



Fulton Hogan Land Development Drury East Plan Change

Integrated Transport Assessment

13 December 2019

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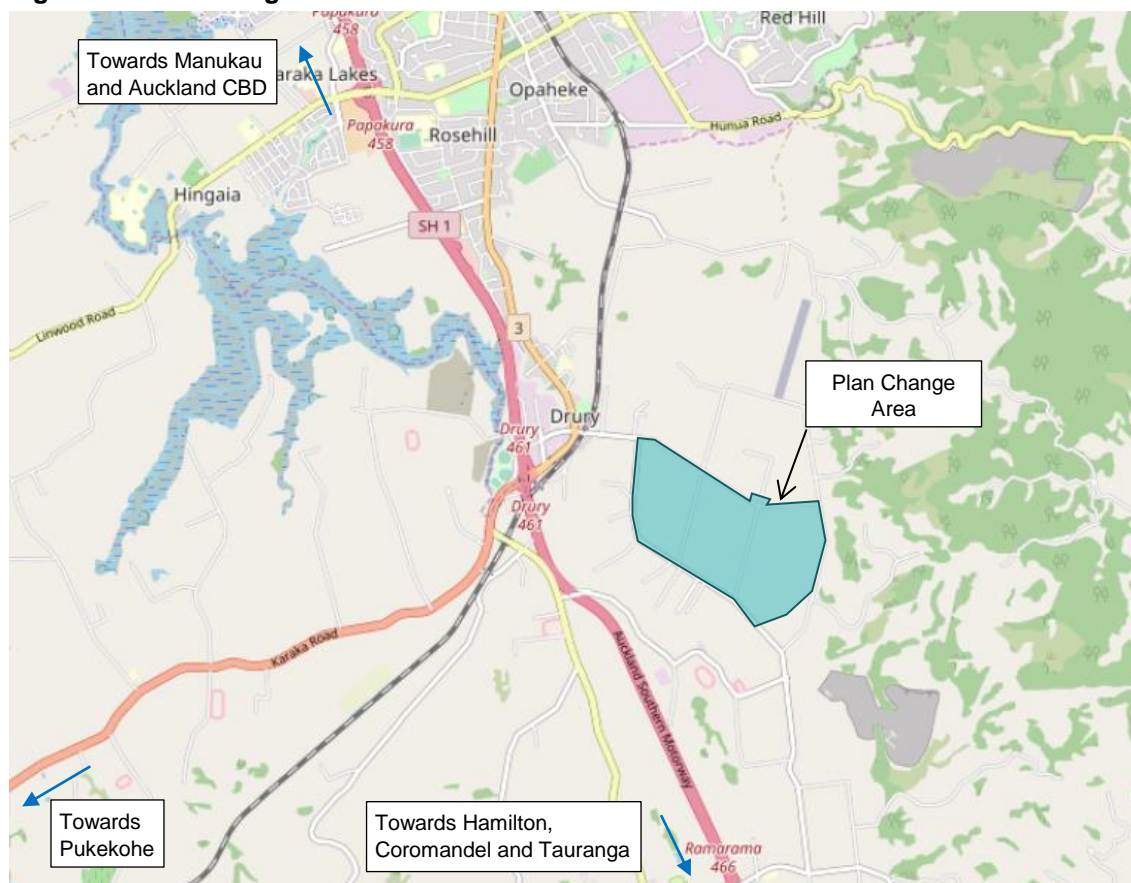
Executive summary

Background

Fulton Hogan Land Development Ltd (FHLDT) is applying for a Plan Change to the Auckland Unitary Plan – Operative in Part (AUP-OIP) to rezone approximately 187ha of land within Drury East from Future Urban Zone (FUZ) to a mix of residential zones (Terrace Housing and Apartment Building, Mixed Housing Urban and Mixed Housing Suburban) serviced by a limited area of business zoning (Mixed Use), consistent with the Council's Drury-Opāheke Structure Plan. The Plan Change also includes a precinct which details the indicative collector road which provides access east to west, links to the wider road network and ensures that development capacity is staged with the release of infrastructure.

The Plan Change area is located approximately 0.6 – 2.6km east of the existing town of Drury and approximately 36km to the south of Auckland CBD. The location is indicated in Figure A below.

Figure A: Plan Change Area Location



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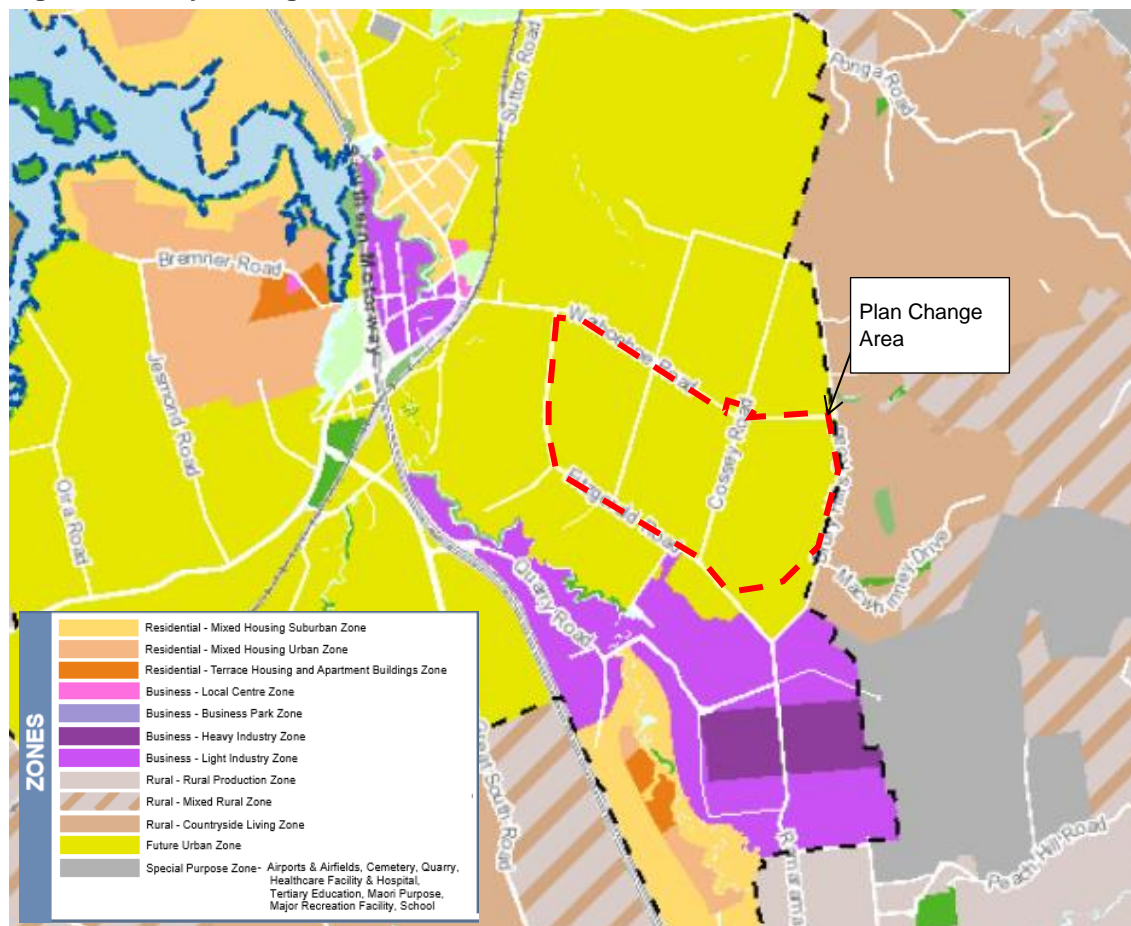
Mott MacDonald (MM) has been commissioned by FHLDT to provide this Integrated Transport Assessment (ITA) to support the Plan Change. The Plan Change will allow for approximately 2,200 – 2,500 households to be developed within the 187ha Plan Change area over time.

Existing Conditions

The Plan Change area currently comprises predominantly rural lifestyle blocks alongside some farming activities.

In the wider context, the Plan Change area and the surrounding locality is within the Future Urban zone under the Auckland Unitary Plan (Operative in Part). The Karaka and Opāheke / Drury Future Urban zone combined, provides for 2,150 hectares of land for urban redevelopment. The local zoning is shown in Figure B.

Figure B: Drury Zoning



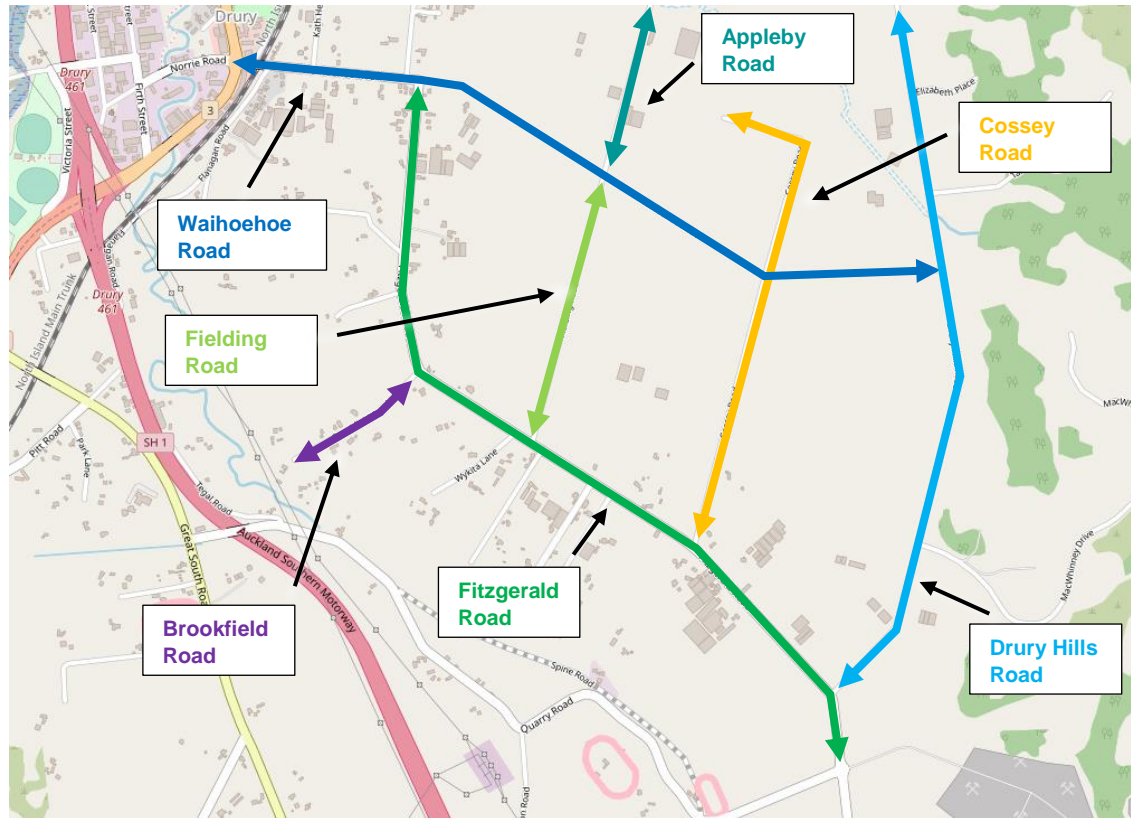
Source: AUP (OIP)

The road network in the vicinity of the Plan Change area is shown in Figure C. The key links within the network have been identified as comprising:

- **Waihoehoe Road** – link with the existing town of Drury and SH1 access, also forms the northern boundary for the Plan Change area;
- **Fitzgerald Road** – link with Drury South and for access towards Ramarama, also forms the western and southern boundaries for the Plan Change area;
- **Drury Hills Road** – forms part of the eastern boundary for the Plan Change area; following the proposed Mill Road alignment as shown in the Council's Drury-Opāheke Structure Plan adopted in August;

- **Brookfield Road** – future upgrade to collector will link towards Drury West;
- **Fielding Road** – north-south link within the Plan Change area boundary;
- **Cossey Road** – north-south link within the Plan Change area boundary; and
- **Appleby Road** – future upgrade to collector will link towards Opāheke.

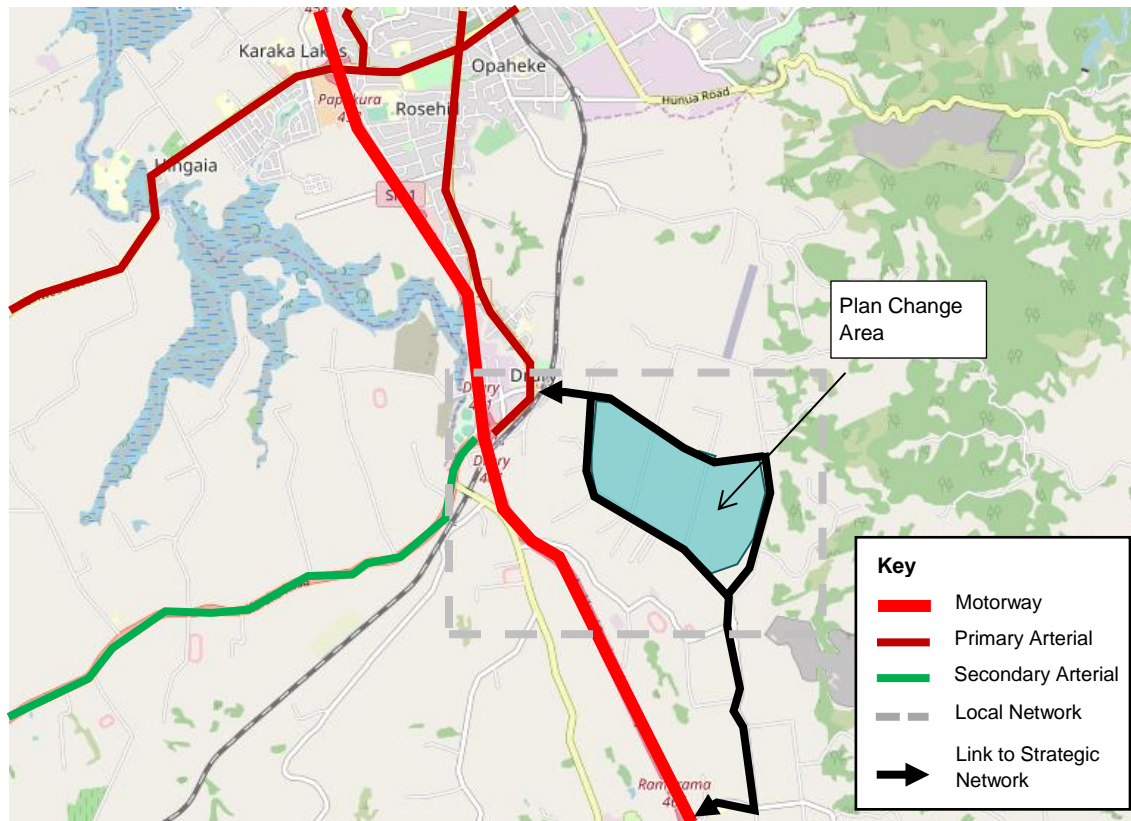
Figure C: Existing Road Network



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The wider road network and connections with strategic movement links are shown in Figure D below, showing that the Plan Change area is located in close proximity to the arterial road network, facilitating highway access to and from the Plan Change area for locations across Auckland.

Figure D: Wider Network Links



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As shown in Figure D, the major components of the wider network around the Plan Change area are:

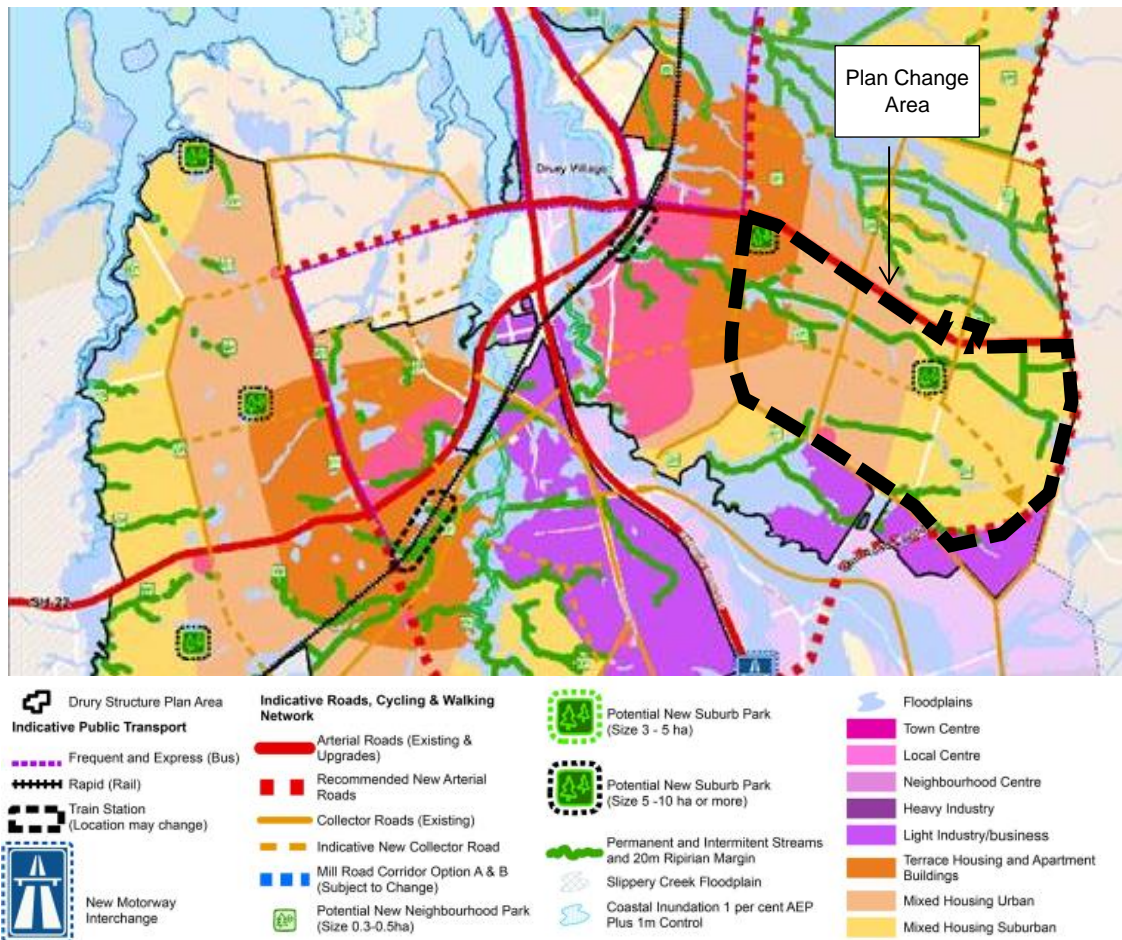
- Great South Road, providing access to and from Papakura and south Auckland;
- Karaka Road (State Highway 22), providing access to Drury West and Pukekohe; and
- SH1, providing access northwards towards the rest of Auckland and southwards towards Waikato and beyond.

Planned Structure Plan Development

The Drury-Opāheke Structure Plan proposes that the land within the Plan Change area be rezoned to 'Terrace Housing and Apartment Buildings', 'Mixed Housing Urban' and 'Mixed Housing Suburban', from west to east across the Plan Change area.

The land use pattern within Council's Structure Plan is shown in Figure E below.

Figure E: Auckland Council's Drury-Opāheke Structure Plan - Land-Use Pattern



Source: Drury-Opāheke Structure Plan (August 2019 draft)

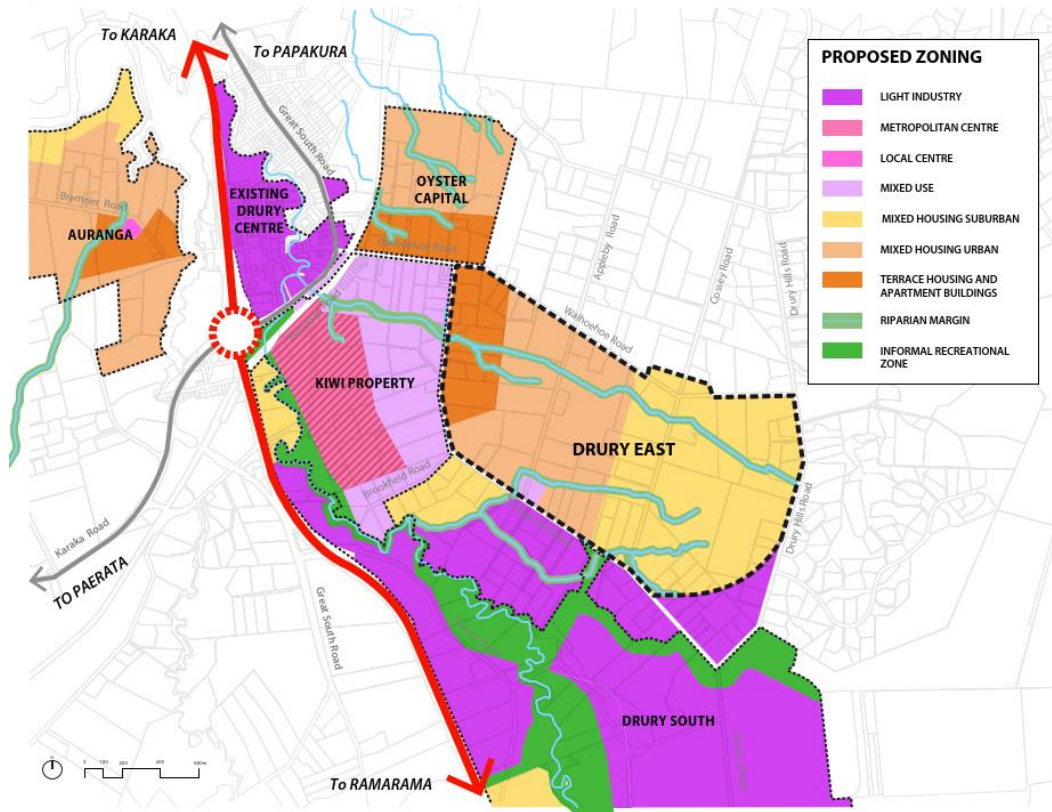
The Council's Structure Plan and its supporting ITA identifies a comprehensive set of transport network upgrades in the Regional Land Transport Plan, Supporting Growth Alliance Indicative Business Case, as well as additional supporting upgrades required to support the identified land uses. These include:

- SH1 Widening;
- New SH1 interchange at Drury South;
- Mill Road arterial corridor;
- New arterial road between Papakura industrial area and Waihoehoe Road;
- Waihoehoe Road upgrade to arterial;
- New rail station at Drury Central;
- Electrification and 4-tracking of rail line through to Pukekohe;
- New network of frequent, express and connector buses; and
- Development of regional, primary and secondary cycle routes.

Plan Change

The zoning pattern proposed within the Plan Change area is shown in Figure F.

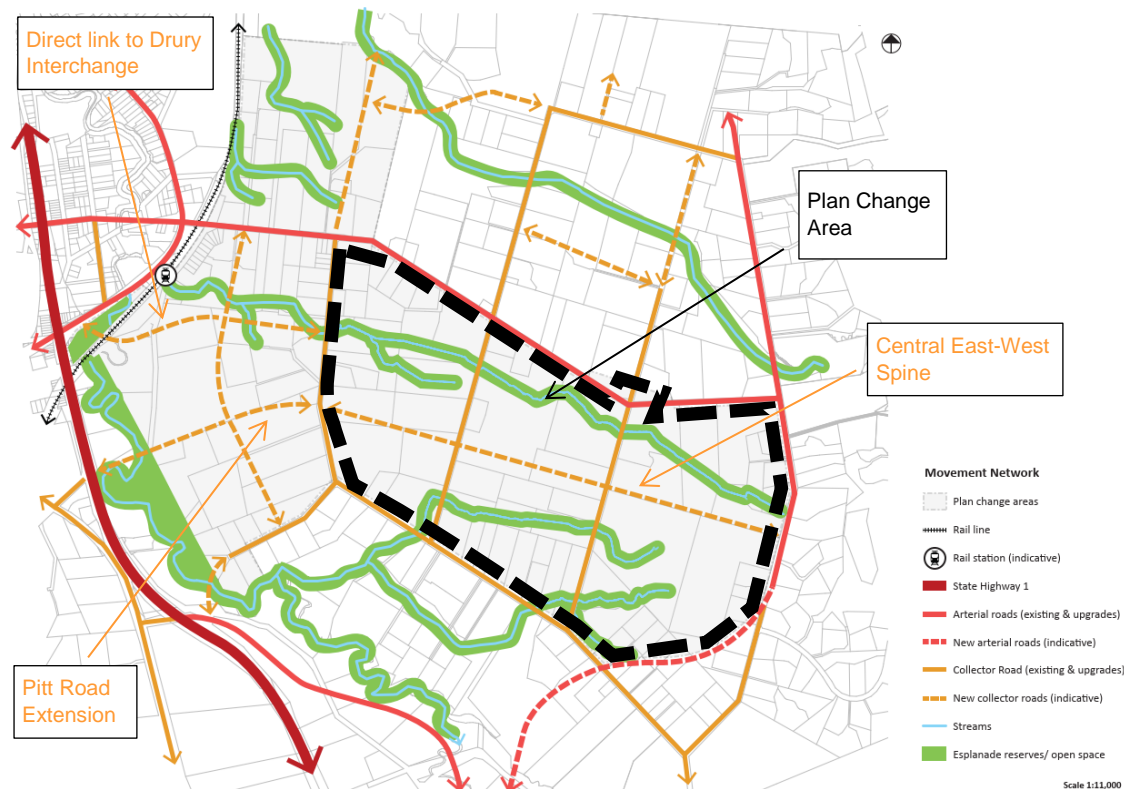
Figure F: Proposed Zoning



Source: Woods

The indicative masterplan movement network for the Plan Change area is presented in Figure G.

Figure G: Indicative Masterplan Movement Network



Source: Barker & Associates

FHLD engaged Woods to undertake a broad masterplanning exercise for the Drury East Plan Change area. The masterplan movement network has been developed in conjunction with Kiwi Property Limited (KP) and Oyster Capital Limited (OCL), with reference to Council, Auckland Transport (AT) and SGA plans for local infrastructure. It shows the hierarchy and typologies of arterial and collector roads for movement to, through and around the Plan Change area and a slower speed local network of local and reserve edge roads for access to activities within the Plan Change area.

The movement network is based on the 'Link Road' alignment for Mill Road. The alignment of the key roads identified in the masterplan movement network are subject to change, subject to the final Mill Road alignment chosen.

The collector roads in the movement network align closely with those proposed in the latest Council's Drury-Opāheke Structure Plan, but the collector road network is modified to provide a Central East-West Spine link through the Plan Change area that will provide good access for public transport, walking and cycling, as well as providing permeability in the Movement Network.

This roading pattern creates a permeable, connected grid for movement, sets the block structure for the graduated density envisaged by the different residential zones and provides defined boundaries for the changes between zones.

Indicative cross-sections for each road type have been developed with reference to the AT Roads and Streets Framework (RASf) and Transport Design Manual (TDM), in coordination with the other Drury East developers (KP and OCL)

Outline access strategies have been developed for walking, cycling, public transport and vehicles, based upon the proposed Movement Network. Key features are:

- Arterial and collector roads have separated cycle lanes and footpaths on both sides of the road;
- Reserve edge roads have a shared path within the riparian reserve for predominantly recreational cycling and walking;
- All intersections of collector and/or arterial roads will provide pedestrian and cycle crossing facilities;
- Local roads will be designed for good pedestrian permeability using small block sizes and providing reasonably direct through pedestrian routes wherever possible.
- The cycleways and footpaths will provide connectivity between residential neighbourhoods and Drury town centre (existing and proposed), as well as the proposed public transport network.
- The focus for the proposed network is a well-connected Rapid Transport Network, using electric trains extended to Pukekohe, extra rail capacity and a new rail station at Drury Central. The new station will be a key interchange for routes at all levels of the hierarchy, enabling good access between Drury East and destinations in south and central Auckland.
- Council's Drury-Opāheke Structure Plan's proposed Frequent transit route between Manukau and Drury West will provide indirect access for the Plan Change area via interchange with the Local bus routes;
- Council's Drury-Opāheke Structure Plan proposes Connector transit route between Papakura and Drury West. The proposed routeing will provide indirect access for the Plan Change area via interchange with the Local bus routes, as well as direct access for the western side of the Plan Change area;
- Public transport access through the Plan Change area will be provided by Local routes accessed by high-quality, well-located bus stops along the Central East-West Spine link and Fitzgerald Road. The walk-up catchments (400m) of the stops will cover the majority of the Plan Change area and the local routes will feed into the wider network via interchange at or near the new Drury East Station; and
- Vehicular access to the Plan Change area will be based on the movement network's road hierarchy, with the majority of vehicle access coming from the arterial network to join the collector network before entering the network of local roads to reach land-use activities within the Plan Change area. Vehicle access from the Plan Change area will reverse this pattern.

Assessment of Transport Effects

The assessment of transport effects for this ITA is based upon the traffic modelling undertaken by Stantec, with additional discussion of key points most relevant to the Plan Change Area. The assessment framework has focussed on the impacts of the Plan Change before 2038 and the infrastructure (additional to that anticipated to be provided by 2028) needed to mitigate those impacts.

Active Travel

Drury East will provide excellent walking and cycling facilities, including:

- Footpaths provided along both sides of all arterial, collector and local roads;
- Off-street cycle lanes provided along both sides of all arterial and collector roads;

- Off-street shared paths alongside reserve edge roads for predominantly recreational cycling and walking; and
- Pedestrian and cycle crossing facilities at all intersections of collector and/or arterial roads.

The movement network for the Plan Change area will enable good pedestrian permeability using small block sizes and providing additional direct walking routes. It is anticipated that walking and cycling flows will be relatively dispersed and the proposed provision will provide sufficient capacity to meet demand.

Public Transport

The Supporting Growth Alliance has identified an indicative frequent and collector bus network serving Drury East and the wider area¹. Stantec and Mott Macdonald have built on this and illustrate how this network could potentially be expanded to cater for development in Drury East and integrate with Drury South. This expanded network is illustrative only. To future-proof for a variety of options, the collector road network will be designed to provide sufficient space to provide for bus services in the future. The walking facilities provided will enable safe access between the public transport network and residential activities within the Plan Change area.

Vehicle Traffic

Stantec has undertaken comprehensive and conservative traffic modelling for the next 3 decades (up to 2048) which focused on determining how the residential and commercial developments within Drury East can be accommodated on the surrounding network in the future. The modelling provides indication of when and what specific upgrades are required based on the anticipated future network and development. Based on the modelling, it is considered that the Plan Change can be supported from a traffic perspective and is unlikely to have a significant adverse effect on the traffic network, provided that the infrastructure required to support the developments is implemented.

Summary

A multi-modal impact assessment has been carried out that demonstrates that:

- the proposed provision of walking and cycling facilities will provide links to the key active mode attractors and generators, with sufficient capacity to meet demand;
- the proposed design of the road network will enable public transport to be a viable choice for trips to and from the Plan Change area; and
- the proposed vehicle access strategy will enable vehicle trips generated by development permitted by the proposed rezoning to be managed so as to not cause undue congestion on the road network.

To address potential adverse impacts and risks from development permitted by the proposed rezoning, mitigation measures and infrastructure upgrades have been identified for specific development and trip generation thresholds.

Recommendation

The conclusion of this ITA is that, on the basis of the proposed movement and access strategies, the transport impacts resulting from the rezoning of the Plan Change area can be

¹ Refer to Figure 0-2 – Public transport network extent, contained in the Supporting Growth Alliance Integrated Transport Assessment for the Drury-Opaheke Structure Plan.

managed in a way that manages adverse effects on the surrounding road network and supports the development of an effective, efficient and safe transport network.

1 Introduction

Fulton Hogan Land Development Limited (FHLD) is applying for a Plan Change to the Auckland Unitary Plan – Operative in Part to rezone approximately 187 hectares of Future Urban land in Drury East to a mix of residential zones (Terrace Housing and Apartment Building, Mixed Housing Urban and Mixed Housing Suburban) serviced by a limited area of business zoning (Mixed Use)

1.1 Plan Change Area Location

The Plan Change area is located approximately 0.6 – 2.6km east of the existing town of Drury and approximately 36km to the south of Auckland CBD. The Plan Change area is largely bounded by Fitzgerald Road to the west and south, Drury Hills Road to the east and Waihoehoe Road to the north, with a smaller portion located immediately to the north of Waihoehoe Road. The location is indicated in Figure 1 below.

Figure 1: Plan Change Area Location



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1.2 Proposed Plan Change

Mott MacDonald (MM) has been commissioned by FHLD to provide this Integrated Transport Assessment (ITA) to support the proposed plan change to rezone approximately 187 hectares of Future Urban land in Drury East to a mix of residential zones (Terrace Housing and Apartment Building, Mixed Housing Urban and Mixed Housing Suburban) serviced by a limited area of business zoning (Mixed Use). The plan change area would allow for approximately 2,200 – 2,500 households to be developed within the 187ha Plan Change area over time.

1.3 Integrated Transport Assessment

An ITA is generally required to support a planning application under the Resource Management Act 1991 (RMA) by providing an assessment of the associated transport effects. An ITA provides a wider scope of assessment when compared to a Traffic Impact Assessment (TIA). The benefits of an ITA is that it provides a more holistic assessment of transport effects, as it takes into account all transport modes.

1.4 Report Structure

The rest of this report is structured as follows:

- **Section 2 - Existing Conditions and Planned Development:** this provides an audit of the existing transport conditions and infrastructure in the vicinity of the Plan Change area, as well as committed future development of transport infrastructure and land;
- **Section 3 - Proposal:** this sets out details of the Plan Change, including the proposed access arrangements for all modes;
- **Section 4 - Assessment of Transport Effects:** this provides an assessment of the impacts of the Plan Change on all modes of travel;
- **Section 5 - Strategic Alignment:** this identifies how the proposal fits with specific transport policies and strategies and the “One System” approach; and
- **Section 6 - Summary and Conclusions:** this draws together the findings of the ITA.

2 Existing Conditions and Planned Development

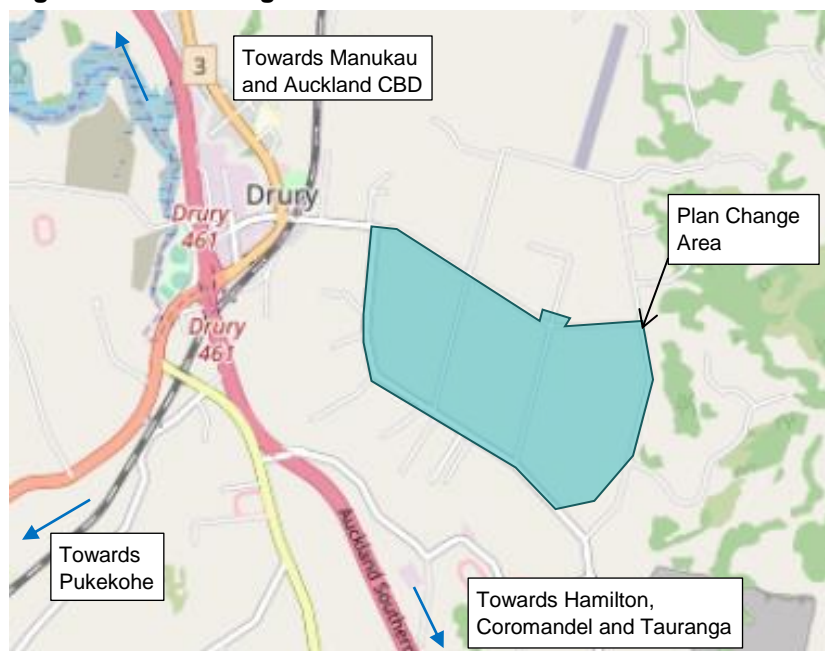
2.1 Land Use

2.2 Plan Change Location

Drury is located approximately 14km to the south of Manukau and 36km south of Auckland CBD. Drury has a current population of around 3,500 people and provides some limited local amenities such as schools, shops, medical and community facilities. The town is located adjacent to State Highway 1 (SH1) which runs along the western boundary of the town and is accessed by an interchange to the south-east.

The Plan Change area is located approximately 0.6 – 2.6km east of the existing town of Drury and is largely bounded by Fitzgerald Road to the west and south, Drury Hills Road to the east (mainly following the proposed Mill Road alignment and Waihoehoe Road to the north, with a smaller portion located immediately to the north of Waihoehoe Road. The location is indicated in Figure 2 below.

Figure 2: Plan Change Area Location



2.2.1 Existing Land-Use

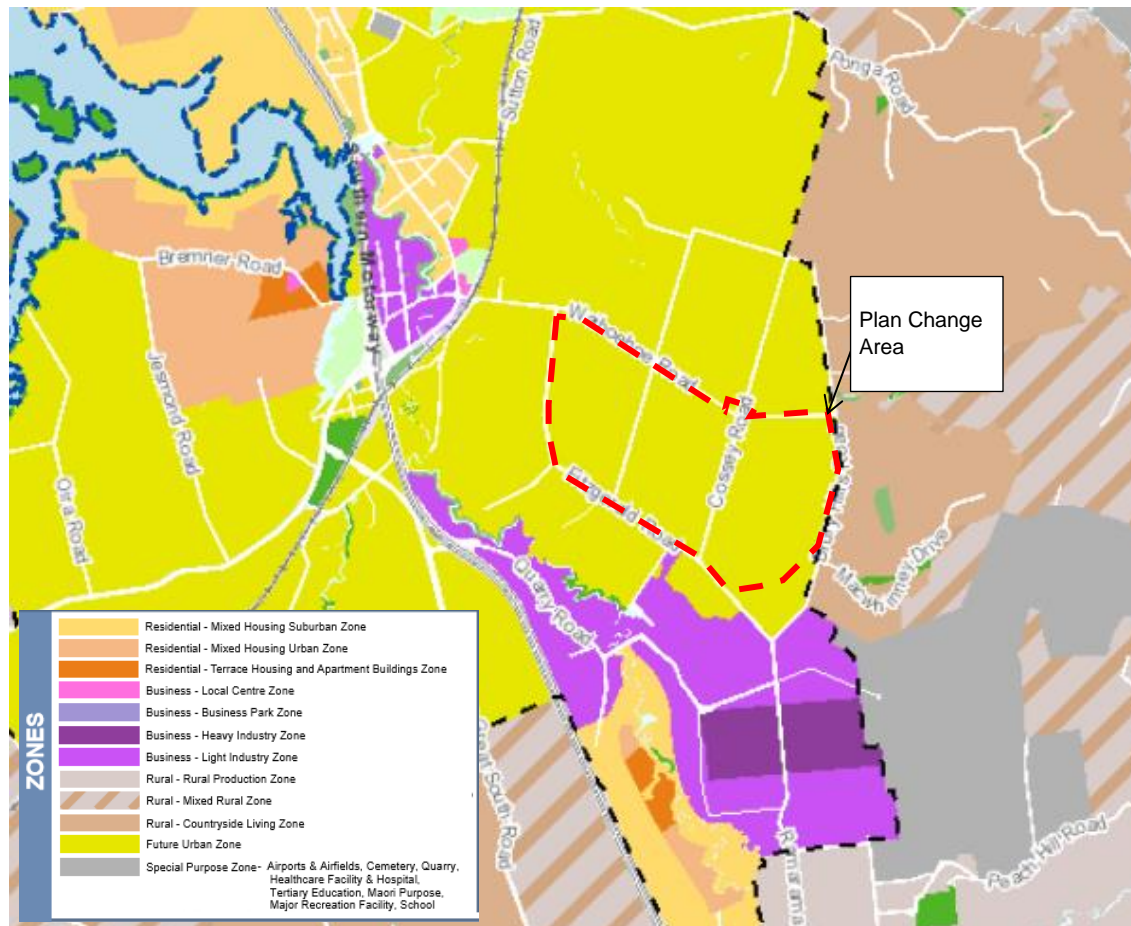
The 187ha Plan Change area is currently predominantly residential, occupied by very low-density housing on large lifestyle sections, alongside some agricultural land.

The land-uses immediately surrounding the Plan Change area are broadly comparable, giving way to more agricultural land to the north and south, and the Drury Hills to the east. At the edge

of the hills and to the south-east of the Plan Change area is the Drury Quarry, which is accessed via Quarry Road which runs east-west around 300-800m to the south of the Plan Change area.

Most of the wider area is zoned as Future Urban Zone (FUZ) within the Auckland Unitary Plan – Operative In Part (AUP-OIP) (see **Section 5.1.4**), identifying it for further development, subject to approval of a Plan Change. The local zoning is shown in Figure 3.

Figure 3: Drury Zoning



Source: AUP (OIP)

2.2.2 Future Land Use

2.2.2.1 Council's Structure Plan for Drury-Opāheke

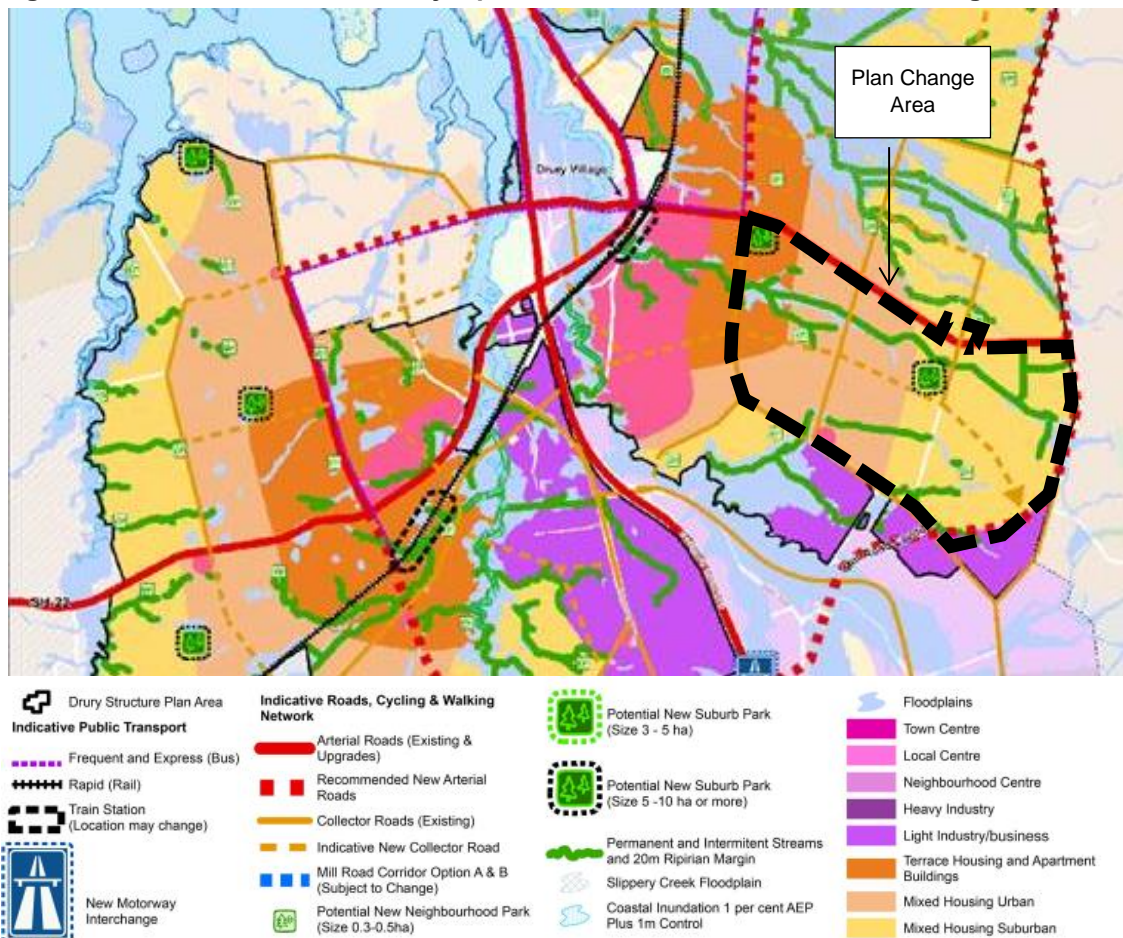
The Drury-Opāheke Structure Plan proposes that the land within the Plan Change area be rezoned to 'Terrace Housing and Apartment Buildings', 'Mixed Housing Urban' and 'Mixed Housing Suburban', from west to east across the Plan Change area. The Structure Plan identifies the following land-uses in the vicinity of the Plan Change area:

- To the north of the Plan Change area, the same west-east pattern is intended, transitioning from 'Terrace Housing and Apartment Buildings', 'Mixed Housing Urban' to 'Mixed Housing Suburban';

- To the south west the intended land-use is 'Mixed Housing Suburban';
- To the south east the intended land-use is light industrial / business;
- To the west of the Plan Change area the intended land-use is 'Terrace Housing and Apartment Buildings' and beyond that a large centre; and
- No changes in land-use are planned to the east of the Plan Change area.

The Council's Drury-Opāheke Structure Plan zoning is shown in Figure 4 below.

Figure 4: Auckland Council's Drury-Opāheke Structure Plan Land-Use Zoning



Source: Drury-Opāheke Structure Plan (August 2019 draft)

2.2.2.2 Drury South

In 2014 a Plan Change was approved to provide for industrial land at Drury South. Subsequently a Special Housing Area within Drury South was approved, rezoning industrial land use as residential (1,000 dwellings). This development will occur over a 30-year period, with access via interchanges at Drury, Ramarama and Drury South (see **Section 2.2.4**).

The development relies upon several infrastructure schemes to be implemented as development progresses including:

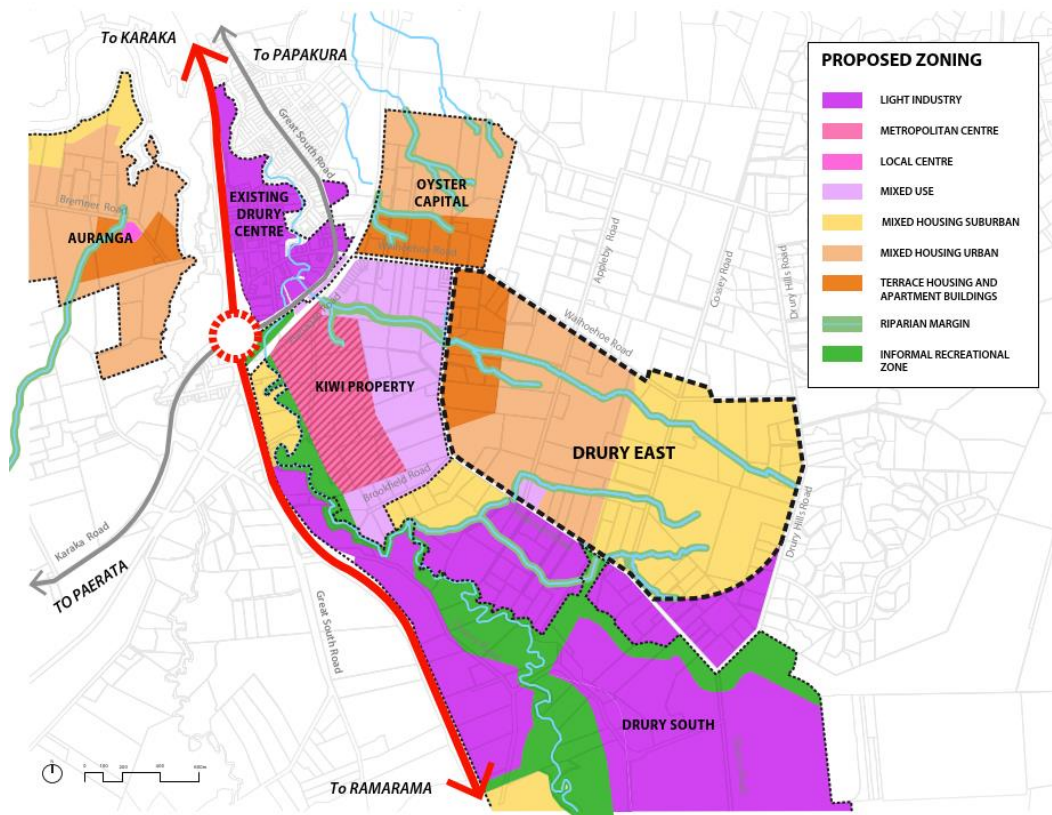
- Ramarama Interchange upgrade;

- Connection to the proposed Mill Road corridor;
- Upgrade of the Great South Road intersection on SH22;
- Provision of a new north-south corridor including consideration of connections to the Mill Road corridor and a potential Drury South Interchange; and
- Provision of a new internal road network to serve the development.

2.2.2.3 Parallel Plan Change Applications

We understand that Kiwi Property Limited (KP) and Oyster Capital Limited (OCL) are applying for Plan Changes to rezone land in the vicinity of the Plan Change area. The proposed zoning for the wider Drury East area, including the KP and OCL proposals is shown in Figure 5

Figure 5: Proposed Zoning - Nearby Developers



Source: Woods

This ITA and the proposals detailed in this ITA have been developed in co-ordination with KP, OCL and their consultants to:

- provide a consistent approach to assessment of the potential transport impacts of Plan Changes in Drury East based on common assumptions; and
- support development of an integrated transport network across Drury East that provides transport choices and is contributes to a quality compact urban form.

The parallel Plan Change applications are understood to include:

- **KP:** applying for a Plan Change to the AUP -OIP to rezone approximately 95ha of FUZ land in Drury East to a mix of Business - Metropolitan Centre, Business - Mixed Use and Open

Space-Informal Recreation zones. The Plan Change also includes a precinct which contains provisions that provide for the development of a new, comprehensively planned and transport-orientated centre at Drury that supports high density retail, commercial, residential and employment-generating activities.

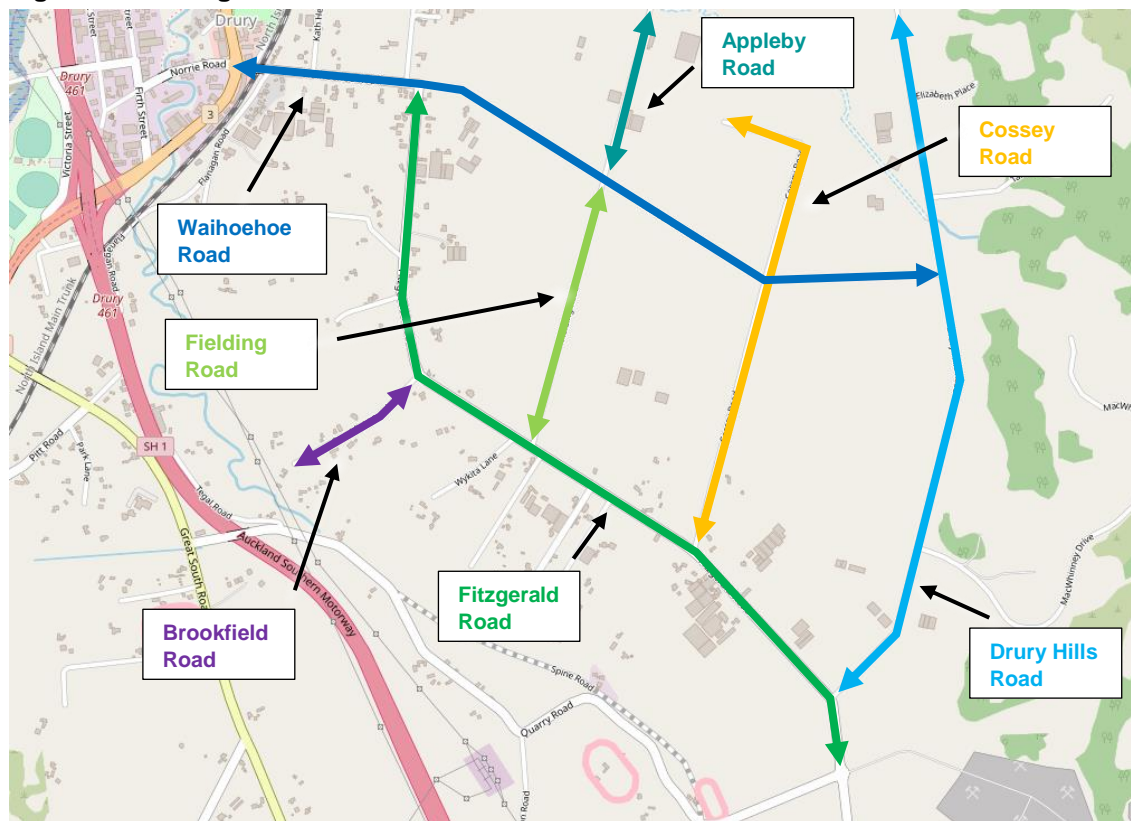
- **OCL:** applying for a Plan Change to the AUP -OIP to rezone approximately 48.9 hectares of FUZ land in Drury East to a mix of residential zones (Terrace Housing and Apartment Building and Mixed Housing Urban).

2.2.3 Existing Road Network

The road network in the vicinity of the Plan Change area is shown in Figure 6. The key links within the network have been identified as comprising:

- **Waihoehoe Road** – link with the existing town of Drury and SH1 access, also forms the northern boundary for the Plan Change area;
- **Fitzgerald Road** – link with Drury South and for access towards Ramarama, also forms the western and southern boundaries for the Plan Change area;
- **Drury Hills Road** – forms part of the eastern boundary for the Plan Change area; following the proposed Mill Road alignment as shown in the Council's Drury-Opāheke Structure Plan adopted in August;
- **Brookfield Road** – future upgrade to collector will link towards Drury West (see **Section 2.2.4**);
- **Fielding Road** – north-south link within the Plan Change area boundary;
- **Cossey Road** – north-south link within the Plan Change area boundary; and
- **Appleby Road** – future upgrade to collector will link towards Opāheke (see **Section 2.2.4**).

Figure 6: Existing Road Network



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The key links are briefly described in the following sections:

2.2.3.1 Waihoehoe Road

Waihoehoe Road is a rural collector road linking Great South Road to the west with Drury Hills Road to the east. At the western end, the speed limit is 50km/h, increasing to 70km/h east of Flanagan Road and then to 80km/h east of Fitzgerald Road. A single traffic lane is provided in each direction. Marked parking restrictions are in force between the rail bridge and the intersection with Great South Road, in the form of no-stopping lines.

Between the Great South Road and Fitzgerald Road intersections, Waihoehoe Road is a collector road, providing access to roadside land-uses, local roads and connecting with arterial roads. Between Fitzgerald Road and Drury Hill Road, Waihoehoe Road is designated as a local road.

There are five main intersections along Waihoehoe Road (as well as several minor ones on the outskirts of Drury which provide access to small cul-de-sacs at Tui Street, Flanagan Road and Kath Henry Lane):

- Great South Road / Waihoehoe Road: four-arm roundabout intersection (Figure 7) providing two entry lanes on the northern and western approaches and one lane on other approaches and exits;
- Fitzgerald Road meets Waihoehoe Road at a priority T-intersection that provides a right-turn box for westbound traffic;

- Fielding Road / Appleby Road meet Waihoehoe Road at a priority cross-roads;
- Cossey Road: meets Waihoehoe Road at a priority cross-roads; and
- Drury Hills Road is met by Waihoehoe Road at a priority T-intersection (Figure 8).

Figure 7: Great South Road / Waihoehoe Road



Source: Mott MacDonald

Figure 8: Drury Hills Road / Waihoehoe Road



Source: Mott MacDonald

2.2.3.2 Fitzgerald Road

Fitzgerald Road is a rural collector road (80km/h speed limit) linking Waihoehoe Road to the north with Quarry Road to the south. One traffic lane is provided in each direction and there are no marked parking restrictions.

There are six main intersections on Fitzgerald Road:

- Waihoehoe Road (Figure 9) (described in **Section 2.2.3.1** above);
- Brookfield Road meets Fitzgerald Road at a priority T-intersection;
- Fielding Road meets Fitzgerald Road at a priority T-intersection;
- Cossey Road meets Fitzgerald Road at a priority T-intersection;
- Drury Hills Road meets Fitzgerald Road at a priority T-intersection; and
- Quarry Road: four-arm roundabout intersection (Figure 10) providing one entry lane and one exit lane on all arms.

