BEFORE THE SELWYN DISTRICT COUNCIL

UNDER	the Resource Management Act 1991
IN THE MATTER OF	Private Plan Change 71 to the Selwyn District Plan
AND	Four Stars Development Group Ltd (The Applicant)

SUMMARY STATEMENT OF MATHEW (MAT) ROSS COLLINS ON BEHALF OF SELWYN DISTRICT COUNCIL

Transport

09 February 2022

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1 INTRODUCTION

1.1 My full name is Mathew (Mat) Ross Collins. I have been engaged by Selwyn District Council (Council) as its transport expert for PC71 since August 2021 and I prepared the Transportation Hearing Report, attached to Council's s42a report. As that report did not set out my qualifications and experience, I have set these out below.

1.2 I hold a Bachelor of Engineering (Hons) from the University of Auckland and have a post-graduate certificate in transportation and land use planning from Simon Fraser University in Vancouver, Canada. I have been employed by Flow Transportation Specialists since February 2019, where I hold the position of Associate at Flow Canterbury.

1.3 I have over 6 years of experience as a transportation planner and engineer in public and private sector land development projects, which includes experience with strategic land use and transport planning, plan changes, Integrated Transport Assessments, development consenting, and notices of requirement.

1.4 My experience includes acting for Waka Kotahi NZ Transport Agency, Auckland Transport and Auckland Council, Kāinga Ora, Whangarei District Council, Kaipara District Council, and various private developers throughout New Zealand. This work has involved:

(a) Plan change applications including multiple Selwyn Private Plan Changes, Drury East, Drury West, Warkworth North, the Whangarei District Plan Changes for Urban and Services, Mangawhai Central, Avondale Jockey Club, and Pukekohe Raceway.

(b) Resource consent applications including large precincts: Drury South Industrial, Drury Residential, Redhills, Silverdale 3, Drury 1, Waiata Shores, and Crown Lynn Yards.

(c) Designation, Outline Plan of Works, and resource consent applications for major infrastructure including Healthy Waters St Marys Bay Stormwater Water Quality Programme, Watercare Huia Water Treatment Plant replacement, Watercare Huia 1 Watermain replacement, and several Ministry of Education Schools.

2 CODE OF CONDUCT

2.1 I have read and am familiar with the Environment Court's Code of Conduct for Expert Witnesses, contained in the Environment Court Practice Note 2014, and agree to comply with it. My qualifications as an expert are set out above.

2.2 Other than where I state that I am relying on the advice of another person, I confirm that the issues addressed in this summary statement are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

3 SUMMARY OF TRANSPORT MATTERS

3.1 I have reviewed the following Statements of Evidence and Summaries of Evidence from the Applicant:

(a) Lisa Williams (Transport)

(b) Fiona Ashton (Planning).

3.2 I have reviewed the following evidence from Submitters:

(a) Marcus Hayden Langman (on behalf of CRC and CCC)

(b) Mark David Allan and Rebecca Jayne Parish (on behalf of Foodstuffs (South Island)).

3.3 I have reviewed the following Summary Statements from other specialists acting for Council:

(a) Liz White (Planning)

(b) Hugh Nicholson (Urban Design and Landscape).

3.4 Unless otherwise discussed below, I consider that matters identified in my Transportation Hearing Report have been resolved through evidence from the Applicant's experts.

3.5 In my view the following transport matters remain in contention and/or require further consideration:

(a) Transport connectivity to Levi Road

(b) Timing of the connection of Broadlands Drive extension with Lincoln Rolleston Road

(c) Provision of a shared-use walking and cycling path along the frontage of ODP Area 14 with Lincoln Rolleston Road

(d) Cumulative effects on the wider transport network

(e) Transport connectivity between ODP Area 4 and ODP Area 14.

3.6 I discuss these matters in the following section of my summary statement.

4 Transport connectivity to Levi Road

4.1 In paragraph 3.2 of the Urban Design and Landscape Hearing Report (page 3) Mr Nicholson recommended that a second road connection to Levi Road be shown on the ODP.

4.2 In paragraphs 33 - 34 of her evidence Ms Williams discusses this connection and recommends that, if a second road connection is included, it be located to the east of Goldrush Road and that it be designed to discourage through traffic.

4.3 I support Ms Williams on this matter. Levi Road is a critical through movement corridor between Rolleston and Christchurch, and its importance will only increase in the future. I therefore support the location shown for this second road connection in Figure 2 rev. 1 of Mr Nicholson's summary statement.

4.4 In addition, I consider that the ODP narrative appropriately identifies the through movement function of Levi Road, and that the second connection can be provided while not compromising its primary function.

5 Timing of the connection of Broadlands Drive extension with Lincoln Rolleston Road

5.1 In Section 5.1 of the Transportation Hearing Report (page 16) I recommended that a planning mechanism be included requiring the formation of a roundabout at the intersection of Lincoln Rolleston Road and Broadlands Drive, and the extension of Broadlands Drive over ODP Area 4 to ODP Area 5.

5.2 In paragraph 24 of her evidence Ms Williams supports my recommendation, and puts forward a threshold of 491 dwellings at which point the roundabout and connection are required.

5.3 While I agree with the approach Ms Williams has taken to establish this threshold from a traffic efficiency perspective, in my view this does not adequately address potential effects on the effectiveness of the transport network.

5.4 With the northern and southern portions of PC71 potentially separated by Deferred zoning (or a retained Rural zoning, as recommended by Ms White), the northern block could develop with only one or two road accesses, both onto Levi Road. This would limit the connectivity and resilience of the transport network within the northern block.

5.5 I therefore recommend that a planning mechanism be incorporated requiring the Broadlands Drive connection to Levi Road to be formed in conjunction with any development within the southern portion of the northern block, as discussed and shown by Mr Nicholson in paragraph 2.8 and Figure 2 rev 1 of his Summary Statement.

6 Provision of a shared-use walking and cycling path along the frontage of ODP Area 14 with Lincoln Rolleston Road

6.1 In Section 5.4 of the Transportation Hearing Report (page 19) I recommended that the ODP identify walking/cycling facilities along the site frontage with Lincoln Rolleston Road, including safe crossing points to the shared use path on the western side of Lincoln Rolleston Road.

6.2 In paragraph 26 of her Statement of Evidence, Ms Williams considers that the existing shared use path on the western side of Lincoln Rolleston Road, along with crossing points at new intersections, are sufficient, as the existing shared use path allows for two-way cycling movements.

6.3 I disagree with Ms Williams on this matter, and consider that cycling facilities are required on the eastern side of Lincoln Rolleston Road because:

(a) Lincoln Rolleston Road is an arterial road, which creates a barrier to crossing movements for pedestrians and cyclists;

(b) Development within PC71 will generate internal cycling demand (i.e. residents cycling to other locations within PC71), which will be suppressed if cyclists are required to cross Lincoln Rolleston Road to use the cycle facilities, then cross back to the eastern side of the road at their destination; and

(c) Cycling facilities along the eastern side of Lincoln Rolleston Road will help address the disconnected nature of the northern and southern sections of PC71, which will occur as a result of the Deferred Zoning (or a retained Rural zoning, as recommended by Ms White).

7 Cumulative effects on the wider transport network

7.1 In paragraphs 127 to 136 of his Statement of Evidence, Mr Langman discusses his concern with the cumulative effects that multiple Plan Changes with the Selwyn District could have on the wider transport network, particularly for key commuting routes between Rolleston and Christchurch.

7.2 In my experience "out of sequence" development, as referenced by Mr Langman, creates complex challenges for Councils and Road Controlling Authorities. Assessing the effects of such development on the long term planning and funding commitments associated with bulk transport infrastructure is complex and requires assessment of multiple landuse scenarios.

7.3 Helpfully, and independently to the multiple Plan Changes within the Selwyn District, Council has engaged QTP to assess the transport effects of two future landuse scenarios for Selwyn District. As the QTP report was not available at the time of writing my hearing report, I have attached it as Appendix A to my Summary Statement.

7.4 The QTP analysis compares two future growth scenarios:

(a) Scenario 1 (2038): growth in Selwyn based on forecasts agreed by Greater Christchurch Partnership Committee for households, population, and employment.

(b) Scenario 2 (2038): Scenario 1 plus an additional 10,000 dwellings (Selwyn District only), without any changes to employment, or any changes to households in Christchurch or Waimakariri. These households were added into the model to approximate the multiple Plan Changes for rezoning that have been lodged with Selwyn Council.

7.5 QTP found that:

(a) Travel patterns in both Scenarios are indicated to remain similar to 2021, but with an increased magnitude proportional to population increase (increase of around 32% of peak hour trips);

(b) There is and will be high demand between Selwyn and Christchurch, with approximately 50% of Selwyn's peak hour trips starting or finishing in Christchurch, with trips distributing across available corridors between the two Districts;

(c) For both Scenarios limited growth is indicated on some commuter routes (such as Springs Road and Shands Road, due to downstream constraints in Christchurch) resulting in other routes seeing a higher increase in traffic (such as SH1/SH76, Maddisons Road, and Waterholes Road); and

(d) For both Scenarios, more than 90% of peak hour trips are indicated to be by private vehicle.

7.6 The figure overleaf plots the difference in Scenario 2 peak hour traffic flows compared with Scenario 1.

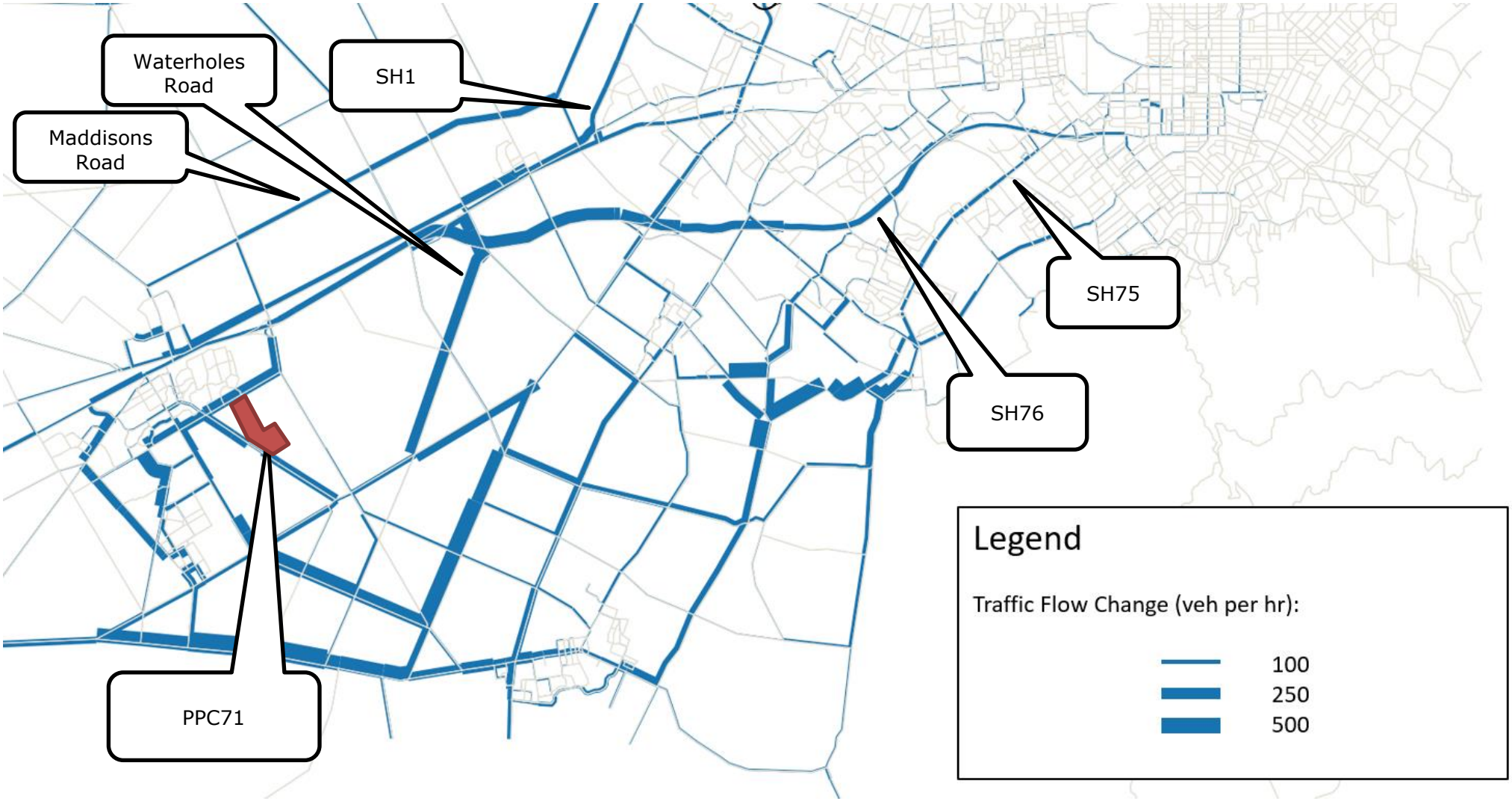
7.7 The QTP report supports my commentary on the potential effects of PC71 on the wider transport network, which I discuss in Section 4 and 7 of my Hearing Report and summarise below:

(a) Should PPC71 affect the quantum of residential growth within Selwyn, without a corresponding increase in local employment and access to services, additional impact on the Greater Christchurch transport network can be expected as additional residents in Selwyn travel to access services and employment.

