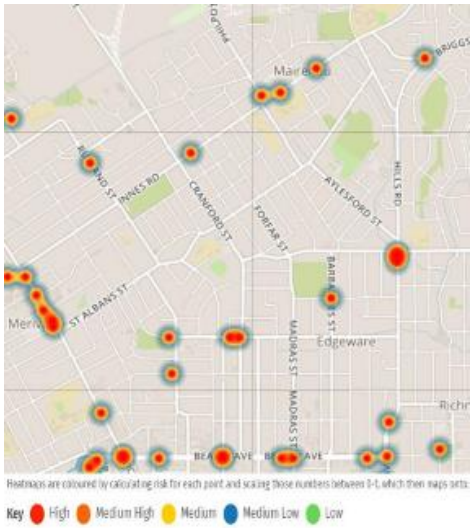


Figure C-3: Pedestrian (Source: https://roadsafetyrisk.co.nz/maps/heat-maps#-43.50249565148537,172.6360273361206,15)

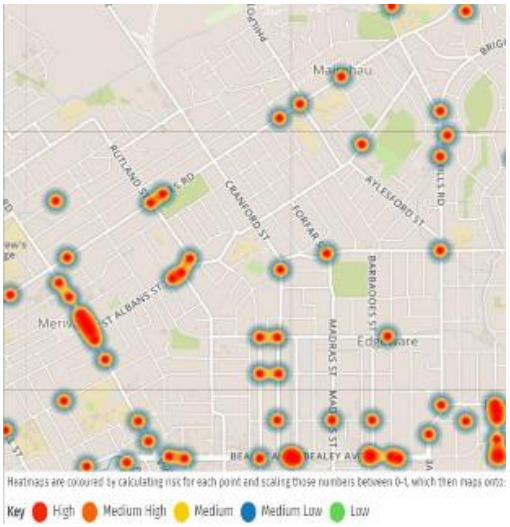


Figure C-4: Cyclist (Source: https://roadsafetyrisk.co.nz/maps/heat-maps#-43.50249565148537,172.6360273361206,15)

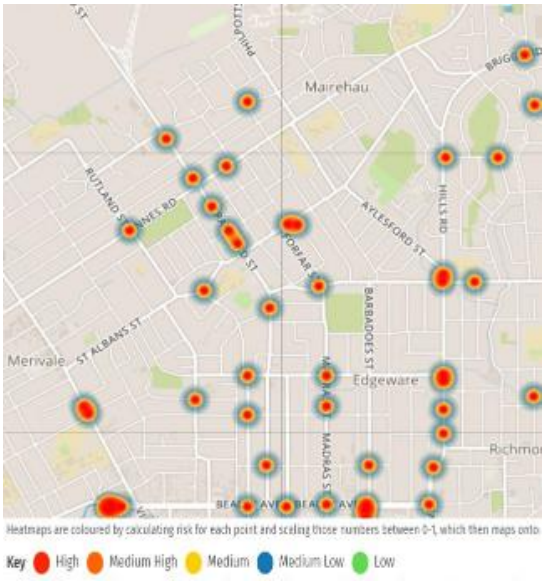


Figure C-5: Motorcyclist (Source: https://roadsafetyrisk.co.nz/maps/heat-maps#-43.50249565148537,172.6360273361206,15)

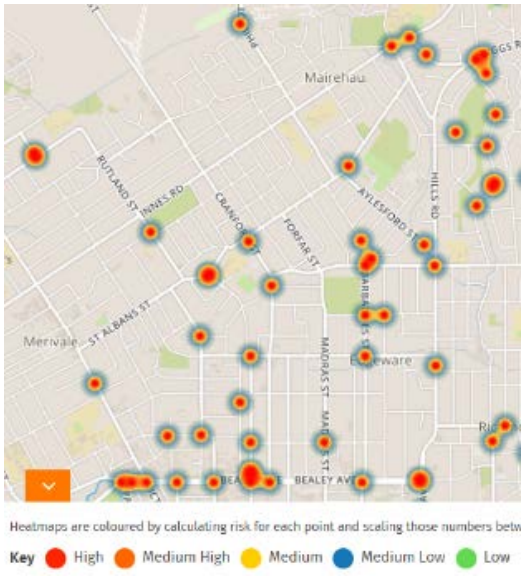


Figure C-6: Speed (https://roadsafetyrisk.co.nz/maps/heat-maps#-43.50249565148537,172.6360273361206,15)

In terms of vulnerable users Cranford Street has experienced a higher amount of motorcycle crashes than most other nearby streets.

Pedestrian crashes have occurred east of Cranford Street on Innes Road (near school crossing), and also around Edgeware Village and near St Albans Park. In total there were 11 pedestrian (including one mobility) crashes that occurred in the study area in the period of 2013-2017. Of these 2 were minors, and 3 were older than 65. The crashes resulted in 2 DSI (8% of the DSI) which is lower than the national average[27] for 2016 (10%).

[27] National data for pedestrians and cyclists obtained from: https://www.transport.govt.nz/resources/road-safety-resources/roadcrashstatistics/motorvehiclecrashesinnewzealand/motor-vehicle-crashes-in-new-zealand-2016/

There were 3 recorded cyclist DSI in the study area (12.5% of the DSI), which is higher than the national average of 6.2% for 2016. Cyclist crashes have generally occurred south of Westminster Street.

Figure shows crashes that had speed as a main factor. Cranford Street performed relatively well compared with other major roads, except around the Westminster Street / Cranford Street intersection, and immediately south of the Berwick Street / Cranford Street intersection. Locations were speeds was a bigger factor include Barbadoes Street between Edgeware Road and Warrington Street, and Flockton Street. This may be a result of the current wide lanes on these roads and the unsignalised Barbadoes/ Warrington intersection.

The pre-CNC crash data will form an important part of monitoring the crash effects of the CNC.

Table C-1: Selection of Existing Vehicle Counts (Source: http://ccc.interpret.co.nz/trafficcount/)

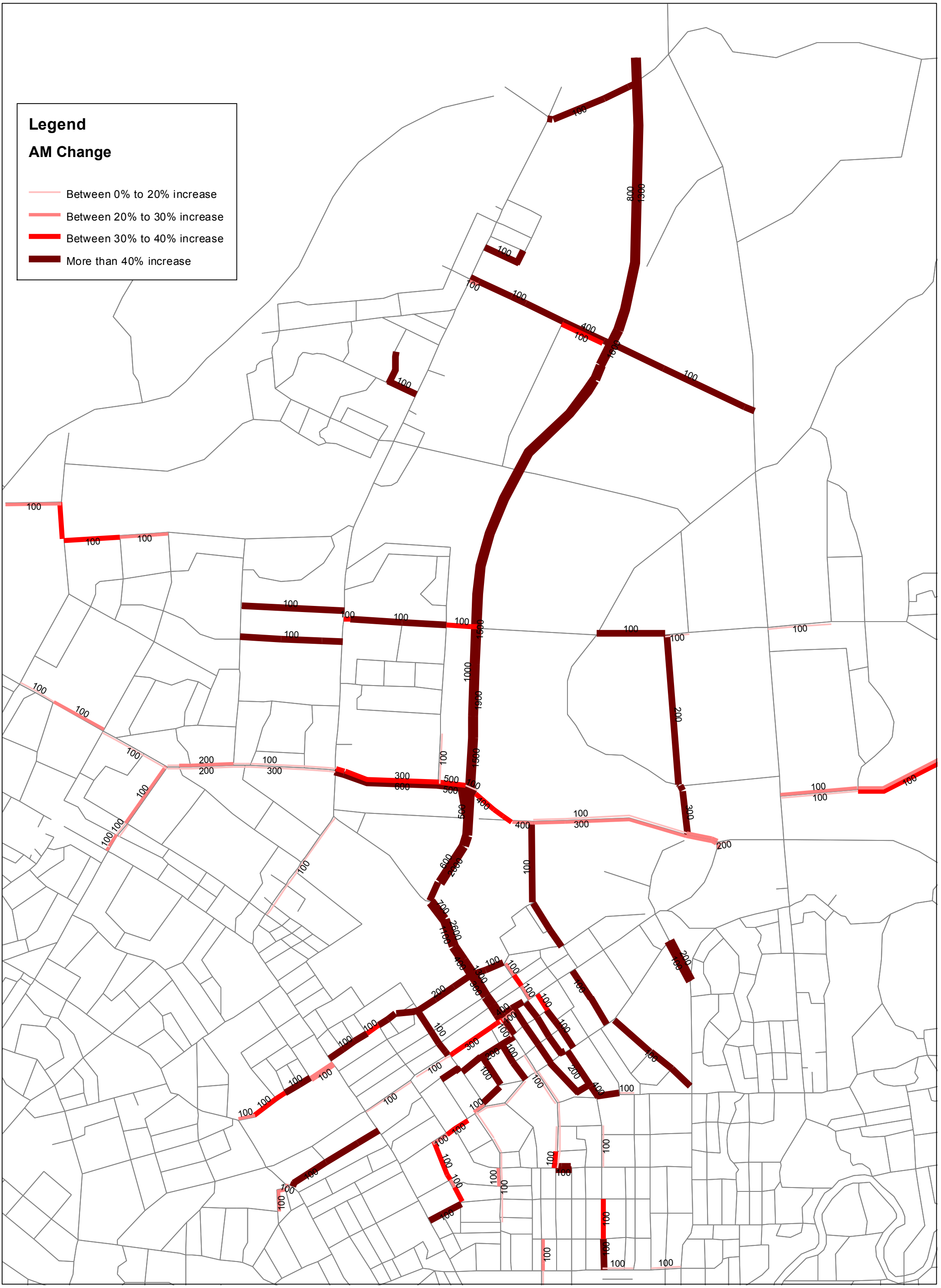
Location	**AADT**
Berwick Street (East of Cranford)	12,326 (2014)
Cranford Street (North of Berwick)	20,596 (2017)
Warrington Street (East of Forfar)	10,790 (2013)
Courtenay Street (NE Trafalgar)	2,632 (2013)
Barbadoes (North of Bealey)	8,191 (2016)
Madras (North of Bealey)	8,274 (2016)
Sherborne (South of Canon)	12,974 (2017)

Appendix D Jacobs Modelling (D1 to D4)

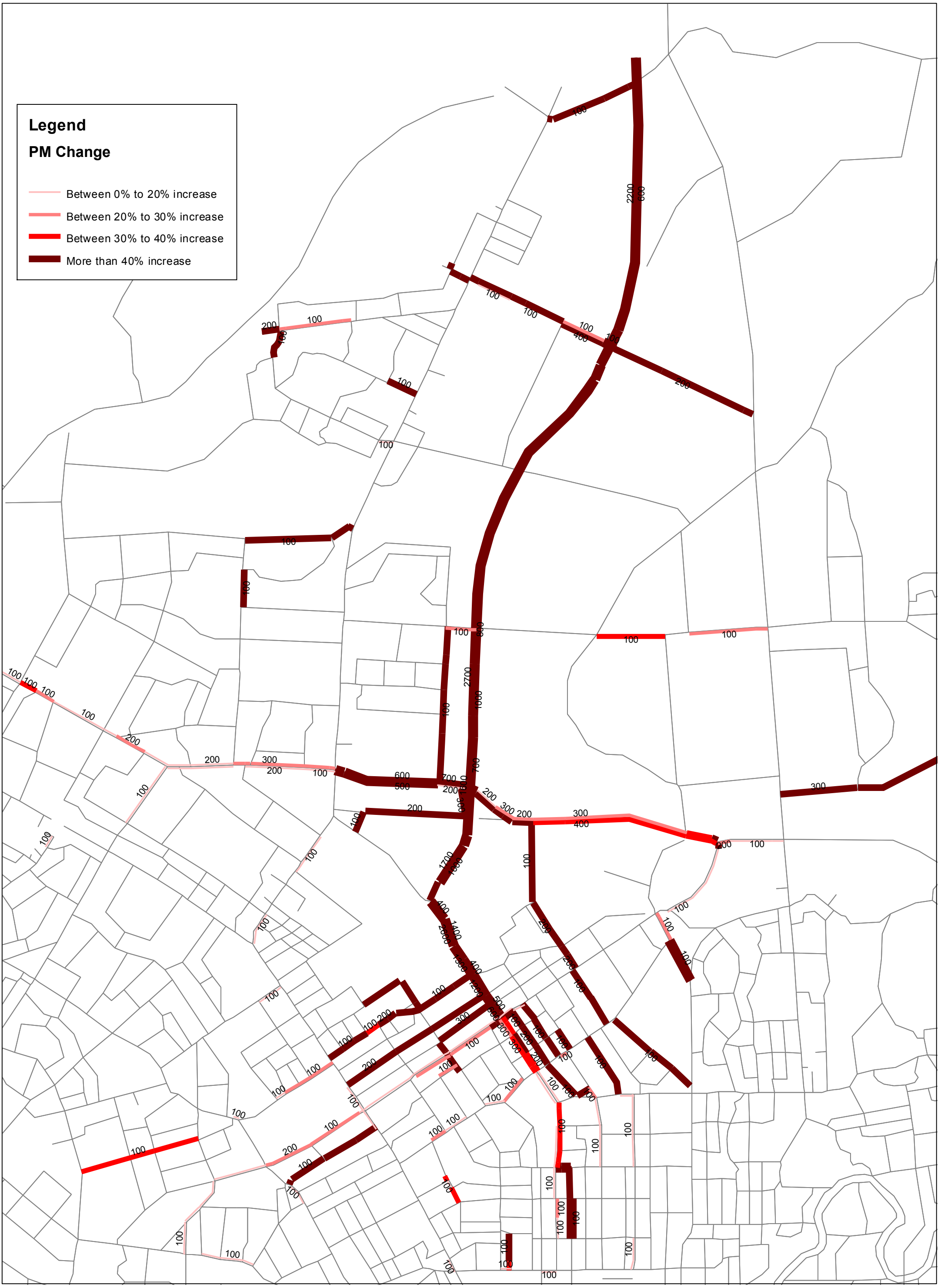
The figures in this appendix are to be viewed with the understanding that traffic modelling has certain limitations. In particular, the predicted changes to low volume roads have more ambiguity due to there being a multitude of route choices.

Further, there are streets that appear in these modelling plots as affected that we do not necessarily believe that effects will occur. This is resultant from a limitation of the modelling tools that they show effects well away from the major network changes. We have made this judgement based on expert knowledge of the network, and monitoring will pick-up any wider effects that are significant.

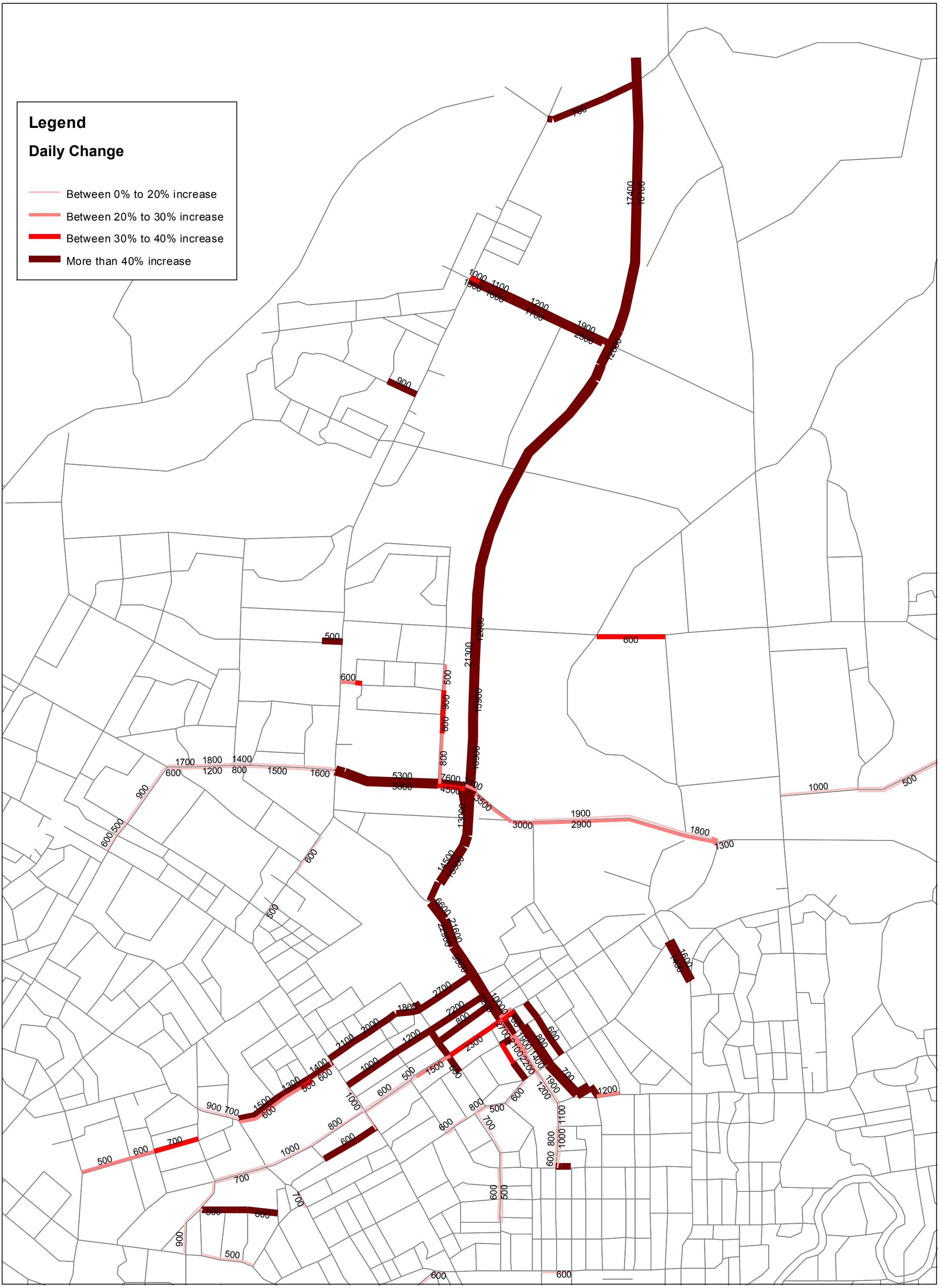
D.1 Do Nothing Change Flow Plots



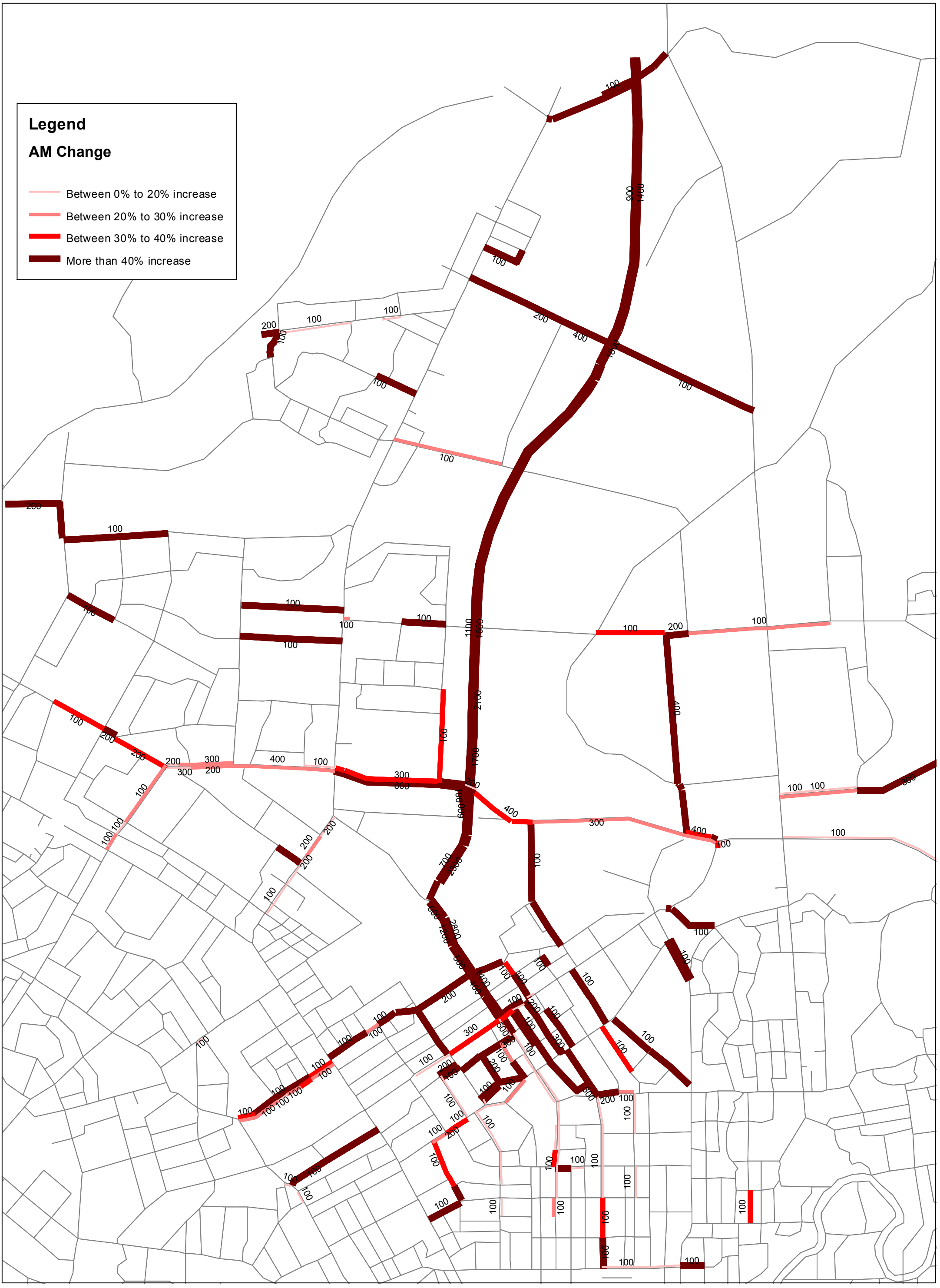
Year 2021: Hourly Traffic Volume Difference (PCUs) - with/without CNC
CNC03 vs NoCNC03 (Differences less than 50 pcu/h are not shown on the plot)



