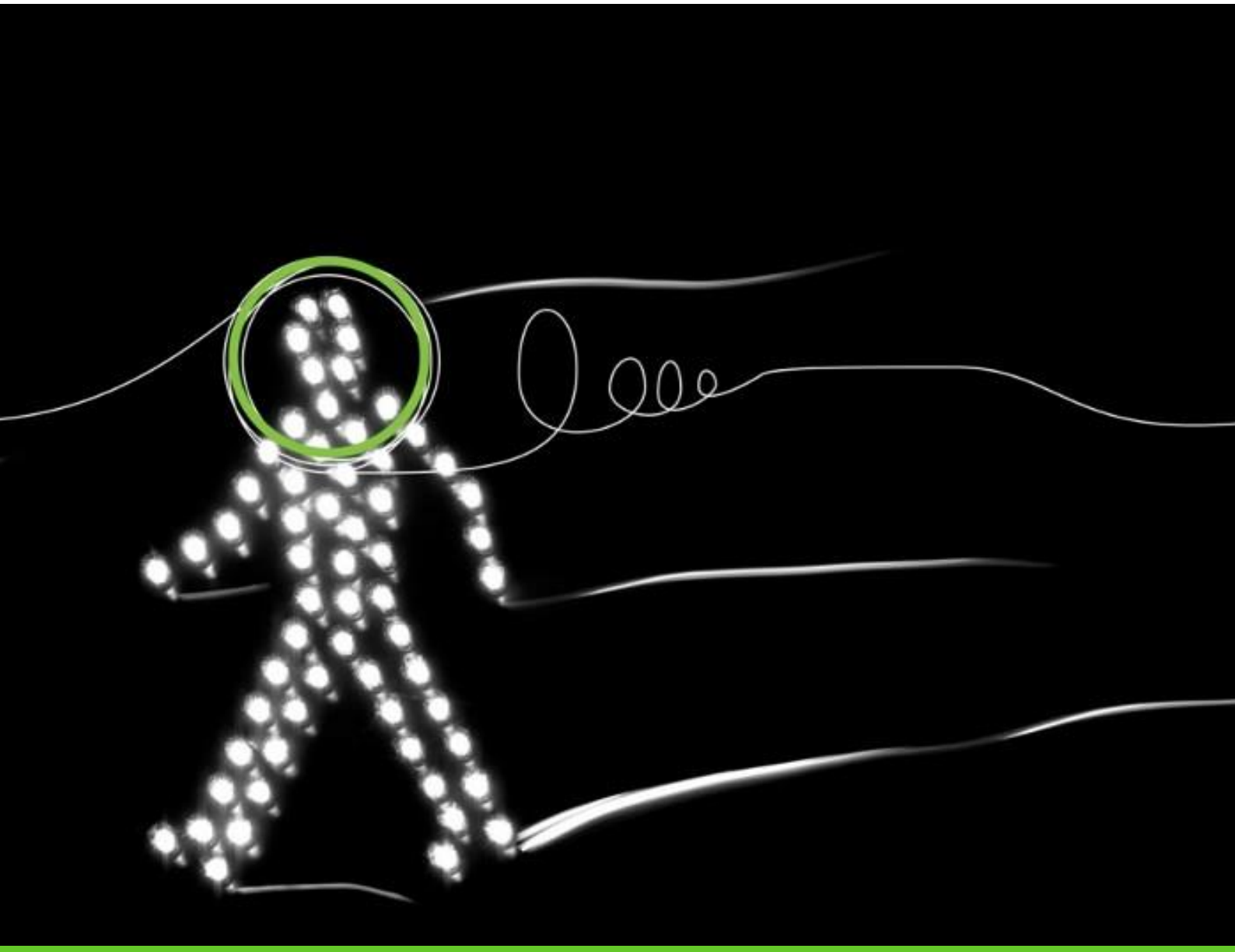
GTAconsultants



Traffic Modelling for PSP 1062 Beveridge Central

Client // Metropolitan Planning Authority
Office // VIC
Reference // 15M1263000
Date // 03.02.15

Traffic Modelling for

PSP 1062 Beveridge Central

Issue: A 03.02.15

Client: Metropolitan Planning Authority
Reference: 15M1263000
GTA Consultants Office: VIC

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
A-Dr	19/12/14	Draft	Emma Akiyama Reeves Sal Ahmad		Reece Humphreys	
A	03/02/14	Final	Sal Ahmad	Reece Humphreys	Reece Humphreys	

GTAconsultants
MELBOURNE SYDNEY BRISBANE CANBERRA
ADELAIDE GOLD COAST TOWNSVILLE PERTH
www.gta.com.au

Table of Contents

Appendices

Figures

Tables

1. Introduction

1.1 Background

The Beveridge Central (1062) PSP comprises of approximately 280 hectares (gross) of land either side of the Hume Freeway at Beveridge. It is expected to ultimately accommodate 2,500 residential homes and a population of 10,500. The precinct's primary land use is identified as residential.

The precinct is split in half by the Hume Freeway, with one half to the East (including the Beveridge Township), which abuts the recently approved Lockerbie North Precinct, and the other half to the West of the Hume Freeway abutting the Mandalay development. The land is currently zoned as Urban Growth Zone (UGZ) within the precinct. The PSP is proposed to include a series of future arterial roads bordering the precinct, Rankin Street to the south, Patterson Street (E14) to the west, Stewart Street to the east and Camerons Lane/Beveridge Road to the north.

The Hume Freeway interchange at Lithgow Street, providing the current single access the precinct is to be decommissioned by 2046 and retained as a grade separated crossing of the freeway. New interchanges are proposed to be constructed at Camerons Lane and Rankin Street to provide key access points to the precinct.

The MPA, in consultation with the Shire of Mitchel is preparing to facilitate the future development of this precinct. The envisioned plan is primarily guiding new development neighbourhoods in growth areas, including services and facilities required to support that community.

1.2 Purpose of this Report

GTA Consultants (GTA) has been engaged by the Metropolitan Planning Authority (MPA) to undertake strategic transport modelling to determine the anticipated demands on the transport network. The outputs will be used to:

- Inform the road cross sections for an interim (2026) and ultimate (2046) scenario.
- Understand the need for any further infrastructure including duplicating arterial roads in the future or additional turn lanes at an intersection.
- Determine the functional intersection design requirements for an interim (2026) and ultimate (2046) scenario. The layouts will then be used as input into the preparation of the Development Contributions Plan (DCP).

This report is intended to provide the MPA with strategic modelling advice for the purpose of assisting with the transport planning for the PSP. All inputs and assumptions have been provided to GTA from the MPA through its stakeholders.

It is important to note that the preparation of this report has been completed to the best possible industry standards and expertise. GTA do not take any responsibility for the realisation of these assumptions and associated outputs and they should be read in this context.

1.3 References

In preparing this report, reference has been made to a number of background documents, including:

- plans for the PSP prepared by Metropolitan Planning Authority

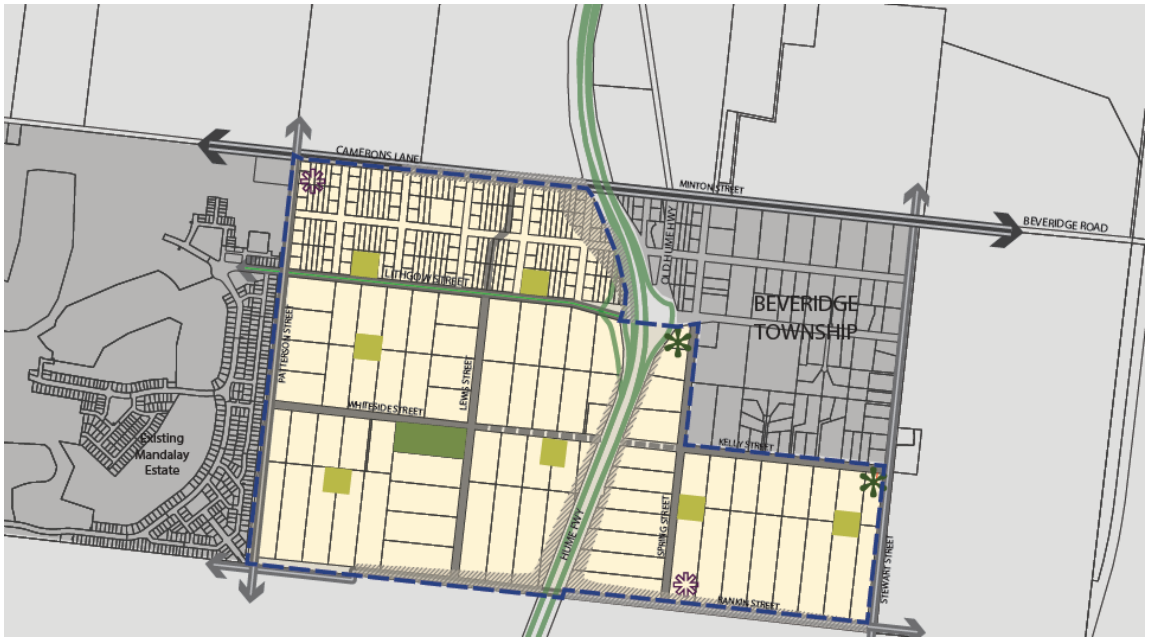
- Victorian Integrated Transport Model (VITM)
- VITM Northern Growth Corridor Model
- various technical data as referenced in this report
- other documents as nominated.

2. Site Context

2.1 Subject Site

The Beveridge Central PSP (No. 1062) is located within the Mitchell Shire Council municipal area north of the Melbourne CBD. The precinct is bound by Camerons Lane to the north, Patterson Street to the west, Rankin Street to the south, and the Stewart Street to the east. The layout of the Beveridge Central PSP boundary is shown in Figure 2.1. It is surrounded by the proposed growth area communities of greater Merrifield, Donnybrook and Beveridge, with the Lockerbie PSP to the south of the precinct. The Hume Freeway effectively splits the precinct into two, half to the east abutting the Lockerbie North precinct and the other half west of the Hume Freeway abutting the Mandalay Estate in the Beveridge South West precinct.