(b) However, the wider area effects of an "out of sequence" Plan Change such as PC71 may not be overly apparent in a macro scale regional traffic model. As the vehicle movements generated by a Plan Change distribute across the wider transport network, they become a smaller and smaller proportion of the total trips on the network.

7.8 I am therefore of the view that, while PC71 will have effects on the wider transport beyond those assessed by Ms Williams, these effects (including cumulative effects of other Plan Changes) are more appropriately addressed at a District and/or Regional level.

Figure 1: Indicative changes in AM traffic flows, Scenario 2 vs Scenario 1



8 Transport connectivity between ODP Area 4 and ODP Area 14

8.1 In its submission on PC71, Foodstuffs (South Island) raised concerns with the proposed changes to ODP Area 4, including the extension of Broadlands Drive over the southern portion of ODP Area 4. I have discussed this matter in Section 6.6 and 8.7 of my Transport Hearing Report.

8.2 In my view, the extension of Broadlands Drive over ODP Area 4 is a key component of the future transport network because:

(a) Broadlands Drive will fulfil a role as a major east/west link through Rolleston, particularly with the anticipated traffic demands on Levi Road

(b) The form of the urban land uses and transport network to the west of Lincoln Rolleston Road precludes any alternative east/west link

(c) Broadlands Drive is a key link to enabling access for all transport modes into PC71.

8.3 I have been provided development plans for the Foodstuffs (South Island) resource consent application, and I consider that the proposed supermarket does not compromise the extension of Broadlands Drive extension through ODP Area 4.

8.4 The proposed supermarket may compromise the proposed northern local road connection between ODP Area 4 and ODP Area 14. However in my view this can be assessed and addressed through the subdivision/land use consent application process.

9 Summary

9.1 I recommend the following, noting that Ms White has addressed these in her Summary Statement:

(a) That a planning mechanism be included, requiring the construction of the Broadlands Drive connection with Lincoln Rolleston Road; and

(b) That the ODP identify that the Lincoln Rolleston Road frontage upgrade include cycle facilities and safe crossing points.

9.2 Subject to the adoption of Ms White's amendments to the ODP, I consider that there are no transport impediments to the approval of PC71.

Mat Collins
09 February 2022

Quality Transport Planning

Future Year Transport Model Outputs

Selwyn 2031 Update (Selwyn 2051)

October 2021

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Document Issue Record

Version No	Prepared By	Description	Date
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Document Verification

Role	Name	Signature	Date
Preparation	John Falconer		21 October 2021
Reviewer			
Approval	John Falconer		21 October 2021

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Contents

Appendices

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1 Introduction

1.1 This report sets out the results of future year scenario transport modelling used to inform the Selwyn 2031 Update (Selwyn 2051).

1.2 The modelling utilises regional transport models (both CTM and CAST) that are jointly owned and operated by the Greater Christchurch Partnership (GCP). The GCP have agreed future year (2028, 2038 and 2048) base input assumptions relating to landuse and network supply agreed at the regional level, to enable a consistent planning approach. From these base scenarios, additional scenarios can be developed (e.g. redistributing where growth occurs and/or the overall scale of growth).

1.3 The purpose of the transport modelling in this application is to help understand both the current and potential future:

- transport patterns of Selwyn District based traffic, including trip origins, destinations and usage by the most common modes (light vehicles, heavy vehicles, bus and cycle), and how this relates to accessibility.
- performance of the Selwyn District transport network in terms of utilisation of road links by mode and the overall Level of Service (LoS) of road links and intersections.
- impact of Selwyn housing and employment on the Greater Christchurch network, including the proportion of traffic using key arterial roads and intersections.

1.4 Collectively, this information will inform the likely transport impacts of future landuse demand (additional population and employment) associated with the scale and location of particular growth areas and how this may vary across alternative scenarios.

1.5 The specific tasks performed by QTP are summarised below:

- Provide analysis of the current state of the transport network, across a range of transport modes (walking, cycling, car, and bus), including:
  a. Accessibility to land-use activities (e.g. employment, KACs, and schools);
  b. Peak time flows (vehicle trips and bus passengers) on road links;
  c. Trip patterns between key locations; and
  d. Identification of intersections and links that are at or near capacity (resulting in poor level of service);
- Assess the impact of current Selwyn housing and employment on the Greater Christchurch transport network; in particular the impact of peak time flows into and out of Selwyn's townships.
- The testing of alternate land-use scenarios, developed in conjunction with SDC.

1.6 The model outputs and outcomes associated with the first two bullets above are documented in the report titled '*Transport Model Outputs for Selwyn 2031 Update (Selwyn 2051) V1.PDF'*. This report documents the last bullet point; the testing of alternate land-use scenarios.

2 Transport Model Application

2.1 Modelling Overview

2.1.1 Greater Christchurch extends over three Territorial Local Authorities (TLAs); Christchurch City, Waimakariri District to the north, and Selwyn District to the south. While each TLA is governed separately, many decisions made by one TLA have an impact on the other two (and other stakeholders), especially in relation to transport.

2.1.2 As part of this, a joint committee known as the Greater Christchurch Partnership Committee (**GCPC**) has formally been established, with representatives from each Partner's organisations to lead and coordinate projects.

2.1.3 The GCPC have collectively prepared forecasts of population, households and employment and at the Territorial Local Authority (TLA) level (within the Greater Christchurch area). These forecasts are reasonably consistent with Statistics NZ (sub-national) population forecasts released in 2017[1]; when applying the Medium Growth projection within Christchurch City and the Medium-High projection to Waimakariri and Selwyn Districts.

2.1.4 In addition to the above 'default' forecasts (hereafter called Scenario 1), this report includes testing of an alternate land-use scenario (hereafter called Scenario 2), which includes an additional 10,000 households located in Selwyn townships by 2038. Population and Household totals for Christchurch City and Waimakariri District remain unchanged (i.e. Scenario 2 has a net gain of 10,000 households relative to Scenario 1 at 2038, all allocated to Selwyn District).

2.1.5 Specific locations (Meshblocks) where residential capacity has been added to Scenario 2 , as supplied by SDC, are included in **Appendix A**.

2.2 Software Capability

2.2.1 The CTM is a traditional regional four stage[2] transport model, covering the Greater Christchurch area and implemented in CUBE Voyager software. It was commissioned in 2005 and completed in 2009. The cost of the model was significant (in the order of $2m), with approximately half of this cost allocated to data collection. The CTM provides a meaningful response to the most critical factors that affect the transport system; travel demand (based on spatial population and landuse activity) and the available transport linkages (network provision) that facilitate movement between locations.

2.2.2 The CAST model, implemented in the SATURN software, uses travel demand estimated by the CTM and provides a much more detailed simulation of intersection operation and interaction, whilst still modelling the operation of the entire Greater Christchurch road network[3]. In this regard the modelling is extremely powerful as it simulates localised impacts whilst also capturing the effects on the wider road network. The detailed simulation modelling is achieved through use of the Cyclical Flow Profile which tracks

[1] Note the CTM and CAST models are currently being updated to 2018 Census data and new forecasts are imminent, however the 2017 forecasts still reasonably represent anticipated spatial growth patterns in the short to medium term.
[2] The four stages being trip generation, trip distribution, mode choice and traffic assignment.
[3] Some local roads such as cul-de-sacs and others without a significant through-traffic potential are not included.

the arrival and departure profiles of vehicles through the network through every 'step' (typically 1 second) of the adopted cycle time.

2.3 Model Limitations

2.3.1 When interpreting transport model outputs, it is important to note that the model attempts to represent complex human behaviour in a pragmatic manner such that it is possible to make reasonable and useful predictions of potential outcomes in the future.

2.3.2 While all such transport models are simplifications of reality, they provide a foundation for quantitative estimates of likely effects and potential benefits that can be helpful for decision-makers. In reality, there are many individual motivators for choosing to travel (or not) in the first place, let alone which mode or routes or modes are taken.

2.3.3 Any tool or model framework which 'aggregates' such individual choices will, inevitably, use generalised assumptions (such as aggregation to zones, 'household types', etc.). In many cases these assumptions may have a degree of error or simply be 'wrong' at an individual level. However, 'on the whole' such models seek to provide a reasonable approximation to the observed or anticipated behaviour of the target population at a particular point in time – and most pertinently for planning purposes, need to respond (sensibly) to key variables, including demographic changes and potential policy interventions or levers.

2.3.4 The transport models have been calibrated to reflect 2006 travel behaviour, with an inherent assumption that this will continue. While over the last few decades this has been proven (empirically) to be a valid assumption, the recent (2021) government policy statements on land transport and housing and urban development suggest (correctly) that significant intervention is needed in the near future to force travel behaviour change in order to address climate change, sustainability issues, urban design and to provide better long-term social outcomes.

2.3.5 The transport models will therefore continue to evolve to reflect latest policy and wider societal changes, with regularly updated planning horizons and modelling techniques based on the best information available at the time.

2.3.6 Indeed, it was the insights provided by transport models that have helped (in part) build the case for change are now seeing.

3 Future Year (2038) Network Model Outputs

3.1 Model Outputs

3.1.1 The full range of model output plots for the modelled 2038 year are included in Appendix B.

3.1.2 A selection of these are duplicated in this section where further discussion and interpretation is warranted. Due to space constraints, these have been reduced in size, however the reader may therefore refer to the full-size versions in the appendix for more detailed information.

3.1.3 Only the morning peak period has been reported because this period has the greatest impact within Selwyn District. The evening peak period generally has similar traffic patterns but in the inverse direction. However, trips travelling from Christchurch to Selwyn during the evening peak (i.e. peak flow direction) are highly constrained by the Christchurch City network, which regulates the rate at which trips cross the border from Christchurch to Selwyn. This limits effects relative to the morning peak.

3.1.4 In line with the project scope, the outputs have been grouped into four themes:

- ***Trip Patterns*** – to understand broadly where people (and goods) are travelling within Greater Christchurch.
- ***Traffic Flows*** – to understand the how traffic flows might change between 2021 and 2038 (for both Scenario 1 and Scenario 2) and also understand the differences at 2038 between Scenario 1 and Scenario 2.
- ***Network Performance*** – to identify how the traffic flows above relate to the available network capacity and the resulting Level of Service (LoS).

3.2 Trip Patterns

3.2.1 A summary of vehicle trips to and from Selwyn is provided below.

Figure 3-1: Morning Peak 2021 Vehicle Trip Summary

AM Peak 2038 Base – 2hr (0700-0900) Vehicle Trip Summaries by mode

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Light Vehicle	From Selwyn GC to	9,180	2,620	9,700	70	1,330	50	22,950
	To Selwyn GC from	9,180	330	5,090	280	70	50	15,000
	From Selwyn Ext to	1,280	200	1,100	60	40	70	2,750
	To Selwyn Ext from	1,330	260	1,120	50	40	50	2,850
	TOTAL Trips	18,360	2,950	14,790	350	1,400	100	37,950

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Heavy Vehicle	From Selwyn GC to	120	10	360	30	30	30	580
	To Selwyn GC from	120	10	310	30	30	10	510
	From Selwyn Ext to	30	80	270	30	-	30	440
	To Selwyn Ext from	30	80	280	30	-	10	430
	TOTAL Trips	240	20	670	60	60	40	1,090

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
TOTAL	From Selwyn GC to	9,300	2,630	10,060	100	1,360	80	23,530
	To Selwyn GC from	9,300	340	5,400	310	100	60	15,510
	From Selwyn Ext to	1,310	280	1,370	90	40	100	3,190
	To Selwyn Ext from	1,360	340	1,400	80	40	60	3,280
	TOTAL Trips	18,600	2,970	15,460	410	1,460	140	39,040

3.2.2 This figure shows that during the morning peak period:

- Vehicle trip patterns are indicated to remain similar to 2021, but with increased magnitude (from 29,400 tips per day in 2021 to 39,000 in 2038, i.e. +32%).
- Heavy vehicle trips are a very small proportion (3%) of total Selwyn based traffic. This proportion remains similar to 2021.
- There is still high transport demand between Selwyn District and Christchurch in 2038 (with approximately 50% of Selwyn trips having an origin or destination in Christchurch, as was also the case in 2021), with more than 90% of trips indicated to be by private vehicle (despite assumed improved PT services in future years).