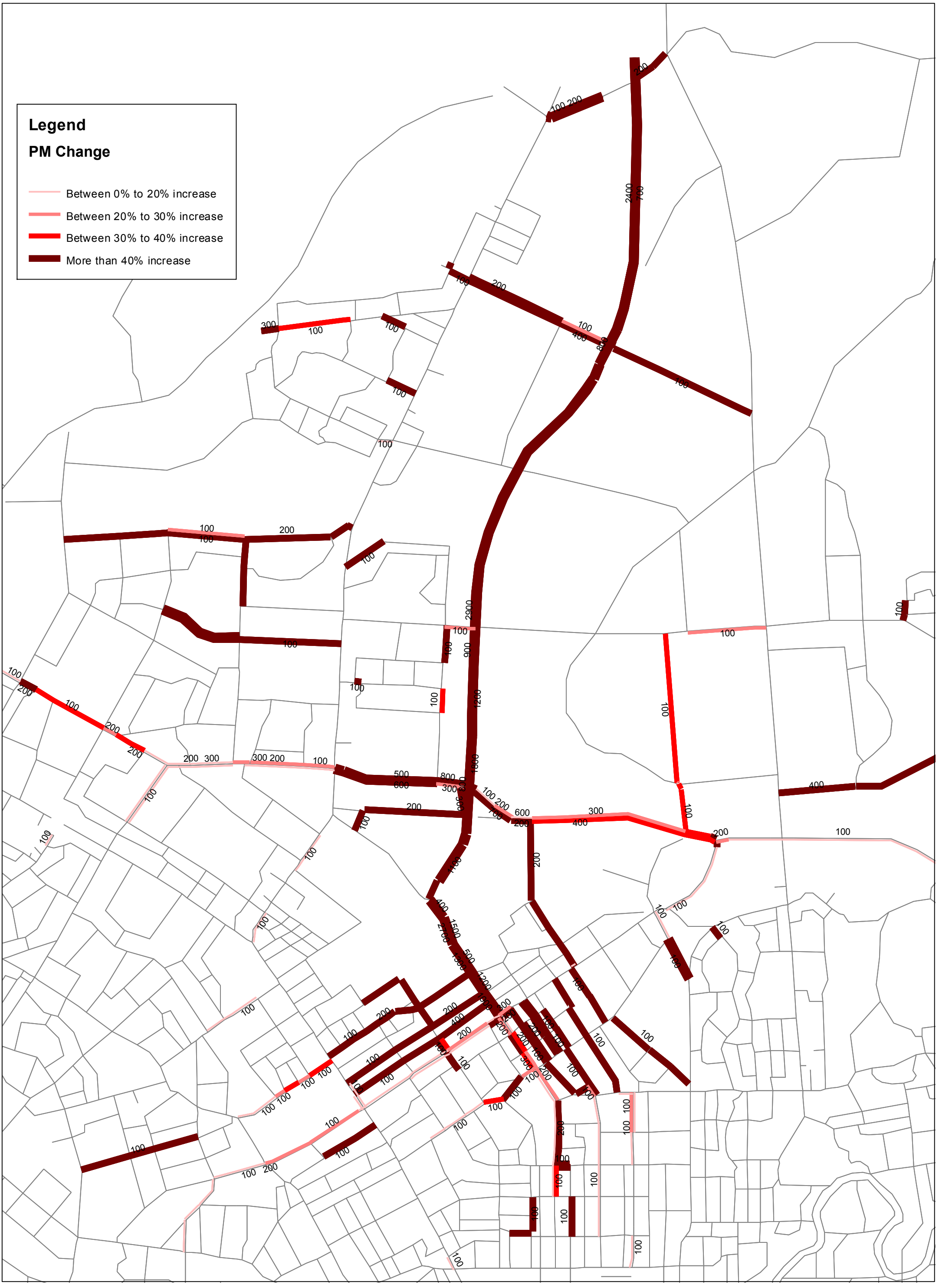
Year 2021: Hourly Traffic Volume Difference (PCUs) - with/without CNC
CNC03 vs NoCNC03 (Differences less than 50 pcu/h are not shown on the plot)



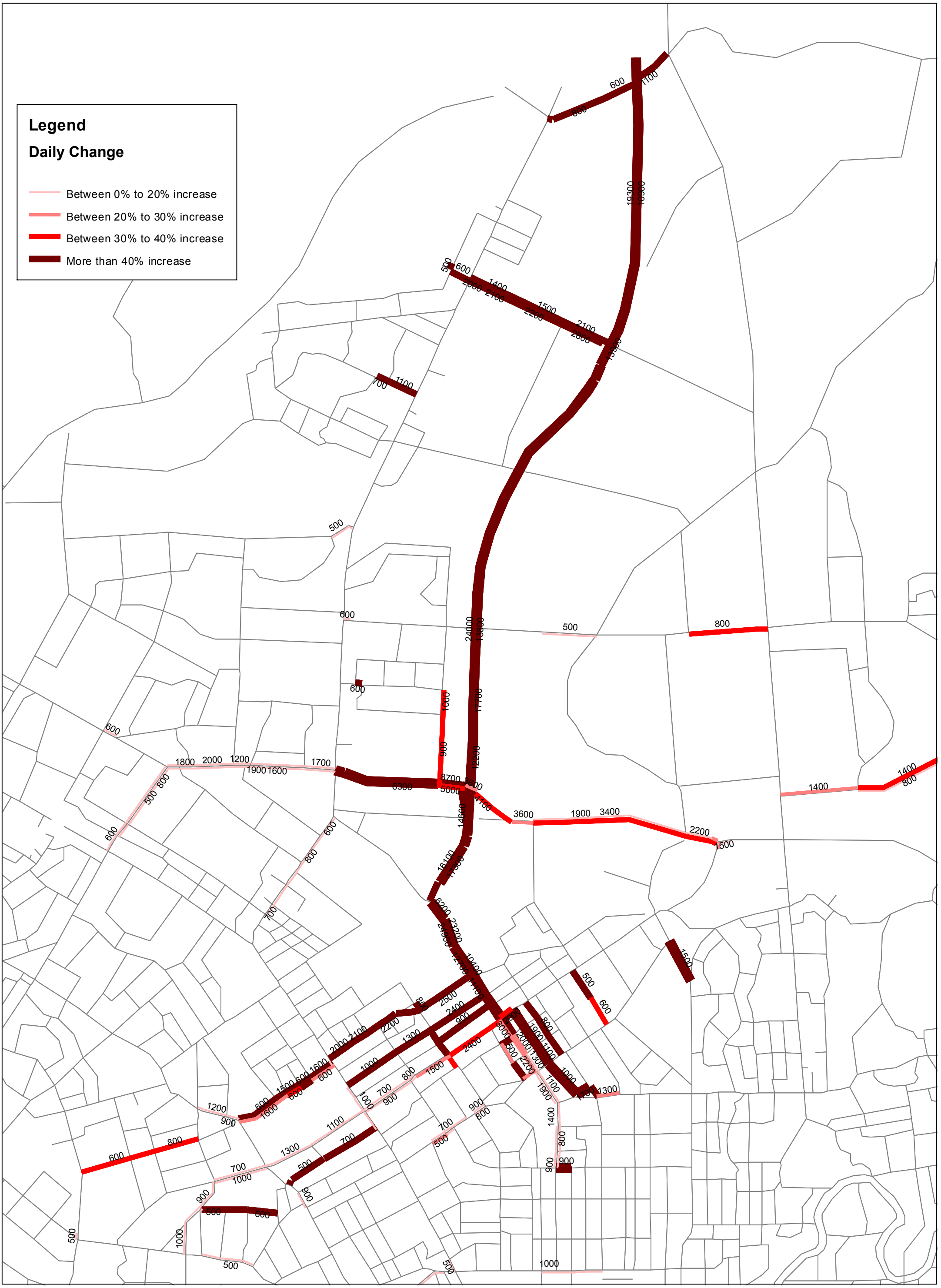
Year 2021: Daily Traffic Volume Difference - with/without CNC
CNC03 vs NoCNC03 (Differences less than 500 vpd are not shown on the plot)



Year 2031: Hourly Traffic Volume Difference (PCUs) - with/without CNC
CNC03 vs NoCNC03 (Differences less than 50 pcu/h are not shown on the plot)



Year 2031: Hourly Traffic Volume Difference (PCUs) - with/without CNC
CNC03 vs NoCNC03 (Differences less than 50 pcu/h are not shown on the plot)



Year 2031: Daily Traffic Volume Difference - with/without CNC
CNC03 vs NoCNC03 (Differences less than 500 vpd are not shown on the plot)

D.2 Traffic Volumes

* zones connected
^ on screenline, not monitored

AADT			DM	DM with CNC	Clearway with CNC	Clearway with CNC (Innes to Bealey & signals)
			NoCNC03	CNC03	CNC04e	CNC04g
			2021			
Screenline	**Location**	**Direction**	**AADT**			
North South 1 (East of Cranford Street/Sherborne Street)	McFaddens Road	EB	1,520	1,518	1,263	1,282
		WB	968	368	324	358
		Total	**2,488**	**1,886**	**1,586**	**1,639**
	Weston Road	EB	292	6	0	0
		WB	439	137	111	128
		Total	**730**	**143**	**111**	**129**
	Knowles St	EB	18	-	-	-
		WB	0	-	-	-
		Total	**19**	**-**	**-**	**-**
	Innes Road	EB	5,947	7,500	6,426	6,560
		WB	6,067	8,282	8,332	8,434
		Total	**12,014**	**15,782**	**14,758**	**14,994**
	Malvern Street	EB	960	187	204	266
		WB	932	182	35	59
		Total	**1,891**	**368**	**239**	**326**
	Dee Street	EB	284	128	98	104
		WB	982	427	273	298
		Total	**1,266**	**556**	**371**	**402**
	Westminster Street	EB	3,247	2,501	2,213	2,447
		WB	2,492	2,109	2,053	2,227
		Total	**5,739**	**4,611**	**4,265**	**4,673**
	Berwick Street	EB	5,943	6,274	8,507	7,335
		WB	4,523	4,775	8,043	5,352
		Total	**10,466**	**11,049**	**16,550**	**12,687**
	Oxley Avenue (not in model)	EB				
		WB				
		Total	**-**	**-**	**-**	**-**
	Winton Street	EB	397	721	364	593
		WB	2,006	1,956	1,012	974
		Total	**2,403**	**2,677**	**1,377**	**1,567**
	Cornwall Street^	EB	45	38	39	40
		WB	893	1,057	208	935
		Total	**938**	**1,096**	**248**	**975**
	Edgware Road	EB	905	1,537	1,538	1,769
		WB	1,027	1,401	1,668	2,459
		Total	**1,932**	**2,937**	**3,206**	**4,229**
	Canon Street	EB	2,076	1,873	1,720	1,478
		WB	2,855	2,756	2,165	2,687
		Total	**4,932**	**4,629**	**3,885**	**4,166**
	Purchas Street	EB	2,715	2,583	3,005	2,182
		WB	3,987	3,965	3,591	3,235
		Total	**6,701**	**6,548**	**6,596**	**5,417**
North South 2 (West of Cranford Street/Sherborne Street)	McFaddens Road*	EB	1,644	4,357	4,439	4,228
		WB	2,160	1,621	1,699	1,618
		Total	**3,804**	**5,978**	**6,137**	**5,846**
	Weston Road*	EB	479	2,655	2,389	2,473
		WB	182	76	88	78
		Total	**661**	**2,731**	**2,478**	**2,550**
	Knowles St*	EB	13	796	705	612
		WB	10	-	-	-
		Total	**24**	**796**	**705**	**612**
	Innes Road	EB	6,381	5,785	5,765	5,787
		WB	7,222	9,518	9,243	9,229
		Total	**13,603**	**15,303**	**15,008**	**15,016**
	Malvern Street	EB	2,210	1,962	1,703	1,706
		WB	649	1,071	566	541
		Total	**2,859**	**3,032**	**2,270**	**2,247**
	Westminster Street	EB	404	632	694	614
		WB	424	500	498	466
		Total	**828**	**1,132**	**1,192**	**1,081**
	Courtenay Street	EB	3,196	3,617	3,522	3,732
		WB	4,700	5,269	4,700	4,530
		Total	**7,896**	**8,886**	**8,222**	**8,262**
	Edgware Road	EB	1,037	1,228	1,247	1,476
		WB	2,068	2,253	2,698	2,212
		Total	**3,105**	**3,481**	**3,944**	**3,689**
	Canon Street	EB	2,473	2,179	2,390	1,669
		WB	2,093	1,877	1,921	1,453
		Total	**4,566**	**4,056**	**4,311**	**3,122**
	Purchas Street	EB	5,806	5,470	5,510	4,841
		WB	2,348	2,154	2,594	1,492
		Total	**8,153**	**7,624**	**8,104**	**6,333**
	Rutland Street	NB	1,897	4,379	4,096	3,997
		SB	1,872	2,131	2,219	2,222
		Total	**3,769**	**6,510**	**6,314**	**6,219**

East West 1 (North of Innes Road)	Cranford Street	NB	10,381	16,819	17,787	17,502
		SB	10,513	20,536	20,997	21,051
		Total	**20,894**	**37,355**	**38,784**	**38,552**
	Jameson Avenue	NB	1,091	964	969	966
		SB	1,391	1,433	1,259	1,266
		Total	**2,482**	**2,397**	**2,228**	**2,232**
	Nancy Avenue	NB	283	179	152	182
		SB	346	229	236	196
		Total	**630**	**407**	**388**	**378**
	Philpotts Road	NB	1,705	1,774	1,602	1,611
		SB	1,353	222	197	181
		Total	**3,057**	**1,995**	**1,798**	**1,792**
East West 2 (South of Innes Road)	Papanui Road	NB	9,280	9,468	9,308	9,304
		SB	8,616	8,346	8,274	8,308
		Total	**17,896**	**17,814**	**17,582**	**17,612**
	Browns Road	NB	1,596	1,358	1,385	1,396
		SB	1,615	1,569	1,475	1,495
		Total	**3,211**	**2,927**	**2,860**	**2,891**
	Somme Street*	NB	1,103	1,142	932	887
		SB	1,218	1,476	1,397	1,302
		Total	**2,321**	**2,618**	**2,329**	**2,189**
	Rutland Street	NB	3,018	3,419	3,229	3,072
		SB	1,731	1,873	1,938	1,868
		Total	**4,749**	**5,292**	**5,167**	**4,940**
	Gosset Street (not in model)	NB				
		SB				
		Total	-	-	-	-
	Carrington Street	NB	42	114	109	85
		SB	263	585	311	286
		Total	**305**	**700**	**419**	**371**
	Jacobs Street (not in model)	NB				
		SB				
		Total	-	-	-	-
	Roosevelt Avenue	NB	343	237	208	228
		SB	2,212	3,015	2,102	2,109
		Total	**2,555**	**3,253**	**2,310**	**2,337**
	Cranford Street	NB	9,382	11,522	12,954	12,700
		SB	8,459	10,395	13,667	13,757
		Total	**17,841**	**21,917**	**26,621**	**26,456**
	Mersey Street*	NB	2	1,395	1,450	1,542
		SB	254	1,032	583	662
		Total	**255**	**2,427**	**2,034**	**2,204**
	Severn Street	NB	429	759	451	430
		SB	376	971	269	269
		Total	**805**	**1,730**	**720**	**699**
	Thames Street	NB	559	544	462	488
		SB	470	702	403	466
		Total	**1,029**	**1,246**	**864**	**955**
	Francis Avenue	NB	547	239	123	175
		SB	806	138	128	88
		Total	**1,354**	**377**	**251**	**263**
	Kensington Avenue	NB	1,568	2,067	2,053	2,053
		SB	1,210	1,157	1,142	1,142
		Total	**2,778**	**3,223**	**3,195**	**3,195**
	Mahars Road	NB	609	638	641	614
		SB	699	727	748	728
		Total	**1,308**	**1,364**	**1,389**	**1,342**
	Manuka Street^	NB	28	0	0	0
		SB	0	0	0	0
		Total	**28**	**1**	**1**	**0**
	Hills Road	NB	5,633	4,647	4,672	4,658
		SB	5,611	5,480	5,422	5,520
		Total	**11,244**	**10,127**	**10,094**	**10,178**
West 3 (t Albans Road)	Bristol Street	NB	795	902	711	755
		SB	1,785	2,083	1,802	1,642
		Total	**2,581**	**2,985**	**2,514**	**2,398**
	Gordon Avenue (not in model)	NB				
		SB				
		Total	-	-	-	-
	Abberley Crescent	NB	491	638	625	646
		SB	348	354	346	337
		Total	**839**	**993**	**971**	**983**
	Albany Street (not in model)	NB				
		SB				
		Total	-	-	-	-
	Springfield Road	NB	5,969	6,195	5,869	5,766
		SB	7,673	8,346	7,639	7,490
		Total	**13,642**	**14,540**	**13,507**	**13,257**
	Trafalgar Street*	NB	381	386	381	378
		SB	550	549	536	535
		Total	**931**	**935**	**917**	**913**
	Cranford Street	NB	10,784	11,978	13,388	13,075
		SB	10,147	12,014	15,029	15,337

East (South of St		**Total**	**20,930**	**23,992**	**28,417**	**28,412**
	Mersey Street*	NB	497	1,669	1,478	1,572
		SB	251	960	578	647
		Total	**748**	**2,629**	**2,056**	**2,219**
	Forfar Street*	NB	3,520	2,126	2,313	1,935
		SB	1,487	1,724	796	797
		Total	**5,007**	**3,849**	**3,109**	**2,731**
	Mayfield Avenue (not in model)	NB				
		SB				
		Total	-	-	-	-
	Francis Avenue	NB	131	214	84	135
		SB	1,352	268	154	126
		Total	**1,482**	**481**	**238**	**261**
	Flockton Street*	NB	47	74	56	54
		SB	1,069	1,050	1,072	1,016
		Total	**1,116**	**1,124**	**1,128**	**1,070**
	Aylesford Street	NB	1,559	1,912	1,946	1,946
		SB	1,037	1,072	1,116	1,114
		Total	**2,596**	**2,984**	**3,062**	**3,060**
East West 4 (South of Berwick Street)	Cranford Street	NB	8,557	9,050	6,725	9,314
		SB	6,445	7,531	7,846	9,537
		Total	**15,003**	**16,581**	**14,571**	**18,851**
	Forfar Street	NB	5,414	5,743	10,604	7,107
		SB	4,546	4,691	2,488	3,763
		Total	**9,960**	**10,434**	**13,092**	**10,870**
	Barbadoes Street	NB	1,977	1,974	926	1,034
		SB	5,618	5,701	10,591	6,605
		Total	**7,596**	**7,676**	**11,517**	**7,639**
	Geraldine Street*	NB	16	23	51	189
		SB	18	20	6	8
		Total	**35**	**43**	**57**	**197**
	Cleveland Street	NB				
		SB				
		Total	-	-	-	-
	Woodville Street	NB				
		SB				
		Total	-	-	-	-
	Hills Road	NB	8,770	8,436	8,139	8,347
		SB	8,961	8,601	7,616	8,505
		Total	**17,731**	**17,037**	**15,755**	**16,852**

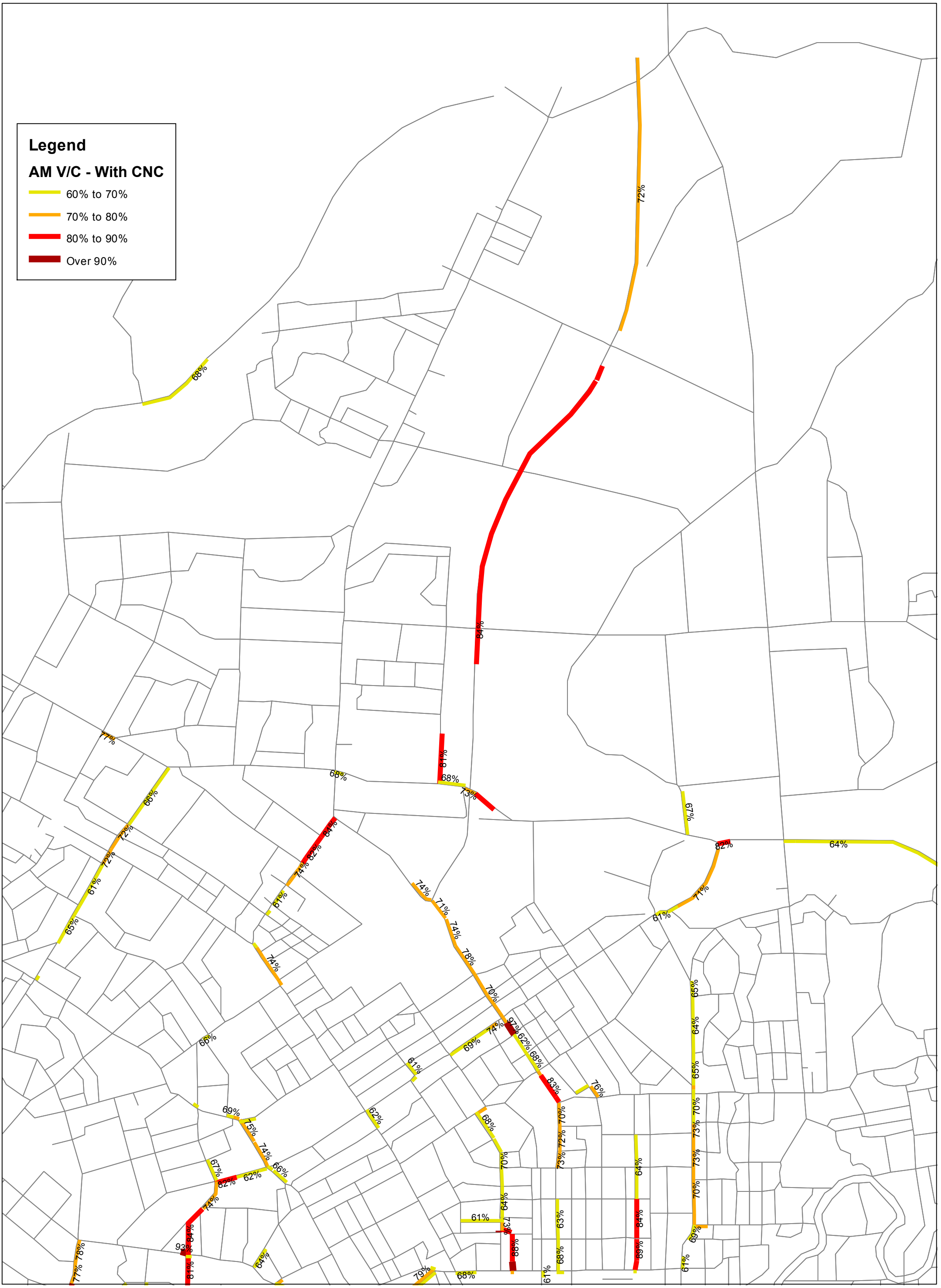
* zones connected
^ on screenline, not monitored

AADT			DM	DM with CNC	Clearway with CNC	Clearway with CNC (Innes to Bealey & signals)
			NoCNC03	CNC03	CNC04e	CNC04g
			2031			
Screenline	**Location**	**Direction**	**AADT**			
North South 1 (East of Cranford Street/Sherborne Street)	McFaddens Road	EB	1,441	1,689	1,448	1,528
		WB	821	300	288	313
		Total	**2,262**	**1,989**	**1,736**	**1,841**
	Weston Road	EB	246	71	1	9
		WB	285	78	68	89
		Total	**532**	**149**	**69**	**98**
	Knowles St	EB	15	-	-	-
		WB	0	0	-	-
		Total	**15**	**0**	-	-
	Innes Road	EB	6,076	8,123	6,761	6,895
		WB	6,239	8,904	8,862	8,924
		Total	**12,316**	**17,027**	**15,622**	**15,819**
	Malvern Street	EB	1,120	168	173	235
		WB	1,042	304	20	49
		Total	**2,162**	**472**	**192**	**285**
	Dee Street	EB	262	110	83	99
		WB	960	424	226	278
		Total	**1,222**	**535**	**309**	**377**
	Westminster Street	EB	3,215	2,514	2,302	2,483
		WB	2,568	2,188	2,143	2,345
		Total	**5,784**	**4,702**	**4,445**	**4,828**
	Berwick Street	EB	5,690	5,796	8,302	6,886
		WB	4,877	5,004	8,202	5,496
		Total	**10,567**	**10,800**	**16,505**	**12,381**
	Oxley Avenue (not in model)	EB				
		WB				
		Total	-	-	-	-
	Winton Street	EB	480	647	397	545
		WB	1,853	1,515	1,041	1,040
		Total	**2,333**	**2,162**	**1,438**	**1,585**
	Cornwall Street^	EB	53	35	43	46
		WB	950	838	153	819
		Total	**1,003**	**872**	**195**	**864**
	Edgware Road	EB	1,282	2,156	1,820	2,300
		WB	1,362	1,908	1,964	2,743
		Total	**2,644**	**4,064**	**3,783**	**5,043**
	Canon Street	EB	2,065	1,841	1,772	1,387
		WB	2,867	2,863	2,196	2,831
		Total	**4,931**	**4,704**	**3,969**	**4,218**
	Purchas Street	EB	2,610	2,357	2,896	1,993
		WB	4,039	3,887	3,688	3,028
		Total	**6,649**	**6,245**	**6,584**	**5,021**
North South 2 (West of Cranford Street/Sherborne Street)	McFaddens Road*	EB	1,785	4,238	4,297	4,231
		WB	2,048	1,434	1,550	1,423
		Total	**3,833**	**5,672**	**5,848**	**5,653**
	Weston Road*	EB	444	2,871	2,916	2,907
		WB	176	44	52	47
		Total	**620**	**2,915**	**2,968**	**2,954**
	Knowles St*	EB	24	899	770	717
		WB	15	-	-	-
		Total	**39**	**899**	**770**	**717**
	Innes Road	EB	6,568	6,239	5,977	6,103
		WB	7,314	9,688	9,472	9,389
		Total	**13,882**	**15,928**	**15,449**	**15,492**
	Malvern Street	EB	2,099	2,066	1,843	1,723
		WB	666	1,159	700	631
		Total	**2,765**	**3,225**	**2,544**	**2,354**
	Westminster Street	EB	534	775	757	698
		WB	539	610	615	581
		Total	**1,073**	**1,386**	**1,372**	**1,279**
	Courtenay Street	EB	3,236	3,630	3,626	3,680
		WB	5,103	5,505	5,135	5,108
		Total	**8,339**	**9,134**	**8,760**	**8,788**
	Edgware Road	EB	1,170	1,417	1,357	1,732
		WB	2,298	2,508	2,829	2,355
		Total	**3,468**	**3,926**	**4,186**	**4,087**
	Canon Street	EB	2,420	2,029	2,335	1,477
		WB	2,168	2,003	2,038	1,582
		Total	**4,587**	**4,033**	**4,373**	**3,058**
	Purchas Street	EB	5,467	5,414	5,299	4,669
		WB	2,349	1,988	2,509	1,384
		Total	**7,816**	**7,402**	**7,808**	**6,053**
	Rutland Street	NB	2,253	4,411	4,297	4,285
		SB	2,097	2,205	2,264	2,285