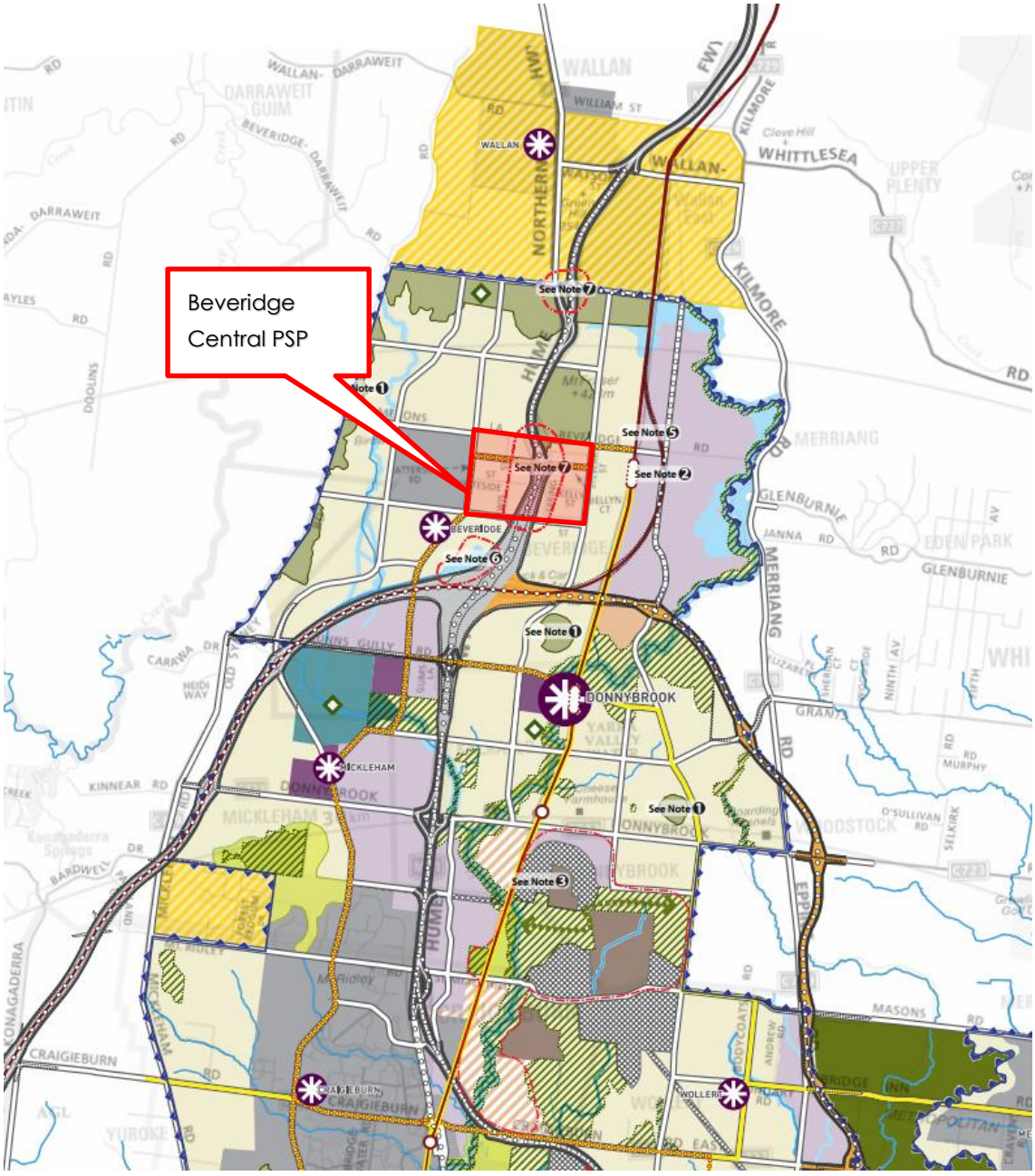
Figure 2.1: Beveridge Central PSP



2.2 Northern Growth Corridor

The location of the Beveridge Central PSP in relation to the wider Northern Growth Corridor and its local context are illustrated in Figure 2.2.

Figure 2.2: Beveridge Central PSP in the Context of the Northern Growth Corridor



SKM was commissioned by MPA (formerly GAA) to calibrate and refine the Department of Transport's (now DTPLI) Victorian Integrated Transport Model (VITM) for Melbourne's North Growth Corridor. The refinements to VITM included the following:

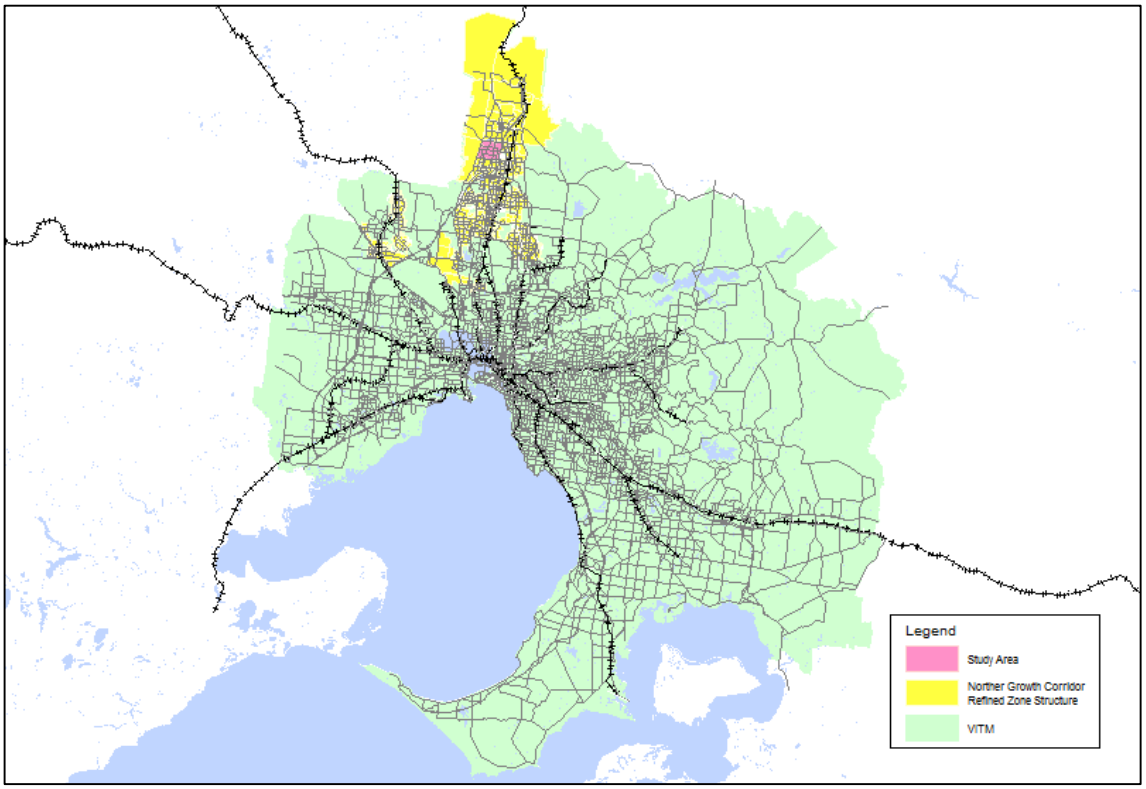
- disaggregation of the zone system within the growth corridor
- updates to the future modelled land use yields to reflect the level of growth predicted by the MPA within the corridor
- updates to the road network within the corridor.

The purpose of the project was to provide a strategic model of the North Growth Corridor which could be to understand the transport needs of the MPA, Hume City Council, Sunbury City

Council, Whittlesea City Council and VicRoads for projects (such as PSPs) within the corridor. This model is referred to as the NGC VITM hereafter.

The context of the study area as it relates to the northern growth area and the study area for Beveridge Central PSP is shown in Figure 2.3.

Figure 2.3: VITM Zone Structure in the Context of the Northern Growth Corridor Model



3. PSP Context

3.1 Urban Structure Plan

The indicative Urban Structure Plan for the Beveridge Central PSP is shown Figure 3.1. The plan was developed by MPA as part of the structure planning process.

Figure 3.1: Beveridge Central Draft Future Urban Structure

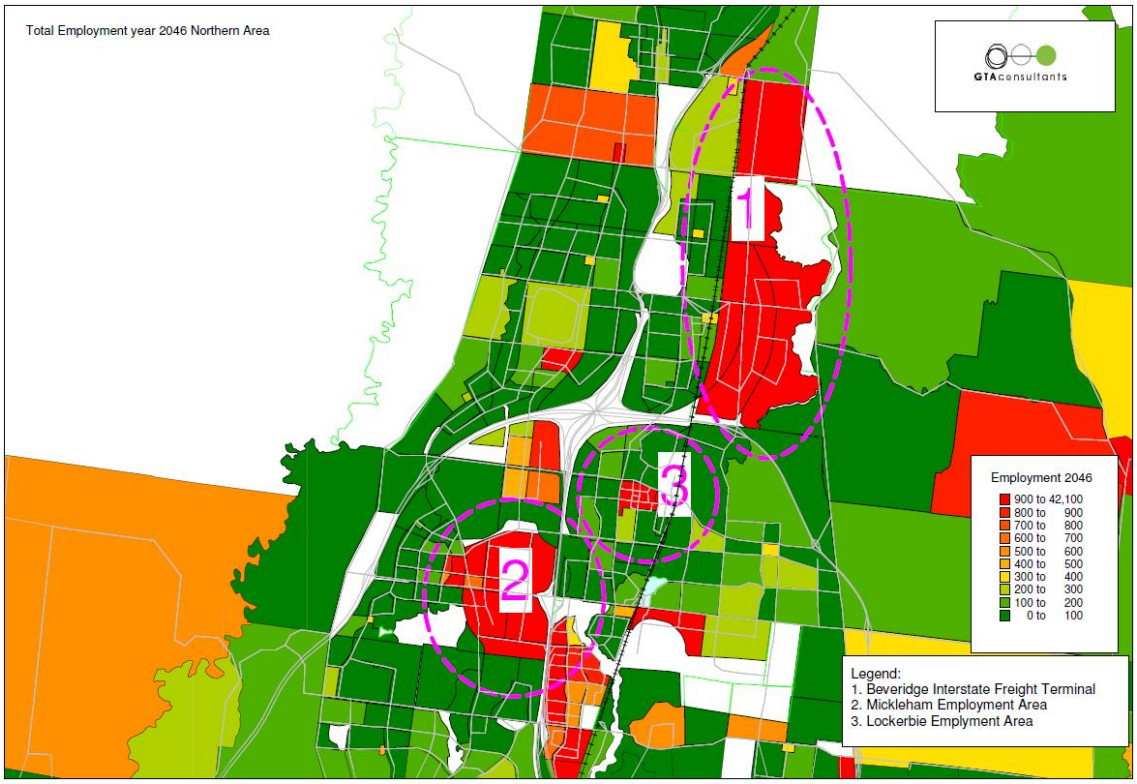
The Beveridge Central PSP comprises of primarily residential land uses with up to seven new local parks. The precinct includes a total of two Local Convenience Centres (LCCs) that provides future residents with access to day-to-day shopping needs. The road network will consist of two north-south arterial roads, three lower order north-south connectors as well as a series of east-west connectors. Further discussion on the road layout is provided in Section 4.

3.2 Surrounding Land Uses

The study area is surrounding by a range of proposed residential and economic land uses, as depicted in Figure 3.2. The proposed northern Local Town Centre of Lockerbie North is to be located immediately east of the Beveridge PSP which forecasts a high proportion of jobs (employment) as well as Wallan located on to the north of the precinct.

Figure 3.2 has been prepared to demonstrate the employment forecast within the VITM zones in the surrounding employment areas as they relate to the study area.

Figure 3.2: Northern Growth Corridor – VITM Employment Characteristics



The areas depicted in Figure 3.2 highlight the influence that these are likely to have on the travel patterns across the network. Of note are the Mickleham Employment Area, Donnybrook Town Centre and the Beveridge Interstate Freight terminal, that are all forecast to exhibit high employment numbers thus influencing travel patterns in the region.

4. Existing and Future Road Network

4.1 Overview

The boundaries of the PSP are bounded by Camerons Lane to the north, Patterson Street to the west, Rankin Street to the south, and the Stewart Street to the east. The existing and anticipated future characteristics of key roads in the vicinity of the PSP area are discussed below. This section describes the key arterials bounding the PSP.

4.2 Arterial Road Network

4.2.1 Hume Freeway

The Hume Freeway corridor along eastern boundary of the precinct and is the most significant north – south corridor linking northern Victoria with the Melbourne CBD. The freeway cross section is generally configured with two traffic lanes and an emergency lane in each direction separated by a 30m central median. The 50 metre carriageway (approx.) is set within a 75 metre road reserve (approx.). The large road reserve allows for additional traffic lanes to be added to the corridor to cater for future growth. This reserve has recently been refined and reduced in consultation with VicRoads.