Figure 9: Waihoehoe Road / Fitzgerald Road



Source: Mott MacDonald

Figure 10: Quarry Road / Fitzgerald Road



Source: Mott MacDonald

2.2.3.3 Drury Hills Road

Drury Hills Road is a rural local road (80km/h speed limit) linking Appleby Road to the north with Fitzgerald Road to the south. One traffic lane is provided in each direction and there are no marked parking restrictions (Figure 11).

There are two main intersections on Drury Hills Road:

- Waihoehoe Road (described in **Section 2.2.3.1** above); and
- Fitzgerald Road (described in **Section 2.2.3.2** above).

Figure 11: Drury Hills Road



Source: Mott MacDonald

2.2.3.4 Brookfield Road

Brookfield Road is a rural local road (80km/h speed limit) providing access from Fitzgerald Road to adjacent land-uses. One traffic lane is provided in each direction and there are no marked parking restrictions.

There is one main intersection on Brookfield Road:

- Fitzgerald Road (Figure 12) (described in **Section 2.2.3.2** above).

Figure 12: Fitzgerald Road / Brookfield Road



Source: Mott MacDonald

2.2.3.5 Fielding Road and Cossey Road

Fielding Road and Cossey Road are rural local roads (80km/h speed limit) providing access from Waihoehoe Road and Fitzgerald Road to adjacent land-uses. Both roads provide one traffic lane in each direction and there are no marked parking restrictions.

Each road has two main intersections (Figure 13 and Figure 14):

- Waihoehoe Road (described in **Section 2.2.3.1** above); and
- Fitzgerald Road (described in **Section 2.2.3.2** above).

Figure 13: Fitzgerald Road / Fielding Road



Source: Mott MacDonald

Figure 14: Waihoehoe Road / Cossey Road



Source: Mott MacDonald

2.2.3.6 Appleby Road

Appleby Road is a rural local road (80km/h speed limit) that provides access from Waihoehoe Road and Drury Hills Road to adjacent land-uses. One traffic lane is provided in each direction and there are no marked parking restrictions. A culvert approximately 600m north of Waihoehoe Road narrows the carriageway to one lane, with priority assigned to southbound traffic (Figure 15).

Appleby Road has one main intersection, as well as two minor access cul-de-sacs (Harry Dodd Road and Cossey Road):

- Waihoehoe Road (described in **Section 2.2.3.1** above).

Figure 15: Appleby Culvert

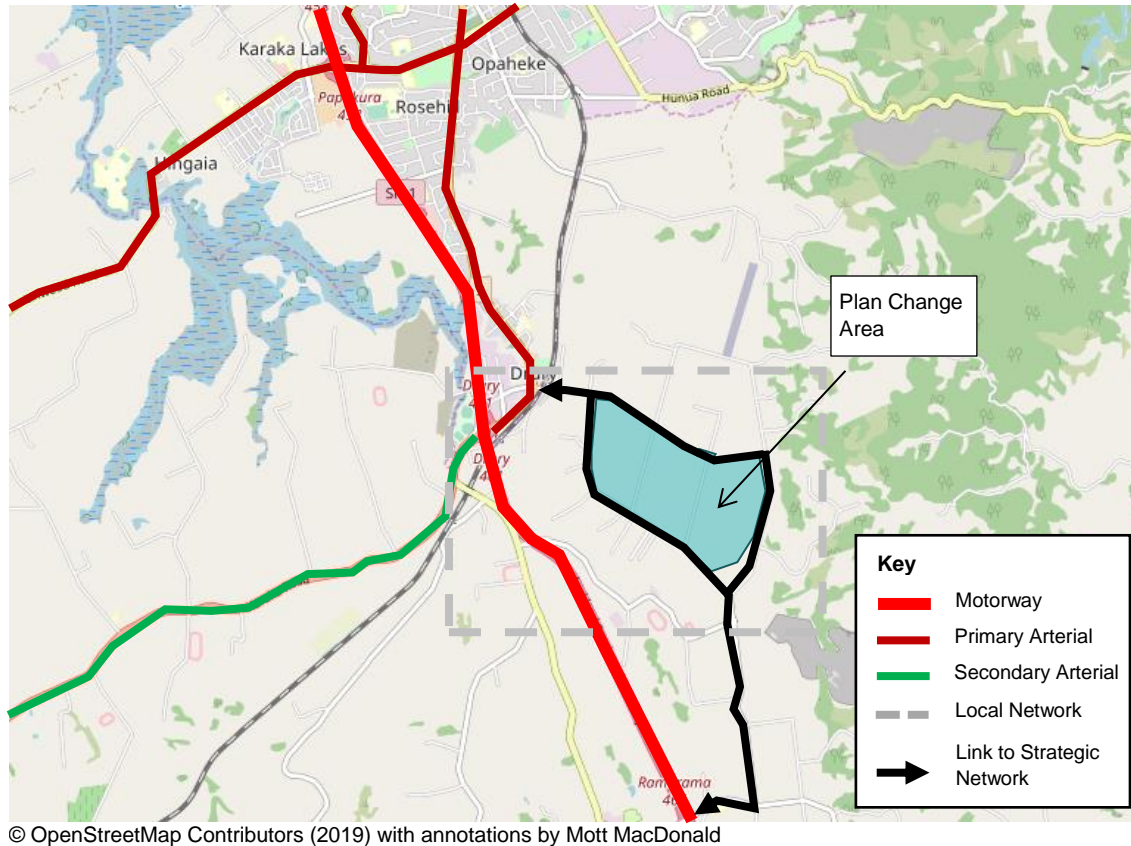


Source: Mott MacDonald

2.2.3.7 Wider Network

The wider road network and connections with strategic movement links are shown in Figure 16. It can be seen that the Plan Change area is located in close proximity to the arterial road network, facilitating highway access to and from the Plan Change area for locations across Auckland.

Figure 16: Wider Network Links



As shown in Figure 16, the major components of the wider network around the Plan Change area are:

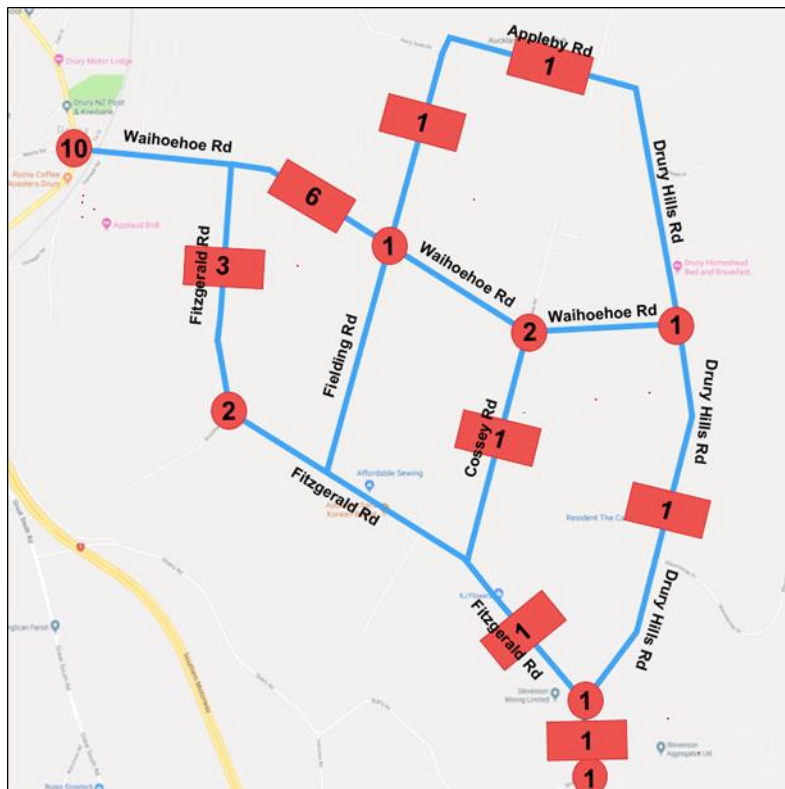
- Great South Road, providing access to and from Papakura and south Auckland;
- Karaka Road (State Highway 22), providing access to Drury West and Pukekohe; and
- SH1, providing access northwards towards the rest of Auckland and southwards towards Waikato and beyond.

2.2.3.8 Crash Analysis

The Transport Agency's Crash Analysis System (CAS) data for the most recent five-year period (2014 to 2018) has been reviewed for the road network in the vicinity of the Plan Change area as shown in Figure 6.

The number of crashes at each intersection / mid-block is shown in Figure 17.

Figure 17: CAS History Map



Source: CAS

Figure 17 shows that the only concentrations of accidents are at:

- the Great South Road / Waihoehoe Road intersection – primarily vehicles failing to give way, resulting in two minor injury crashes with people on bicycles and one minor injury crash with vehicles only; and
- the midblock section of Waihoehoe Road between the Fitzgerald Road and Fielding Road intersections – predominantly drivers losing control in wet road conditions, resulting in two minor injury crashes.

These concentrations broadly follow the pattern of traffic volumes.

A summary of the crashes that have occurred follows in Table 1, Table 2 and Table 3. Full outputs from CAS are provided in **Appendix A**.

Table 1: Historical Crash Data - Severity

Crash Severity	Number	%	Social Cost (\$m)
Fatal	0	0	0
Serious	3	9	2.75
Minor Injury	10	30	1.05
Non-Injury	20	61	0.65
Total	33	100	4.45

Source: CAS

Table 2: CAS Analysis – Main Crash Factors

Main Crash Factors	Qty
Alcohol	6 (18%)
Too fast	8 (24%)
Failed Give Way/Stop	9 (27%)
Failed keep left	3 (9%)
Incorrect lane / position	3 (9%)
Poor handling	7 (21%)
Poor observation	6 (18%)
Poor judgment	2 (6%)
Disabled/old/ill	1 (3%)
Road factors	7 (21%)
Weather	1 (3%)
Other	7 (21%)

Source: CAS

Table 3: CAS Analysis – Crash Types

Main Crash Type and Cause	Qty
Overtaking Crashes	1 (3%)
Straight Road Lost Control/ Head On	9 (27%)
Bend-Lost Control/Head On	9 (27%)
Rear End/Obstruction	5 (15%)
Crossing/Turning	9 (27%)
Pedestrian Crashes	0 (0%)
Miscellaneous Crashes	0 (0%)

Source: CAS

The information extracted from the CAS database for the last five years in the study area shows that:

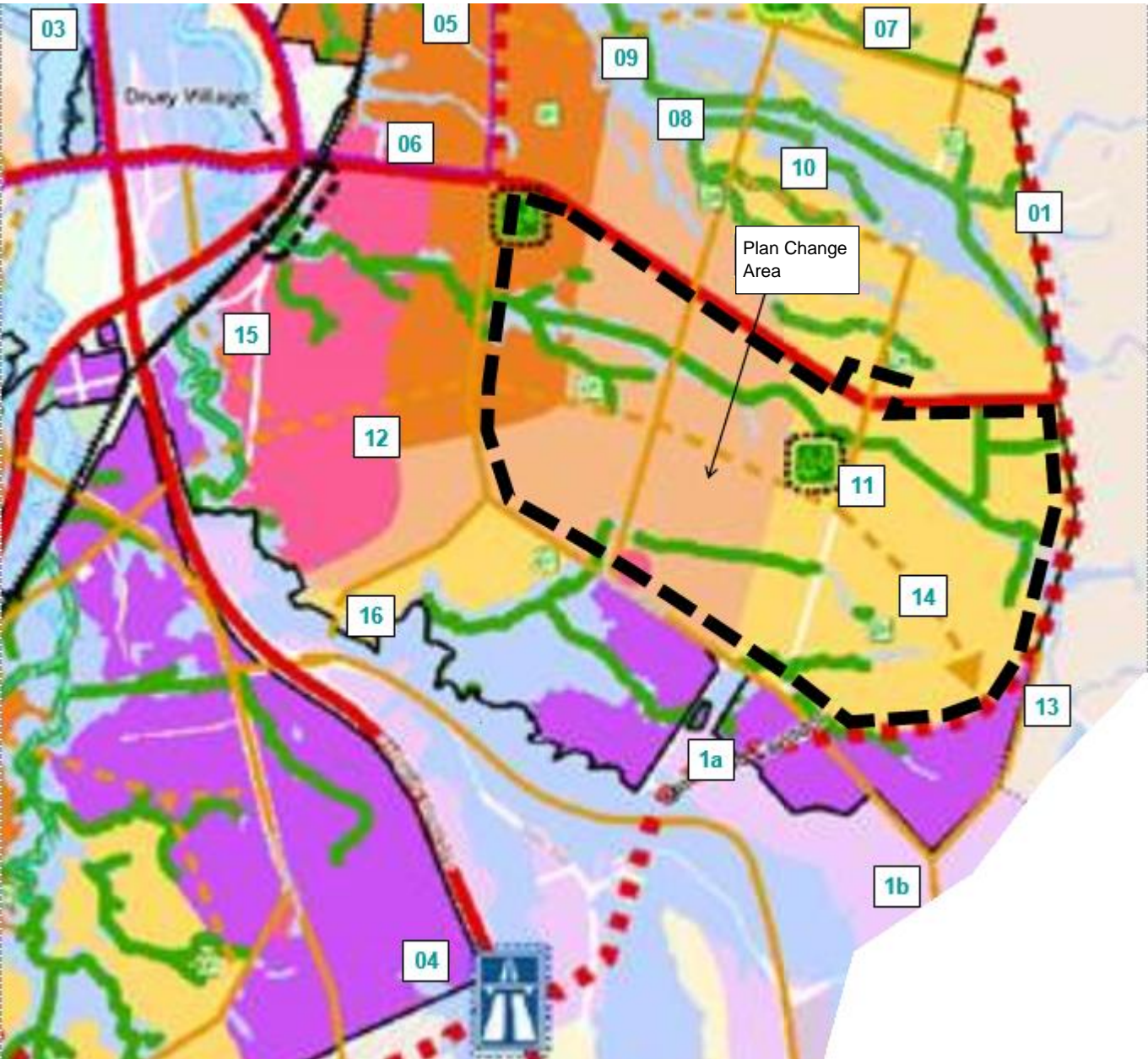
- There were 33 crashes in total during the period examined;
- Most of the crashes were non-injury crashes (61%) while 39% resulted in injuries;
- Most of the injury crashes were minor (10 crashes), but there were three serious crashes; and
- There were four reported crashes involving two cyclists, one moped and one motorcycle.

The accidents analysed are generally typical for a rural road network with a number of intersections – losing control and failure to give way at intersections being the most common. It is anticipated that the proposed changes to the speed regime and anticipated road design improvements will significantly reduce the accidents per user-km across this network and that overall, the analysis of the CAS data does not reveal a pattern of accidents that would suggest there is a significant road safety problem in the vicinity of the Plan Change area .

2.2.4 Planned Future Road Network

The existing and indicative future road network, including planned upgrades to the existing network is outlined in Figure 18 and Table 4. Some of the planned upgrades and indicative future connections are funded, as noted in Table 4.

Figure 18: Auckland Council’s Drury-Opāheke Structure Plan Road Network



Source: Drury-Opāheke Structure Plan

Table 4: Future Road Network Plans

Reference	Project	Programme	Description	Indicative Owner
01	Mill Road	NLTP / RLTP / SGA IBC	Strategic corridor to support improved local access to future urban areas, improve resilience by reducing reliance on SH1. Two options for alignment through Drury East – ‘Link Road’ (1a) or ‘FUZ Edge’ (1b) (IBC SR2H).	AT
02	SH1 Widening (Manukau – Papakura)	RLTP	SH1 widening to provide additional lanes for the Manukau to Papakura section and upgrade Takanini Interchange. Scheduled completion December 2019.	NZTA
03	SH1 Widening (Papakura – Bombay)	RLTP	SH1 widening to provide additional lanes for the Papakura to Bombay section and upgrade Drury Intersection (IBC SR1A).	NZTA
04	SH1 Drury South Interchange	NLTP / RLTP / SGA IBC	New SH1 interchange to connect with Mill Road.	NZTA
05	New north-south arterial	SGA IBC	New arterial road between Papakura industrial area and Waihoehoe Road (IBC AR10).	AT
06	Waihoehoe Road	SGA IBC	Upgrade Waihoehoe Road to arterial (IBC AR11).	AT
07	Jack Paterson Road extension	Structure Plan	Urbanisation and southward extension of Jack Paterson Road as a collector to connect to Appleby Road.	Developers
08	Appleby Road	Structure Plan	Urbanisation of Appleby Road as a collector.	Developers
09	Westward connection from Appleby Road	Structure Plan	Collector connection between Appleby Road and new north-south arterial.	Developers
10	Eastward connection from Appleby Road	Structure Plan	Collector connection between Appleby Road and Cossey Road.	Developers
11	Cossey Road	Structure Plan	Urbanisation of Cossey Road as a collector.	Developers
12	Pitt Road extension	Structure Plan	Collector connection between Cossey Road and Pitt Road, crossing SH1	Developers
13	Drury Hills Road	Structure Plan	Upgrade Drury Hills Road to collector between Waihoehoe Road and Fitzgerald Road. Not needed if FUZ Edge option chosen for Mill Road.	Developers
14	Drury Hills Road – Fitzgerald Road link	Structure Plan	Collector connection between Drury Hills Road and Fitzgerald Road.	Developers
15	Eastward connection from Great South Road	Structure Plan	Collector connection between Great South Road and Pitt Road extension.	Developers
16	Brookfield Road extension	Structure Plan	Extension of Brookfield Road to connect with Quarry Road Bridge as collector.	Developers

Source: Drury-Opāheke and Pukekohe-Paerata Structure Plan Draft Integrated Transport Assessment (April 2019)

The proposed network will provide an effective framework for access to and from the Plan Change area, providing direct access to the new Drury Metropolitan Centre via an east-west collector road and upgraded SH1 interchange, as well as alternate access to SH1 via the new interchange on Mill Road. Direct arterial access will also be provided to Papakura and Takanini.

2.3 Public Transport Network

2.3.1 Existing Public Transport Network

Existing public transport provision in Drury is limited. The nearest bus stop is located in Great South Road in the centre of Drury, north of the intersection with Waihoehoe Road. This is approximately 700-3,000m from the Plan Change area.

The bus stop provides a shelter, seat, flag and waste bin. Printed timetable information is also displayed. One public bus route serves these stops, summarised in Table 5.

Table 5: Bus Route from Great South Road (Mondays to Fridays)

Route	Description	First Bus	Last Bus	Typical Headway (mins)	
				Peak	Off-Peak
376	Drury – Papakura Shops via Great South Rd	0550	2040	30	60
	Papakura Shops – Drury via Great South Rd (terminates)	0602	2122	30	60

Source: AT

Table 5 shows that route 376 provides a low-frequency service to Papakura Town Centre and rail station. This route operates from early in the morning to early evening.

The nearest rail station is at Papakura, approximately 5-6km to the north and accessible via bus route 376 and via park and ride.

The station provides access to Southern Line rail services operating on the North Island Main Trunk line (NIMT), summarised in Table 6.

Table 6: Rail Lines from Papakura Station (Mondays to Fridays)

Line	Description	First Train	Last Train	Typical Headway (mins)	
				Peak	Off-Peak
Southern	(Pukekohe) – Papakura – Otahuhu - Britomart	0514	2204	8-12	20
	Britomart – Otahuhu – Papakura – (Pukekohe)	0540	2230	10	20

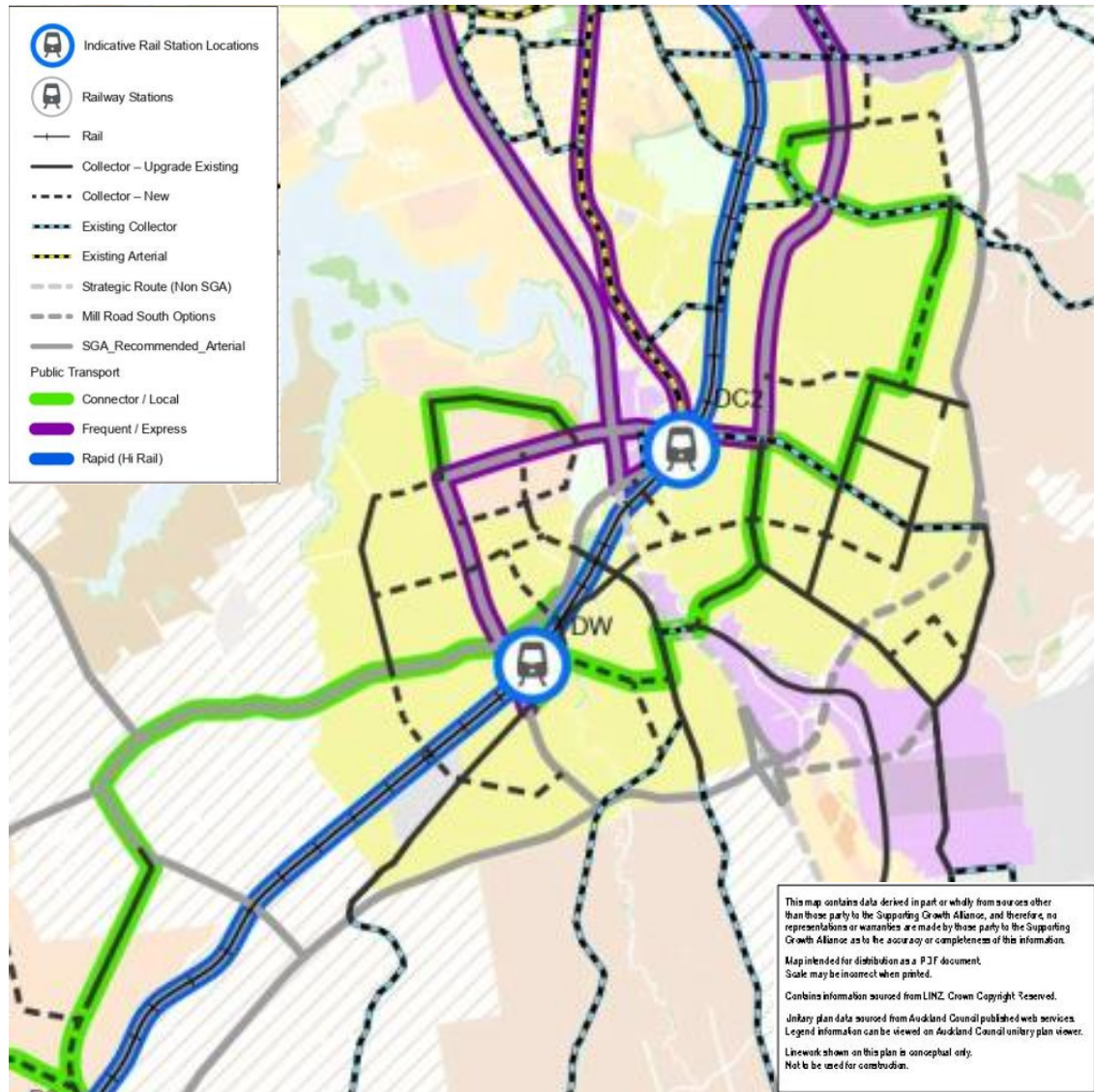
Source: AT

Table 6 shows that Papakura Station provides access to frequent services to Britomart (in 50 mins), Otahuhu (in 25 mins) and other destinations along the Southern Line. This route operates from early in the morning to late evening.

2.3.2 Planned Future Public Transport Network

The Drury-Opāheke Structure Plan and supporting ITA (discussed in more detail in **Section 5.2.4**) draws together and builds upon plans for the Drury public transport network, including those being developed by the Supporting Growth Alliance (SGA) through the Business Case process. These plans are summarised in Table 7 and Figure 19.

Figure 19: Supporting Growth – Draft Public Transport South Network (Drury)



Source: Drury-Opāheke and Pukekohe-Paerata Structure Plan Draft Integrated Transport Assessment (April 2019)
(edited by Mott MacDonald for clarity)

Table 7: Future Public Transport Network Plans

Reference	Project	Programme	Description	Indicative Owner
01	Pukekohe Rail Electrification	NLTP / RLTP	Electrification of NIMT between Papakura and Pukekohe, additional EMUs to extend services.	KiwiRail / AT
02	Rail capacity upgrades	SGA IBC	Increased rail capacity to four tracks between Wiri and Pukekohe (IBC option MT9B), and frequent Southern Line electric train services terminating at Pukekohe.	KiwiRail / AT
03	New rail station	SGA IBC	New rail station at Drury Central (IBC DC2).	AT

Reference	Project	Programme	Description	Indicative Owner
04	Frequent and express buses	SGA IBC	Frequent and express bus network and associated priority – potentially utilising SH1 shoulders, Great South Road and various arterial and collector roads (IBC MT3C, MT4I, MT4K, MT4L).	NZTA / AT
05	Connector buses	SGA IBC	Connector bus network operating on arterial and collector roads.	AT
06	Small park-and-ride at Drury Central	SGA IBC	New park-and-ride facilities at Drury Central.	AT

Source: Drury-Opāheke and Pukekohe-Paerata Structure Plan Draft Integrated Transport Assessment (April 2019)

The proposed public transport network will provide access to the rapid transit network at Drury Central (new rail station indicated to be located immediately to the south east of the Great South Road / Waihoehoe Road intersection). Drury Central is also expected to be accessible via a proposed park and ride facility. This will provide a service at least every 10 minutes towards Manukau and Auckland CBD, as well as to Pukekohe (based on Auckland Regional Public Transport Plan standards). In addition, there will also be frequent / express bus services to Papakura (via Great South Road and the new north-south arterial link) and to Manukau (via SH1), operating at least every 10 minutes. A connector bus service (operating at least every 20 minutes) is planned to connect with Drury West via the west side of the Plan Change area, through to Papakura via Appleby Road.

2.4 Active Travel Network

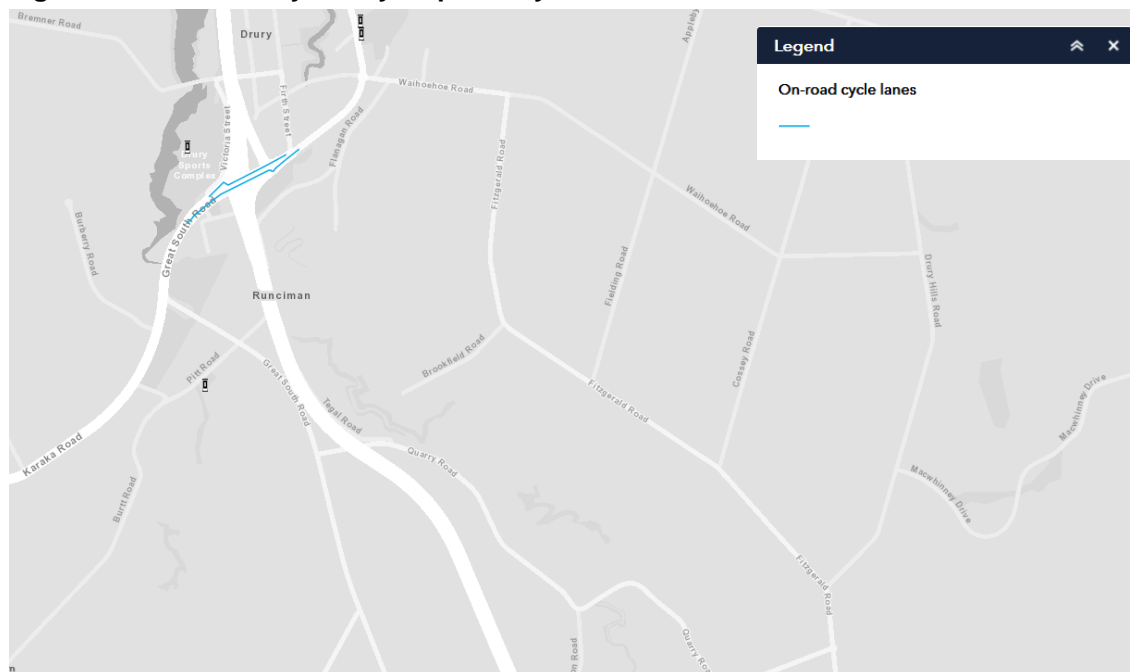
2.4.1 Existing Walking and Cycling Network

The existing walking and cycling network in the vicinity of the Plan Change area is very limited. The environment is currently rural, with no noteworthy facilities for pedestrians or cyclists provided

A footpath has been provided along the northern side of Waihoehoe Road between Great South Road and Fitzgerald Road, providing some limited amenity for pedestrians at the outskirts of Drury.

Figure 20 shows the cycleways local to the Plan Change area. It can be seen that the only cycle facilities currently provided are on-road cycle lanes on either side of Great South Road in the vicinity of the Drury SH1 interchange.

Figure 20: Auckland Cycleway Map - Drury



Source: AT

2.4.2 Planned Future Walking and Cycling Network

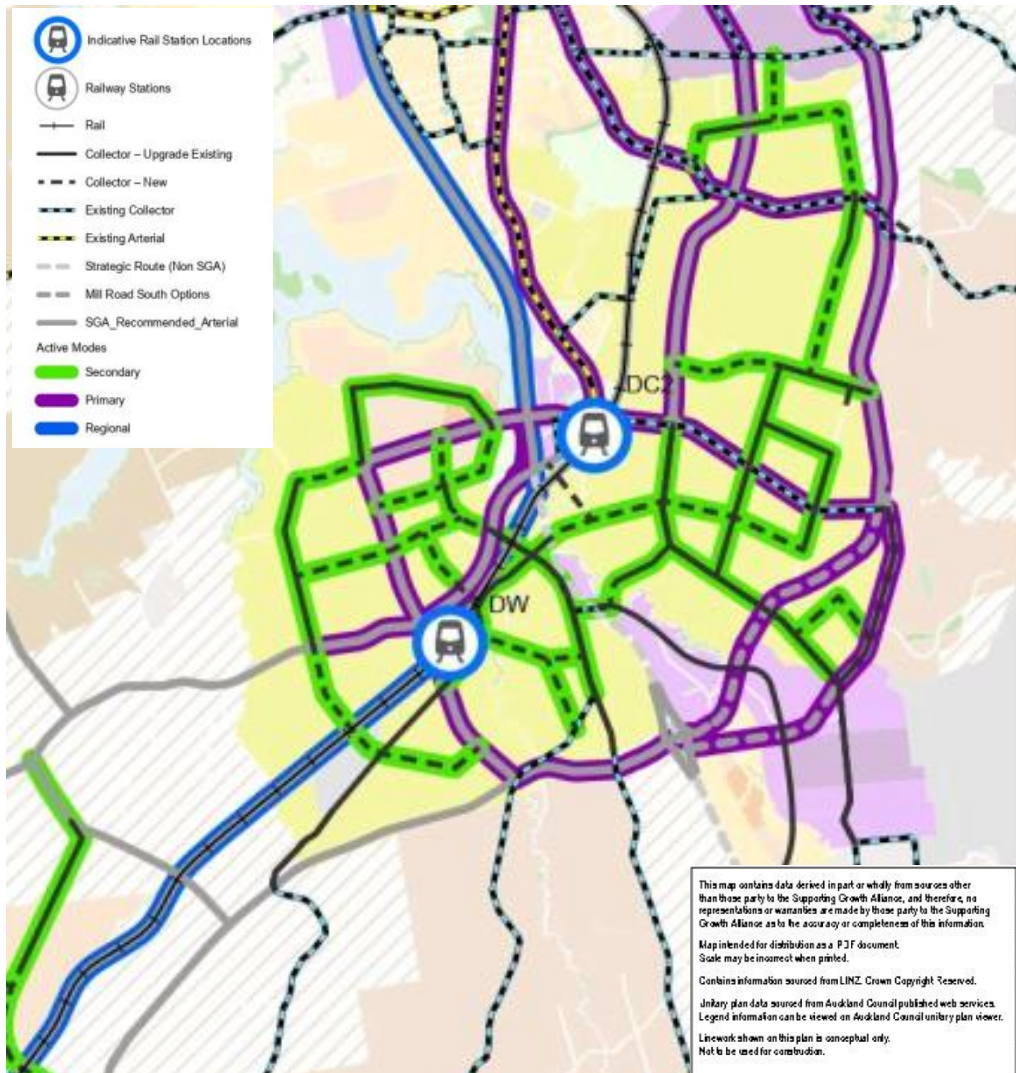
The Drury-Opāheke Structure Plan and supporting ITA (discussed in more detail in **Section 5.2.4**) draws together and builds upon plans for the Drury active travel network, including those being developed by the SGA through the Business Case process. These plans are summarised in Table 8 and Figure 21.

Table 8: Future Active Travel Network Plans

Reference	Project	Programme	Description	Indicative Owner
01	Regional Cycle Route	RLTP	Regional cycle route adjacent to SH1 and NIMT, with grade-separated active mode crossings of SH1 and NIMT.	NZTA
02	Primary Cycle Routes	SGA IBC	Primary cycle routes on all arterial roads.	AT
03	Secondary Cycle Routes	SGA IBC	Secondary cycle routes on collector network.	Developers
04	Greenways Network	Structure Plan	Walking and cycling routes in local roads, reserves and riparian areas for recreation and supplemental connectivity.	Local Boards

Source: Drury-Opāheke and Pukekohe-Paerata Structure Plan Draft Integrated Transport Assessment (April 2019).

Figure 21: Supporting Growth – Draft Active Travel South Network (Drury)



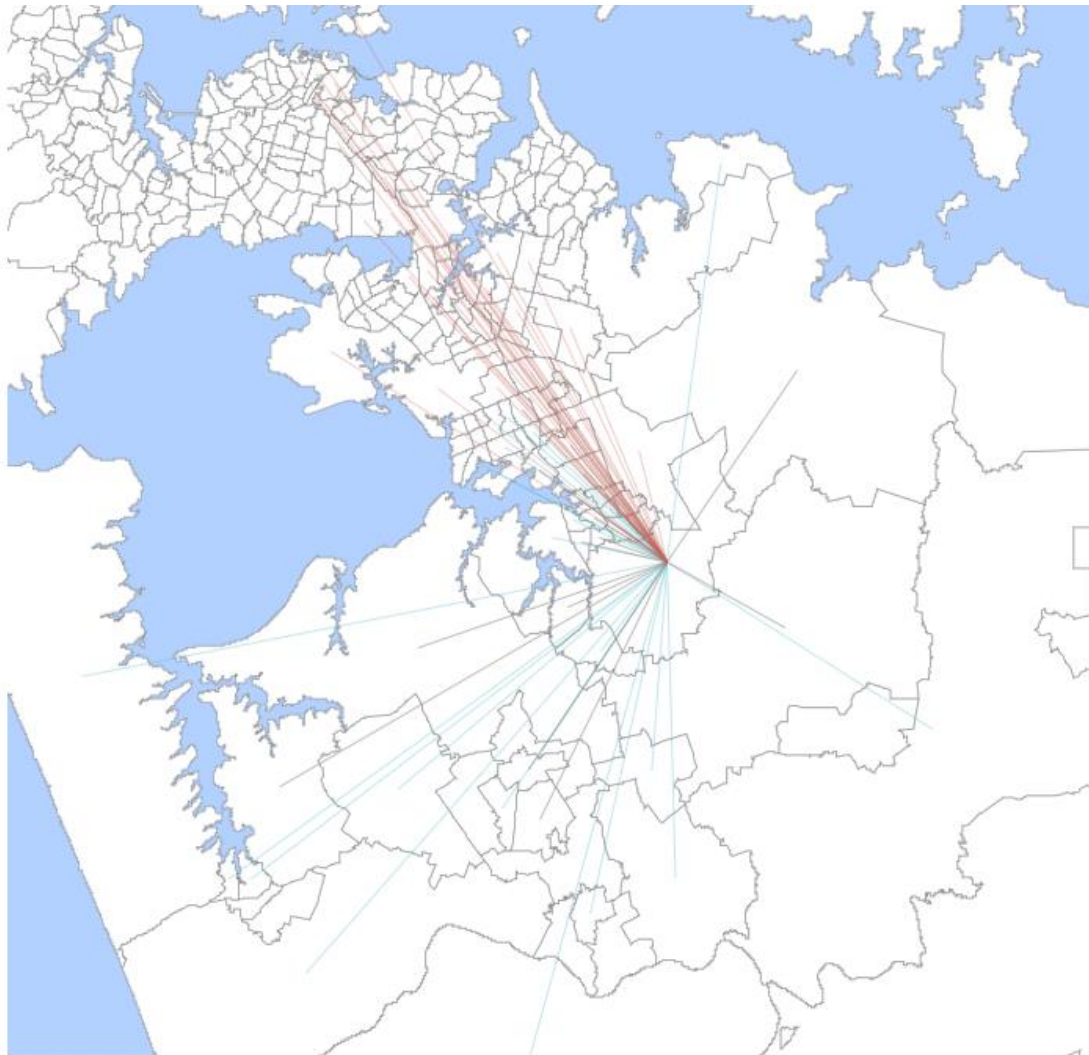
Source: Drury-Opāheke and Pukekohe-Paerata Structure Plan Draft Integrated Transport Assessment (April 2019) (edited by Mott MacDonald for clarity).

The proposed active travel network provides for good connectivity across the Plan Change area and onward accessibility to Drury Centre and Drury Central rail station. Longer distance journeys would also be provided for, including linkages with Drury West, Drury South and Papakura.

2.5 Travel to Work

Data from the 2013 Census has been analysed, reviewing the work address data for the local area unit for the Plan Change area ('Drury'). The work addresses are illustrated in Figure 22 (red for Drury residents commuting out and blue for workers commuting into Drury).

Figure 22: Drury Commuting Map



Source: Census 2013 (Commuter View)

Figure 22 shows that Drury residents who commute outside the local area predominantly have places of work located to the north, in south and central Auckland.

Travel patterns are expected to change considerably as a result of the planned transport schemes described in this chapter. For example, Papakura East is an existing residential area in south Auckland that is located a few kilometres from the rapid transit network, so Census data from this area has been reviewed by way of comparison.

The aggregated commute distributions for Drury and Papakura East are detailed in Table 9.

Table 9: Current Distribution of Work Locations

Location	Drury Proportion	Papakura East Proportion
Local Area Unit	27.0%	7.0%
South Auckland (except Drury)	47.5%	71.5%
Central Auckland	22.5%	19.5%

Location	Drury Proportion	Papakura East Proportion
Other	3.0%	2.0%

Source: Census 2013

Table 9 shows that in both Drury and Papakura East, more than 75% of people work in south Auckland, although a higher proportion of Drury residents work more locally. Around 20% of residents in both areas work in the isthmus.

Census 2013 data has also been reviewed to assess the model splits for Drury and Papakura East.

Table 10: Current Travel to Work Mode Split

Location	Drury Proportion	Papakura East Proportion
Private vehicle (Drive)	91.0%	83.5%
Private vehicle (Passenger)	3.0%	7.0%
Train	3.0%	3.5%
Bus	0.0%	2.0%
Walk/cycle/jog	2.0%	3.0%
Motorcycle	1.0%	1.0%

Source: Census 2013

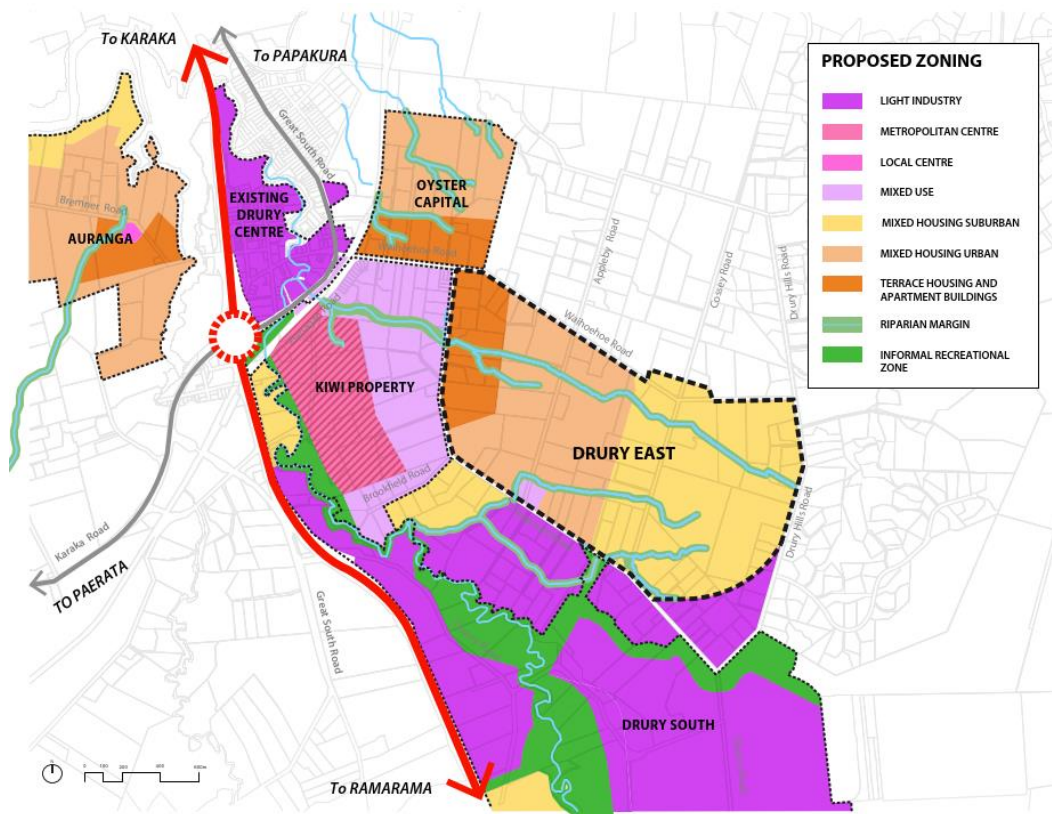
Table 10 shows a very high (91%) driver mode share for Drury commuters. The driver mode share in Papakura East is materially lower, with higher levels of car-sharing and public transport use. This shows what might be expected for future travel behaviour in Drury from the planned changes in infrastructure and land use.

3 Proposal

3.1 Change to Zoning

The proposed zoning pattern for the Plan Change area is shown in Figure 23 (a larger version is enclosed as **Appendix B**).

Figure 23: Proposed Zoning



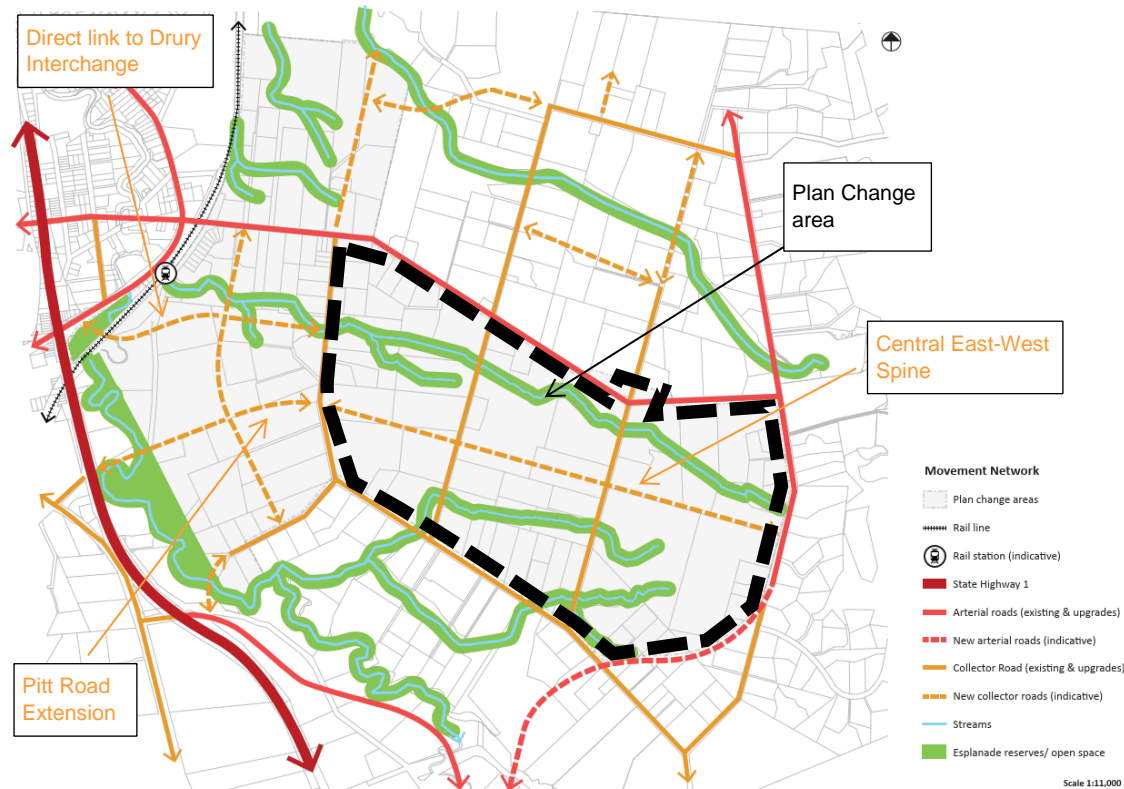
Source: Woods

3.2 Multi-Modal Access

3.2.1 Movement Network

The indicative masterplan movement network for the Plan Change area is presented in Figure 24.

Figure 24: Indicative Masterplan Movement Network



Source: Barker & Associates

FHLD engaged Woods to undertake a broad masterplanning exercise for the Drury East Plan Change area. The masterplan movement network has been developed in conjunction with KP and OCL, with reference to Council, AT and SGA plans for local infrastructure (**see Section 5.2**). It shows the hierarchy and typologies of arterial and collector roads for movement to, through and around the Plan Change area. A slower speed local network of local and reserve edge roads for access to activities within the Plan Change area is anticipated.

The movement network is based on the 'Link Road' alignment for Mill Road. The alignment of the key roads identified in the masterplan movement network are subject to change, subject to the final Mill Road alignment chosen.

The collector roads in the movement network align closely with those proposed in the Structure Plan (**Section 5.2.4**), but replaces the Drury Hills Road – Fitzgerald Road link (Table 4, Item 14) by extending the Pitt Road extension (Table 4, Item 12) further east, although it is noted that the Pitt Road extension is a long-term aspiration. A Central East-West Spine link through the Plan Change area will provide good access for public transport, walking and cycling, as well as fulfilling the Drury Hills Road – Fitzgerald Road link's role of providing sufficient permeability in the Movement Network.

A direct link to the Drury interchange (as shown in Figure 24) to the Drury Centre is identified and is desirable to provide convenient access to the Centre from Stage Highway 1, although we note that this is not a requirement.

This roading pattern creates a permeable, connected grid for movement, sets the block structure for the graduated density envisaged by the different residential zones and provides defined boundaries for the changes between zones.

Indicative cross-sections for each road type have been developed with reference to the AT Roads and Streets Framework (RASf) and Transport Design Manual (TDM), in coordination with the other Drury East developers (KP and OCL). The key cross-section parameters are shown in Table 11 below.

All road cross-sections are indicative and subject to later detailed design.

Table 11: Construction standards for road types within the Drury Precinct

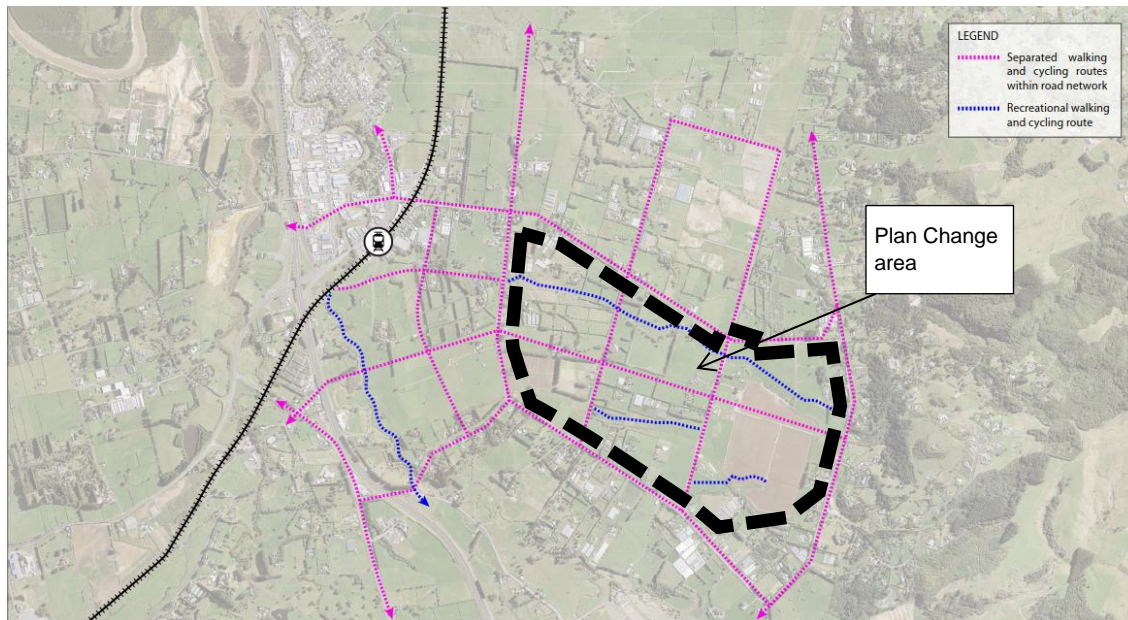
Corridor width	Carriageway	Median	Cycle Paths	Street trees / Rain Garden / Parking	Footpath	Design Speed	Vehicle Access Restriction
Arterial Road (Waihoehoe Rd)							
29.6m - 32m	12.4m – 14m *	3m solid median	2.1m each side plus buffers	Trees / Rain garden 1.5m minimum each side, ideally between cycle path and footpath. On-street parking (interspersed between trees) minimum 2.2m.	2.4m each side	40-50kph	Yes – as per AUP E27.6.4.1(3)(c)
Collector Road (Central East-West Spine)							
28m	7m	2.6m-3m solid median	1.8m each side plus buffers	Trees / Rain garden 1.5m minimum each side, ideally between cycle path and footpath. On-street parking (interspersed between trees) minimum 2.2m.	1.8m each side	40kph	No
Collector Road							
23m - 23.5m	6.4m - 7m	Not required	1.8m each side plus buffers	Trees / Rain garden 1.5m minimum each side, ideally between cycle path and footpath. On-street parking (interspersed between trees) minimum 2.2m.	1.8m each side	40kph	No
Local Road							
16m	6m	Not required	Not required	1.5m minimum each side if trees intended, or 2.2m minimum if on-street parking provided.	1.8m each side	30kph	No
Local Road – Park Edge							
13.5m	6m	Not required	3m reserve shared path	1.5m minimum each side if trees intended, or 2.2m minimum if on-street parking provided.	1.8m on lot side	30kph	No
Key retail street/main street							
20m	6m	Not required	Not required	Landscaping can be provided in the footpath zone using tree pits instead.	3m each side	30kph	Yes – as per E27.6.4.1(1)(b)

Note: * Precinct rules will enable the progressive upgrade of Waihoehoe Road

3.2.2 Walking and Cycling

The indicative masterplan walking and cycling network for the Plan Change area is presented in Figure 25.

Figure 25: Indicative Masterplan Walking and Cycling Network



Source: Barker & Associates

One of the project goals is to establish a connected, permeable and safe walking and cycling network, as a key component of the wider Movement Network. Key features are:

- Arterial and collector roads have separated cycle lanes and footpaths on both sides of the road;
- Reserve edge roads have a shared path within the riparian reserve for predominantly recreational cycling and walking;
- All intersections of collector and/or arterial roads will provide pedestrian and cycle crossing facilities; and
- Local roads will be designed for good pedestrian permeability using small block sizes and providing reasonably direct through pedestrian routes wherever possible.

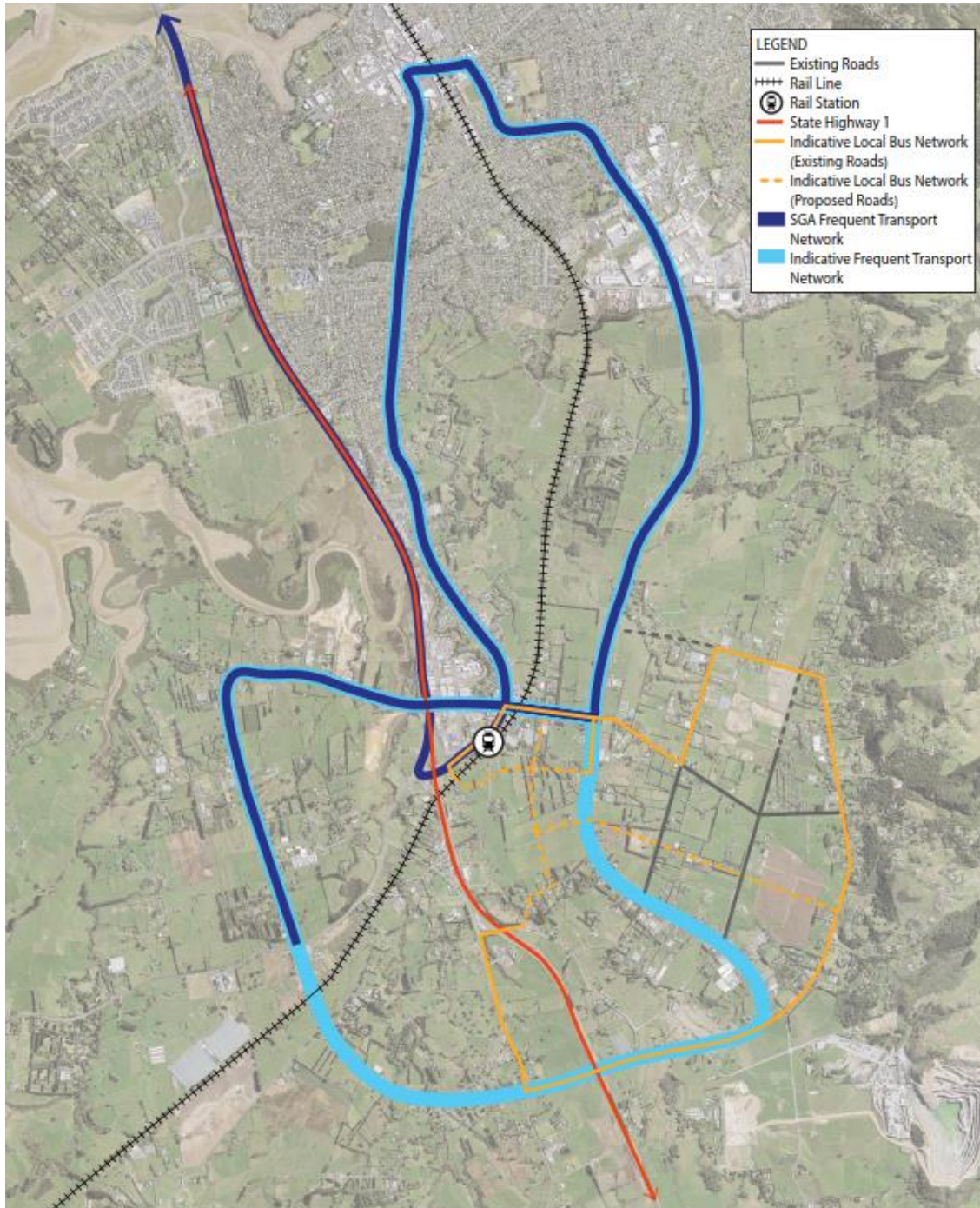
The cycleways and footpaths will provide connectivity between residential neighbourhoods and Drury town centre (existing and proposed), as well as the proposed public transport network (see **Section 3.2.3**). Much of the Drury East land is between 0.5km and 2km from the town centres and proposed rail station. The cycleways will also provide connectivity to employment opportunities in the industrial-zoned land in Drury South.

3.2.3 Public Transport

Figure 26 illustrates the future Frequent and Connector bus services for Drury identified in the SGA ITA as discussed above. It also illustrates how this network could potentially be expanded to cater for development in Drury East. The expanded network is illustrative only and AT will be responsible for implementing any future bus networks in Drury East. To future-proof for a variety

of options, the cross section requirements for collector roads noted in Table 11 provide sufficient space to provide for bus services in the future.

Figure 26: Indicative Masterplan Public Transport Network



Source: Barker and Associates

Any future public transport access is to be provided by a network based on the AT hierarchy of Rapid, Frequent, Connector and Local routes (Figure 27).