3.3 Traffic Flows

3.3.1 The following plots indicate the implication of the trip patterns in relation to the available roads that make up the transport network how these are used.

3.3.2 General traffic flow patterns for 2038 appear to be broadly similar to 2021, but are about 25% (on average) higher as indicated below shown below:

Figure 3-2: Morning Peak 2021 Traffic Flow

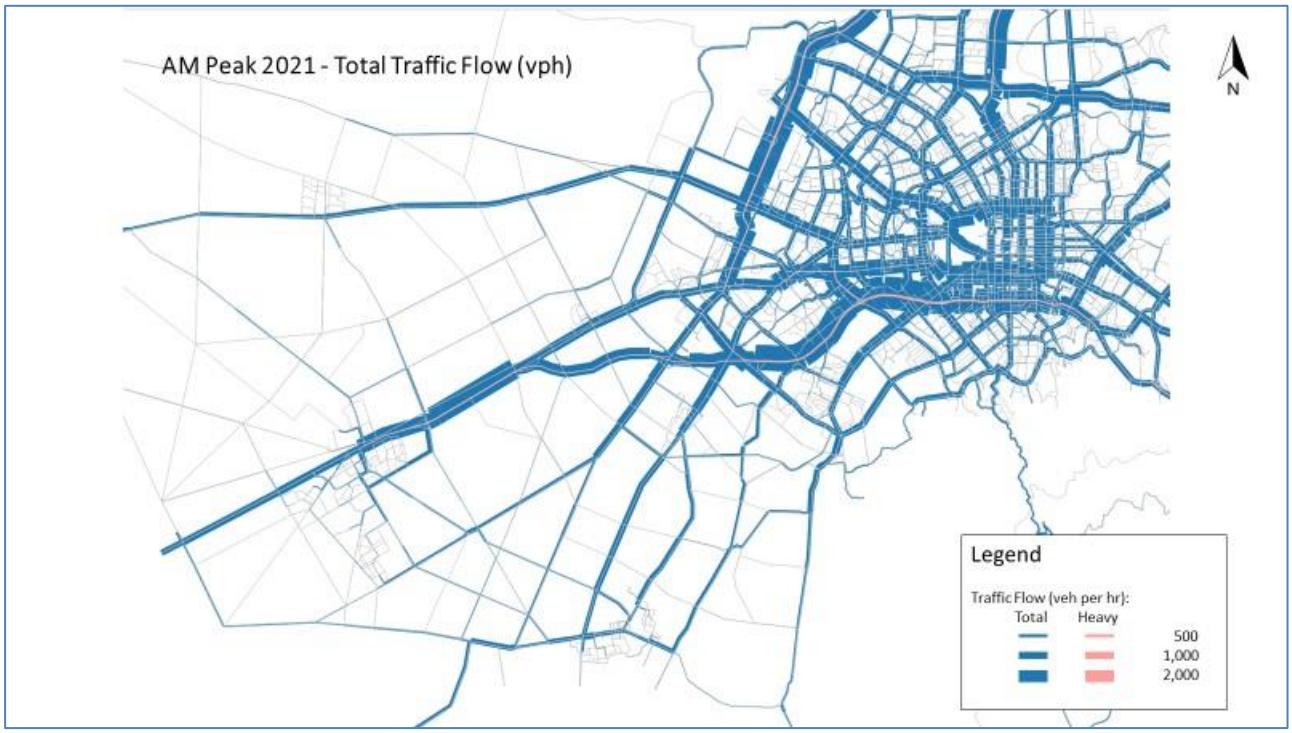
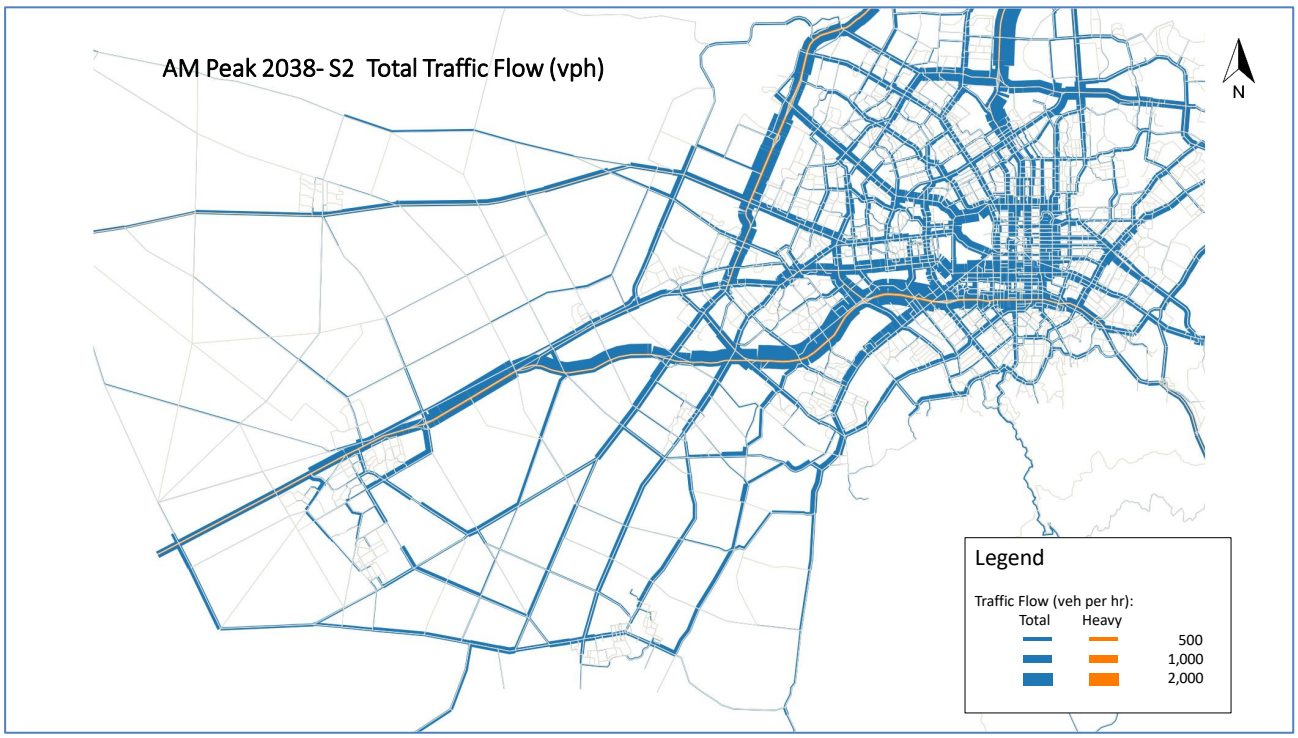


Figure 3-3: Morning Peak 2038 Traffic Flow



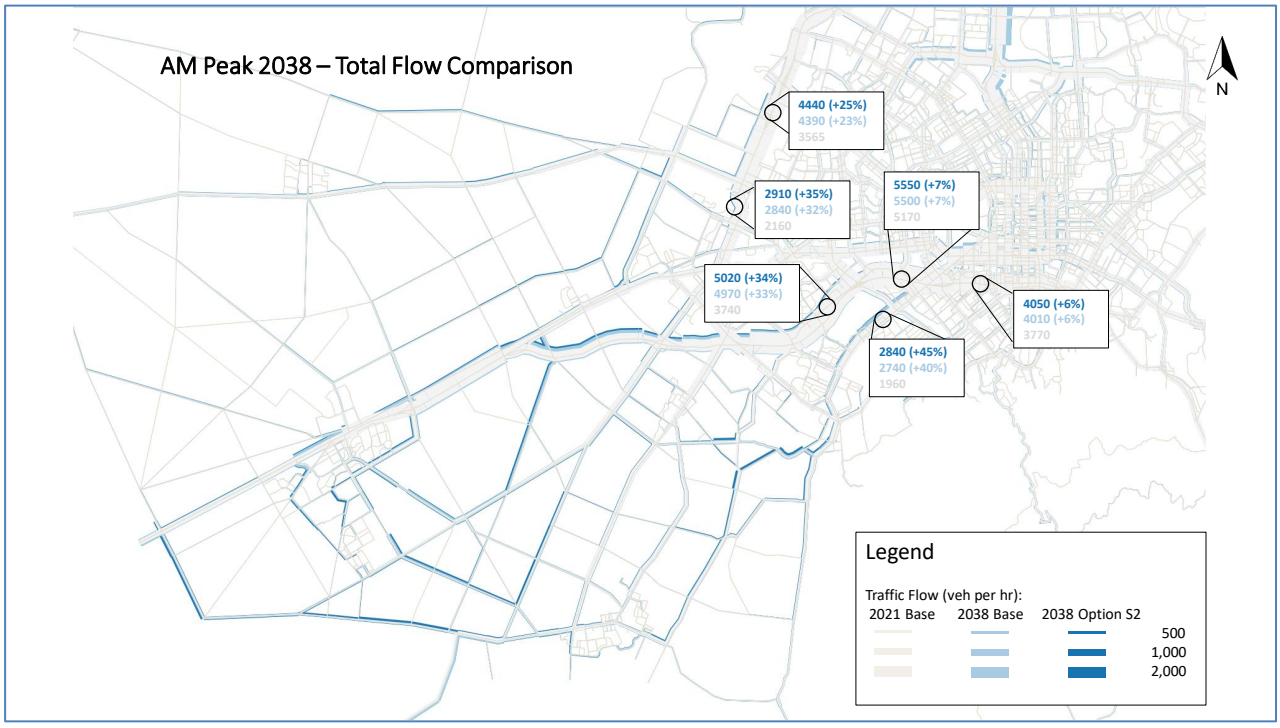
3.3.3 This increase in overall traffic flow is indicated to be almost directly proportional to the population increase as shown in Table 3-1 below.

Table 3-1: Estimated increase in population and vehicle trips 2021 to 2038 (Scenario 2)

Greater Christchurch	Forecast Year		Change	
	2021	2038	abs	%
Population	495,027	617,262	+122,235	25%
Vehicle Trips	172,626	218,127	+45,501	26%

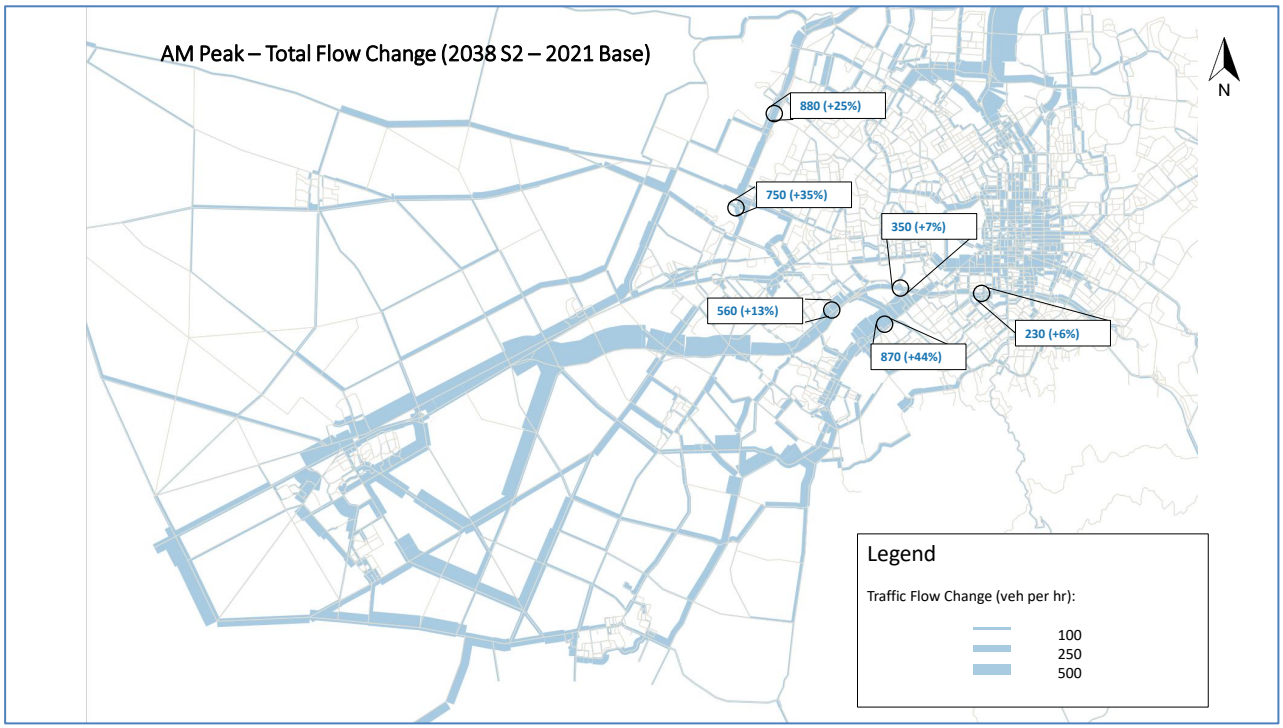
3.3.4 Figure 3-4 below shows just the Selwyn based component of traffic (with incremental changes for both Scenario 1 and 2 between 2021 and 2038).