4.2.2 Camerons Lane

Camerons Lane located on the northern boundary of the precinct and is configured as a two lane rural cross-section (one lane in each direction) adjacent to the site. The North Growth Corridor Plan identifies that sections of Camerons Lane will be upgraded to Arterial Standard with up to two lanes in each direction.

The existing interchange at Lithgow Street does not meet current VicRoads standards and it is proposed to be replaced by a full interchange at Camerons Lane in the future. As a result, it is earmarked to attract funding via GAIC or GAIC WIK, particularly from the Lithgow development.

4.2.3 Patterson Street

Patterson Street is a two-way partially unsealed road aligned in a north-south direction located to the western boundary of the PSP. It provides connection to Camerons Lane to the north and Rankin Street to the south, and will ultimately consist of a four lane cross section (two lanes in each direction) through the study area. It is assumed that this will be in place by 2046.

4.2.4 Rankin Street

Rankin Street is a two-way partially unsealed road aligned in an east-west direction located to the southern boundary of the PSP. It provides a connection to Patterson Street to the west and Stewart Street to the east, and will ultimately consist of a four-lane cross section (two lanes in each direction) through the study area.

4.2.5 Stewart Street

Stewart Street is a two-way partially unsealed road aligned in a north-south direction located to the eastern boundary of the PSP. It provides connection to Rankin Street to the south and

Beveridge Road to the north, and will ultimately consist of a four-lane cross section (two lanes in each direction) through the study area.

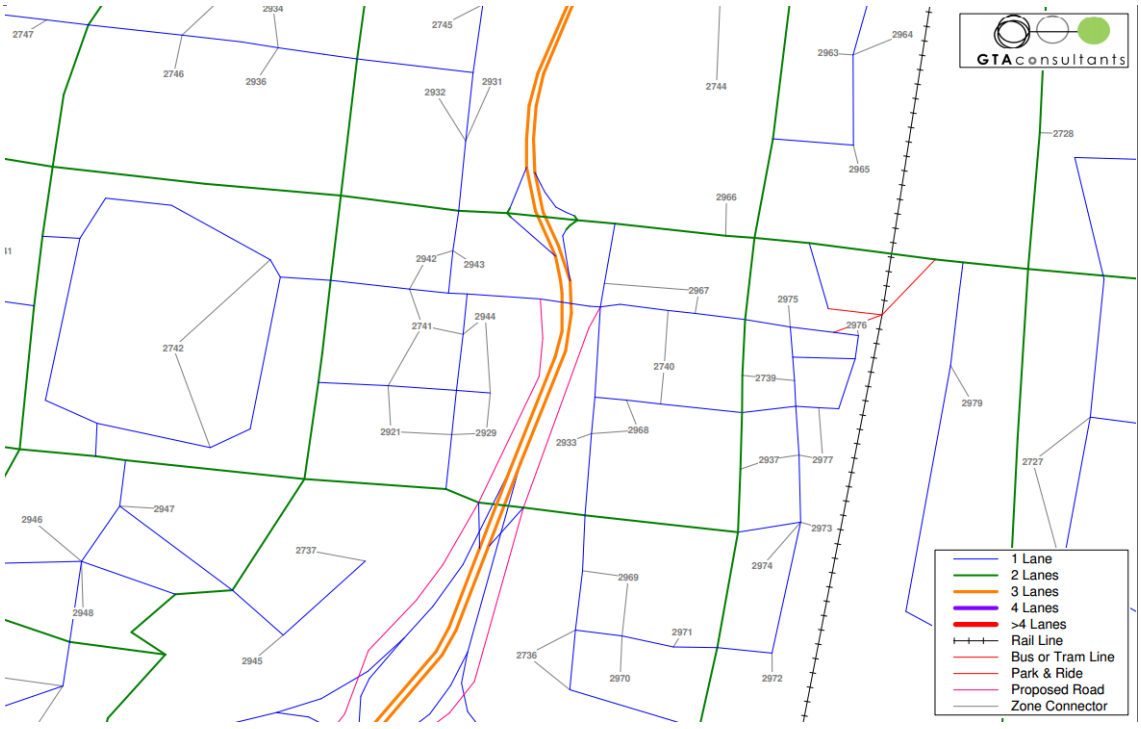
4.3 Internal Road Network

The internal road network is underpinned by a grid network of collector and boulevard road types that provide internal connectivity to local convenience centres as well as the external network. Key features of the network include:

- Camerons Lane is proposed to be connected in an east-west direction over Hume Freeway with conjunction with proposed relocation of diamond interchange from Lithgow Street by 2046
- Rankin Street is proposed to be connected in an east-west direction over Hume Freeway in conjunction with proposed city bound interchange.
- All other internal collector roads are proposed to have one lane in each direction.

The refined road network as depicted in the VITM model is shown in Figure 4.1.

Figure 4.1: Beveridge Central PSP VITM Road Network (2046)



Further discussion on the transport modelling is provided in Section 5.

5. Transport Modelling

5.1 Background

VITM is a tool developed by the Department of Transport, Planning and Local Infrastructure (Formerly DoT) to assist in the planning of road and public transport infrastructure in Victoria. It is a multimodal strategic model that uses future population, employment and land use data projections to forecast travel behaviour and the impacts of changes to the road and public transport networks. VITM contains all major freeways, main arterials and connector roads within the Melbourne Statistical Division.

The model is a link-based traffic model which is implemented in the CUBE Voyager software environment (developed by Citilabs). The model version that is used for this project was obtained from the DTPLI in May 2013, version VITM2012_V120110 GAA NGC. This is the latest release of the model from the DTPLI (DoT formerly).

The MPA commissioned a study to refine the Victorian Integrated Transport Model (VITM) for Melbourne's North Growth Corridor. The refinements to VITM included the following:

- disaggregation of the zone system within the growth corridor
- updates to the future modelled land use yields to reflect the level of growth predicted by the MPA within the corridor
- updates to the road network within the corridor.

The purpose of the project was to provide a strategic model of the North Growth Corridor which could be to understand the transport needs of the MPA, Hume City Council, Whittlesea City Council and VicRoads for projects (such as PSPs) within the corridor.

This model formed the basis for the VITM modelling undertaken as part of this package of work.

5.2 Design Years - Interim (2026) vs. Ultimate (2046)

Both interim and ultimate traffic volumes are presented in this report. The interim traffic volumes represent the +10 year scenario (~2026) and the ultimate volumes the 2046 scenario. The interim volumes are used to inform intersection works up to the interim scenario for inclusion into the Development Contributions Plan (DCP), whilst the ultimate volumes are used to validate the provision of ultimate road reserves including flaring requirements at intersections.

5.3 GTA Road Network Refinements

GTA refined a copy of the Northern Growth Corridor version of VITM and has used it in the assessment of the Beveridge Central PSP. For the purposes of this assessment the following network refinements were made to the NGC VITM (both the 2026 and 2046 models):

- additional and editing road network in the study area
- refinement of the zones to reflect the proposed Beveridge Central PSP
- refinement of the zone centroid connection locations for the PSP.

The extent of the GTA network refinements are shown in Figure 5.1 to Figure 5.4.

Figure 5.1: NGC - VITM Road Network - 2026

Figure 5.2: Refined VITM Road Network - 2026

The VITM Road Network 2026 is shown in Figure 5.1. Refinements made to this network are shown in Figure 5.2 adopting the following refinements:

- 100 km/hr along the Hume Freeway
- 60 km/hr along Lithgow Street (Fairhaven Avenue to Hume Freeway on ramp)
- Addition of Whiteside Street link, with 50 km/hr (Patterson Street to Lewis Street)
- Removal of link, south of Lewis Street and part of Rankin Street (east of Lewis Street)
- Removal of Hume Freeway and Camerons Lane link
- Modifications to Park & Ride links at the train station, Beveridge Road and proposed new road east of Lithgow Street

Figure 5.3: NGC - VITM Road Network - 2046

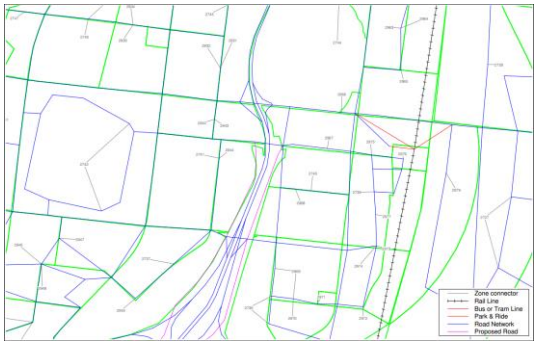


Figure 5.4: Refined VITM Road Network - 2046

The VITM Road Network 2046 shown in Figure 5.3. The refined VITM Road Network is shown Figure 5.4 adopting the following refinements:

- Mandalay Road with 2 lanes
- Stewart Street with 2 lanes (south of Rankin Street)
- 80 km/hr along Camerons Lane (Mandalay Road to Hume Freeway)
- 80 km/hr along Beveridge Road (Hume Freeway to Merriang Road)
- 60 km/hr along Patterson Road
- 50 km/hr along Lithgow Street (Patterson Road to Stewart Street)
- 50 km/hr along Malcolm Street
- Addition of Whiteside Street link, with 50 km/hr (Patterson Street to Lewis Street)
- Removal of link, south of Lewis Street and part of Ranking Street (east of Lewis Street)
- Modifications to Park & Ride links at the rail line, Beveridge Road and proposed new road east of Lithgow Street

The GTA refinements were undertaken in consultation with MPA and were made to enhance how the NGC VITM reflected the likely access arrangements for the Beveridge Central PSP. It is

highlighted that the GTA refinements did not result in any noteworthy changes to the 2026 and 2046 VITM network beyond the bounds of the study area.

Plots of the road network characteristics (i.e. speeds, lanes, capacities etc.) are located in Appendix A.

5.4 Land use Refinements

In addition to the road network refinements, the zone configuration of the PSP was desegregated for the purpose of the traffic assessment. The zone system was based around the proposed urban structure plan's land uses and road network characteristics.

The zone refinements are shown graphically in Figure 5.5 and Figure 5.6, whilst Figure 5.7 provides details of the zone numbering adopted for the study area.

Figure 5.5: NGC VITM Zone Structure

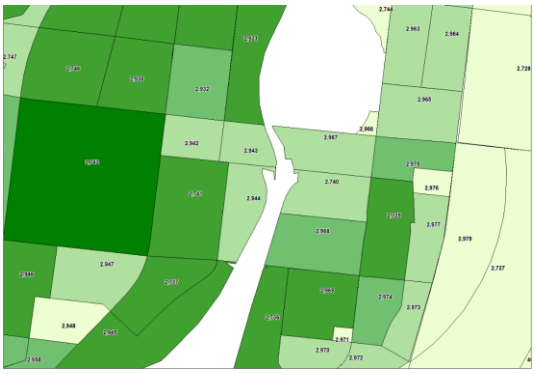
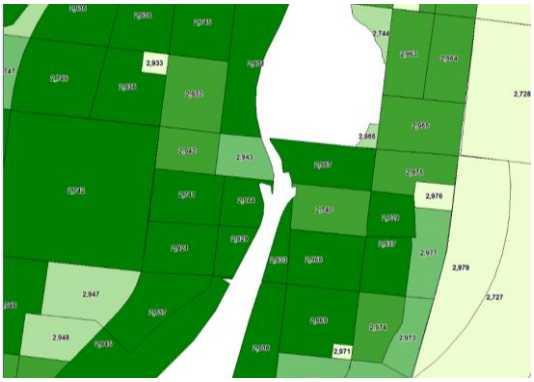


Figure 5.6: Refined VITM Zone Structure



In addition, the land use specifications for the zones have been provided from the MPA, and are shown and summarised in Figure 5.7 and Table 5.1.