Figure 27: Public Transport Network Hierarchy

		RAPID	FREQUENT	CONNECTOR	OTHER
Aspiration					
Services Layer		RAPID	FREQUENT	CONNECTOR	OTHER SERVICES (Local, rural-township, peak-only, school, Total Mobility and on-demand services)
Defining Feature		CORE – ALL DAY NETWORK			SUPPORTING NETWORK
Minimum hours of operation		5:30am – 11:30pm			No minimum
City Centre Services Minimum Headway		10 minutes		20 minutes	Driven by need
Non-City Centre services 7am-7pm, 7 days		10 minutes		20 minutes	
Minimum Headway Outside those times		20 minutes		30 minutes	
Achieving Efficiency and Reliability		Dedicated Right of Way	Whole-of-route priority	Priority measures	Limited priority measures

Source: AT Regional Public Transport Plan 2018-28, amended by MM for presentation clarity

- **Rapid** – the focus for the proposed network is a well-connected Rapid Transport Network, using electric trains extended to Pukekohe, extra rail capacity and a new rail station at Drury Central. The new station will be a key interchange for routes at all levels of the hierarchy, enabling good access between Drury East and destinations in south and central Auckland.
- **Frequent** – the Council's Drury-Opāheke Structure Plan proposes a Frequent transit route between Manukau and Drury West connecting to the surrounding rail stations, town centres and employment areas. It is anticipated that buses will be prioritised within this corridor to help achieve the mode split targets from the Auckland Plan. The proposed routeing will provide indirect access for the Plan Change area to the connected destinations via interchange with the Local bus routes. There is potential to expand the FTN in Drury East as indicated in Figure 26.
- **Connector** – the Council's Drury-Opāheke Structure Plan also proposes a Connector transit route between Papakura and Drury West. The proposed routeing will provide indirect access for the Plan Change area to the connected destinations via interchange with the Local bus routes, as well as direct access for the western side of the Plan Change area.
- **Local** – public transport access through the Plan Change area can be provided by local routes accessed by high-quality, well-located bus stops along the Central East-West Spine link and Fitzgerald Road. The walk-up catchments (400m) of these potential stops would cover the majority of the Plan Change area and the local routes would feed into the wider network via interchange at or near the new Drury Central Station.

3.2.4 Vehicular Access

Vehicular access to the Plan Change area will be based on the road hierarchy identified in the Movement Network (**Section 3.2.1**) with the majority of vehicle access coming from the arterial network to join the collector network before entering the network of local roads to reach land-

use activities within the Plan Change area (as illustrated in Figure 28). Vehicle access from the Plan Change area will reverse this pattern.

Access to land and connectivity between road types will be controlled as indicated in Table 12.

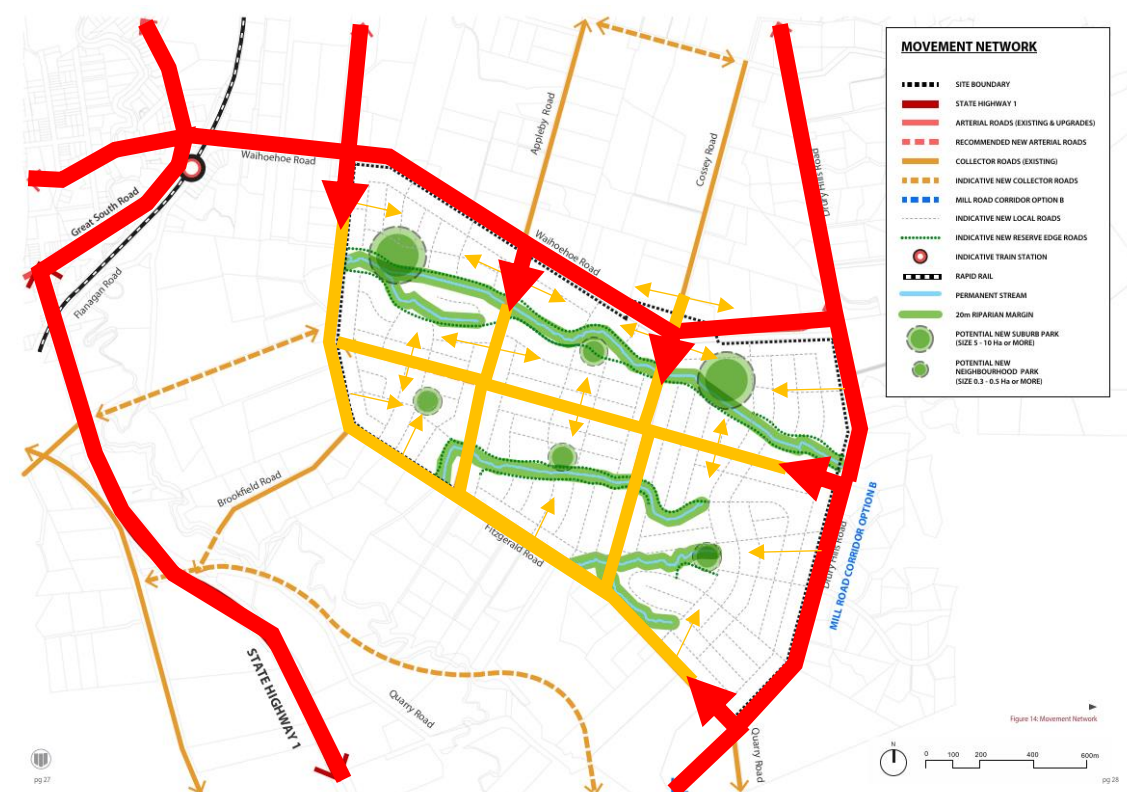
Table 12: Access / Connectivity Control

	Arterial	Collector	Local	Land-Use
Arterial	✓✓	✓✓	✓	✗
Collector	✓✓	✓✓	✓✓	✓
Local	✓	✓✓	✓✓	✓✓
Land-Use	✗	✓	✓✓	N/A

Notes: ✓✓ – Access generally provided ✓ – Access may be provided ✗ – Access generally not provided

As shown in Table 12, direct access is not intended to be provided from arterial roads into land-use activities, but direct connection to local roads may be provided at limited locations. Direct access may also be provided at limited locations between collector roads and land-use activities. The access provisions of the AUP (OIP) will apply to future development in the Plan Change area, including the consenting requirement for any vehicle access onto an arterial road.

Figure 28: Indicative Masterplan Vehicle Access



Source: Woods, as annotated by Mott MacDonald

All vehicle access, including for servicing, delivery and emergency vehicles will follow this indicative pattern; more detailed access plans for specific vehicle types will need to be developed for specific consenting applications as required.

4 Assessment of Transport Effects

4.1 Traffic Modelling and Road Network Impacts

Traffic modelling has been undertaken by Stantec to assess the traffic effects of the proposed developments within Drury East. The modelling has considered the proposed developments by KP, FHLD, and OCL, as well as which infrastructure is required at certain decades to unlock developers' desired developments. A copy of the Stantec modelling report has been included in **Appendix C**.

4.1.1 Approach

The traffic modelling was undertaken using a three-tiered approach, consisting of a macro strategic model (MSM), a mesoscopic project model (SATURN), and a localised intersection operational model (Sidra Intersection). The assessment period spans three decades, from the beginning of the developments in 2023 through to 2048. The modelling has considered the SGA future transport network, as reported in the SGA ITA for Drury-Opāheke and Pukekohe-Paerata areas. However, the land use assumptions have been adjusted to align with KP, FHLD and OCL's desired build rates and to reflect the developer's proposed staging for the wider Drury area.

The modelling focused on assessing what network upgrades would be required to support the development of Drury East in Decade 1 and beyond. This included considering various access scenarios, including one with a direct access to the Drury Centre from the Drury Interchange and one that did not.

The modelling undertaken has adopted the Council's MSM model public transportation mode share assumptions. The MSM model assumed a lower public transport mode share for Drury East compared to Drury West. Given the future public transport services and infrastructure that are planned for Drury East, and the proximity of Plan Change areas to the future train station, this assumption is considered conservative and it is expected that in reality there will be a higher uptake of public transport by Drury East residents, employees, and visitors. This will likely reflect an overall lower amount of traffic on the network compared to the demand assumed in the modelling assessment. Therefore, it is noted that the modelling is conservative.

We have reviewed the methodology and approach adopted by Stantec and agree that it is sound, for the purposes of assessing the required upgrades.

A summary of the traffic modelling results is presented below.

4.1.2 Modelling Results

In general, the modelling has found that the KP, FHLD and OCL Drury East Plan Changes can be accommodated by the surrounding transportation network, augmented by several targeted local upgrades within the first two decades. These are primarily:

- the signalisation of the Great South Road / Waihoehoe Road roundabout prior to 2028; and
- a network capacity upgrade prior to 2028 which could be achieved through:
 - provision of a direct access from the Drury interchange to the Metropolitan Centre; or
 - earlier provision of local upgrades such as the widening of Great South Road and Waihoehoe Road (to Fitzgerald Road).

- a network capacity upgrade prior to 2038 which could be achieved through:
 - doubling the northbound ramps at the Drury Interchange; or
 - an earlier provision of the Southern Mill Road connection to Fitzgerald Road.

The 2028 traffic modelling shows that a direct access to the Metropolitan Centre could form the primary access route to and from the Metropolitan Centre, with the FHL and OCL Plan Change areas primarily accessed via Great South Road / Waihoehoe Road intersection. The Great South Road / Waihoehoe Road intersection would also form the primary access route to the Metropolitan Centre in the absence of a direct access from State Highway 1.

The 2038 and 2048+ traffic modelling is satisfactory as all the key infrastructure required to support the growth is anticipated to have been implemented within those decades. The required upgrades for the KP, FHL and OCL Drury East Plan Changes are explained further in **Section 4.1.3** below.

For full development, in 2048+ it is anticipated that there will be multiple options for accessing the Plan Change area, including the future Mill Road corridor (and its connection to Fitzgerald Road), a potential Pitt Road overpass, Station Road, further upgrades to Waihoehoe Road, Fitzgerald Road and a potential Brookfield / Quarry Road connection to SH1. These are considered the main connections, with various Local Road connections also assumed. SH1, Great South Road and the future Mill Road will provide linkage to the north and south, while Great South Road provides links to the west and east.

It is noted that all upgrades that have been identified through the modelling can be delivered in stages in response to the actual development, future changes in the market and availability of required funding.

Based on the modelling, the proposed Drury East Plan Changes can be supported from a traffic capacity and performance perspective. Given that the infrastructure required to support the developments is implemented, the developments are unlikely to have a significant adverse effect on the traffic network.

4.1.3 Development Thresholds and Mitigations

The modelling outcomes above have formed the basis for determining the thresholds for development within the Drury East development area. The thresholds are presented in two formats; the land use in terms of number of dwellings and gross floor areas (GFA), and overall trip generation relating to the relevant areas.

These thresholds are summarised in Table 13 and Table 14 below. It is noted that the precinct provisions for Drury East development will contain a number of methodology options for assessing the development triggers based on the thresholds set out below.

Table 13: Development Thresholds for Infrastructure Upgrades

Timeframe	Drury East Development Threshold			Infrastructure Upgrade Required
	Residential (dwellings)	Retail (GFA, m²)	Commercial (GFA, m²)	
Without Direct Access to Metropolitan Centre				
2026	1,310	23,680	13,200	● Upgrade to the Great South Road / Waihoehoe Road intersection
2028	2,172	39,830	22,200	● Upgrade Waihoehoe Road to increase to four lanes between Great South Road / Waihoehoe intersection and the Drury Boulevard.

Timeframe	Drury East Development Threshold			Infrastructure Upgrade Required
	Residential (dwellings)	Retail (GFA, m ²)	Commercial (GFA, m ²)	
				<ul style="list-style-type: none"> Upgrade to Great South Road / Waihoehoe Road intersection to lengthen the approach, turning and exit lanes on Great South Road northern approach SH1 three-laning to Drury (funded) SH22 widening to Karaka (funded) Rail Electrification Papakura to Pukekohe (funded) New Drury East and West Stations (not funded but temporary stations can be provided as part of rail electrification to Pukekohe)
2033	3,406	62,430	34,800	<ul style="list-style-type: none"> Upgrade to Great South Road to increase to four lanes between the Drury Interchange and to 400m north of the Great South Road / Waihoehoe Road intersection. Upgrade Waihoehoe Road to increase from two lanes to four lanes between Drury Boulevard and Fitzgerald Road
2033 - 2038	4,023	73,200	40,800	<p>One of the following upgrades:</p> <ul style="list-style-type: none"> Upgrade the Drury Interchange to double the northbound on-ramp and south bound off-ramps at the Drury interchange; or Upgrades to provide the Drury South Interchange and the Mill Road Corridor from Drury Interchange to Fitzgerald Road
2038	4,640	83,960	46,800	<ul style="list-style-type: none"> Upgrade to Great South Road / Waihoehoe Road intersection to add an additional left-hand turn lane on the Norrie Road approach and reallocate lanes on the Waihoehoe Road approach SH1 three-laning Drury to Bombay SH1 Drury South Interchange Mill Road full route Pukekohe Expressway full route Opaheke Road (Papakura to Waihoehoe Road)
2048	6,428	107,650	60,000	<ul style="list-style-type: none"> Upgrade to Great South Road / Waihoehoe Road intersection to provide an additional exit lane on Norrie Road, reallocate lanes on the Waihoehoe and Great South Road approaches, and increase the length of the left-turn lane on the Waihoehoe Road approach. Third Main Rail Line Pukekohe to Papakura
With Direct Access to Metropolitan Centre				
2026	1,310	23,680	13,200	<ul style="list-style-type: none"> Upgrade to the Great South Road/Waihoehoe Road intersection
2028	2,172	39,830	22,200	<ul style="list-style-type: none"> Upgrade Waihoehoe Road to increase to four lanes between Great South Road / Waihoehoe intersection and the Drury Boulevard. Upgrade to Great South Road / Waihoehoe Road intersection to lengthen the approach, turning and exit lanes on Great South Road northern approach SH1 three-laning to Drury (funded) SH22 widening to Karaka (funded) Rail Electrification Papakura to Pukekohe (funded) New Drury East and West Stations (not funded but temporary stations can be provided as part of rail electrification to Pukekohe)
2033-2038	4,023	73,200	40,800	<ul style="list-style-type: none"> Upgrade to Great South Road to increase to four lanes between the Drury Interchange and to 400m

Timeframe	Drury East Development Threshold			Infrastructure Upgrade Required
	Residential (dwellings)	Retail (GFA, m ²)	Commercial (GFA, m ²)	
				<p>north of the Great South Road / Waihoehoe Road intersection.</p> <ul style="list-style-type: none"> Upgrade Waihoehoe Road to increase from two lanes to four lanes between Drury Boulevard and Fitzgerald Road. And one of the following upgrades in addition to the above upgrades: <ul style="list-style-type: none"> Upgrade the Drury Interchange to double the northbound on-ramp and south bound off-ramps at the Drury interchange; or Upgrades to provide the Drury South Interchange and the Mill Road Corridor from Drury Interchange to Fitzgerald Road.
2038	4,640	83,960	46,800	<ul style="list-style-type: none"> Upgrade to Great South Road / Waihoehoe Road intersection to add an additional left-hand turn lane on the Norrie Road approach and reallocate lanes on the Waihoehoe Road approach. SH1 3-laning Drury to Bombay SH1 Drury South Interchange Mill Road full route Pukekohe Expressway full route Opaheke Road (Papakura to Waihoehoe Road)
2048	6,428	107,650	60,000	<ul style="list-style-type: none"> Upgrade to Great South Road/Waihoehoe Road intersection to provide an additional exit lane on Norrie Road, reallocate lanes on the Waihoehoe and Great South Road approaches, and increase the length of the left-turn lane on the Waihoehoe Road approach. Third Main Rail Line Pukekohe to Papakura

Table 14: Trip Generation Thresholds for Infrastructure Upgrades

Timeframe	Drury East Trip Generation Threshold		Infrastructure Upgrade Required
	Inbound Trip Generation in vehicles per hour	Outbound Trip Generation in vehicles per hour	
Without Direct Access to Metropolitan Centre			
2026	AM Peak: 790 PM Peak: 1,110	AM Peak: 1,100 PM Peak: 840	<ul style="list-style-type: none">Upgrade to the Great South Road / Waihoehoe Road intersection
2028	AM Peak: 970 PM Peak: 1,600	AM Peak: 1,490 PM Peak: 1,150	<ul style="list-style-type: none">Upgrade Waihoehoe Road to increase to four lanes between Great South Road / Waihoehoe intersection and the Drury Boulevard.
			<ul style="list-style-type: none">Upgrade to Great South Road / Waihoehoe Road intersection to lengthen the approach, turning and exit lanes on Great South Road northern approach
			<ul style="list-style-type: none">SH1 three-laning to Drury (funded)
			<ul style="list-style-type: none">SH22 widening to Karaka (funded)
			<ul style="list-style-type: none">Rail Electrification Papakura to Pukekohe (funded)

Timeframe	Drury East Trip Generation Threshold		Infrastructure Upgrade Required
	Inbound Trip Generation in vehicles per hour	Outbound Trip Generation in vehicles per hour	
			<ul style="list-style-type: none"> New Drury East and West Stations (not funded but temporary stations can be provided as part of rail electrification to Pukekohe)
2033	AM Peak: 1,360 PM Peak: 1,820	AM Peak: 1,810 PM Peak: 1,430	<ul style="list-style-type: none"> Upgrade to Great South Road to increase to four lanes between the Drury Interchange and to 400m north of the Great South Road / Waihoehoe Road intersection. Upgrade Waihoehoe Road to increase from two lanes to four lanes between Drury Boulevard and Fitzgerald Road
2033 - 2038	AM Peak: 1,500 PM Peak: 2,130	AM Peak: 2,030 PM Peak: 1,700	<ul style="list-style-type: none"> One of the following upgrades: <ul style="list-style-type: none"> Upgrade the Drury Interchange to double the northbound on-ramp and south bound off-ramps at the Drury interchange; or Upgrades to provide the Drury South Interchange and the Mill Road Corridor from Drury Interchange to Fitzgerald Road
2038	AM Peak: 1,640 PM Peak: 2,430	AM Peak: 2,240 PM Peak: 1,960	<ul style="list-style-type: none"> Upgrade to Great South Road/Waihoehoe Road intersection to add an additional left hand turn lane on the Norrie Road approach and reallocate lanes on the Waihoehoe Road approach SH1 three-laning Drury to Bombay SH1 Drury South Interchange Mill Road full route Pukekohe Expressway full route Opaheke Road (Papakura to Waihoehoe Road)
2048	AM Peak: 3,160 PM Peak: 4,200	AM Peak: 3,720 PM Peak: 4,190	<ul style="list-style-type: none"> Upgrade to Great South Road/Waihoehoe Road intersection to provide an additional exit lane on Norrie Road, reallocate lanes on the Waihoehoe and Great South Road approaches, and increase the length of the left-turn lane on the Waihoehoe Road approach. Third Main Rail Line Pukekohe to Papakura
With Direct Access to Metropolitan Centre			
2026	AM Peak: 910 PM Peak: 1,430	AM Peak: 1,230 PM Peak: 1,150	<ul style="list-style-type: none"> Upgrade to the Great South Road/Waihoehoe Road intersection
2028	AM Peak: 1,130 PM Peak: 1,870	AM Peak: 1,660 PM Peak: 1,410	<ul style="list-style-type: none"> Upgrade Waihoehoe Road to increase to four lanes between Great South Road / Waihoehoe intersection and the Drury Boulevard. Upgrade to Great South Road / Waihoehoe Road intersection to lengthen the approach, turning and exit lanes on Great South Road northern approach SH1 three-laning to Drury (funded) SH22 widening to Karaka (funded) Rail Electrification Papakura to Pukekohe (funded) New Drury East and West Stations (not funded but temporary stations can be provided as part of rail electrification to Pukekohe)
2033-2038	AM Peak: 1,630 PM Peak: 2,220	AM Peak: 2,160 PM Peak: 1,790	<ul style="list-style-type: none"> Upgrade to Great South Road to increase to four lanes between the Drury Interchange and to 400m north of the Great South Road / Waihoehoe Road intersection.

Timeframe	Drury East Trip Generation Threshold		Infrastructure Upgrade Required
	Inbound Trip Generation in vehicles per hour	Outbound Trip Generation in vehicles per hour	
			<ul style="list-style-type: none"> Upgrade Waihoehoe Road to increase from two lanes to four lanes between Drury Boulevard and Fitzgerald Road. And one of the following upgrades in addition to the above upgrades: Upgrade the Drury Interchange to double the northbound on-ramp and south bound off-ramps at the Drury interchange; or Upgrades to provide the Drury South Interchange and the Mill Road Corridor from Drury Interchange to Fitzgerald Road.
2038	AM Peak: 1,850 PM Peak: 2,470	AM Peak: 2,450 PM Peak: 2,000	<ul style="list-style-type: none"> Upgrade to Great South Road / Waihoehoe Road intersection to add an additional left-hand turn lane on the Norrie Road approach and reallocate lanes on the Waihoehoe Road approach. SH1 three-laning Drury to Bombay SH1 Drury South Interchange Mill Road full route Pukekohe Expressway full route Opaheke Road (Papakura to Waihoehoe Road)
2048	AM Peak: 3,230 PM Peak: 4,320	AM Peak: 3,780 PM Peak: 4,300	<ul style="list-style-type: none"> Upgrade to Great South Road / Waihoehoe Road intersection to provide an additional exit lane on Norrie Road, reallocate lanes on the Waihoehoe and Great South Road approaches, and increase the length of the left-turn lane on the Waihoehoe Road approach. Third Main Rail Line Pukekohe to Papakura

4.1.4 Parking Assessment

Off-Street Parking Requirements

The AUP – OIP outlines the parking requirements with respect to activity, zone and/or location. The Plan Change does not propose to vary these requirements. For all studio and one-bedroom dwellings in residential mixed housing urban zones, there is no requirement for provision of parking or a maximum limit on the parking provision. Larger dwellings located in residential mixed housing suburban zones require a minimum level of parking, which is summarised in **Table 15 below**.

Table 15: Vehicle Parking Rates

Activity	Dwelling type	Minimum Rate	Maximum Rate
Residential – Mixed Housing Urban Zone	Studio	No minimum	No maximum
	1 bedroom	No minimum	No maximum
	≥2 bedrooms	1 per dwelling	No maximum
Residential – Mixed Housing Suburban Zone	Studio	0.5 per dwelling (rounded down to nearest whole number)	No maximum
	1 bedroom	0.5 per dwelling (rounded down to nearest whole number)	No maximum
	≥2 bedrooms	1 per dwelling	No maximum

Source: AUP-OIP

It is expected that all dwellings within mixed housing urban and suburban zones in the Plan Change area will contain two or more bedrooms, resulting in the need for a minimum of one vehicle park per dwelling. Furthermore, it can be assumed that all houses will contain a garage facility to cater to off-street parking demand.

On-Street Parking

The proposed road network in the vicinity of the Plan Change will provide on-street public parking to help support the functional and operational requirements of activities and efficient use of land. The indicative cross-sectional designs for each road type, as outlined in **Section 3.2.1**, provide for on-street parking demand as follows:

- Arterial Road: no on-street parking is anticipated:
 - Waihoehoe Road.
- Collector Roads: 2.3m wide kerbside parking provided on both sides of the road:
 - Central East-West Spine;
 - Cossey Road;
 - Appleby Road; and
 - Fitzgerald Road.
- Local Roads: 2.4m wide kerbside parking provided on both sides of the road.
- Reserve Edge Roads: no on-street parking is proposed.

Bicycle Parking

Table 16 summarises the AUP – OIP bicycle parking requirements (the Plan Change does not propose to vary these requirements). It is reasonable to assume that each dwelling will have sufficient space within or directly outside property grounds to accommodate a visitor's bicycle, eliminating the need to provide dedicated short-term bicycle-parking facilities such as bicycle stands. It is expected that bicycles parked outside properties will be secure given they will be in plain sight of residents and the general public. On the assumption that all dwellings will provide a dedicated garage that can suitably house a bicycle, no long-stay secure bicycle parks are deemed necessary.

Table 16: Bicycle Parking Rates

Activity Dwelling type	Visitor (short-stay)	Minimum Rate	Secure (long-stay) Minimum Rate
Residential	Developments of 20 or more dwellings	1 per 20 dwellings	1 per dwelling without a dedicated garage
	Visitor accommodation and boarding houses	1 space plus 1 space per 20 rooms/beds	1 per 10 FTE employees
	Retirement village and residential care	1 space plus 1 space per 3- units / apartments	1 per 10 FTE employees

Source: AUP-OIP

It is expected that the resulting development within the Plan Change area will (at least) meet all minimum parking requirements as set out in the AUP-OIP.

4.1.5 Servicing and Deliveries

All servicing and deliveries are expected to take place on-street using available parking to keep traffic lanes clear. It is anticipated that these functions will typically be carried out by utility

vehicles and vans, with the largest vehicle expected to be trucks used for roadside waste collection. This will be addressed as part of future resource consent processes.

The road network for future development of the Plan Change area will be designed to accommodate the largest expected servicing / delivery vehicle.

4.2 Active Travel

As detailed in **Section 3.2.2**, the Plan Change area will provide excellent walking and cycling facilities, including:

- Footpaths provided along both sides of all arterial, collector and local roads;
- Off-street cycle lanes provided along both sides of all arterial and collector roads;
- Off-street shared paths alongside reserve edge roads for predominantly recreational cycling and walking; and
- Pedestrian and cycle crossing facilities at all intersections of collector and/or arterial roads.

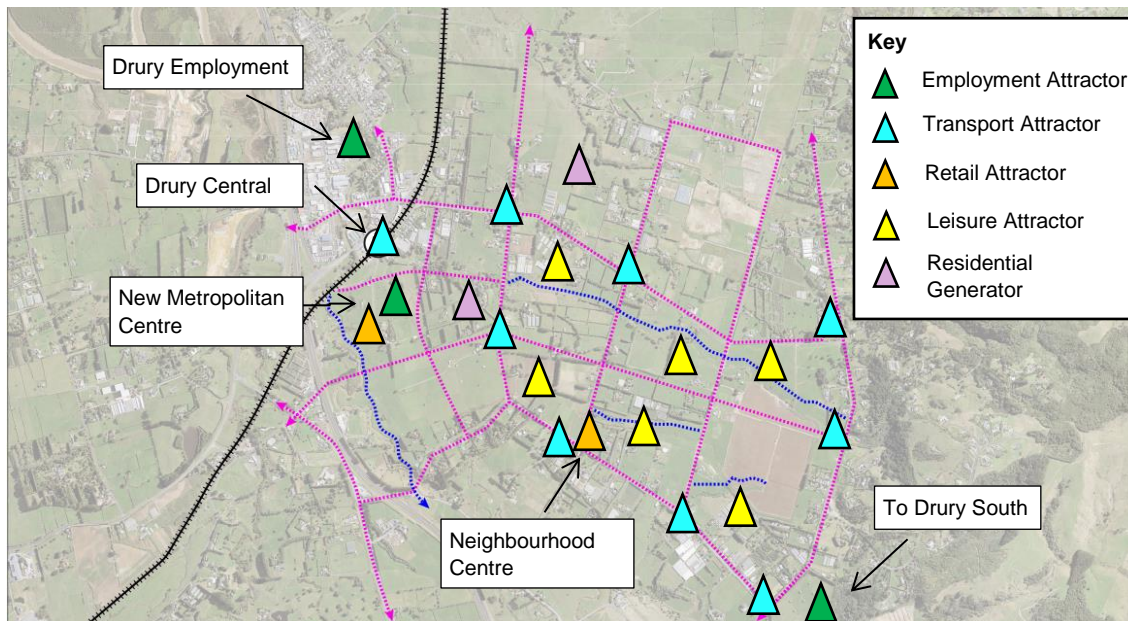
The movement network for the Plan Change area will enable good pedestrian permeability using small block sizes and providing additional direct walking routes.

The main attractors for walking and cycling trips for the Plan Change area are anticipated to be as follows:

Table 17: Walking and Cycling Attractors

Attractor	Walking	Cycling
Neighbourhood Centre	✓	✓
New Metropolitan Centre	✓	✓
Drury Central Rail Station	✓	✓
Bus Stops	✓	
Local Parks	✓	✓
Drury South Employment		✓
Existing Drury Employment		✓

Figure 29: Active Mode Attractors



Source: Barker and Associates (Map), Annotated by Mott MacDonald

As shown in Figure 29, the active mode attractors are expected to be relatively evenly distributed across the Plan Change area, with the exception of those around the new Drury Centre and Drury Central rail station.

Figure 29 also shows that local residential trip generators are located to the west of Fitzgerald Road (KP proposes to rezone this area Mixed Use zone) and north of Waihoehoe Road (OCL is proposing to rezone this area Terrace Housing and Apartment Building zone). As the attractors located within the Plan Change area are minor and expected to have catchments extending no further than the Plan Change area boundaries, it is not anticipated that significant volumes of non-resident pedestrians or cyclists will use the facilities within the Plan Change area.

It is therefore anticipated that walking and cycling flows will be relatively dispersed and the proposed provision will provide sufficient capacity to meet demand.

4.3 Public Transport Impacts

The future public transport network that will serve the Plan Change area are set out in the SGA ITA and Stantec and Mott Macdonald has indicatively shown an additional network of connector routes for Drury East that may be implemented by Auckland Transport in the future (detailed in **Section 3.2.3**). Importantly, the collector road network will be designed to accommodate bus services, which will provide Auckland Transport with flexibility in designing the future PT network. A network of Rapid, Frequent and Connector routes defined in the draft Drury-Opāheke Structure Plan provide access to and from Manukau, Auckland CBD, Papakura, Drury West and the wider network. The catchment for this network will include part of the western side of the Plan Change area directly.

5 Strategic Alignment

This chapter outlines how the proposal fits with specific transport policies and strategies and the “One System” approach. Reference has been made to the objectives and policies of Auckland Transport’s strategic plans including:

- Government Policy Statement on Land Transport;
- Auckland Plan;
- Auckland Transport Alignment Project;
- Auckland Unitary Plan;
- Regional Public Transport Plan; and
- Regional Arterial Road Plan.

The proposal has also been considered for its alignment with existing plans for infrastructure and development:

- Regional Land Transport Plan;
- Future Urban Land Supply Strategy;
- Drury-Opāheke Structure Plan; and
- Supporting Growth – South Network Business Case.

In preparing this ITA, consideration has also been given to the following strategic plans, which have been reviewed and are considered to have no material influence upon the strategic ‘fit’ of the Plan Change:

- Corridor Management Plans;
- Auckland Cycle Network;
- The Ferry Development Plan;
- Centre Based Transport Studies;
- Comprehensive Parking Management Plans; and
- AT’s Asset Management Plan.

5.1 Policies and Strategies

5.1.1 Government Policy Statement (Land Transport) (2018)

The Government Policy Statement 2018/19-2027/28 (GPS) on land transport was released on 28 June 2018. The GPS sets out the Government’s 10-year strategy for land transport investment. The GPS influences decisions on how the National Land Transport Fund will be invested across activity classes. It also guides the Transport Agency and Local Government on the types of activities that should be included in the National Land Transport Programme and Regional Land Transport Plans.

The GPS sets out the key objectives for the land transport system (see Figure 30), covering improvements in safety, accessibility, transport choice and value for money, as well as reductions in greenhouse gas emissions and local pollutants.

The four objectives of the 2018/19 GPS are supported by three themes:

- A mode-neutral approach to transport planning and investment decisions;
- Incorporating technology and innovation into the design and delivery of land transport and investment; and
- Integrating land use and transport planning and delivery.

Figure 30: Strategic Direction of the GPS 2018



Source: <https://www.transport.govt.nz>

The Plan Change area will have good access to the wider network via the future Rapid Transit Network (Southern Rail Line at Drury Central station) and is designed to support access by active modes and public transport, as well as links to the road network via SH1 and Mill Road. This will align with GPS objectives for Access and Environment, as well as the themes on mode neutrality and integration of land use and transport planning.

5.1.2 Auckland Plan 2050 (2018)

The Auckland Plan 2050 details the 30-year spatial framework for the growth and development of Auckland, with the aim of to ensure Auckland grows in a way that will meet the opportunities and challenges of the future. The plan is required by legislation to contribute to Auckland's social, economic, environmental and cultural well-being.

The plan sets out high level strategic directions for transport and access:

- **Direction 1** – Better connect people, places, goods and services;
- **Direction 2** – Increase genuine travel choices for a healthy, vibrant and equitable Auckland; and
- **Direction 3** – Maximise safety and environmental protection.

These directions are supplemented by seven focus areas for actions to follows these directions:

- **Focus area 1** – Make better use of existing transport networks;

- **Focus area 2** – Target new transport investment to the most significant challenges;
- **Focus area 3** – Maximise the benefits from transport technology;
- **Focus area 4** – Make walking, cycling and public transport preferred choices for many more Aucklanders;
- **Focus area 5** – Better integrate land use and transport;
- **Focus area 6** – Move to a safe transport network, free from death and serious injury; and
- **Focus area 7** – Develop a sustainable and resilient transport system.

The Plan Change will enable significant residential growth in close proximity to the future Rapid Transit Network (Southern Rail Line at Drury Central station) and is designed to support access by active modes and public transport. There will also be good access for motor vehicles, provided via the link to the SH1 interchange at Drury and future Mill Road arterial link. This accessibility supports the direction for transport planning and land-use development integration outlined in the Auckland Plan 2050.

5.1.3 Auckland Transport Alignment Project (2018)

The Auckland Transport Alignment Project (ATAP) is a joint project between AC and the Government to determine a coordinated strategic transport approach for Auckland. The latest version (April 2018) of ATAP focuses on investment priorities for the 2018-28 period, based on assumed funding of \$28 billion over that decade.

These priorities are based upon a vision shared between the Government and AC that transport investment decisions must deliver “*broad economic, social, environmental and cultural benefits to Auckland and New Zealand by providing safe, reliable and sustainable access to opportunities*” by:

- Easily connecting people, goods and services to where they need to go;
- Providing high quality and affordable travel choices for people of all ages and abilities;
- Seeking to eliminate harm to people and the environment;
- Supporting and shaping Auckland’s growth; and
- Creating a prosperous, vibrant and inclusive city.

The agreed strategic approach to achieve the vision is based on three integrated components:

- Making better use of existing networks;
- Targeting new investment to the most significant challenges; and
- Maximising new opportunities to influence travel demand.

The Plan Change will enable new urban growth within the Auckland region and is located close to existing and future transport networks for active modes, public transport and private vehicles (via walking/cycling links to Drury Station and both the link to the SH1 interchange at Drury and future Mill Road arterial link). This aligns with the vision and strategic approach for transport investment set out in ATAP.

5.1.4 Auckland Unitary Plan (Operative in Part) (2018)

The AUP was made ‘Operative in Part’ in September 2016 and was updated in November 2018. The AUP is the principal statutory planning document for Auckland, specifying:

- What can be built and where;

- *How to create a higher quality and more compact Auckland;*
- *How to provide for rural activities; and*
- *How to maintain the marine environment.*

The AUP -OIP designates the Plan Change area and wider surrounding area as Future Urban Zone (FUZ) in readiness for urbanisation and further development.

In particular, the AUP contains specific requirements (standards) for transport infrastructure relating to access to land, parking and loading space provision with the aim of achieving the following objectives:

1. *Land use and all modes of transport are integrated in a manner that enables:*
 - a. *the benefits of an integrated transport network to be realised; and*
 - b. *the adverse effects of traffic generation on the transport network to be managed.*
2. *An integrated transport network including public transport, walking, cycling, private vehicles and freight, is provided for.*
3. *Parking and loading supports urban growth and the quality compact urban form.*
4. *The provision of safe and efficient parking, loading and access is commensurate with the character, scale and intensity of the zone.*
5. *Pedestrian safety and amenity along public footpaths is prioritised.*
6. *Road/rail crossings operate safely with neighbouring land use and development.*

This ITA demonstrates that the Plan Change and indicative design is consistent with the AUP-OIP objectives and standards.

5.1.5 Regional Public Transport Plan (2018)

The Auckland Regional Public Transport Plan (RPTP) was prepared by AT in 2018 to update the previous RPTP (2015). The RPTP details AT's proposals for the Auckland region public transport network. This includes both defining the routes that will comprise the network over the next ten years and describing the policies and procedures that apply to those routes.

Chapter 6 of the RPTP defines a policy framework that provides guidance to AT in making decisions about the network over the short and medium terms. Policy 1.4 states that AT must "*Encourage mutually supportive land-use and public transport development policies*" by undertaking a number of actions, including:

- a) *"Work with Auckland Council to support land-use intensification at locations on the rapid and frequent service network.*

The Plan Change is consistent with the RPTP policy framework due to its close proximity to the rapid transit network (accessed at Drury Central station).

5.1.6 Regional Arterial Road Plan (2009)

The Regional Arterial Road Plan (RARP) was prepared by the Auckland Regional Transport Authority (ARTA), the predecessor to Auckland Transport. The RARP identifies a network of regional arterial roads, sitting within the wider road hierarchy of motorways, strategic routes, regional arterial roads, district arterial routes, collector roads and local roads.

The RARP recognises that regional arterial roads play an important role in Auckland's Transport network, by linking districts and urban areas within the region, connecting regionally significant facilities, and playing a critical role in the movement of people and goods within the region. The RARP identifies that a key aim is for these roads to operate efficiently and effectively, and to be managed and developed in a manner that is sensitive to the surrounding environment. On regional arterial roads, the movement of people and goods on the road should generally have priority over the access function of the road.

Great South Road is identified as a regional arterial road by the RARP. This ITA shows that the proposed plan change will not materially impact traffic movements on Great South Road or affect the access function of this road.

5.1.7 Regional Freight Network (2009)

The Regional Freight Network (RFN) was prepared for the Auckland Regional Council, the predecessor to AC. The RFN identifies a network that links major areas of freight generation and attraction both within the Region and to and from locations outside the Region in such a way that the movement of freight would be facilitated and the impact of this movement on the community would be minimised.

Drury Quarry is identified as a major freight generator within the RFN and Quarry Road is the RFN link to wider RFN via Great South Road, SH22 and SH1. This ITA shows that the proposed plan change will not materially impact traffic movements on Quarry Road or affect the freight access function of this road, consistent with the RFN aims.

5.2 Infrastructure and Development Programmes

5.2.1 Regional Land Transport Plan (2018)

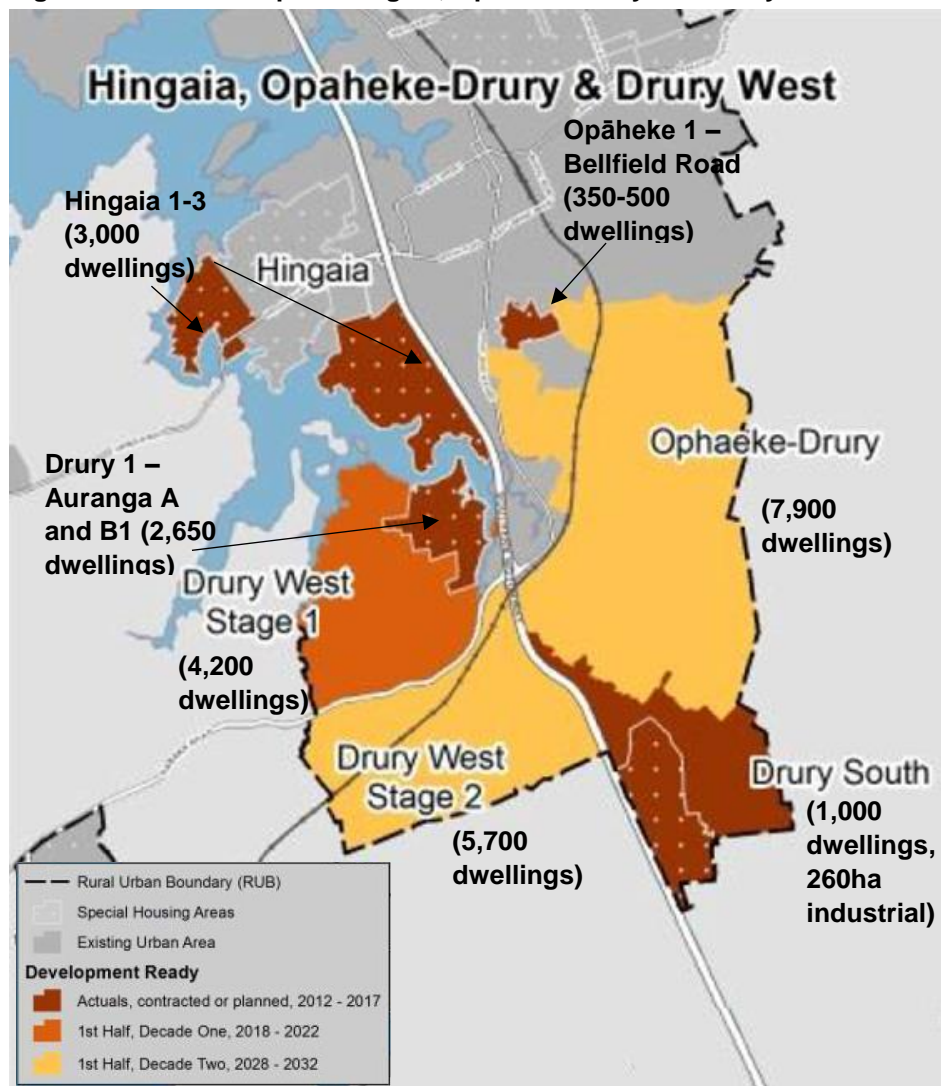
The Auckland Regional Land Transport Plan (RLTP) is a ten-year investment programme prepared by AT, together with both the Transport Agency and KiwiRail under the Land Transport Management Act 2003.

The RLTP sets out the transport investment programme for the Auckland region enabled by all funding allocations (i.e. both from the Government via the National Land Transport Programme, and AC via the Long Term Plan). The projects committed through the current (2018-2028) RLTP relevant to the Plan Change area are listed in **Section 2.2.4** of this ITA.

5.2.2 Future Urban Land Supply Strategy (2012)

The Future Urban Land Supply Strategy (FULSS) identifies a programme for the release of Future Urban Zone (FUZ) land for development, in line with the planned staging of infrastructure development. Figure 4-2 sets out the planned staging and indicative number of dwellings as set out in the FULSS for the Hingaia, Opaheke-Drury and Drury West areas.

Figure 31: FULSS Map for Hingaia, Opaheke-Drury and Drury West



Source: FULSS

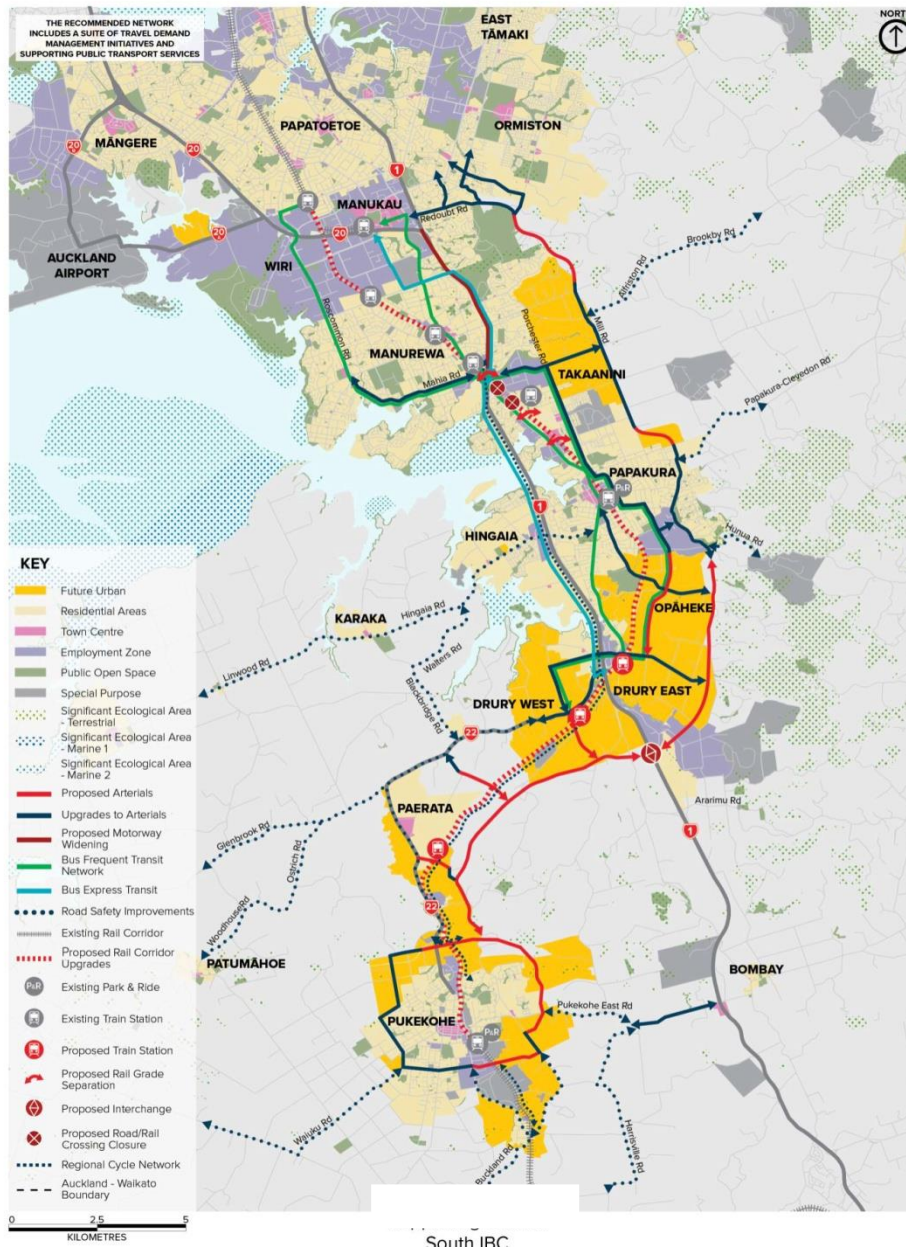
The timeframes for development in the FULSS are indicative only and reflect when Auckland Council intends to initiate Plan Changes to live-zone the land in-line with planned staging of bulk infrastructure development. The timing of actual development will be subject to market conditions, developer readiness, land ownership patterns, and underlying regional growth trends.

5.2.3 Supporting Growth – Draft South Network Business Case

The Supporting Growth Programme (previously referred to as the Transport for Future Urban Growth, or TFUG and also known as Te Tupu Ngātahi) was formed between the Transport Agency, AC and AT to plan the required transport network and urban infrastructure for the FULSS growth areas and prepare Business Cases for implementation.

The original TFUG network for the South developed in 2016, has been further developed via the Business Case process and is now at the Indicative Business Case (IBC) stage. The draft IBC network is shown in Figure 32.

Figure 32: Supporting Growth South IBC - Draft Recommended Network



Source: Supporting Growth

The key elements of the current recommended IBC network relevant to the Plan Change area are as follows:

- New Drury Central rail station;
- Four-tracking of the NIMT rail line between Manukau and Pukekohe;
- Active mode connection between Pukekohe and Drury;
- New Frequent Transit Network (FTN) bus route and associated new and upgraded roads between Drury and Manukau via Papakura;
- New Express Transit bus route between Drury and Manukau via SH1;

- Capacity improvements on SH1; and
- Arterial links between Drury and Papakura, including new Mill Road arterial along eastern edge (four lanes and upgraded for safety), with onward arterial connections through to Takanini and Manukau (to the north) and SH1 and Pukekohe (to the south and west).

5.2.4 Drury-Opāheke Structure Plan (2019)

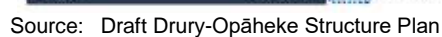
Auckland Council released a final structure plan for Drury-Opāheke in August 2019, together with a supporting ITA (covering both Drury-Opāheke and Pukekohe-Paerata). The structure plan sets out the arrangement of land-uses and guides the provision of key infrastructure.

The proposed land-use pattern and transport infrastructure for Drury-Opāheke is shown in Figure 33 below.

The key elements of the draft structure plan relevant to the plan change land are as follows:

- Large town centre to be located in Drury, to the south and east of Great South Road;
- To the east of the town centre and at the western edge of the Plan Change area, land-use transitions to Terrace Housing and Apartment Buildings, then to Mixed Housing Urban and Mixed Housing Suburban.
- Land to the south of Fitzgerald Road, adjacent to Drury South, will be zoned as Light Industrial;
- Drury Central rail station has been identified as being located immediately to the south east of the Great South Road / Waihoehoe Road intersection.
- New and upgraded arterial roads as follows:
 - Waihoehoe Road linking from Drury Central rail station to the new Mill Road alignment;
 - New arterial linking from the Waihoehoe Road / Fitzgerald Road intersection northwards through Opāheke to Papakura;
 - Mill Road connecting a new SH1 interchange to the south with the Waihoehoe Road / Drury Hills Road intersection before continuing northwards. There are two options for the alignment of this section of Mill Road: either a 'Link Road' option (A), or a 'FUZ edge' option (B). The alignment will be chosen through the Detailed Business Case process for the Supporting Growth South Network.
- Most existing roads in the vicinity of the Plan Change area will be upgraded to collector status, except for:
 - Cossey Road between Fitzgerald Road and a new intersection approximately 600m to the north.
- New collector roads as follows:
 - Extension of Brookfield Road to the south to tie in with Quarry Road;
 - Extension of Cossey Road to the west to tie in with Appleby Road;
 - New connecting collectors linking Appleby Road with the arterial network to the west and north;
 - New east-west collector from Cossey Road to the new town centre and Great South Road; and
 - New collector in the south-east corner of the Plan Change area, joining Fitzgerald Road and Drury Hills Road (or Mill Road corridor B).
- New public transport links as follows:

- Figure 33: Structure Plan Land-Use**



The Structure Plan also recommends that plan changes consider the following matters relevant to transport and land use integration:

- Inclusion of the Structure Plan ITA recommended network as a minimum.
- Additional detail e.g. locations where traffic signals or other mechanisms to provide for pedestrian connectivity are specifically required.
- Increased urban density near railway stations and along the FTN corridor. Consideration of how precinct provisions can enable/require better horizontal density could be useful. Minimum dwelling densities (e.g. 35 per ha) or minimum occupant densities (e.g. 90 persons per ha) could be specified.
- How the local street network can provide a high level of connectivity using a rectangular grid as much as possible.
- How to ensure that street block size and length should is not too large or too long (greater than 120m long) to provide for connectivity, particularly in areas close to centres and public transport.
- Street block depth that accommodates rear loading (rear garaging on lanes) in medium to high density areas.
- Park edge roads.
- Provision of integrated walking and cycling networks along roads, reserves, streams and other corridors.

6 Conclusions

6.1 Plan Change Summary

Fulton Hogan Land Development Limited (FHLD) is applying for a Plan Change to the AUP-OIP to rezone approximately 187ha of Future Urban land in Drury East to a mix of residential zones (Terrace Housing and Apartment Building, Mixed Housing Urban and Mixed Housing Suburban) serviced by a limited area of business zoning (Mixed Use), consistent with the Council's Drury-Opāheke Structure Plan. The plan change would allow for approximately between 2,200-2,500 households to be developed within the 187ha Plan Change area over time.

Access to the rezoned land will be via a multi-modal movement network that will provide links for people travelling in private vehicles, in buses, on bikes and on foot. Key links will be to the existing Drury township, Drury Interchange, planned rail station (Drury Central) and the future Mill Road corridor.

6.2 Assessment of Impacts

A multi-modal impact assessment has been carried out that demonstrates that:

- the proposed provision of walking and cycling facilities will provide links to the key active mode attractors and generators, with sufficient capacity to meet demand;
- the proposed public transport access strategy and provision of infrastructure will enable public transport to be a viable choice for trips to and from the Plan Change area
- the proposed vehicle access strategy will enable vehicle trips generated by development permitted by the proposed rezoning to be managed so as to not cause undue congestion on the road network; and
- adequate parking for bicycles and vehicles can be provided within the Plan Change area in line with requirements for the level of development permitted by the proposed rezoning.

6.3 Mitigation

To address potential adverse impacts and risks from development permitted by the proposed rezoning, a suite of mitigation measures have been identified and aligned with thresholds for development and trip generation.

6.4 Recommendation

The conclusion of this ITA is that, on the basis of the proposed movement and access strategies, the transport impacts resulting from the rezoning of the Plan Change area can be managed in a way that manages adverse effects on the surrounding road network and supports the development of an effective, efficient and safe transport network.

Appendices

A.	Plan Change Area Location	Error! Bookmark not defined.
B.	CAS Data	63
C.	Proposed Zoning	64
D.	Modelling Report	65

A. CAS Data

Crash List: Drury

Overall Crash Statistics

Crash Severity	Number	%	Social cost (\$m)
Fatal	0	0	0
Serious	3	9	2.75
Minor Injury	10	30	1.05
Non-injury	20	61	0.65
	33	100	4.45

Crash Numbers

Year	Fatal	Serious	Minor	Non-inj
2014	0	0	3	2
2015	0	1	1	3
2016	0	0	1	6
2017	0	1	2	5
2018	0	1	3	4
TOTAL	0	3	10	20
Percent	0	9	30	61

Note: Last 5 years of crashes shown

Overall Casualty Statistics

Injury Severity	Number	% all casualties
Death	0	0
Serious Injury	3	23
Minor Injury	10	77
	13	100

Casualty Numbers

Year	Fatal	Serious	Minor
2014	0	0	3
2015	0	1	1
2016	0	0	1
2017	0	1	2
2018	0	1	3
TOTAL	0	3	10
Percent	0	23	77

Note: Last 5 years of casualties shown

Crash Type and Cause Statistics

Crash Type	All crashes	% All crashes
Overtaking Crashes	1	3
Straight Road Lost Control/Head On	9	27
Bend - Lost Control/Head On	9	27
Rear End/Obstruction	5	15
Crossing/Turning	9	27
Pedestrian Crashes	0	0
Miscellaneous Crashes	0	0
TOTAL	33	100

Crash factors (*)	All crashes	% All crashes
Alcohol	6	18
Too fast	8	24
Failed Give way/Stop	9	27
Failed Keep Left	3	9
Incorrect Lane/posn	3	9
Poor handling	7	21
Poor Observation	6	18
Poor judgement	2	6
Disabled/old/ill	1	3
Road factors	7	21
Weather	1	3
Other	7	21
TOTAL	60	180

Crashes with a:

Driver factor	45	135
Environmental factor	8	24

(*) factors are counted once against a crash - ie two fatigued drivers count as one fatigue crash factor.

Note: Driver/vehicle factors are not available for non-injury crashes for Northland, Auckland, Waikato and Bay of Plenty before 2007. This will influence numbers and percentages.