Figure 3-4: Morning Peak 2038 Selwyn Based Traffic Flow – Incremental Changes



3.3.5 Figures on the following page show the change in 2038 (Scenario 2) relative to 2021 (Figure 3-5 and the change between Scenario 1 and 2 (Figure 3-7). This is the same information presented in Figure 3-4, but with an exaggerated bandwidth scale to better distinguish changes on individual roads.

Figure 3-5: Morning Peak Base Traffic Change (2021 to 2038 Scenario 2)



3.3.6 The above figures indicate that traffic travelling between Selwyn and Christchurch City will distribute itself over all available corridors across the boundary; SH74 West Coast Road, SH1Main South Road, CSM2, Shands Road, Springs Road, Whincops Road and SH75 Halswell Road.

3.3.7 It is apparent that traffic interactions and network constraints within Christchurch City, combined with ongoing development of south-west Christchurch, have a significant impact on how Selwyn traffic distributes to use the most viable routes.

3.3.8 For example, there is only very limited traffic growth on Springs and Sands Roads due to downstream constraints across the border in Christchurch reducing the attractiveness of these routes relative to alternatives. Such alternatives include Ellesmere Road connecting into Halswell Road. While Halswell Road is also indicated to be congested in the future, traffic growth distributes in varying extents to all available routes according to Waldrop's first and second principles[4].

3.3.9 These principles (which also underpin the traffic modelling) state that as networks become increasingly congested, trips spread themselves over multiple routes such that an equilibrium is reached where journey times by all available routes are similar. This also results in all routes being simultaneously degraded to some extent as a consequence of the increased traffic.

3.3.10 As a result of this equilibrium, some interesting route choices can materialise. A good

[4] https://en.wikipedia.org/wiki/John_Glen_Wardrop

example of that is the obvious increase in traffic on Waterholes Road. While overall total traffic flows on Waterholes Road remain relatively low compared to other roads, this route becomes increasingly attractive from south Rolleston to Christchurch, enabled by the roundabout at SH1/Dawsons, where eastbound (peak flow direction) traffic on SH1 have to give way to all traffic using the Waterholes Road route (where the latter turns right at the roundabout towards Christchurch but only having to give way to lesser westbound traffic flow).

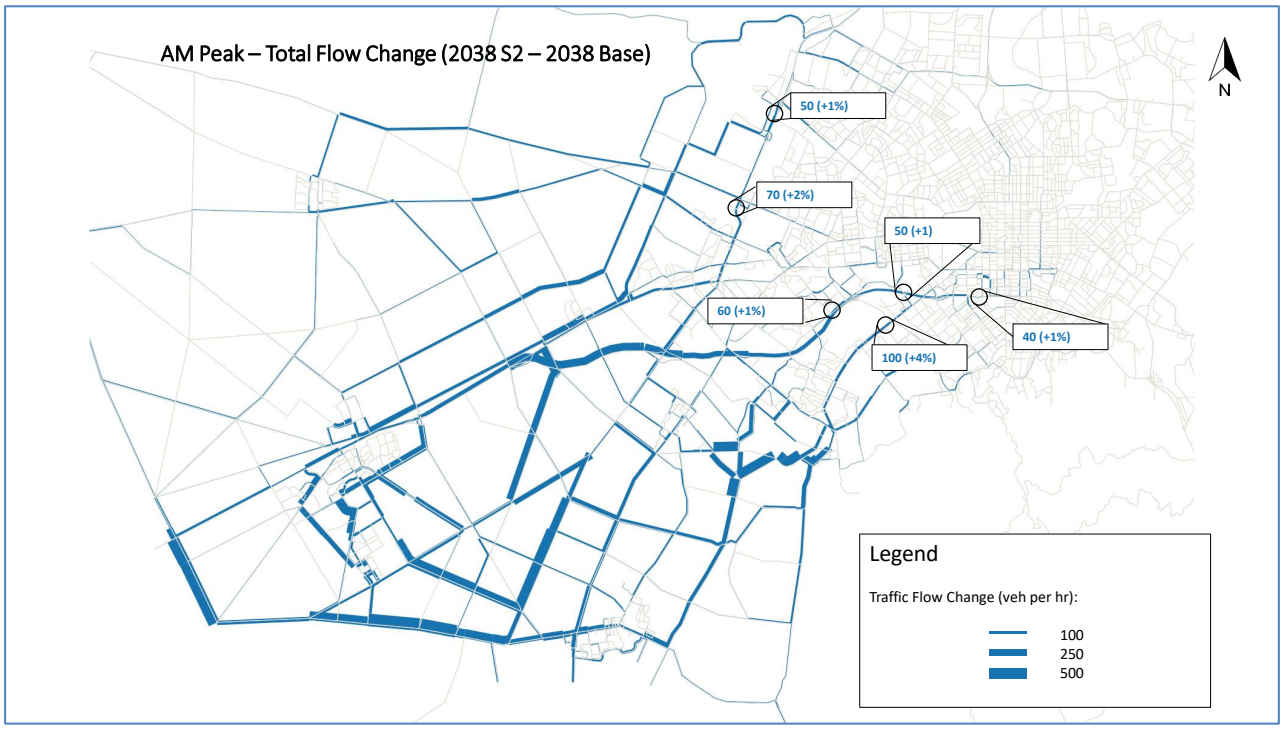
3.3.11 An additional factor (also included in the CAST model) is that trip demand is elastic. That is that demand for travel will change in response to cost[5]. Therefore, trip retiming (peak spreading), changing mode, or deciding not to make a trip, increasingly occur as congestion increases, which provides a dampening effect to increasing travel demand.

3.3.12 This effect, combined with the equilibrium theory described earlier, has resulted in a negligible increase in Brougham Street traffic in the future. This appears to be sensible, given that Brougham Street has already reached capacity during peak periods, resulting in long queues extending up the southern motorway during the morning peak, as recorded in the picture below (picture taken 2km west of Barrington Street during the morning peak in October 2021).

Figure 3-6 – Existing morning peak queuing on southern motorway 2km west of Barrington Street.

[5] This works both ways, where reducing travel delays and 'easing congestion' is likely to simply increase travel demand, and therefore congestion will still exist. This is known as 'induced traffic' and is why no city has ever been able to 'build its way out of congestion' (at least without resorting to some form of road pricing).

Figure 3-7: Morning Peak Base Traffic Change (2021 to 2038 Scenario 2)



3.3.13 The changes in traffic flows between Scenario 1 and Scenario 2 (at 2038) follow a similar pattern to the changes between 2021 and 2038. This is not surprising, given all the added capacity for Scenario 2 was added to the townships (primarily West Melton, Rolleston, Prebbleton and Lincoln), so it tends to simply reinforce existing growth areas which in turn reinforces existing travel patterns[6].

[6] Although theoretically an increasing level of self-sufficiency and opportunities for active modes should also result thereby offsetting some of the indicated traffic growth.

3.4 Network Performance

3.4.1 The following plots identify how traffic flows relate to the available network capacity and the resulting Level of Service (LoS).

3.4.2 Figure 3-8 provides a summary of average intersection delay, for each intersection as a whole, and for the worst movement (almost always a right turn). Link volume to capacity ratio (reflecting how much of the available capacity is being used) is also displayed.

3.4.3 Intersections normally have less overall capacity than adjacent road links. Therefore, intersections are often the limiting factor in terms of network capacity.

Figure 3-8: Morning Peak 2038 Network Performance (Scenario 1)

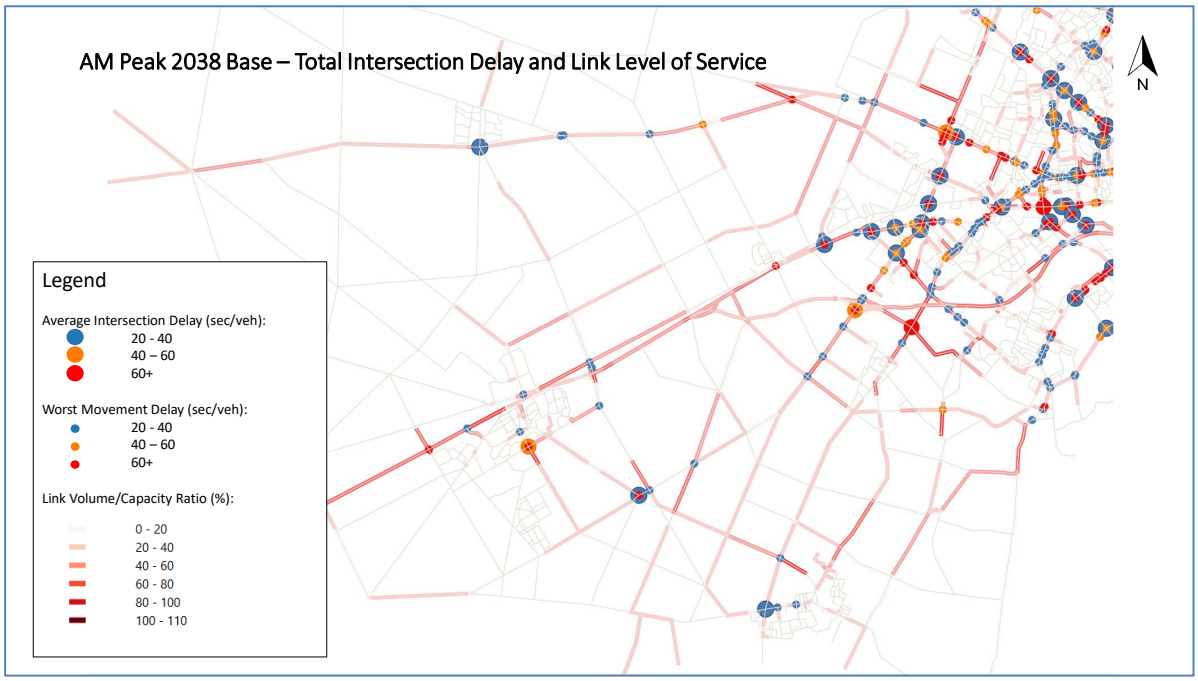
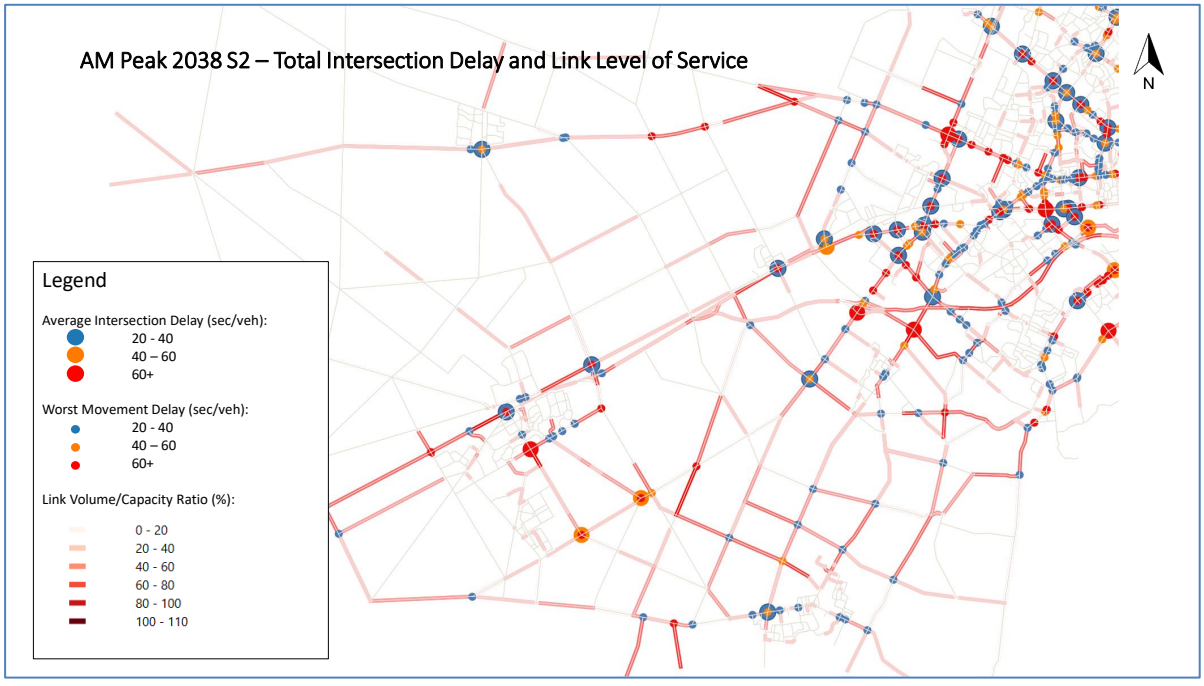


Figure 3-9: Morning Peak 2038 Network Performance (Scenario 2)



3.4.4 There appear to be a few deficiencies and bottlenecks within the Selwyn District portion of greater Christchurch in 2038 Scenario 1. A few potential issues (but note that these are not necessarily unacceptable and may in fact be required to achieve other desired outcomes) that stand out include:

- Tennyson/Lowes/Springston-Rolleston traffic signals.
- Springs Road/Marshs Road roundabout.
- Potential for congestion (due to high V/C) on some sections of SH1, Shands Rd and Springs Road.