Figure 5.7: Beveridge Central PSP Zone Numbering

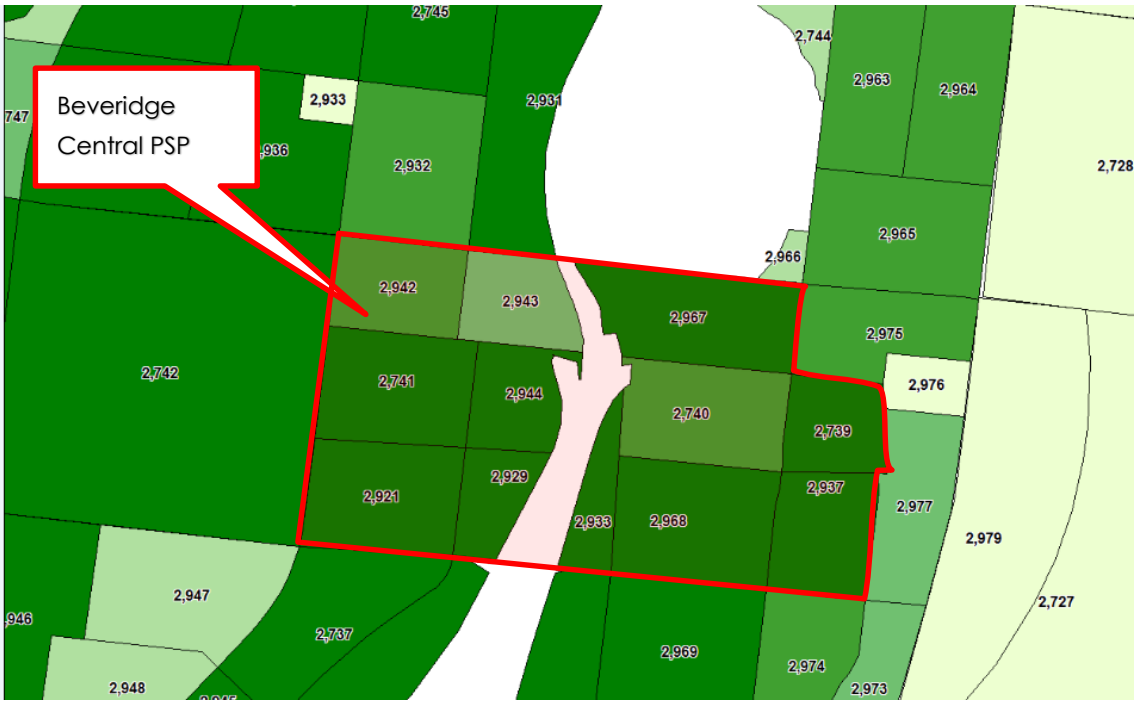


Table 5.1: Beveridge Central PSP Land Use Summary (2026 and 2046)

Zone	2026				2046			
	Population	Dwelling	Employment	Enrolment	Population	Dwelling	Employment	Enrolment
2942	743	266	68	0	991	354	91	0
2943	504	180	12	0	672	240	16	0
2741	1,040	371	25	0	1,386	495	33	0
2921	1,260	450	30	0	1,680	600	40	0
2944	788	281	19	0	1,050	375	25	0
2929	529	189	13	0	706	252	17	0
2967	67	24	0	0	90	32	0	0
2740	59	21	0	0	78	28	0	0
2968	1,164	416	40	0	1,552	554	54	0
2933	643	230	15	0	857	306	20	0
2739	221	79	58	400	294	105	77	400
2937	851	304	20	0	1,134	405	27	0
Total PSP	**7,867**	**2,810**	**300**	**400**	**10,490**	**3,746**	**400**	**400**

As shown in Table 5.1, population in the Beveridge Central PSP are to increase by 33% from 2026 to 2046, 33% for employment and no increase for enrolment. Ultimately, the PSPs will total a population over 10,490, including 3,746 households, 400 jobs and 400 enrolments.

Of note for the PSP in that it exhibits a low amount of jobs and enrolments relative to the population, meaning that trips to and from the precinct are likely to be tidal.

5.5 Public Transport Refinements

The existing VITM public transport network for 2046 is shown in Figure 5.8. GTA refined the public transport network to reflect PTV proposed bus route layout in 2046. This includes the number of routes, their paths and their frequencies. An updated layout of the PT network is shown in Figure 5.9. It should be noted that the public transport network south of the Donnybrook Road are assumed to have no change.

Figure 5.8: VITM Northern Growth Corridor Model – Public Transport Routes 2046

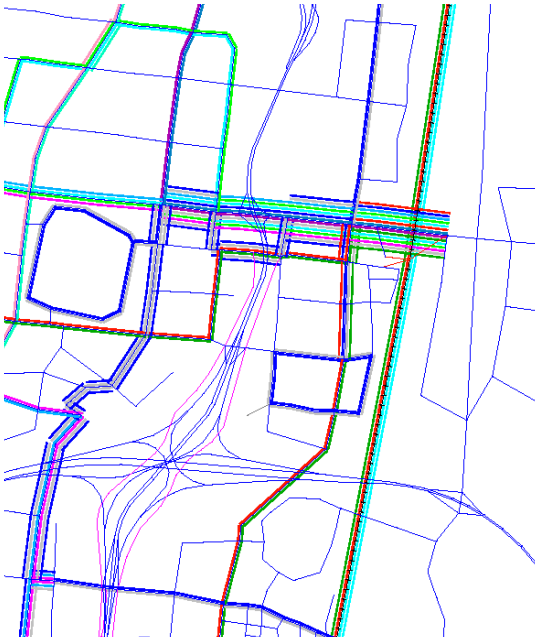
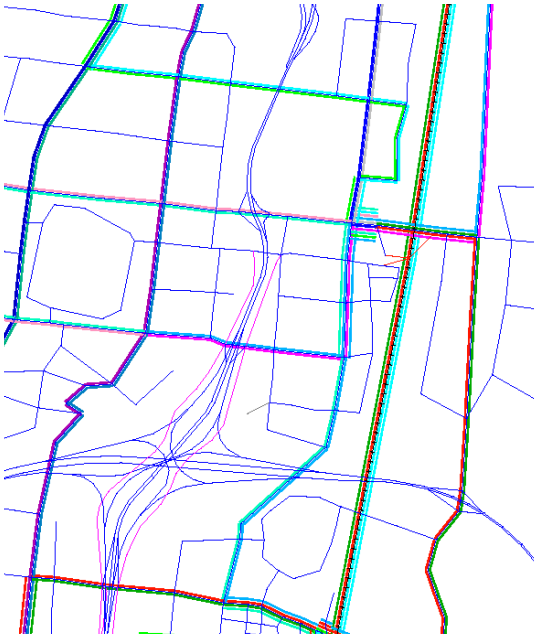


Figure 5.9: Refined VITM Northern Growth Corridor Model – Public Transport Routes 2046



5.6 Scenarios

A total of two scenarios have been tested as part of this project, including:

- the interim (2026) model (including the Base Case)
- the ultimate (2046) model (including the Base Case).

It is noted that each of the scenario includes the same land uses identified in Table 5.1.

6. Anticipated Traffic Volumes

6.1 Introduction

An assessment of the PSP transport demands and network performance has been undertaken for the each scenario in this section of the report. The outcomes from the assessment will inform the road network requirements at full development.

6.2 VITM Traffic Generation

Table 6.1 lists the inputs and outputs of the VITM modelling. It shows the AM and PM 2-hour peak and daily traffic generation for the PSP along with the corresponding land use inputs.

Table 6.1: Updated VITM Traffic Generation

Year	Land Use			AM 2 hr Trips	PM 2 Hr Trips	Daily Vehicle Trips
	Residential (hh)	Employment (jobs)	Schools (enrolments)			
2026	2,800	300	400	3,534	4,005	25,300
2046	3,800	400	400	3,858	4,706	29,800

The model outputs suggest that by 2046 the PSP is expected to generate traffic in the order of 24,625 vehicle trips per day with 3,794 and 4,685 vehicles for the AM and PM 2-hour peak periods, respectively.

Adopting a typical (industry standard) two-hour to peak hour factor of 0.55, the PSP is anticipated to generate in the order of 2,087 vehicles in the AM peak hour and 2,577 vehicles in the PM peak hour.

6.3 Validation of VITM Traffic Generation

6.3.1 First Principles Generation Rates

A summary of the individual land uses and the resulting first principles traffic generation for the study area is provided in Table 6.2. This assessment compares the modelled traffic volume outputs to commonly used generation rates as confirmation that VITM is generating realistic traffic demands.

Table 6.2: First Principles Traffic Generation Assessment

Area	Land Use	Yield	Traffic Generation Rate			Reduction Factor for Internal Trips	Resultant Trips		
			AM (1hr)	PM (1hr)	Daily		AM (1hr)	PM (1hr)	Daily
2026	Residential [1]	2,810 dwellings	0.7 trips / hh	0.7 trips / hh	7.0 trips / hh	15%[1]	1,672	1,672	16,720
	Employment (jobs)	300 jobs	[2] 0.5 trips / 3 jobs	[2] 4.6 trips / 3 jobs	[2] 50 trips / 3 jobs	[3] 25%	37	342	3,723
	School	400 enrolments	[4] 0.75 trips / enrol	[4] 0 trips / enrol	[4] 1.5 trips / enrol	n/a	300	0	600
Total							**2,3009**	**2,014**	**21,042**
2046	Residential [1]	3,746 dwellings	0.7 trips /hh	0.7 trips /hh	7.0 trips /hh	15%[1]	2,229	2,229	22,289
	Employment (jobs)	400 jobs	[2] 0.5 trips / 3 jobs	[2] 4.6 trips /3 jobs	[2] 50 trips / 3 jobs	[3] 25%	50	457	4,964
	School	400 enrolments	[4] 0.75 trips / enrol	[4] 0 trips / enrol	[4] 1.5 trips / enrol	n/a	300	0	600
Total							**2,579**	**2,686**	**27,852**

[1] Daily rate based on VISTA 09 data for the Whittlesea LGA, with the peak hour rates assumed to be 10% of the daily rate. A reduction factor of 15% has been applied to account for inter-zonal trips

[2] Daily rate sourced from the RTANSW "Guide to Traffic Generating Developments" report (dated October 2002) with PM peak hour rate assumed to be 10% of the daily rate. An AM rate of 0.5 trips/100sqm has been adopted for service vehicle movements given that the LTC will not be fully operational during the AM peak hour. A rate of 3 jobs per 100sqm has been adopted for this assessment.

[3] Based on Section 3.3 of the RTANSW "Guide to Traffic Generating Developments" report. It is assumed that 25% of all trips within the PSP will be internal to the zone given that the PSP includes a number of LTC's and schools.