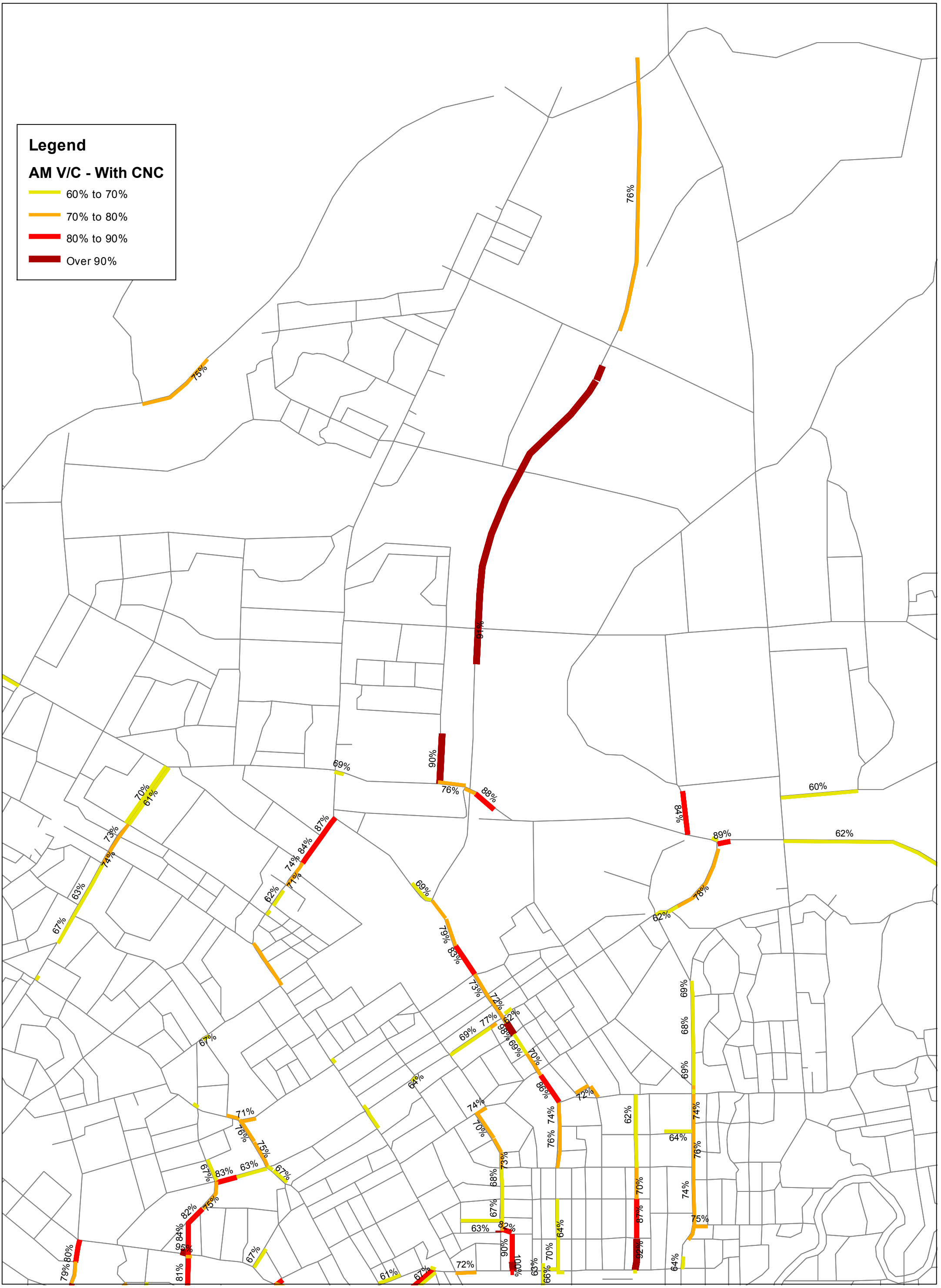
East West 1 (North of Innes Road)		**Total**	**4,350**	**6,615**	**6,561**	**6,570**
	Cranford Street	NB	10,728	18,475	19,069	18,738
		SB	10,852	21,773	22,283	22,287
		Total	**21,580**	**40,249**	**41,353**	**41,025**
	Jameson Avenue	NB	1,351	926	933	929
		SB	1,614	1,694	1,500	1,559
		Total	**2,965**	**2,620**	**2,433**	**2,488**
	Nancy Avenue	NB	289	233	182	235
		SB	347	332	252	235
		Total	**636**	**565**	**433**	**470**
	Philpotts Road	NB	1,726	1,994	1,872	1,825
		SB	1,354	176	162	153
		Total	**3,081**	**2,170**	**2,035**	**1,978**
East West 2 (South of Innes Road)	Papanui Road	NB	9,763	9,805	9,647	9,710
		SB	8,819	8,621	8,565	8,566
		Total	**18,582**	**18,426**	**18,212**	**18,275**
	Browns Road	NB	1,681	1,414	1,349	1,349
		SB	1,731	1,642	1,525	1,528
		Total	**3,412**	**3,056**	**2,875**	**2,877**
	Somme Street*	NB	1,277	1,306	1,150	1,026
		SB	1,287	1,637	1,551	1,470
		Total	**2,563**	**2,944**	**2,702**	**2,495**
	Rutland Street	NB	3,164	3,576	3,391	3,391
		SB	1,929	2,046	2,061	1,980
		Total	**5,093**	**5,622**	**5,452**	**5,371**
	Gosset Street (not in model)	NB				
		SB				
		Total	-	-	-	-
	Carrington Street	NB	38	110	110	85
		SB	209	616	348	298
		Total	**246**	**726**	**459**	**382**
	Jacobs Street (not in model)	NB				
		SB				
		Total	-	-	-	-
	Roosevelt Avenue	NB	435	174	298	243
		SB	2,436	2,984	2,180	2,242
		Total	**2,871**	**3,158**	**2,478**	**2,484**
	Cranford Street	NB	10,013	12,033	13,399	13,186
		SB	8,906	10,877	14,274	14,344
		Total	**18,918**	**22,910**	**27,673**	**27,530**
	Mersey Street*	NB	9	1,900	1,919	2,024
		SB	275	1,438	1,053	1,084
		Total	**284**	**3,338**	**2,972**	**3,108**
	Severn Street	NB	475	868	536	508
		SB	400	1,186	350	419
		Total	**875**	**2,055**	**886**	**927**
	Thames Street	NB	561	589	473	503
		SB	481	816	523	650
		Total	**1,042**	**1,404**	**996**	**1,153**
	Francis Avenue	NB	581	360	211	283
		SB	869	289	142	115
		Total	**1,450**	**649**	**353**	**398**
	Kensington Avenue	NB	1,556	2,129	2,160	2,112
		SB	1,169	1,080	1,066	1,066
		Total	**2,725**	**3,210**	**3,226**	**3,178**
	Mahars Road	NB	713	640	630	614
		SB	679	719	726	705
		Total	**1,392**	**1,359**	**1,356**	**1,319**
	Manuka Street^	NB	110	66	44	1
		SB	0	0	0	0
		Total	**110**	**66**	**44**	**1**
	Hills Road	NB	5,818	4,903	4,938	5,013
		SB	6,058	5,890	5,847	5,964
		Total	**11,876**	**10,793**	**10,785**	**10,977**
est 3 bans Road)	Bristol Street	NB	972	1,070	851	874
		SB	1,887	2,283	2,052	1,876
		Total	**2,859**	**3,353**	**2,903**	**2,750**
	Gordon Avenue (not in model)	NB				
		SB				
		Total	-	-	-	-
	Abberley Crescent	NB	733	924	899	882
		SB	373	378	380	381
		Total	**1,106**	**1,302**	**1,278**	**1,263**
	Albany Street (not in model)	NB				
		SB				
		Total	-	-	-	-
	Springfield Road	NB	6,216	6,313	6,127	6,016
		SB	8,384	8,861	8,338	8,281
		Total	**14,600**	**15,174**	**14,465**	**14,296**
	Trafalgar Street*	NB	395	408	398	397
		SB	541	568	545	538
		Total	**935**	**976**	**943**	**935**
		NB	11,411	12,471	14,067	13,766

East We (South of St Al	Cranford Street	SB	10,483	12,403	15,439	15,652
		Total	**21,894**	**24,874**	**29,506**	**29,419**
	Mersey Street*	NB	599	2,260	1,942	2,089
		SB	336	1,344	1,005	1,079
		Total	**935**	**3,603**	**2,947**	**3,168**
	Forfar Street*	NB	3,831	2,267	2,454	2,120
		SB	1,695	2,141	1,121	1,217
		Total	**5,526**	**4,408**	**3,575**	**3,337**
	Mayfield Avenue (not in model)	NB				
		SB				
		Total	-	-	-	-
	Francis Avenue	NB	269	422	141	219
		SB	1,629	478	172	210
		Total	**1,899**	**899**	**313**	**430**
	Flockton Street*	NB	46	77	72	60
		SB	1,105	1,208	1,255	1,102
		Total	**1,151**	**1,285**	**1,328**	**1,162**
	Aylesford Street	NB	1,556	1,982	2,049	2,018
		SB	1,099	1,029	1,079	1,080
		Total	**2,655**	**3,011**	**3,128**	**3,098**
East West 4 (South of Berwick Street)	Cranford Street	NB	8,887	9,372	7,201	9,870
		SB	7,097	8,458	8,419	10,313
		Total	**15,984**	**17,830**	**15,620**	**20,183**
	Forfar Street	NB	6,102	6,531	11,173	7,778
		SB	4,550	4,710	2,500	3,954
		Total	**10,652**	**11,241**	**13,673**	**11,732**
	Barbadoes Street	NB	2,432	2,441	1,172	1,311
		SB	6,110	6,329	11,108	7,012
		Total	**8,542**	**8,770**	**12,280**	**8,323**
	Geraldine Street*	NB	35	36	78	217
		SB	29	51	9	11
		Total	**64**	**87**	**87**	**227**
	Cleveland Street	NB				
		SB				
		Total	-	-	-	-
	Woodville Street	NB				
		SB				
		Total	-	-	-	-
	Hills Road	NB	9,060	8,926	8,675	8,879
		SB	9,167	8,942	8,170	8,835
		Total	**18,228**	**17,868**	**16,846**	**17,714**

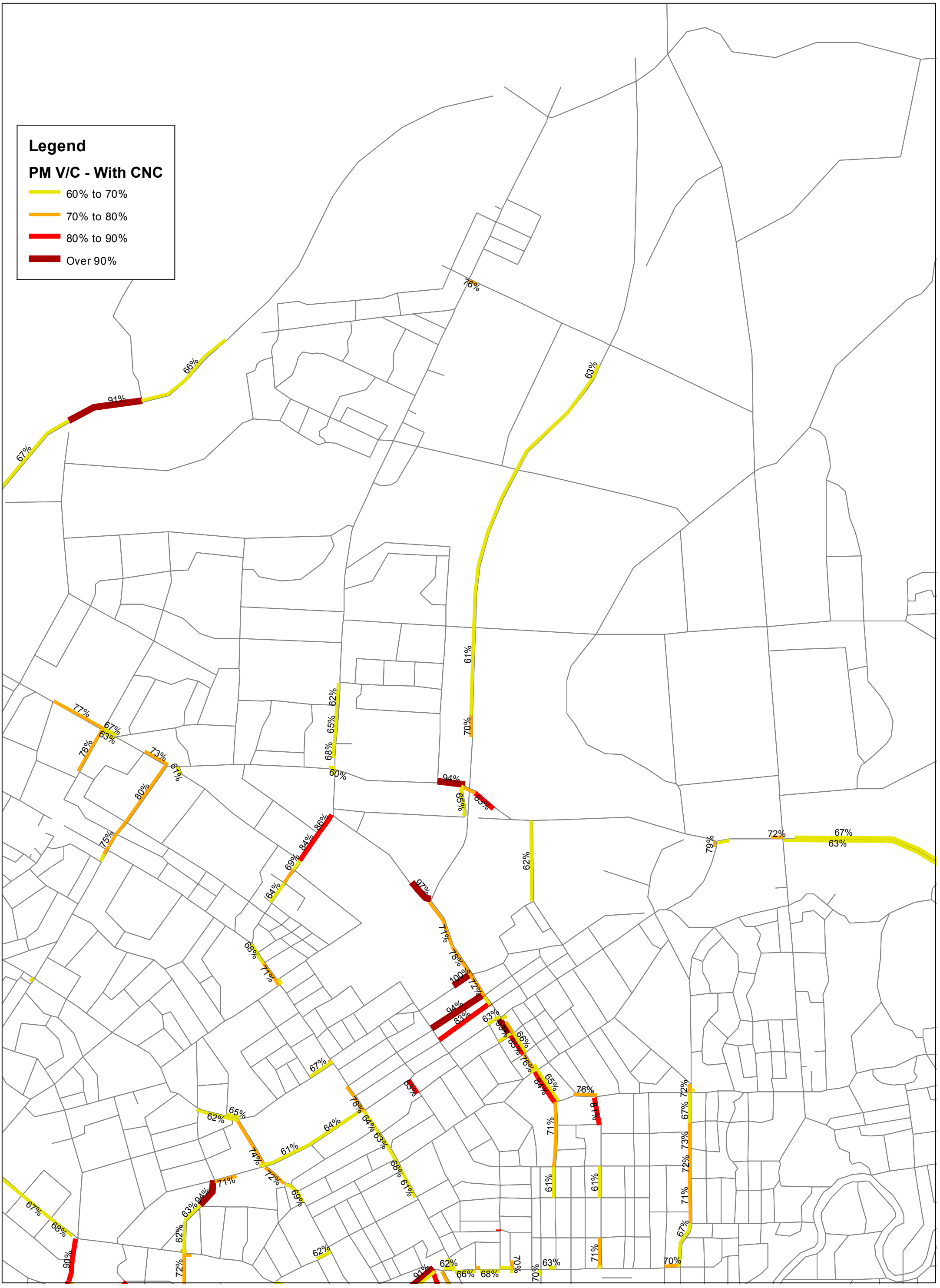
D.3 V/C Ratios and Delay for Key Intersections



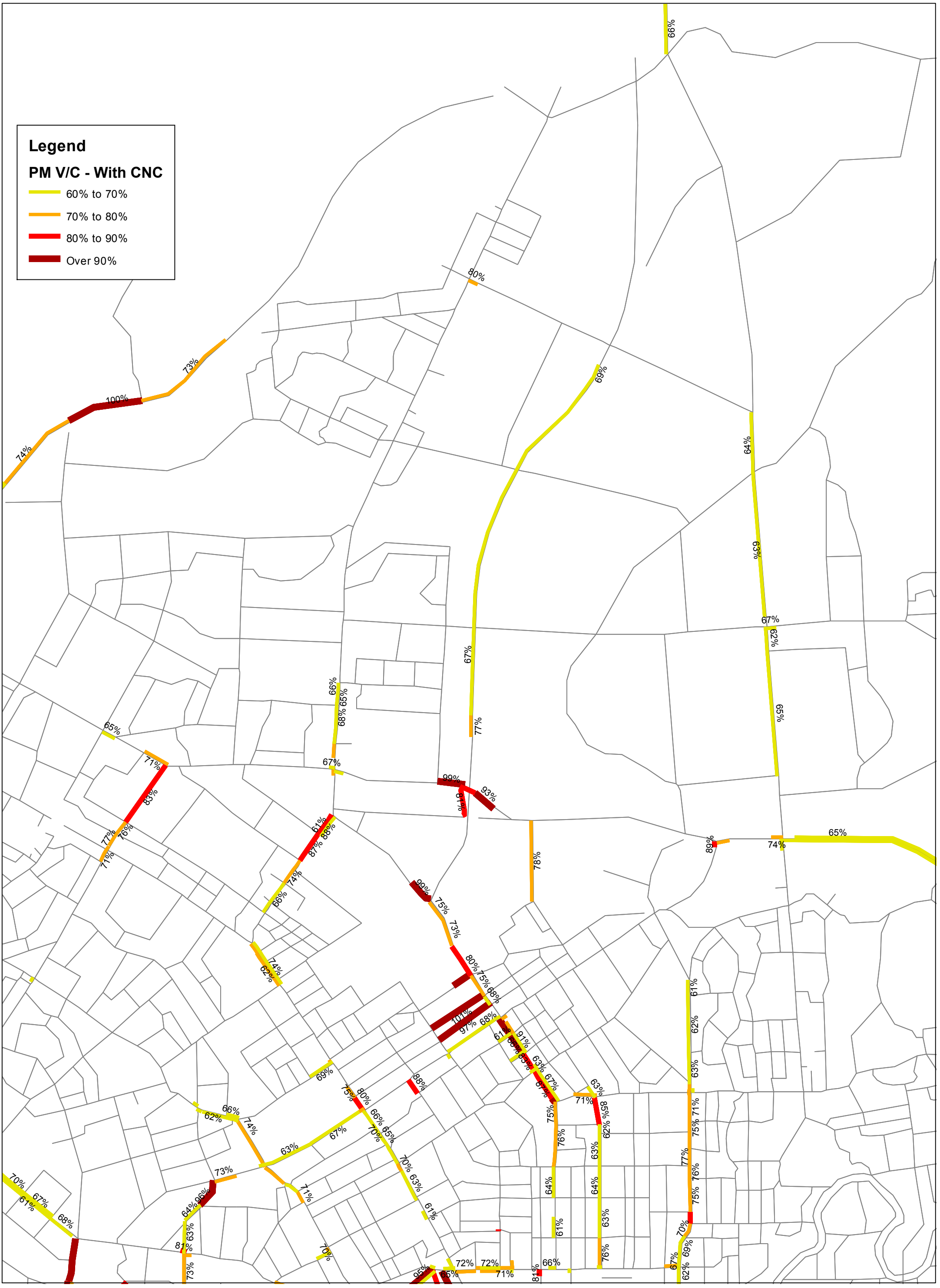
Year 2021: Volume/Capacity Ratio - Option CNC03
(V/C less than 60% are not shown on the plot)



Year 2031: Volume/Capacity Ratio - Option CNC03
(V/C less than 60% are not shown on the plot)



Year 2021: Volume/Capacity Ratio - Option CNC03
(V/C less than 60% are not shown on the plot)



Year 2031: Volume/Capacity Ratio - Option CNC03
(V/C less than 60% are not shown on the plot)