3.4.5 It is noted that some deficiencies that occurred in 2021 no longer apply in 2038 due to various infrastructure improvements, especially those associated with the SH1 Rolleston improvements.

3.4.6 Relative to Scenario 1, additional deficiencies are apparent in Scenario 2. These are effectively all related to the increased population and include:

- Additional pressure on Tennyson/Lowes/Springston-Rolleston traffic signals.
- Additional pressure on Springs Road/Marshs Road roundabout.
- Lincoln Rolleston and Selwyn Road priority intersection.
- Springston Rolleston Road/Selwyn Road priority intersection.
- Ellesmere Jct/Gerald/Springs (Lincoln) traffic signals.
- Shands/Marshs traffic signals.
- Toswill/Trices priority intersection.

3.4.7 These ‘deficiencies’ do not necessarily need to be addressed or mitigated however, for the reasons stated in paragraphs 3.3.11 and 3.3.12 (the exception to this would be if there is an obvious safety risk or conflicts with other modes).

3.4.8 These types of deficiencies are also likely to occur at certain points in the network regardless of specific locations where residential growth is added.

3.4.9 From a transport planning point of view, the best strategy for accommodating growth (in the current environment) is therefore to consolidate as much as possible (with increased densities) to improve overall access to Public Transport and enable active modes (which require relatively short distances). This approach may make private vehicle travel less attractive than is currently is, although it will still be reasonably attractive relative to other modes, resulting in a better balance between modes, which in turn leads to more choice.

APPENDIX A – Scenario 2 Inputs

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Input Targets - Selwyn Scenario 1

TLA[1]	Input Total	2006	2013	2018	2028	2038	2048
Selwyn	ERPopulation	21,971	31,530	41,026	55,089	62,780	73,484
	Households	7,691	9,943	14,147	19,675	23,252	28,263
	Adults (15+)	16,963	24,536	32,795	43,777	50,950	60,495
	Workers	12,500	17,553	22,943	31,111	35,386	41,365
	Students	5,265	7,614	9,767	12,546	13,735	15,623
	Non-Students	15,124	21,299	28,855	38,895	45,265	53,743

[1]Note these refer to only the parts of the districts within the CTM/CAST model (UDS/LURP) area.

Input Targets - Selwyn Scenario 2

TLA[1]	Input Total	2006	2013	2018	2028	2038	2048
Selwyn	ERPopulation	21,971	31,530	41,026	71,981	89,912	99,612
	Households	7,691	9,943	14,147	25,708	33,301	38,312
	Adults (15+)	16,963	24,536	32,795	57,200	72,969	82,004
	Workers	12,500	17,553	22,943	40,650	50,680	56,073
	Students	5,265	7,614	9,767	16,392	19,671	21,178
	Non-Students	15,124	21,299	28,855	50,821	64,828	72,852

[1]Note these refer to only the parts of the districts within the CTM/CAST model (UDS/LURP) area.

Added Household Capacity for Scenaro 2

PC	Township	MB	2028	2038	Total
64	Rolleston F SE	4010047	353	236	589
		2719417	249	159	408
67	West Melton S	4011164	39	26	65
		4011163	40	26	66
68	Prebbleton W Hamptons	4011165	492	328	820
69	Lincoln	2720800	600	400	1000
		4010021	600	400	1000
70	Rolleston F FW	2719416	480	320	800
71	Rolleston Flight Contours	4008019	396	264	660
72	Prebbleton Trices	2500100	177	118	295
73	Rolleston L3	2719004	600	400	1000
		2719005	660	440	1100
74	West Melton E	4000454	78	52	130
75	Rolleston E	4008019	168	112	280
76	Rolleston E Maddisons	2719416	93	62	155
77	West Melton W	4000456	150	100	250
		4000452	165	110	275
78	Rolleston SE	4008019	453	303	756
79	Prebbleton	2500200	120	80	200
		2500400	120	80	200
			6033	4016	10049