Note: % represents the % of crashes in which the cause factor appears

Number of parties in crash	All crashes	% All crashes
Single party	19	58
Multiple party	14	42
TOTAL	33	100

Driver and Vehicle Statistics

Note: Driver information is not computerised for non-injury crashes

Drivers at fault or part fault in injury crashes

Age	Male	%	Female	%	Total	%
15-19	0	0	0	0	0	0
20-24	3	33	1	25	4	31
25-29	1	11	0	0	1	8
30-39	0	0	0	0	0	0
40-49	1	11	1	25	2	15
50-59	3	33	2	50	5	38
60-69	1	11	0	0	1	8
70+	0	0	0	0	0	0
TOTAL	9	100	4	100	13	100

Drivers at fault or part fault in injury crashes

Licence	Male	Female	Total	%
Full	8	3	11	85
Learner	0	0	0	0
Restricted	1	1	2	15
Never licensed	0	0	0	0
Disqualified	0	0	0	0
Overseas	0	0	0	0
Expired	0	0	0	0
Other/Unknown	0	0	0	0
TOTAL	9	4	13	100

Vehicles involved in injury crashes

	No. of vehicles	% Injury crashes
SUV	2	15
Car/Stn Wagon	8	62
Motor Cycle	1	8
Moped	1	8
Bicycle	2	15
Truck	3	23
Van Or Utility	1	8
TOTAL	18	139

Note: % represents the % of injury crashes in which the vehicle appears

Crash List: Drury

Road Environment Statistics

Road Type	Local road	%	State highway	%	Total	%
Urban	11	33	0	0	11	33
Open Road	22	67	0	0	22	67
TOTAL	33	100	0	0	33	100

Time Period Statistics

Day/Period	All crashes	% All crashes
Weekday	21	64
Weekend	12	36
TOTAL	33	100

Conditions	Injury	Non-injury	Total	%
Light/overcast	9	11	20	61
Dark/twilight	4	9	13	39
TOTAL	13	20	33	100

Day/Period	0000-0259	0300-0559	0600-0859	0900-1159	1200-1459	1500-1759	1800-2059	2100-2400	Total
Weekday	2	0	4	2	3	5	4	1	21
Weekend	2	1	0	3	1	2	1	2	12
TOTAL	4	1	4	5	4	7	5	3	33

Note: Weekend runs from 6 pm on Friday to 6 am on Monday

Conditions	Injury	Non-injury	Total	%
Dry	10	9	19	58
Wet	3	11	14	42
Ice/snow	0	0	0	0
TOTAL	13	20	33	100

Intersection/mid-block	All crashes	% All crashes
Intersection	16	48
Midblock	17	52
TOTAL	33	100

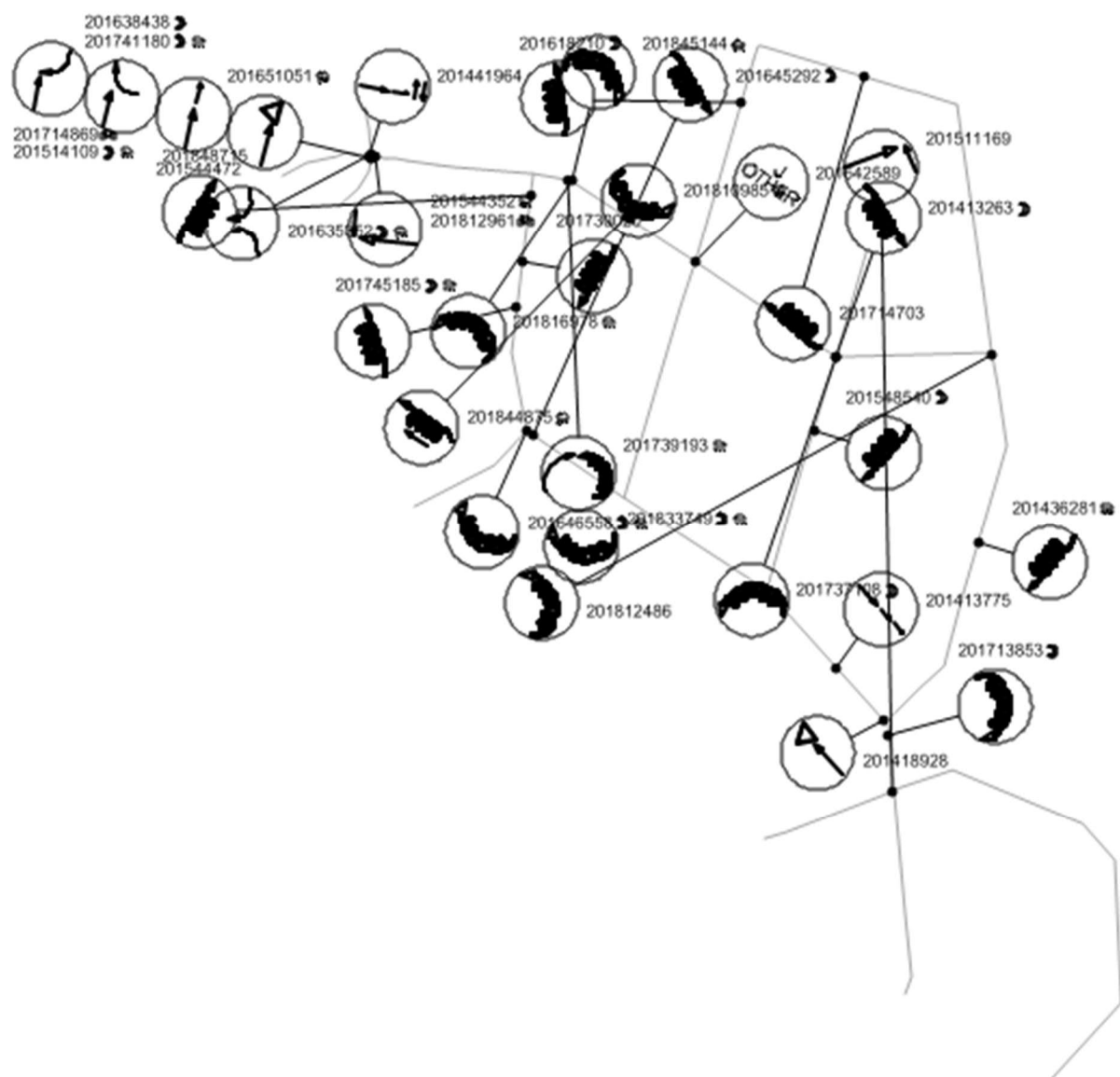
Day/Period	0000-0259	0300-0559	0600-0859	0900-1159	1200-1459	1500-1759	1800-2059	2100-2400	Total
Mon	1	0	2	0	0	0	0	0	3
Tue	0	0	1	0	0	2	1	0	4
Wed	0	0	1	1	2	3	0	0	7
Thu	0	0	0	1	0	0	3	1	5
Fri	1	0	0	0	1	0	0	0	2
Sat	1	0	0	2	1	1	0	2	7
Sun	1	1	0	1	0	1	1	0	5
TOTAL	4	1	4	5	4	7	5	3	33






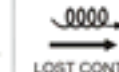

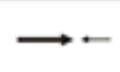











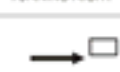

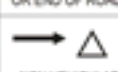
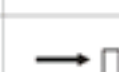

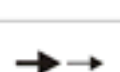
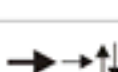





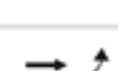
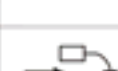




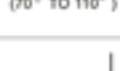







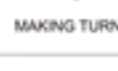























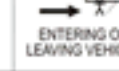

Objects Struck	Injury crashes	%	Non-injury crashes	%
Crashes w/obj.struck	6	46	10	50

Object Struck	Injury crashes	%	Non-injury crashes	%
Cliff Bank	1	8	2	10
Fence	1	8	6	30
Guard Rail	0	0	1	5
Slip Or Flood	0	0	1	5
Post Or Pole	2	15	3	15
Traffic Sign	1	8	1	5
Tree	1	8	2	10
Ditch	1	8	3	15
Stray Animal	2	15	0	0
TOTAL	9		19	

Note: % represents the % of crashes in which the object is struck

Month	Injury	%	Non-injury	%	Total	%
Jan	1	8	0	0	1	3
Feb	4	31	1	5	5	15
Mar	1	8	1	5	2	6
Apr	0	0	2	10	2	6
May	4	31	2	10	6	18
Jun	0	0	1	5	1	3
Jul	0	0	4	20	4	12
Aug	1	8	5	25	6	18
Sep	0	0	2	10	2	6
Oct	0	0	0	0	0	0
Nov	0	0	1	5	1	3
Dec	2	15	1	5	3	9
TOTAL	13	100	20	100	33	100



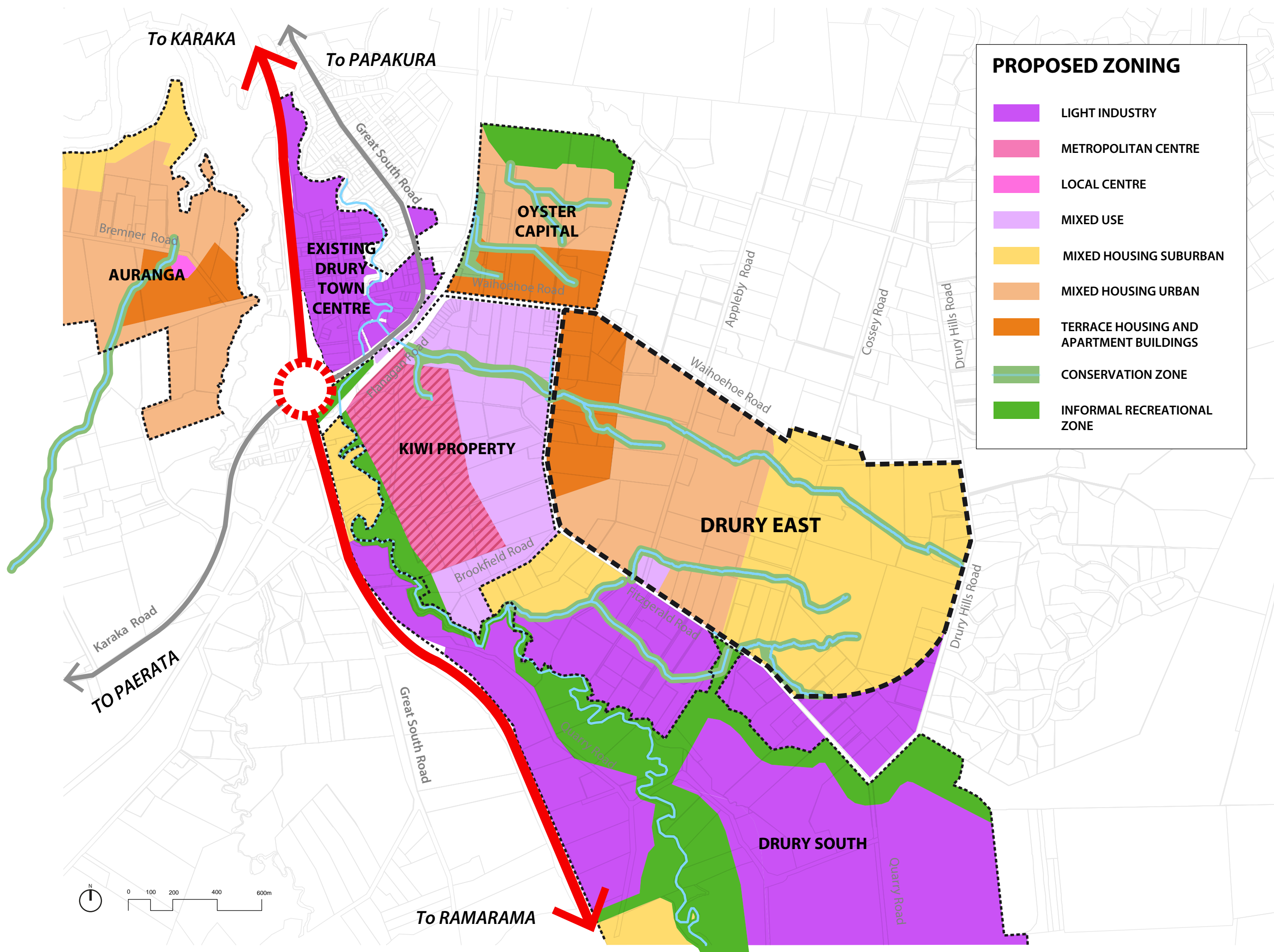
	TYPE	A	B	C	D	E	F	G	O
A	OVERTAKING AND LANE CHANGE	 PULLING OUT OR CHANGING LANE TO RIGHT	 HEAD ON	 CUTTING IN OR CHANGING LANE TO LEFT	 LOST CONTROL (OVERTAKING VEHICLE)	 SIDE ROAD	 LOST CONTROL (OVERTAKEN VEHICLE)	 WEAVING IN HEAVY TRAFFIC	OTHER
B	HEAD ON	 ON STRAIGHT	 CUTTING CORNER	 SWINGING WIDE	 BOTH OR UNKNOWN	 LOST CONTROL ON STRAIGHT	 LOST CONTROL ON CURVE		OTHER
C	LOST CONTROL OR OFF ROAD (STRAIGHT ROADS)	 OUT OF CONTROL ON ROADWAY	 OFF ROADWAY TO LEFT	 OFF ROADWAY TO RIGHT					OTHER
D	CORNERING	 LOST CONTROL TURNING RIGHT	 LOST CONTROL TURNING LEFT	 MISSED INTERSECTION OR END OF ROAD					OTHER
E	COLLISION WITH OBSTRUCTION	 PARKED VEHICLE	 CRASH OR BROKEN DOWN	 NON VEHICULAR OBSTRUCTIONS (INCLUDING ANIMALS)	 WORKMANS VEHICLE	 OPENING DOOR			OTHER
F	REAR END	 SLOW VEHICLE	 CROSS TRAFFIC	 PEDESTRIAN	 QUEUE	 SIGNALS T	 OTHER		OTHER
G	TURNING VERSUS SAME DIRECTION	 REAR OF LEFT TURNING VEHICLE	 LEFT TURN SIDE SIDE SWIPE	 STOPPED OR TURNING FROM LEFT SIDE	 NEAR CENTRE LINE	 OVERTAKING VEHICLE	 TWO TURNING		OTHER
H	CROSSING (NO TURNS)	 RIGHT ANGLE (70° TO 110°)							OTHER
J	CROSSING (VEHICLE TURNING)	 RIGHT TURN RIGHT SIDE	OBsolete	 TWO TURNING					OTHER
K	MERGING	 LEFT TURN IN	 RIGHT TURN IN	 TWO TURNING					OTHER
L	RIGHT TURN AGAINST	 STOPPED WAITING TO TURN	 MAKING TURN						OTHER
M	MANOEUVRING	 PARKING OR LEAVING	 "U" TURN	 "U" TURN	 DRIVEWAY MANOEUVRE	 PARKING OPPOSITE	 ANGLE PARKING	 REVERSING ALONG ROAD	OTHER
N	PEDESTRIANS CROSSING ROAD	 LEFT SIDE	 RIGHT SIDE	 LEFT TURN LEFT SIDE	 RIGHT TURN RIGHT SIDE	 LEFT TURN RIGHT SIDE	 RIGHT TURN LEFT SIDE	 MANOEUVRING VEHICLE	OTHER
P	PEDESTRIANS OTHER	 WALKING WITH TRAFFIC	 WALKING FACING TRAFFIC	 WALKING ON FOOTPATH	 CHILD PLAYING (TRICYCLE)	 ATTENDING TO VEHICLE	 ENTERING OR LEAVING VEHICLE		OTHER
Q	MISCELLANEOUS	 FELL WHILE BOARDING OR ALIGHTING	 FELL FROM MOVING VEHICLE	 TRAIN	 PARKED VEHICLE RAN AWAY	 EQUESTRIAN	 FELL INSIDE VEHICLE	 TRAILER OR LOAD	OTHER

* = Movement applies for left and right hand bends, curves or turns

First Street	Second street or landmark	Crash Number	Date DD/MM/YYYY	Day	Time HHMM	Description of Events	Crash Factors (ENV = Environmental factors)	Road	Natural Light	Weather	Junction	Cntrl	Tot Inj F S M A E I T R N
Distance													
APPLEBY ROAD	200W COSSEY ROAD	201714703	25/01/2017	Wed	1625	CAR1 WBD on APPLEBY ROAD lost control; went off road to right, CAR1 hit Ditch	CAR1 Too far right	Dry	Overcast	Fine	Unknown	N/A	1
APPLEBY ROAD	170S HARRY DODD ROAD	201618210	03/12/2016	Sat	2230	CAR1 NBD on APPLEBY ROAD lost control; went off road to left, CAR1 hit Post Or Pole	CAR1 alcohol test above limit or test refused, too fast on straight, too far left/right, emotionally upset/road rage	Dry	Dark	Fine	Unknown	N/A	1
COSSEY ROAD	300S WAIHOEHOE ROAD	201548540	08/11/2015	Sun	0550	SUV1 SBD on COSSEY ROAD lost control; went off road to right, SUV1 hit Fence, Tree, Ditch	SUV1 Lost control Under Acceleration, showing off wheelspins etc, stolen vehicle	Dry	Dark	Fine	Unknown	N/A	
DRURY HILLS ROAD	200N MACWHINNEY DRIVE	201436281	05/05/2014	Mon	0755	CAR1 SBD on DRURY HILLS ROAD lost control; went off road to right, CAR1 hit Cliff Bank, Fence	CAR1 suddenly swerved to avoid animal	Wet	Overcast	Fine	Unknown	N/A	
DRURY HILLS ROAD	I WAIHOEHOE ROAD	201812486	06/02/2018	Tue	1615	MOPED1 NBD on DRURY HILLS ROAD lost control turning left	MOPED1 alcohol test below limit, lost control when turning, new driver / under instruction	Dry	Bright	Fine	T Type Junction	Give Way Sign	1
FITZGERALD ROAD	30S BROOKFIELD ROAD	201810985	01/02/2018	Thu	1810	VAN1 SBD on FITZGERALD ROAD lost control turning left, VAN1 hit Cliff Bank, Post Or Pole, Stray Animal	VAN1 alcohol test below limit, lost control, suddenly swerved to avoid animal	Wet	Overcast	Heavy Rain	Unknown	N/A	1
FITZGERALD ROAD	I BROOKFIELD ROAD	201646558	25/08/2016	Thu	1018	SUV1 NBD on FITZGERALD ROAD lost control turning right, SUV1 hit Fence, Guard Rail, Traffic Sign on right hand bend	SUV1 lost control when turning	Wet	Dark	Unknow	T Type Junction	Give Way Sign	
FITZGERALD ROAD	400E COSSEY ROAD	201413775	28/05/2014	Wed	1600	SUV1 EBD on FITZGERALD ROAD hit rear end of CAR2 stop/slow for queue	SUV1 following too closely	Dry	Bright	Fine	Unknown	Nil	1
FITZGERALD ROAD	15N DRURY HILLS ROAD	201418928	13/12/2014	Sat	0928	MOTOR CYCLE1 NBD on FITZGERALD ROAD hit obstruction, MOTOR CYCLE1 hit Stray Animal	MOTOR CYCLE1 lost control, suddenly swerved to avoid animal ENV: visibility limited by curve, household pet rushed out or playing	Dry	Bright	Fine	T Type Junction	Give Way Sign	1
FITZGERALD ROAD	50S DRURY HILLS ROAD	201713853	19/05/2017	Fri	0050	TRUCK1 SBD on FITZGERALD ROAD lost control turning right, TRUCK1 hit Fence, Tree on right hand bend	TRUCK1 alcohol test above limit or test refused, Entering / On curve	Dry	Dark	Fine	Unknown	N/A	1
FITZGERALD ROAD	520N WAIHOEHOE ROAD	201745185	15/07/2017	Sat	0155	CAR1 NBD on FITZGERALD ROAD lost control; went off road to left, CAR1 hit Post Or Pole	CAR1 alcohol test above limit or test refused, lost control due to road conditions	Wet	Dark	Light Rain	Unknown	N/A	
FITZGERALD ROAD	80S WAIHOEHOE ROAD	201848715	23/09/2018	Sun	1147	CAR1 NBD on FITZGERALD ROAD lost control; went off road to right, CAR1 hit Post Or Pole	CAR1 too fast on straight	Dry	Bright	Fine	Unknown	N/A	
FITZGERALD ROAD	340S WAIHOEHOE ROAD	201730020	13/12/2017	Wed	1304	TRUCK1 SBD on FITZGERALD ROAD lost control; went off road to right, TRUCK1 hit Fence, Tree, Ditch	TRUCK1 alcohol suspected, Too far right, Other Illness	Dry	Bright	Fine	Unknown	N/A	
GREAT SOUTH ROAD	I NORRIE ROAD	201544472	29/08/2015	Sat	1400	CAR1 NBD on GREAT SOUTH ROAD hit rear end of SUV2 stopped/moving slowly	CAR1 following too closely SUV2 Suddenly Braked	Dry	Overcast	Fine	Roundabo	Give Way Sign	
GREAT SOUTH ROAD	I NORRIE ROAD	201635352	24/03/2016	Thu	2200	CAR1 NBD on GREAT SOUTH ROAD merging hit CAR2 also merging	CAR1 Failed to give way At a priority traffic control CAR2 alcohol test below limit	Wet	Dark	Light Rain	Roundabo	Give Way Sign	
GREAT SOUTH ROAD	I NORRIE ROAD	201714869	28/02/2017	Tue	0715	CYCLIST2 (Age 33) turning right hit by oncoming CAR1 EBD on GREAT SOUTH ROAD	CAR1 Failed to give way At a priority traffic control, Did not check / notice another party	Dry	Overcast	Fine	Roundabo	Give Way Sign	1
GREAT SOUTH ROAD	I NORRIE ROAD	201651051	28/09/2016	Wed	1230	CAR1 NBD on GREAT SOUTH ROAD hit obstruction, CAR1 hit Slip Or Flood	ENV: slippery	Wet	Overcast	Fine	Roundabo	Give Way Sign	
GREAT SOUTH ROAD	I WAIHOEHOE ROAD	201544352	30/08/2015	Sun	1615	SUV1 WBD on WAIHOEHOE ROAD hit CAR2 crossing at right angle from right	SUV1 too fast on straight, Failed to give way At a priority traffic control, stolen vehicle	Wet	Overcast	Light Rain	Roundabo	Give Way Sign	

First Street	Second street or landmark	Crash Number	Date DD/MM/YYYY	Day	Time HHMM	Description of Events	Crash Factors (ENV = Environmental factors)	Road	Natural Light	Weather	Junction	Cntrl	Tot F S M A E I T R N	Inj
GREAT SOUTH ROAD	I WAIHOEHOE ROAD	201514109	24/05/2015	Sun	1800	CAR2 turning right hit by oncoming SUV1 NBD on GREAT SOUTH ROAD	SUV1 Failed to give way At a priority traffic control, Did not check / notice another party ENV: heavy rain	Wet	Twilight	Heavy Rain	Roundabo	Give Way Sign		1
GREAT SOUTH ROAD	I WAIHOEHOE ROAD	201812961	14/03/2018	Wed	0900	CAR1 WBD on WAIHOEHOE ROAD hit CYCLIST2 (Age 77) crossing at right angle from right	CAR1 Failed to give way At a priority traffic control	Dry	Bright	Fine	Roundabo	Give Way Sign		1
GREAT SOUTH ROAD	I WAIHOEHOE ROAD	201638438	30/04/2016	Sat	2205	CAR1 NBD on GREAT SOUTH ROAD hit CAR2 merging from the right	CAR1 alcohol test below limit, Failed to give way At a priority traffic control, Did not check / notice another party CAR2 alcohol test below limit	Dry	Dark	Fine	Roundabo	Give Way Sign		
GREAT SOUTH ROAD	I WAIHOEHOE ROAD	201741180	12/06/2017	Mon	0001	CAR1 NBD on GREAT SOUTH ROAD hit VAN2 merging from the right	CAR1 alcohol test below limit, Failed to give way At a priority traffic control	Wet	Dark	Fine	Roundabo	Give Way Sign		
NORRIE ROAD	I GREAT SOUTH ROAD	201441964	06/08/2014	Wed	1640	VAN1 EBD on NORRIE ROAD hit rear end of VAN2 stop/slow for cross traffic	VAN1 failed to notice car slowing, attention diverted	Dry	Overcast	Fine	Roundabo	Give Way Sign		
QUARRY ROAD	I FITZGERALD ROAD	201511169	17/02/2015	Tue	1630	CAR1 EBD on QUARRY ROAD hit TRUCK2 crossing at right angle from right	TRUCK2 Failed to give way At a priority traffic control, Did not check / notice another party	Dry	Bright	Fine	Roundabo	Give Way Sign		1
WAIHOEHOE ROAD	I APPLEBY ROAD	201642589	02/07/2016	Sat	1540	VAN1 EBD on WAIHOEHOE ROAD hit turning CAR2	CAR2 Approaching a traffic control, did not stop at stop sign	Dry	Bright	Fine	X Type Junction	Stop Sign		
WAIHOEHOE ROAD	I COSSEY ROAD	201737108	06/04/2017	Thu	2055	CAR1 WBD on WAIHOEHOE ROAD lost control turning left, CAR1 hit Ditch	CAR1 alcohol test above limit or test refused, Lost control Under Acceleration, evading enforcement, Over the speed limit	Dry	Dark	Fine	X Type Junction	Stop Sign		
WAIHOEHOE ROAD	I COSSEY ROAD	201413263	11/05/2014	Sun	0234	CAR1 EBD on WAIHOEHOE ROAD lost control; went off road to right, CAR1 hit Traffic Sign	CAR1 alcohol suspected, Entering / On curve	Dry	Dark	Fine	X Type Junction	Give Way Sign		1
WAIHOEHOE ROAD	140E FITZGERALD ROAD	201833749	27/02/2018	Tue	1900	VAN1 NBD on WAIHOEHOE ROAD lost control turning right on right hand bend	VAN1 alcohol test below limit, lost control due to road conditions	Wet	Twilight	Heavy Rain	Unknown	N/A		
WAIHOEHOE ROAD	140E FITZGERALD ROAD	201739193	17/05/2017	Wed	0800	SUV1 WBD on WAIHOEHOE ROAD lost control on curve and hit CAR2 head on	SUV1 lost control due to road conditions ENV: road slippery (surface bleeding / defective)	Wet	Overcast	Light Rain	Unknown	N/A		
WAIHOEHOE ROAD	150E FITZGERALD ROAD	201845144	20/07/2018	Fri	1300	TRUCK1 EBD on WAIHOEHOE ROAD lost control turning right on right hand bend	TRUCK1 alcohol test below limit, lost control due to road conditions ENV: road slippery (rain)	Wet	Overcast	Fine	Unknown	N/A		
WAIHOEHOE ROAD	150E FITZGERALD ROAD	201816978	18/08/2018	Sat	0920	TRUCK1 WBD on WAIHOEHOE ROAD lost control turning left	TRUCK1 alcohol test below limit, lost control due to road conditions ENV: road slippery (rain)	Wet	Bright	Light Rain	Unknown	N/A		1
WAIHOEHOE ROAD	70W WYCLIFFE PLACE	201645292	11/08/2016	Thu	2040	VAN1 EBD on WAIHOEHOE ROAD lost control; went off road to right, VAN1 hit Fence, Post Or Pole	VAN1 Too far right	Dry	Dark	Fine	Unknown	N/A		
WAIHOEHOE ROAD	90W WYCLIFFE PLACE	201844875	23/07/2018	Mon	0730	CAR1 NBD on WAIHOEHOE ROAD lost control while overtaking, CAR1 hit Cliff Bank, Fence	CAR1 alcohol test below limit, Inappropriate speed, lost control, inexperience	Wet	Bright	Fine	Unknown	N/A		

B. Proposed Zoning



PROPOSED ZONING

	LIGHT INDUSTRY
	METROPOLITAN CENTRE
	LOCAL CENTRE
	MIXED USE
	MIXED HOUSING SUBURBAN
	MIXED HOUSING URBAN
	TERRACE HOUSING AND APARTMENT BUILDINGS
	CONSERVATION ZONE
	INFORMAL RECREATIONAL ZONE

C. Modelling Report

DRURY EAST MODELLING

PREPARED FOR KIWI PROPERTY, FULTON HOGAN AND OYSTER CAPITAL

November 2019



This document has been prepared for the benefit of Kiwi Property, Fulton Hogan and Oyster Capital. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person. The aim of this report is to collate the modelling undertaken and present the results in one document for ease of reference. This report, alongside the modelling files, will become the basis for the individual Integrated Transportation Assessments (ITAs) for developer plan changes to be written.

This disclaimer shall apply notwithstanding that the report may be made available to other persons for an application for permission or approval to fulfil a legal requirement.

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REVISION SCHEDULE

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B	18.6.19	Draft	T. Atkinson	D. Hughes	D. Hughes	D. Hughes
C	08.08.19	Draft	G. Surja / T. Atkinson	D. Hughes	D. Hughes	D. Hughes
D	06.09.19	Draft following B&A comments	G. Surja	D. Hughes	D. Hughes	D. Hughes
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F	18.11.19	Final	G. Surja	D. Hughes	D. Hughes	D. Hughes

Kiwi Property, Fulton Hogan and Oyster Capital

Drury East Modelling

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Executive Summary

Stantec has undertaken traffic modelling to assess the traffic effect of the proposed developments within Drury East. The modelling has considered proposed development by Kiwi Property (**Kiwi**), Fulton Hogan, and Oyster Capital. The modelling has also determined which infrastructure is required at certain decades to unlock developers' planned developments.

The traffic modelling has been undertaken using a three-tiered approach, consisting of a macro strategic model (MSM), a mesoscopic project model (SATURN), and a localised intersection operational model (Sidra Intersection). The assessment period spans three decades, between the anticipated start of the developments in 2023 through to 2048. The modelling has considered the Supporting Growth future transport network, as reported in the SGA ITA for Drury-Opaheke and Pukekohe-Paerata areas. The land use assumptions, however, have been adjusted to align with Kiwi, Fulton Hogan, and Oyster Capital's desired build rates.

The existing capacity constraint on the network surrounding Drury East due to the ongoing SH1 Southern Improvements roadworks is acknowledged. At a high level, it is assumed that the completion of the roadworks will alleviate the pressure on the network.

The modelling has remained consistent with the public transportation mode share assumptions in the MSM model. The MSM model assumed a lower public transport mode share for Drury East compared to Drury West. Given the future public transport services and infrastructure that are planned for Drury East, and the proximity of the Drury Metropolitan Centre to future train station, this assumption is considered conservative and it is expected that in reality there will be a higher uptake of public transport by Drury East residents, employees, and visitors. This will likely reflect lower traffic on the overall network compared to the demand assumed in the modelling assessment. Moreover, should the network become increasingly constrained due to the development traffic and/or the growth in background traffic, this could result in the potential to further encourage an increase in PT uptake by Drury East residents and workers.

The modelling demonstrated that the rezoning can be accommodated by the surrounding transport network, with several targeted local upgrades recommended within the first two decades.

These are primarily the provision of access to the Metropolitan Centre (preferably the direct access via Drury Interchange, if feasible), the signalisation of the Great South Road / Waihoehoe Road roundabout prior to 2028, and a network capacity upgrade prior to 2038 which could be achieved through doubling the northbound ramps at the Drury Interchange or an earlier provision of the Southern Mill Road connection to Fitzgerald Road. The 2038 and 2048+ traffic modelling is satisfactory as all the key infrastructure required to support the growth is anticipated to have been implemented within those decades.

A more conservative scenario which considers no provision of direct access to the Metropolitan Centre has also been modelled and analysed. The modelling shows that without the direct access to Metropolitan Centre, some local upgrades within the development site will need to be provided earlier such as the widening of Great South Road and Waihoehoe Road. Similar to when the direct access is provided, a network capacity upgrade prior to 2038 through doubling the northbound ramps at the Drury Interchange or an earlier provision of the Southern Mill Road connection to Fitzgerald Road will be required. Following the 2038 and 2048+ infrastructure upgrades, traffic modelling shows that the network performance will be satisfactory.

While the modelling provides indication of when and what specific upgrades are required based on the anticipated future network and development, it is noted that further refinements to the extent and timeframe of upgrades may be explored and adopted in further stages of the planning process and as the actual development progresses. The modelling has been undertaken at a level appropriate for a Plan Change and therefore has not specifically considered the potential impact of construction traffic relating to each upgrade. It is noted that any construction impact on the network will be temporary and will be managed appropriately.

Based on the modelling, it is considered that the Drury East plan change can be supported from a traffic perspective and is unlikely to have a significant adverse effect on the traffic network, given that the infrastructure required to support the developments is implemented.

1. Introduction

To accommodate further growth and to facilitate urbanisation in Drury, Council has undertaken Structure plans for Drury-Opaheke and Pukekohe-Paerata. The Drury-Opaheke area is divided into Drury East / Central / South (**Drury East**) and Drury West, as shown in **Figure 1-1** below. State Highway 1 (**SH1**) separates Drury East and Drury West and provides a direct connection northbound and southbound.

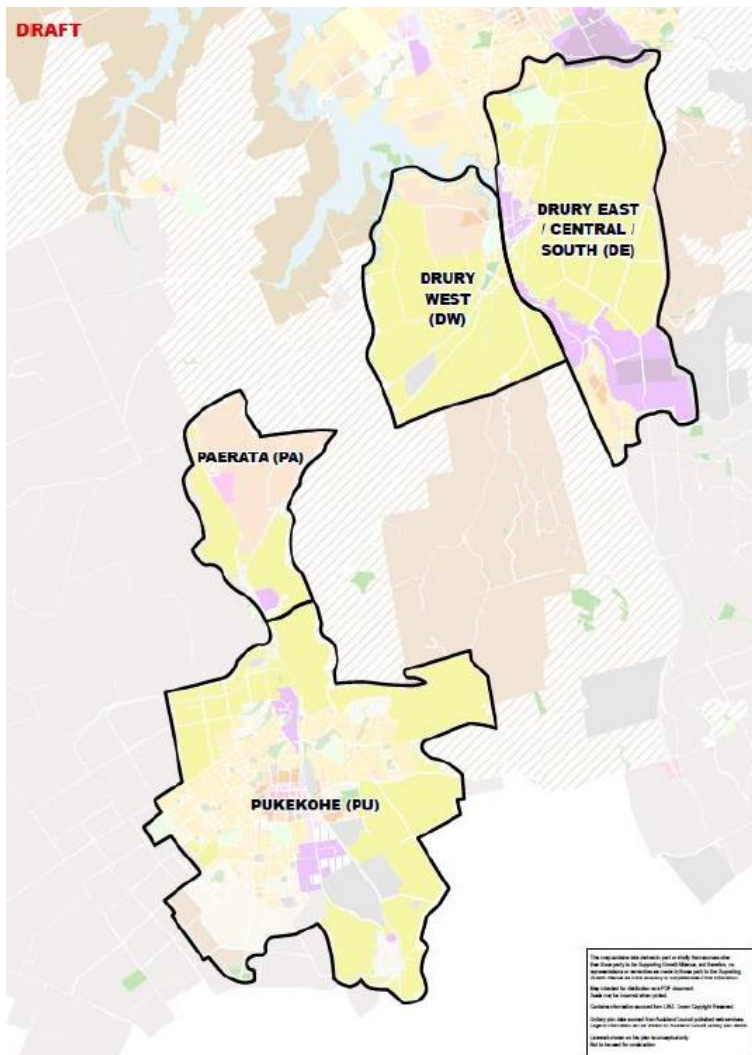


Figure 1-1: Geographic subdivisions of Structure Plan Areas (draft)

On 2 April 2019, a Draft Integrated Transport Assessment by Supporting Growth Alliance (**SGA ITA**) was released. This outlined the transportation effects of the proposed Structure Plan areas for Drury-Opaheke and Pukekohe-Paerata, as part of the Council's Future Urban Land Supply Strategy (**FULSS**). The Drury-Opaheke Structure Plan Area is shown in **Figure 1-2** below.

Whilst the SGA ITA provides further clarity to the Structure Plan, there are limitations to the level of detail provided. The majority of the modelling methodology and results focussed on the full 2048+ development, rather than the interim years (i.e. 2028 and 2038) and various inputs and assumptions are not clearly defined.

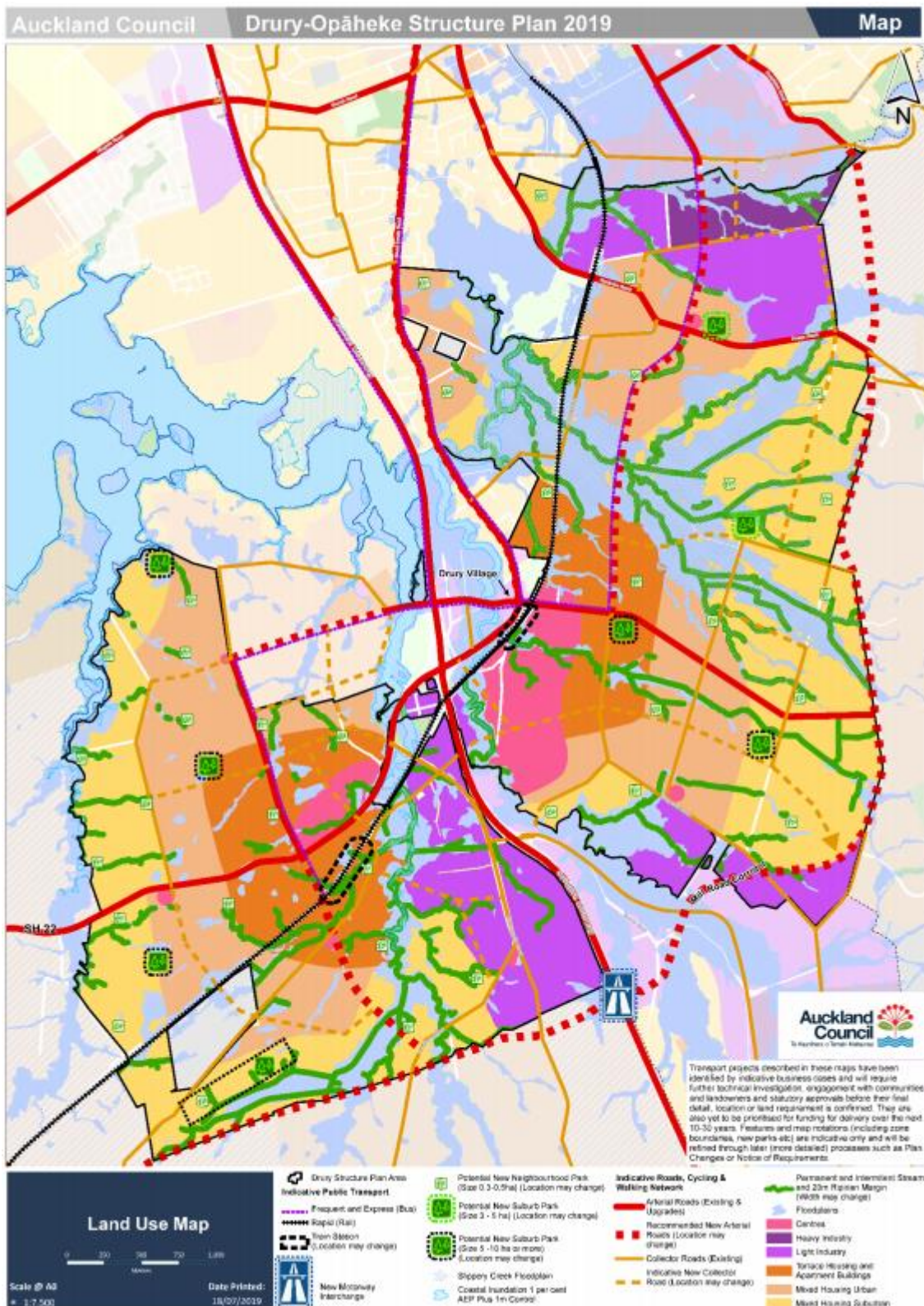


Figure 1-2: Drury-Opāheke Structure Plan 2019 (from SGA ITA)

Kiwi Property, Fulton Hogan and Oyster Capital have substantial landholdings within Drury East and are seeking to progress development ahead of the Council's current staging. Kiwi Property is proposing to develop a Metropolitan Centre (i.e. mixed use) whilst Fulton Hogan and Oyster Capital are both proposing primarily residential development. The broad proposed plan change areas for each property owner are outlined in **Figure 1-3** below.

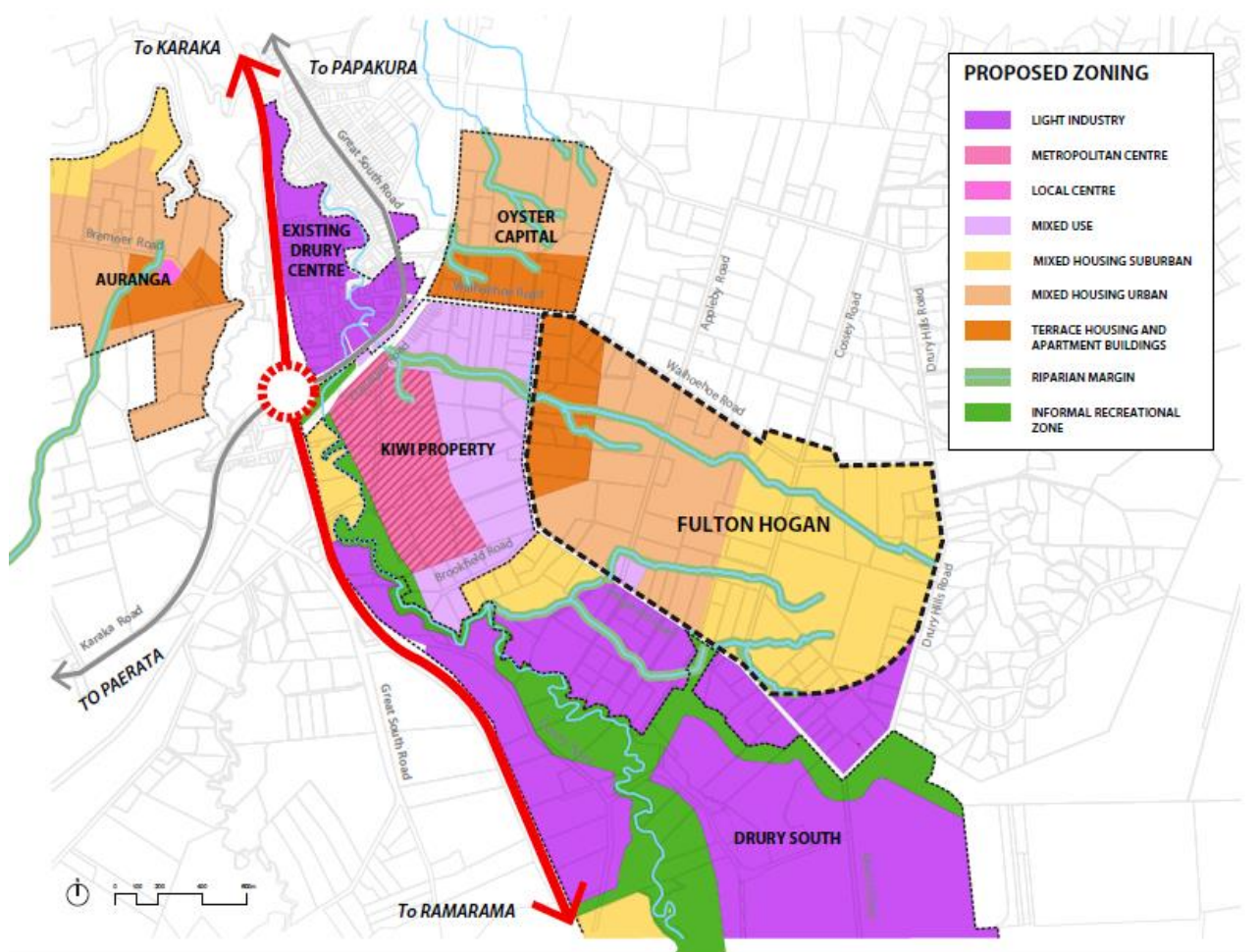


Figure 1-3: Kiwi, Fulton Hogan and Oyster Capital broad proposed plan change areas in the context of the Draft Structure Plan boundary

The traffic effects due to the proposed developments are required to be assessed on the surrounding network, and the access routes to each site also need to be considered. There is currently a high level of congestion on the surrounding network, particularly on SH1 north of Drury Interchange and Great South Road. This is primarily caused by the ongoing SH1 Southern Improvements (SI) roadworks north of Papakura, which encourages trip diversions via Great South Road, particularly during the morning peak in the northbound direction. As a result, the Great South Road / Waihoehoe Road roundabout is currently under a great deal of pressure and almost at capacity. It is understood that the SI roadworks are due to be completed at the end of 2019 and the construction of the SH1 Papakura to Drury widening scheme is expected to commence in 2020. This is explained in further detail in this report.

Therefore, it is important to understand what additional infrastructure will be required to enable development as desired by Kiwi, Fulton Hogan, and Oyster Capital, prior to or beyond any committed future network upgrades.

Various modelling scenarios have been undertaken to investigate whether new accesses need to be provided for the Metropolitan Centre, where these accesses could be provided and their feasibility, and what effect the combined developments have on the road network at various points in the future.

In the early stages of the study, several potential new accesses to the Metropolitan Centres were considered and assessed through SATURN modelling, including:

- Direct access via the Drury Interchange;
- Firth Street access; and
- Quarry Road access via Quarry Road off-ramp and Quarry Road / Brookfield Road connection.

The modelling assessment showed that all the above accesses will be able to accommodate the proposed land use within the first decade of development. With any of the above accesses in place, the delay on the Drury Interchange north facing ramps in peak times will not exceed 100 seconds, which is considered acceptable.

Therefore, it is considered that there are several potential access options to the Metropolitan Centre, which can be implemented at appropriate timing depending on the actual development rates of the Metropolitan Centre and the surrounding sites. From a planning perspective, a legible and direct access to the Metropolitan Centre via Drury Interchange is considered desirable, although its feasibility may be affected by the SH1 Papakura to Bombay scheme, which may include works on the Drury Interchange. This is discussed further in this report.

The traffic assessment has also considered the minimum future scenario, where no access to the Metropolitan Centre is assumed for the foreseeable future. The purpose of this consideration is to gain a firmer understanding of the necessity of a new access.

It is considered that the Fulton Hogan and Oyster Capital properties will be accessible via Waihoehoe Road and Fitzgerald Road. The Drury Interchange and the Great South Road / Waihoehoe Road intersection are considered key connections along the main development traffic routes. The modelling has therefore focussed on the future traffic effects on the aforementioned two connections.

This traffic modelling report describes the modelling methodology and land use assumptions for Drury East, outlines the various scenarios investigated and discusses the effects on the relevant surrounding road network. Through the modelling assessment, land use thresholds for infrastructure upgrades in terms of dwellings, commercial and retail Gross Floor Area (**GFA**) have been identified. The thresholds will inform the planning policy proposed as part of the Drury East Plan Changes.

2. Modelling

2.1 Background

The original modelling used Transport for Future Urban Growth (**TFUG**), now referred to as the Supporting Growth Alliance (**SGA**), SATURN models based on Auckland Forecasting Centre's (**AFC**) ART3 models for years 2026, 2036 and 2046.

The ART3 model has since been restructured and rebased to 2016 conditions (previously 2011 based) and is now called the Macro Strategic Model (**MSM**). There are some notable differences between the previous ART3 model and the new MSM model, as follows:

- The passenger transport model (MPT) has been improved and better integrated with the MSM;
- The MSM model has a revised zone system (more zones) to better represent greenfield areas;
- The land use assumptions between the ART3 model and MSM model were different. MSM results, in terms of demand, were provided by AFC for 2028, 2038 and 2048+, and these used land use inputs with Drury variations according to development staging provided by Barker and Associates (B&A), initially in February 2019. Previously obtained ART3 demands were based on standard land use assumptions and the Drury demands were then scaled to match specific Drury land use schedules; and
- Some coding differences at the key intersections, in terms of capacity allowance, have been observed between the two models.

An evaluation was then undertaken of the Council/SGA land use assumptions to provide values more reflective of the anticipated development within Drury West and Drury East. These latest assumptions were provided by B&A, the first revision is dated Friday 31 May 2019, and the second (latest at the time of report writing) is dated 1 July 2019. The land use assumptions included the proposed dwellings for each decade (2028, 2038 and 2048+) for the Drury-Opaheke area and Pukekohe-Paerata area. The land uses within Drury West included the Auranga development and the land uses in Drury East incorporated the proposed development for Kiwi Property, Fulton Hogan and Oyster Capital. These updated land uses will be discussed in further detail in this report.

2.2 Modelling Methodology

2.2.1 Modelling Approach

Traffic modelling for Drury has been undertaken primarily using a three-tiered approach, consisting of a macro strategic model, a mesoscopic project model, and a localised intersection operational model. The strategic model is the AFCs MSM. The MSM is an EMME based conventional four stage model¹ covering the wider Auckland area.

The mesoscopic model is a SATURN based multi-user class (light vehicle and heavy vehicle) user equilibrium assignment model detailing the road network and intersections in the area. The mesoscopic model takes the private vehicle and heavy vehicle demands from MSM and further disaggregates the zoning to give a greater level of detail.

Sidra Intersection was used to test the operational performance of the existing Great South Road / Waihoehoe Road roundabout over the first decade, and aid in identifying potential intervention measures to ensure an acceptable level of service is maintained.

2.2.2 Model Extent

The zoning areas for the MSM model is shown in **Figure 2-1** below. Potential staging for the Drury-Opaheke area has also been provided on **Figure 2-2**, overlaid by the MSM model zoning, to show the comparison in the areas. From this comparison, it can be seen that the MSM zoning areas do not directly align with the

¹ The four stages consist of trip generation, distribution, mode split, and assignment.

proposed staging areas. However, the staging diagram (**Figure 2-2**) is indicative only and the household breakdown per stage and decade is discussed further below.

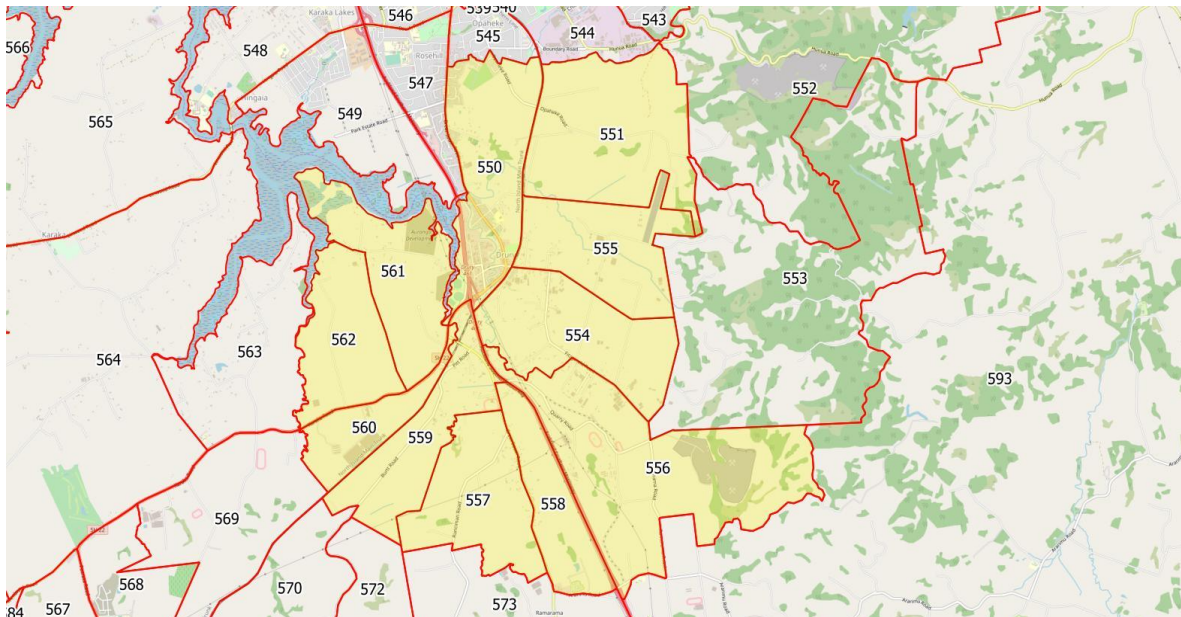


Figure 2-1: Latest MSM Model Zoning Map

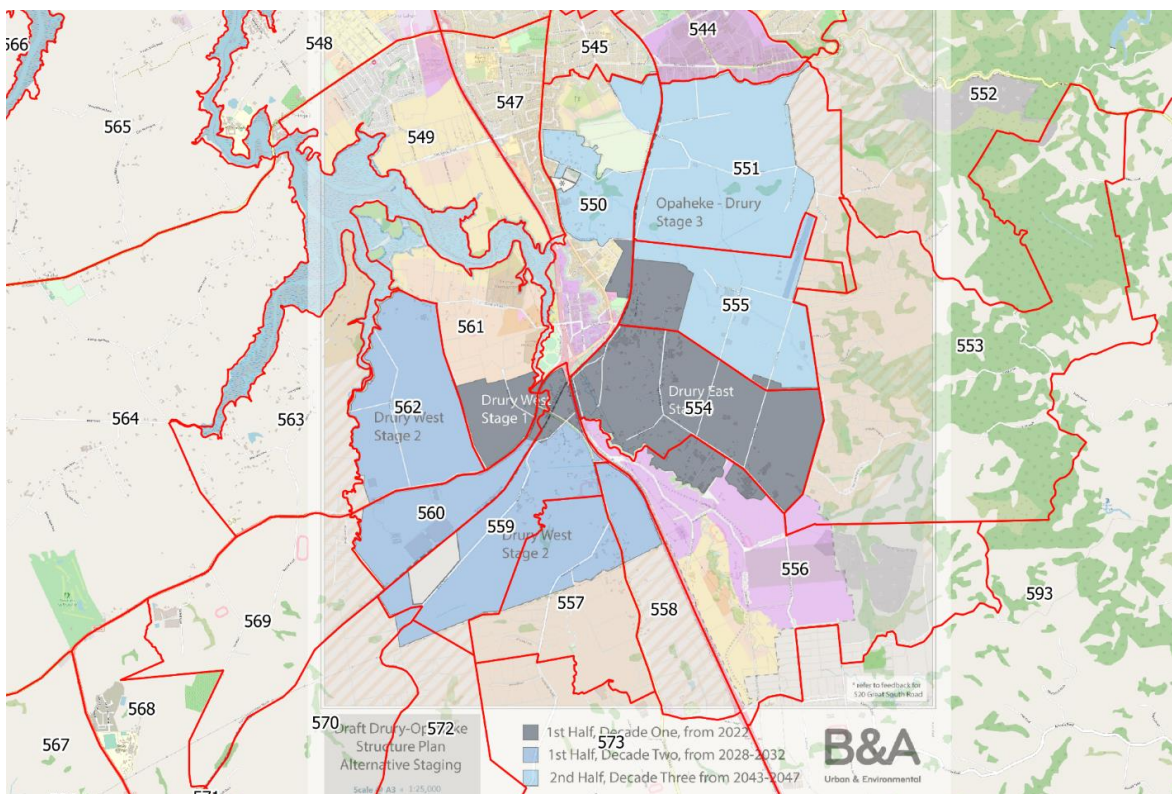


Figure 2-2: MSM Model areas overlaid on B&A Staging Plan

The MSM model was used as a base in the SATURN modelling, to allow more representative and accurate results to be determined. The extent of the SATURN model is shown in **Figure 2-3** below.

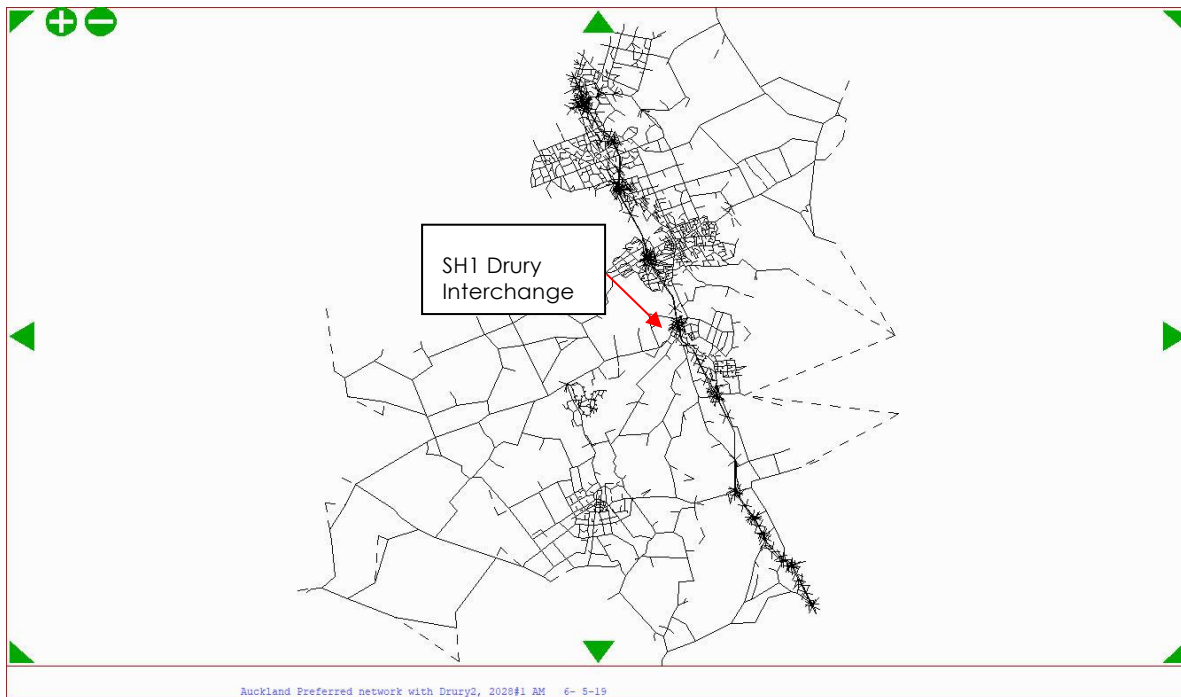


Figure 2-3: SATURN Model Extent

2.2.3 Modelling Scenarios

The land use scenarios considered in the modelling are grouped in decades, to align with the SGA infrastructure upgrades decade-timeframe and the land use assumptions (discussed in Sections 2.3 and 2.6 below);

- Prior to 2028 – This is the decade from now until 2028 before any committed infrastructure upgrades are completed, noting the sites are anticipated to develop from 2023;
- 2028 – This is the decade in which the constrained 2028 infrastructure is completed and 2028 to 2037 traffic demands are anticipated;
- 2038 – This is the decade in which most but not all of the infrastructure upgrades are anticipated, and 2038-2047 traffic demands are expected; and
- 2048+ - At this stage all of the infrastructure upgrades and the proposed development are assumed to be completed.