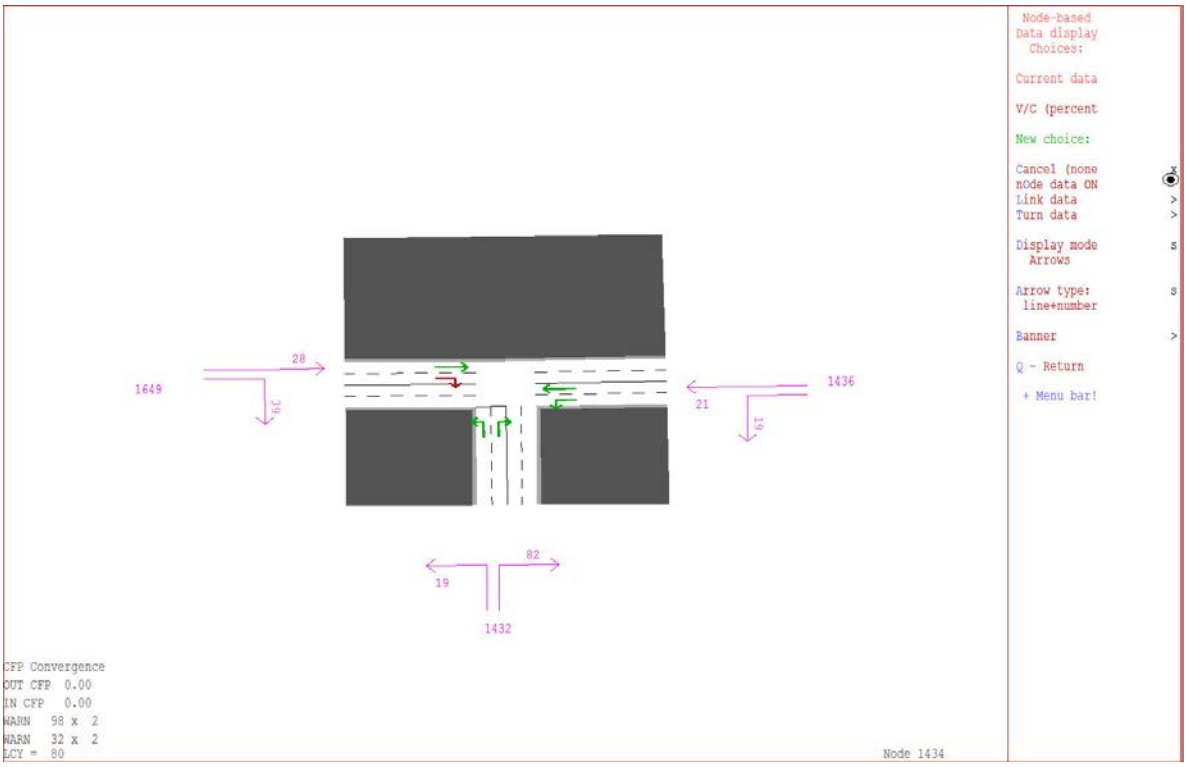


Figure 1: Barbadoes / Warrington Intersection, 2021 PM peak CNC03

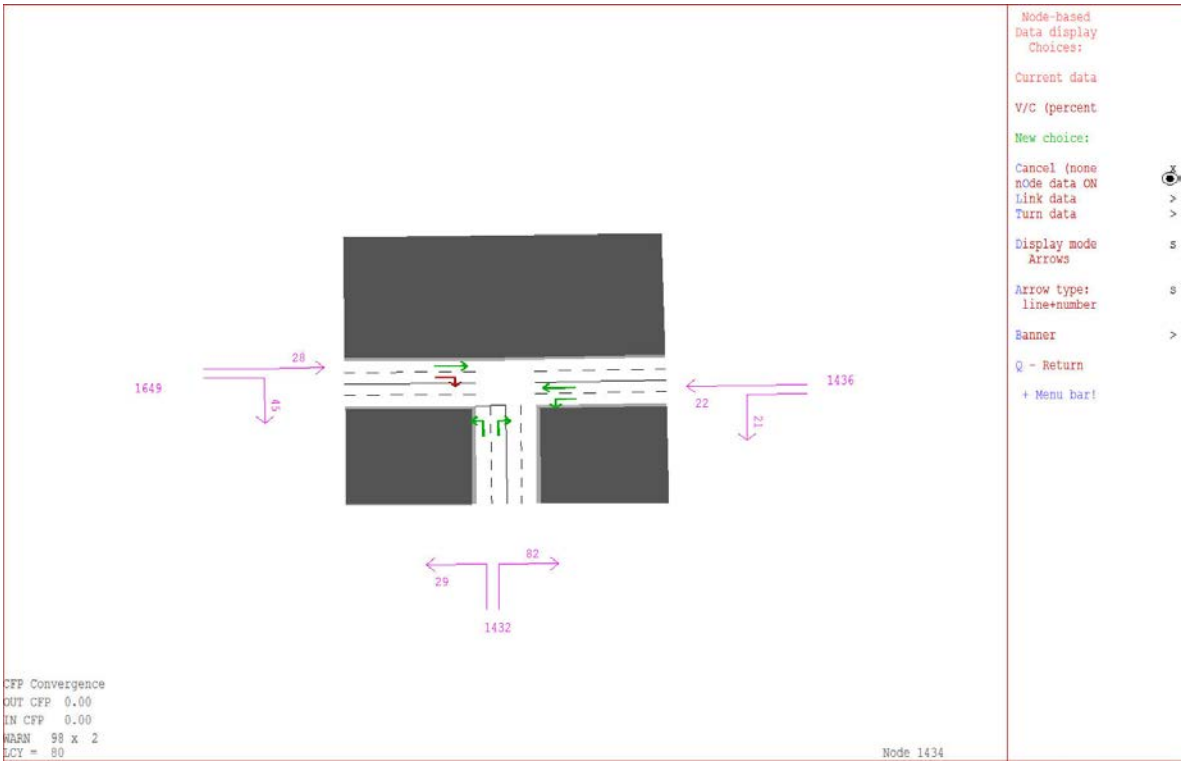


Figure 2: Barbadoes / Warrington Intersection, 2031 PM peak CNC03

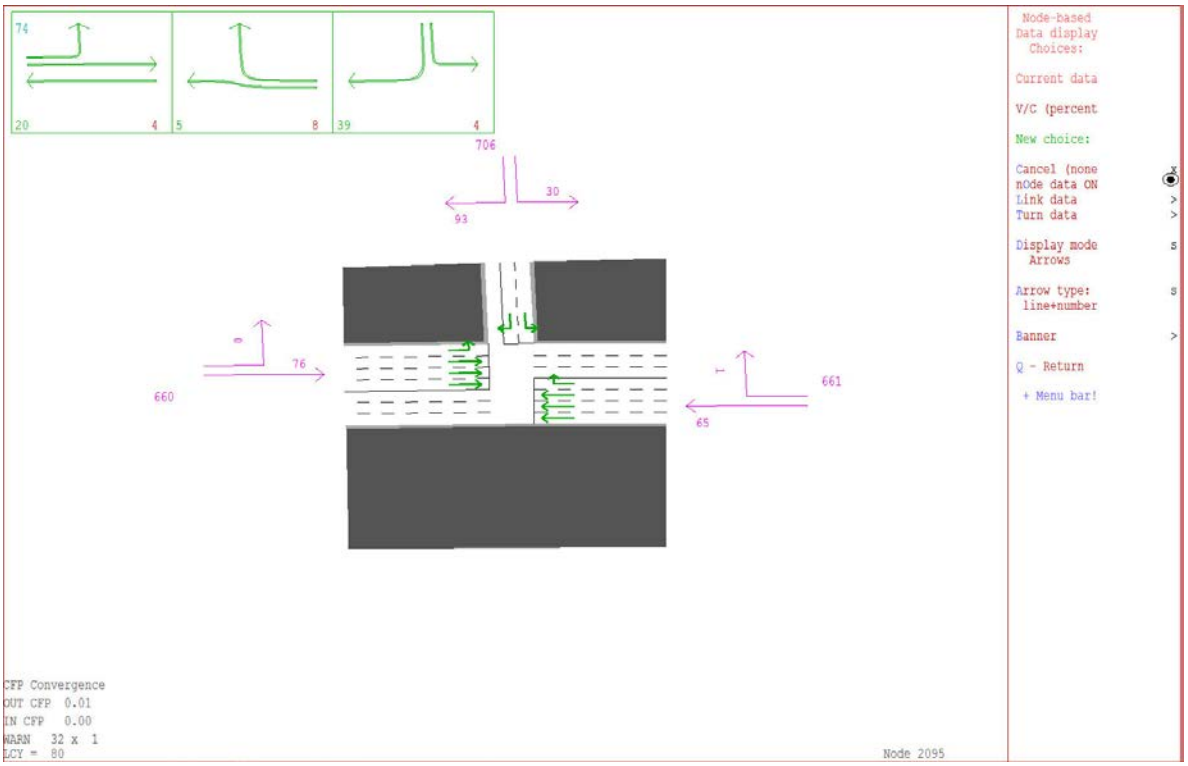


Figure 3: Bealey / Sherborne Intersection, 2021 AM peak CNC0*3*

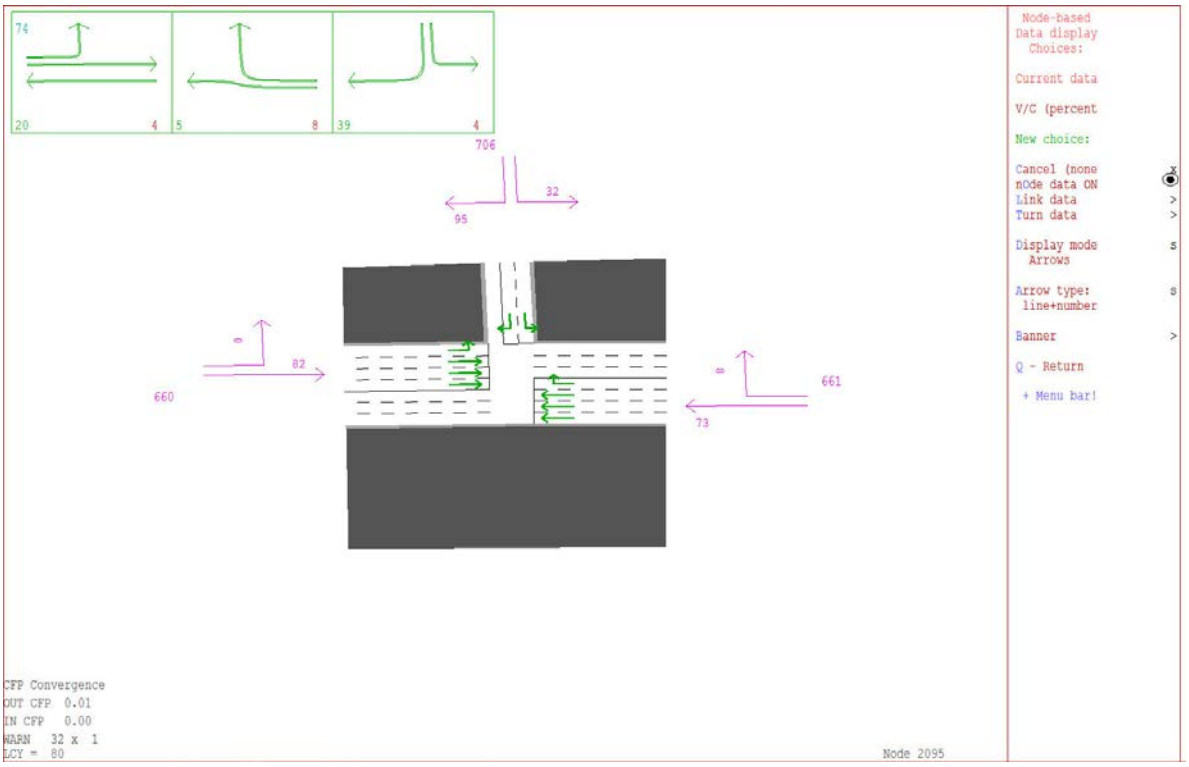


Figure 4: Bealey / Sherborne Intersection, 2031 AM peak CNC0*3*

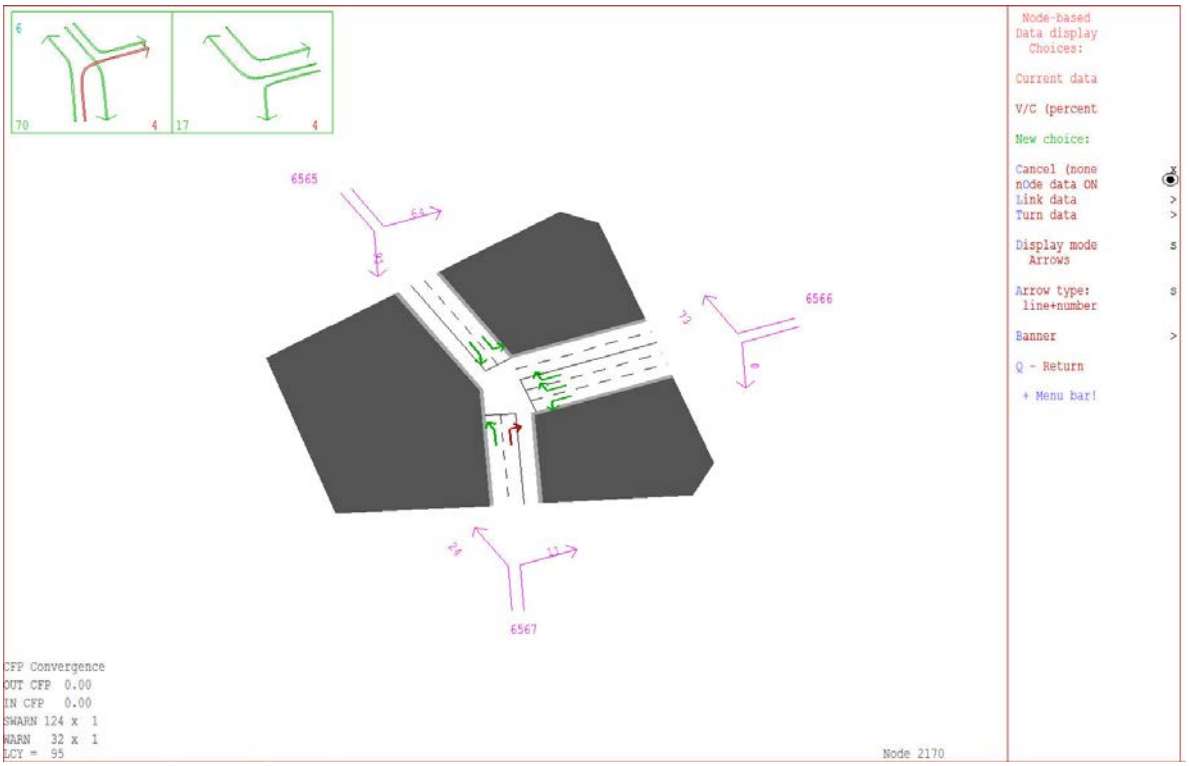


Figure 5: Berwick / Cranford Intersection, 2021 AM peak CNC04e

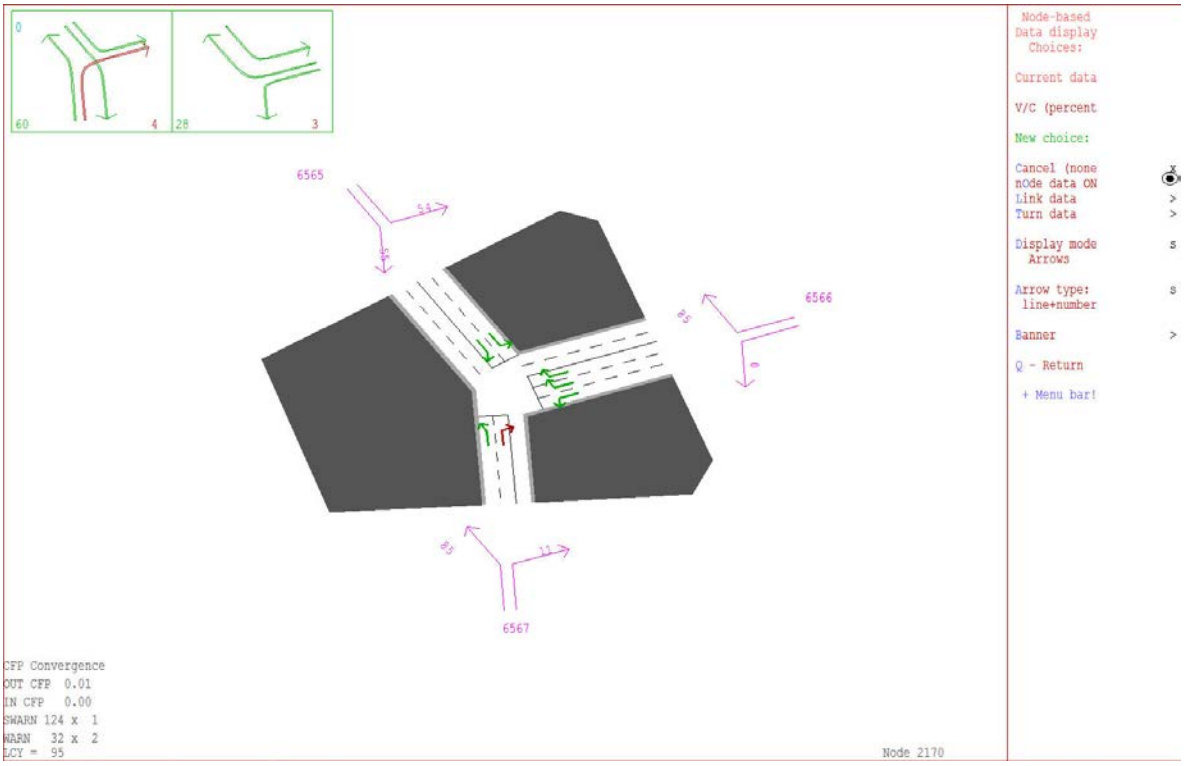


Figure 6: Berwick / Cranford Intersection, 2021 PM peak CNC04e

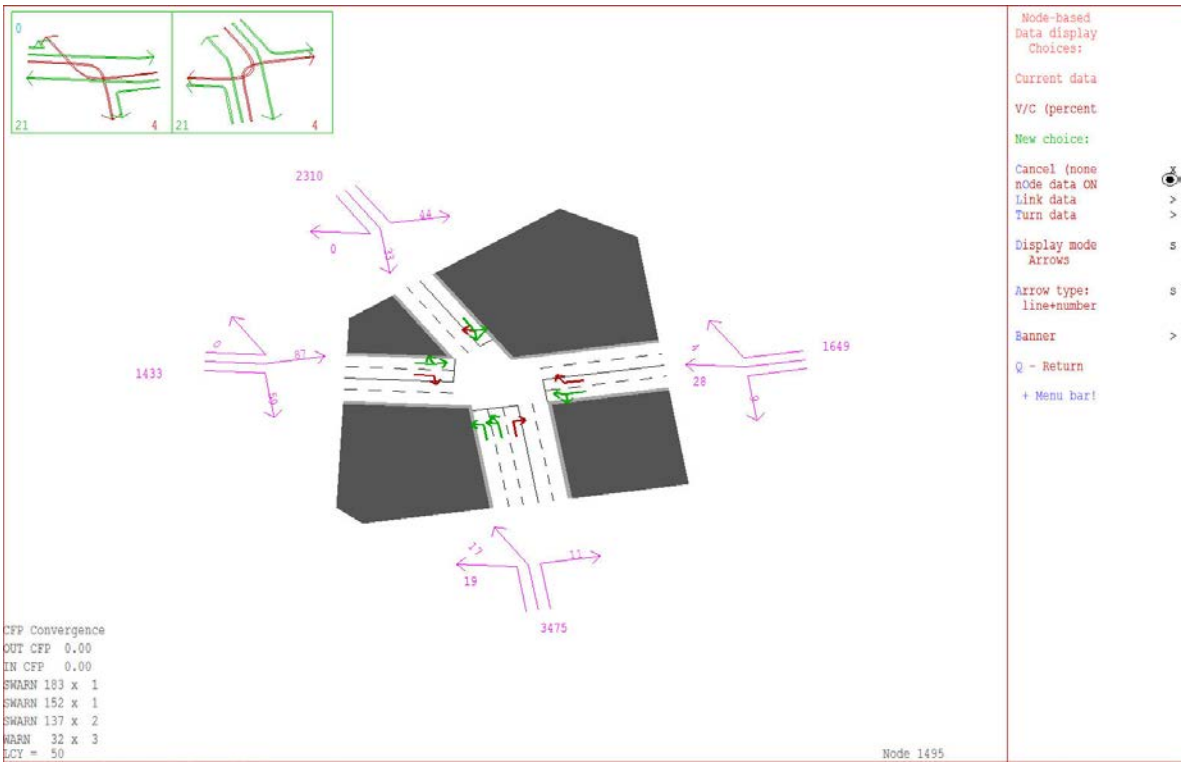


Figure 7: Forfar / Warrington Intersection, 2021 AM peak CNC04e

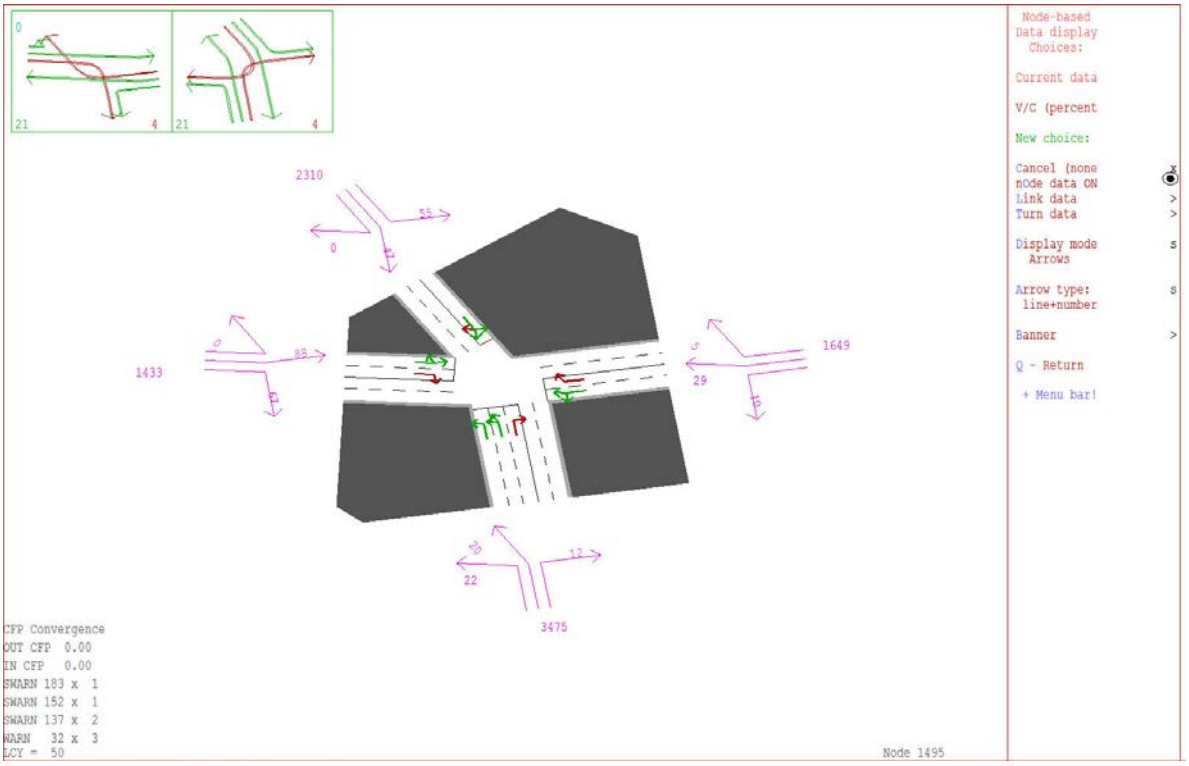
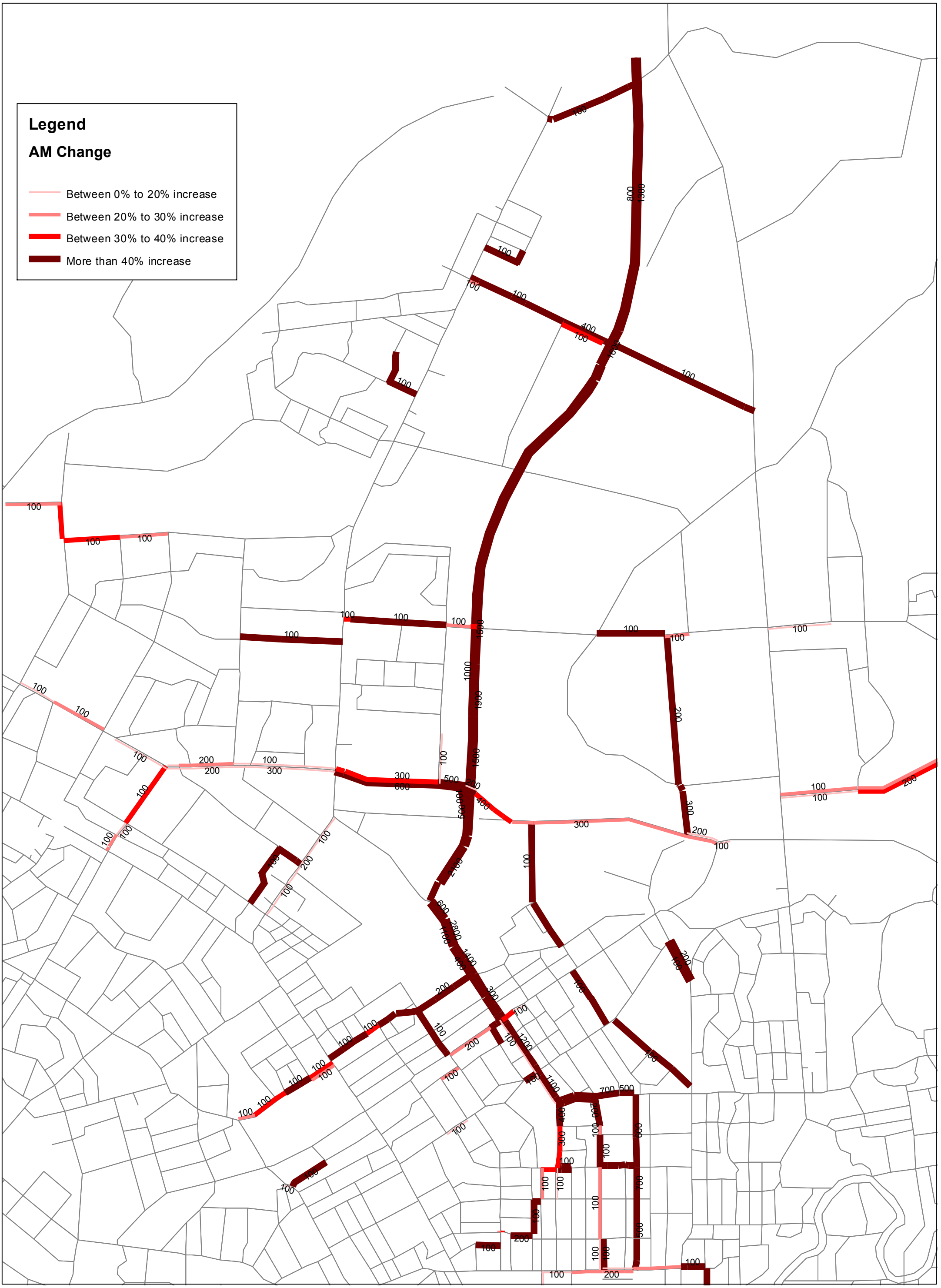
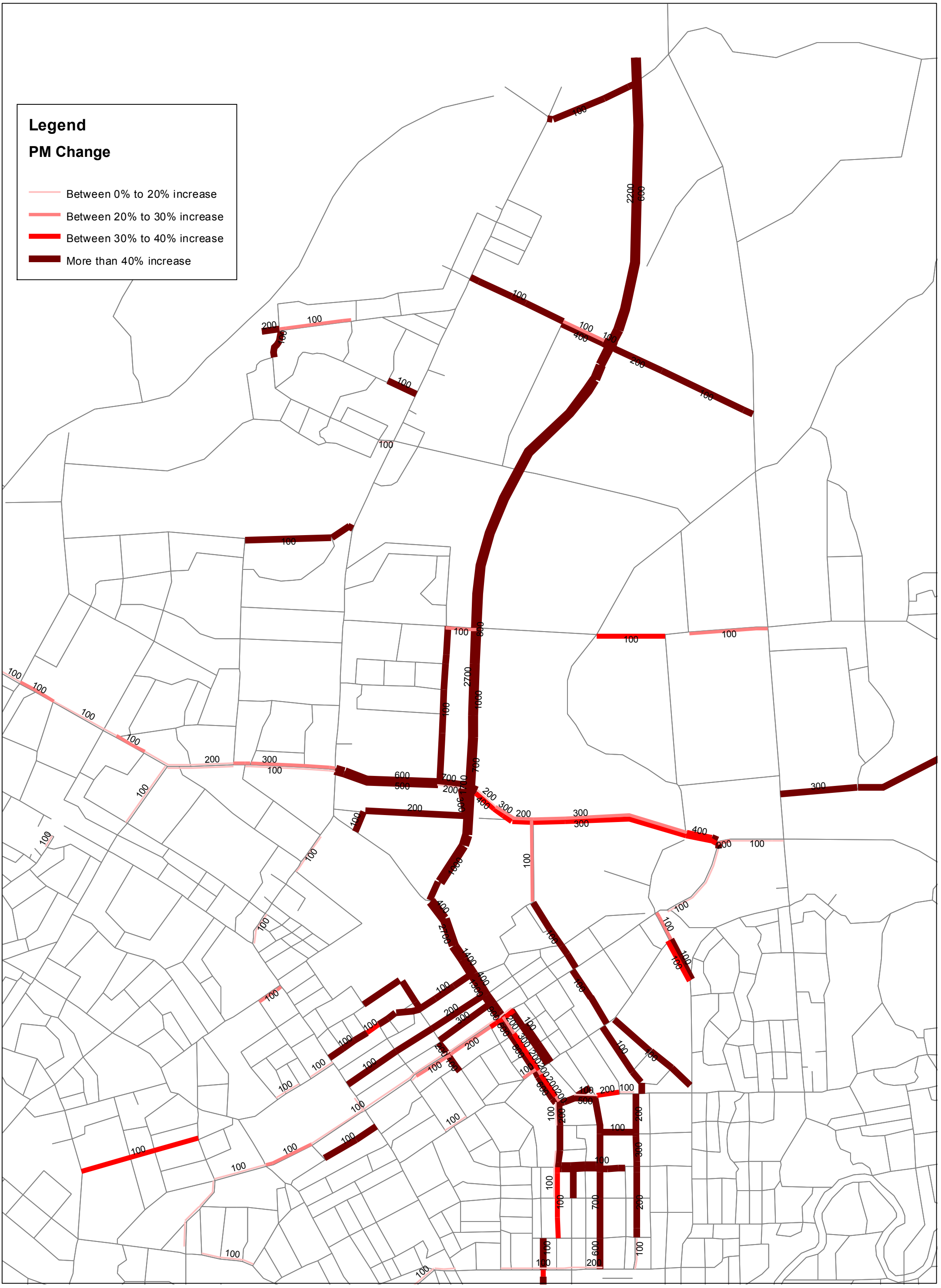