APPENDIX B – 2038 AM Plots

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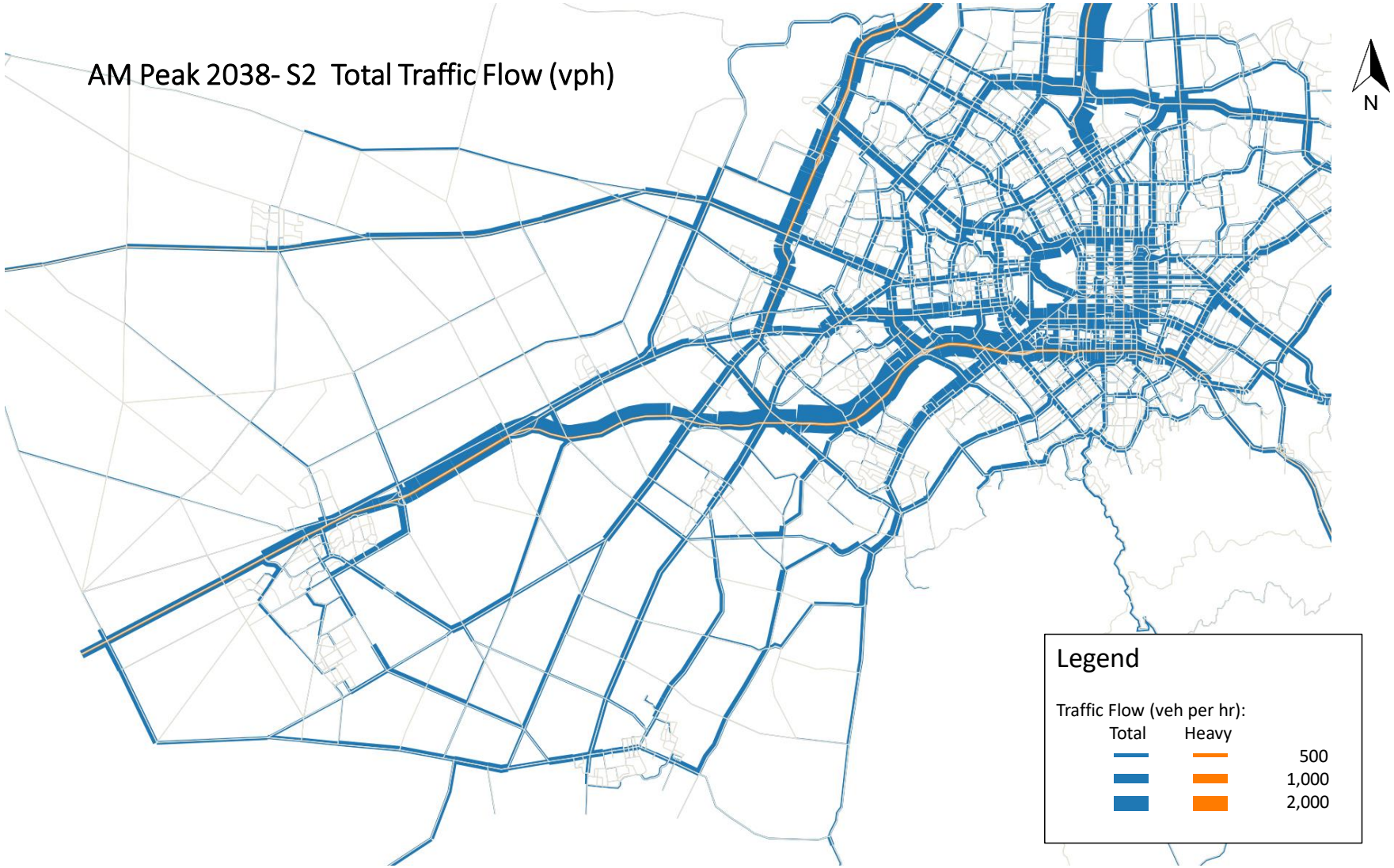
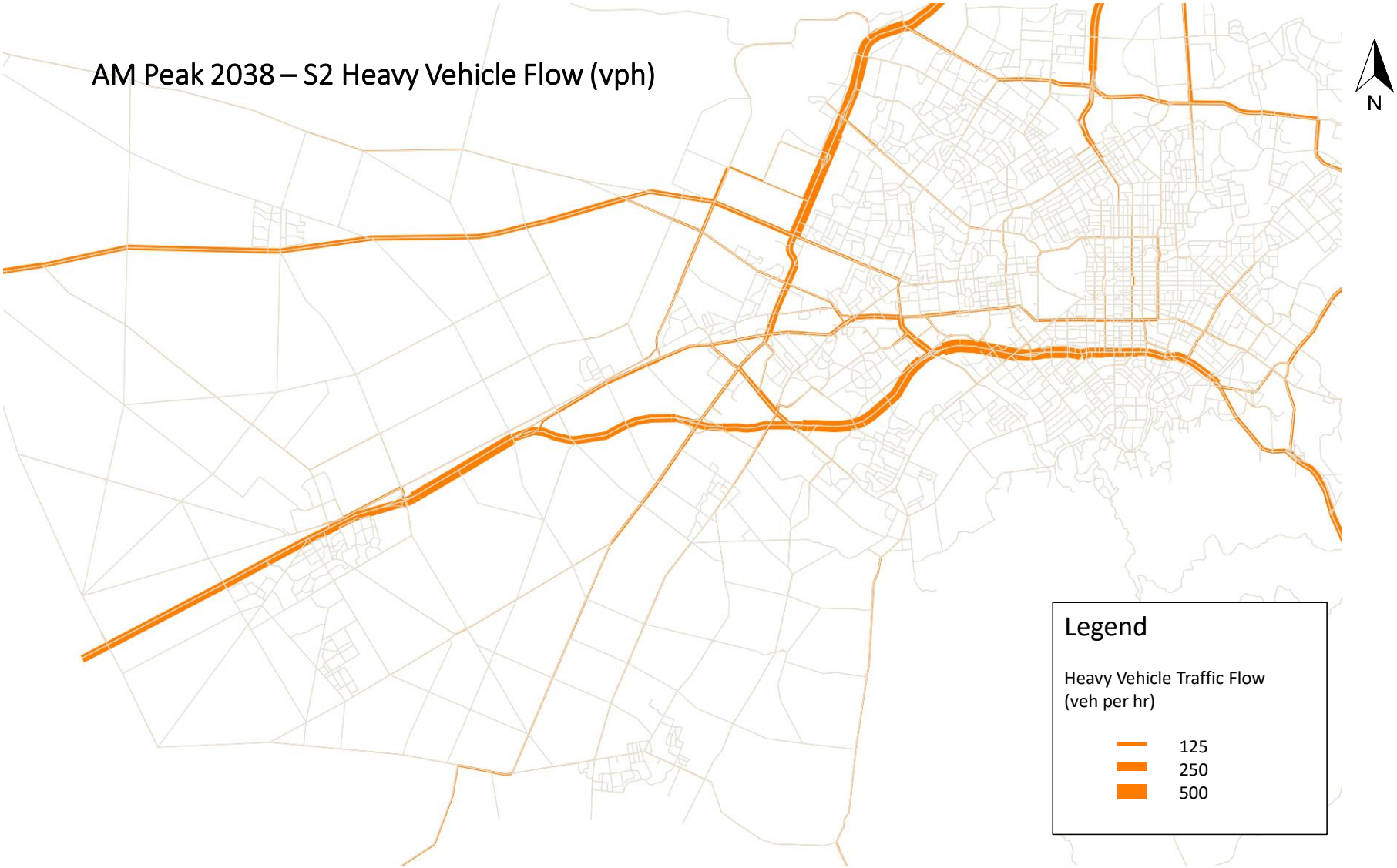
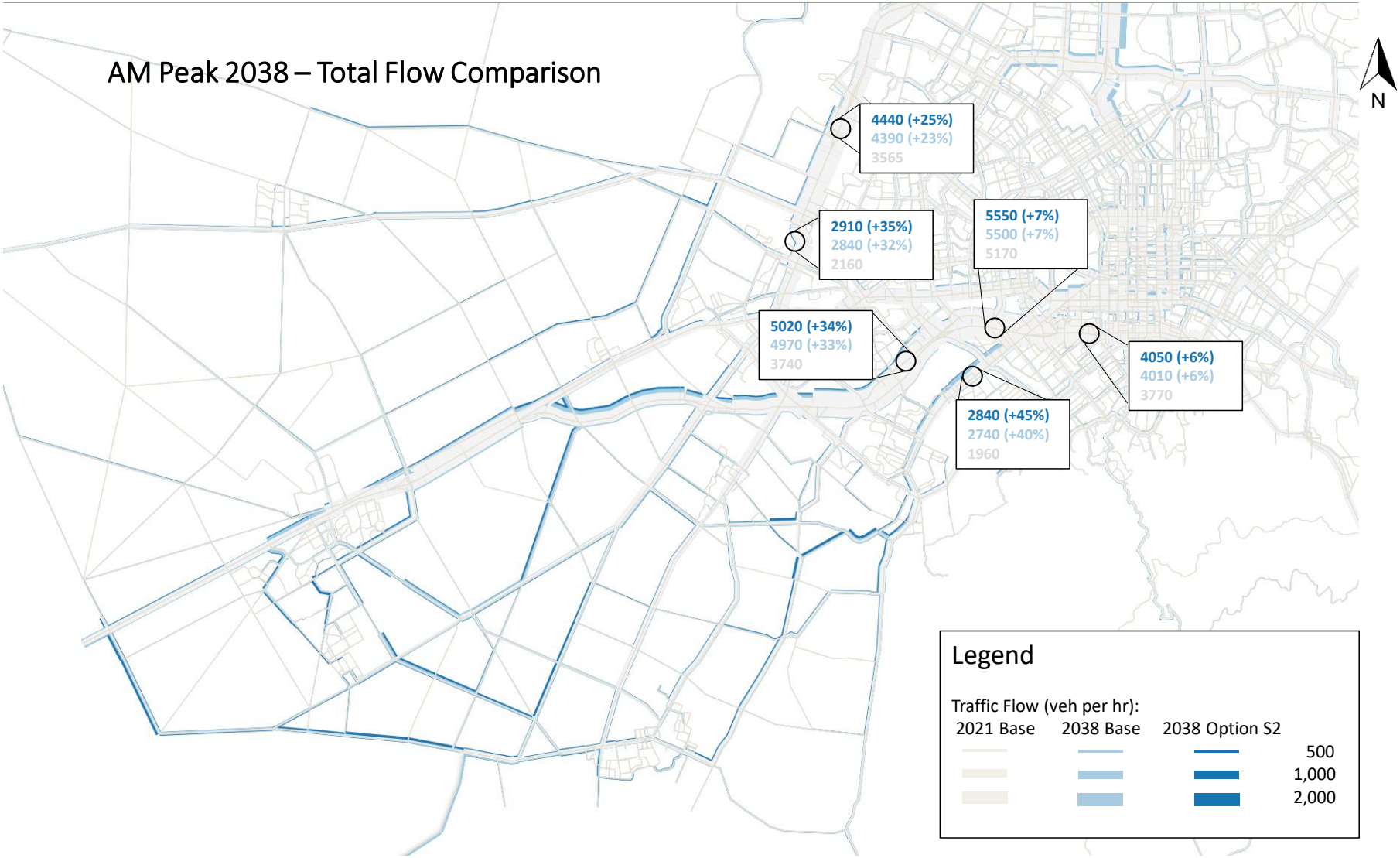
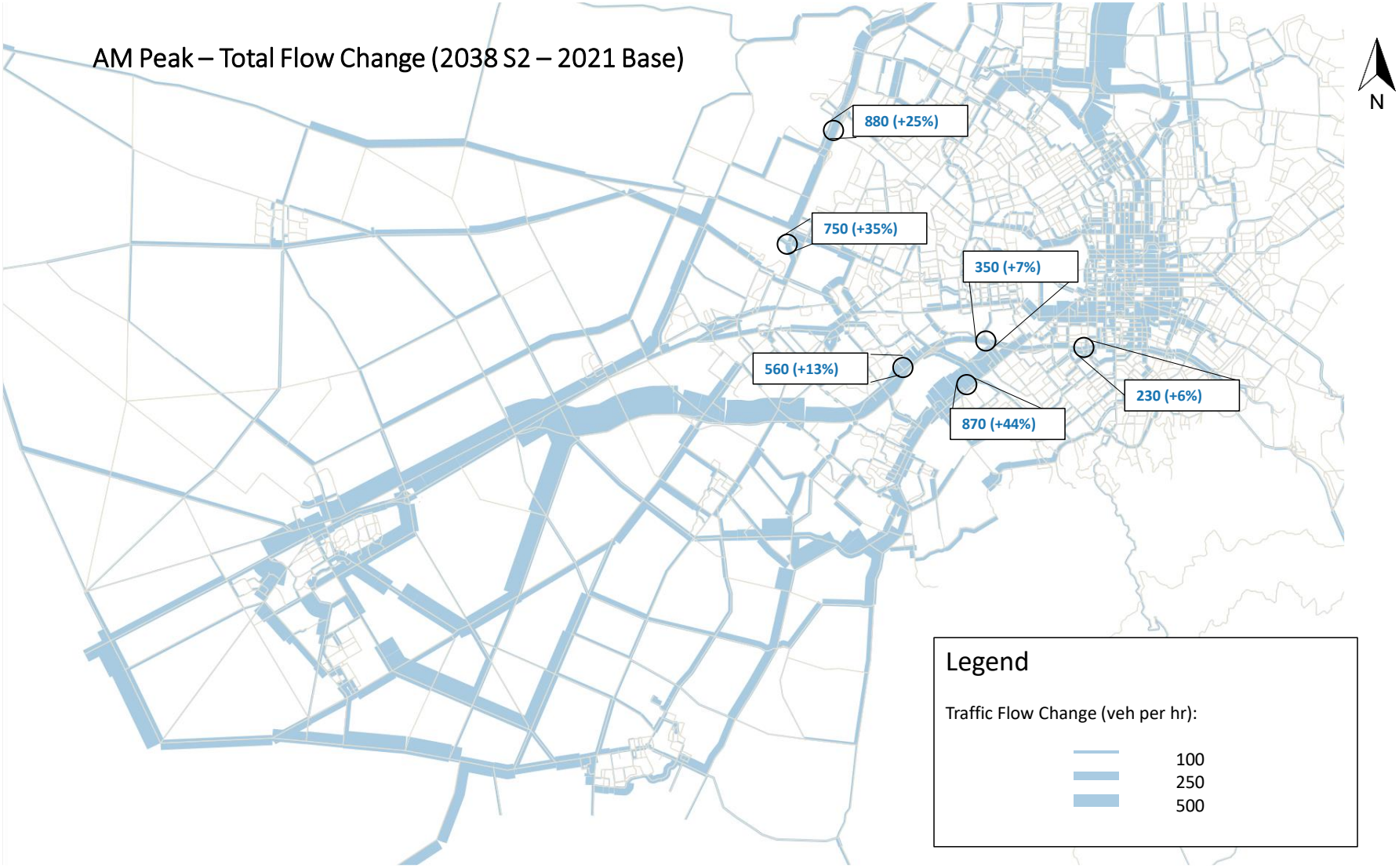
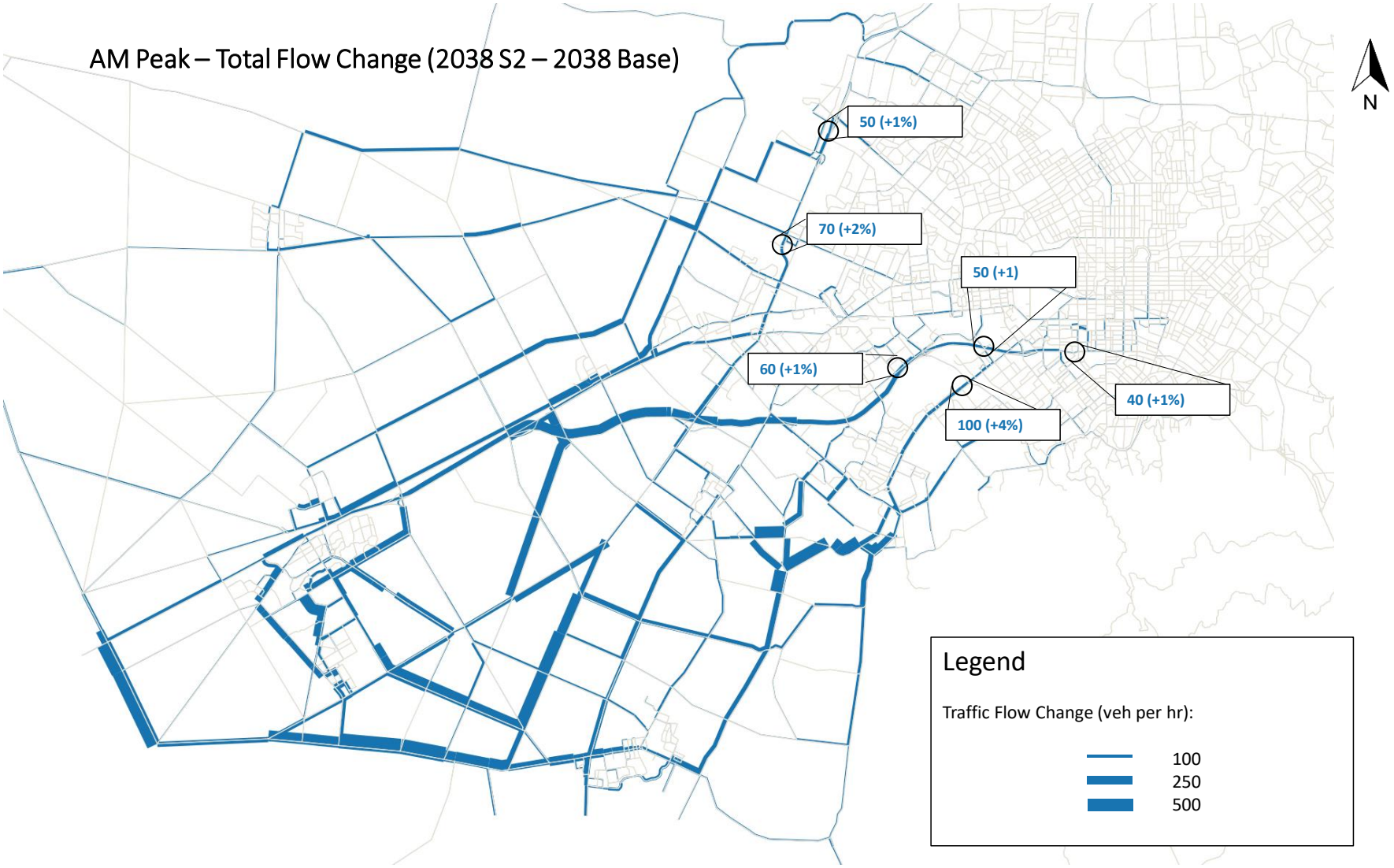

AM Peak 2038- S2 Total Traffic Flow (vph)
N
Legend
Traffic Flow (veh per hr):
Total
Heavy
500
1,000
2,000