[4] Based on a first principles assessment

It is highlighted that the first principles assessment outlined in Table 6.2 takes into consideration the results of the Victorian Integrated Survey of Travel and Activity 2009 (VISTA09) undertaken by the DoT/DTPLI. VISTA09 is a comprehensive survey of how, when and why Victorians travel and is both more recent and locality specific than most other available empirical data sources. The average VISTA09 traffic generation rate of 6.0 movements per dwelling for the Mitchell LGA is lower than other empirical data sources which generally have a daily generation rate in the order of 8.0 – 10.10 vehicle movements per dwelling. The lower VISTA 09 generation rate can be partially attributed to amongst other things, a low data sample for this area.

It is likely that the future Mitchell LGA will operate similarly to both the Hume and Whittlesea LGAs. VISTA 09 data indicates that both the Hume and the Whittlesea's LGAs have a daily traffic generation rate of 7.0 trips per household. This calculates to be a total of 21, 042 daily trips in 2026 and 27, 852 daily trips in 2046.

6.3.2 Comparison of VITM and First Principles Volume Analysis

A comparison of the GTA VITM generation and first principles generation assessment is provided in Table 6.3.

Table 6.3: VITM versus First Principles Assessment

Year	Traffic Volumes	AM Peak	PM Peak	Daily
2026	VITM	1,944	2,203	25,300
	First Principle Assessment	2,009	2,014	21,042
	% Difference	-3%	9%	17%
2046	VITM	2,122	2,588	29,800
	First Principle Assessment	2,579	2,686	27,852
	% Difference	-22%	-4%	7%

Table 6.3 show that the forecast GTA VITM traffic demands are generally within 20% of the AM, PM and daily trips to those of a first principles assessment, noting that some of the land use rates and yields can vary depending on the ultimate mix and density of development, and the strategic nature of VITM. It is noted that the first principle assessment uses a generation rate based on Hume and Whittlesea LGAs.

6.4 Daily Modelled Volumes

Figure 6.1: Transport Network with Key Locations - 2046

Based on the outcomes of the VITM modelling, the expected two-way daily traffic volumes on key roads for 2046 are summarised in Table 6.4.

Table 6.4: Summary of Ultimate Daily Volumes on Key Roads (2046)

No.	Road Name	Expected Daily Traffic Volume (two-way)	Proposed Classification and No. lanes	Daily Traffic Volume Limit Associated with Classification	Austroads Capacity Limit (based on No. lanes) [1]	Proposed Classification is Considered Appropriate?
1	Stewart Street (south of Rankin Street)	20,800	Secondary Arterial (4 lanes)	12,000 to 40,000vpd	36,000vpd	Yes
2	Camerons Lane (west of Hume Freeway)	27,900	Primary Arterial (4 lanes)	Greater than 30,000vpd	54,000vpd	Yes
3	Stewart Street (north of Camerons Lane)	30,400	Secondary Arterial (4 lanes)	12,000 to 40,000vpd	36,000vpd	Yes
4	Beveridge Road (west of Epping-Kilmore Road)	22,400	Secondary Arterial (4 lanes)	12,000 to 40,000vpd	36,000vpd	Yes
5	Rankin Street (west of Hume Freeway)	14,000	Secondary Arterial (4 lanes)	12,000 to 40,000vpd	36,000vpd	Yes
6	Rankin Street (east of Hume Freeway)	7,800	Secondary Arterial (4 lanes)	12,000 to 40,000vpd	36,000vpd	Yes

[1] Capacity limits scoured from Austroads Standards "Guide to Traffic Management – Part 3 Traffic Studies and Analysis" document from Table 4.3 as follows: 2-lane road: 18,000vpd, 4–lane road: 36,000vpd, 6-lane road 54,000vpd.

As shown in Table 6.4 the proposed road classifications generally align with the daily traffic volume ranges associated with the classification and Austroads based road capacity limits. Indeed, the volumes indicate that Rankin Street could be considered to provide more capacity than what would be required, based on traffic demand alone. Further investigation of the usage of these roads should be undertaken through the PSP design process, including consideration of road management within local town centres and through school precincts. This could be in the form of lane management, parking management and Public Transport Priority if, and when, required.

6.5 Model Plots

In addition to the information presented in this section, a range of outputs have been extracted from the model. The intention of these is to assist in the understanding of travel demand for the two design years. These are located within Appendix B and include the following:

- Select Link Analysis Plots for the four locations in the year 2026 and the six locations in the year 2046 identified above, for the AM and PM peak periods, and by direction
- Degree of saturation for the AM and PM peak
- Daily volume plots
- Travel speed plots for the AM and PM peak period.

The SLA plots, along with the daily volume plots, demonstrate that, as expected, there is a large proportion of traffic from the PSP travelling to the employment areas and arterial road network to the north and south. In particular, Stewart Street carries the highest daily volumes as well as links near the Hume Freeway such as the Camerons Lane.

7. Network Assessment

7.1 Overview

A range of outputs have been extracted from the model and are reported in this section. These are:

- Link volumes at key locations for the AM, PM and Daily periods. These have been reported for both the interim (2026) and ultimate design years (2046).
- Volume to capacity or degree of saturation outputs for the respective peak periods and design years.
- Select link plots or assessments for the key locations previously identified.
- Network Performance characteristics.

The outputs are discussed in the following sections with a summary provided thereafter.

7.2 Link Volumes

7.2.1 Interim 2026

Four to six key locations within the PSP have been identified in consultation with MPA to report on a range of outputs including volumes and capacity information. The key locations for each design years are shown graphically in Figure 7.1 and Figure 6.1.

Figure 7.1: Transport Network with Key Locations - 2026

The link volumes for the key locations, as identified in Section 6 (Figure 7.1), have been extracted from the model and are summarised in Table 7.1.

Table 7.1: AM/PM/Daily Peak Link Volumes 2026

No	Road Name	AM Peak (2 hrs)	PM Peak (2 hrs)	Daily
1	Stewart Street south of Rankin Street NB	478	1288	4100
	Stewart Street south of Rankin Street SB	1147	813	4400
2	Lithgow Street west of Hume Freeway EB	1689	1364	11400
	Lithgow Street west of Hume Freeway WB	1187	2146	10800
3	Stewart Street north of Camerons Lane NB	96	816	1700
	Stewart Street north of Camerons Lane SB	696	368	2200
4	Camerons Lane west of Epping-Kilmore Road EB	117	95	700
	Camerons Lane west of Epping-Kilmore Road WB	69	150	700

7.2.2 Ultimate (2046)

The link volumes for the key locations, as identified in Section 6 (Figure 6.1), have been extracted from the model and are summarised in Table 7.2.

Table 7.2: AM/PM/Daily Peak Link Volumes 2046

No	Road Name	AM (two hours)	PM (two hours)	Daily
1	Stewart Street south of Rankin Street NB	1116	2525	10600
	Stewart Street south of Rankin Street SB	1945	1545	10200
2	Camerons Lane west of Hume Freeway EB	2738	1997	14200
	Camerons Lane west of Hume Freeway WB	1417	3199	13700
3	Stewart Street north of Camerons Lane NB	1554	3645	14600
	Stewart Street north of Camerons Lane SB	3567	2058	15700
4	Camerons Lane west of Epping-Kilmore Road EB	2370	1438	11400
	Camerons Lane west of Epping-Kilmore Road WB	1186	2572	11000
5	Rankin Street west of Hume Freeway EB	1672	880	6500
	Rankin Street west of Hume Freeway WB	658	2214	7500
6	Rankin Street east of Hume Freeway EB	455	957	3800
	Rankin Street east of Hume Freeway WB	917	574	4000

As discussed previously, the expected volumes for Stewart Street and Camerons Lane exhibit those of a duplicated road, however Rankin Street, based on the daily volumes could potentially be reduced to one lane in each direction.

7.3 Degree of Saturation

The volume to capacity ration (degree of saturation) is a good indicator as to the operation of the network at the specific link locations. The volume to capacity ratio (VCR) are also able to be correlated with the Level of Service Definitions as defined in Austroads outlined in Table 7.3.

Table 7.3: Level of Service Definitions

LOS	Definition	Volume to Capacity Ratio
A	Conditions of free flow, speed is controlled by driver's desires, speed limits or physical Roadway conditions	0.0-0.35
B	Conditions of stable flow, operating speeds begin to be restricted, little or no restrictions on manoeuvrability from other vehicles	0.35-0.50
C	Conditions of stable flow, speeds and manoeuvrability more closely restricted, occasional backups behind left-turning vehicles at intersections	0.50-0.75
D	Conditions approach unstable flow, tolerable speeds can be maintained but temporary restrictions may cause extensive delays, little freedom to manoeuvre	0.75-0.90
E	Conditions approach capacity, unstable flow with stoppages of momentary duration, manoeuvrability severely limited	0.90-1.00
F	Forced flow conditions, stoppages for long periods, low operating speeds	1.00 or >1.00

7.3.1 Interim 2026

The VCR outputs for the key locations, as identified in Section 6 (Figure 7.1), have been extracted from the model and are summarised in Table 7.4.

Table 7.4: AM and PM Peak (two hour) Volume to Capacity Outputs and Level of Service 2026

No	Road Name	AM Peak	PM Peak
1	Stewart Street south of Rankin Street NB	0.28	0.76
	Stewart Street south of Rankin Street SB	0.67	0.48
2	Lithgow Street west of Hume Freeway EB	1.06	0.85
	Lithgow Street west of Hume Freeway WB	0.74	1.34
3	Stewart Street north of Camerons Lane NB	0.06	0.48
	Stewart Street north of Camerons Lane SB	0.41	0.22
4	Camerons Lane west of Epping-Kilmore Road EB	0.10	0.08
	Camerons Lane west of Epping-Kilmore Road WB	0.06	0.13

Table 7.4 shows that Lithgow Street will reach its capacity in both the AM and PM peak periods. This supports the need for the Camerons Lane interchange to be implemented as land use is realised.

7.3.2 Ultimate 2046

The VCR outputs for the key locations, as identified in Section 6 (Figure 6.1), have been extracted from the model and are summarised in Table 7.5.

Table 7.5: AM and PM Peak (two hour) Volume to Capacity Outputs and Level of Service 2046

No	Road Name	AM Peak	PM Peak
1	Stewart Street south of Rankin Street NB	0.28	0.63
	Stewart Street south of Rankin Street SB	0.49	0.39
2	Camerons Lane west of Hume Freeway EB	0.81	0.59
	Camerons Lane west of Hume Freeway WB	0.42	0.94
3	Stewart Street north of Camerons Lane NB	0.39	0.91
	Stewart Street north of Camerons Lane SB	0.89	0.51
4	Camerons Lane west of Epping-Kilmore Road EB	0.59	0.36
	Camerons Lane west of Epping-Kilmore Road WB	0.30	0.64
5	Rankin Street west of Hume Freeway EB	0.49	0.26
	Rankin Street west of Hume Freeway WB	0.19	0.65
6	Rankin Street east of Hume Freeway EB	0.13	0.28
	Rankin Street east of Hume Freeway WB	0.27	0.16

The information presented in Table 7.5 indicates that relocation of freeway interchange by 2046 removes the pressure on Lithgow Street whilst maintaining Camerons Lane degree of saturation within desirable levels (i.e. D or less). In addition, whilst the network performs at acceptable Levels of Service, Camerons Lane and Stewart Street should be monitored at the intersection level to ensure good operating conditions are maintained.

7.4 Plots

A range of pots for the Modelled Scenarios have been prepared and are located in Appendix C and Appendix D. These include:

- Daily Link Volumes
- AM and PM Peak Period Travel Speeds
- AM and PM Peak Period Degree of Saturation
- Select link analysis for the AM & PM peak periods.