A breakdown of the infrastructure expected in each decade is outlined in **Table 2-6**.

2.3 Land Use Assumptions

The AFC MSM model, with the original Council land use assumptions, was used as a base model for both the Stantec modelling and the SGA model, in order to create a standard baseline.

B&A then reconfigured the land use assumptions to align with the proposed developers staging plan for the Drury Structure Plan area and refined the yield predictions for areas already live zoned and under development at Auranga and Drury South. There were several iterations of land use assumptions, and the latest revision is dated July 2019.

The land use assumptions in the MSM were re-evaluated to reflect the latest (July 2019) figures provided by B&A, as these were considered to be the most realistic yields based on known constraints and build times. The projected build out rates anticipated by the Drury East developers between 2023 to 2028 (Decade 1), contained in a B&A memo dated 27 June 2019, have also been considered and incorporated in the latest land use assumptions.

In relation to the wider context of the area, it is considered that the previous MSM results can be refactored, thus bypassing the need for a new run (and associated delays). This is a valid approach and is unlikely to have a significant impact on the accuracy of the modelling results.

The live-zoned Auranga land (2,650 dwellings) and residential land in Drury South (1,000 dwellings) have been included within the Drury West and Drury East land use assumptions outlined in **Table 2-1** below. If these areas were incorporated into the SGA model, both sets of assumptions total 26,440 dwellings at 2048+.

It is noted that the assumptions are still considered conservative, as considerable development has been predicted for areas that face unresolved environmental issues (such as the Opaheke flood plain).

The SGA ITA does not clearly outline the land use assumptions for each year and the SGA modified version of the model was not accessible to Stantec. Therefore, a year-by-year comparison between the SGA land use and the latest land use adopted in Stantec modelling cannot be stated with certainty. However, using the growth from 2016 and 2048+, as outlined in Table 7-3 of the SGA ITA, and the growth rate per year in Figure 7-3 of the ITA, a comparison between the number of households could be estimated for Drury West and Drury East. A comparison between the latest land use assumptions adopted in Stantec modelling and the SGA land use assumptions is presented in **Table 2-1**.

It is noted that Drury West includes the MSM zones 557, 558, 559, 560, 561, and 562; while Drury East includes the MSM zones 550, 551, 554, 555, and 556. The Kiwi, Fulton Hogan, and Oyster Capital development are contained within the zones 554 and 555. For zone by zone land use assumptions breakdown, refer to **Appendix A**.

Table 2-1: Land Use Assumptions for Drury- Opaheke Area

	Drury West				Drury East			
Developers Land Use Assumptions (Revised Land Use dated 1.7.19)								
	2016	2028	2038	2048+	2016	2028	2038	2048+
Population ²	943	3887	15234	37413	2710	11237	16745	29425
Households / Dwellings	357	1482	5928	14946	962	3934	6402	11494
Employment / Jobs ³	565	1540	3247	4163	1543	5787	12086	15420
SGA Land use Assumptions (provided within the SGA ITA) ⁴								
	2016	2028	2038	2048+	2016	2028	2038	2048+
Households/Dwellings	357	2221	7701	12014	962	2307	7488	10776

Due to the staging changes, some differences can be observed between the B&A land use assumptions and the SGA households estimated from the ITA. Overall, the latest model assumes a slightly higher land use for the 2028 and 2048+ years (an additional 888 and 3,650 respectively) and assumes 2,859 less for the 2038 year. This difference in 2048+ is assumed to be due to the live-zoned areas of Auranga and Drury South residential as discussed above.

The employment assumptions for Drury East have been adjusted using an estimated target build-out of 60,000m² of commercial (office), 107,650 m² of retail park, and the expected level of employment of 5,090 jobs.⁵ For commercial employment, a rate of 17.6m²/person has been adopted. This is based on the New Zealand national office density reported in the Colliers Workplace Report (2016). The remaining

² The population land use assumptions were not provided by B&A. These have been estimated using a ratio of the old households / new households

³ The employment land use assumptions were not provided by B&A. These have been estimated from the Stantec Drury Modified MSM run, however have been adjusted with the indicative target full non-residential build out for Kiwi known at the time of modelling.

⁴ The SGA households have been assumed from the information provided with Table 7-3 and Figure 7-3 within the ITA. These cannot be confirmed with certainty as the land use assumptions per decade are not outlined within the ITA.

⁵ According to the 2048 Masterplan Vision Hybrid Concept Urban Design Framework (February 2019) by Civitas.

employment are therefore retail park-related jobs. No adjustments have been made to the Drury West employment further to the Council MSM assumptions.

Table 2-2: Land Use Assumptions for Pukekohe - Paerata Area

	Pukekohe - Paerata			
Developers Land Use Assumptions (Based on MSM land use assumptions)				
	2016	2028	2038	2048+
Population ⁶	23137	41393	54624	57793
Households / Dwellings	8184	15018	20396	22276
Employment / Jobs ⁷	8903	11702	14659	16235

Table 2-2 does not include the SGA decade-by-decade land use assumptions, as the decade-by-decade breakdown could not be determined from the SGA ITA information provided. Therefore, these could not be accurately assumed. It is noted that the above assumptions are based on the Council MSM without any further modification.

The land use assumptions, per MSM zone, have also been provided for households and employment in **Figure 2-4** and **Figure 2-5** below for the Drury-Opaheke area only. The full household, employment and population land use assumptions are broken down per MSM zone and decade (2028, 2038 and 2048+) in **Appendix A** of this report.

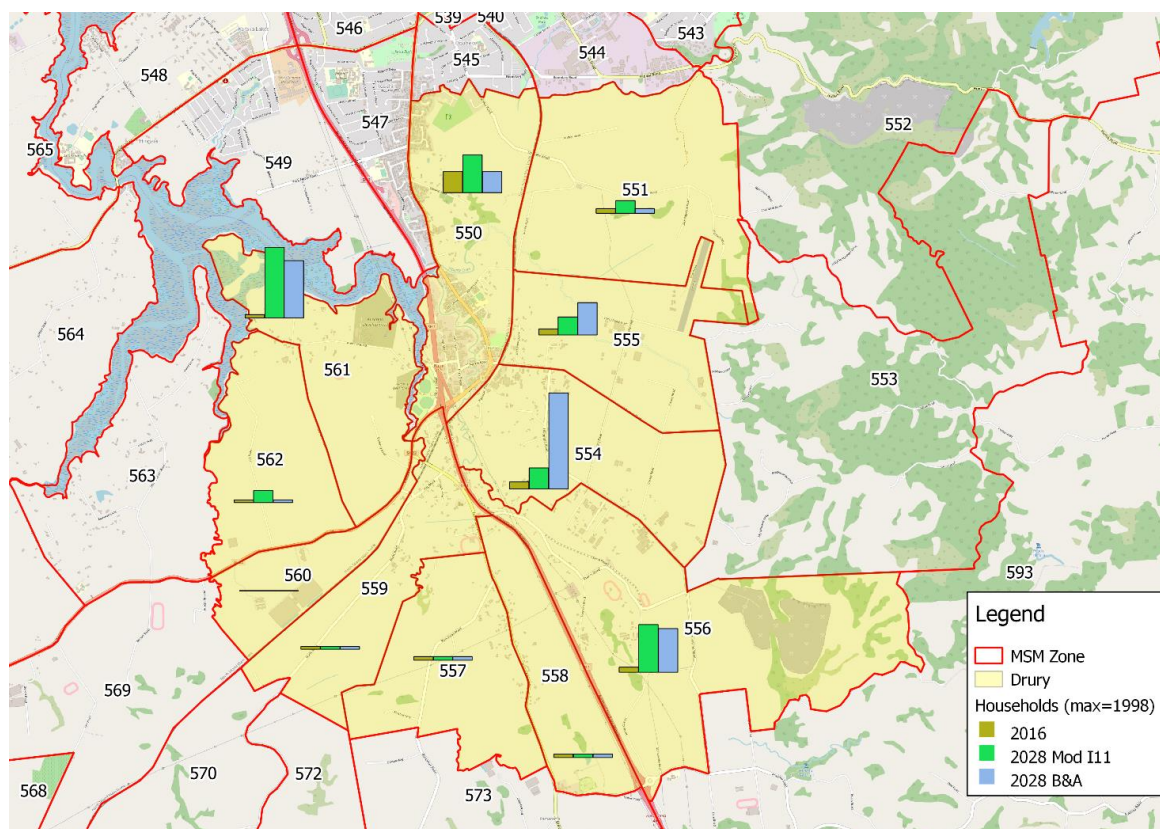


Figure 2-4: Households for 2016, 2028 (MSM standard land use assumptions) and 2028 (B&A Land use assumptions) per MSM Zone for Drury-Opaheke Area

⁶ The population land use assumptions were not provided by B&A. These have been estimated using a ratio of the old households / new households

⁷ The employment land use assumptions were not provided by B&A. These have been estimated from the Stantec Drury Modified MSM run.

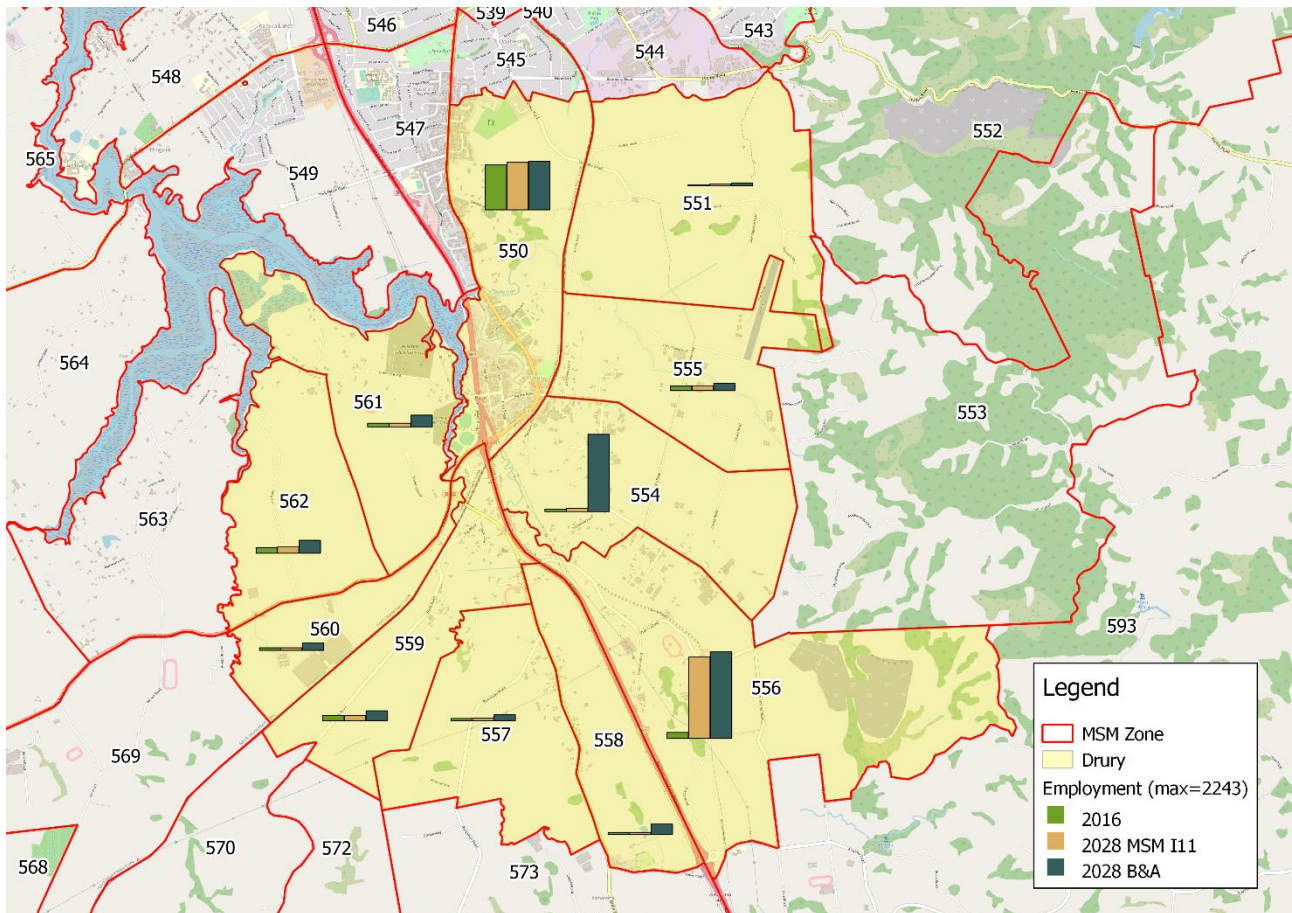


Figure 2-5: Employment for 2016, 2028 (MSM standard land use assumptions) and 2028 (B&A Land use assumptions) per MSM Zone for Drury-Opaheke area

The above two figures demonstrate that the B&A land uses assume a significant increase in households and employment within the Drury East zone (554) between 2016 to 2028.

2.4 Trip Generation

The peak hour trip rates have been assessed for each MSM zone in the relevant Drury-Opaheke area, as shown in **Appendix B**. The Drury West and Drury East total estimated car trip rates per household are summarised in **Table 2-3** below, for the peak hour periods. The residential trip rates have been undertaken on a per-household basis, as this is the common measure for such rates.

It is noted that the source of the trip generation was determined from the MSM model, as the model was validated to 2016 observed traffic and Public Transport (PT) data, indicating that it generates appropriate levels of travel at an aggregate level.

Table 2-3: Estimated Hourly Household Car Trip Rate⁸

2016			2028		2038		2048+	
	AM	PM	AM	PM	AM	PM	AM	PM
East	0.96	0.83	0.72	0.64	0.69	0.63	0.64	0.59
West	0.82	0.71	0.49	0.43	0.46	0.40	0.41	0.36
Total	0.92	0.80	0.62	0.55	0.58	0.52	0.53	0.48

From **Table 2-3**, the total peak hour car trip rate per household is approximately 0.92 for the AM peak and 0.80 for the PM peak in 2016. In 2028, the car trip rate per household decreases to approximately 0.62 in the AM peak and 0.55 in the PM peak. Therefore, a larger decrease is observed in the AM peak (32% reduction) compared to the PM peak (25% reduction).

These car trip rates are affected by PT usage. For example, as the PT uptake increases from 2016 to 2028, the car trip rate is anticipated to decrease as less people are making trips via cars. The PT mode share is discussed in further detail below.

This difference between the two peak periods is likely due to the AM period encompassing a larger demographic (e.g. school children and working parents) than the PM period (which is likely to only capture the working parents and not school children). It is also more likely that school children use PT rather than driving.

It is also noted that Drury West sees a more significant reduction in future trip generation than Drury East. On further analysis, this appears to be caused by difference in model coding, with more zones and connection in Drury West than East. This is a quirk of the model which should be corrected in future iterations, however, at this time the results for Drury East should be considered very conservative. This is also discussed in **Section 2.5** below.

2.4.1 Trip Distribution

2.4.1.1 Select Link Analysis (SLA)

Select Link Analysis (**SLA**) was undertaken for the inbound and outbound trips in peak periods to understand the trip pattern on the network following the first decade (2028). The links selected for analysis are the Great South Road / Waihoehoe Road intersection and the Drury Interchange direct access, as these are the two main access points for inbound and outbound traffic to and from Drury East. SLA analysis within the Fulton Hogan or Oyster Capital plan change areas have not been included as these areas do not contain any link that provides a unique route for Drury East inbound and outbound trip.

It is noted that the analysis has considered the target 2028 development in the Kiwi, Fulton Hogan, and Oyster Capital Plan Change areas.

In the AM peak, the analysis shows that the outbound trips from the Drury Metropolitan Centre travel northbound on SH1 and Great South Road via the Drury Interchange direct access. Outbound trips from other parts of Drury East; such as trips from the Fulton Hogan and Oyster Capital plan change areas, as well as Drury South, are observed to get onto SH1 and Great South Road to travel northbound via the Great South Road / Waihoehoe Road intersection. Refer to **Figure 2-6** for the SLA plots of outbound trips.

In the PM peak, the analysis shows that the inbound trips into the Drury Metropolitan Centre travel either via the direct access or the Great South Road / Waihoehoe Road intersection. Other inbound trips access Drury East via the Great South Road / Waihoehoe Road intersection. Refer to **Figure 2-7** for the SLA plots of inbound trips.

⁸ The household car trip rate is estimated from MSM home based car person trips (2hr). Divide this by HH, then convert to car trips by dividing by 1.3 (assumed car occupancy rate), and then multiplying by 0.59 (assumed 2hr to 1hr peak factor).



Figure 2-6: AM Peak - Outbound Trips via Direct Access (left) and Great South Road / Waihoehoe Road Intersection (right)



Figure 2-7: PM Peak - Inbound Trips via Direct Access (left) and Great South Road / Waihoehoe Road Intersection (right)

2.4.1.2 Existing Commuter Census Data for Drury

The latest (2013) commuter census data for Drury shows that most commuters in the area originate or end their trips outside of Drury, and that currently there is only a small proportion of internal trips. It is noted 30% of employment trips within the Drury area originate from within the Drury area unit itself. However, there is still higher level of outbound commute compared to that of inbound commute given the current land use and employment opportunity in Drury.

It is expected that in the future, as the Metropolitan Centre Transit Orientated Development (**TOD**) is developed and more jobs are created, the commuting pattern will change with more significant commuting trips originating to and from within the Drury area (East and West). As discussed in the next sections, given the future infrastructure upgrades and service, a greater proportion of these commuting trips are likely to be undertaken via alternative modes other than private cars in the future.

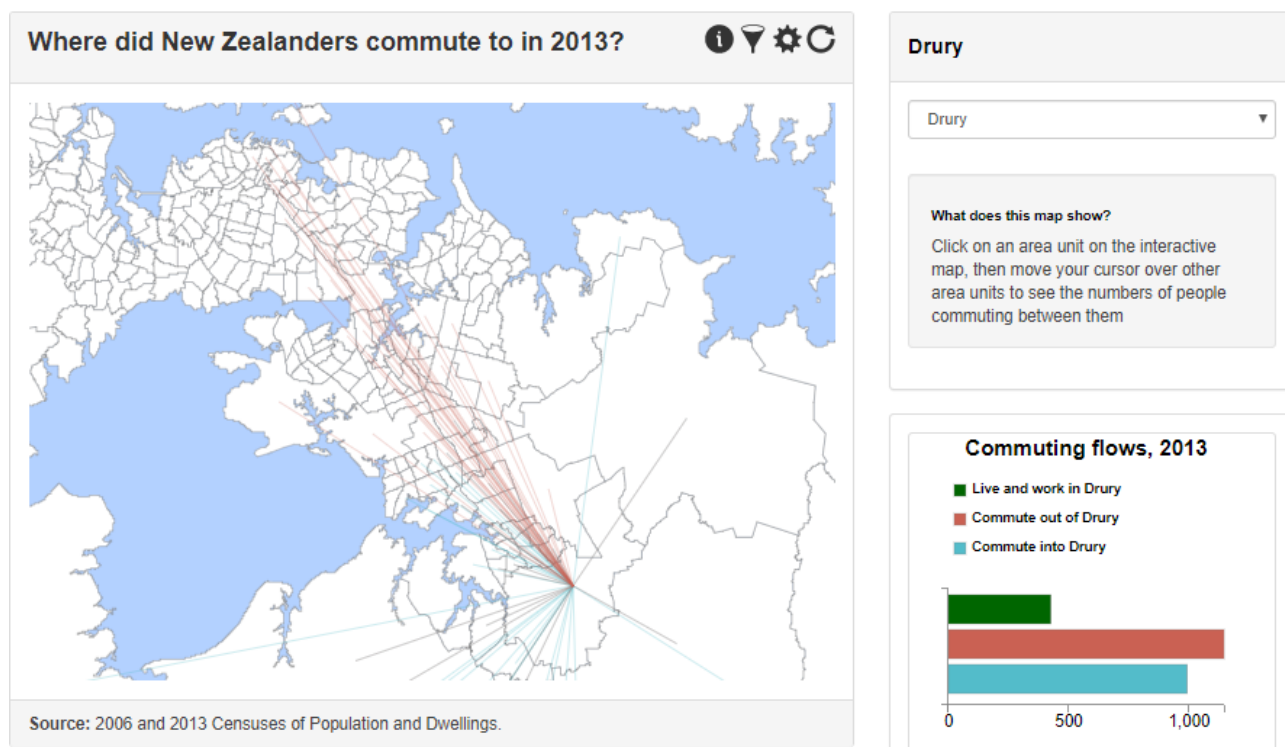


Figure 2-8: Drury Commuter Census Diagram

2.5 Public Transport Assumptions

The PT mode share is summarised for Drury West and Drury East in **Table 2-4** below. The breakdown of PT mode share per MSM model and decade is outlined in **Appendix B** of this report. The resulting mode split will vary based on the trip purpose and origin / destination of the movement.

Table 2-4: Summary of PT mode share for Drury East and Drury West for 2016 and 2028

2016					2028			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
East	7%	2%	1%	6%	14%	3%	3%	11%
West	7%	1%	1%	6%	19%	5%	6%	18%
Total	7%	2%	1%	6%	16%	3%	4%	14%

Table 2-4 shows that the total percentage of PT mode share increases by 9% between 2016 and 2028 for the AM peak period. It is anticipated that this increase in PT is due to the construction of the Drury West and Drury Central train stations (which were included within the AFC base model). From **Appendix B** it is observed that the PT increase for zone 560 (Drury West) is approximately 17%, due to the implementation of the Drury West train station. However, in zone 554 (where the Drury Central train station is located) the PT increase is only 5%. As both of these zones are proposed to have new train stations, it is suspected that this difference in PT percentage is due to the difference in model coding within the two zones, leading to very conservative modelling outcomes in Drury East.

The current PT mode share for various urban Metropolitan Centre areas adjacent to the Frequent Transit Network (FTN) in Auckland, have been obtained from Stats NZ Commuter View and are shown in **Table 2-5**.

Table 2-5: PT Mode Share for Various Metropolitan Centre Areas in Auckland

Area	PT Mode Share (Commuting Journey Survey 2013)
New Lynn	14%
Kingsland	22%
Newmarket	22%
Mt Albert	15%

The assumed PT mode share for Drury East falls towards the lower end of the spectrum of the Auckland areas observed above, while Drury West PT trip mode share sits in the middle of the range. Therefore, it is considered that the PT mode share for Drury East should at least be at the same level as Drury West, and that the MSM assumption of Drury East PT mode share is underestimated.

2.6 Infrastructure Upgrade Assumptions

The same infrastructure upgrade timing as the SGA for the years 2028, 2038 and 2048+ has been assumed and is presented in the **Table 2-6** below.

Table 2-6: Infrastructure Upgrade Assumptions

Decade	TFUG / SGA / Stantec Assumed Infrastructure
2028	SH1 3-laning Papakura to Drury SH22 widening to Karaka Rail Electrification Papakura to Pukekohe New Drury East and West Stations
2038	SH1 3-laning Drury to Bombay SH1 Drury South Interchange Mill Road full route (Papakura to SH1) Pukekohe Expressway full Route (SH1 to Pukekohe) Opaheke Road (Papakura to Waihoehoe Rd)
2048+	Third Main Rail Line Pukekohe to Papakura

The SH1 Papakura to Bombay is a project undertaken by the New Zealand Transport Agency⁹. These upgrades include additional vehicle lanes, wider shoulders to future-proof for bus services along the SH1 corridor, improvements to interchanges, enabling rail line electrification, and a shared walking and cycling path to support future growth in housing and employment.

The SH1 Upgrade is divided into two stages. The first stage of the SH1 Papakura to Bombay project will deliver improvements between Papakura to Drury. This stage is divided into two sub-stages (phases) for the southbound and northbound lanes, with an estimated timeframe below:

- Phase 1 is the southbound 3-laning: Phase 1 is currently in design phase, with construction anticipated to commence in 2020 and estimated completion in 2022; and

⁹ <https://www.nzta.govt.nz/media-releases/launch-of-sh1-papakura-to-bombay-projects-design-and-consenting-phase/>

- Phase 2 is the northbound 3-laning and SH1 Drury Interchange improvement: Phase 2 is currently in the planning stage, with construction estimated to commence in 2021 (following completion of Phase 1) and estimated completion in 2024.

The second stage of the SH1 Papakura to Bombay project will deliver similar improvements to Stage 1, between Drury and Bombay. It also includes a proposed new interchange between Drury and Ramarama (referred to as 'Drury South'). The Drury South Interchange will provide a connection point for other key transport projects being planned under the Supporting Growth Programme; Mill Road Corridor Alignment and Pukekohe Expressway.

For modelling purposes, the above upgrades have been assumed to be in place in accordance to the SGA assumed timeframes, as outlined in Table 2-6. However, in order to understand the required local upgrades to support development in the immediate years (prior to 2028), the more refined timeframe for Phase 1 and Phase 2 of the SH1 Papakura to Drury project has been considered. This is explained in further detail in this report.

2.7 Local Upgrade Assumptions

The developer-led staging will generate additional traffic volumes in the Drury East area prior to the completion of key infrastructure upgrades assumed by SGA in 2028. As discussed earlier, the surrounding network is currently congested due to the on-going roadworks on SH1 and the resulting north-south trip diversions along Great South Road. Therefore, in order to access and accommodate the proposed development, it is initially assumed that some local Drury East infrastructure is required to be upgraded within the immediate vicinity of the site, within the first decade (2028). This is to ensure sufficient access capacity to and from the site.

The Metropolitan Centre can have multiple connections to the external network, which could be implemented in stages depending on the actual rate of development, while Fulton Hogan and Oyster Capital properties can be primarily accessed via Waihoehoe Road and Fitzgerald Road.

For the modelling purposes the preferred direct access via Drury Interchange has been assumed. However, it is noted that the other options (i.e. access via Firth Street or Quarry Road) will all work from a capacity perspective and therefore offer some flexibility in the future selection process. This is discussed further in **Section 2.7.1**.

Moreover, a conservative scenario has also been considered where it is assumed no new direct access will be provided to the Metropolitan Centre. Modelling under this scenario has assisted in understanding how the requirement for other local and wider upgrades are triggered should the direct access not be provided, and therefore its criticality.

Overall, the potential local infrastructure upgrades that are considered relevant to the accessibility of Drury East developments are:

- The preferred direct access to the Metropolitan Centre from the Drury Interchange;
- Great South Road / Waihoehoe Road Intersection Upgrade;
- Great South Road Upgrade;
- Waihoehoe Road Upgrade; and
- Urbanisation of Fitzgerald Road and Brookfield Road.

Explanations of what each upgrade entails are provided in the following sections. **Figure 2-9** below illustrates the location of these local upgrades in relation to the plan change areas. Traffic modelling was undertaken to confirm whether the above local upgrades are required and the approximate timeframe for those upgrades. These results are discussed in further detail within **Section 3** of this report.

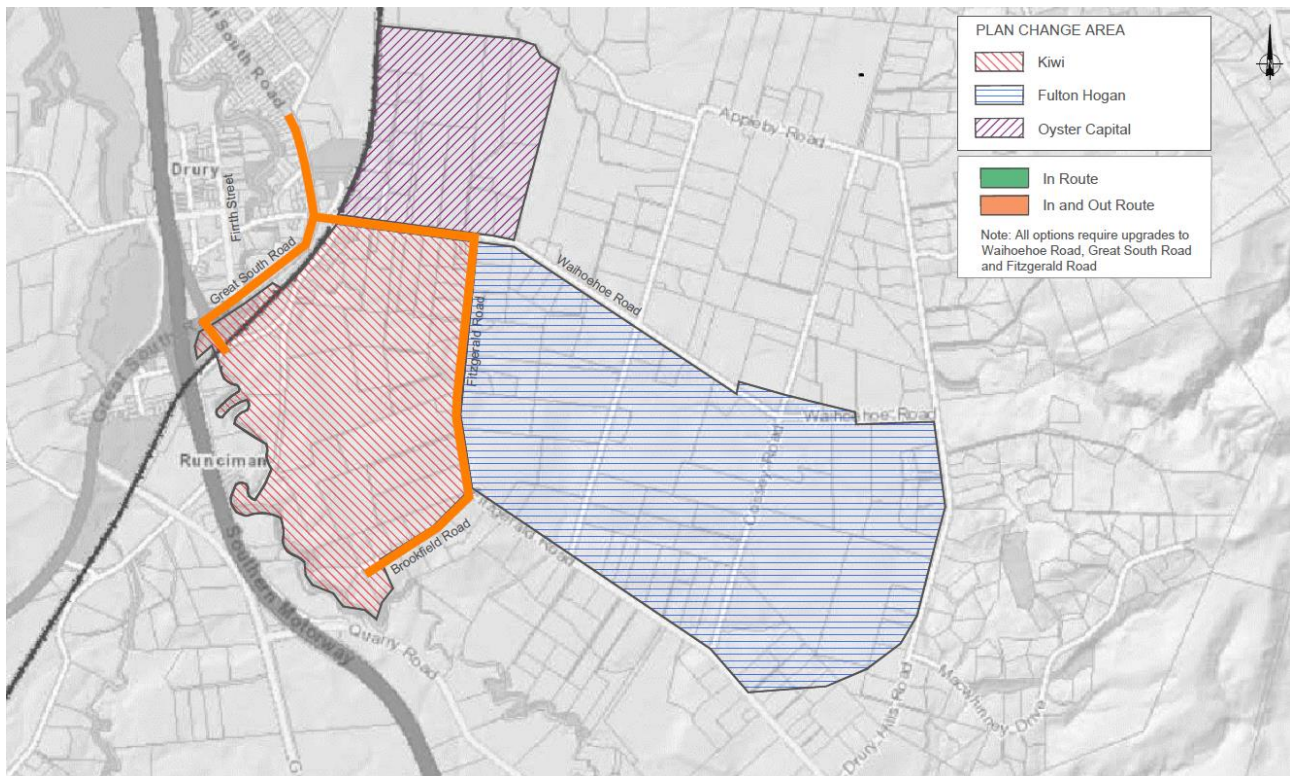


Figure 2-9: Potential Local Upgrades within Drury East (assuming preferred direct access via Drury Interchange)

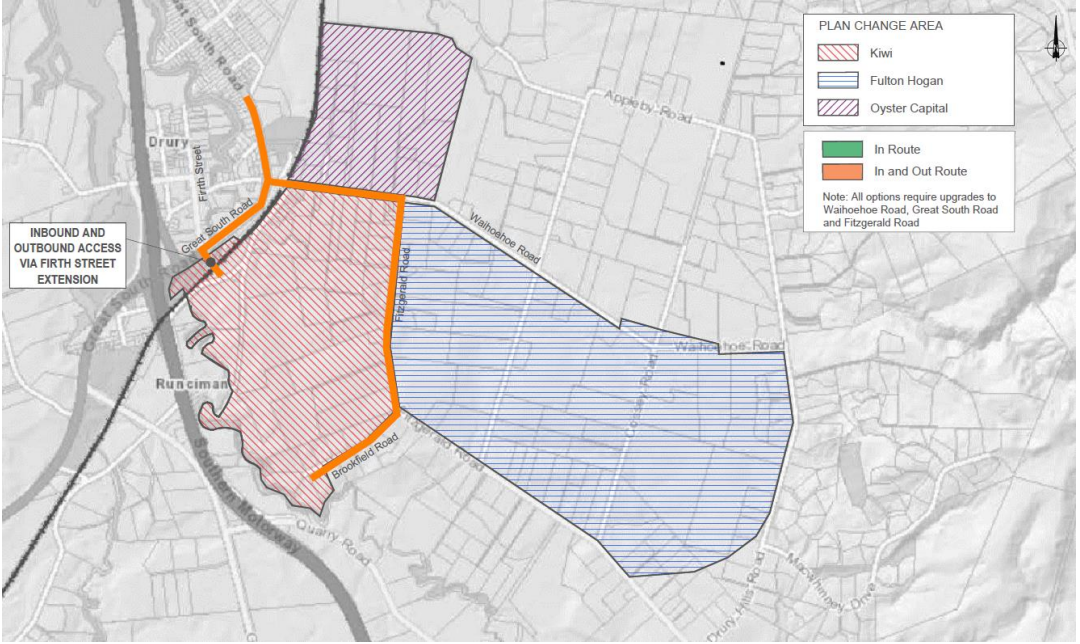
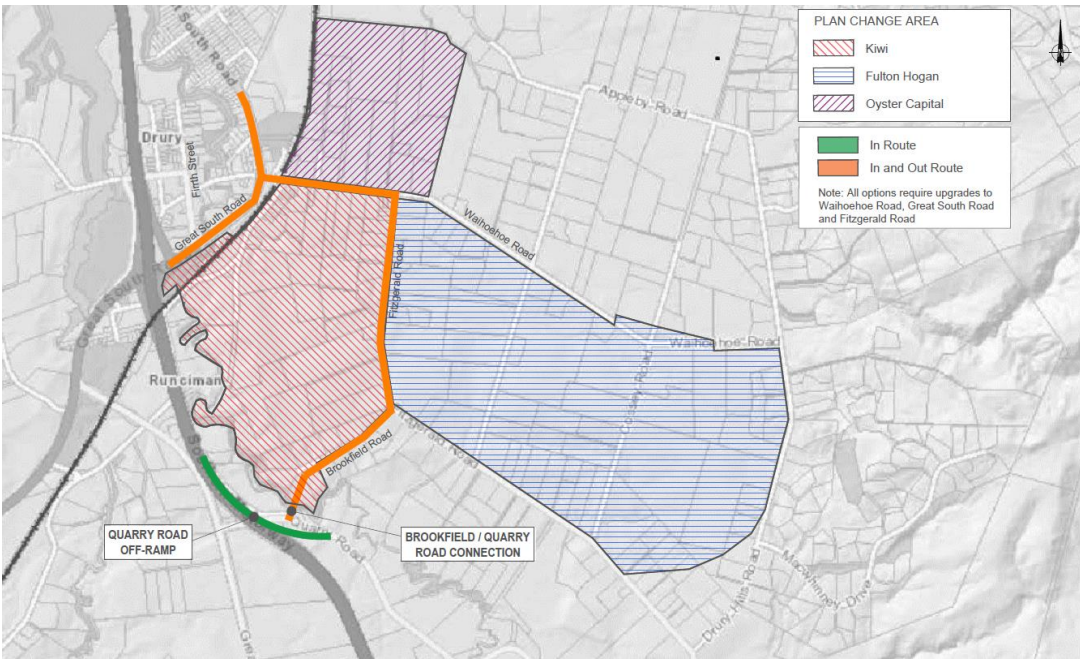
2.7.1 Access to the Metropolitan Centre

Direct and legible access is desirable to the viability of the metropolitan centre and the surrounding residential areas. One potential access location that will fulfil the criterion is a direct access from the Drury Interchange. An access at this location will provide a primary route from SH1 and Great South Road, over the rail line, directly into Drury East Metropolitan centre. From a planning perspective, a direct connection (inbound and outbound) is preferable as it aids wayfinding into the site and general convenience for users (especially in regard to active transportation).

There is also the potential to align the direct access construction with the committed SH1 Drury Interchange upgrades that are planned to occur during Phase 2 of the SH1 Papakura to Drury project. Further liaison with NZTA is required to ensure that the proposed connection is compatible with the interchange upgrade and confirmation around the timing of the Drury interchange upgrade is essential.

Alternatively, a two-way access via Firth Street or an off-ramp via Quarry Road are also feasible in the absence of the above preferred option to provide access to the centre from SH1. These alternative accesses are illustrated in **Table 2-7**.

Table 2-7: Alternative Options for Access to Metropolitan Centre

Alternative Access Options	Description and Diagram
Firth Street	<p>Inbound and outbound via Firth Street, upgraded Great R / Waihoehoe intersection, 2028 Constrained + road upgrades to Waihoehoe Road and Fitzgerald Road.</p> 
Quarry Road	<p>Quarry Road Off-Ramp (Brookfield / Quarry Road Connection) + upgraded Great South Road / Waihoehoe Road intersection, road upgrades to Waihoehoe Road and Fitzgerald Road.</p> 

Modelling of the above alternative options, along with several others, have been undertaken previously and reported in the Drury East Modelling Report Rev B dated 18 June 2019. In the aforementioned document, the preferred direct access, Firth Street access, and Quarry Road access are referred to as

Option 1A, Option 3, and Option 2B respectively. **It is noted that the modelling results show that all access options, when considered separately, result in acceptable traffic conditions.**

In reality, the implementation of any new access to the Metropolitan Centre can be provided in stages at an appropriate rate as the centre development unfolds. It is noted that a provision of access from SH1 will have more notable impact on the scale and timing of other transport upgrades in Drury East, compared to other potential access locations. Regardless, as noted before, the modelling undertaken has considered the impact of different scenarios for accessing the Metropolitan Centre; both with and without the direct access from SH1.

2.7.2 Great South Road / Waihoehoe Road Intersection Upgrade

The Great South Road / Waihoehoe Road roundabout currently serves as the main access to Drury East to and from SH1. The existing roundabout is currently constrained and congested particularly during the AM peak hour when the northbound traffic demand is high. The single lane approaches to the roundabout on the west and south legs are the key limiting factor on its current performance. It is also noted that the current SH1 roadworks associated with the Southern Corridor Improvements project is constraining the SH1 capacity and has resulted in some rat-running through the arterial network via the roundabout.

To cater for the future land use and travel demand in Drury East, an upgrade to the current intersection is needed. It is envisioned that the roundabout will be upgraded to a signalised intersection, with higher capacity on each intersection leg and provision for pedestrian crossings. This requirement for an upgrade has been assessed through modelling and is discussed in later sections. **It is noted that the upgrade can be provided in stages throughout the decades, as noted in relevant later sections.**

Future improvements to this roundabout have also been considered in the transport study for the live-Auranga precinct.

2.7.3 Other Local Upgrades

2.7.3.1 Great South Road and Waihoehoe Road Upgrades

The future upgrade to Great South Road involves four-laning the road between the Drury Interchange to approximately 400m north of the Great South Road / Waihoehoe Road roundabout. A similar upgrade to Waihoehoe Road between the roundabout and Fitzgerald Road is also considered important.

The widening of Great South Road and Waihoehoe Road will complement the upgrade to the Great South Road / Waihoehoe Road roundabout and as such should ideally be simultaneously implemented. As later discussed in **Section 3.1.3**, there will be widening required at the approaches of the signalised intersection to accommodate the turning volumes and queues.

Within the first two decades, the two-way traffic volumes at the Great South Road and Waihoehoe Road corridors can reach 22,000 and 31,000 vehicles per day (**vpd**), respectively. Further breakdown of the link volume growth over the years in the first decade is included in **Section 3.1**. According to the Highway Capacity Manual (**HCM**), such level of daily volumes should be accommodated on a four-lane corridor. This supports the case for the four-laning of Great South Road and Waihoehoe Road within the two decades, and discussed in detail in **Section 3.1.4**.

However, as already noted above, depending on the actual rate of development in Drury East, the upgrades may be delivered progressively to suit.

2.7.3.2 Fitzgerald Road and Brookfield Road Urbanisation

Other local upgrades that are considered important to complement and serve the development are the urbanisation of Fitzgerald Road and Brookfield Road. Eventually this will result in the roads transforming to urban collector standard.

Similar to the Great South Road and Waihoehoe Road upgrades, the urbanisation will be driven by the desire to unlock the appropriate 'place-function' of the corridor, that will enhance the Town Centre. As such, this will depend on the actual development rate and can in fact be upgraded progressively as development occurs. At the current target build out rates, while it is considered ideal that these are provided within the first decade, it is noted that the necessity does not originate from a capacity

perspective. Therefore, the urbanisation of the Fitzgerald Road and Brookfield Road are not considered key infrastructure upgrades and therefore have not been included in further discussions.

It is also noted that some improvements to Fitzgerald Road, including the upgrading of the right turn bay on Waihoehoe Road at the Waihoehoe Road/Fitzgerald Road intersection, are a requirement for development occurring in Drury South.

3. Modelling Results

Stantec has undertaken extensive traffic modelling of the current and future network to investigate and understand the effects of various development land use scenarios on the surrounding network and to determine which infrastructure is required at certain decades to unlock the proposed development.

The future network assumptions are based on the SGA assumptions and considers the assumed local upgrades as discussed in **Section 2.6** and **2.7**, for each decade until 2048+.

It is noted that while the modelling has considered the traffic effects on the wider network, the focus of the assessment and reporting is on the Drury Interchange and the Great South Road / Waihoehoe Road intersection, due to their relevance to the developments.

The modelling results are summarised in **Appendix C**. SATURN plots and SIDRA movement summary results are available in **Appendix D** and **Appendix E**, respectively.

3.1 Prior to 2028

Drury East developers have projected the desired build out rates prior to 2028, based on the assumption that development land will be ready by 2021 for civil works to commence in the next available earthworks season. The build out rates have been obtained from the B&A memo, dated 27 June 2019, and has been incorporated in Stantec's land use assumptions for modelling.

The SGA ITA assumed that the first set of infrastructure upgrades will be fully completed in 2028. Therefore, it is necessary to establish whether any additional infrastructure is required to enable developer land use prior to the full 2028 upgrades.

In order to determine those requirements, yearly modelling scenarios considering the developer land uses up to the year 2028 on the current (2016 MSM) network have been undertaken. The current timeframe assumptions for the SH1 Papakura to Drury, as outlined in **Section 2.6**, have been considered in the modelling to ensure that the network modelled is realistic.

The key local infrastructure upgrades that were investigated in the first decade modelling, in addition to the committed infrastructure upgrades, include:

1. Direct access to Drury East via Drury Interchange; and
2. Great South Road / Waihoehoe Road Intersection Upgrade.

In order to understand the effect of the traffic generated from the proposed development sites on the surrounding network and the required infrastructure upgrades, a modelling scenario was investigated. The modelling scenario included the future predicted traffic demand with the Great South Road / Waihoehoe Road roundabout unchanged, and without the direct Drury Interchange access into the site. In order to provide a comparison, modelling was also undertaken for the same traffic demand, but with a direct Drury Interchange access.

The effect of the development on the traffic network (in particular the Drury interchange and Great South Road / Waihoehoe Road intersection) was then assessed in further detail.

This was undertaken to illustrate how the roundabout would perform both with and without a direct access. The list of first decade (existing to 2028) scenarios modelled is included in **Table 3-1**.

Table 3-1: First decade scenarios

Land Use (LU)	Network Infrastructure	SH1 Papakura to Bombay	SH1 Drury Interchange Northbound On-ramp & Southbound Off-ramp Configurations	Infrastructure Additional to the Assumed Infrastructure
2023	2016	Stage 1 Phase 1 only (southbound 3 laning)	Single	With and without Drury Interchange Direct Access to Drury East
2024	2016	Stage 1 Complete (Phases 1 and 2) (northbound & southbound 3-laning)	Single	
2025	2016		Single	
2025	2016		Single	
2026	2016		Single	
2027	2016		Single	
2028	2016		Single	
2028	2028 (discussed in the next section)		Single	

It is noted that the first decade modelling has assumed completion of the Phase 2 SH1 Papakura to Drury scheme in 2024. Therefore, from 2024 onwards it is considered the SH1 Papakura to Drury Northbound three-laning is complete.

3.1.1 SH1 Papakura to Bombay Three-Laning

As noted above, the primary modelling has assumed that Stage 1 of the SH1 Papakura to Bombay project is completed by 2024, where three lanes are provided in both the northbound and southbound directions.

Additional modelling has been undertaken at a high level to understand if there would be any significant difference in the local network performance should the northbound three-laning not be implemented according to the assumed timeframe, and instead provided at the end of the first decade (2028) as per the SGA broad assumption for 2028.

Given that the local road network on Drury East (particularly Great South Road and the Great South Road/Waihoehoe Road roundabout) are already constrained, there seems to be no notable differences regardless of whether an additional lane in the northbound direction is provided. The roundabout upgrade to a signalised intersection is required by 2026 regardless of the provision, consistent with the outcomes reported in **Section 3.1.3**.

However, without the three-laning, the delay on the northbound section of SH1 will continue to increase year by year to a predicted maximum of 280 seconds in 2028. This supports the case for NZTA to deliver the three-laning by 2028, as assumed by the SGA.

Therefore, despite the modelling assumption that the three-laning of SH1 Northbound is implemented by the end of 2024, there is no evidence that it is required to support the Drury East development prior to 2028, and therefore does not form part of the required upgrades within the first decade.

Similarly, although the three-laning of SH1 Southbound is assumed to be in place early within the first decade, it is not considered necessary to accommodate the Drury East development prior to 2028 and therefore does not form part of the required upgrades within the first decade.

3.1.2 Great South Road / Waihoehoe Road Roundabout

The modelling of the roundabout performance for the first decade was undertaken using Sidra Intersection, with the traffic demand originating from the SATURN model. The results for the interim years 2023 and 2028, with and without Drury Interchange direct access in place, are reported in **Table 3-2** and **Table 3-3** below.

Table 3-2: Roundabout Performance Modelling Results - without Drury Interchange Direct Access

Scenario – Without Drury Interchange direct access		Worst Level of Service (LoS)	Degree of Saturation (DoS)	Maximum Queue Length (m)	Maximum Delay (s)
2023	AM	B	0.55	33	17
	PM	C	0.75	68	29
2024	AM	B	0.66	53	19
	PM	C	0.73	62	27
2025	AM	C	0.88	138	30
	PM	E	0.94	147	54
2026	AM	F	1.20	740	213
	PM	F	1.13	453	158
2027	AM	F	1.67	1684	627
	PM	F	1.34	953	337
2028	AM	F	1.85	2053	789
	PM	F	1.19	752	196

Table 3-3: Roundabout Performance Modelling Results – with Drury Interchange Direct Access

Scenario – With Drury Interchange Direct Access		Worst Level of Service (LoS)	Degree of Saturation (DoS)	Maximum Queue Length (m)	Maximum Delay (s)
2023	AM	B	0.57	36	18
	PM	B	0.49	31	14
2024	AM	B	0.61	42	19
	PM	B	0.50	31	13
2025	AM	C	0.83	101	24
	PM	B	0.58	40	15
2026	AM	F	1.18	709	197
	PM	B	0.73	65	19
2027	AM	F	1.45	1246	430
	PM	C	0.86	109	28
2028	AM	F	1.75	1798	699
	PM	E	1.01	260	68

The modelling results show that with or without the Drury Interchange direct access to Drury East, the roundabout will have sufficient capacity until 2025. Without the Drury Interchange direct access in place, the roundabout is operating at a constrained capacity in the PM peak in 2025. The main reason for this difference in outcome is because the availability of a direct access at the Interchange means that there will be less demand on the roundabout for traffic originating to and from Drury East, and therefore is expected to ease the traffic demand at the roundabout.

At 2026, regardless of the provision of the direct access, a capacity upgrade is required, either to a larger-capacity roundabout or a signalised intersection. Given that the Drury East Metropolitan Centre development is committed to providing efficient and safe facility for non-motorised users, such as pedestrians and cyclists; **it is considered that a signalised intersection with crossing facility is preferred.**

Should a direct access be selected for implementation, the timeframe may be synchronised with the SH1 Drury Interchange upgrades, which is planned to occur with the Phase 2 of SH1 Papakura to Drury, currently scheduled for completion in 2024.

It may also be possible to delay the upgrade of the roundabout through achievement of adequate additional PT mode shift for Drury East trips. Based on the modelling results, the required additional mode shift to PT in Drury East in the critical peak period (AM Peak) was investigated.

This was assessed by comparing the number of vehicle trips at the roundabout that turn into and out of Waihoehoe Road (as these are trips that could be transferred to PT) for before and after the trigger year. The turn volumes for year 2026 (the first year where the roundabout fails) and year 2028 (the last year in the first decade) have been compared with that of year 2025 (the final year that the roundabout, in its current form, is expected to work). The difference in vehicle trips was then converted to person trips by applying a vehicle occupancy of 1.2 and the mode split recalculated. The results of this adjustment are shown below.

Table 3-4: Assessment of Required Mode Shift to PT to Sustain Roundabout Performance

	Number of trips requiring shift to PT (compared to 2025)	Total car person trips	Total PT passenger trips	Overall PT mode share
Drury East				
Mode Share in first decade (as per SGA / Council MSM)		12,934	1,265	9%
2026	229	12,705	1,494	10%
2028	438	12,496	1,703	12%
Drury West				
Mode Share in first decade (as per SGA / Council MSM)		5,991	1,009	14%

Results from MSM show a lower PT mode share in Drury East (9%) compared to Drury West (14%) even though both are similarly served by PT. This difference is likely due to different connection coding and zone size (assumed centre of mass / walk distance).

The Great South Road / Waihoehoe Road roundabout capacity analysis for 2026 and 2028 tabled above demonstrates that, in the absence of a direct access to the Metropolitan Centre, the PT mode share needs to be in the order of 10% and 12% respectively to maintain an acceptable LOS. Compared to the current MSM assumptions, this is an additional 1% and 3% of mode shift to PT in 2026 and 2028 respectively.

Considering the future PT infrastructure and services that will be in proximity of the Metropolitan Centre, the required mode shares are very likely to be achieved, as well as being a more realistic assumption for Drury

East when compared to Drury West. Further, it is acknowledged that there is potential for congestion on the surrounding network to contribute to the increase in PT uptake for Drury East residents and workers.

3.1.3 Great South Road / Waihoehoe Road Intersection Initial Upgrade

Further modelling has been undertaken to understand the extent of upgrade required to the Great South Road / Waihoehoe Road intersection and how the upgrade can be staged through the decades. Through an iterative process, suitable interim and final layouts of a signalised intersection that will be able to provide an acceptable safety and efficiency performance to all modes throughout 2028, 2038, and 2048 was determined.

In 2026, the upgrade initially includes a staggered pedestrian crossing on the north arm and full pedestrian crossings on the east and south arms. The north, east, and south arms all have four approach lanes, including several short turning lanes. The initial signalised intersection layout is shown in **Figure 3-1**.

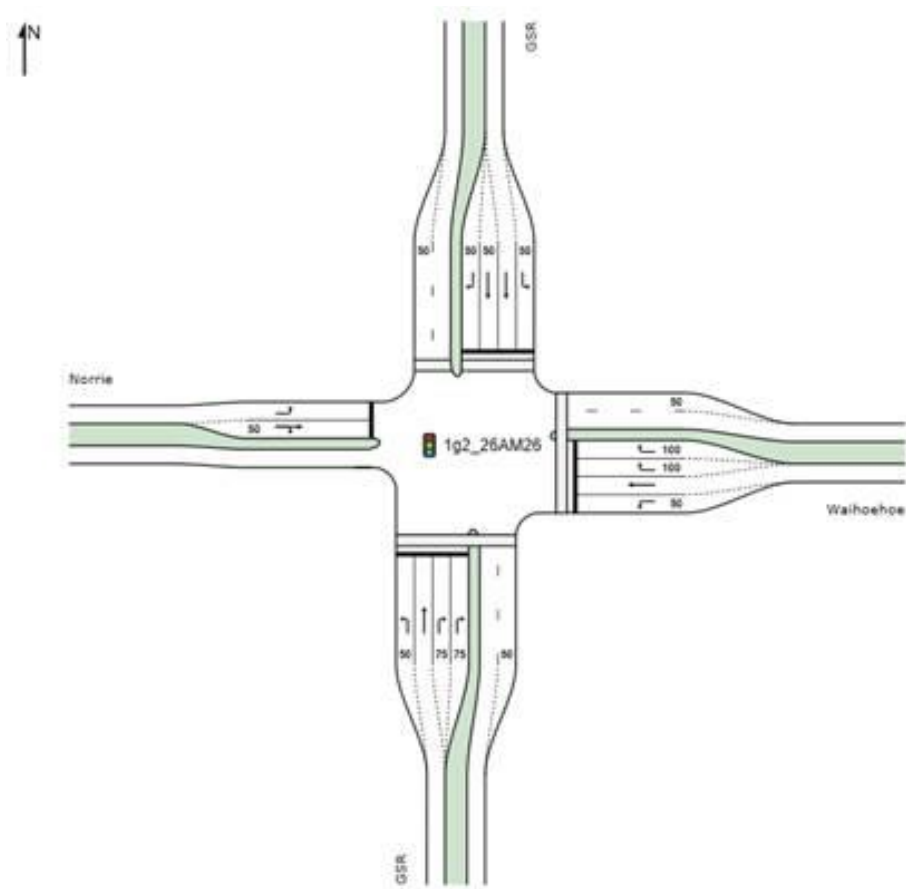


Figure 3-1: 2026 Signalised Intersection Layout

The above layout has been tested with the 2028, 2038 and 2048 land use scenarios, and the required upgrades and the potential staging to implement them have been identified. These are discussed in **Section 3.2** and **Section 3.3**.

It is noted that as the future pedestrian demand through the intersection is unknown, default pedestrian parameters in the modelling software have been retained for the modelling of the later decades; i.e. the 2038 and 2048 land use. However, for the earlier decades, an appropriate adjustment¹⁰ has been made to the model given that low pedestrian demand is expected.

¹⁰ A 50% reduction applied to the Pedestrian Actuation parameter for the 2028 land use modelling of the signalised intersection.

3.1.4 Local Road Upgrades

To understand the likely timeframe for the Waihoehoe Road and Great South Road upgrade, the forecast daily link volumes (in vpd) for the roads have been analysed for each year in the first decade.

The HCM general daily service volumes for urban street facilities (Chapter 16 Exhibit 16-14) indicates that for a two-lane street of similar speed environments, up to 17,900 vehicles/day can be accommodated on the road at LOS E. This is therefore used as a threshold for determining when corridor widening at Great South Road and Waihoehoe Road are needed.

The daily link volumes have been estimated by taking the forecast AM peak volumes of the Waihoehoe Road and Great South Road approaches at the Great South Road / Waihoehoe Road roundabout from the SATURN model and multiplying the peak hour volumes by 10. These volumes are presented in **Table 3-5**.

Table 3-5: Estimated Daily Link Volumes on Waihoehoe Road and Great South Road

Year	Waihoehoe Road (between Great South Road and Drury Boulevard Road) (vpd)	Great South Road (South of Great South Road / Waihoehoe Road Intersection) (vpd)	Great South Road (North of Great South Road / Waihoehoe Road Intersection) (vpd)
Without Drury Interchange Direct Access			
2023	8,700	12,500	12,800
2024	11,500	13,000	12,700
2025	15,500	14,100	13,800
2026	17,700	15,500	15,100
2027	17,500	17,000	16,500
2028	27,700	13,500	17,700
2033	28,500	16,700	18,800
2038 prior to 2038 SGA upgrades	31,000	14,600	22,300
2038 with 2038 SGA upgrades	18,200	10,200	12,500
2048	16,000	12,500	16,000
With Drury Interchange Direct Access			
2023	11,100	14,100	13,200
2024	12,100	14,400	13,700
2025	14,300	15,350	14,600
2026	16,400	15,500	15,500
2027	17,600	15,700	16,600
2028	18,200	14,800	15,700
2033	22,100	14,800	16,700
2038 prior to 2038 SGA upgrades	24,000	12,900	19,800
2038 with 2038 SGA upgrades	13,700	6,800	11,800
2048	11,500	7,800	15,100

From the above breakdown, it can be seen that with or without the Drury Interchange direct access, the daily volume of Waihoehoe Road will increase above 17,900vpd from 2028. The significant increase in the daily flow on Waihoehoe Road without the direct access in place in 2028 is primarily due to the continuously increasing traffic volumes related to the Metropolitan Centre, that would otherwise be travelling via the direct access instead.