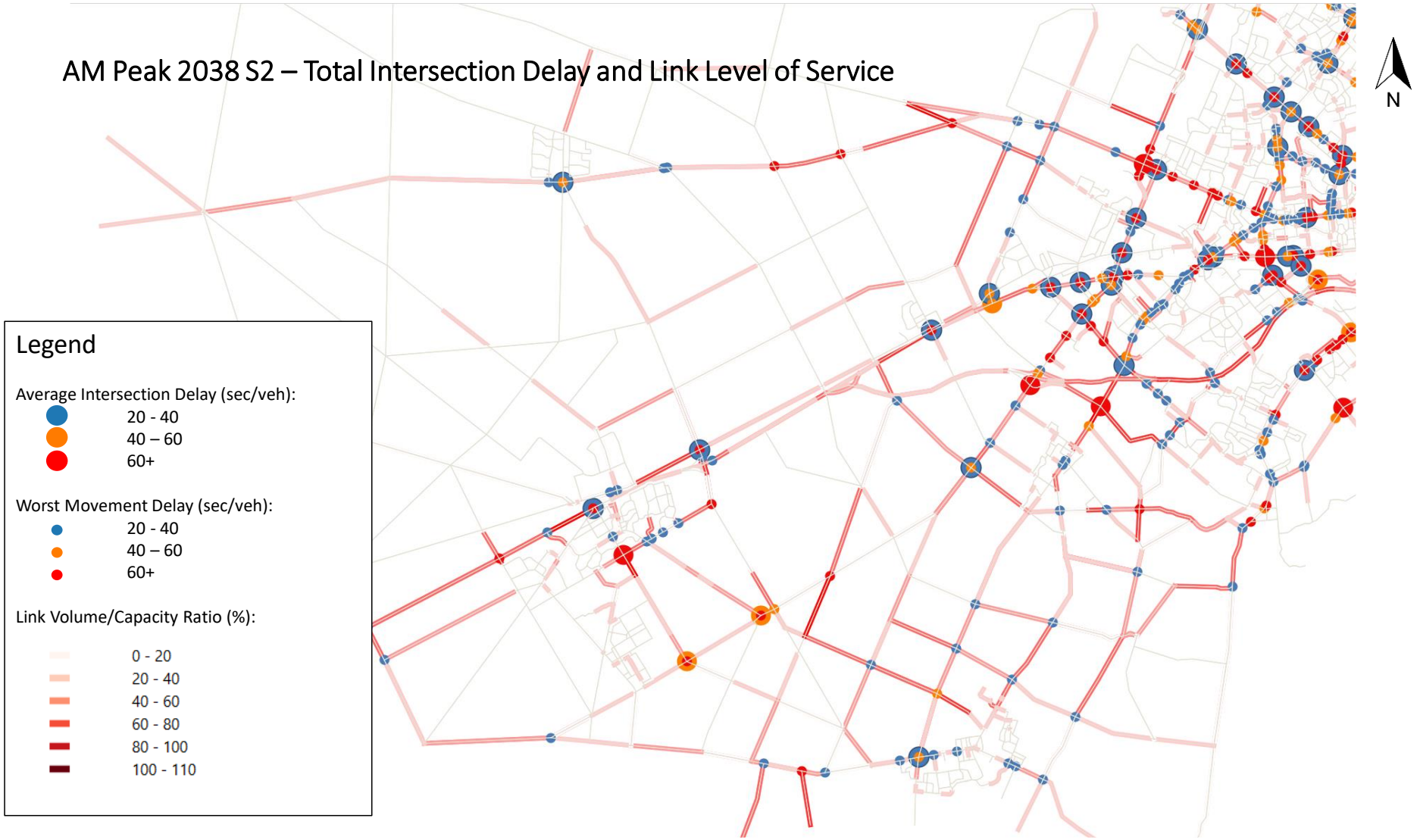

AM Peak 2038 – S2 Heavy Vehicle Flow (vph)
N
Legend
Heavy Vehicle Traffic Flow
(veh per hr)
125
250
500


AM Peak 2038 – Total Flow Comparison
N
4440 (+25%)
4390 (+23%)
3565
2910 (+35%)
2840 (+32%)
2160
5550 (+7%)
5500 (+7%)
5170
5020 (+34%)
4970 (+33%)
3740
4050 (+6%)
4010 (+6%)
3770
2840 (+45%)
2740 (+40%)
1960
Legend
Traffic Flow (veh per hr):
2021 Base
2038 Base
2038 Option S2
500
1,000
2,000

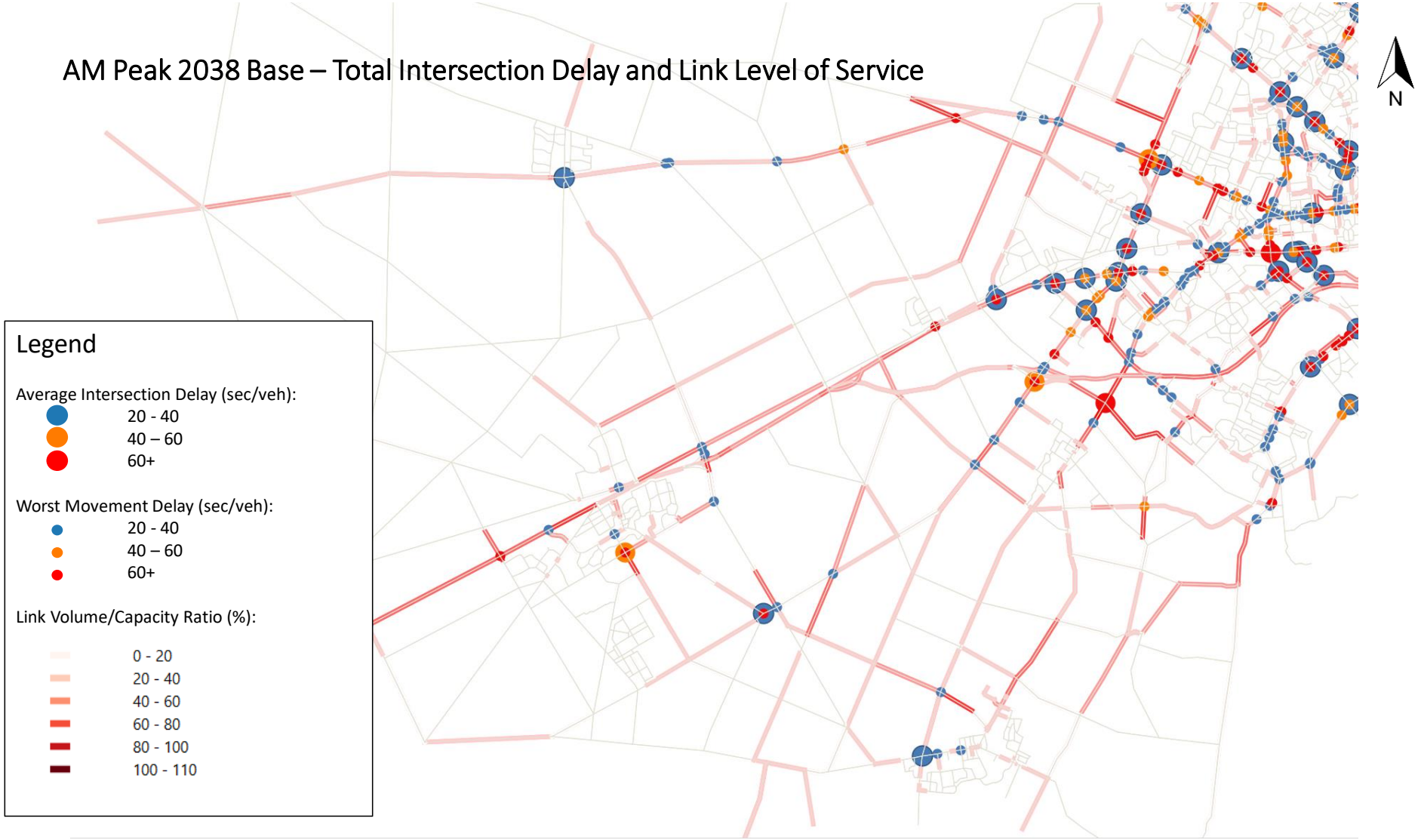




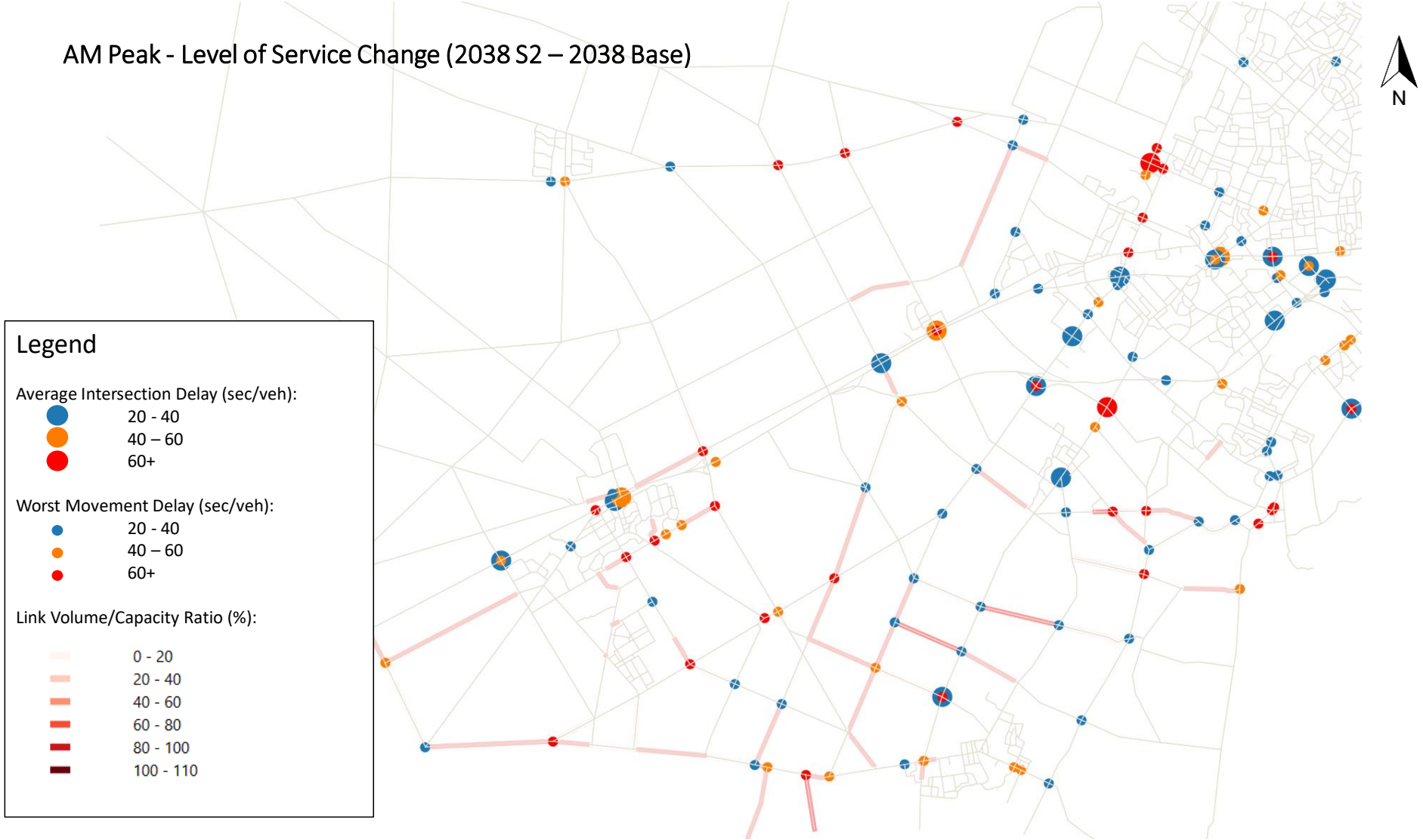
AM Peak 2038 S2 – Total Intersection Delay and Link Level of Service



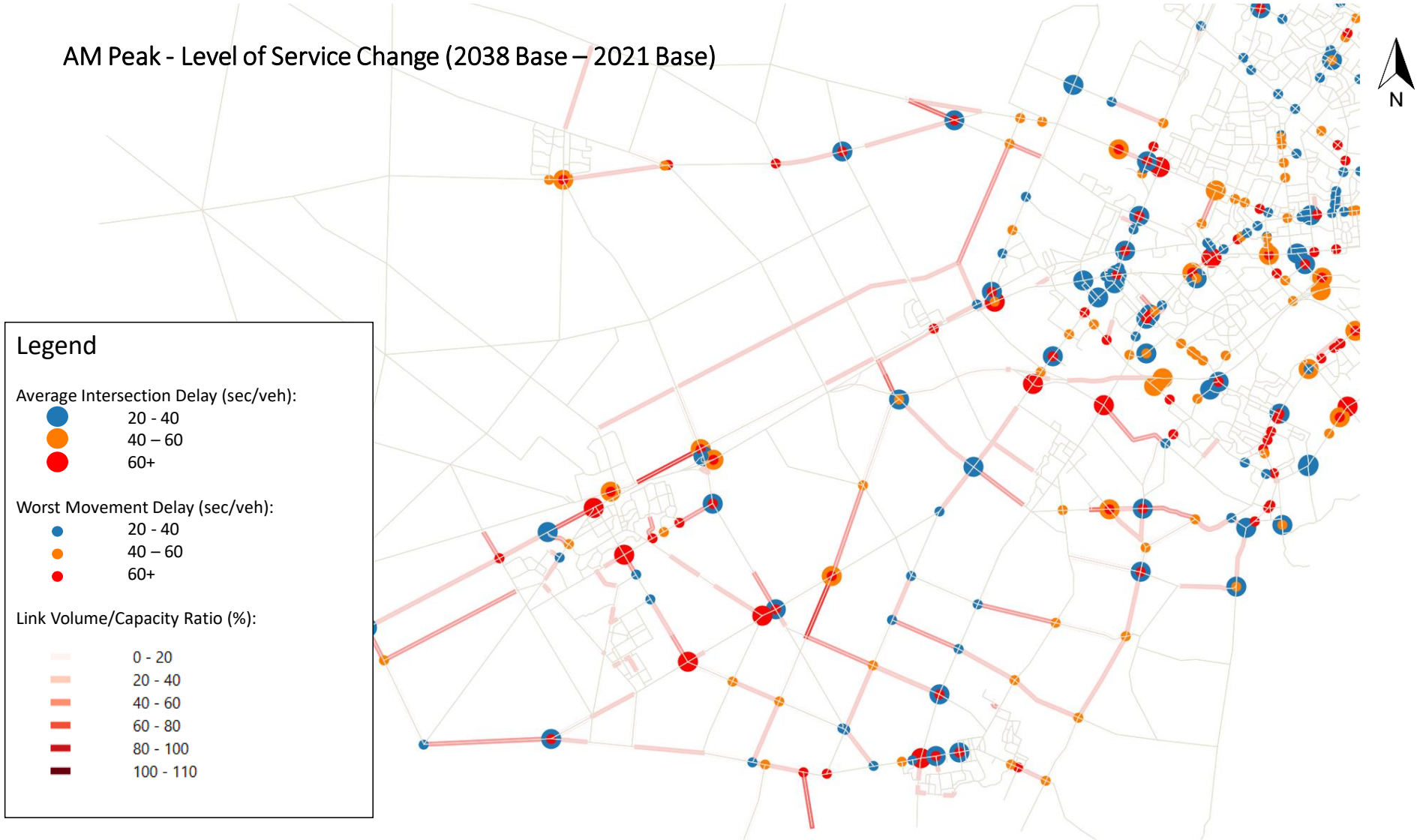
AM Peak 2038 Base – Total Intersection Delay and Link Level of Service