Figure 8: Forfar / Warrington Intersection, 2031 AM peak CNC04e

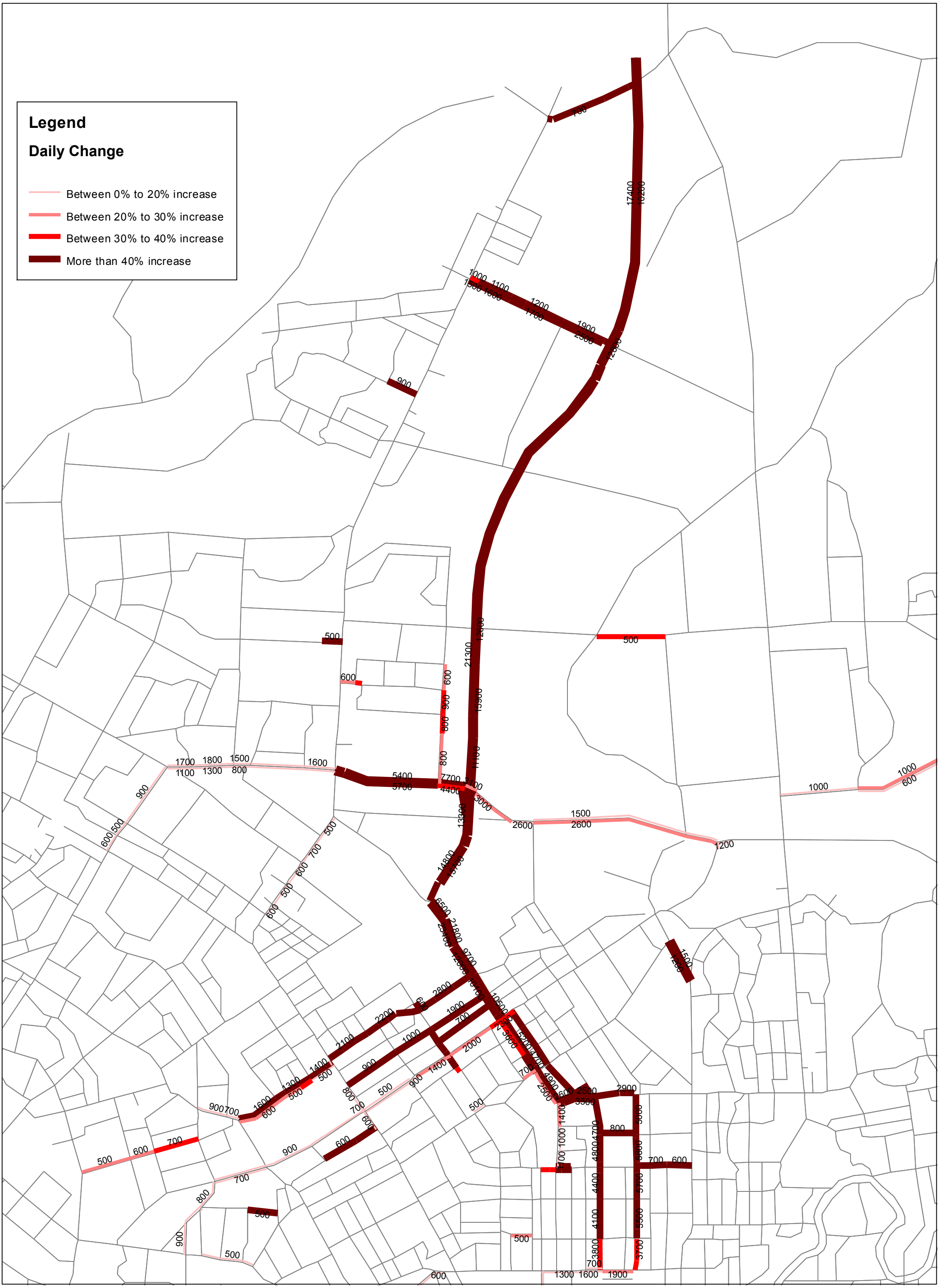
D.4 Change Flow Plots with Arterial Upgrades



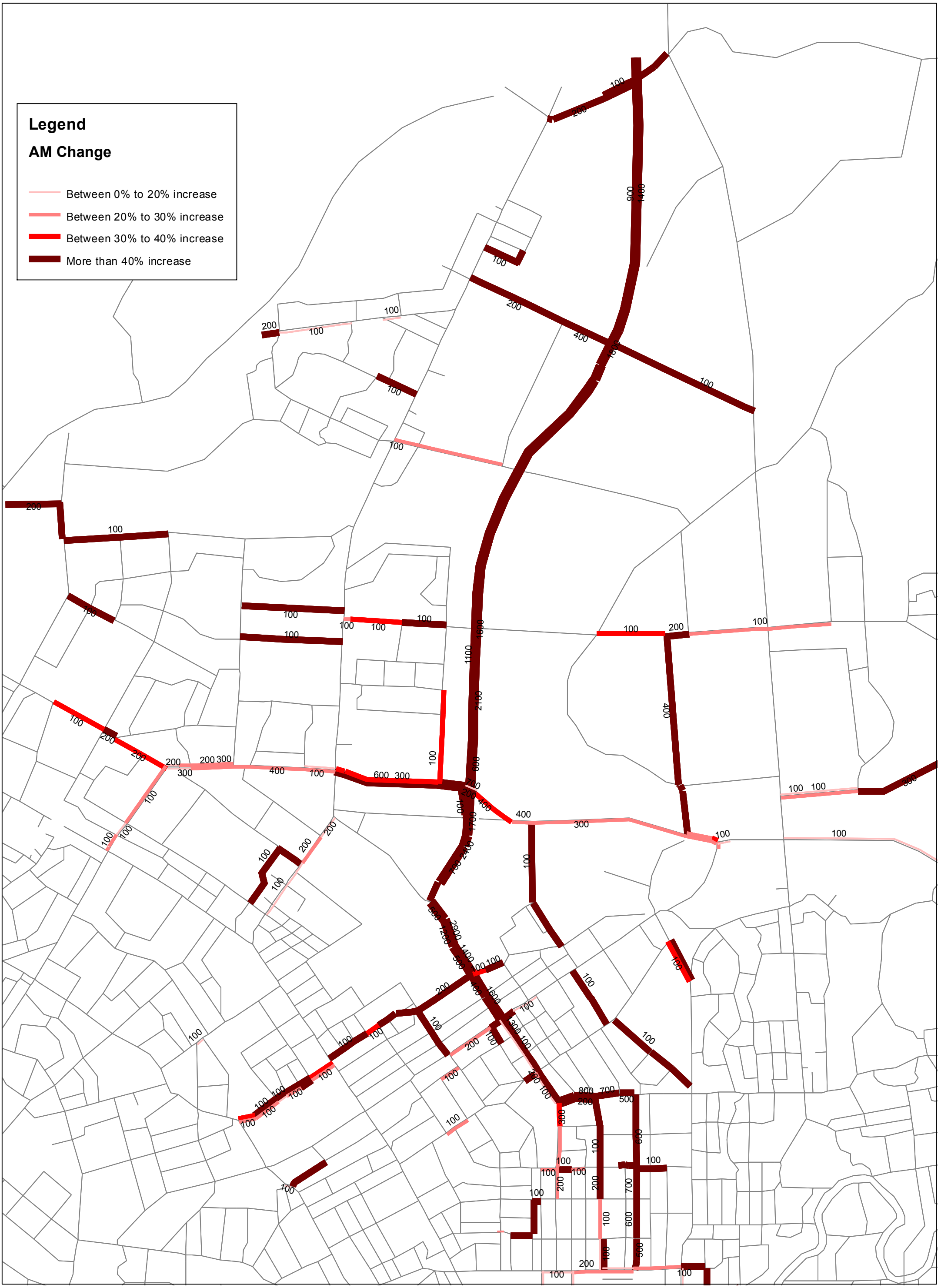
Year 2021: Hourly Traffic Volume Difference (PCUs) - with/without CNC
CNC04e vs NoCNC03 (Differences less than 50 pcu/h are not shown on the plot)



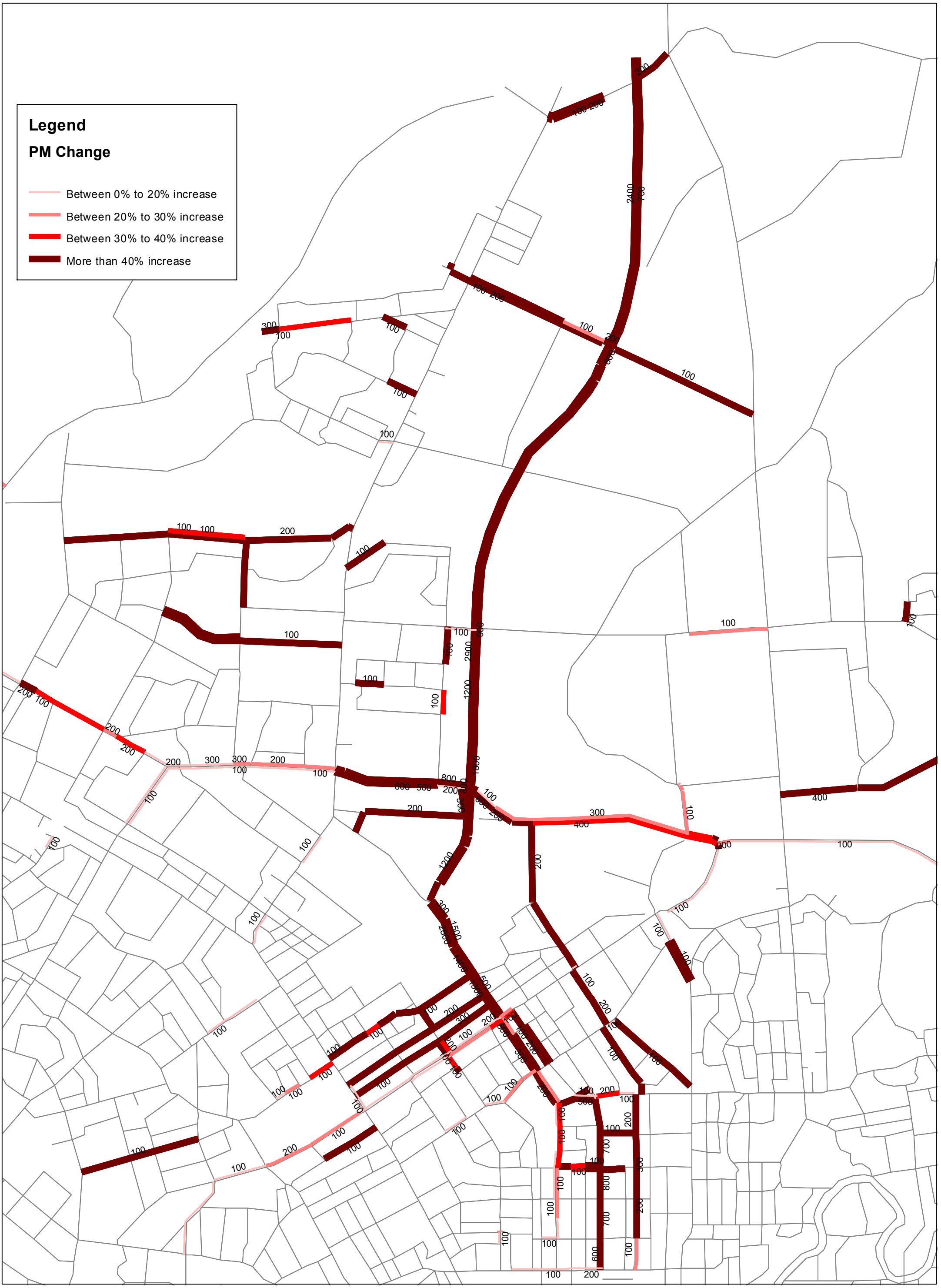
Year 2021: Hourly Traffic Volume Difference (PCUs) - with/without CNC
CNC04e vs NoCNC03 (Differences less than 50 pcu/h are not shown on the plot)



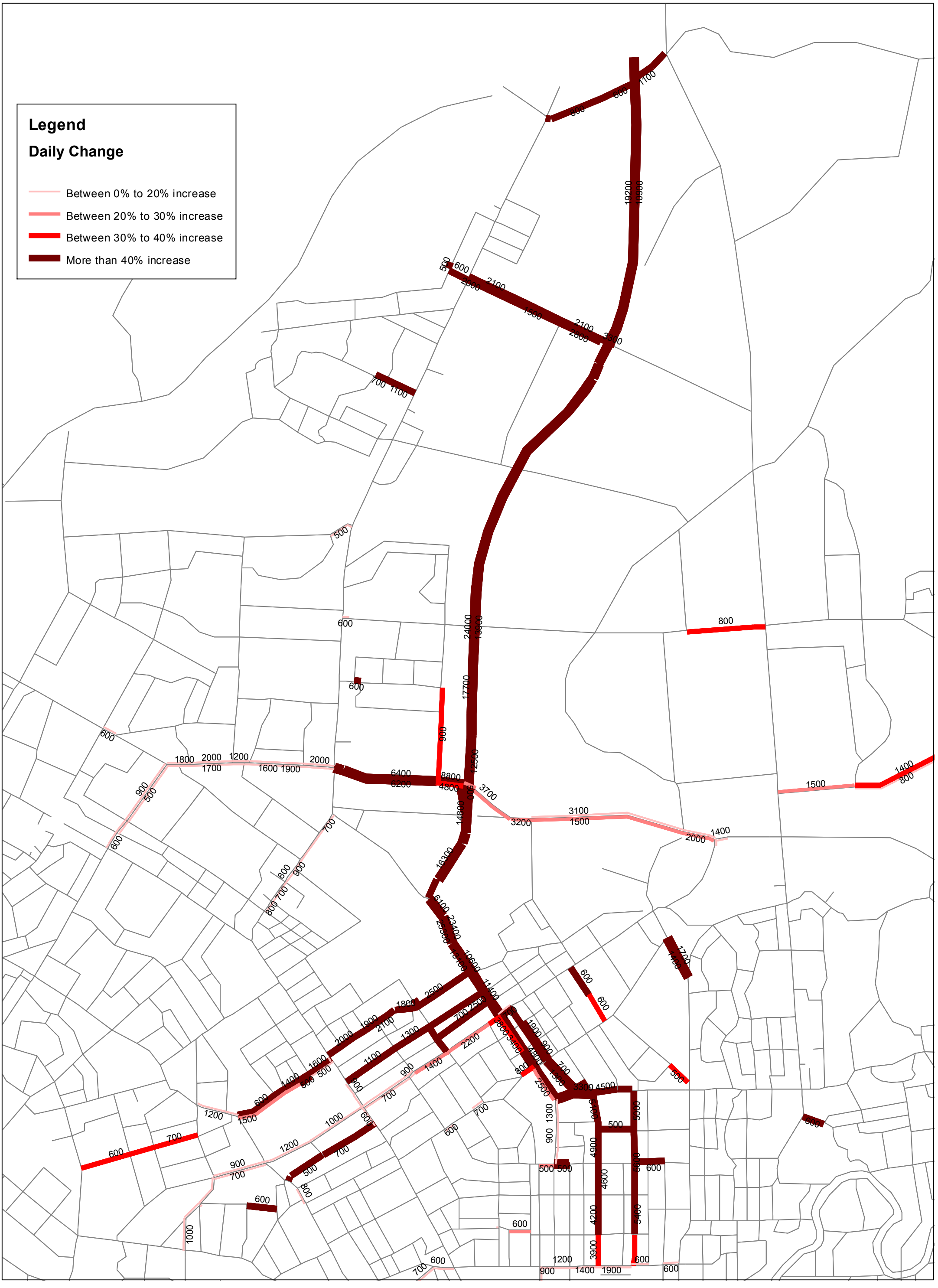
Year 2021: Daily Traffic Volume Difference - with/without CNC
CNC04e vs NoCNC03 (Differences less than 500 vpd are not shown on the plot)



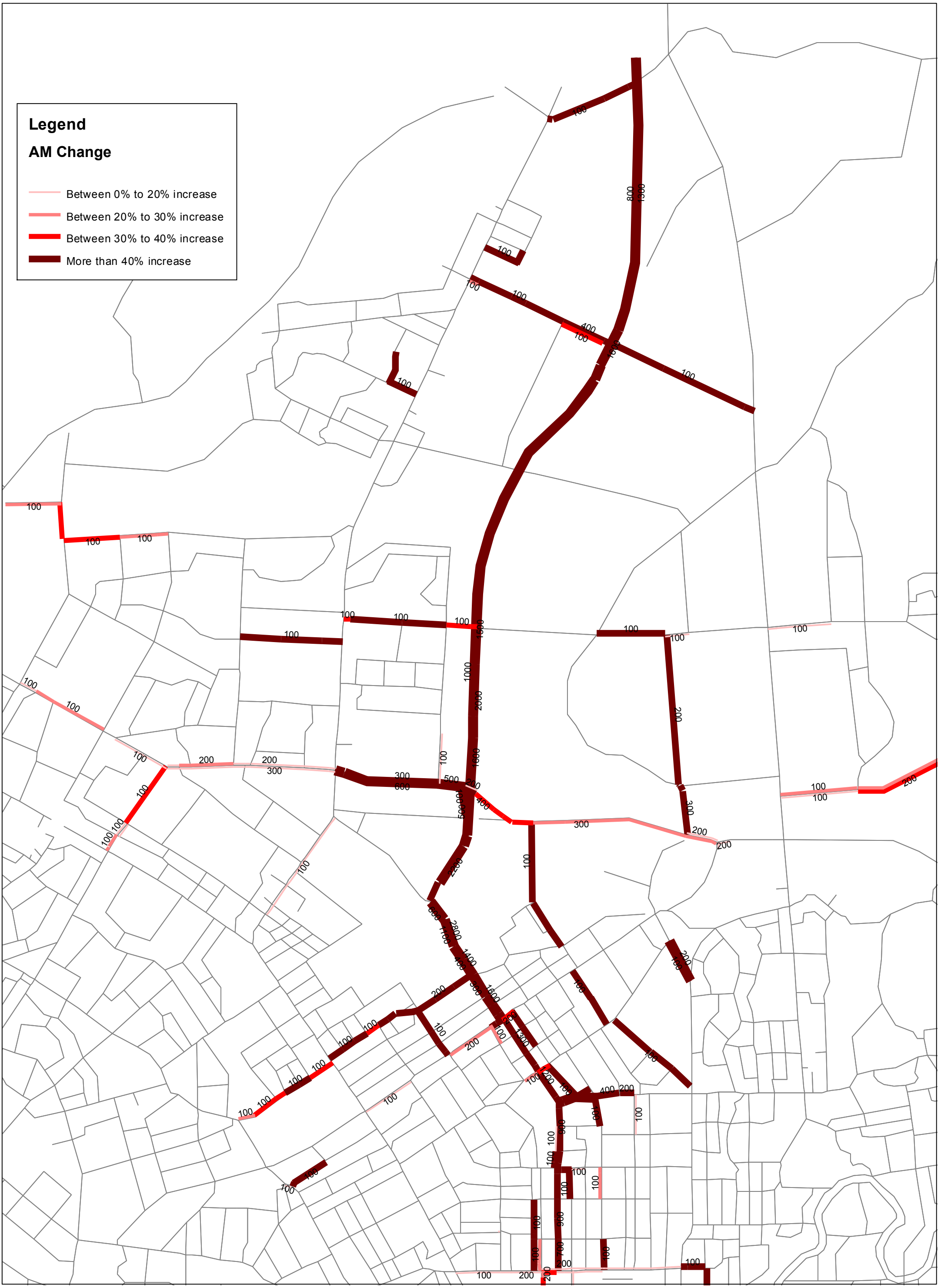
Year 2031: Hourly Traffic Volume Difference (PCUs) - with/without CNC
CNC04e vs NoCNC03 (Differences less than 50 pcu/h are not shown on the plot)