8. Intersection Volumes

8.1 Methodology

VITM is a strategic network model and hence care should be exercised when extracting individual links or turning movement flows. It typically is not used for determining intersection turning movements as it is not used for this purpose, and turning movements are influenced by a number of factors not included in VITM.

Nevertheless, a requirement of the brief is to develop intersection turning movements to assist in determining the infrastructure requirements for the PSP. As such, we have developed an approach that seeks to provide a balanced outcome for each intersection.

The approach adopted in arriving at future turning flows for the purpose of assessing the PSPs is summarised as follows:

- Extract AM and PM peak period (2-hour) intersection turning movements from VITM for key intersections and covert to peak hour flows using the 0.55 factor.
- Assess each intersection individually to ensure that turn flows are reasonable having regard for the arterial and local road networks and adjacent activity centre and schools and make refinements where appropriate.
- Factor the VITM traffic volumes to achieve consistency with the anticipated first principles traffic generation assessment.
- Engineering 'judgement' has been applied to turning movements that exhibit low or unrealistic movements based on the network layout and accounting for individual.

In terms of the quantum of intersection turning movements, the results for all option are provided in Appendix E.

8.2 Intersections Assessed

A total of 11 intersections have been selected within the study area, as depicted in Figure 8.1.

Figure 8.1: Key Intersection Locations

The resultant intersection turning movements, for the AM and PM peak periods for the interim (2026) and ultimate (2046) scenarios are located in Appendix E.

9. Conclusion

Strategic transport modelling of the Beveridge Central PSP has been undertaken using the Victoria Integrated Transport Model (VITM). The information presented within this report outlines the land use inputs, assumptions and resultant transport demands for the proposed road network.

The results show that the road network in 2026 demonstrates is more capable of accommodating the demands of the PSP as well as the addition of through trips; however the Lithgow Street interchange will experience congestion by 2026, thus supporting the introduction of Camerons Lane.

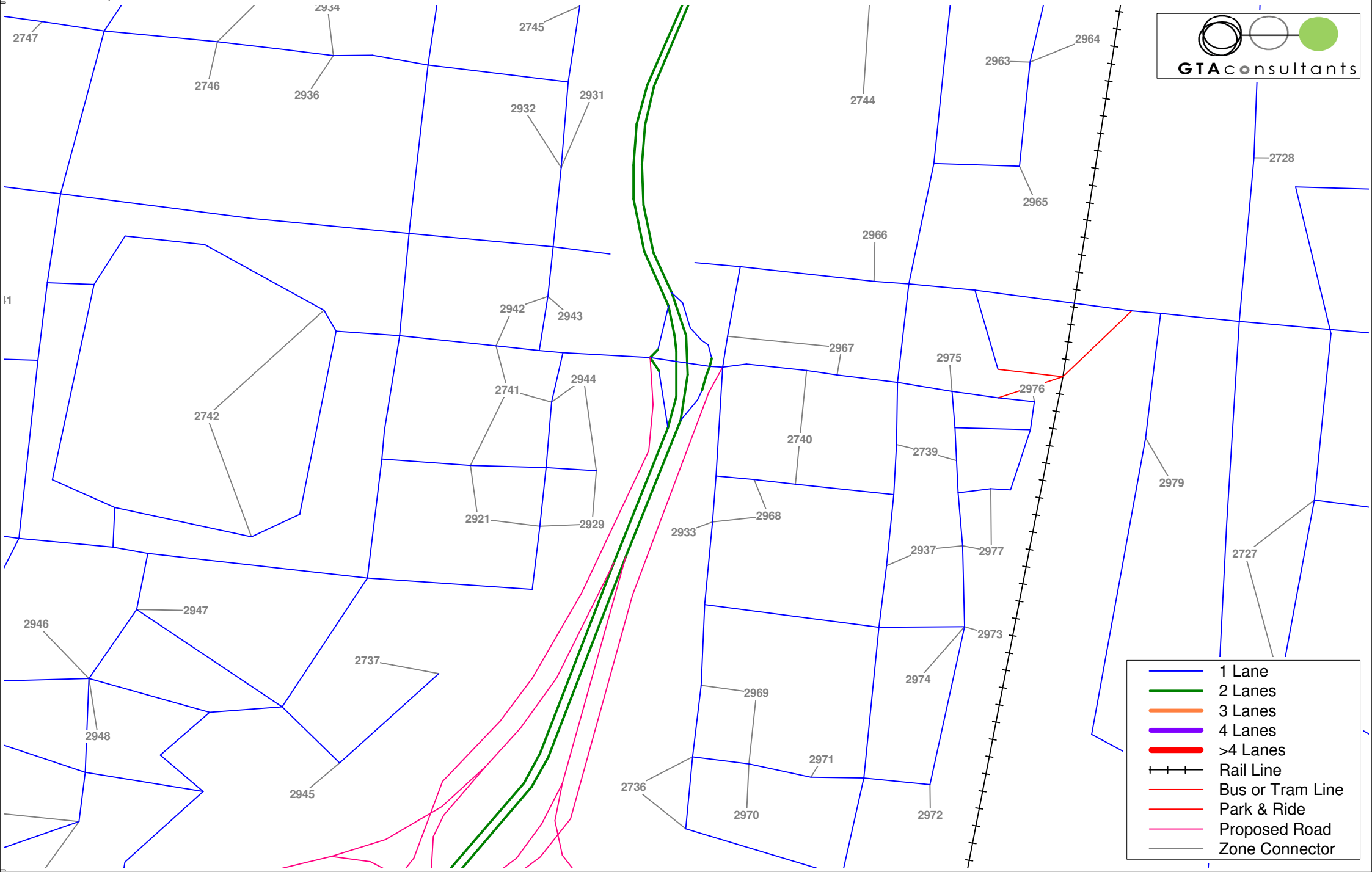
By 2046, with the interchange relocated, the network will operate well with sufficient capacity in the road network.

Indeed, the modelling demonstrates, that based on traffic capacity alone, that some links (i.e. Rankin Street) may provide too much capacity, and that investigation into the management of the road network, in consultation with key stakeholders, is recommended.

Appendix A

Interim (2026) and Ultimate (2046) Modelled Road Networks

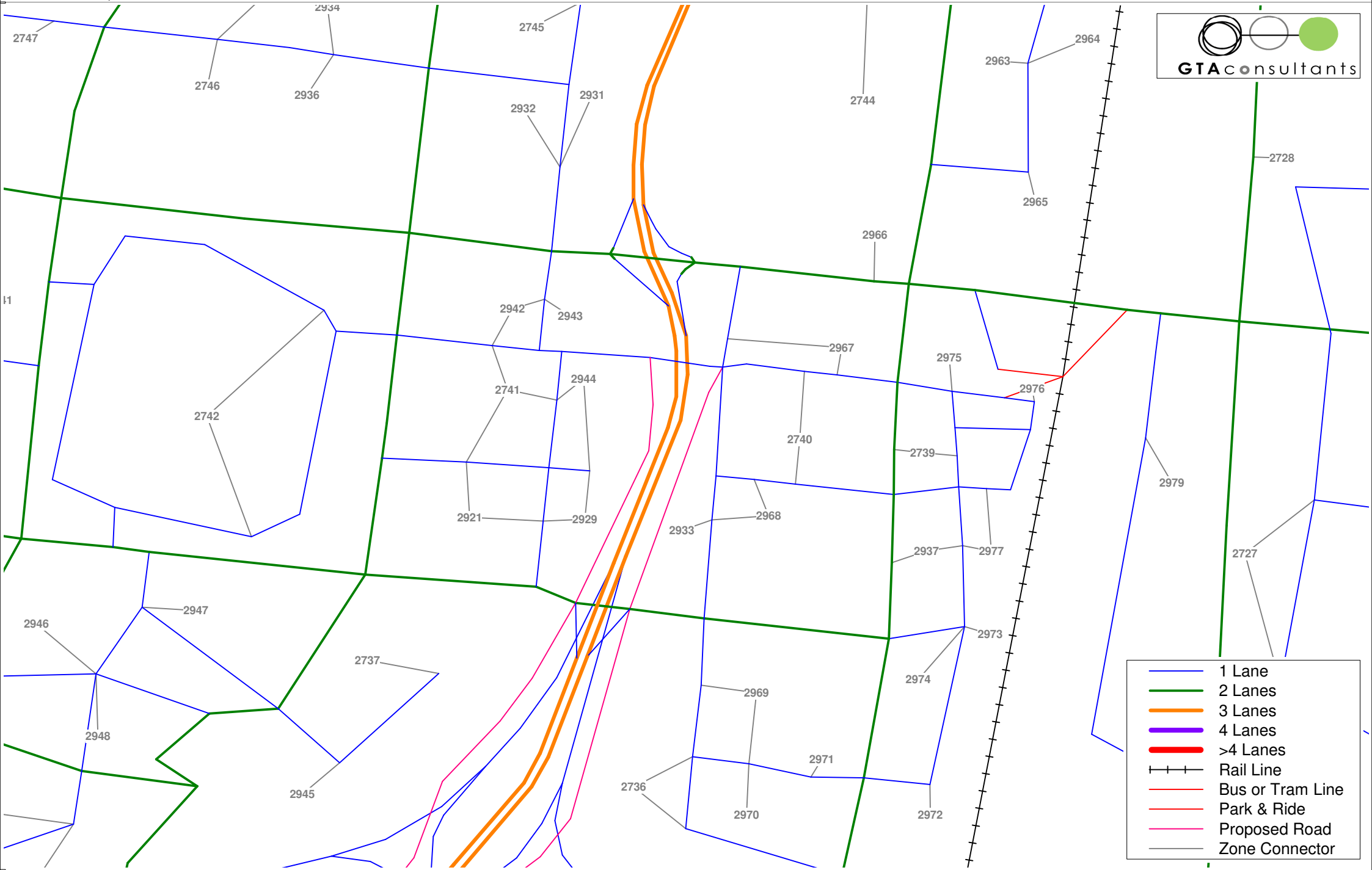
VITM Northern Growth Corridor Model
15M1263000 - Updated Road Network and No. of Lanes - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026\HWY_AM_WITHTOLL_SL_Y2026.NET
16/10/2014