The daily volume of Great South Road north of the roundabout will raise to 18,800vpd in 2033 without the direct access, however with direct access this level of demand is observed at some point between 2033 and 2038.

The daily volume of Great South Road south of the roundabout does not seem to exceed the threshold set for widening upgrade. However, it is recommended that the corridor is widened between the Drury Interchange and the intersection at the same time as the Great South Road north of the roundabout, due to the presence of other intersections intermittently throughout the length, its function as a primary PT route, and location of the future rail station and Park & Ride on the section. In addition, further widening on Waihoehoe Road to Fitzgerald Road ideally should be aligned with the above upgrades and the potential upgrade of the right turn lane from Waihoehoe Road to Fitzgerald Road¹¹.

Table 3-6 shows a summary of timeframes for corridor widening based on the results above.

Table 3-6: Timeframe for Corridor Widening

	Waihoehoe Road (between Great South Road / Waihoehoe Road intersection and Drury Boulevard Road)	Great South Road South (between Drury Interchange and the Great South Road / Waihoehoe Road intersection)	Great South Road North (between Great South Road/Waihoehoe Road intersection and East Street)
Without Direct Access	2028	2033	2033
With Direct Access	2028	2033-2038	2033-2038

3.2 2028

The primary aim of modelling the 2028 land use modelling is to understand whether the 2028 network, as planned under the Supporting Growth Programme, will be able to support the developer-led land uses.

The modelling has focused on the performance of SH1 Drury Interchange Northbound On-ramp and Southbound Off-ramp, as these are key indicators of the connectivity and capacity of the network to accommodate the proposed development. The modelling seeks to understand whether improving the Drury Interchange, in terms of its number of lanes on the north-facing ramps or bringing forward the southern Mill Road upgrade¹² is beneficial in helping unlock more land use potential.

Testing of more advanced land use scenarios (i.e. 2033 and 2038 land uses) has also been undertaken on the 2028 network and the above-mentioned network variations. The purpose of the modelling is to understand whether further upgrades will be needed prior to the implementation of the full 2038 network upgrades. The modelling has assumed some minor adjustments to the ramp meter timing, where necessary, in order to reduce delay and queuing of traffic to a reasonable level. In reality, any modification and upgrades to ramp meters are to be determined by NZTA.

The list of Decade 2 scenarios modelled is included in **Table 3-7**.

¹¹ Drury South Industrial Precinct Plan - I410.8.2 f(ii) noting that Drury South will carry out upgrade of the right turn bay on Waihoehoe Rd at its intersection with Fitzgerald Rd, under the scenario where development of the precinct proceeds in advance of the Mill Rd Corridor project.

¹² The Southern Mill Road upgrade comprises of SH1 Drury South interchange, connections to Great South Road on the west and Fitzgerald Road on the east (as per the SGA Extended Network)

Table 3-7: Decade two modelling scenarios

Land Use (LU)	Network	SH1 Papakura to Bombay	SH1 Drury Interchange Northbound On-ramp & Southbound Off-ramp Configurations	Infrastructure Additional to the Assumed Infrastructure
2028	2028	As per SGA Assumptions	Single	Local Intersection Upgrades and Waihoehoe Road widening (with or without a new Metropolitan Centre access)
			Double	Local Intersection Upgrades and Waihoehoe Road widening (with or without a new Metropolitan Centre access)
			Single	Local Intersection Upgrades and Waihoehoe Road widening (with or without a new Metropolitan Centre access) + Mill Road to Fitzgerald
2033	2028	As per SGA Assumptions	Single	Local Intersection Upgrades with a new Metropolitan Centre access and Waihoehoe Road widening, or Local Intersection Upgrades with Waihoehoe Road and Great South Road widening and without a new Metropolitan Centre access.
			Double	Local Intersection Upgrades with a new Metropolitan Centre access and Waihoehoe Road widening, or Local Intersection Upgrades with Waihoehoe Road and Great South Road widening and without a new Metropolitan Centre access.
			Single	Local Intersection Upgrades with a new Metropolitan Centre access and Waihoehoe Road widening + Mill Road to Fitzgerald, or Local Intersection Upgrades with Waihoehoe Road and Great South Road widening and without a new Metropolitan Centre access + Mill Road to Fitzgerald
2038	2028	As per SGA Assumptions	Single	Local Intersection Upgrades, Waihoehoe Road, and Great South Road widening (with or without a new Metropolitan Centre access)
			Double	Local Intersection Upgrades, Waihoehoe Road, and Great South Road widening (with or without a new Metropolitan Centre access)
			Single	Local Intersection Upgrades, Waihoehoe Road, and Great South Road widening (with or without a new Metropolitan Centre access) + Mill Road to Fitzgerald

A summary of the second decade modelling results is presented in **Table 3-8** and **Table 3-10**. For simplicity, only the delays on the SH1 Northbound On-ramp and Southbound Off-ramp are shown. Full modelling results are available in **Appendix C**.

3.2.1 Modelling Results with Provision of Direct Access to Metropolitan Centre

Table 3-8: Decade two SATURN modelling results - Drury Interchange with Direct Access to Metropolitan Centre

Land Use (LU)	Network	SH1 Drury Interchange Northbound On-ramp & Southbound Off-ramp Configurations	Infrastructure Additional to the local upgrades + Supporting Growth Assumptions	Peak Period	Delay (s) at SH1 Drury Interchange	
					Northbound On-ramp	Southbound On-ramp
With New Access to Metropolitan Centre						
2028	2028	Single		AM	319	36
				PM	0	161
		Double		AM	35	22
				PM	1	115
		Single	Mill Road to Fitzgerald	AM	122	31
				PM	0	133
2033	2028	Single		AM	394	43
				PM	0	158
		Double		AM	15	24
				PM	1	108
		Single	Mill Road to Fitzgerald	AM	162	37
				PM	0	152
2038	2028	Single		AM	1177	62
				PM	0	215
		Double		AM	92	54
				PM	1	117
		Single	Mill Road to Fitzgerald	AM	370	47
				PM	0	161

The results show that the SH1 Drury Interchange, while constrained, will be capable of accommodating the future traffic demand in 2028 through to 2033. In 2033, the delay on the SH1 Drury Interchange northbound on-ramp, in its current single-lane form but with an optimised ramp metering, reaches 400 seconds in the AM peak. In an urban context, this level of delay at a peak period is considered acceptable. It is noted that there is opportunity to relieve some pressure at the interchange through increasing (doubling) the

number of lanes at the northbound on-ramp and southbound off-ramp or bringing forward the southern Mill Road connection to Fitzgerald Road.

However, within the second decade (2033-2038), the SH1 Interchange capacity will be exceeded by the traffic demand. The model shows a delay of up to 1200 seconds in 2038 prior to the implementation of the assumed 2038 upgrades. An interim capacity upgrade will be needed to sustain the SH1 Drury Interchange until the implementation of the 2038 network upgrades. The modelling shows that either doubling the SH1 Drury Interchange on-ramp and off-ramp, or bringing forward the southern Mill Road upgrade, will relieve significant pressure on the interchange particularly on the AM peak.

As noted previously, any modification or upgrade to the SH1 ramps, including the ramp meter timing, and the potential effect on the SH1 network will be agreed through consultation with NZTA.

The proposed Great South Road / Waihoehoe Road signalised intersection layout shown in **Figure 3-1** has been modelled in Sidra Intersection software using the 2028 land use.

To accommodate the demand arising from the 2028 land use, several upgrades are needed to the Great South Road / Waihoehoe Road signalised intersection. The upgraded layout is shown in **Figure 3-2**.

The performance of the intersection is reported in **Table 3-9**.

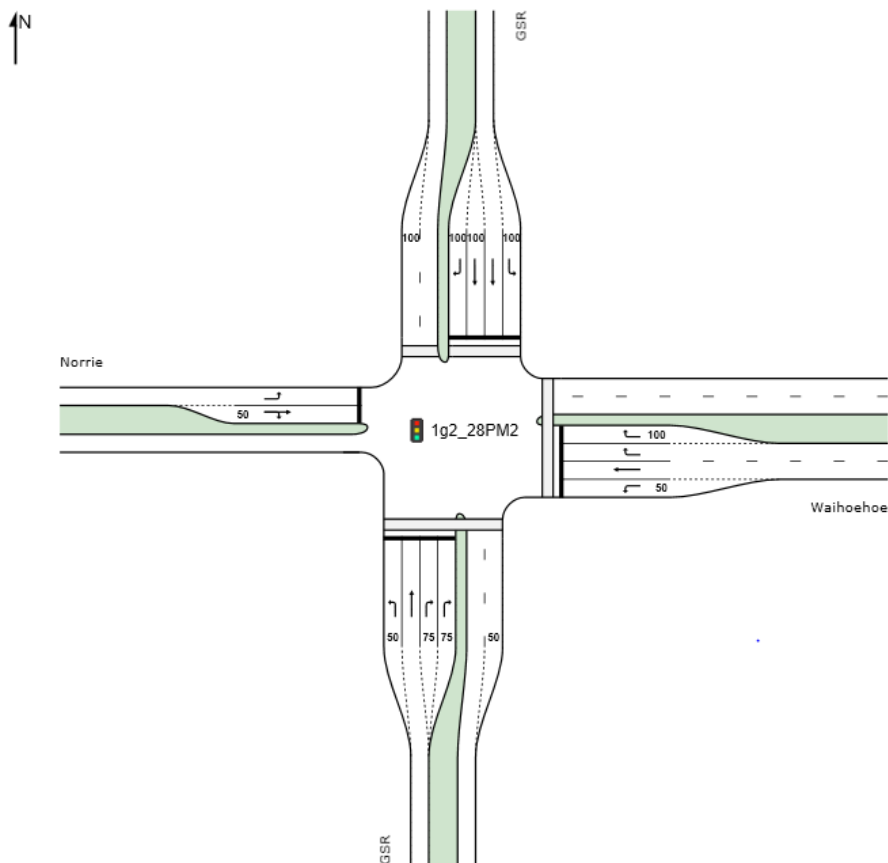


Figure 3-2: 2028 Signalised Intersection Layout

Table 3-9: Decade Two Sidra Modelling Results - Great South Road / Waihoehoe Road Intersection (With Direct Access)

Proposed Great South Road / Waihoehoe Road Signalised Intersection		Level of Service (LoS)	Degree of Saturation (DoS)	Maximum Queue Length (m)	Maximum Delay (s)
2028	AM	D	0.89	257	69
	PM	C	0.89	210	38

The modelling shows that the signalised intersection will perform at an acceptable level of service from a capacity perspective, with a LOS D and C on the morning peak and afternoon peak, respectively, and a maximum queue length of 69m.

3.2.2 Modelling Results without Provision of Direct Access to Metropolitan Centre

Table 3-10: Decade two SATURN Modelling Results - Drury Interchange Without Direct Access to Metropolitan Centre

Land Use (LU)	Network	SH1 Drury Interchange Northbound On-ramp & Southbound Off-ramp Configurations	Infrastructure Additional to the local upgrades + Supporting Growth Assumptions	Peak Period	Delay (s) at SH1 Drury Interchange	
					Northbound On-ramp	Southbound On-ramp
Without Direct Access to Metropolitan Centre						
2028	2028	Single		AM	364	29
				PM	0	162
		Double		AM	32	30
				PM	1	164
		Single	Mill Road to Fitzgerald	AM	115	25
				PM	0	92
2033	2028	Single		AM	432	37
				PM	0	142
		Double		AM	8	38
				PM	1	142
		Single	Mill Road to Fitzgerald	AM	148	30
				PM	0	82
2038	2028	Single		AM	1135	48
				PM	0	208

Land Use (LU)	Network	SH1 Drury Interchange Northbound On-ramp & Southbound Off-ramp Configurations	Infrastructure Additional to the local upgrades + Supporting Growth Assumptions	Peak Period	Delay (s) at SH1 Drury Interchange	
					Northbound On-ramp	Southbound On-ramp
		Double		AM	39	55
				PM	1	204
		Single	Mill Road to Fitzgerald	AM	385	31
				PM	0	85

Modelling of the no direct access to Metropolitan Centre scenario for the second decade shows practically similar results to the previous scenario where direct access is provided. Drury Interchange will be constrained beyond 2028, however, further upgrades will not be necessary within the first half of the second decade. Without any upgrade to the interchange or the network, the delay on the northbound on-ramp in the AM peak will be just over 400 seconds. As noted previously, this is considered acceptable in an urban context.

Further within the second decade (between 2033 and 2038), the interchange capacity will be exceeded by the traffic demand. By 2038, a delay of over 1130 seconds in the AM peak on the northbound on-ramp is observed. An interim capacity upgrade between 2033 and 2038, such as the doubling of the ramps or bringing forward the southern Mill Road upgrade will alleviate the traffic demand and delays at the interchange.

The proposed signalised intersection layout shown in **Figure 3-2** has been modelled in Sidra Intersection software using the 2028 land use assuming no direct access to the Metropolitan Centre. The outcome of the modelling is shown in **Table 3-11**.

Table 3-11: Decade Two Sidra Modelling Results - Great South Road / Waihoehoe Road Intersection (Without Direct Access)

Proposed Great South Road / Waihoehoe Road Signalised Intersection		Level of Service (LoS)	Degree of Saturation (DoS)	Maximum Queue Length (m)	Maximum Delay (s)
2028	AM	D	0.90	238	57
	PM	D	0.89	184	64

The modelling shows that the intersection has sufficient capacity without the direct access to Metropolitan Centre, where both the morning peak and afternoon peak experiences LOS D and similar level of queues and delays.

It is noted however that if the PT uptake on Drury East is similar to what has been predicted for Drury West, the future performance of the signalised intersection is expected to improve.

3.3 2038 and 2048+

By 2038 and 2048+, according to the Supporting Growth Programme, extensive network upgrades will have been delivered within the Drury-Opaheke area that will significantly increase the overall network capacity and create a conducive transport environment to housing and commercial development.

Modelling of the 2038 and 2048+ land use scenarios on the respective network has been undertaken to confirm that the developer-led land uses can be accommodated efficiently in the network particularly at

the SH1 Drury Interchange. The modelling has assumed that the north-facing ramps at the interchange remain at one-lane, which is considered conservative given that it is likely to be upgraded as part of the SH1 Papakura to Drury upgrade scheduled for 2028. This is not to be confused with the model results reported in the previous sections which indicate that an interim capacity upgrade in the form of either ramp-doubling or Mill Road southern connection is required, in the absence of the assumed 2038 and 2048 Supporting Growth Programme upgrades.

The list of Decades 3 and 4 scenarios modelled is included in **Table 3-12**.

Table 3-12: Decade Three Modelling Scenarios

Land Use (LU)	Network	SH1 Papakura to Bombay	SH1 Drury Interchange Northbound On-ramp & Southbound Off-ramp Configurations	Infrastructure Additional to the Assumed Infrastructure
2038	2038	As per SGA Assumptions	Single	All Local Upgrades (with or without a new Metropolitan Centre access)
2048+	2048+	As per SGA Assumptions	Single	All Local Upgrades (with or without a new Metropolitan Centre access)

Beyond 2038, the critical transportation network upgrades in the Drury – Opaheke area such as the full SH1 Papakura to Bombay, SH1 Drury South Interchange, Mill Road full route, and Pukekohe Expressway are expected to be in place. These upgrades altogether will significantly improve the network connectivity, capacity and resilience, and will in turn relieve the pressure on the SH1 Drury Interchange.

The modelling results for the third decade land use and network scenarios are presented in **Table 3-13** and **Table 3-14** where the direct access to Metropolitan Centre is included, and **Table 3-15** and **Table 3-16** where the direct access to Metropolitan Centre is excluded.

3.3.1 Modelling Results with Provision of Direct Access to Metropolitan Centre

Table 3-13: Decade Three SATURN modelling results - Drury Interchange

Land Use (LU)	Network	SH1 Drury Interchange Northbound On-ramp & Southbound Off-ramp Configurations	Peak Period	Delay (s) at SH1 Drury Interchange	
				Northbound On-ramp	Southbound On-ramp
With Direct Access to Metropolitan Centre					
2038	2038	Single	AM	1	20
			PM	0	36
2048+	2048+	Single	AM	2	26
			PM	0	32

As evidenced by the modelling results, the SH1 Drury Interchange shows an acceptable capacity performance in 2038 through to 2048+. Given that all the critical upgrades are delivered, the delays on the SH1 Drury Interchange northbound on-ramp and southbound off-ramp are very low (less than 1 minute on any peak period) even with a single-lane ramp. Given the high likelihood that the SH1 Drury Interchange upgrades would result in an increase to the ramps capacity, the modelling results are considered conservative. The remainder of the SATURN network appears to also operate in a satisfactory manner.

The proposed signalised intersection layout has also been tested using the 2038 and 2048 land uses.

The upgraded signalised intersection layout that needs to be provided to accommodate the 2038 demand is shown in **Figure 3-3**. In addition to the 4-laning of the Great South Road and Waihoehoe Road as discussed in **Section 3.1.4**, it includes the following upgrades:

- Waihoehoe Road (east arm): Reallocation of turning lanes
- Norrie Road (west arm): Additional left-turn short lane
- Conversion to full pedestrian crossing on the north arm (from staggered)

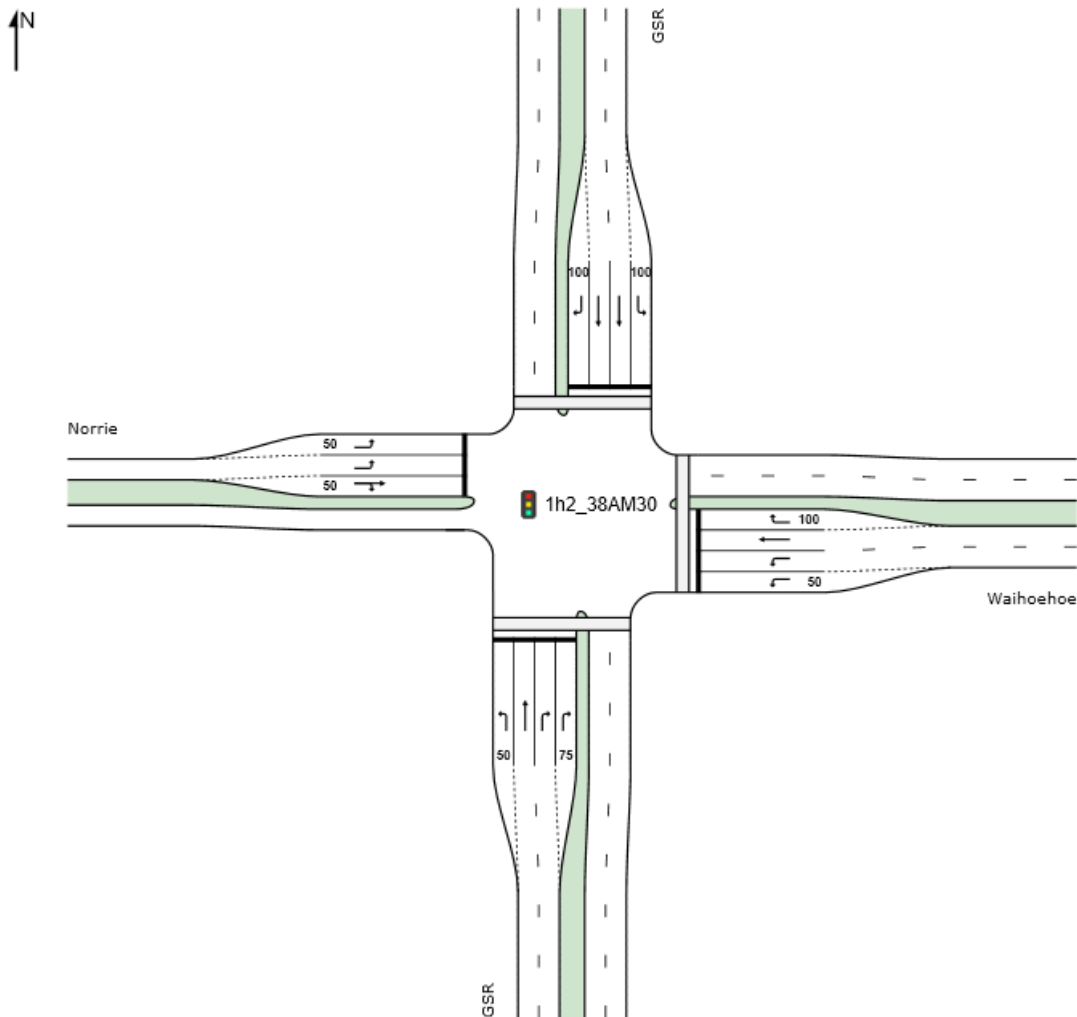


Figure 3-3: 2038 Signalised Intersection Layout

The upgraded signalised intersection layout that needs to be provided to accommodate the 2048 demand is shown in **Figure 3-4**. Additional upgrades that are required further to the 2038 layout shown above are the reallocation of turning lanes on the Great South Road North and Waihoehoe Road, the lengthening of the left-turn short lane on Waihoehoe Road, and the provision of additional short exit lane on Norrie Road.

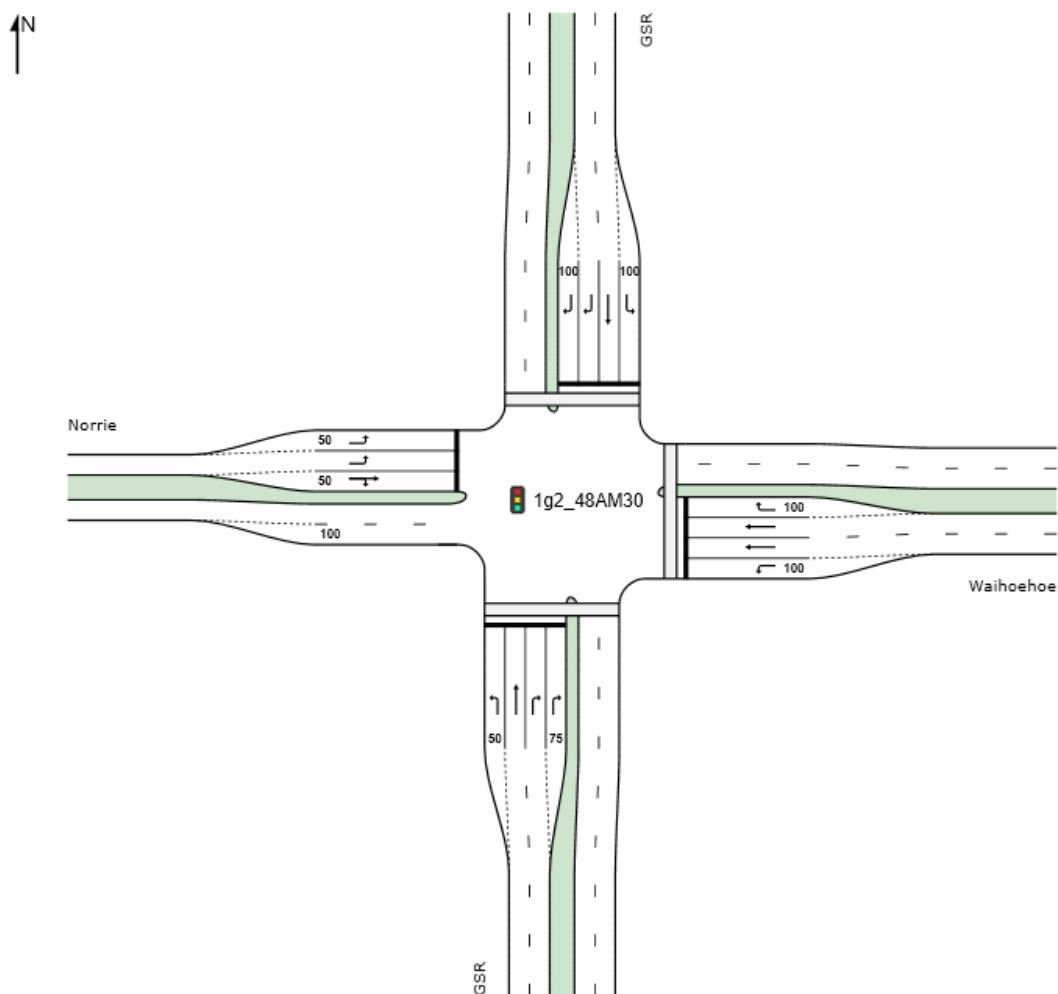


Figure 3-4: 2048 Signalised Intersection Layout

The outcome of the modelling of the signalised intersection with the 2038 and 2048 demand, with direct access in place, is shown in **Table 3-14**.

Table 3-14: Decade Three Sidra Modelling Results - Great South Road / Waihoehoe Road Intersection (With Direct Access)

Proposed Great South Road / Waihoehoe Road Signalised Intersection		Level of Service (LoS)	Degree of Saturation (DoS)	Maximum Queue Length (m)	Maximum Delay (s)
2038	AM	D	0.85	69	44
	PM	D	0.87	216	56
2048	AM	D	0.86	100	44
	PM	D	0.85	182	61

The modelling shows that the signalised intersection will perform at an acceptable LOS D throughout the second and third decades. However, there is generally a reduction in the maximum predicted queue length compared to 2028, particularly in the morning peak. This was expected given the extensive network upgrades that will take place by 2038 and will take more pressure off the Great South Road / Waihoehoe Road Intersection. It is noted again that by 2038, the staggered pedestrian crossing across the north intersection arm can be converted into a full crossing. The conversion will benefit active-users travelling east – west at the intersection.

3.3.2 Modelling Results without Provision of Direct Access to Metropolitan Centre

Table 3-15: Decade Three SATURN modelling results - Drury Interchange

Land Use (LU)	Network	SH1 Drury Interchange Northbound On-ramp & Southbound Off-ramp Configurations	Peak Period	Delay (s) at SH1 Drury Interchange	
				Northbound On-ramp	Southbound Off-ramp
Without new access to Metropolitan Centre					
2038	2038	Single	AM	1	15
			PM	0	25
2048+	2048+	Single	AM	1	21
			PM	0	24

The modelling results show that without the direct access, the SH1 Drury Interchange also shows an acceptable capacity performance in 2038 throughout to 2048+. Similar to the scenario where direct access is in place, the satisfactory results are expected as all key upgrades to the infrastructure have been delivered by 2038. The remainder of the SATURN network appears to also operate in a satisfactory manner.

The proposed signalised intersection layouts shown in **Figure 3-3** and **Figure 3-4** have also been tested using the 2038 and 2048 land uses respectively, assuming no direct access to the Metropolitan Centre. The outcome of the modelling is shown in **Table 3-16**.

Table 3-16: Decade Three Sidra Modelling Results - Great South Road / Waihoehoe Road Intersection (Without Direct Access)

Proposed Great South Road / Waihoehoe Road Signalised Intersection		Level of Service (LoS)	Degree of Saturation (DoS)	Maximum Queue Length (m)	Maximum Delay (s)
2038	AM	D	0.77	91	40
	PM	D	0.85	110	45
2048	AM	D	0.90	183	63
	PM	E	1.00	293	115

The modelling shows that the signalised intersection will perform at LOS D through the second decade, with a slight drop in performance to LOS E in the third decade. Although this indicates that there may be further optimisation required to the intersection beyond 2048, the timeframe is very far into the future and therefore cannot be predicted with certainty.

Therefore, it is concluded that beyond 2038, the signalised intersection with full pedestrian crossings across the north, east, and south arms will be sufficient for the future traffic demand, regardless the provision of the direct access to Metropolitan Centre.

4. Development Threshold

Triggers for infrastructure upgrades have been identified based on the modelling results and the predicted Drury East developers' land use assumptions. These triggers are referred to as the 'development thresholds'.

The development thresholds are presented in two formats:

1. The level of land use for residential (in dwelling units), and commercial and retail park in gross floor area (**GFA**). **Table 4-1** summarises the thresholds given that the direct access to Metropolitan Centre is provided, and **Table 4-2** summarises the thresholds should the direct access to Metropolitan Centre not be provided.
2. The inbound and outbound trips generated in vehicles per hour (**vph**), in the morning and the afternoon peak hours. **Table 4-3** summarises the thresholds given that the direct access to Metropolitan Centre is provided, and **Table 4-4** summarises the thresholds should the direct access to Metropolitan Centre not be provided.

The land use thresholds indicate the new and additional development that can be implemented within the Drury East area, on top of what currently exists. The residential land use is determined in accordance with the methodology set out in Section 2.3. The commercial and retail park development thresholds have been approximated based on the land use assumptions within the MSM and adjusted using the developers target commercial and retail build rates. The thresholds correspond to the land use within MSM Zone 554 and 555, within which Kiwi, Fulton Hogan, and Oyster Capital properties are contained.

The inbound and outbound trips thresholds indicate the overall inbound and outbound trips in the peak hours, to and from the MSM Zone 554 and 555. The access points considered in the assessment are the direct access (where assumed available), the Great South Road/Waihoehoe Road intersection, Quarry Road, Opaheke Road (following its implementation), and Mill Road southern connection (following its implementation).

The thresholds correspond to the MSM Zone 554 and 555, within which Kiwi, Fulton Hogan, and Oyster Capital properties are contained.

Therefore, given the current understanding of the networks, the additional number of dwellings, retail and commercial GFA (in sqm), or the overall trip generation within the Drury East Zone 554 and 555 should not reach or exceed the following thresholds outlined respectively in **Table 4-1** and **Table 4.2**, or **Table 4-3** and **Table 4-4**, until such time that the identified infrastructure upgrades are constructed.

The precinct provisions for Drury East development contain a number of methodology options for assessing the development triggers based on the thresholds set out below.

Table 4-1: Development Thresholds for Infrastructure Upgrades – With Drury Interchange Direct Access

Timeframe	Drury East Development Threshold			Infrastructure Upgrade Required
	Residential (Dwellings)	Retail (GFA)	Commercial (GFA)	
With Direct Access to Metropolitan Centre				
2026	1,310 units	23,680m²	13,200m²	Upgrade to the Great South Road/Waihoehoe Road intersection
2028	2,172 units	39,830m²	22,200m²	Upgrade Waihoehoe Road to increase to four lanes between Great South Road/Waihoehoe intersection and the Drury Boulevard. Upgrade to Great South Road/Waihoehoe Road intersection to lengthen the approach, turning and exit lanes on Great South Road northern approach SH1 three-laning to Drury (funded) SH22 widening to Karaka (funded) Rail Electrification Papakura to Pukekohe (funded) New Drury East and West Stations (not funded but temporary stations can be provided as part of rail electrification to Pukekohe)
2033-2038	4,023 units	73,200m²	40,800m²	Upgrade to Great South Road to increase to four lanes between the Drury Interchange and to 400m north of the Great South Road/Waihoehoe Road intersection. Upgrade Waihoehoe Road to increase from two lanes to four lanes between Drury Boulevard and Fitzgerald Road. And one of the following upgrades in addition to the above upgrades: <ul style="list-style-type: none">Upgrade the Drury Interchange to double the northbound on-ramp and south bound off-ramps at the Drury interchange; orUpgrades to provide the Drury South Interchange and the Mill Road Corridor from Drury Interchange to Fitzgerald Road.
2038	4,640 units	83,960m²	46,800m²	Upgrade to Great South Road/Waihoehoe Road intersection to add an additional left-hand turn lane on the Norrie Road approach and reallocate lanes on the Waihoehoe Road approach. SH1 3-laning Drury to Bombay SH1 Drury South Interchange Mill Road full route Pukekohe Expressway full route Opaheke Road (Papakura to Waihoehoe Road)
2048	6,428 units	107,650m²	60,000m²	Upgrade to Great South Road/Waihoehoe Road intersection to provide an additional exit lane on Norrie Road, reallocate lanes on the Waihoehoe and Great South Road approaches, and increase the length of the left-turn lane on the Waihoehoe Road approach. Third Main Rail Line Pukekohe to Papakura

Table 4-2: Development Thresholds for Infrastructure Upgrades – Without Drury Interchange Direct Access

Timeframe	Drury East Development Threshold			Infrastructure Upgrade Required
	Residential (Dwellings)	Retail (GFA)	Commercial (GFA)	
Without Direct Access to Metropolitan Centre				
2026	1,310 units	23,680m²	13,200m²	Upgrade to the Great South Road/Waihoehoe Road intersection
2028	2,172 units	39,830m²	22,200m²	Upgrade Waihoehoe Road to increase to four lanes between Great South Road/Waihoehoe intersection and the Drury Boulevard. Upgrade to Great South Road/Waihoehoe Road intersection to lengthen the approach, turning and exit lanes on Great South Road northern approach SH1 three-laning to Drury (funded) SH22 widening to Karaka (funded) Rail Electrification Papakura to Pukekohe (funded) New Drury East and West Stations (not funded but temporary stations can be provided as part of rail electrification to Pukekohe)
2033	3,406 units	62,430m²	34,800m²	Upgrade to Great South Road to increase to four lanes between the Drury Interchange and to 400m north of the Great South Road/Waihoehoe Road intersection. Upgrade Waihoehoe Road to increase from two lanes to four lanes between Drury Boulevard and Fitzgerald Road
2033 - 2038	4,023 units	73,200m²	40,800m²	One of the following upgrades: <ul style="list-style-type: none">Upgrade the Drury Interchange to double the northbound on-ramp and south bound off-ramps at the Drury interchange; orUpgrades to provide the Drury South Interchange and the Mill Road Corridor from Drury Interchange to Fitzgerald Road
2038	4,640 units	83,960m²	46,800m²	Upgrade to Great South Road/Waihoehoe Road intersection to add an additional left-hand turn lane on the Norrie Road approach and reallocate lanes on the Waihoehoe Road approach SH1 three-laning Drury to Bombay SH1 Drury South Interchange Mill Road full route Pukekohe Expressway full route Opaheke Road (Papakura to Waihoehoe Road)
2048	6,428 units	107,650m²	60,000m²	Upgrade to Great South Road/Waihoehoe Road intersection to provide an additional exit lane on Norrie Road, reallocate lanes on the Waihoehoe and Great South Road approaches, and increase the length of the left-turn lane on the Waihoehoe Road approach. Third Main Rail Line Pukekohe to Papakura

Table 4-3 Trip Generation Thresholds for Infrastructure Upgrades – With Drury Interchange Direct Access

Time-frame	Drury East Trip Generation Thresholds		Infrastructure Upgrade Required
	Inbound Trip Generation in vehicles per hour (vph)	Outbound Trip Generation in vehicles per hour (vph)	
With Direct Access to Metropolitan Centre			
2026	AM Peak: 910 PM Peak: 1,430	AM Peak: 1,230 PM Peak: 1,150	Upgrade to the Great South Road/Waihoehoe Road intersection
2028	AM Peak: 1,130 PM Peak: 1,870	AM Peak: 1,660 PM Peak: 1,410	Upgrade Waihoehoe Road to increase to four lanes between Great South Road/Waihoehoe intersection and the Drury Boulevard. Upgrade to Great South Road/Waihoehoe Road intersection to lengthen the approach, turning and exit lanes on Great South Road northern approach SH1 three-laning to Drury (funded) SH22 widening to Karaka (funded) Rail Electrification Papakura to Pukekohe (funded) New Drury East and West Stations (not funded but temporary stations can be provided as part of rail electrification to Pukekohe)
2033-2038	AM Peak: 1,630 PM Peak: 2,220	AM Peak: 2,160 PM Peak: 1,790	Upgrade to Great South Road to increase to four lanes between the Drury Interchange and to 400m north of the Great South Road/Waihoehoe Road intersection. Upgrade Waihoehoe Road to increase from two lanes to four lanes between Drury Boulevard and Fitzgerald Road. And one of the following upgrades in addition to the above upgrades: <ul style="list-style-type: none">Upgrade the Drury Interchange to double the northbound on-ramp and south bound off-ramps at the Drury interchange; orUpgrades to provide the Drury South Interchange and the Mill Road Corridor from Drury Interchange to Fitzgerald Road.
2038	AM Peak: 1,850 PM Peak: 2,470	AM Peak: 2,450 PM Peak: 2,000	Upgrade to Great South Road/Waihoehoe Road intersection to add an additional left-hand turn lane on the Norrie Road approach and reallocate lanes on the Waihoehoe Road approach. SH1 three-laning Drury to Bombay SH1 Drury South Interchange Mill Road full route Pukekohe Expressway full route Opaheke Road (Papakura to Waihoehoe Road)
2048	AM Peak: 3,230 PM Peak: 4,320	AM Peak: 3,780 PM Peak: 4,300	Upgrade to Great South Road/Waihoehoe Road intersection to provide an additional exit lane on Norrie Road, reallocate lanes on the Waihoehoe and Great South Road approaches, and increase the length of the left-turn lane on the Waihoehoe Road approach. Third Main Rail Line Pukekohe to Papakura

Table 4-4: Trip Generation Thresholds for Infrastructure Upgrades – Without Drury Interchange Direct Access

Timeframe	Drury East Trip Generation Thresholds		Infrastructure Upgrade Required
	Inbound Trip Generation in vehicles per hour (vph)	Outbound Trip Generation in vehicles per hour (vph)	
Without Direct Access to Metropolitan Centre			
2026	AM Peak: 790 PM Peak: 1,110	AM Peak: 1,100 PM Peak: 840	Upgrade to the Great South Road/Waihoehoe Road intersection
2028	AM Peak: 970 PM Peak: 1,600	AM Peak: 1,490 PM Peak: 1,150	Upgrade Waihoehoe Road to increase to four lanes between Great South Road/Waihoehoe intersection and the Drury Boulevard. Upgrade to Great South Road/Waihoehoe Road intersection to lengthen the approach, turning and exit lanes on Great South Road northern approach SH1 three-laning to Drury (funded) SH22 widening to Karaka (funded) Rail Electrification Papakura to Pukekohe (funded) New Drury East and West Stations (not funded but temporary stations can be provided as part of rail electrification to Pukekohe)
2033	AM Peak: 1,360 PM Peak: 1,820	AM Peak: 1,810 PM Peak: 1,430	Upgrade to Great South Road to increase to four lanes between the Drury Interchange and to 400m north of the Great South Road/Waihoehoe Road intersection. Upgrade Waihoehoe Road to increase from two lanes to four lanes between Drury Boulevard and Fitzgerald Road
2033 - 2038	AM Peak: 1,500 PM Peak: 2,130	AM Peak: 2,030 PM Peak: 1,700	One of the following upgrades: <ul style="list-style-type: none">Upgrade the Drury Interchange to double the northbound on-ramp and south bound off-ramps at the Drury interchange; orUpgrades to provide the Drury South Interchange and the Mill Road Corridor from Drury Interchange to Fitzgerald Road
2038	AM Peak: 1,640 PM Peak: 2,430	AM Peak: 2,240 PM Peak: 1,960	Upgrade to Great South Road/Waihoehoe Road intersection to add an additional left hand turn lane on the Norrie Road approach and reallocate lanes on the Waihoehoe Road approach SH1 three-laning Drury to Bombay SH1 Drury South Interchange Mill Road full route Pukekohe Expressway full route Opaheke Road (Papakura to Waihoehoe Road)
2048	AM Peak: 3,160 PM Peak: 4,200	AM Peak: 3,720 PM Peak: 4,190	Upgrade to Great South Road/Waihoehoe Road intersection to provide an additional exit lane on Norrie Road, reallocate lanes on the Waihoehoe and Great South Road approaches, and increase the length of the left-turn lane on the Waihoehoe Road approach. Third Main Rail Line Pukekohe to Papakura

5. Conclusions

Modelling has been undertaken to assess the effect of the proposed development within Drury East by Kiwi Property, Fulton Hogan, and Oyster Capital. The assessment period spans three decades, between the start of the development in 2023 through to 2048. The assessment has considered the SGA's future transport network, and further adjusted the SGA land use assumptions to align with the developers target build rates.

In general, the modelling has found that the rezoning can be accommodated by the surrounding transport network, with several targeted local upgrades recommended within the first two decades. These are primarily the provision of access to the Metropolitan Centre (preferably the direct access via Drury Interchange, if feasible), the signalisation of the Great South Road / Waihoehoe Road roundabout prior to 2028, and a network capacity upgrade prior to 2038 which could be achieved through doubling the northbound ramps at the Drury Interchange or an earlier provision of the Southern Mill Road connection to Fitzgerald Road. The 2038 and 2048+ traffic modelling is satisfactory as all the key infrastructure required to support the growth is anticipated to have been implemented within those decades.

A more conservative scenario which considers no provision of direct access to the Metropolitan Centre has also been modelled and analysed. The modelling shows that without the direct access to Metropolitan Centre, some local upgrades within the development site will need to be provided earlier, such as the widening of Great South Road and Waihoehoe Road between Drury Boulevard Road and Fitzgerald Road. Similar to when the direct access is provided, a network capacity upgrade prior to 2038 through doubling the northbound ramps at the Drury Interchange or an earlier provision of the Southern Mill Road connection to Fitzgerald Road will be required. Following the 2038 and 2048+ infrastructure upgrades, traffic modelling shows that the network performance will be satisfactory.

It is noted that the provision of the new access to the Metropolitan Centre does not affect the Great South Road / Waihoehoe Road signalised intersection upgrade staging, as the modelling has demonstrated.

Therefore, the Drury East plan change can be supported from a traffic perspective and is unlikely to have a significant adverse effect on the traffic network, given that the infrastructure required to support the development is implemented.

Further refinement to the design of the additional upgrades identified in the memo will be undertaken as the consenting process progresses.

Summary of the infrastructure upgrades that will be required through the next three decades, as assumed by the SGA and as found by the Drury East Modelling is shown in **Table 5-1**.

Table 5-1: Summary of Drury Infrastructure Upgrades

Year	TFUG / SGA Assumed Infrastructure	Other Infrastructure Upgrades as per Drury East Modelling
With Drury Interchange Direct Access to Metropolitan Centre		
2026		Upgrade to the Great South Road/Waihoehoe Road intersection
2028	SH1 3-laning Papakura to Drury SH22 widening to Karaka Rail Electrification Papakura to Pukekohe New Drury East and West Stations	Upgrade Waihoehoe Road to increase to four lanes between Great South Road/Waihoehoe intersection and the Drury Boulevard. Upgrade to Great South Road/Waihoehoe Road intersection to lengthen the approach, turning and exit lanes on Great South Road northern approach
2033 - 2038		Upgrade to Great South Road to increase to four lanes between the Drury Interchange and to 400m north of the Great South Road/Waihoehoe Road intersection; and Upgrade Waihoehoe Road to increase from two lanes to four lanes between Drury Boulevard and Fitzgerald Road; And one of the following: Upgrade the Drury Interchange to double the northbound on-ramp and south bound off-ramps at the Drury interchange; or Upgrades to provide the Drury South Interchange and the Mill Road Corridor from Drury Interchange to Fitzgerald Road.
2038	SH1 3-laning Drury to Bombay SH1 Drury South Interchange Mill Road full route (Papakura to SH1) Pukekohe Expressway Full Route (SH1 to Pukekohe) Opaheke Road (Papakura to Waihoehoe Road)	Upgrade to Great South Road/Waihoehoe Road intersection to add an additional left-hand turn lane on the Norrie Road approach and reallocate lanes on the Waihoehoe Road approach
2048	Third Main Rail Line Pukekohe to Papakura	Upgrade to Great South Road/Waihoehoe Road intersection to provide an additional exit lane on Norrie Road, reallocate lanes on the Waihoehoe and Great South Road approaches, and increase the length of the left-turn lane on the Waihoehoe Road approach.

Without Drury Interchange Direct Access to Metropolitan Centre		
2026		Upgrade to the Great South Road/Waihoehoe Road intersection
2028	SH1 3-laning Papakura to Drury SH22 widening to Karaka Rail Electrification Papakura to Pukekohe New Drury East and West Stations	Upgrade Waihoehoe Road to increase to four lanes between Great South Road/Waihoehoe intersection and the Drury Boulevard. Upgrade to Great South Road/Waihoehoe Road intersection to lengthen the approach, turning and exit lanes on Great South Road northern approach
2033		Upgrade to Great South Road to increase to four lanes between the Drury Interchange and to 400m north of the Great South Road/Waihoehoe Road intersection. Upgrade Waihoehoe Road to increase from two lanes to four lanes between Drury Boulevard and Fitzgerald Road.
2033 - 2038		Upgrade the Drury Interchange to double the northbound on-ramp and south bound off-ramps at the Drury interchange; or Upgrades to provide the Drury South Interchange and the Mill Road Corridor from Drury Interchange to Fitzgerald Road.
2038	SH1 3-laning Drury to Bombay SH1 Drury South Interchange Mill Road full route (Papakura to SH1) Pukekohe Expressway Full Route (SH1 to Pukekohe) Opaheke Road (Papakura to Waihoehoe Road)	Upgrade to Great South Road/Waihoehoe Road intersection to add an additional left-hand turn lane on the Norrie Road approach and reallocate lanes on the Waihoehoe Road approach
2048	Third Main Rail Line Pukekohe to Papakura	Upgrade to Great South Road/Waihoehoe Road intersection to provide an additional exit lane on Norrie Road, reallocate lanes on the Waihoehoe and Great South Road approaches, and increase the length of the left-turn lane on the Waihoehoe Road approach.

Appendices



Appendix A Land Use Assumptions (dated 1.7.19¹³) per MSM Zone for each decade

¹³ The Land use assumptions for households were provided by Barkers and Associates dated 1.7.19 and did not include population or employment assumptions. The population land use was interpolated by Stantec using a linear relationship with the households.

Table A-1: Drury - Opaheke Area

		2016			2028			2038			2048+		
MSM Zone	Location	Pop	HH	Emp	Pop	HH	Emp	Pop	HH	Emp	Pop	HH	Emp
550	East	1250	438	1169	1181	438	1258	1130	438	1300	3411	1369	1407
551	East	340	99	32	298	99	81	279	99	1538	6681	2472	1739
554	East	421	148	69	5362	2050	2006	11216	4318	4213	10841	4318	5349
555	East	369	168	117	1834	438	199	1666	638	306	6119	2426	863
556	East	330	109	156	2563	909	2243	2453	909	4729	2372	909	6063
557	West	221	79	65	206	79	157	795	322	331	2271	952	425
558	West	132	76	51	124	76	273	152	97	576	230	152	739
559	West	186	59	134	173	59	262	2579	972	553	8578	3342	709
560	West	34	13	70	32	13	196	1947	718	413	6568	2498	530
561	West	195	70	100	3193	1195	311	6894	2696	656	10169	4117	840
562	West	175	60	144	158	60	340	2868	1123	717	9596	3885	920
	East	2710	962	1543	11237	3934	5787	16745	6402	12086	29425	11494	15420
	West	943	356	565	3887	1482	1540	15234	5928	3247	37413	14946	4163
	Total	3653	1318	2108	15124	5416	7327	31979	12330	15333	66838	26440	19582

Table A-2: Pukekohe - Paerata Area

	2016			2028			2038			2048+		
MSM Zone	Pop	HH	Emp	Pop	HH	Emp	Pop	HH	Emp	Pop	HH	Emp
569	221	75	97	937	329	100	1793	657	99	1729	657	99
574	3072	972	296	4819	1665	306	7022	2573	302	8289	3203	300
575	3979	1354	976	4349	1579	1418	4503	1711	1951	4446	1752	2199
576	4062	1298	298	4901	1695	316	5301	1929	316	5302	2004	315
577	700	332	2331	1123	553	2678	1437	722	2881	1659	846	3038
578	2769	974	517	5320	1987	594	6033	2352	599	6017	2432	601
580	161	63	73	2043	762	632	2774	1077	1492	2879	1158	1916
581	6708	2640	3750	7182	2745	4004	7571	2809	4216	7808	2829	4339
582	143	48	56	134	48	60	125	47	61	123	48	61
583	167	56	155	1087	393	379	1561	591	843	1664	653	1096
567	169	58	21	1331	463	21	2149	779	21	2338	878	21
568	158	48	74	4981	1739	76	8321	3039	75	9353	3544	75
571	151	45	88	2567	839	615	4958	1707	607	4766	1720	604
579	678	221	171	621	221	502	1076	403	1195	1419	552	1572
Total	23137	8184	8903	41393	15018	11702	54624	20396	14659	57793	22276	16235

Appendix B PT Mode Share and Household Car Trip Rates

Table B-1: Public Transport Mode Share per MSM zone

	2016				2028				2038				2048+			
	AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
MSM Zone	Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
550	6%	2%	1%	5%	12%	4%	3%	10%	15%	8%	7%	14%	18%	9%	8%	16%
551	10%	0%	1%	9%	16%	2%	3%	14%	14%	6%	6%	12%	17%	7%	7%	15%
554	9%	1%	1%	8%	14%	3%	4%	12%	15%	6%	6%	13%	15%	8%	7%	13%
555	9%	0%	1%	7%	16%	3%	3%	14%	17%	5%	6%	15%	18%	6%	7%	16%
556	8%	0%	0%	7%	11%	1%	2%	8%	11%	5%	4%	9%	11%	6%	5%	9%
557	6%	0%	0%	6%	12%	4%	5%	13%	12%	6%	7%	14%	13%	6%	8%	15%
558	6%	0%	0%	6%	7%	5%	5%	8%	7%	8%	8%	9%	7%	10%	9%	10%
559	8%	1%	1%	6%	23%	6%	8%	21%	24%	7%	10%	22%	27%	8%	11%	25%
560	6%	1%	2%	4%	23%	5%	7%	20%	26%	7%	11%	24%	28%	8%	12%	26%
561	7%	0%	1%	6%	20%	6%	7%	19%	18%	5%	7%	17%	21%	6%	8%	19%
562	7%	1%	1%	6%	16%	4%	4%	14%	18%	6%	7%	17%	20%	6%	8%	19%
East	7%	2%	1%	6%	14%	3%	3%	11%	14%	6%	6%	13%	15%	7%	7%	13%
West	7%	1%	1%	6%	19%	5%	6%	18%	20%	6%	8%	19%	23%	7%	9%	21%
Total	7%	2%	1%	6%	16%	3%	4%	14%	17%	6%	6%	15%	19%	7%	7%	17%

Table B-2: Household Car Trip Rate per MSM Zone

MSM Zone	2016		2028		2038		2048+	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
550	1.25	1.08	0.94	0.82	0.71	0.62	0.55	0.48
551	0.67	0.56	0.56	0.48	0.77	0.70	0.55	0.49
554	0.62	0.53	0.66	0.59	0.64	0.57	0.65	0.61
555	0.72	0.63	0.52	0.44	0.47	0.40	0.45	0.39
556	0.82	0.71	1.11	1.05	1.11	1.07	1.23	1.21
557	0.68	0.57	0.49	0.45	0.48	0.45	0.45	0.42
558	0.48	0.41	0.92	0.89	1.38	1.33	1.43	1.39
559	0.99	0.85	0.49	0.42	0.43	0.38	0.39	0.34
560	1.56	1.35	0.43	0.37	0.43	0.37	0.39	0.33
561	0.84	0.74	0.49	0.42	0.46	0.40	0.40	0.36
562	1.07	0.97	0.51	0.44	0.46	0.40	0.41	0.36
East	0.96	0.83	0.72	0.64	0.69	0.63	0.64	0.59
West	0.82	0.71	0.49	0.43	0.46	0.40	0.41	0.36
Total	0.92	0.80	0.62	0.55	0.58	0.52	0.53	0.48

Appendix C SATURN Summary Results

Table C-1: SATURN Modelling Results for Drury Interchange

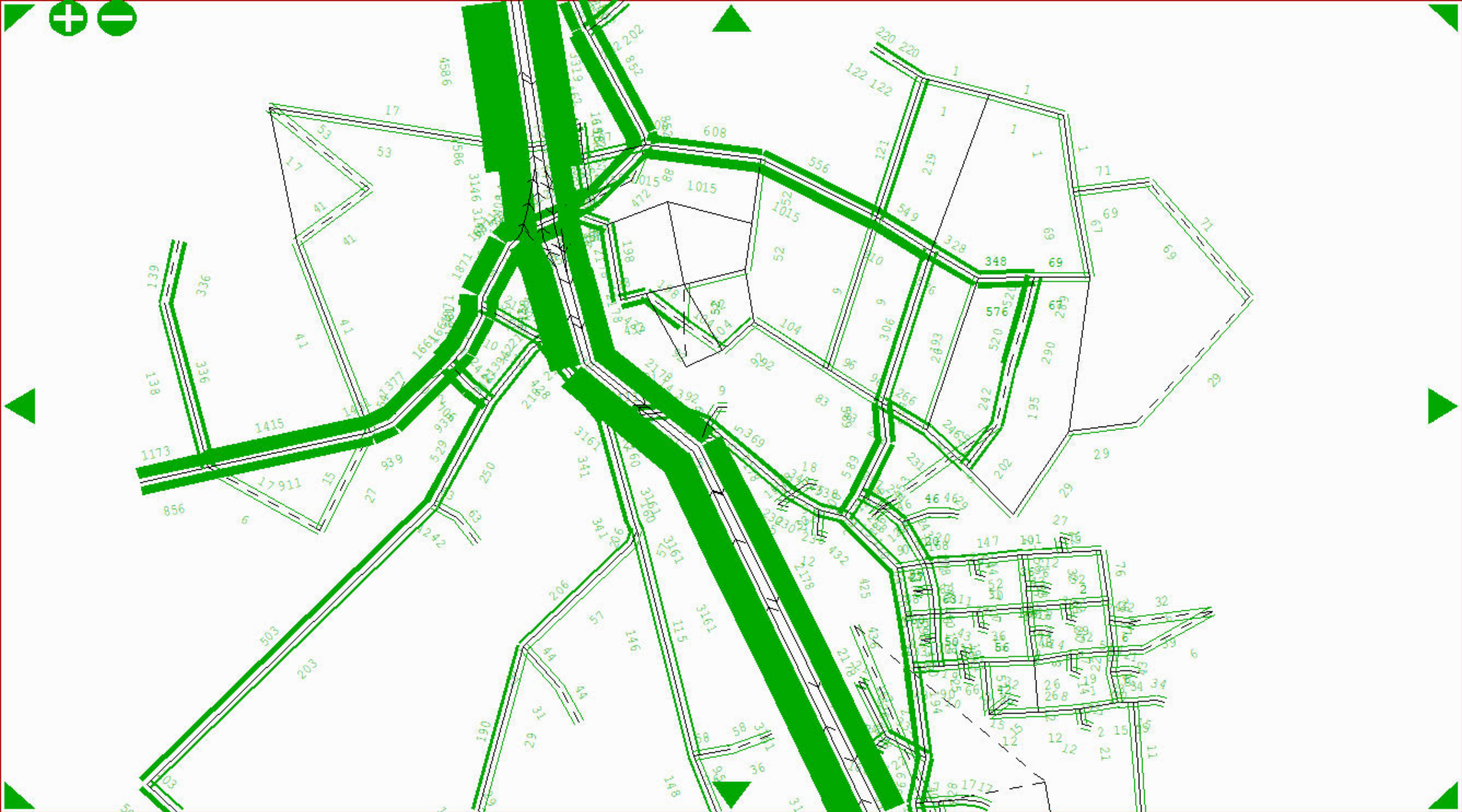
				Drury Interchange							
				Northbound On-ramp		Southbound Off-ramp		Great South Road Through Eastbound		Great South Road Through Westbound	
Land Use	Network	No. lane on the on/off ramps	Peak	Flow (veh)	Delay (sec)	Flow (veh)	Delay (sec)	Flow (veh)	Delay (sec)	Flow (veh)	Delay (sec)
With Drury Interchange Direct Access to Metropolitan Centre											
2023	2016 SH1 Northbound 2-lane	Single	AM	1428	27	934	23	974	22	1117	21
			PM	1052	0	1612	58	388	44	2117	22
2028	2016 SH1 Northbound 2-lanes	Single	AM	1423	167	1170	34	848	25	1424	21
			PM	1374	0	1876	58	343	47	2345	22
	2016 SH1 Northbound 3-lanes	Single	AM	1392	318	1241	35	822	24	1404	18
			PM	1526	0	1902	59	244	49	2393	23
2028	2028	Single	AM	1408	319	1258	36	774	23	1454	18
			PM	1446	0	1750	161	271	51	2208	25
		Double	AM	2170	35	1304	22	810	25	1595	41
			PM	1474	1	1859	115	274	49	2262	25
	2028 + Mill Rd to Fitzgerald	Single	AM	1388	122	1124	31	984	23	1306	17
			PM	1265	0	1690	133	306	29	2029	22
2033	2028	Single	AM	1419	394	1409	43	1093	34	1685	21
			PM	1521	0	1746	158	270	56	2228	25
		Double	AM	2147	15	1485	24	1097	28	1758	35
			PM	1586	1	1852	108	268	52	2230	25
	2028 + Mill Rd to Fitzgerald	Single	AM	1376	162	1264	37	1083	24	1400	17
			PM	1392	0	1582	152	332	27	1955	21
2038	2028	Single	AM	1671	1177	1597	62	842	52	1835	31
			PM	1614	0	1761	215	237	66	2215	25
		Double	AM	2238	92	1676	54	721	39	1815	92
			PM	1677	1	1954	117	230	60	2283	26