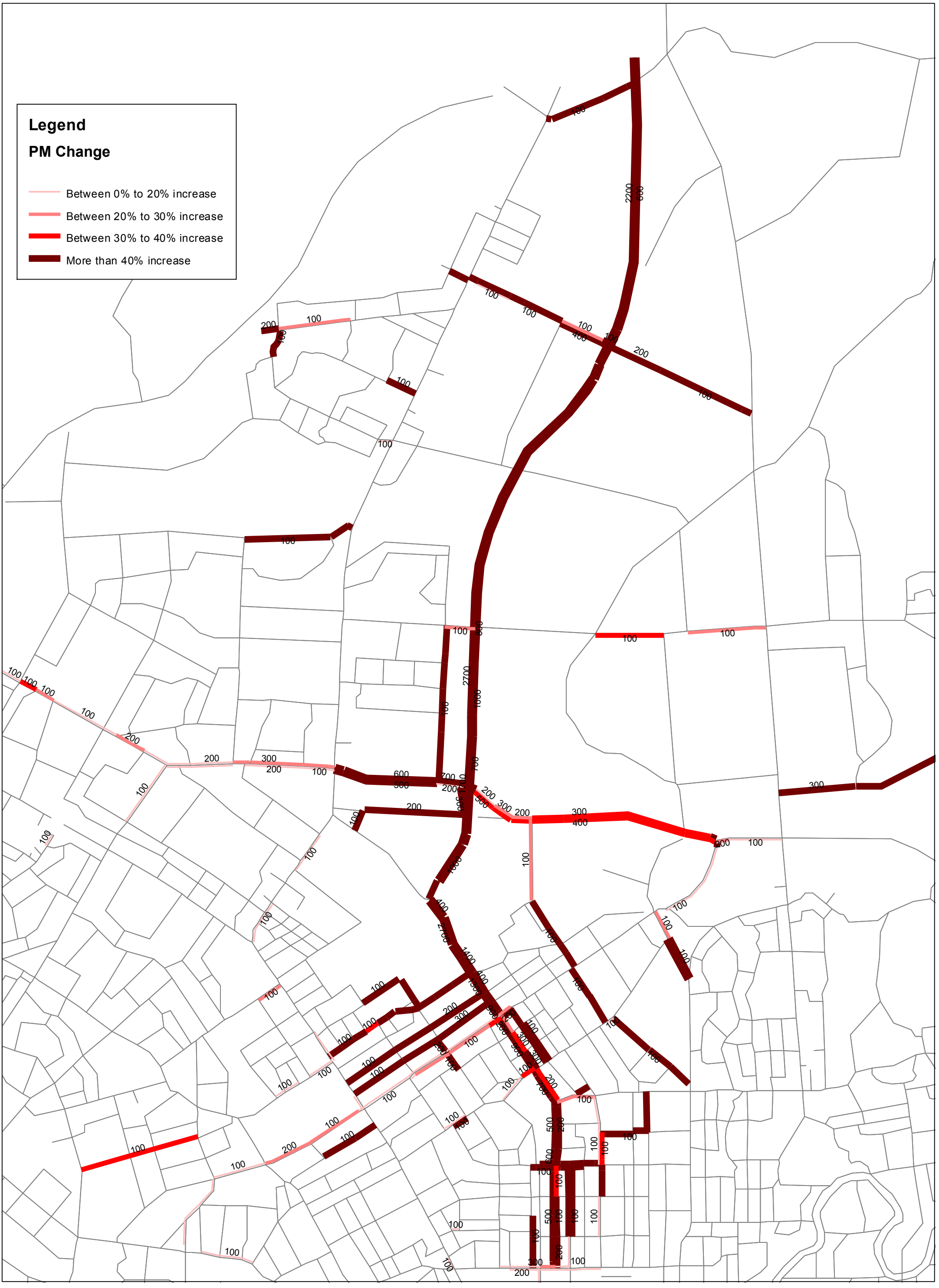
Year 2031: Hourly Traffic Volume Difference (PCUs) - with/without CNC
CNC04e vs NoCNC03 (Differences less than 50 pcu/h are not shown on the plot)



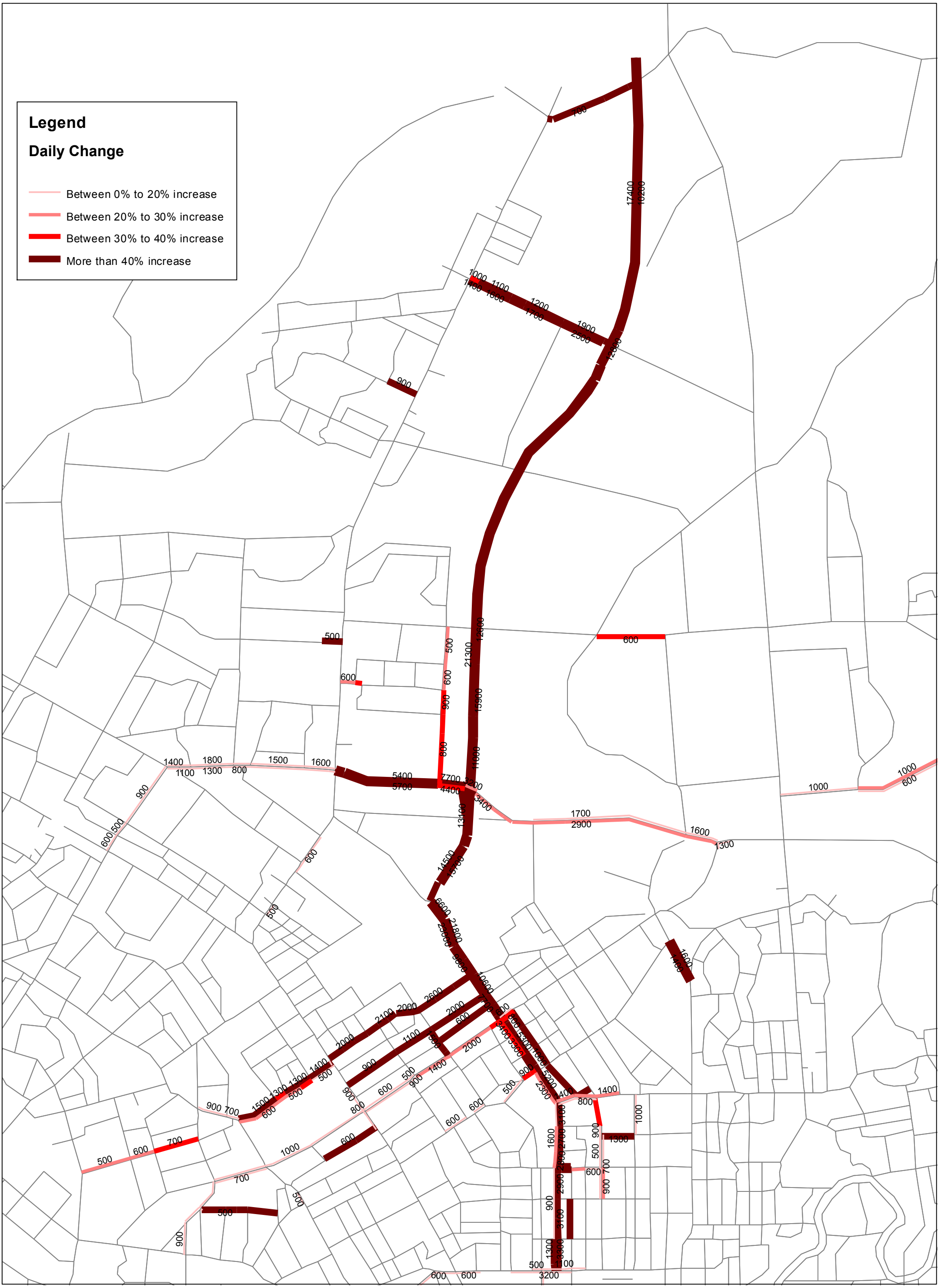
Year 2031: Daily Traffic Volume Difference - with/without CNC
CNC04e vs NoCNC03 (Differences less than 500 vpd are not shown on the plot)



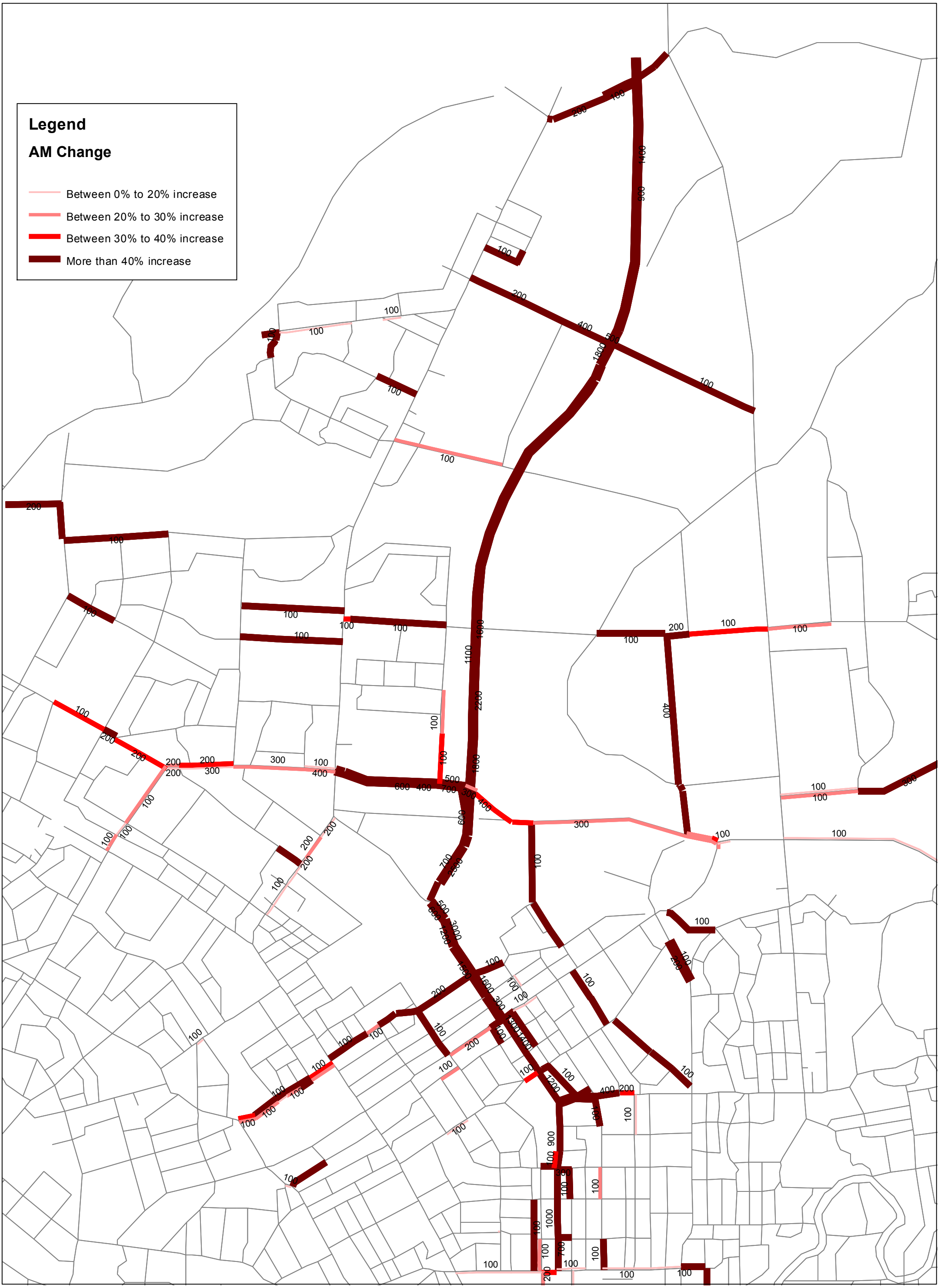
Year 2021: Hourly Traffic Volume Difference (PCUs) - with/without CNC
CNC04g vs NoCNC03 (Differences less than 50 pcu/h are not shown on the plot)



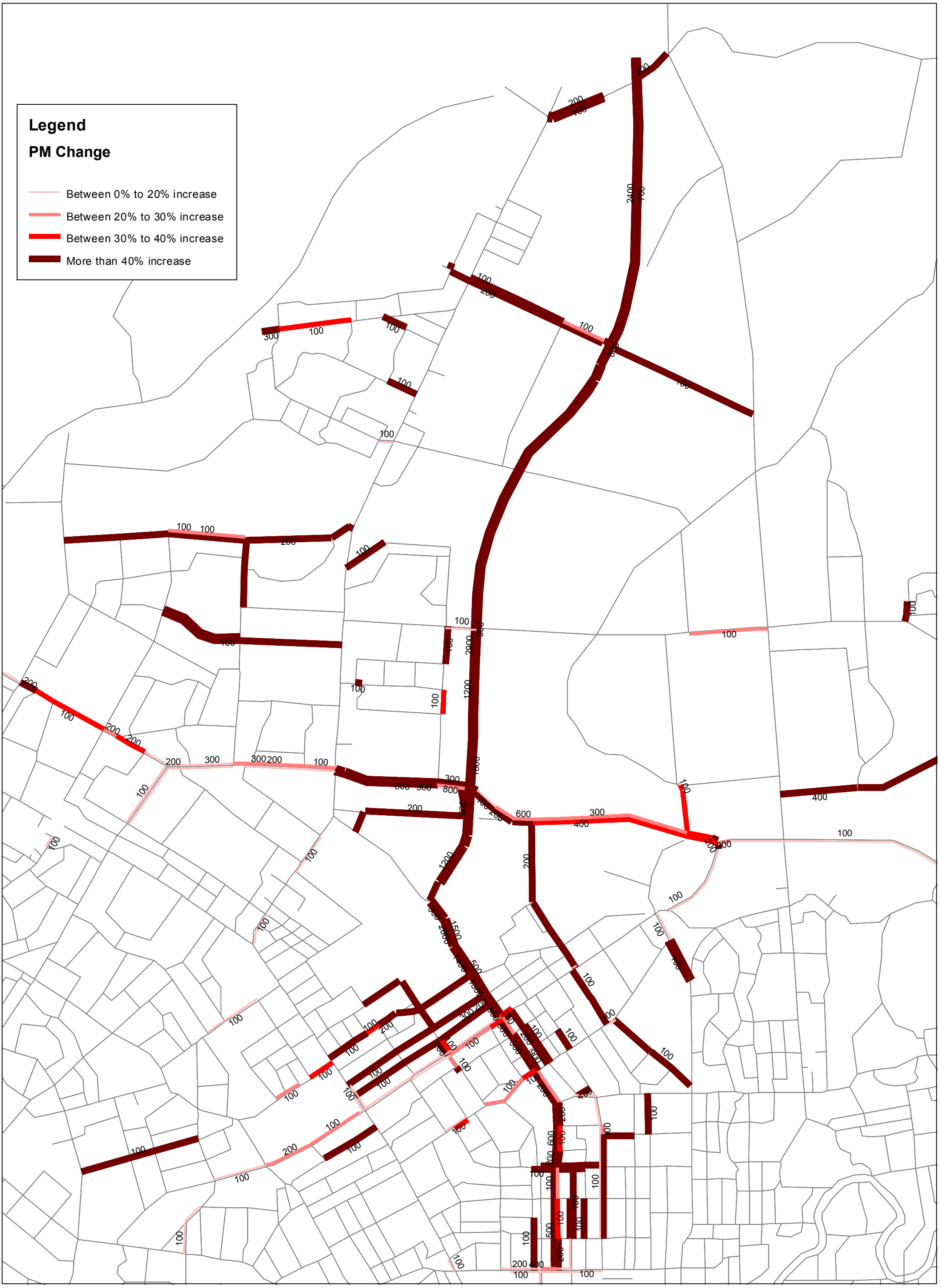
Year 2021: Hourly Traffic Volume Difference (PCUs) - with/without CNC
CNC04g vs NoCNC03 (Differences less than 50 pcu/h are not shown on the plot)



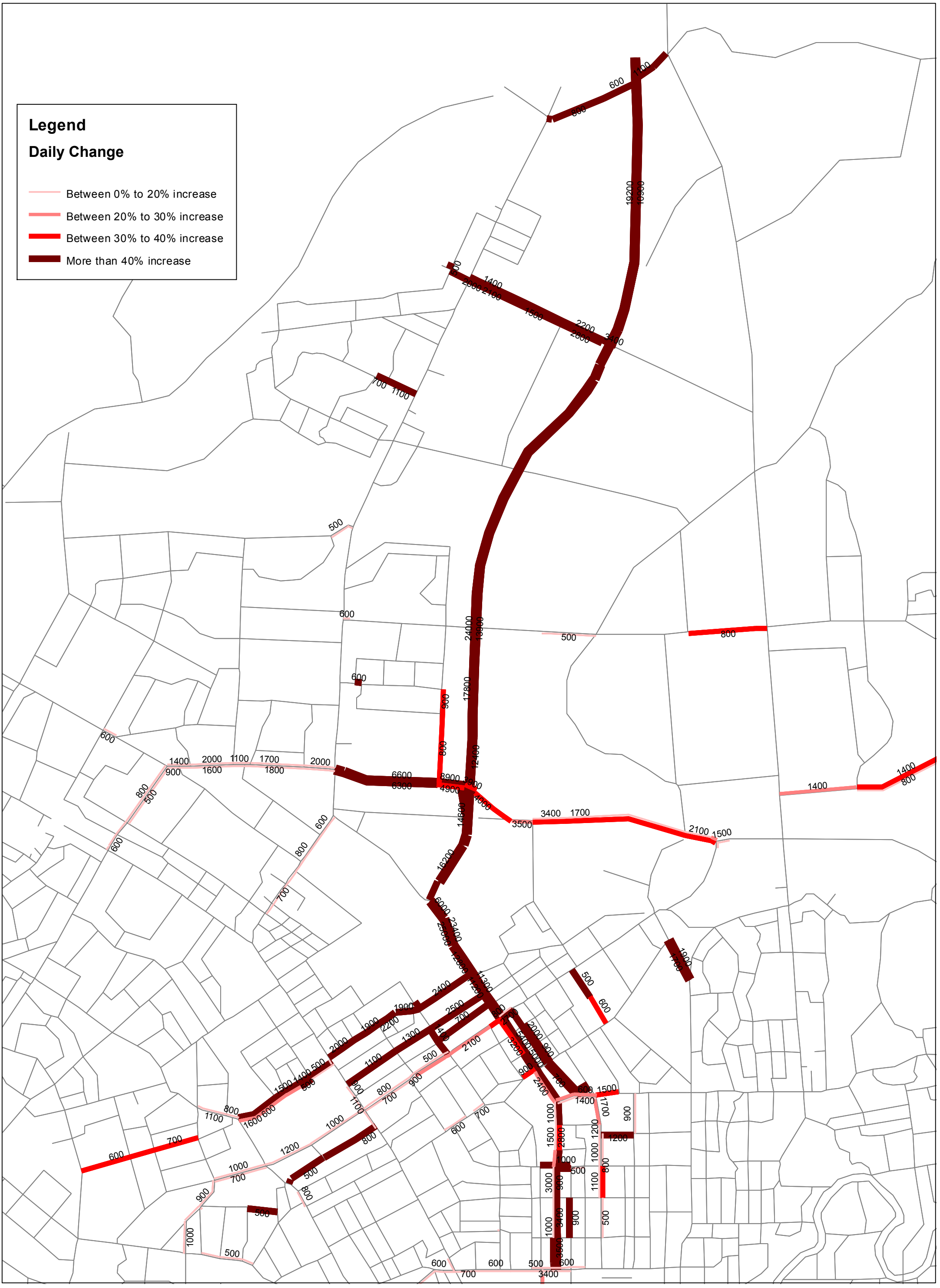
Year 2021: Daily Traffic Volume Difference - with/without CNC
CNC04g vs NoCNC03 (Differences less than 500 vpd are not shown on the plot)



Year 2031: Hourly Traffic Volume Difference (PCUs) - with/without CNC
CNC04g vs NoCNC03 (Differences less than 50 pcu/h are not shown on the plot)

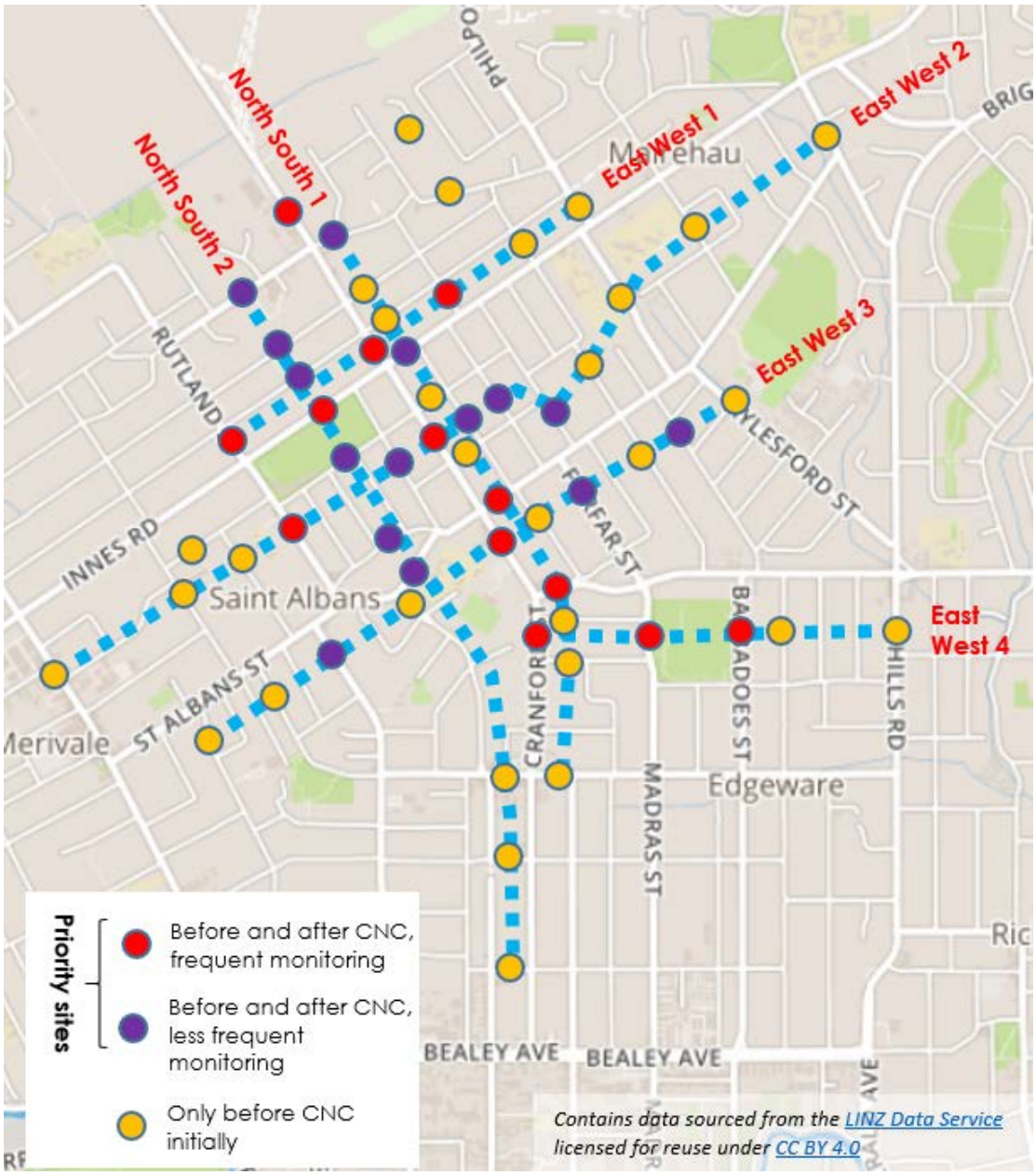


Year 2031: Hourly Traffic Volume Difference (PCUs) - with/without CNC
CNC04g vs NoCNC03 (Differences less than 50 pcu/h are not shown on the plot)



Year 2031: Daily Traffic Volume Difference - with/without CNC
CNC04g vs NoCNC03 (Differences less than 500 vpd are not shown on the plot)

Appendix E Monitoring Screens



Appendix F Consultation Leaflet

Why are we consulting?