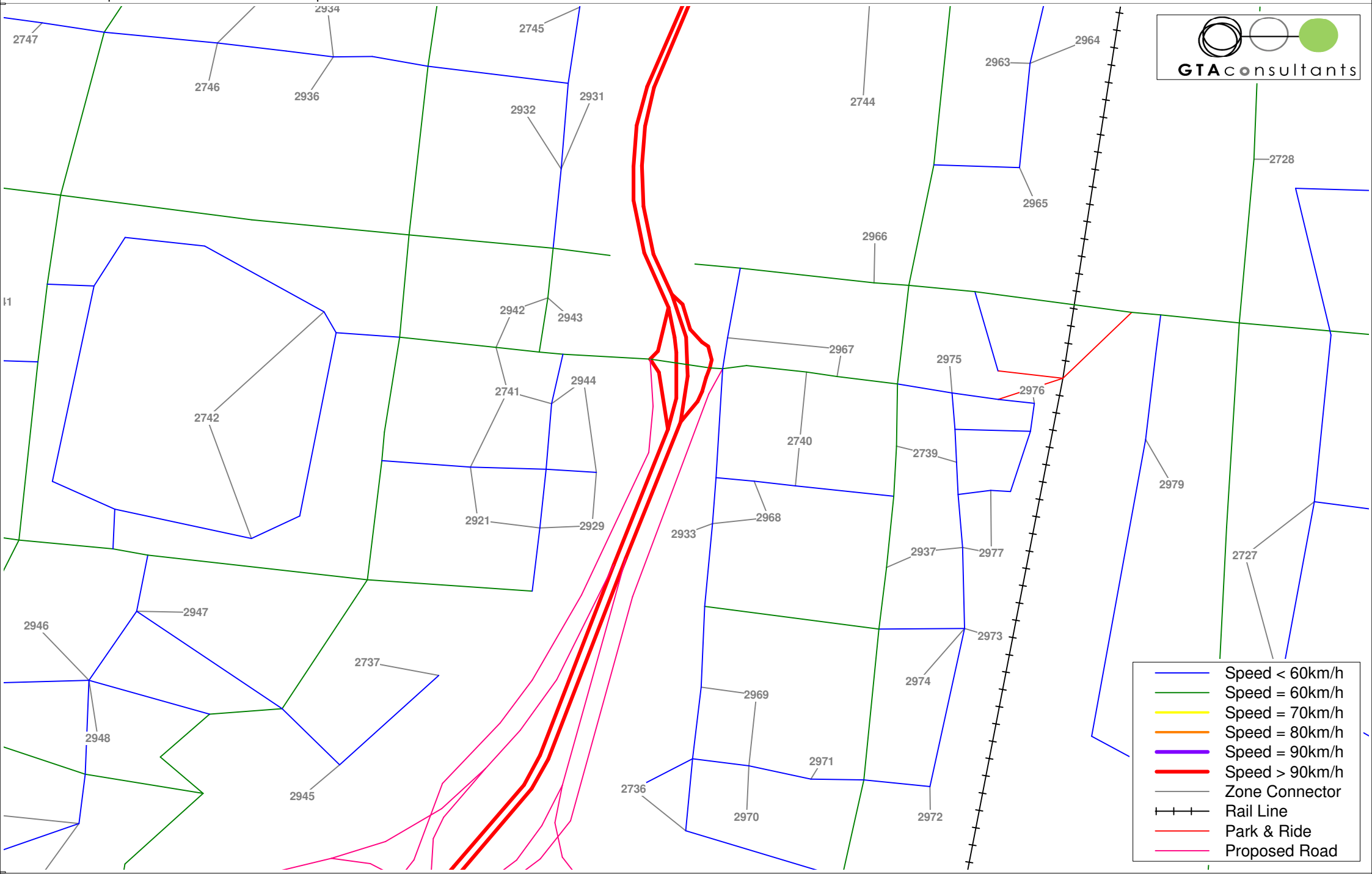
cube

VITM Northern Growth Corridor Model
15M1263000 - Updated Road Network and No. of Lanes - Year 2046



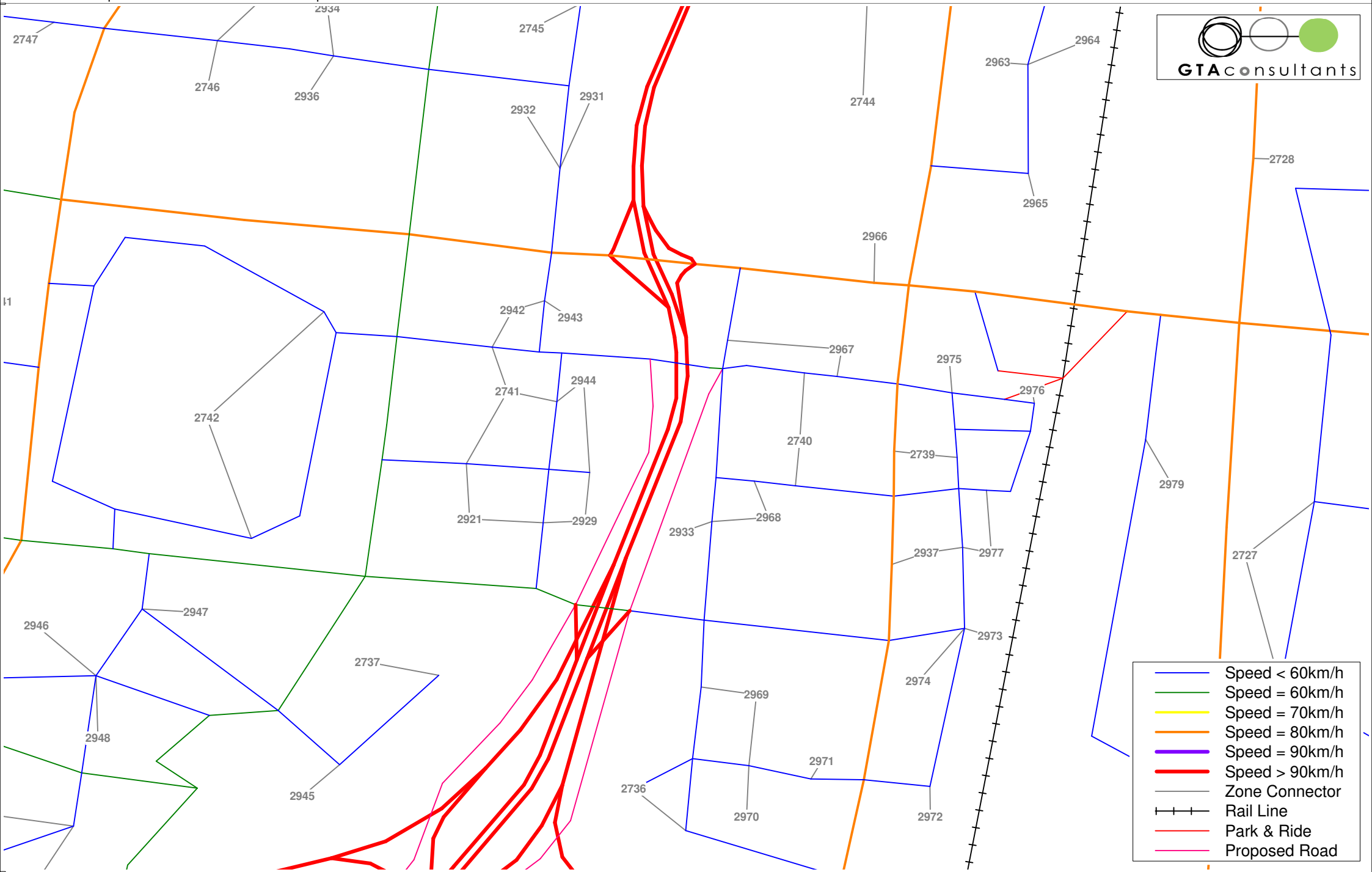
M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046\HWY_AM_WITHTOLL_SL_Y2046.NET
16/10/2014

VITM Northern Growth Corridor Model
15M1263000 - Updated Road Network and Posted Speed - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026\HWY_AM_WITHTOLL_SL_Y2026.NET
16/10/2014

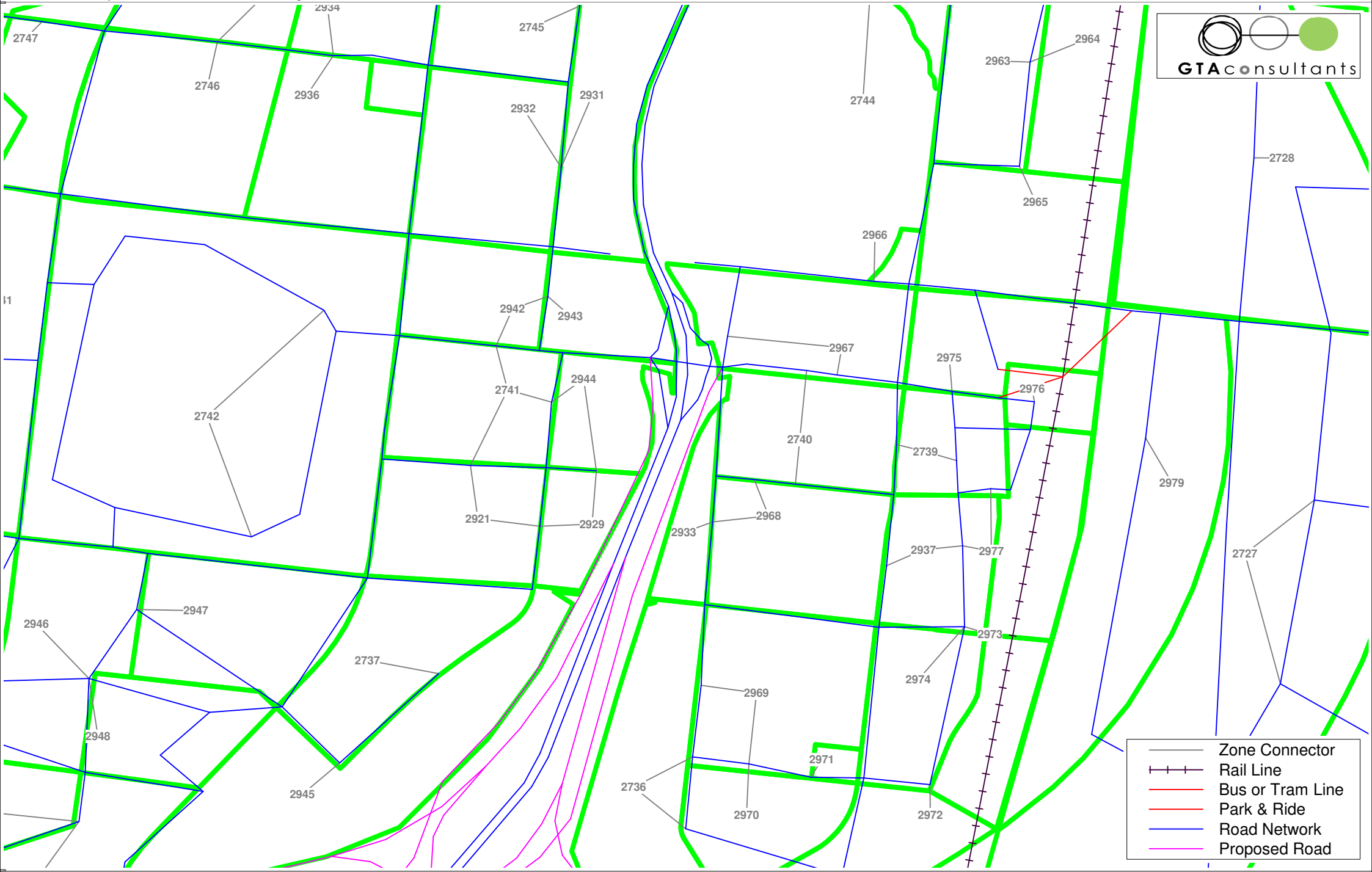
VITM Northern Growth Corridor Model
15M1263000 - Updated Road Network and Posted Speed - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046\HWY_AM_WITHTOLL_SL_Y2046.NET
16/10/2014