				Drury Interchange							
				Northbound On-ramp		Southbound Off-ramp		Great South Road Through Eastbound		Great South Road Through Westbound	
Land Use	Network	No. lane on the on/off ramps	Peak	Flow (veh)	Delay (sec)	Flow (veh)	Delay (sec)	Flow (veh)	Delay (sec)	Flow (veh)	Delay (sec)
	2028 + Mill Rd to Fitzgerald	Single	AM	1423	370	1469	47	902	33	1612	18
			PM	1414	0	1696	161	291	34	1955	21
2038	2038	Single	AM	1233	1	871	20	422	21	924	39
			PM	954	0	1229	36	157	49	1380	21
2048	2048	Single	AM	1248	2	1175	26	379	21	1048	33
			PM	1054	0	1211	32	171	49	1332	20
Without Drury Interchange Direct Access to Metropolitan Centre											
2023	2016 SH1 Northbound 2-lane	Single	AM	1434	10	865	20	889	14	1034	14
			PM	982	0	1558	45	400	14	2099	23
2028	2016 SH1 Northbound 2-lanes	Single	AM	1398	114	1216	27	981	17	1168	14
			PM	1254	0	1667	52	421	16	1838	21
	2016 SH1 Northbound 3-lanes	Single	AM	1410	316	1292	29	917	19	1205	14
			PM	1432	0	1789	196	300	14	2076	23
2028	2028	Single	AM	1415	364	1298	29	748	17	1473	20
			PM	1413	0	1778	162	309	13	2209	25
		Double	AM	2166	32	1308	30	757	17	1511	42
			PM	1454	1	1779	164	297	13	2218	25
	2028 + Mill Rd to Fitzgerald	Single	AM	1384	115	1171	25	946	16	1211	16
			PM	1295	0	1783	92	314	14	2241	25
2033	2028	Single	AM	1443	432	1413	37	903	17	1559	20
			PM	1508	0	1778	142	316	12	2344	27
		Double	AM	2131	8	1454	38	959	20	1650	34
			PM	1553	1	1777	142	302	12	2345	27
			Single	AM	1382	148	1284	30	1055	17	1323

				Drury Interchange							
				Northbound On-ramp		Southbound Off-ramp		Great South Road Through Eastbound		Great South Road Through Westbound	
Land Use	Network	No. lane on the on/off ramps	Peak	Flow (veh)	Delay (sec)	Flow (veh)	Delay (sec)	Flow (veh)	Delay (sec)	Flow (veh)	Delay (sec)
	2028 + Mill Rd to Fitzgerald		PM	1413	0	1777	82	317	13	2275	25
2038	2028	Single	AM	1678	1135	1607	48	791	19	1740	27
			PM	1563	0	1765	208	197	11	2277	26
		Double	AM	2175	39	1681	55	855	21	1755	50
			PM	1607	1	1761	204	187	11	2278	26
	2028 + Mill Rd to Fitzgerald	Single	AM	1457	385	1371	31	799	21	1388	15
			PM	1456	0	1776	85	229	12	2321	26
2038	2038	Single	AM	1182	1	849	15	469	8	900	37
			PM	893	0	1226	25	233	8	1471	20
2048	2048	Single	AM	1283	1	1198	21	421	10	1049	34
			PM	1081	0	1862	24	233	7	1676	20

Appendix D SATURN Plots

With Direct Connection



Annotation:

Actual flow

Display of
link anno
Link display
Banner/Title
General

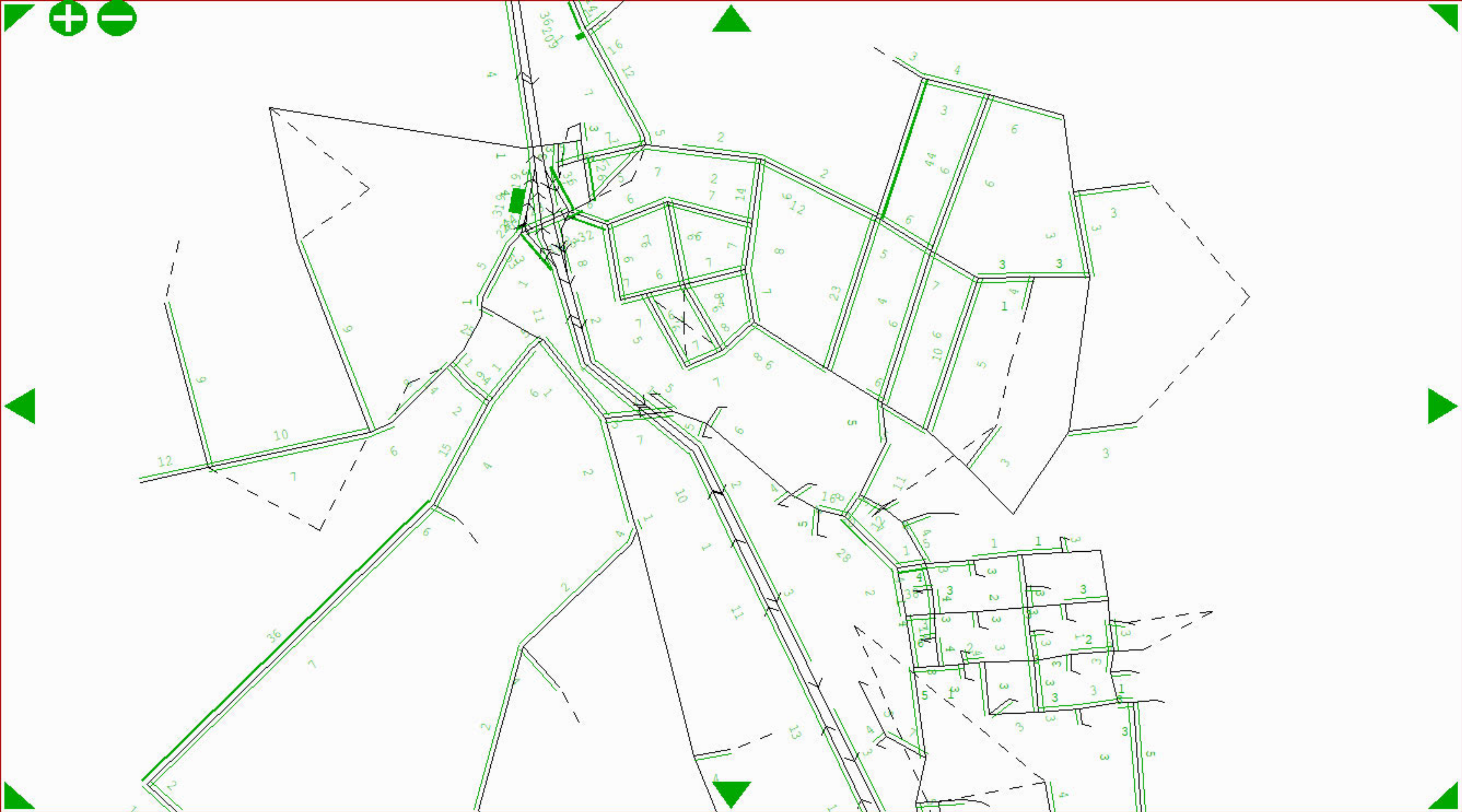
More data

Add temp dat
Actual flow
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Delay sec

Display of

link anno

Link display

Banner/Title

General

More data

Add temp dat

Delay sec

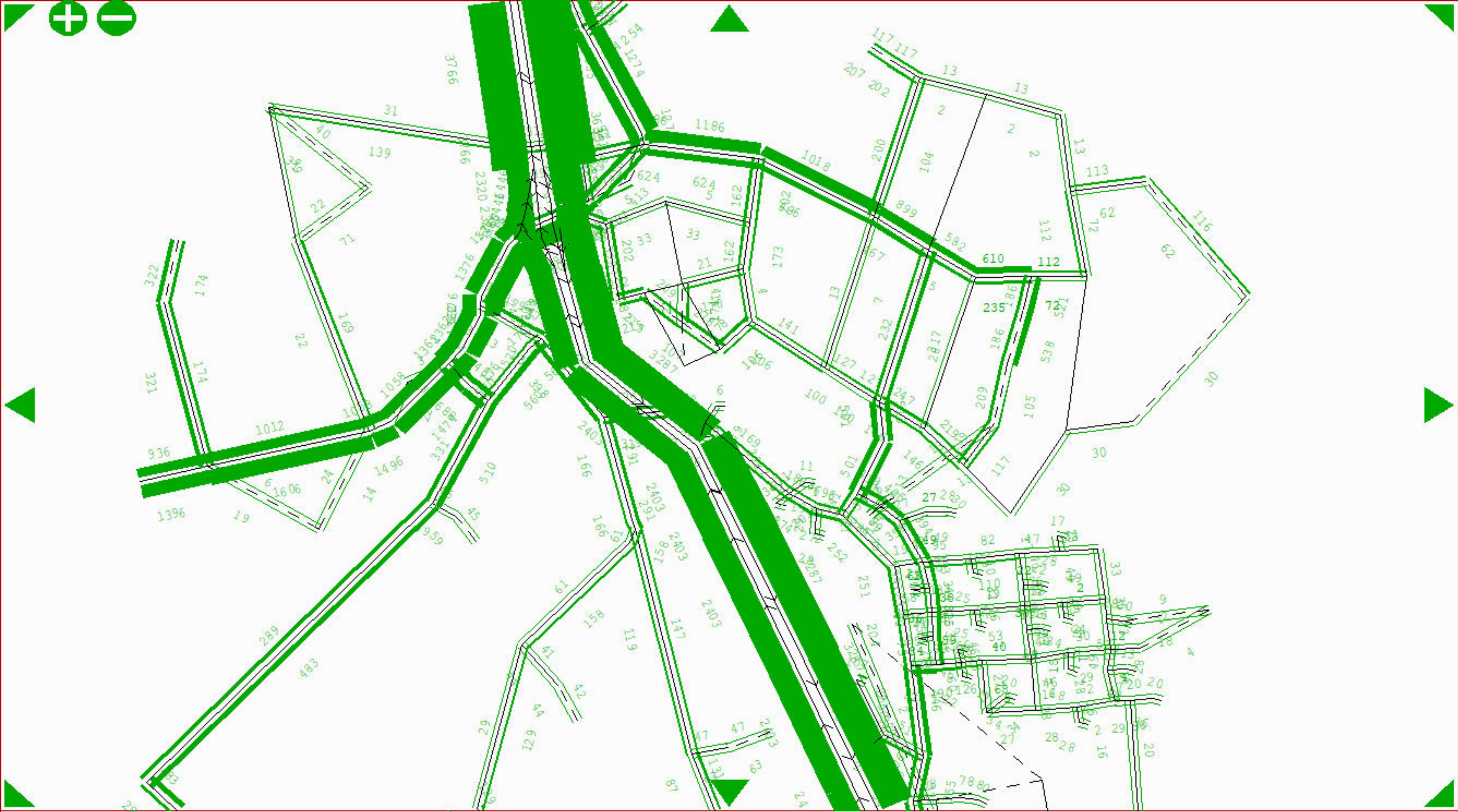
to the D.B.

Options:

-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Actual flow

Display of
link anno
Link display
Banner/Title
General

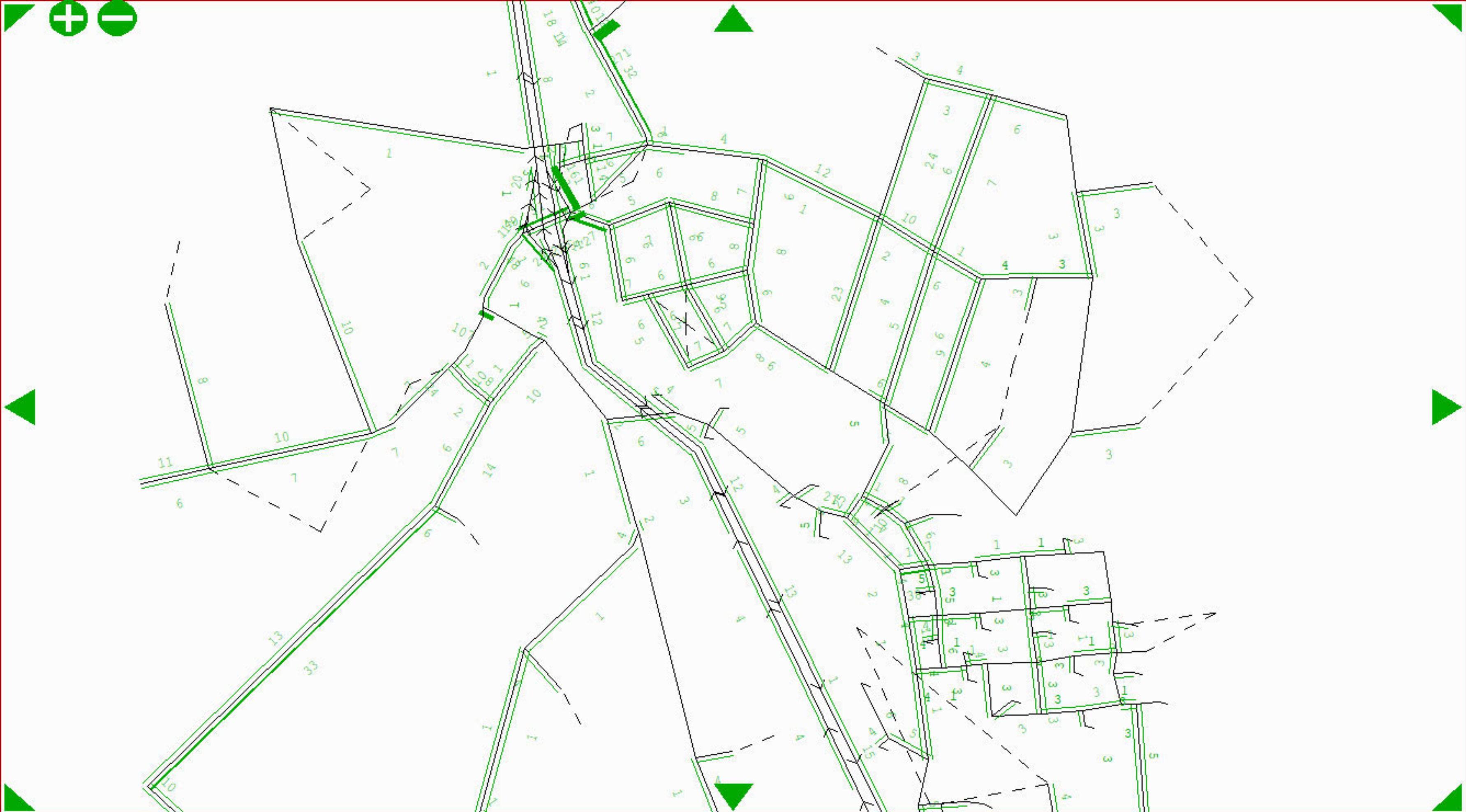
More data

Add temp dat
Actual flow
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Delay sec

Display of

link anno

Link display

Banner/Title

General

More data

Add temp dat

Delay sec

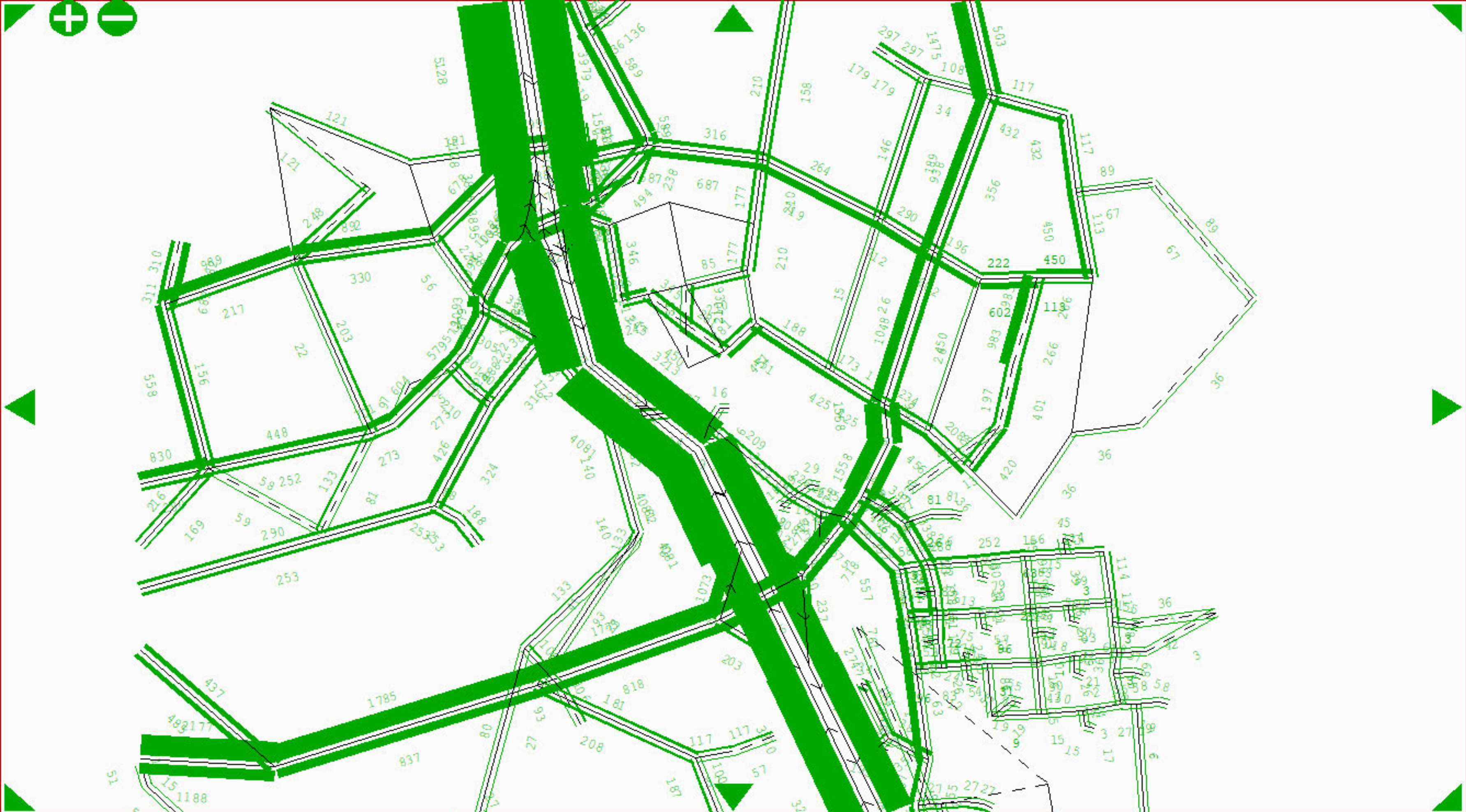
to the D.B.

Options:

-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Actual flow

Display of
link anno
Link display
Banner/Title
General

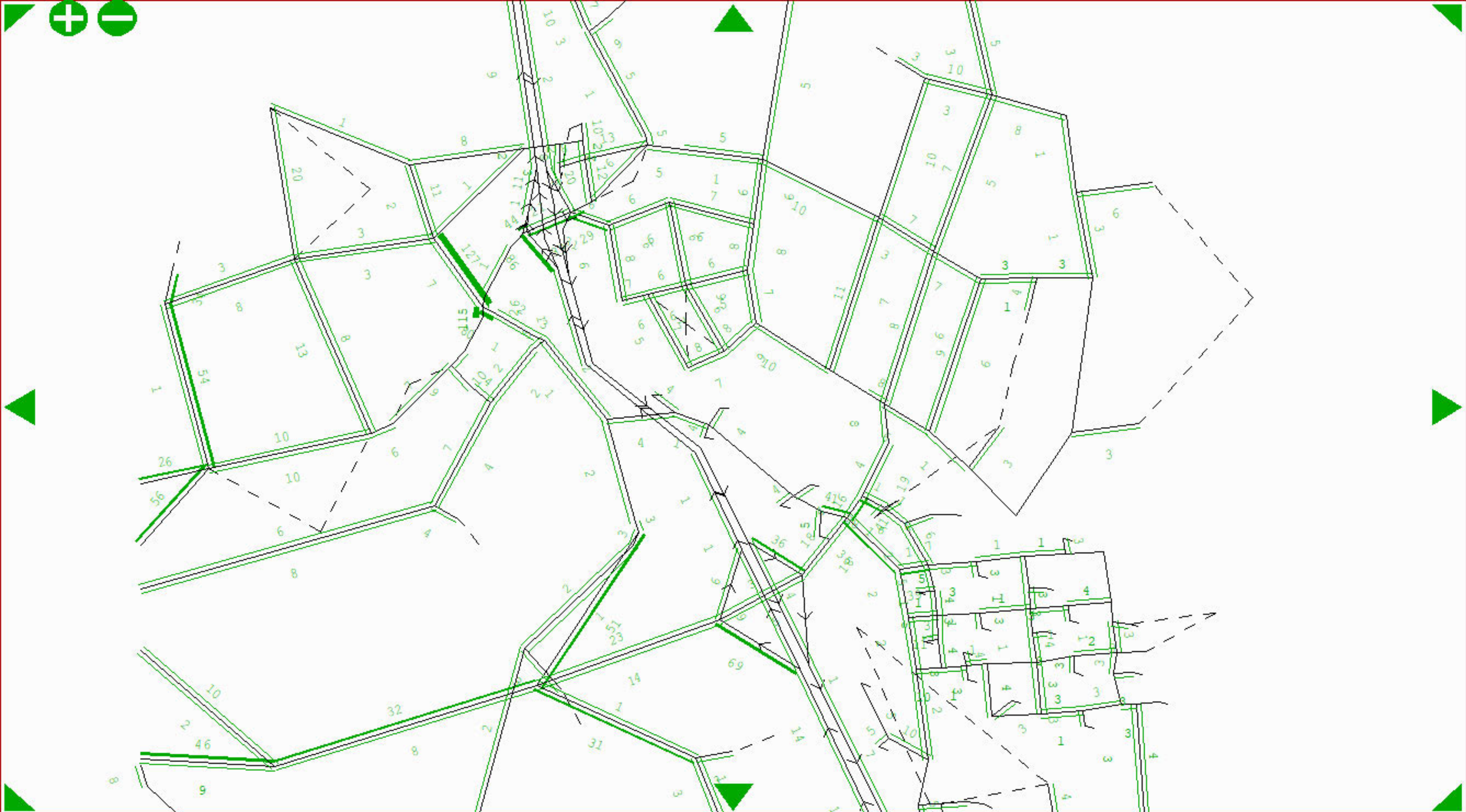
More data

Add temp dat
Actual flow
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Delay sec

Display of
link anno
Link display
Banner/Title
General

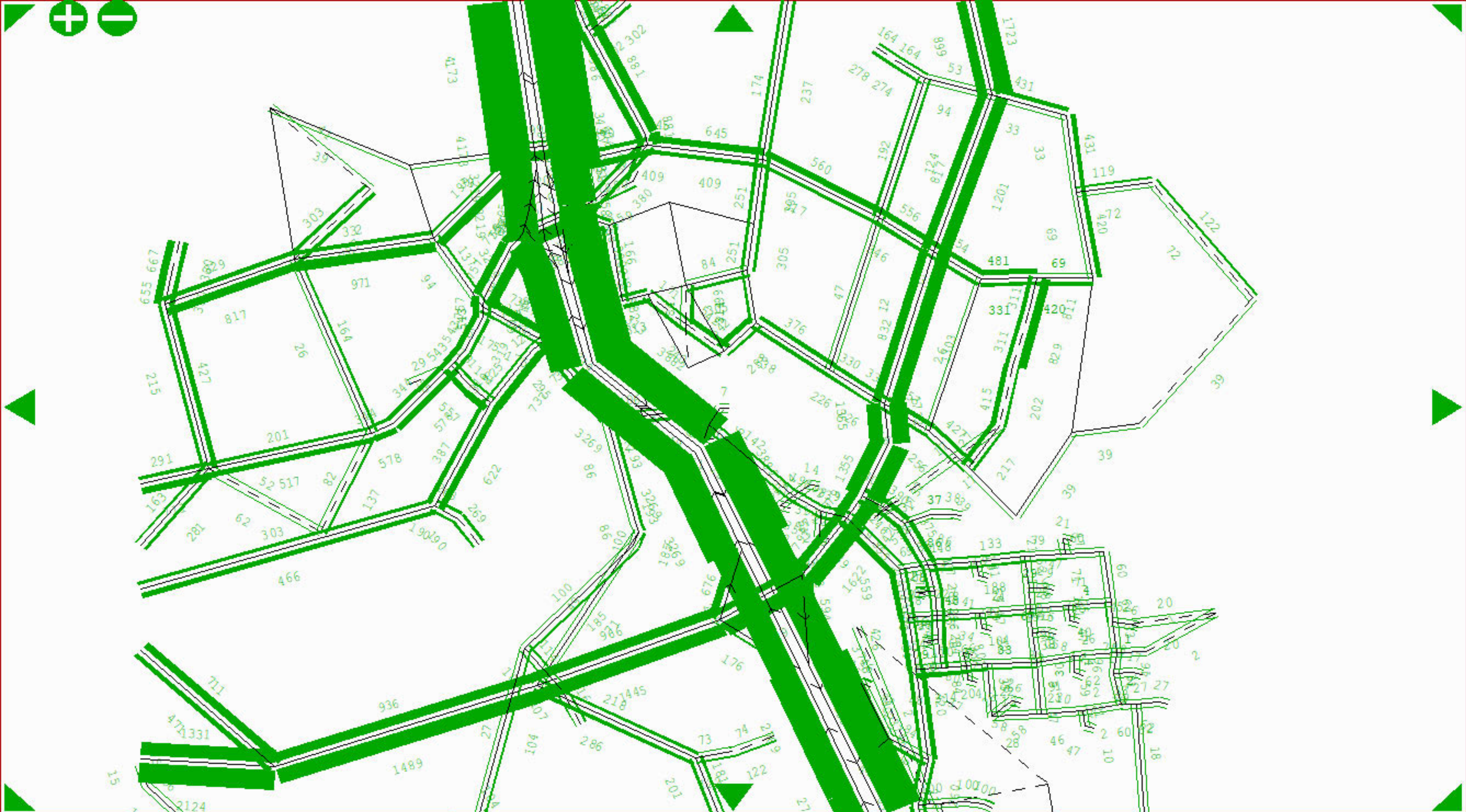
More data

Add temp dat
Delay sec
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Actual flow

Display of
link anno
Link display
Banner/Title
General

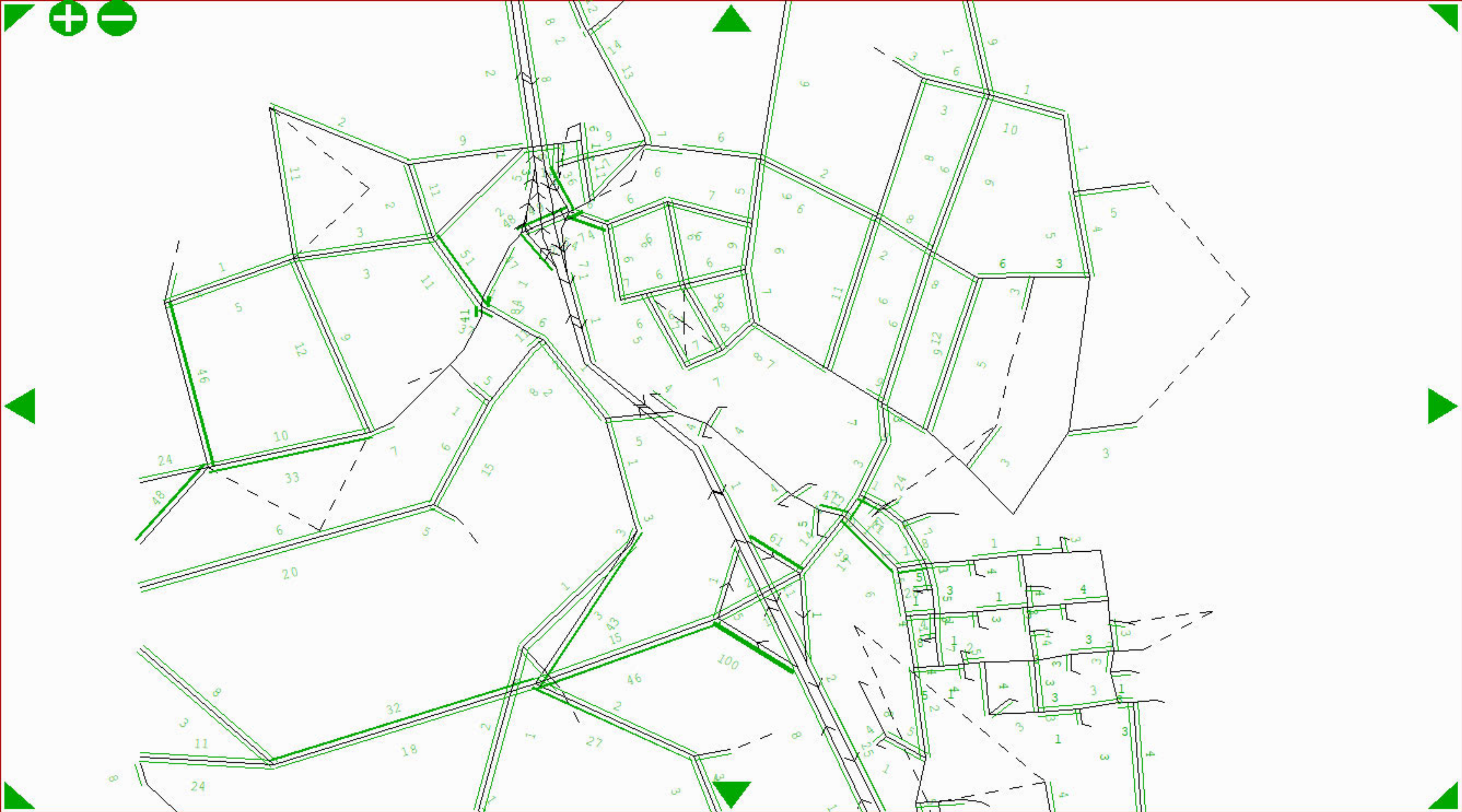
More data

Add temp dat
Actual flow
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Delay sec

Display of
link anno
Link display
Banner/Title
General

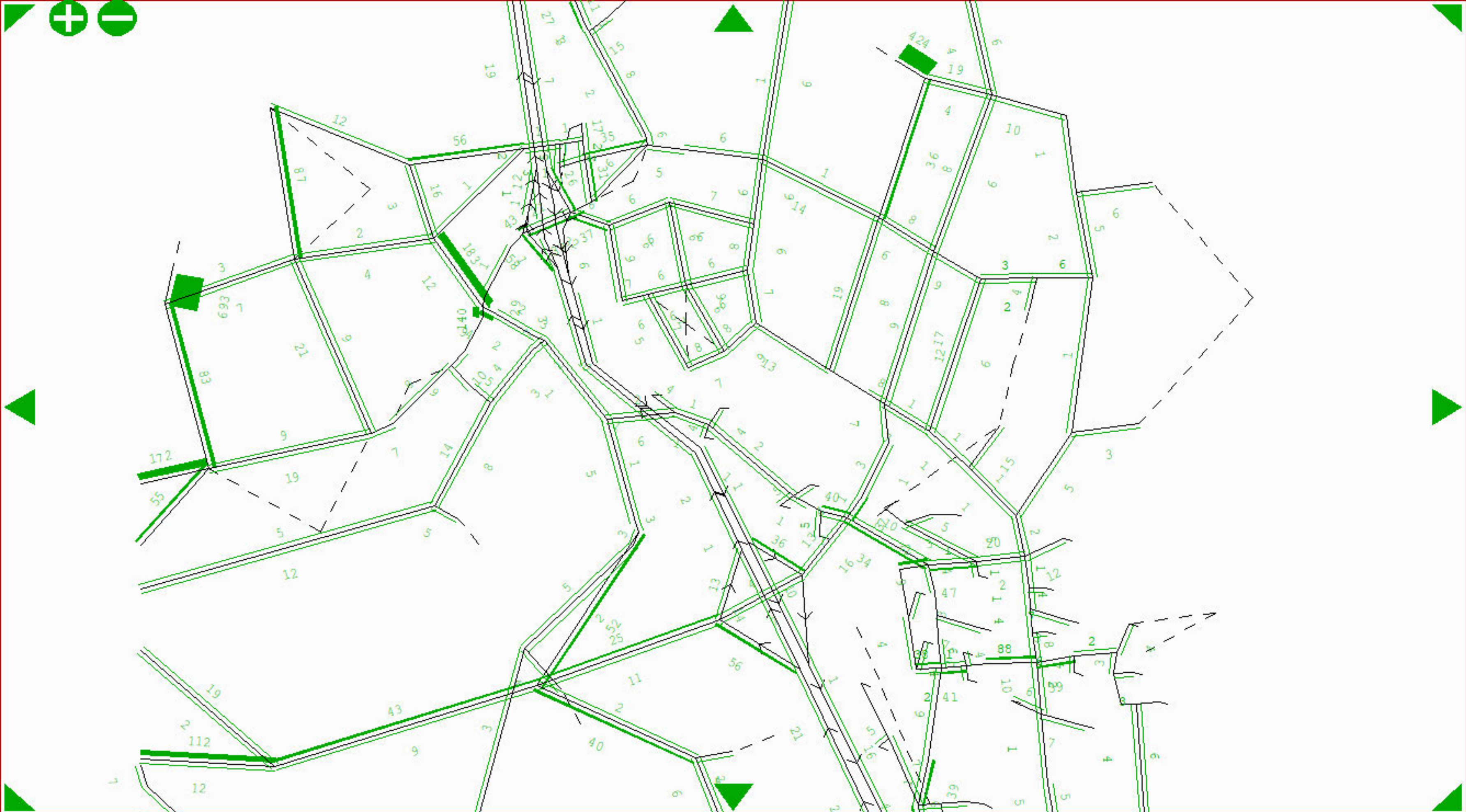
More data

Add temp dat
Delay sec
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Delay sec

Display of
link anno
Link display
Banner/Title
General

More data

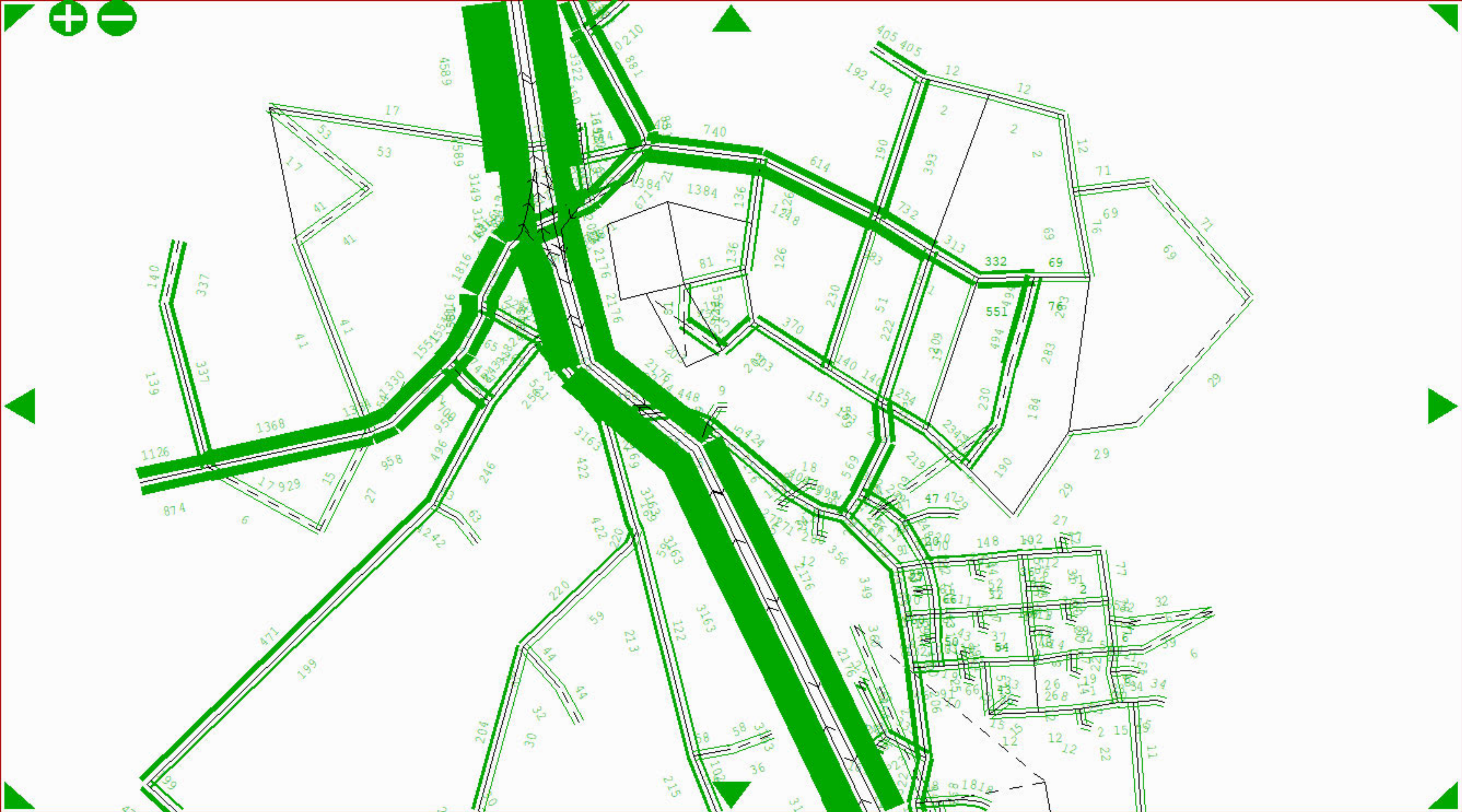
Add temp dat
Delay sec
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!

Without Direct Connection



Annotation:

Actual flow

Display of
link anno
Link display
Banner/Title
General

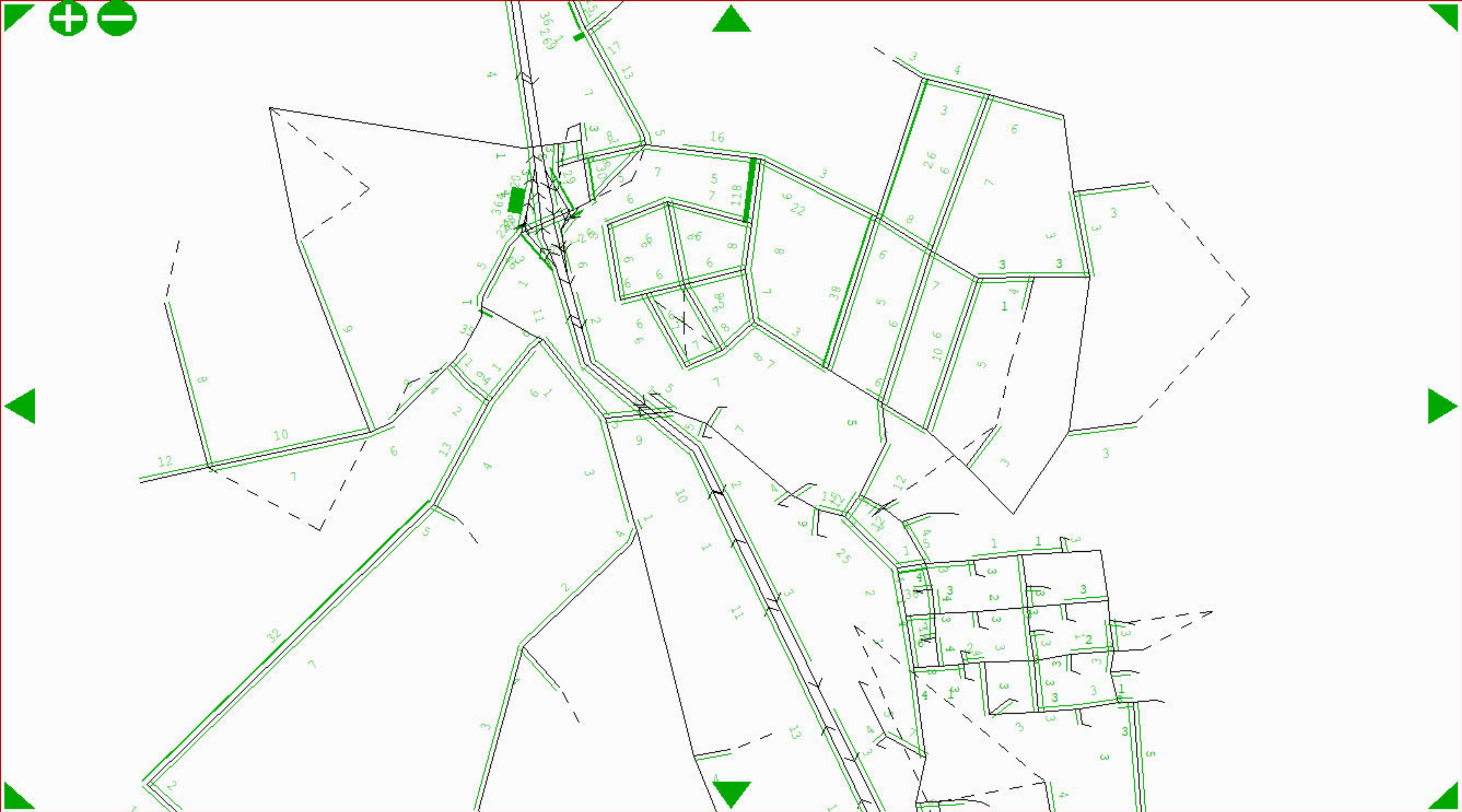
More data

Add temp dat
Actual flow
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Delay sec

Display of

link anno

Link display

Banner/Title

General

More data

Add temp dat

Delay sec

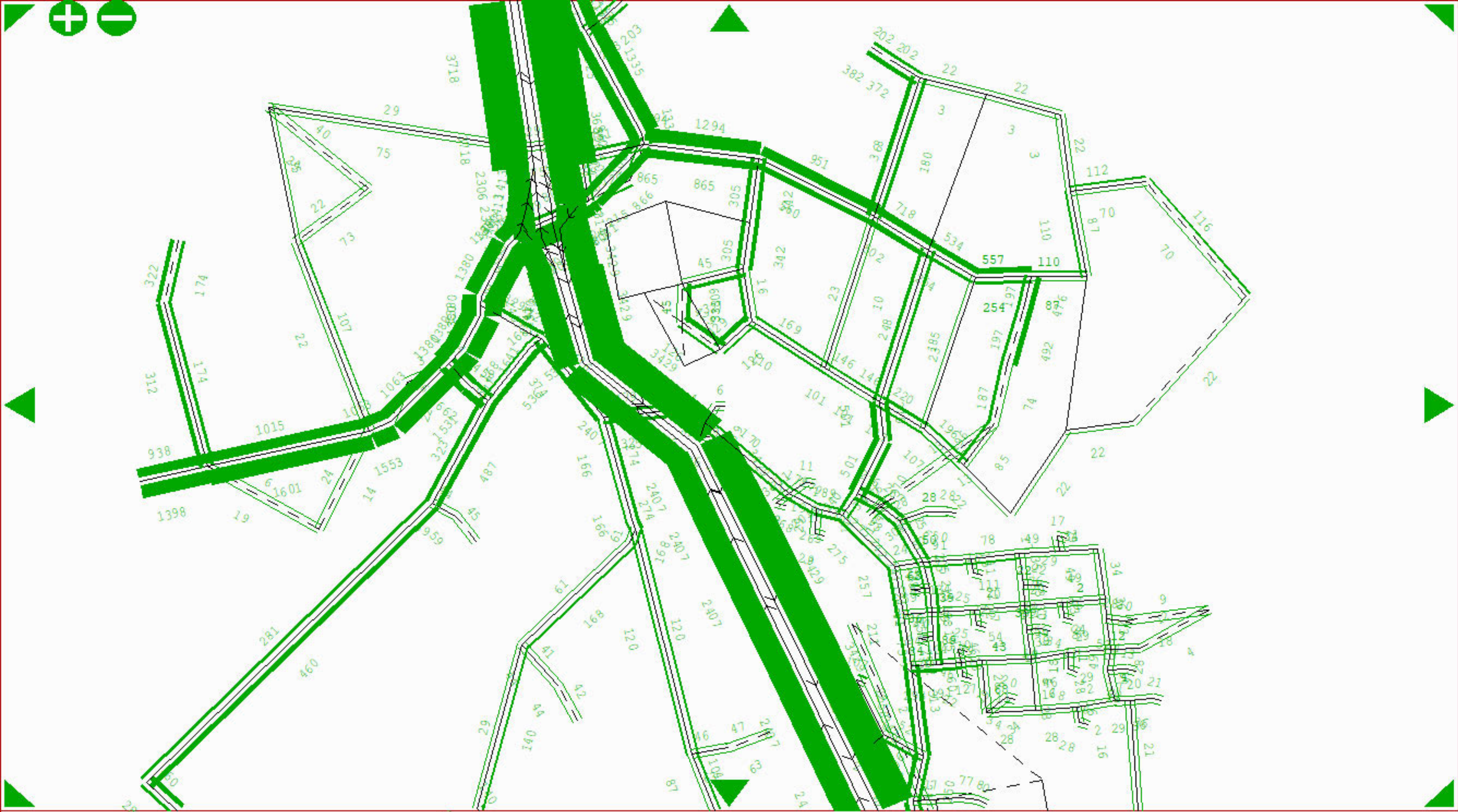
to the D.B.

Options:

-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Actual flow

Display of
link anno
Link display
Banner/Title
General

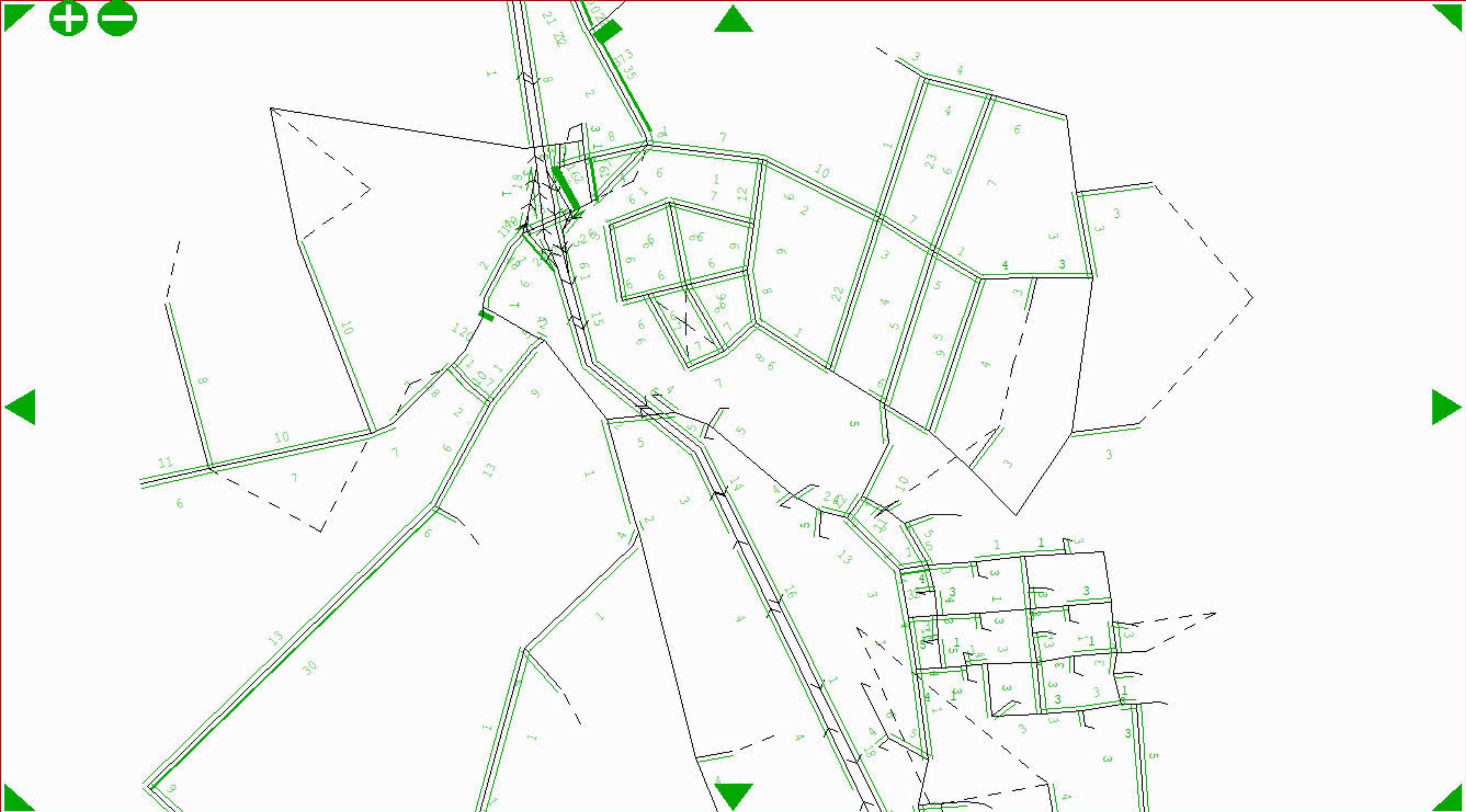
More data

Add temp dat
Actual flow
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Delay sec

Display of
link anno
Link display
Banner/Title
General

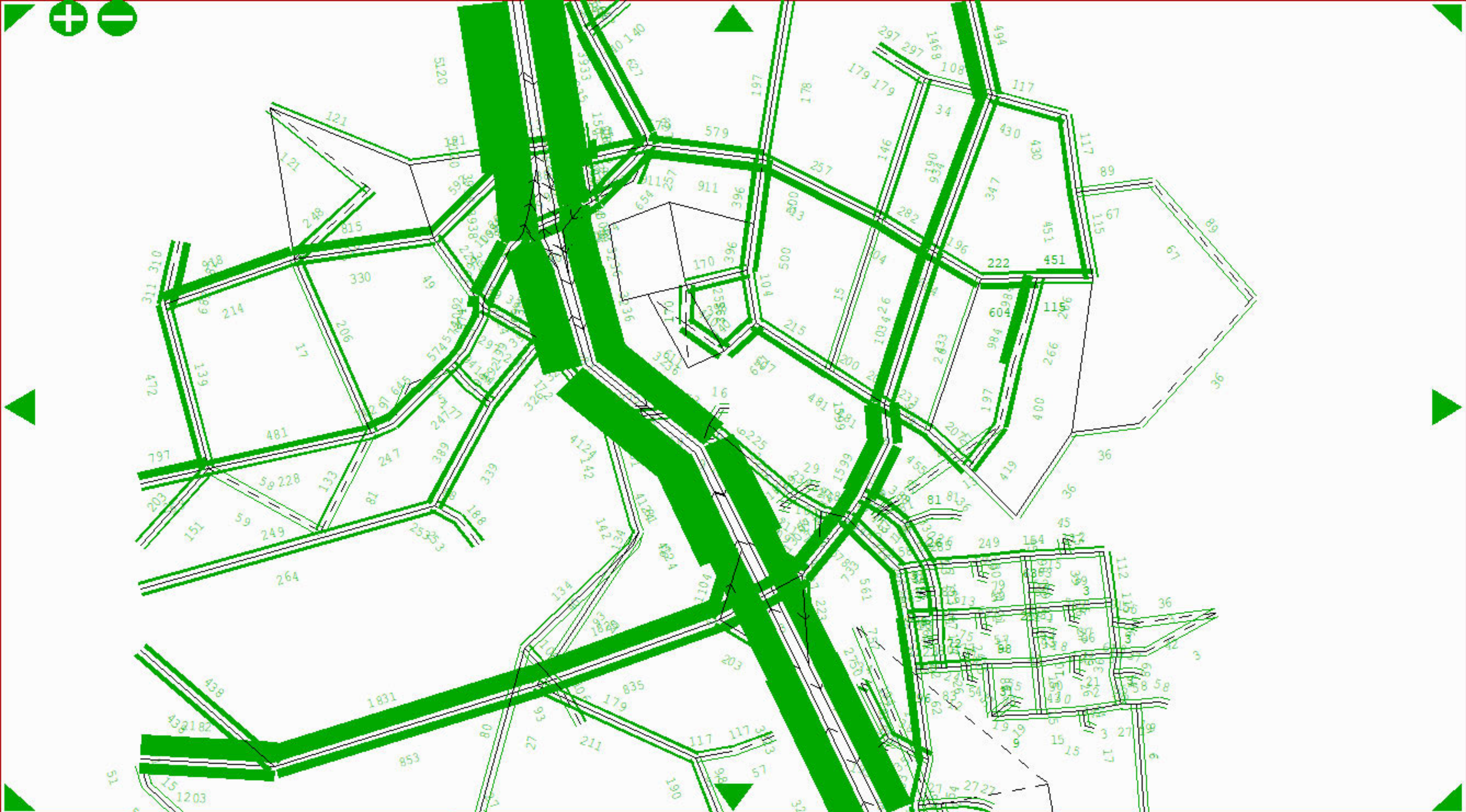
More data

Add temp dat
Delay sec
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Actual flow

Display of
link anno
Link display
Banner/Title
General

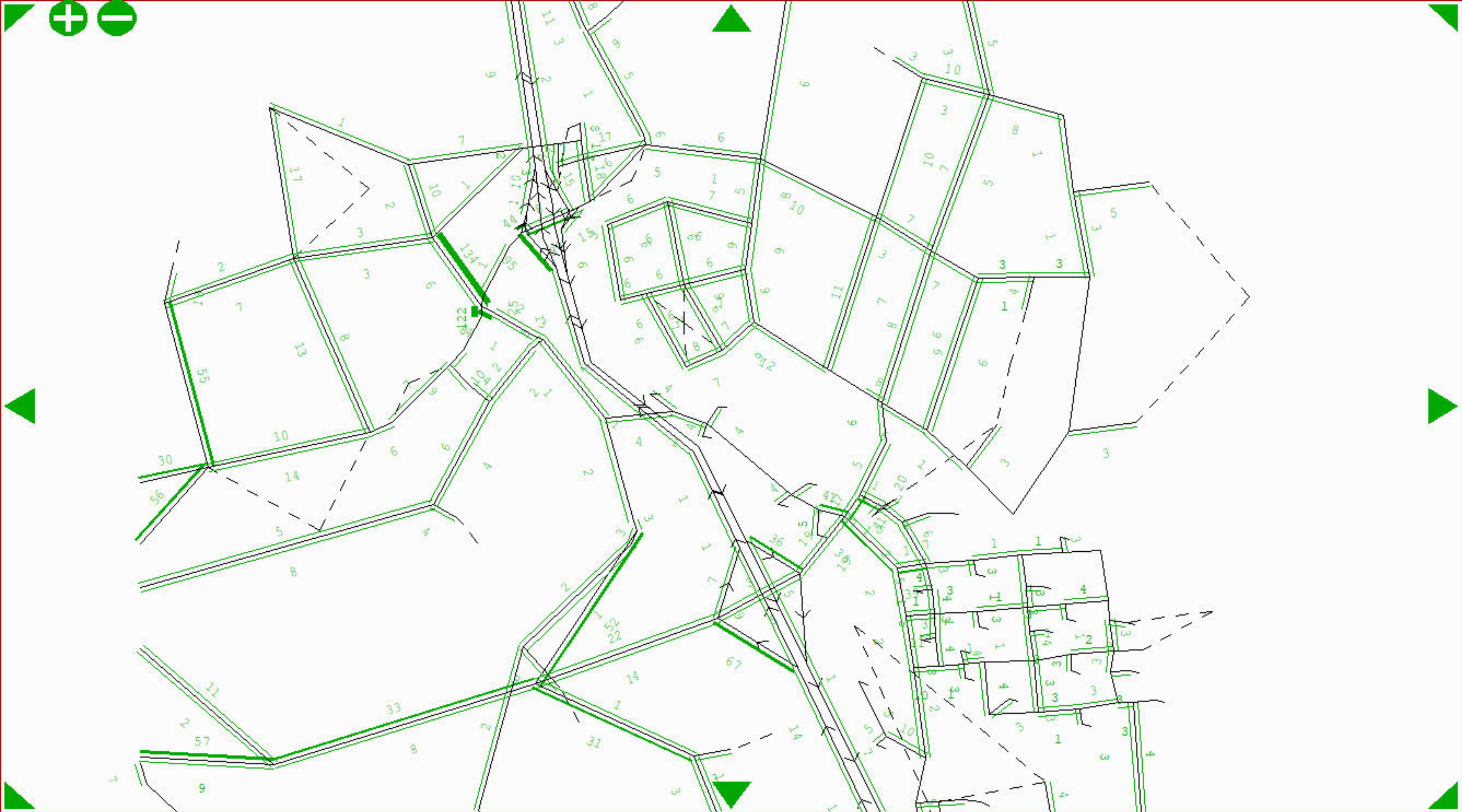
More data

Add temp dat
Actual flow
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Delay sec

Display of

link anno

Link display

Banner/Title

General

More data

Add temp dat

Delay sec

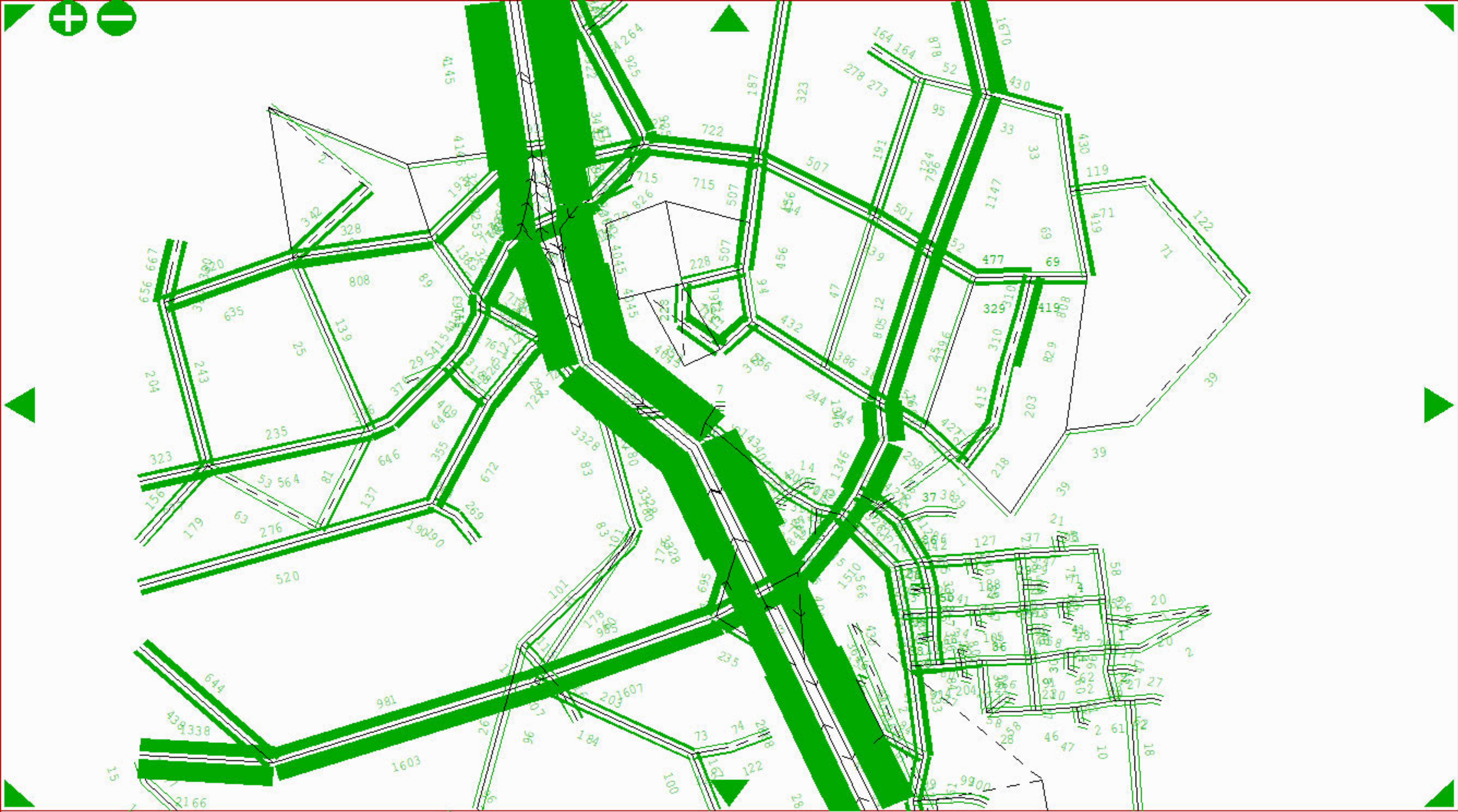
to the D.B.