The Christchurch Northern Corridor will extend the Northern Motorway through to QEII Drive and Cranford Street. You can find out more about the project at **nzta.govt.nz/cnc**.

This project finishes at the intersection of Cranford Street and Innes Road. A downstream effects management plan for Cranford Street and the surrounding area south of Innes Road will be prepared to manage the impact of the additional people and vehicles travelling through.

The plan will look to improve connections to help commuters to get where they need to go while maintaining the sense of community for businesses and residents in the area. This consultation will help to inform that plan.

Further consultation on each individual project from tha plan will happen before it is implemented.

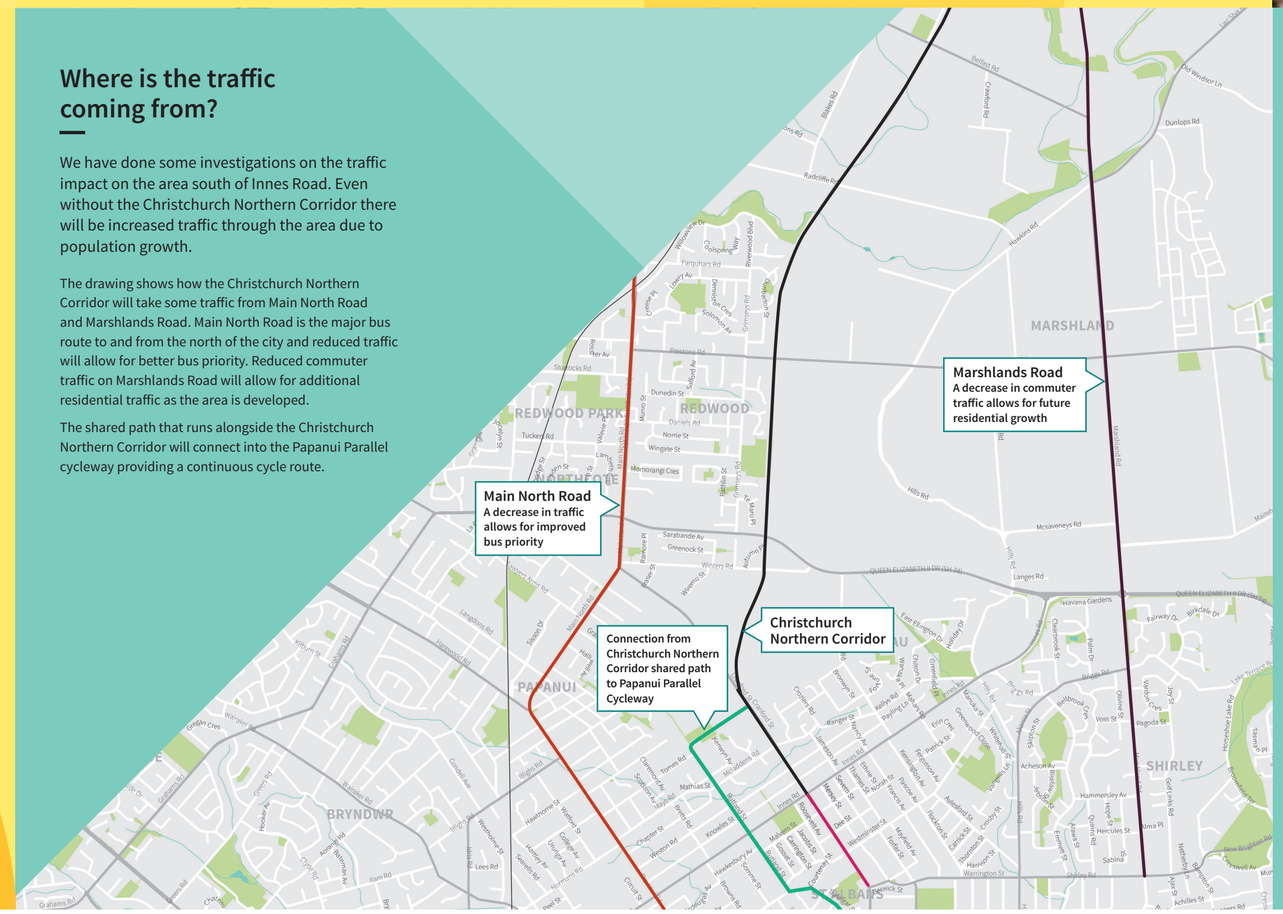
Impressions of the Christchurch Northern Corridor

Where is the traffic coming from?

We have done some investigations on the traffic impact on the area south of Innes Road. Even without the Christchurch Northern Corridor there will be increased traffic through the area due to population growth.

The drawing shows how the Christchurch Northern Corridor will take some traffic from Main North Road and Marshlands Road. Main North Road is the major bus route to and from the north of the city and reduced traffic will allow for better bus priority. Reduced commuter traffic on Marshlands Road will allow for additional residential traffic as the area is developed.

The shared path that runs alongside the Christchurch Northern Corridor will connect into the Papanui Parallel cycleway providing a continuous cycle route.

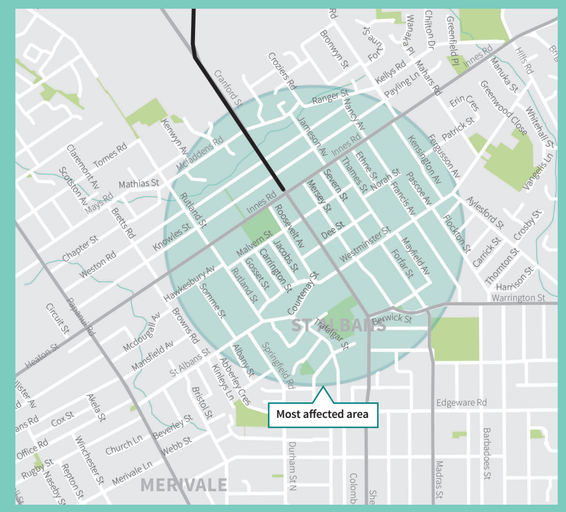


What is the traffic impact?

Investigations we have done show that local streets will be affected in the morning and evening peak periods if no road improvements are made. The impact will vary street by street but a number of streets will have a traffic increase of over 30 percent.

The most affected area is shown in the image below.

We have considered a number of options and found that the best option both for traffic flow and to minimise short cuts through local streets is a combination of main road improvements and some measures to reduce speed in quieter streets. These options are shown over the page.



Timeline

Consultation

↓

Downstream effects management plan prepared

↓

Consultation on individual projects

↓

Construction of approved projects

Drop-in sessions

Come and talk to staff about the proposal

Monday 7 May 2018
Anytime between 4pm – 7pm
St Albans School
17 Sheppard Place, St Albans

Thursday 10 May 2018
Anytime between 10am – 2pm
English Park
Cranford Street, St Albans

Wednesday 16 May 2018
Anytime between 4pm – 7pm
Papanui Street School
120 Papanui Street, Papanui

Thursday 17 May 2018
Anytime between 10am – 2pm
Edgeware Bowling Club, St Albans Park
6 Forfar Street, Edgeware

Engagement Team

03 941 8717
ann.campbell@ccc.govt.nz
53 Hereford Street, Christchurch
PO Box 73016, Christchurch 8154
ccc.govt.nz/haveyoursay

Christchurch City Council

Christchurch City Council

Proposed changes to Cranford Street and the surrounding area

HAVE YOUR SAY

Open until Monday 4 June 2018

ccc.govt.nz/haveyoursay

Why we need to make changes

We're proposing changes to Cranford Street and the surrounding roads to coincide with the completion of the Christchurch Northern Corridor. We'd like to hear your thoughts on how to make this work for commuters and local communities.

We're expecting a significant increase in people travelling on Cranford Street when the Christchurch Northern Corridor opens in 2020. The Christchurch Northern Corridor will improve travel times to and from the north of the city. It will decrease the number of people driving in some areas such as Main North Road and increase the number of people using parts of Cranford Street.

We need to make some changes to Cranford Street and the surrounding streets to improve the travel times for people travelling through and minimise people taking short cuts through side streets which could affect local residents.

Options for your feedback

No.1

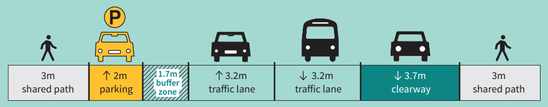
Proposed Cranford Street clearway and one-way connections

A clearway on part of Cranford Street and three-laning sections of Madras/Forfar Street and Barbadoes Street would help to improve the traffic flow in the area and minimise short cuts through local streets.

The clearway on Cranford Street would operate from Innes Road to Berwick Street. There would be a clearway heading south towards the city in the morning peak and a clearway heading north out of town in the evening. This will allow more people to travel through in peak hours.

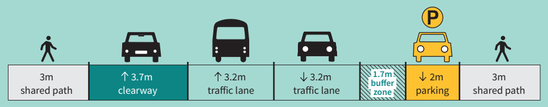
There would be no parking during the hours that the clearway operates.

Morning peak hours: 7 – 9am



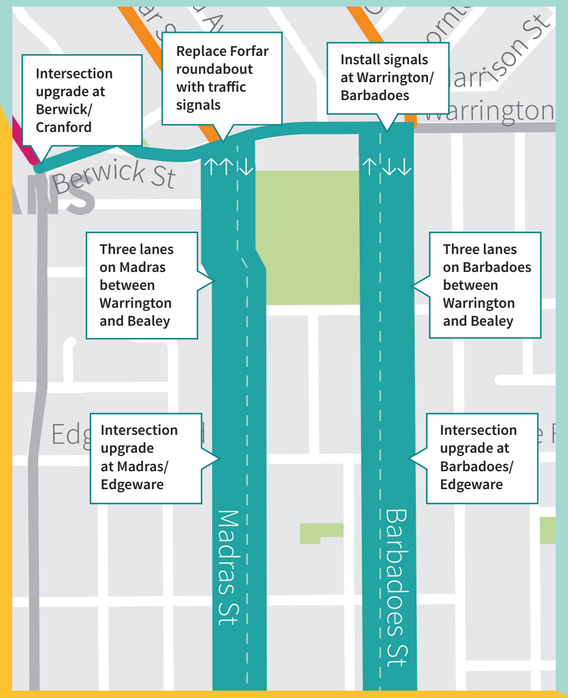
Looking North: Clearway Southbound

Afternoon peak hours: 4 – 6pm

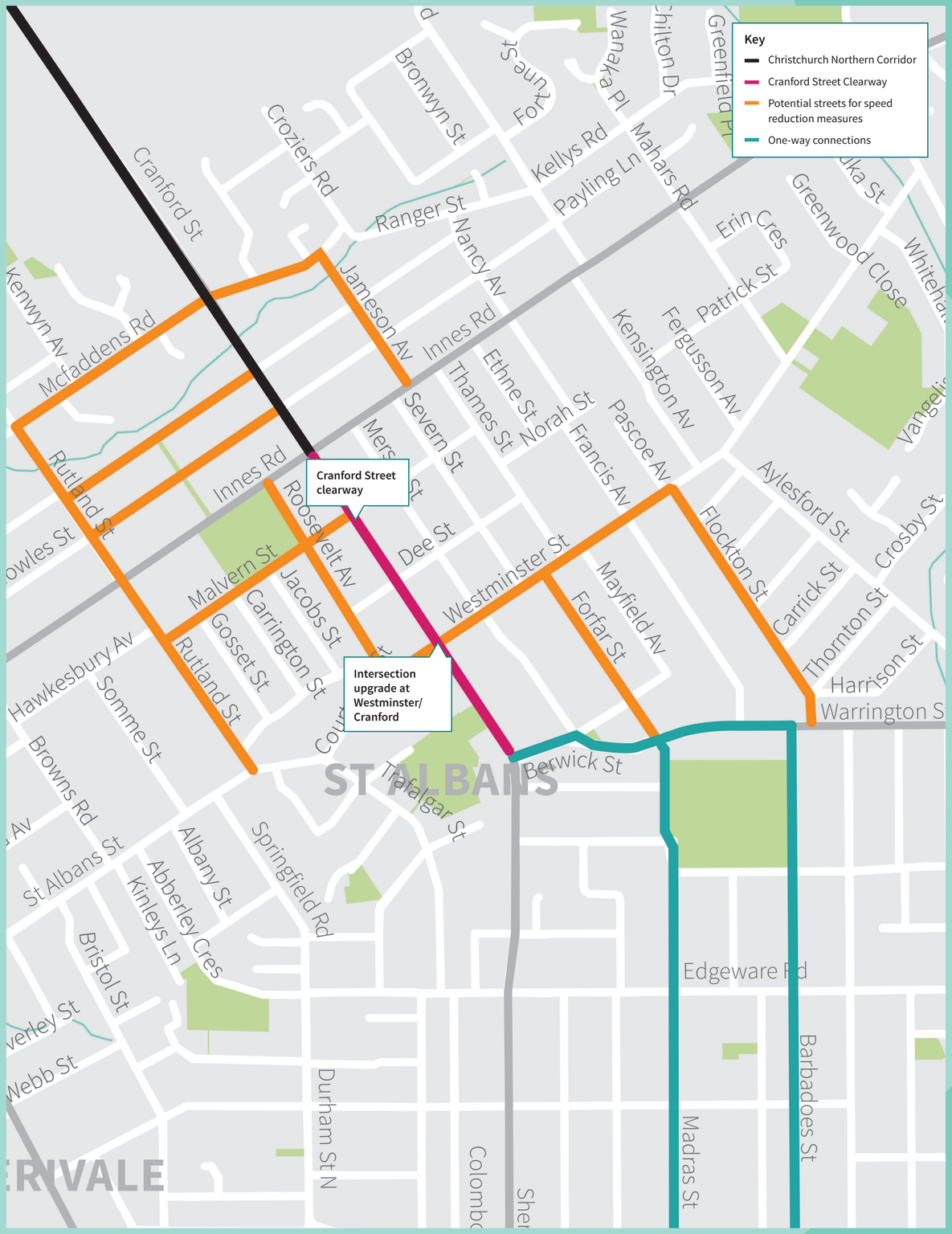


Looking North: Clearway Northbound

Sections of Madras/Forfar Street and Barbadoes Street between Warrington Street and Bealey Avenue would be three-laned within the existing corridor resulting in some loss of parking. The intersections in the area would need to be upgraded to support this change as shown in the map below.



Proposed options showing a reduced number of affected local streets



No.2

Proposal to reduce traffic on side streets

Our investigations show that if the Cranford Street clearway and improved links to the one-way streets are implemented there will be less short cuts through side streets.

These improvements will reduce the number of streets that will require traffic calming as shown on the map.

To discourage short cuts through side streets and improve safety there are a number of options:

- Raised intersections
- Narrowing sections of the road
- Chicanes, bends and landscaping
- Mid-block raised platforms
- Turning restrictions

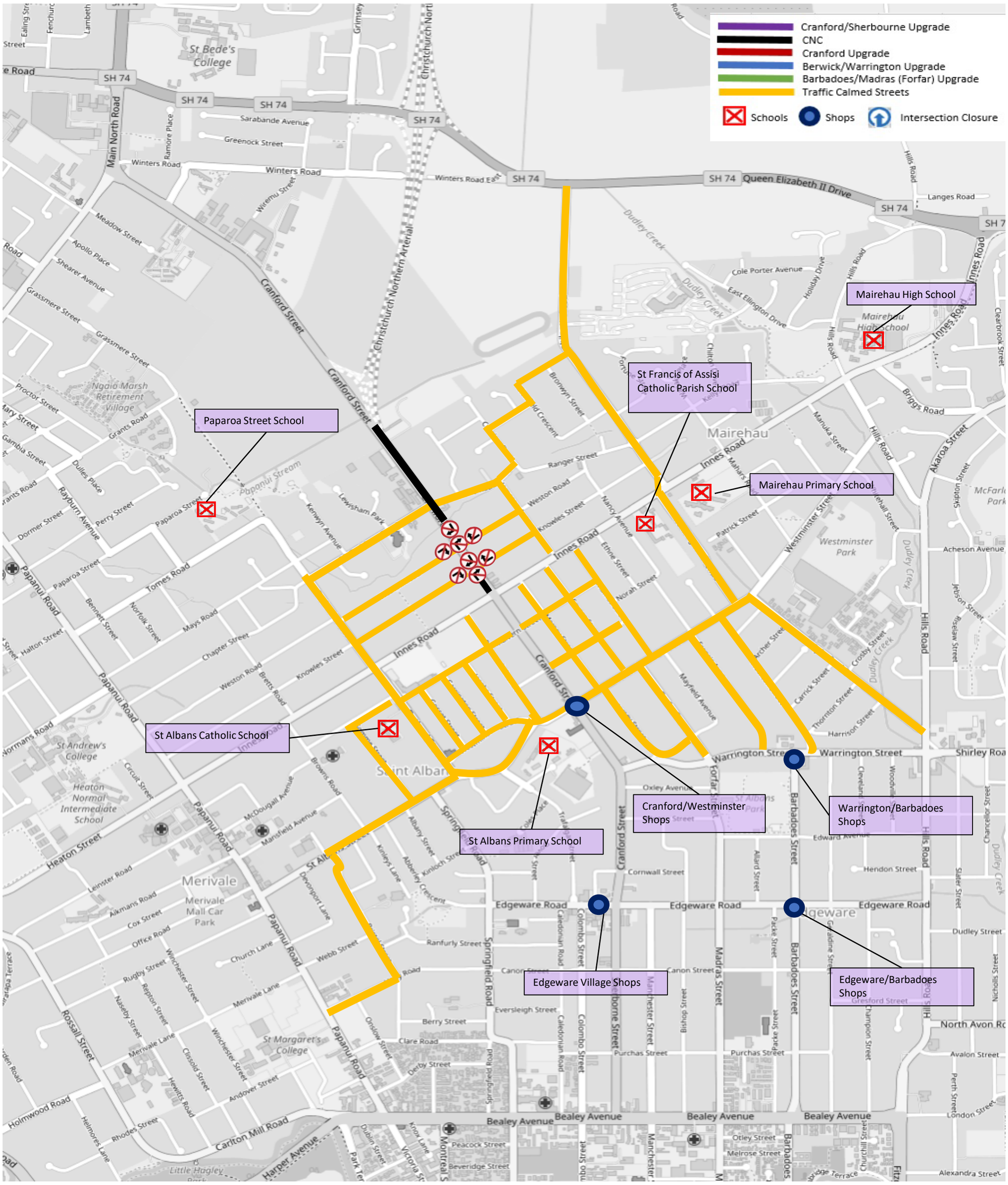
Raised intersection with improved pedestrian crossing facility