AM Peak - Level of Service Change (2038 S2 – 2038 Base)



AM Peak - Level of Service Change (2038 Base – 2021 Base)



AM Peak 2038 S2 – 2hr (0700-0900) Person Trip Summaries by mode

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Light Vehicle	From Selwyn GC to	22,240	4,650	18,580	100	2,340	120	48,030
	To Selwyn GC from	22,240	520	6,950	230	90	60	30,090
	From Selwyn Ext to	2,260	200	1,190	50	60	90	3,850
	To Selwyn Ext from	2,340	260	1,220	40	60	60	3,980
	TOTAL Trips	44,480	5,170	25,530	330	2,430	180	78,120

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
PublicTransport	From Selwyn GC to	30	450	270	10	-	-	760
	To Selwyn GC from	30	10	70	-	-	-	110
	From Selwyn Ext to	-	-	-	-	-	-	-
	To Selwyn Ext from	-	-	-	-	-	-	-
	TOTAL Trips	60	460	340	10	-	-	870

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Cycle	From Selwyn GC to	910	60	220	-	-	-	1,190
	To Selwyn GC from	910	-	40	-	-	-	950
	From Selwyn Ext to	-	-	-	-	-	-	-
	To Selwyn Ext from	-	-	-	-	-	-	-
	TOTAL Trips	1,820	60	260	-	-	-	2,140

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
TOTAL	From Selwyn GC to	23,180	5,160	19,070	110	2,340	120	49,980
	To Selwyn GC from	23,180	530	7,060	230	90	60	31,150
	From Selwyn Ext to	2,260	200	1,190	50	60	90	3,850
	To Selwyn Ext from	2,340	260	1,220	40	60	60	3,980
	TOTAL Trips	46,360	5,690	26,130	340	2,430	180	81,130

AM Peak 2038 S2 – 2hr (0700-0900) Person Trip Summaries by mode (%)

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Light Vehicle	From Selwyn GC to	46%	10%	39%	0%	5%	0%	100%
	To Selwyn GC from	74%	2%	23%	1%	0%	0%	100%
	From Selwyn Ext to	59%	5%	31%	1%	2%	2%	100%
	To Selwyn Ext from	59%	7%	31%	1%	2%	2%	100%
	TOTAL Trips	57%	7%	33%	0%	3%	0%	100%

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
PublicTransport	From Selwyn GC to	4%	59%	36%	1%	0%	0%	100%
	To Selwyn GC from	27%	9%	64%	0%	0%	0%	100%
	From Selwyn Ext to							
	To Selwyn Ext from							
	TOTAL Trips	7%	53%	39%	1%	0%	0%	100%

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Cycle	From Selwyn GC to	76%	5%	18%	0%	0%	0%	100%
	To Selwyn GC from	96%	0%	4%	0%	0%	0%	100%
	From Selwyn Ext to							
	To Selwyn Ext from							
	TOTAL Trips	85%	3%	12%	0%	0%	0%	100%

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
TOTAL	From Selwyn GC to	46%	10%	38%	0%	5%	0%	100%
	To Selwyn GC from	74%	2%	23%	1%	0%	0%	100%
	From Selwyn Ext to	59%	5%	31%	1%	2%	2%	100%
	To Selwyn Ext from	59%	7%	31%	1%	2%	2%	100%
	TOTAL Trips	57%	7%	32%	0%	3%	0%	100%

AM Peak 2038 S2 – 2hr (0700-0900) Vehicle Trip Summaries by mode

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Light Vehicle	From Selwyn GC to	12,770	3,840	13,440	80	1,670	80	31,880
	To Selwyn GC from	12,770	370	4,820	200	70	50	18,280
	From Selwyn Ext to	1,610	140	850	40	40	70	2,750
	To Selwyn Ext from	1,670	180	870	30	40	50	2,840
	TOTAL Trips	25,540	4,210	18,260	280	1,740	130	50,160

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Heavy Vehicle	From Selwyn GC to	140	20	380	30	30	30	630
	To Selwyn GC from	140	10	330	40	30	10	560
	From Selwyn Ext to	30	80	270	30	-	30	440
	To Selwyn Ext from	30	80	280	30	-	10	430
	TOTAL Trips	280	30	710	70	60	40	1,190

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
TOTAL	From Selwyn GC to	12,910	3,860	13,820	110	1,700	110	32,510
	To Selwyn GC from	12,910	380	5,150	240	100	60	18,840
	From Selwyn Ext to	1,640	220	1,120	70	40	100	3,190
	To Selwyn Ext from	1,700	260	1,150	60	40	60	3,270
	TOTAL Trips	25,820	4,240	18,970	350	1,800	170	51,350

AM Peak 2038 S2 – 2hr (0700-0900) Vehicle Trip Summaries by mode (%)

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Light Vehicle	From Selwyn GC to	40%	12%	42%	0%	5%	0%	100%
	To Selwyn GC from	70%	2%	26%	1%	0%	0%	100%
	From Selwyn Ext to	59%	5%	31%	1%	1%	3%	100%
	To Selwyn Ext from	59%	6%	31%	1%	1%	2%	100%
	TOTAL Trips	51%	8%	36%	1%	3%	0%	100%

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Heavy Vehicle	From Selwyn GC to	22%	3%	60%	5%	5%	5%	100%
	To Selwyn GC from	25%	2%	59%	7%	5%	2%	100%
	From Selwyn Ext to	7%	18%	61%	7%	0%	7%	100%
	To Selwyn Ext from	7%	19%	65%	7%	0%	2%	100%
	TOTAL Trips	24%	3%	60%	6%	5%	3%	100%

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
TOTAL	From Selwyn GC to	40%	12%	43%	0%	5%	0%	100%
	To Selwyn GC from	69%	2%	27%	1%	1%	0%	100%
	From Selwyn Ext to	51%	7%	35%	2%	1%	3%	100%
	To Selwyn Ext from	52%	8%	35%	2%	1%	2%	100%
	TOTAL Trips	50%	8%	37%	1%	4%	0%	100%

AM Peak 2038 Base – 2hr (0700-0900) Person Trip Summaries by mode

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Light Vehicle	From Selwyn GC to	16,740	3,150	13,020	80	1,860	70	34,920
	To Selwyn GC from	16,740	460	7,180	340	90	60	24,870
	From Selwyn Ext to	1,800	270	1,540	90	60	90	3,850
	To Selwyn Ext from	1,860	360	1,570	70	60	60	3,980
	TOTAL Trips	33,480	3,610	20,200	420	1,950	130	59,790

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
PublicTransport	From Selwyn GC to	30	300	190	-	-	-	520
	To Selwyn GC from	30	10	70	-	-	-	110
	From Selwyn Ext to	-	-	-	-	-	-	-
	To Selwyn Ext from	-	-	-	-	-	-	-
	TOTAL Trips	60	310	260	-	-	-	630

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Cycle	From Selwyn GC to	340	30	130	-	-	-	500
	To Selwyn GC from	340	-	40	-	-	-	380
	From Selwyn Ext to	-	-	-	-	-	-	-
	To Selwyn Ext from	-	-	-	-	-	-	-
	TOTAL Trips	680	30	170	-	-	-	880

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
TOTAL	From Selwyn GC to	17,110	3,480	13,340	80	1,860	70	35,940
	To Selwyn GC from	17,110	470	7,290	340	90	60	25,360
	From Selwyn Ext to	1,800	270	1,540	90	60	90	3,850
	To Selwyn Ext from	1,860	360	1,570	70	60	60	3,980
	TOTAL Trips	34,220	3,950	20,630	420	1,950	130	61,300

AM Peak 2038 Base – 2hr (0700-0900) Person Trip Summaries by mode (%)

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Light Vehicle	From Selwyn GC to	48%	9%	37%	0%	5%	0%	100%
	To Selwyn GC from	67%	2%	29%	1%	0%	0%	100%
	From Selwyn Ext to	47%	7%	40%	2%	2%	2%	100%
	To Selwyn Ext from	47%	9%	39%	2%	2%	2%	100%
	TOTAL Trips	56%	6%	34%	1%	3%	0%	100%

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
PublicTransport	From Selwyn GC to	6%	58%	37%	0%	0%	0%	100%
	To Selwyn GC from	27%	9%	64%	0%	0%	0%	100%
	From Selwyn Ext to							
	To Selwyn Ext from							
	TOTAL Trips	10%	49%	41%	0%	0%	0%	100%

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Cycle	From Selwyn GC to	68%	6%	26%	0%	0%	0%	100%
	To Selwyn GC from	89%	0%	11%	0%	0%	0%	100%
	From Selwyn Ext to							
	To Selwyn Ext from							
	TOTAL Trips	77%	3%	19%	0%	0%	0%	100%

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
TOTAL	From Selwyn GC to	48%	10%	37%	0%	5%	0%	100%
	To Selwyn GC from	67%	2%	29%	1%	0%	0%	100%
	From Selwyn Ext to	47%	7%	40%	2%	2%	2%	100%
	To Selwyn Ext from	47%	9%	39%	2%	2%	2%	100%
	TOTAL Trips	56%	6%	34%	1%	3%	0%	100%

AM Peak 2038 Base – 2hr (0700-0900) Vehicle Trip Summaries by mode

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Light Vehicle	From Selwyn GC to	9,180	2,620	9,700	70	1,330	50	22,950
	To Selwyn GC from	9,180	330	5,090	280	70	50	15,000
	From Selwyn Ext to	1,280	200	1,100	60	40	70	2,750
	To Selwyn Ext from	1,330	260	1,120	50	40	50	2,850
	TOTAL Trips	18,360	2,950	14,790	350	1,400	100	37,950

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Heavy Vehicle	From Selwyn GC to	120	10	360	30	30	30	580
	To Selwyn GC from	120	10	310	30	30	10	510
	From Selwyn Ext to	30	80	270	30	-	30	440
	To Selwyn Ext from	30	80	280	30	-	10	430
	TOTAL Trips	240	20	670	60	60	40	1,090

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
TOTAL	From Selwyn GC to	9,300	2,630	10,060	100	1,360	80	23,530
	To Selwyn GC from	9,300	340	5,400	310	100	60	15,510
	From Selwyn Ext to	1,310	280	1,370	90	40	100	3,190
	To Selwyn Ext from	1,360	340	1,400	80	40	60	3,280
	TOTAL Trips	18,600	2,970	15,460	410	1,460	140	39,040

AM Peak 2038 Base -2hr (0700-0900) Vehicle Trip Summaries by mode (%)

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Light Vehicle	From Selwyn GC to	40%	11%	42%	0%	6%	0%	100%
	To Selwyn GC from	61%	2%	34%	2%	0%	0%	100%
	From Selwyn Ext to	47%	7%	40%	2%	1%	3%	100%
	To Selwyn Ext from	47%	9%	39%	2%	1%	2%	100%
	TOTAL Trips	48%	8%	39%	1%	4%	0%	100%

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
Heavy Vehicle	From Selwyn GC to	21%	2%	62%	5%	5%	5%	100%
	To Selwyn GC from	24%	2%	61%	6%	6%	2%	100%
	From Selwyn Ext to	7%	18%	61%	7%	0%	7%	100%
	To Selwyn Ext from	7%	19%	65%	7%	0%	2%	100%
	TOTAL Trips	22%	2%	61%	6%	6%	4%	100%

	Location	Selwyn District	Christchuch Central City	Christchuch Other	Wiamakariri District	Selwyn External	Wimakariri External	TOTAL
TOTAL	From Selwyn GC to	40%	11%	43%	0%	6%	0%	100%
	To Selwyn GC from	60%	2%	35%	2%	1%	0%	100%
	From Selwyn Ext to	41%	9%	43%	3%	1%	3%	100%
	To Selwyn Ext from	41%	10%	43%	2%	1%	2%	100%
	TOTAL Trips	48%	8%	40%	1%	4%	0%	100%