Options:

-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Actual flow

Display of
link anno
Link display
Banner/Title
General

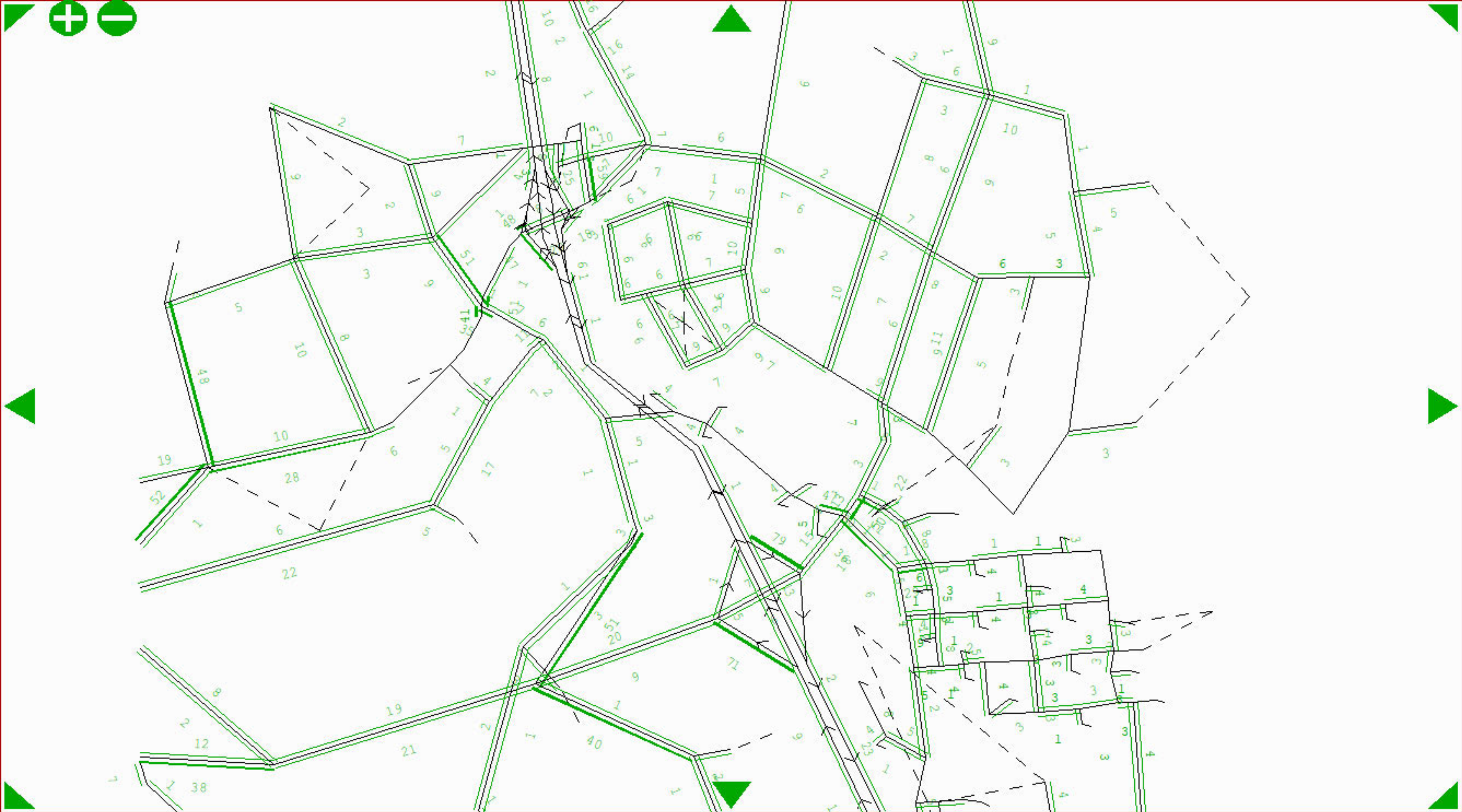
More data

Add temp dat
Actual flow
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Delay sec

Display of

link anno

Link display

Banner/Title

General

More data

Add temp dat

Delay sec

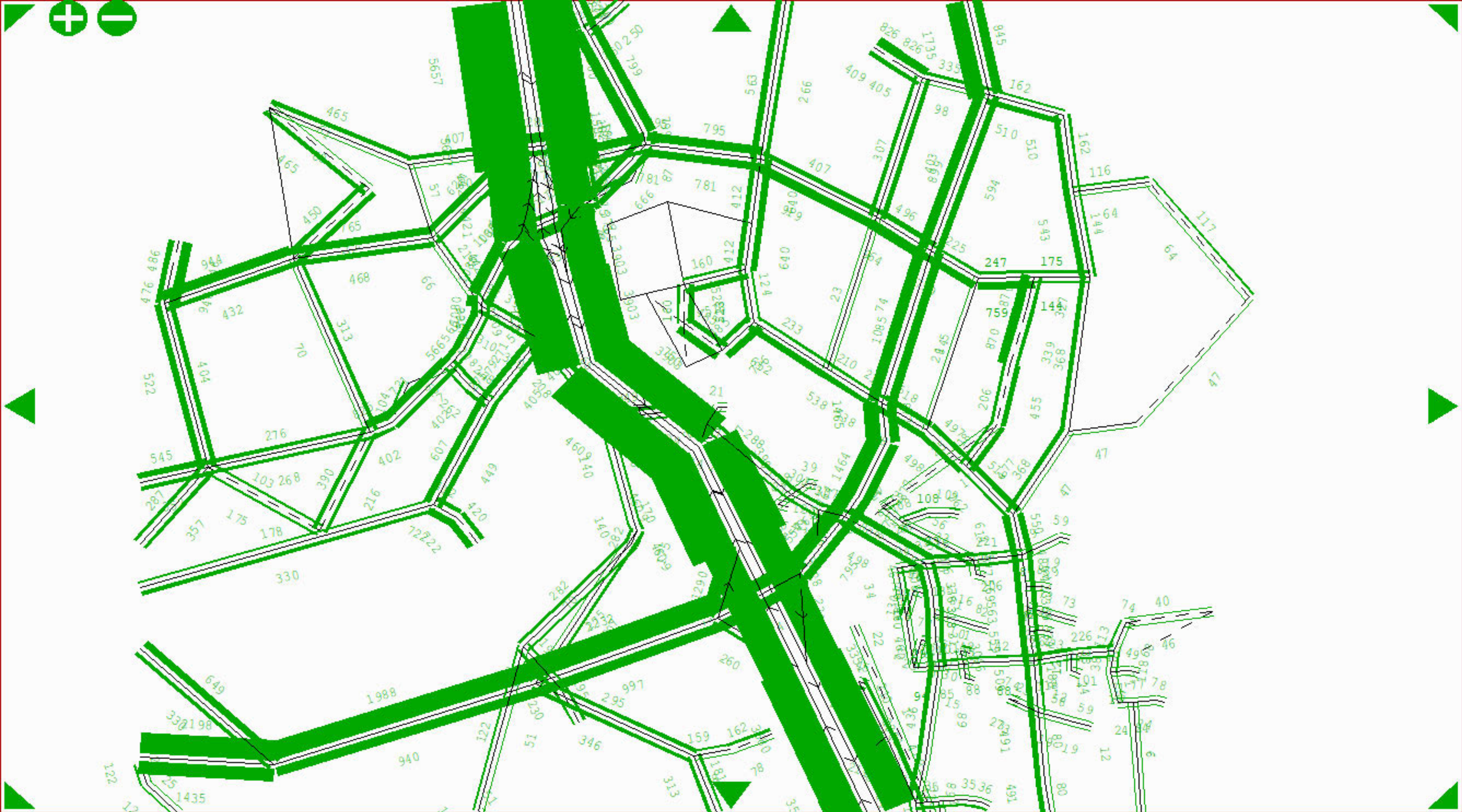
to the D.B.

Options:

-UC,MCC etc.

Q - Return

+ Menu bar!



Annotation:

Actual flow

Display of
link anno
Link display
Banner/Title
General

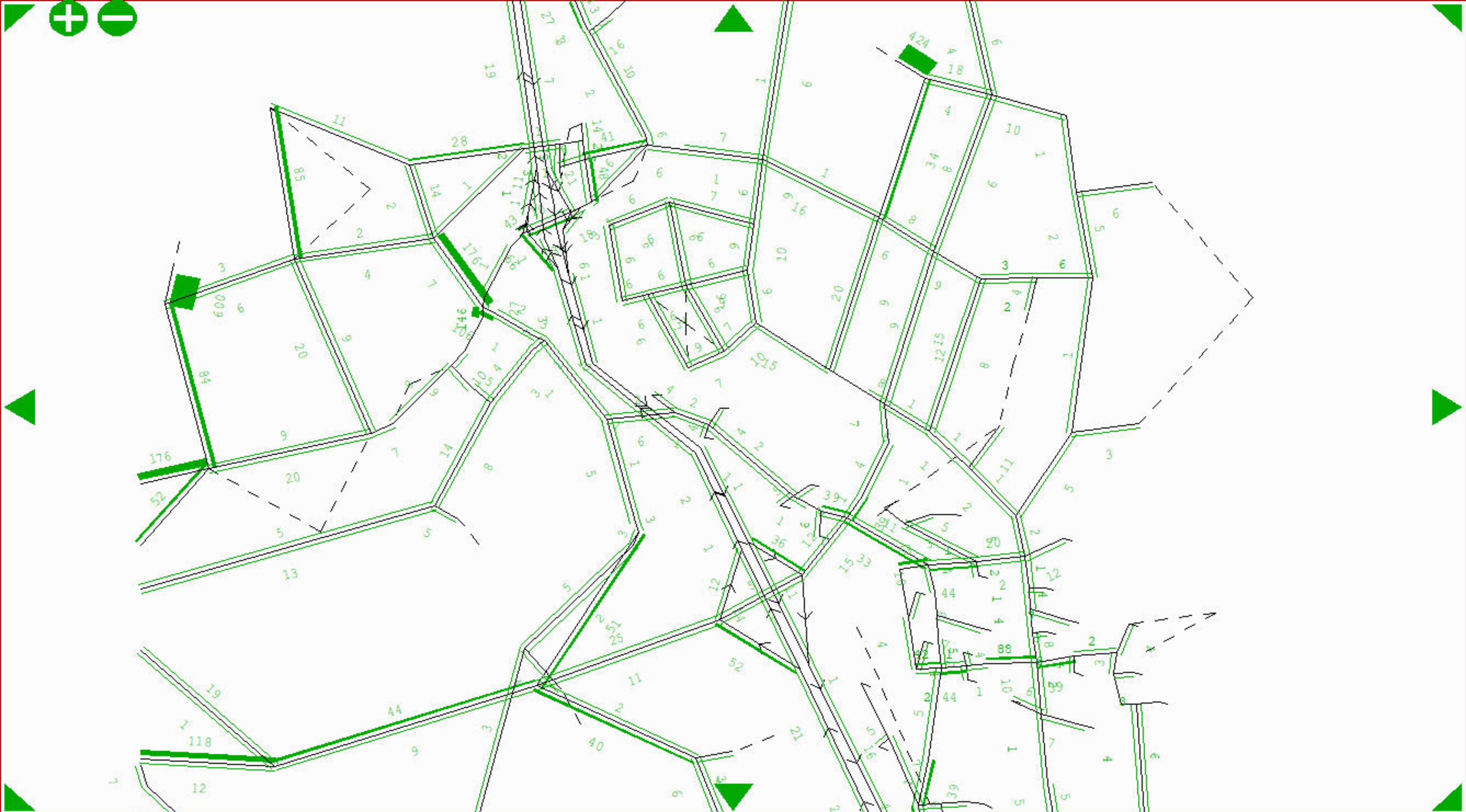
More data

Add temp dat
Actual flow
to the D.B.

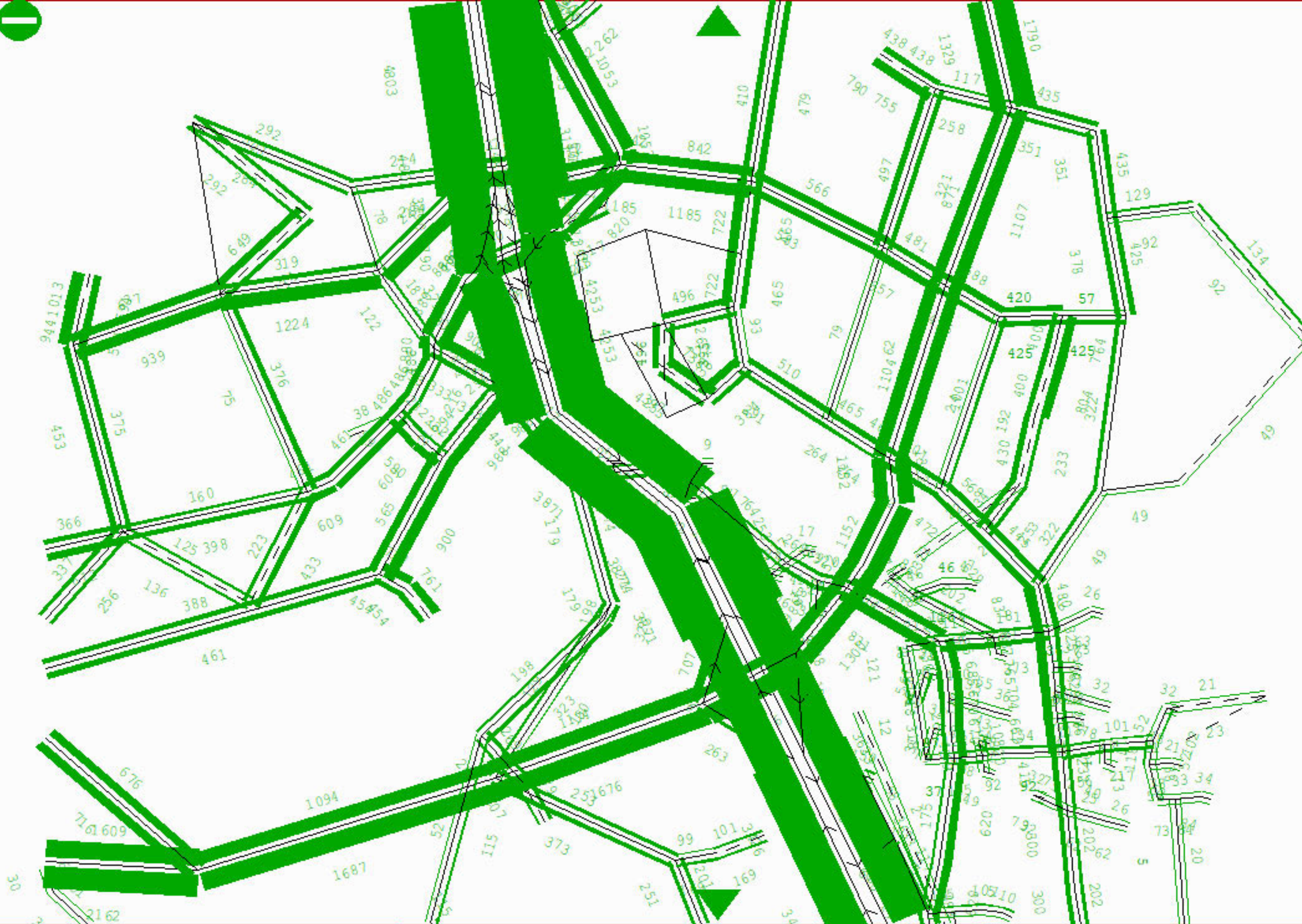
Options:
-UC,MCC etc.

Q - Return

+ Menu bar!



- Annotation:
- Delay sec
- Display of link anno >
- Link display >
- Banner/Title >
- General >
- More data >
- Add temp dat x
- Delay sec to the D.B.
- Options: >
- UC,MCC etc.
- Q - Return
- + Menu bar!



Annotation:

Actual flow

Display of

link anno

Link display

Banner/Title

General

[More data](#)

Add temp dat

Actual flow

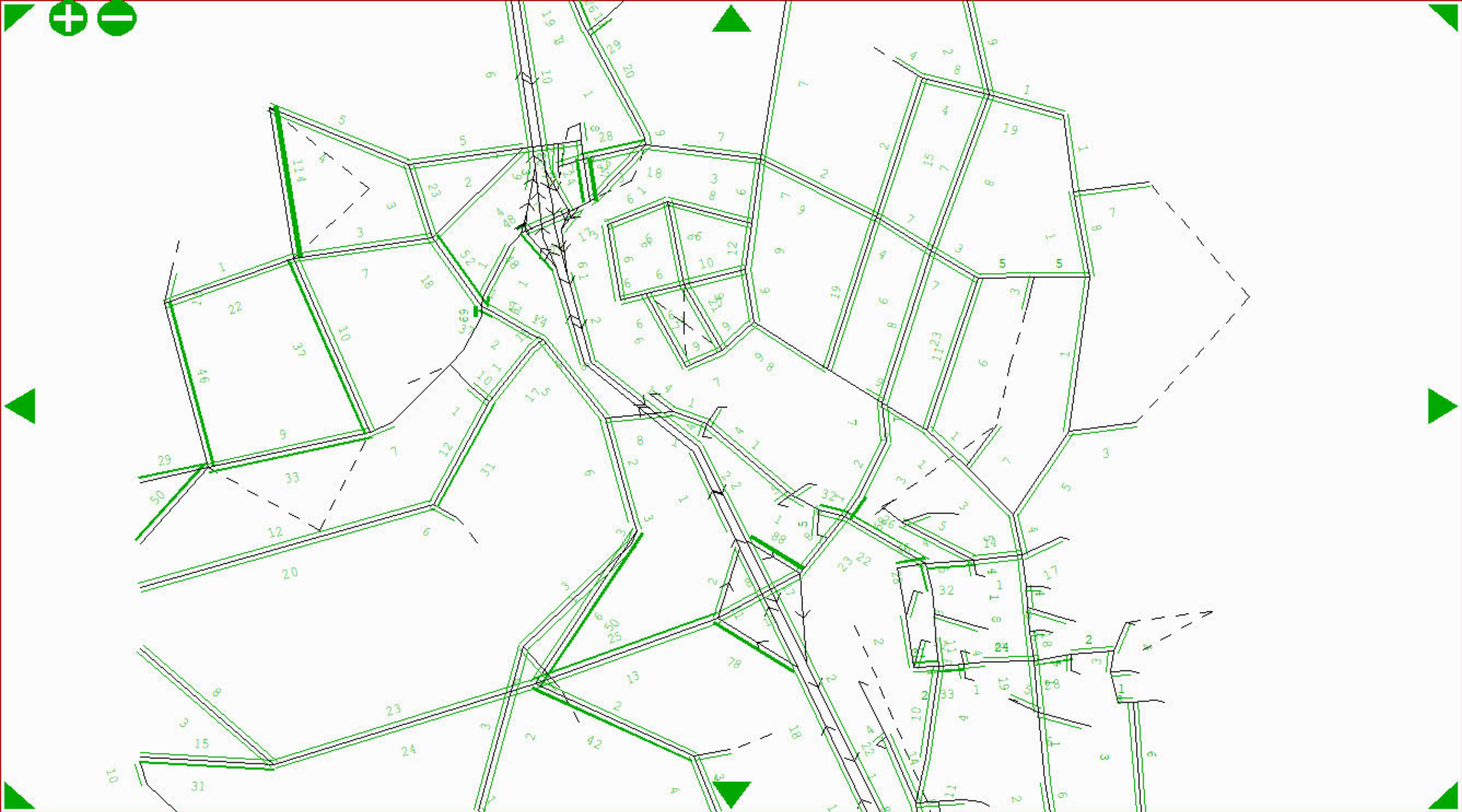
to the D.B.

Options:

- UC, MCC etc.

Q - Return

- + Menu bar!



Annotation:

Delay sec

Display of
link anno
Link display
Banner/Title
General

More data

Add temp dat
Delay sec
to the D.B.

Options:
-UC,MCC etc.

Q - Return

+ Menu bar!

Appendix E SIDRA Results

With Direct Connection

MOVEMENT SUMMARY

 **Site: 1g2_28AM2 [AM Peak 2028 Net2 - GSR / Waihoehoe - 2In NWS With Staggered %Peds]**

AM Peak 2028 Net2 - GSR / Waihoehoe - 2In NWS With Staggered %Peds

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 110 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: GSR												
10	L2	1	0.0	0.001	15.8	LOS B	0.0	0.2	0.57	0.57	0.57	40.8
11	T1	574	9.9	0.897	47.1	LOS D	33.8	256.6	0.97	1.04	1.19	30.5
12	R2	206	8.7	0.811	66.3	LOS E	6.1	45.9	1.00	0.93	1.32	26.3
Approach		781	9.6	0.897	52.2	LOS D	33.8	256.6	0.98	1.01	1.22	29.3
East: Waihoehoe												
1	L2	201	2.1	0.288	21.0	LOS C	5.7	40.9	0.73	0.75	0.73	38.5
2	T1	39	24.3	0.075	28.7	LOS C	1.5	12.4	0.74	0.56	0.74	36.0
3	R2	720	13.2	0.876	48.5	LOS D	26.9	209.6	0.95	0.92	1.09	30.1
Approach		960	11.3	0.876	42.0	LOS D	26.9	209.6	0.90	0.87	1.00	31.7
North: GSR												
4	L2	372	6.5	0.284	9.7	LOS A	6.5	48.1	0.36	0.65	0.36	43.7
5	T1	346	11.9	0.370	25.5	LOS C	9.8	75.9	0.74	0.62	0.74	37.1
6	R2	108	8.7	0.853	68.5	LOS E	6.6	49.4	1.00	0.97	1.41	25.7
Approach		826	9.0	0.853	24.1	LOS C	9.8	75.9	0.60	0.68	0.66	37.5
West: Norrie												
7	L2	74	24.3	0.853	71.0	LOS E	4.5	38.4	1.00	0.97	1.48	25.2
8	T1	16	33.3	0.191	57.4	LOS E	0.9	8.2	0.99	0.69	0.99	28.0
9	R2	1	0.0	0.191	61.9	LOS E	0.9	8.2	0.99	0.69	0.99	28.0
Approach		91	25.6	0.853	68.5	LOS E	4.5	38.4	1.00	0.92	1.39	25.7
All Vehicles		2658	10.6	0.897	40.3	LOS D	33.8	256.6	0.83	0.86	0.97	32.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P4	South Full Crossing	53	49.3	LOS E	0.2	0.2	0.95	0.95	
P1	East Full Crossing	53	49.3	LOS E	0.2	0.2	0.95	0.95	
P21	North Stage 1	53	49.3	LOS E	0.2	0.2	0.95	0.95	
P22	North Stage 2	53	49.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		211	49.3	LOS E			0.95	0.95	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY

 **Site: 1g2_28PM2 [PM Peak 2028 Net2 - GSR / Waihoehoe - 2In NWS With Staggered %Peds]**

PM Peak 2028 Net2 - GSR / Waihoehoe - 2In NWS With Staggered %Peds

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 60 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: GSR												
10	L2	1	0.0	0.002	12.7	LOS B	0.0	0.1	0.71	0.57	0.71	42.2
11	T1	167	14.5	0.563	26.3	LOS C	4.8	37.7	0.97	0.79	0.98	36.8
12	R2	387	6.0	0.816	37.8	LOS D	6.5	47.5	1.00	1.00	1.38	33.0
Approach		556	8.5	0.816	34.3	LOS C	6.5	47.5	0.99	0.93	1.26	34.1
East: Waihoehoe												
1	L2	58	0.0	0.085	11.5	LOS B	0.6	4.2	0.68	0.68	0.68	42.8
2	T1	21	30.0	0.055	19.7	LOS B	0.5	4.3	0.80	0.58	0.80	39.4
3	R2	542	6.0	0.826	31.6	LOS C	11.3	83.1	0.97	0.93	1.16	34.9
Approach		621	6.3	0.826	29.3	LOS C	11.3	83.1	0.93	0.89	1.10	35.7
North: GSR												
4	L2	751	10.0	0.895	33.6	LOS C	27.6	210.1	0.98	1.06	1.32	34.0
5	T1	359	8.8	0.862	32.0	LOS C	9.2	69.3	0.98	0.98	1.32	34.9
6	R2	159	9.3	0.684	34.5	LOS C	4.9	37.2	1.00	0.87	1.16	33.7
Approach		1268	9.5	0.895	33.3	LOS C	27.6	210.1	0.98	1.01	1.30	34.2
West: Norrie												
7	L2	194	7.1	0.822	38.2	LOS D	6.5	48.2	1.00	1.00	1.40	32.6
8	T1	49	14.9	0.213	26.5	LOS C	1.4	11.0	0.93	0.69	0.93	36.7
9	R2	1	0.0	0.213	31.0	LOS C	1.4	11.0	0.93	0.69	0.93	36.7
Approach		244	8.6	0.822	35.8	LOS D	6.5	48.2	0.98	0.94	1.30	33.4
All Vehicles		2689	8.5	0.895	32.8	LOS C	27.6	210.1	0.97	0.96	1.25	34.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P4	South Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90	
P1	East Full Crossing	53	24.4	LOS C	0.1	0.1	0.90	0.90	
P21	North Stage 1	53	24.4	LOS C	0.1	0.1	0.90	0.90	
P22	North Stage 2	53	24.4	LOS C	0.1	0.1	0.90	0.90	
All Pedestrians		211	24.4	LOS C			0.90	0.90	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

MOVEMENT SUMMARY



Site: 1f4_38AM2 [AM Peak 2038 Net2 - GSR / Waihoehoe - 4In WithPeds]

AM Peak 2038 Net2 - GSR / Waihoehoe - 4In WithPeds

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 70 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: GSR												
10	L2	1	0.0	0.002	12.0	LOS B	0.0	0.1	0.64	0.57	0.64	42.6
11	T1	165	31.8	0.551	29.3	LOS C	5.4	48.0	0.96	0.78	0.96	35.8
12	R2	133	4.0	0.234	33.5	LOS C	2.1	15.0	0.91	0.74	0.91	34.3
Approach		299	19.4	0.551	31.1	LOS C	5.4	48.0	0.94	0.76	0.94	35.1
East: Waihoehoe												
1	L2	484	2.0	0.841	42.7	LOS D	9.4	67.0	1.00	1.00	1.36	31.4
2	T1	82	7.7	0.238	27.0	LOS C	2.5	18.4	0.89	0.69	0.89	36.6
3	R2	129	8.1	0.397	32.7	LOS C	4.1	30.4	0.92	0.78	0.92	34.6
Approach		696	3.8	0.841	39.0	LOS D	9.4	67.0	0.97	0.92	1.22	32.5
North: GSR												
4	L2	133	4.8	0.398	32.7	LOS C	4.1	30.2	0.92	0.78	0.92	34.3
5	T1	249	11.4	0.370	27.9	LOS C	3.9	29.8	0.92	0.73	0.92	36.3
6	R2	194	4.9	0.687	37.4	LOS D	6.8	49.4	1.00	0.87	1.11	33.0
Approach		576	7.7	0.687	32.2	LOS C	6.8	49.4	0.94	0.79	0.98	34.7
West: Norrie												
7	L2	478	5.3	0.850	43.5	LOS D	9.4	68.8	1.00	1.01	1.39	31.1
8	T1	53	4.0	0.152	26.4	LOS C	1.6	11.4	0.87	0.66	0.87	36.8
9	R2	1	0.0	0.152	31.0	LOS C	1.6	11.4	0.87	0.66	0.87	36.7
Approach		532	5.1	0.850	41.8	LOS D	9.4	68.8	0.99	0.97	1.34	31.6
All Vehicles		2102	7.4	0.850	36.7	LOS D	9.4	68.8	0.96	0.87	1.15	33.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P4	South Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92	
P1	East Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92	
P2	North Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92	
All Pedestrians		158	29.3	LOS C			0.92	0.92	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY



Site: 1f4_38PM2 [PM Peak 2038 Net2 - GSR / Waihoehoe - 4In WithPeds]

PM Peak 2038 Net2 - GSR / Waihoehoe - 4In WithPeds

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 110 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: GSR												
10	L2	89	0.0	0.156	21.0	LOS C	2.3	16.1	0.76	0.72	0.76	38.6
11	T1	117	9.0	0.410	46.3	LOS D	5.8	43.7	0.95	0.75	0.95	30.7
12	R2	445	2.8	0.345	32.6	LOS C	8.8	62.8	0.78	0.77	0.78	34.6
Approach		652	3.6	0.410	33.4	LOS C	8.8	62.8	0.81	0.76	0.81	34.3
East: Waihoehoe												
1	L2	115	3.7	0.089	29.8	LOS C	2.0	14.6	0.70	0.70	0.70	35.3
2	T1	85	14.8	0.310	45.5	LOS D	4.2	32.8	0.93	0.73	0.93	30.9
3	R2	214	2.0	0.755	56.2	LOS E	11.7	83.5	1.00	0.89	1.12	28.3
Approach		414	5.1	0.755	46.7	LOS D	11.7	83.5	0.90	0.80	0.96	30.5
North: GSR												
4	L2	104	10.1	0.389	50.9	LOS D	5.2	39.3	0.94	0.78	0.94	29.3
5	T1	252	14.2	0.456	46.8	LOS D	6.3	49.5	0.96	0.77	0.96	30.6
6	R2	533	2.4	0.872	49.5	LOS D	30.2	216.0	0.98	0.97	1.16	29.8
Approach		888	6.6	0.872	48.9	LOS D	30.2	216.0	0.97	0.89	1.07	29.9
West: Norrie												
7	L2	280	5.3	0.221	31.2	LOS C	5.2	38.3	0.74	0.74	0.74	34.8
8	T1	109	6.7	0.383	46.0	LOS D	5.5	40.4	0.94	0.75	0.94	30.8
9	R2	1	0.0	0.383	50.6	LOS D	5.5	40.4	0.94	0.75	0.94	30.7
Approach		391	5.7	0.383	35.4	LOS D	5.5	40.4	0.80	0.74	0.80	33.5
All Vehicles		2344	5.3	0.872	42.0	LOS D	30.2	216.0	0.88	0.81	0.93	31.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P4	South Full Crossing	53	49.3	LOS E	0.2	0.2	0.95	0.95	
P1	East Full Crossing	53	49.3	LOS E	0.2	0.2	0.95	0.95	
P2	North Full Crossing	53	49.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		158	49.3	LOS E			0.95	0.95	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 1f4_48AM2 [AM Peak 2048 Net2 - GSR / Waihoehoe - 4In WithPeds]**

AM Peak 2048 Net2 - GSR / Waihoehoe - 4In WithPeds

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: GSR												
10	L2	1	0.0	0.002	13.7	LOS B	0.0	0.1	0.66	0.57	0.66	41.8
11	T1	196	19.9	0.648	35.1	LOS D	7.5	61.7	0.98	0.84	1.03	33.9
12	R2	161	3.3	0.197	32.1	LOS C	2.6	18.7	0.85	0.74	0.85	34.8
Approach		358	12.4	0.648	33.7	LOS C	7.5	61.7	0.92	0.79	0.95	34.3
East: Waihoehoe												
1	L2	273	2.3	0.663	36.4	LOS D	10.1	72.2	0.97	0.84	1.00	33.2
2	T1	129	5.7	0.248	31.3	LOS C	2.8	20.7	0.89	0.69	0.89	35.1
3	R2	168	7.5	0.546	38.3	LOS D	6.2	46.5	0.96	0.80	0.96	32.8
Approach		571	4.6	0.663	35.8	LOS D	10.1	72.2	0.95	0.79	0.96	33.5
North: GSR												
4	L2	175	4.8	0.556	38.4	LOS D	6.5	47.3	0.96	0.80	0.96	32.6
5	T1	276	10.3	0.862	43.6	LOS D	12.4	94.2	1.00	1.06	1.36	31.4
6	R2	298	3.5	0.467	33.7	LOS C	6.6	47.7	0.90	0.78	0.90	34.1
Approach		748	6.3	0.862	38.4	LOS D	12.4	94.2	0.95	0.89	1.08	32.7
West: Norrie												
7	L2	663	3.3	0.819	42.3	LOS D	13.9	100.3	1.00	0.95	1.22	31.5
8	T1	179	6.5	0.550	33.7	LOS C	6.7	49.2	0.96	0.78	0.96	34.3
9	R2	1	0.0	0.550	38.2	LOS D	6.7	49.2	0.96	0.78	0.96	34.3
Approach		843	4.0	0.819	40.4	LOS D	13.9	100.3	0.99	0.92	1.16	32.0
All Vehicles		2520	6.0	0.862	37.8	LOS D	13.9	100.3	0.96	0.86	1.06	32.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P4	South Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93	
P1	East Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93	
P2	North Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93	
All Pedestrians		158	34.3	LOS D			0.93	0.93	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 1f4_48PM2 [PM Peak 2048 Net2 - GSR / Waihoehoe - 4In WithPeds]**

PM Peak 2048 Net2 - GSR / Waihoehoe - 4In WithPeds

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 110 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: GSR												
10	L2	337	0.0	0.587	22.6	LOS C	8.7	61.1	0.90	0.82	0.90	37.9
11	T1	122	6.9	0.423	46.4	LOS D	6.1	45.0	0.95	0.76	0.95	30.7
12	R2	467	2.7	0.441	38.8	LOS D	10.2	73.4	0.86	0.79	0.86	32.7
Approach		926	2.3	0.587	33.9	LOS C	10.2	73.4	0.89	0.80	0.89	34.1
East: Waihoehoe												
1	L2	164	1.9	0.308	37.3	LOS D	6.9	48.9	0.82	0.77	0.82	32.9
2	T1	552	2.5	0.829	46.8	LOS D	19.6	139.8	0.97	0.90	1.07	30.6
3	R2	283	1.5	0.706	48.8	LOS D	14.5	102.7	0.98	0.86	1.01	30.0
Approach		999	2.1	0.829	45.8	LOS D	19.6	139.8	0.95	0.87	1.02	30.8
North: GSR												
4	L2	114	7.4	0.295	43.7	LOS D	5.2	38.4	0.88	0.77	0.88	31.1
5	T1	179	21.8	0.678	49.7	LOS D	9.5	79.0	1.00	0.85	1.05	29.9
6	R2	707	1.9	0.848	47.0	LOS D	25.6	181.8	0.95	0.90	1.05	30.3
Approach		1000	6.1	0.848	47.1	LOS D	25.6	181.8	0.95	0.88	1.03	30.3
West: Norrie												
7	L2	441	4.5	0.421	38.7	LOS D	9.6	69.9	0.86	0.79	0.86	32.5
8	T1	238	4.0	0.846	56.4	LOS E	13.9	100.7	1.00	1.00	1.25	28.3
9	R2	1	0.0	0.846	60.9	LOS E	13.9	100.7	1.00	1.00	1.25	28.3
Approach		680	4.3	0.846	44.9	LOS D	13.9	100.7	0.91	0.87	1.00	30.9
All Vehicles		3605	3.7	0.848	43.0	LOS D	25.6	181.8	0.93	0.85	0.98	31.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P4	South Full Crossing	53	49.3	LOS E	0.2	0.2	0.95	0.95	
P1	East Full Crossing	53	49.3	LOS E	0.2	0.2	0.95	0.95	
P2	North Full Crossing	53	49.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		158	49.3	LOS E			0.95	0.95	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Without Direct Connection

MOVEMENT SUMMARY

 **Site: 1g2_28AM30 [AM Peak 2028 Net30 - GSR / Waihoehoe - 2In NWS With Staggered % Peds]**

AM Peak 2028 Net30 - GSR / Waihoehoe - 2In NWS With Staggered %Peds

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 90 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: GSR												
10	L2	1	0.0	0.002	19.2	LOS B	0.0	0.2	0.72	0.57	0.72	39.3
11	T1	352	10.2	0.866	45.8	LOS D	17.4	132.8	1.00	1.06	1.28	30.8
12	R2	301	8.0	0.857	56.6	LOS E	7.6	56.6	1.00	1.02	1.42	28.2
Approach		654	9.2	0.866	50.8	LOS D	17.4	132.8	1.00	1.04	1.35	29.6
East: Waihoehoe												
1	L2	334	2.5	0.374	13.2	LOS B	6.0	42.9	0.67	0.74	0.67	42.0
2	T1	56	22.6	0.084	18.6	LOS B	1.5	12.9	0.66	0.51	0.66	39.9
3	R2	918	14.2	0.907	40.9	LOS D	30.3	238.0	0.93	0.96	1.12	32.1
Approach		1307	11.6	0.907	32.9	LOS C	30.3	238.0	0.85	0.88	0.99	34.4
North: GSR												
4	L2	400	6.8	0.339	11.5	LOS B	7.5	55.4	0.46	0.69	0.46	42.8
5	T1	349	11.1	0.639	34.1	LOS C	10.5	80.8	0.93	0.77	0.94	34.2
6	R2	103	9.2	0.592	49.3	LOS D	4.6	35.0	1.00	0.80	1.04	29.7
Approach		853	8.9	0.639	25.3	LOS C	10.5	80.8	0.72	0.74	0.73	37.0
West: Norrie												
7	L2	74	24.3	0.698	54.6	LOS D	3.5	30.0	1.00	0.86	1.21	28.4
8	T1	21	35.0	0.207	46.1	LOS D	1.0	8.9	0.98	0.69	0.98	30.7
9	R2	1	0.0	0.207	50.6	LOS D	1.0	8.9	0.98	0.69	0.98	30.6
Approach		96	26.4	0.698	52.7	LOS D	3.5	30.0	0.99	0.82	1.16	28.9
All Vehicles		2909	10.7	0.907	35.3	LOS D	30.3	238.0	0.85	0.87	1.00	33.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P4	South Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94	
P1	East Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94	
P21	North Stage 1	53	39.3	LOS D	0.1	0.1	0.94	0.94	
P22	North Stage 2	53	39.3	LOS D	0.1	0.1	0.94	0.94	
All Pedestrians		211	39.3	LOS D			0.94	0.94	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 1g2_28PM30 [PM Peak 2028 Net30 - GSR / Waihoehoe - 2In NWS With Staggered % Peds]**

PM Peak 2028 Net30 - GSR / Waihoehoe - 2In NWS With Staggered %Peds

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 100 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: GSR												
10	L2	1	0.0	0.001	14.5	LOS B	0.0	0.1	0.62	0.57	0.62	41.4
11	T1	194	17.9	0.411	32.6	LOS C	7.8	63.4	0.87	0.72	0.87	34.7
12	R2	554	13.5	0.860	56.6	LOS E	15.2	118.4	1.00	0.99	1.29	28.2
Approach		748	14.6	0.860	50.3	LOS D	15.2	118.4	0.97	0.92	1.18	29.7
East: Waihoehoe												
1	L2	281	3.4	0.378	16.7	LOS B	6.1	44.2	0.74	0.76	0.74	40.4
2	T1	26	32.0	0.074	33.5	LOS C	1.0	9.1	0.82	0.61	0.82	34.4
3	R2	553	6.3	0.895	52.8	LOS D	20.0	147.7	0.97	0.95	1.19	29.1
Approach		860	6.1	0.895	40.4	LOS D	20.0	147.7	0.89	0.88	1.03	32.2
North: GSR												
4	L2	641	13.3	0.724	22.9	LOS C	23.0	179.6	0.80	0.83	0.80	37.7
5	T1	607	6.1	0.885	44.7	LOS D	24.9	183.6	0.96	0.98	1.15	31.1
6	R2	89	14.1	0.279	42.8	LOS D	3.8	29.9	0.90	0.76	0.90	31.3
Approach		1338	10.1	0.885	34.1	LOS C	24.9	183.6	0.88	0.89	0.97	34.0
West: Norrie												
7	L2	188	7.3	0.889	63.6	LOS E	10.7	79.8	1.00	1.02	1.44	26.6
8	T1	49	14.9	0.260	44.6	LOS D	2.6	20.0	0.95	0.72	0.95	31.0
9	R2	6	0.0	0.260	49.1	LOS D	2.6	20.0	0.95	0.72	0.95	30.9
Approach		244	8.6	0.889	59.3	LOS E	10.7	79.8	0.99	0.95	1.33	27.5
All Vehicles		3191	10.0	0.895	41.5	LOS D	24.9	183.6	0.91	0.90	1.06	31.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P4	South Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94	
P1	East Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94	
P21	North Stage 1	53	44.3	LOS E	0.1	0.1	0.94	0.94	
P22	North Stage 2	53	44.3	LOS E	0.1	0.1	0.94	0.94	
All Pedestrians		211	44.3	LOS E			0.94	0.94	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 1h2_38AM30 [AM Peak 2038 Net30 - GSR / Waihoehoe - 4In With Peds (2038 net)]**

AM Peak 2038 Net30 - GSR / Waihoehoe - 4In With Peds (2038 net)

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: GSR												
10	L2	1	0.0	0.002	13.7	LOS B	0.0	0.1	0.66	0.57	0.66	41.8
11	T1	155	31.3	0.546	33.9	LOS C	5.8	51.2	0.96	0.78	0.96	34.2
12	R2	306	5.8	0.382	33.6	LOS C	5.2	38.2	0.89	0.78	0.89	34.3
Approach		462	14.4	0.546	33.7	LOS C	5.8	51.2	0.91	0.78	0.91	34.3
East: Waihoehoe												
1	L2	613	6.4	0.766	39.6	LOS D	12.3	90.5	0.99	0.91	1.13	32.2
2	T1	105	11.0	0.331	32.2	LOS C	3.7	28.5	0.92	0.72	0.92	34.8
3	R2	168	13.1	0.567	38.6	LOS D	6.3	48.9	0.96	0.80	0.96	32.7
Approach		886	8.2	0.766	38.6	LOS D	12.3	90.5	0.98	0.87	1.08	32.6
North: GSR												
4	L2	140	6.8	0.452	37.7	LOS D	5.1	37.7	0.94	0.79	0.94	32.8
5	T1	282	9.7	0.439	32.9	LOS C	5.1	38.7	0.94	0.75	0.94	34.6
6	R2	191	5.0	0.472	34.3	LOS C	6.6	48.4	0.92	0.80	0.92	33.9
Approach		613	7.6	0.472	34.4	LOS C	6.6	48.4	0.93	0.77	0.93	33.9
West: Norrie												
7	L2	458	5.3	0.569	35.2	LOS D	8.2	59.9	0.94	0.81	0.94	33.5
8	T1	128	4.1	0.390	32.5	LOS C	4.6	33.5	0.93	0.74	0.93	34.7
9	R2	1	0.0	0.390	37.0	LOS D	4.6	33.5	0.93	0.74	0.93	34.6
Approach		587	5.0	0.569	34.6	LOS C	8.2	59.9	0.94	0.80	0.94	33.8
All Vehicles		2548	8.4	0.766	35.8	LOS D	12.3	90.5	0.95	0.81	0.98	33.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P4	South Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93	
P1	East Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93	
P2	North Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93	
All Pedestrians		158	34.3	LOS D			0.93	0.93	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 1h2_38PM30 [PM Peak 2038 Net30 - GSR / Waihoehoe - 4In With Peds (2038 net)]**

PM Peak 2038 Net30 - GSR / Waihoehoe - 4In With Peds (2038 net)

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: GSR												
10	L2	1	0.0	0.002	13.7	LOS B	0.0	0.1	0.66	0.57	0.66	41.8
11	T1	192	6.6	0.585	33.9	LOS C	7.1	52.8	0.97	0.79	0.97	34.2
12	R2	515	8.8	0.655	36.3	LOS D	9.5	71.7	0.96	0.84	0.99	33.4
Approach		707	8.2	0.655	35.6	LOS D	9.5	71.7	0.96	0.83	0.98	33.6
East: Waihoehoe												
1	L2	325	3.6	0.399	33.7	LOS C	5.5	40.0	0.90	0.78	0.90	34.0
2	T1	186	6.8	0.570	33.8	LOS C	6.9	51.3	0.97	0.79	0.97	34.3
3	R2	218	1.9	0.680	40.1	LOS D	8.5	60.2	0.99	0.86	1.06	32.4
Approach		729	3.9	0.680	35.6	LOS D	8.5	60.2	0.94	0.81	0.96	33.5
North: GSR												
4	L2	96	11.0	0.318	36.8	LOS D	3.4	25.9	0.92	0.76	0.92	33.0
5	T1	477	10.4	0.746	37.3	LOS D	9.6	73.3	1.00	0.92	1.14	33.2
6	R2	348	3.3	0.854	45.0	LOS D	15.3	110.4	1.00	0.99	1.29	30.9
Approach		921	7.8	0.854	40.1	LOS D	15.3	110.4	0.99	0.93	1.17	32.3
West: Norrie												
7	L2	279	5.3	0.346	33.4	LOS C	4.7	34.3	0.88	0.77	0.88	34.1
8	T1	103	6.1	0.373	32.4	LOS C	4.3	31.8	0.93	0.74	0.93	34.5
9	R2	19	0.0	0.373	36.9	LOS D	4.3	31.8	0.93	0.74	0.93	34.4
Approach		401	5.2	0.373	33.3	LOS C	4.7	34.3	0.90	0.76	0.90	34.2
All Vehicles		2759	6.5	0.854	36.8	LOS D	15.3	110.4	0.96	0.85	1.03	33.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P4	South Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93	
P1	East Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93	
P2	North Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93	
All Pedestrians		158	34.3	LOS D			0.93	0.93	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 1g2_48AM30 [AM Peak 2048 Net30 - GSR / Waihoehoe - 4In With Peds]**

AM Peak 2048 Net30 - GSR / Waihoehoe - 4In With Peds

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 110 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: GSR												
10	L2	1	0.0	0.001	15.4	LOS B	0.0	0.1	0.61	0.57	0.61	41.0
11	T1	235	14.3	0.658	44.7	LOS D	11.9	93.5	0.98	0.82	0.98	31.1
12	R2	357	5.3	0.378	40.5	LOS D	7.9	57.7	0.87	0.78	0.87	32.2
Approach		593	8.9	0.658	42.1	LOS D	11.9	93.5	0.91	0.80	0.91	31.8
East: Waihoehoe												
1	L2	412	6.6	0.880	58.0	LOS E	24.8	183.5	1.00	0.98	1.24	27.7
2	T1	161	7.2	0.352	45.3	LOS D	5.0	37.0	0.93	0.72	0.93	31.0
3	R2	199	12.2	0.753	56.6	LOS E	11.0	84.8	1.00	0.89	1.13	28.2
Approach		772	8.2	0.880	55.0	LOS D	24.8	183.5	0.98	0.91	1.15	28.5
North: GSR												
4	L2	176	4.8	0.633	53.1	LOS D	9.1	66.6	0.99	0.82	1.00	28.8
5	T1	331	9.6	0.900	60.3	LOS E	20.7	156.7	1.00	1.10	1.33	27.5
6	R2	287	3.7	0.385	39.9	LOS D	8.1	58.7	0.85	0.77	0.85	32.3
Approach		794	6.4	0.900	51.3	LOS D	20.7	156.7	0.94	0.92	1.08	29.3
West: Norrie												
7	L2	584	3.6	0.701	44.0	LOS D	14.2	102.4	0.93	0.84	0.96	31.0
8	T1	276	5.0	0.891	58.3	LOS E	16.7	121.7	0.99	1.08	1.34	27.9
9	R2	1	0.0	0.891	62.8	LOS E	16.7	121.7	0.99	1.08	1.34	27.9
Approach		861	4.0	0.891	48.6	LOS D	16.7	121.7	0.95	0.92	1.08	29.9
All Vehicles		3019	6.7	0.900	49.7	LOS D	24.8	183.5	0.95	0.89	1.07	29.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P4	South Full Crossing	53	49.3	LOS E	0.2	0.2	0.95	0.95	
P1	East Full Crossing	53	49.3	LOS E	0.2	0.2	0.95	0.95	
P2	North Full Crossing	53	49.3	LOS E	0.2	0.2	0.95	0.95	
All Pedestrians		158	49.3	LOS E			0.95	0.95	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 **Site: 1g2_48PM30 [PM Peak 2048 Net30 - GSR / Waihoehoe - 4ln With Peds]**

PM Peak 2048 Net30 - GSR / Waihoehoe - 4ln With Peds

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: GSR												
10	L2	248	0.0	0.304	19.3	LOS B	6.3	44.2	0.69	0.75	0.69	39.3
11	T1	185	5.7	0.462	55.5	LOS E	11.8	87.0	0.92	0.77	0.92	28.5
12	R2	559	8.9	0.738	62.5	LOS E	19.1	143.5	0.97	0.86	1.00	27.0
Approach		993	6.0	0.738	50.4	LOS D	19.1	143.5	0.89	0.81	0.91	29.6
East: Waihoehoe												
1	L2	373	3.1	0.926	85.0	LOS F	31.6	227.3	1.00	1.00	1.29	23.0
2	T1	578	2.4	1.007	95.4	LOS F	36.6	261.2	0.99	1.11	1.33	21.7
3	R2	289	1.5	0.815	71.9	LOS E	21.5	152.7	1.00	0.91	1.11	25.3
Approach		1240	2.4	1.007	86.8	LOS F	36.6	261.2	0.99	1.03	1.27	22.9
North: GSR												
4	L2	103	8.2	0.304	60.6	LOS E	6.5	48.6	0.90	0.77	0.90	27.2
5	T1	362	15.4	1.002	115.2	LOS F	37.0	293.2	1.00	1.29	1.54	19.5
6	R2	617	2.2	0.964	83.4	LOS F	35.3	252.1	0.97	0.97	1.22	23.3
Approach		1082	7.2	1.002	91.9	LOS F	37.0	293.2	0.98	1.06	1.30	22.2
West: Norrie												
7	L2	400	5.0	0.510	58.0	LOS E	12.8	93.6	0.91	0.81	0.91	27.7
8	T1	237	4.0	0.988	105.4	LOS F	30.7	220.0	0.99	1.22	1.51	20.4
9	R2	85	0.0	0.988	109.9	LOS F	30.7	220.0	0.99	1.22	1.51	20.4
Approach		722	4.1	0.988	79.7	LOS E	30.7	220.0	0.95	0.99	1.18	23.9
All Vehicles		4037	4.9	1.007	77.9	LOS E	37.0	293.2	0.96	0.98	1.17	24.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P4	South Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96	
P1	East Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96	
P2	North Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96	
All Pedestrians		158	69.3	LOS F			0.96	0.96	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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