Mid block raised platform with road narrowing

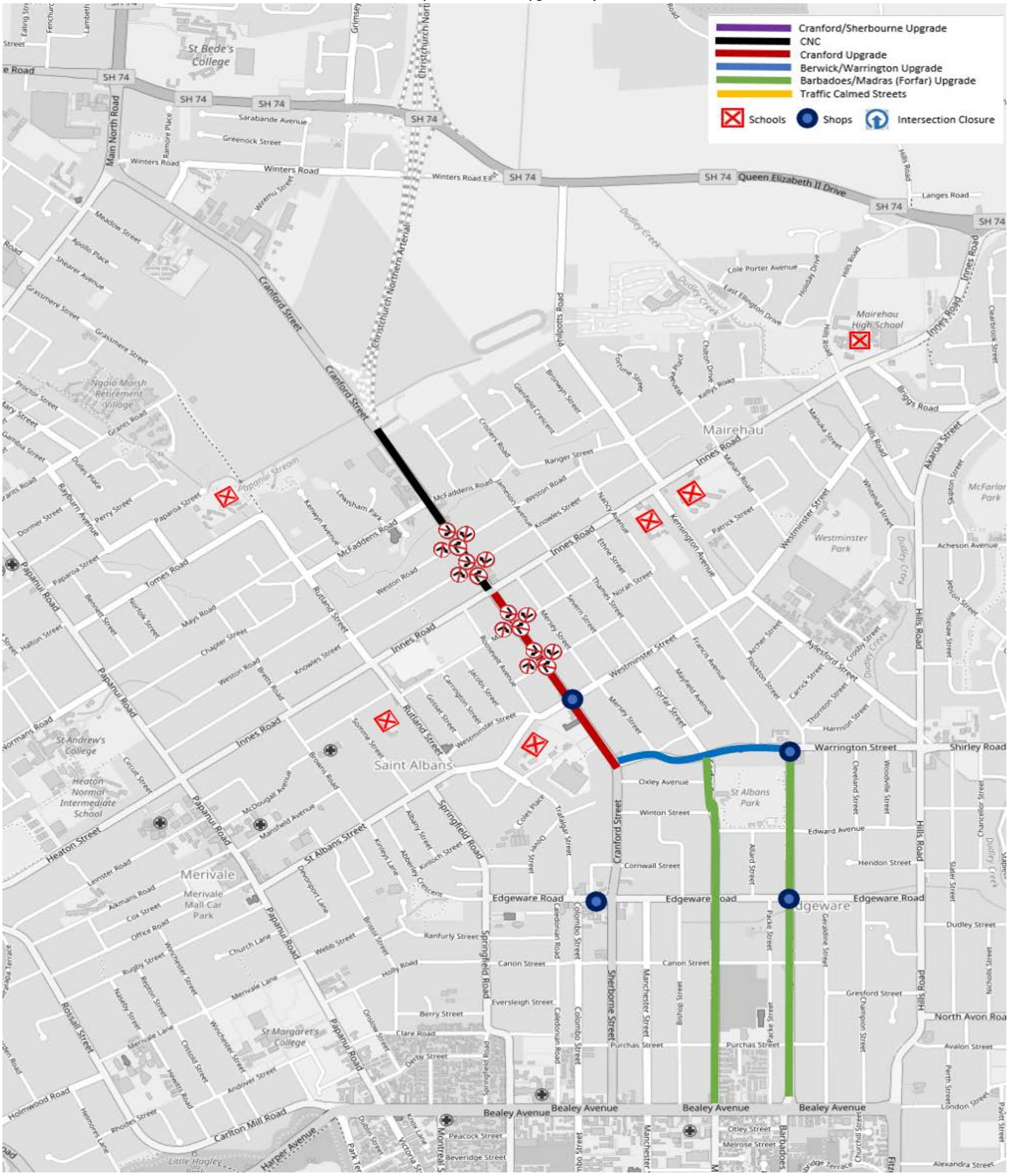
Raised intersection

Appendix G Options Diagrams

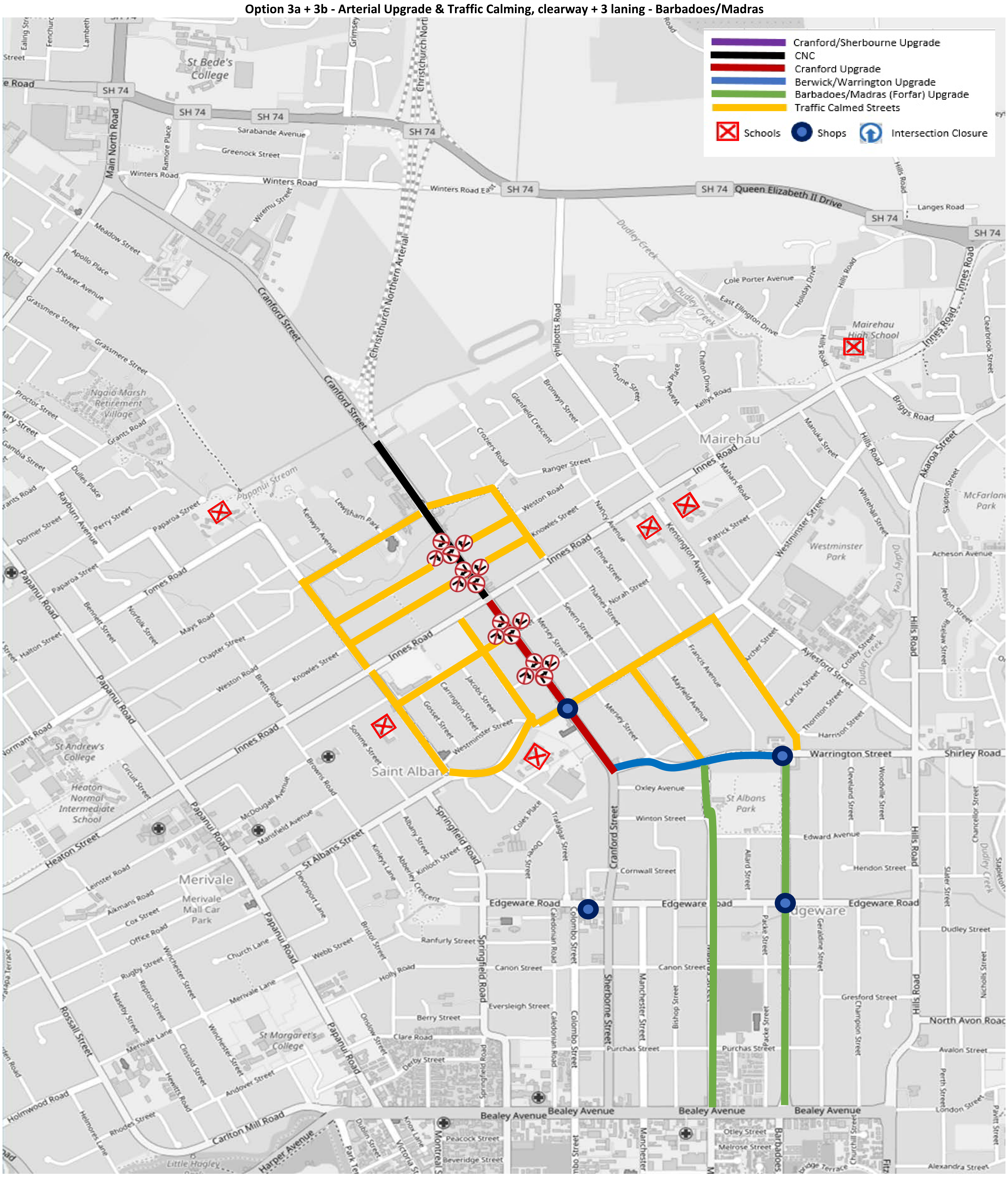
Do Nothing (yellow streets & arterials affected) + Option 1 - traffic calming only (all yellow streets)



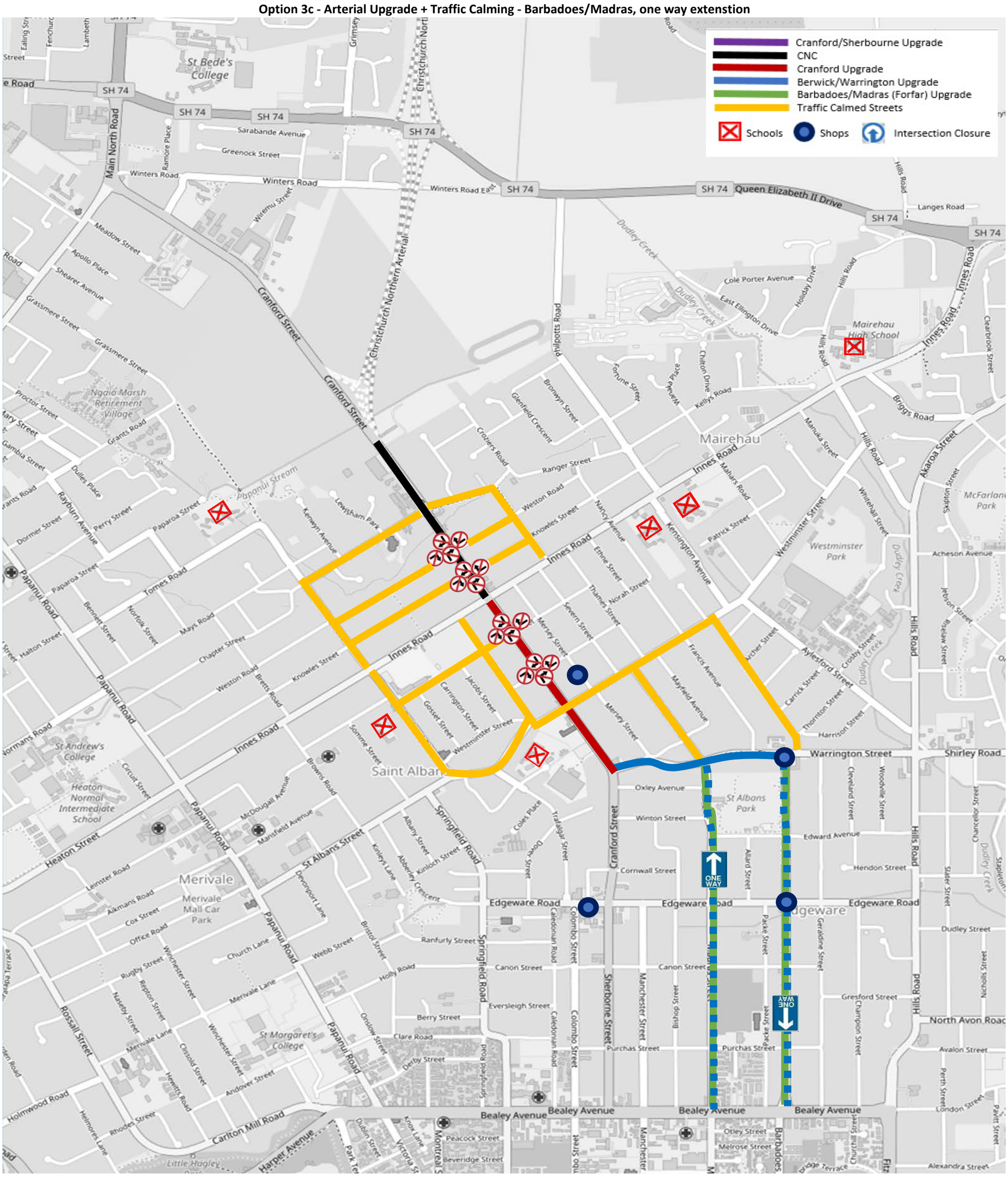
Option 2 - Arterial Upgrade Only



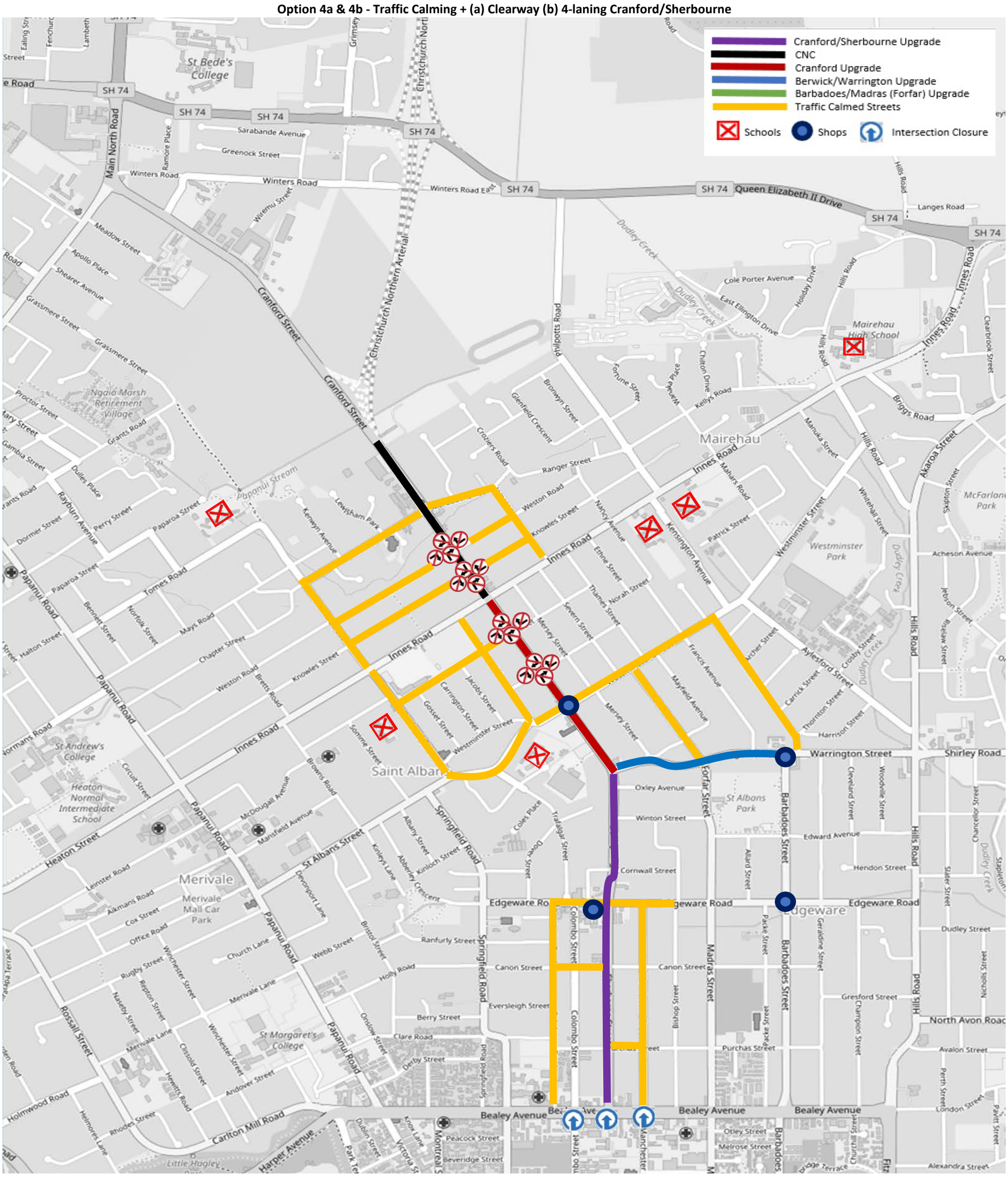
Option 3a + 3b - Arterial Upgrade & Traffic Calming, clearway + 3 laning - Barbadoes/Madras



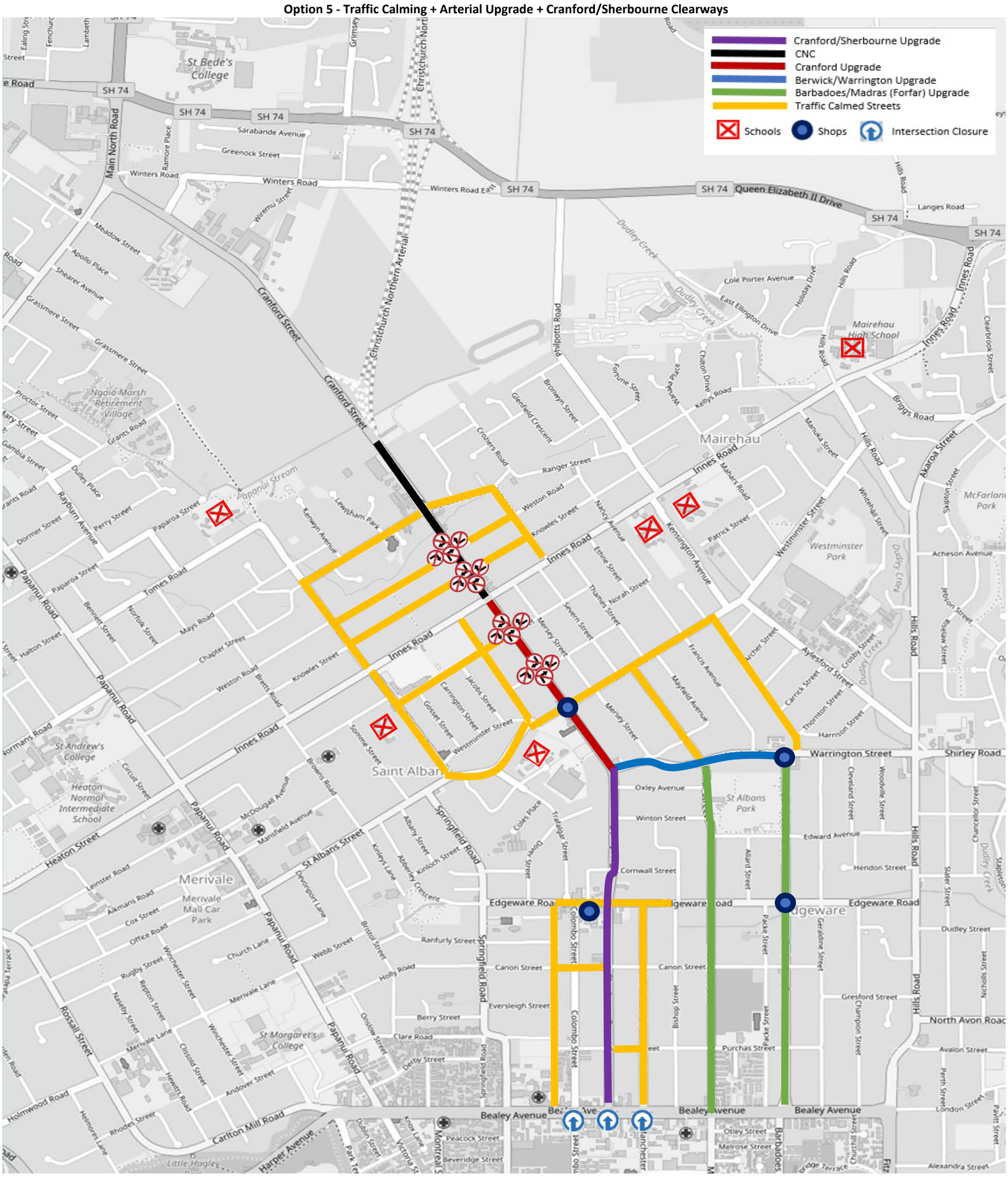
Option 3c - Arterial Upgrade + Traffic Calming - Barbadoes/Madras, one way extenstion



Option 4a & 4b - Traffic Calming + (a) Clearway (b) 4-laning Cranford/Sherbourne



Option 5 - Traffic Calming + Arterial Upgrade + Cranford/Sherbourne Clearways



Appendix H Cycle Route MCA and Safety and Network Functionality Assessments

Multi Criteria Analysis – SANF Application to Cycle Route Identification

Identification, evaluation and selection of a preferred cycle route requires an objective transparent process that can withstand peer review, public scrutiny and permit informed decisions by elected members. This is achieved through a Multi Criteria Analysis (MCA) tool and Safety Audit and Network Functionality (SANF) process.

The purpose of an analysis is to select a preferred route from a number of identified on and off-road route options using a Multi Criteria Analysis (MCA) tool. The MCA assessment process is presented in the July 2016 version of Council's "Cycle Design Guidelines Part B: Design Principles Best Practice Guide".

Route Identification and MCA Assessment

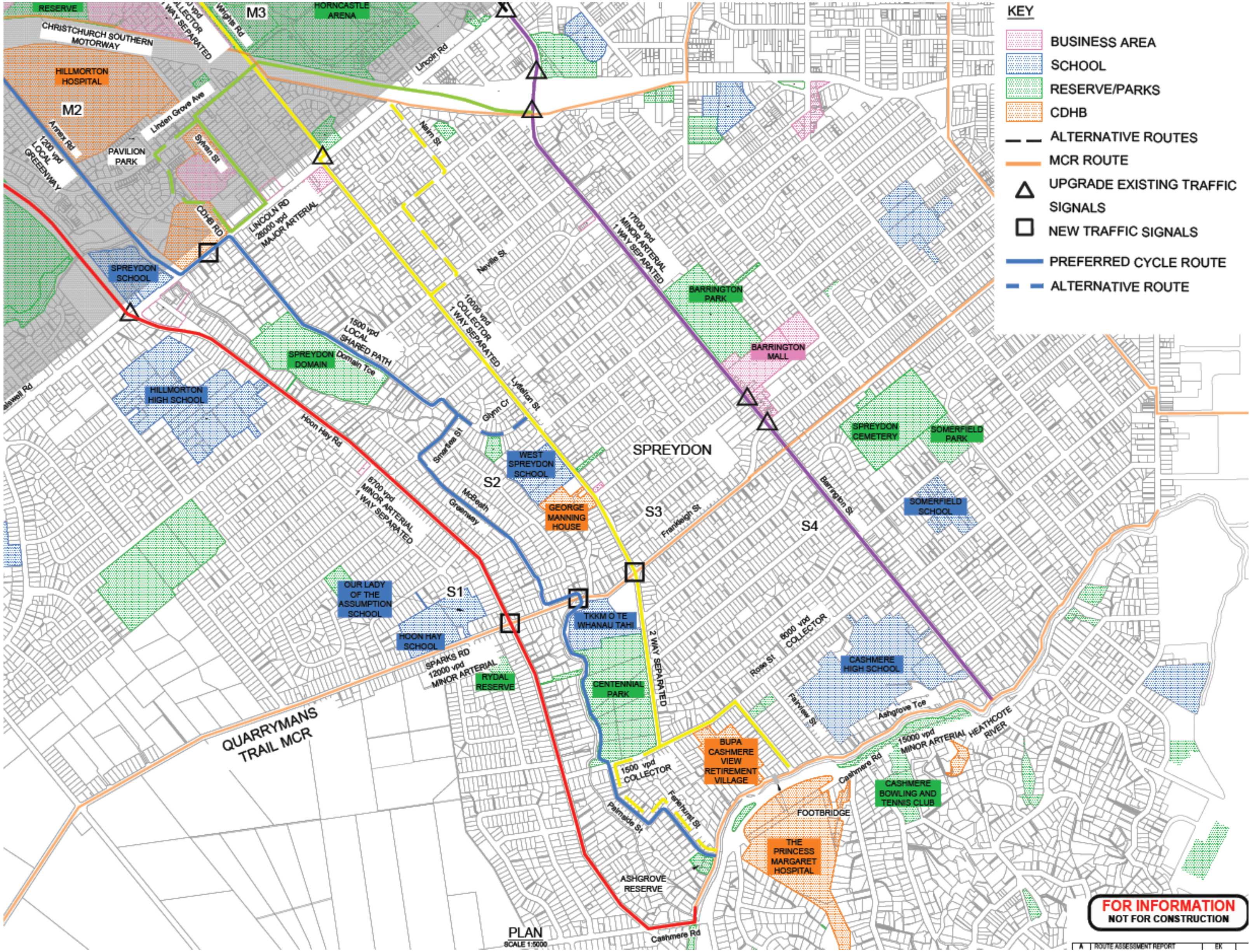
The assessment process involves a site and desktop review of streets within the Route Corridor (an area connecting the start and end points) with streets being linked to form possible routes. Possible facility types are identified, based on cross sectional width, traffic volumes and constraints and are presented on a plan overlaying the land use types.

A shortlist of Route Options is identified from the possible routes, based on logical links to key connections/attractors and available roads within the corridor.

The Route Options are scored in an MCA assessment by a diverse team of people. This assessment scores each option against the following criteria: Safety, Directness, Coherence, Attractiveness, Comfort, Crime Prevention Through Environmental Design (CPTED), Business impact (i.e. change in access and loss of on-street parking), Residence impact (i.e. reduction in on-street parking), operational and network impacts (i.e. changes to the street layout, reduced road width, potential delay to other road users, additional signalised intersections), ease of construction and costs, land purchase/easements and consents. The results are reviewed using sensitivity testing (applying 70% weighting to the broad categories of cyclist criteria, impacts and costs) to confirm the best route option.

SANF Assessment

A SANF assessment involves an independent team of diverse people undertaking a holistic review of the route identification and MCA assessment outcomes to determine whether sufficient analysis has been completed to reach the conclusions and recommendations. A supportive SANF assessment provides transparency and confidence to decision makers that the analysis and impacts on affected parties has been adequately considered. A SANF demonstrates to the public that independent peer reviews have been undertaken.



KEY
BUSINESS AREA
SCHOOL
RESERVE/PARKS
CDHB
ALTERNATIVE ROUTES
MCR ROUTE
UPGRADE EXISTING TRAFFIC SIGNALS
NEW TRAFFIC SIGNALS
PREFERRED CYCLE ROUTE
ALTERNATIVE ROUTE
M2
M3
S1
S2
S3
S4
SPREYDON
CHRISTCHURCH SOUTHERN MOTORWAY
HORNCASTLE ARENA
HILLMORTON HOSPITAL
PAVILION PARK
SPREYDON SCHOOL
HILLMORTON HIGH SCHOOL
SPREYDON DOMAIN
WEST SPREYDON SCHOOL
GEORGE MANNING HOUSE
BARRINGTON PARK
BARRINGTON MALL
SPREYDON CEMETERY
SOMERFIELD PARK
SOMERFIELD SCHOOL
OUR LADY OF THE ASSUMPTION SCHOOL
HOON HAY SCHOOL
TKKM O TE WHANAU TAHI
RYDAL RESERVE
CENTENNIAL PARK
CASHMERE HIGH SCHOOL
BUPA CASHMERE VIEW RETIREMENT VILLAGE
CASHMERE BOWLING AND TENNIS CLUB
FOOTBRIDGE
THE PRINCESS MARGARET HOSPITAL
ASHGROVE RESERVE
QUARRYMANS TRAIL MCR
LINCOLN RD 26000 vpd MAJOR ARTERIAL
17000 vpd MINOR ARTERIAL 1 WAY SEPARATED
10000 vpd COLLECTOR 1 WAY SEPARATED
1500 vpd LOCAL SHARED PATH
1200 vpd LOCAL GREENWAY
8700 vpd MINOR ARTERIAL 1 WAY SEPARATED
SPARKS RD 12000 vpd MINOR ARTERIAL
6000 vpd COLLECTOR
15000 vpd MINOR ARTERIAL
1500 vpd COLLECTOR
2 WAY SEPARATED
HEATHCOTE RIVER
Lincoln Rd
Linden Grove Ave
Annex Rd
Sylvan St
CDHB RD
Wrights Rd
Nairn St
Neville St
Lyttelton St
Glynn Cr
Smarts St
McBeath Greenway
Domain Tce
Hoon Hay Rd
Frankleigh St
Barrington St
Rose St
Fairview St
Ashgrove Tce
Cashmere Rd
Palmside St
Ferniehurst St
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