cube

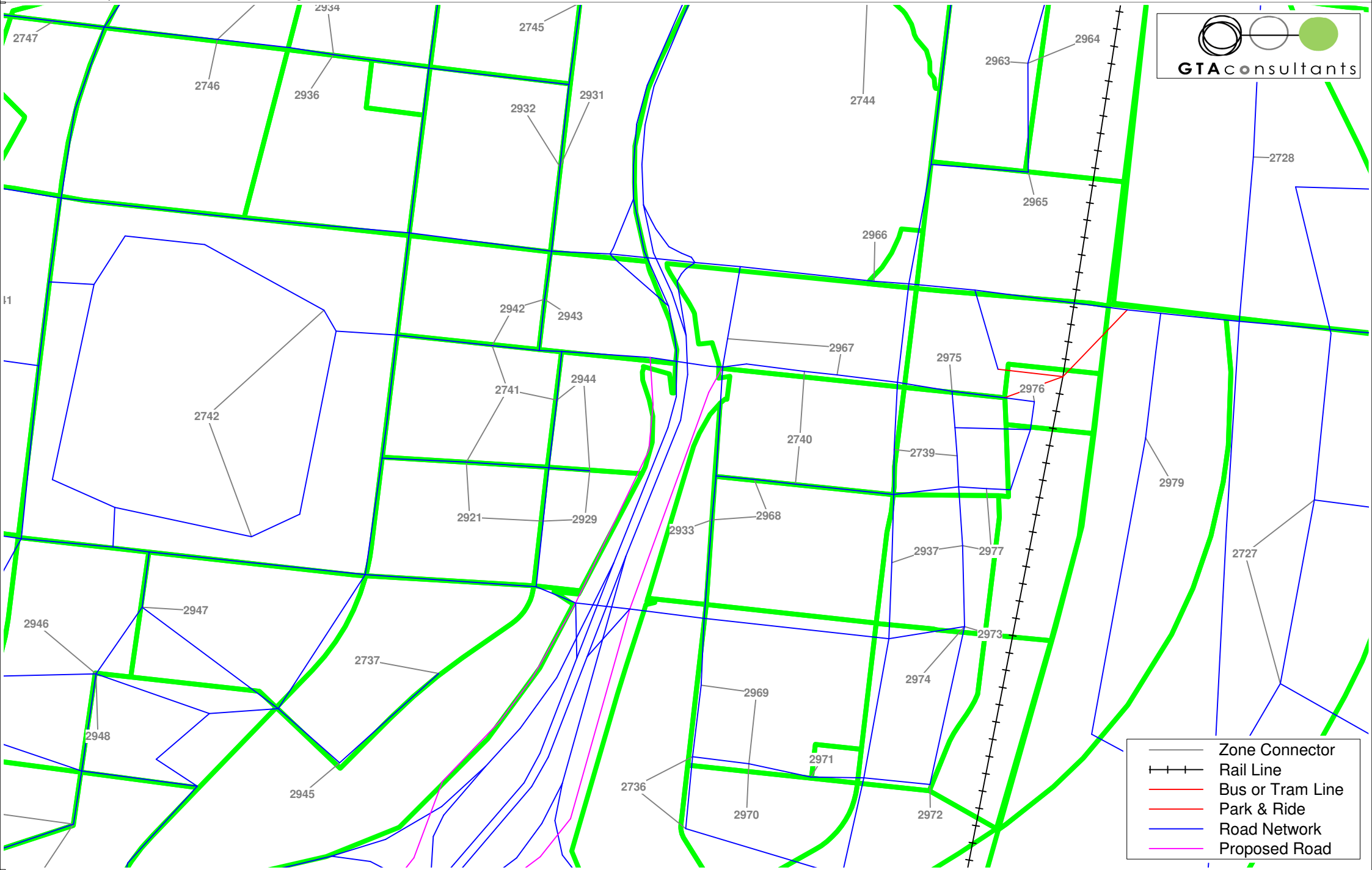
VITM Northern Growth Corridor Model
15M1263000 - Updated Road Network and Zoning - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026\HWY_AM_WITHTOLL_SL_Y2026.NET
16/10/2014

cube

VITM Northern Growth Corridor Model
15M1263000 - Updated Road Network and Zoning - Year 2046



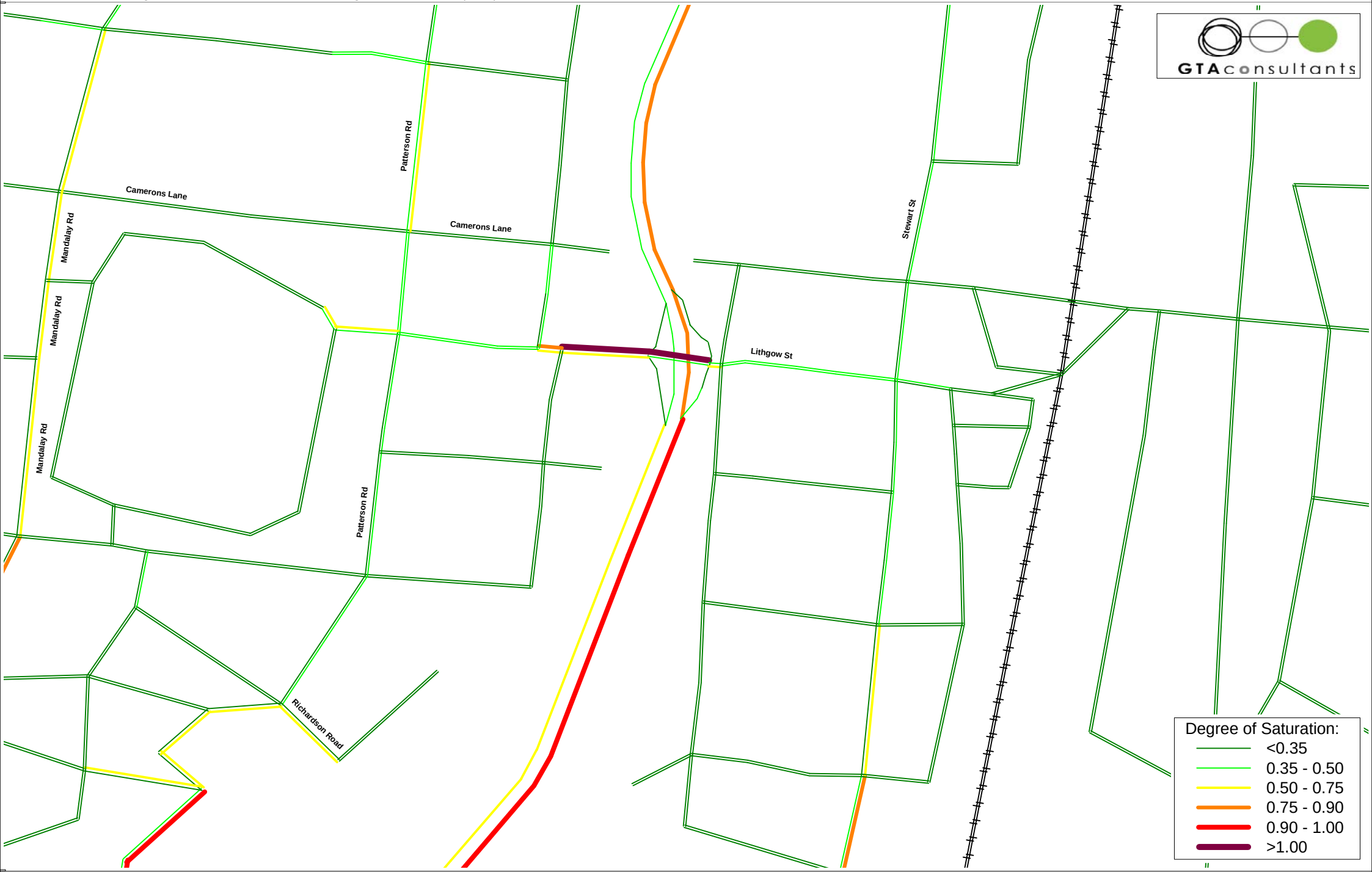
M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046\HWY_AM_WITHTOLL_SL_Y2046.NET
16/10/2014

cube

Appendix B

Interim (2026) and Ultimate (2046) Base Network Output Plots

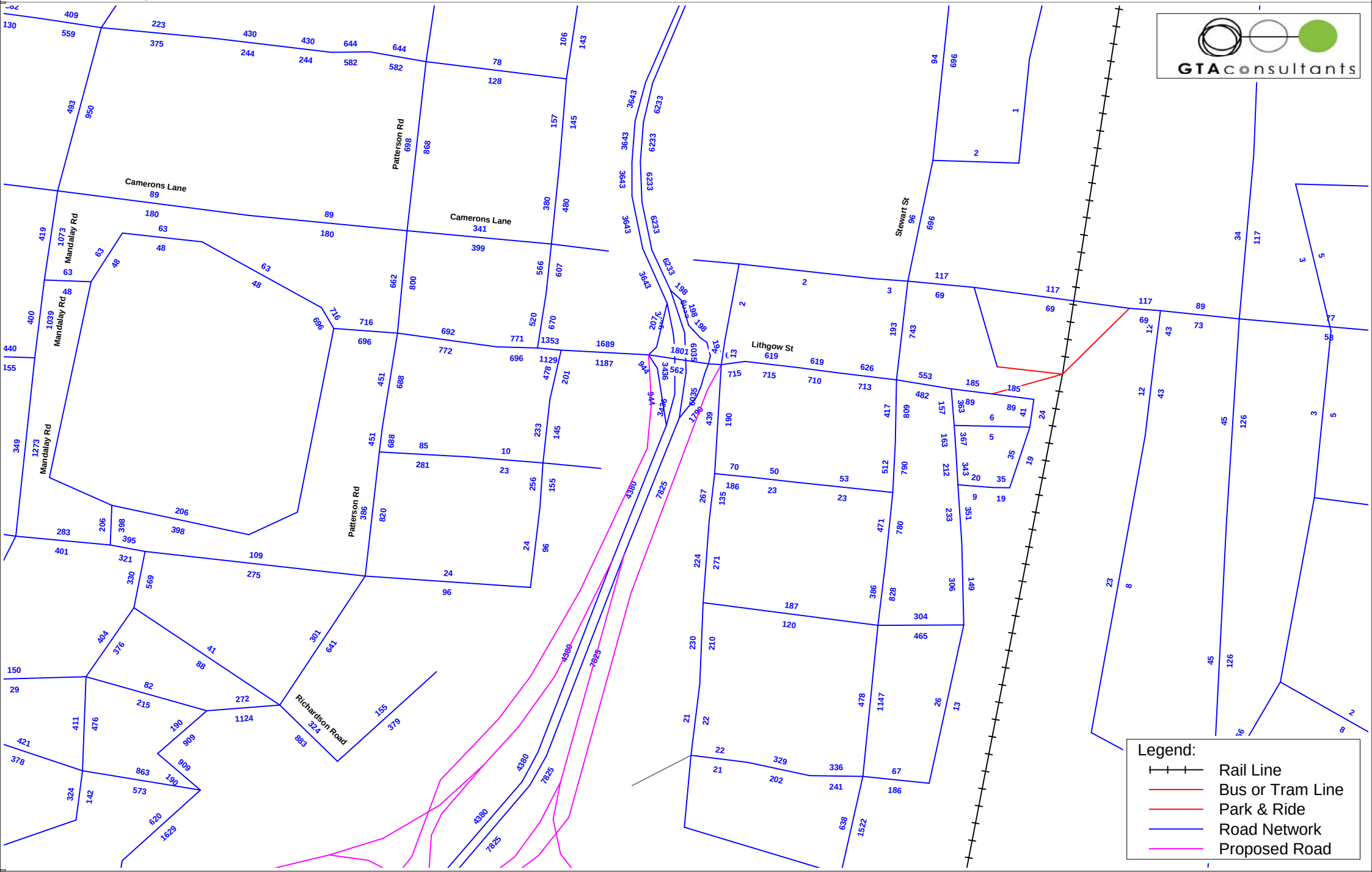
VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak Degree of Saturation (DOS) - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
15/12/2014

VITM Northern Growth Corridor Model

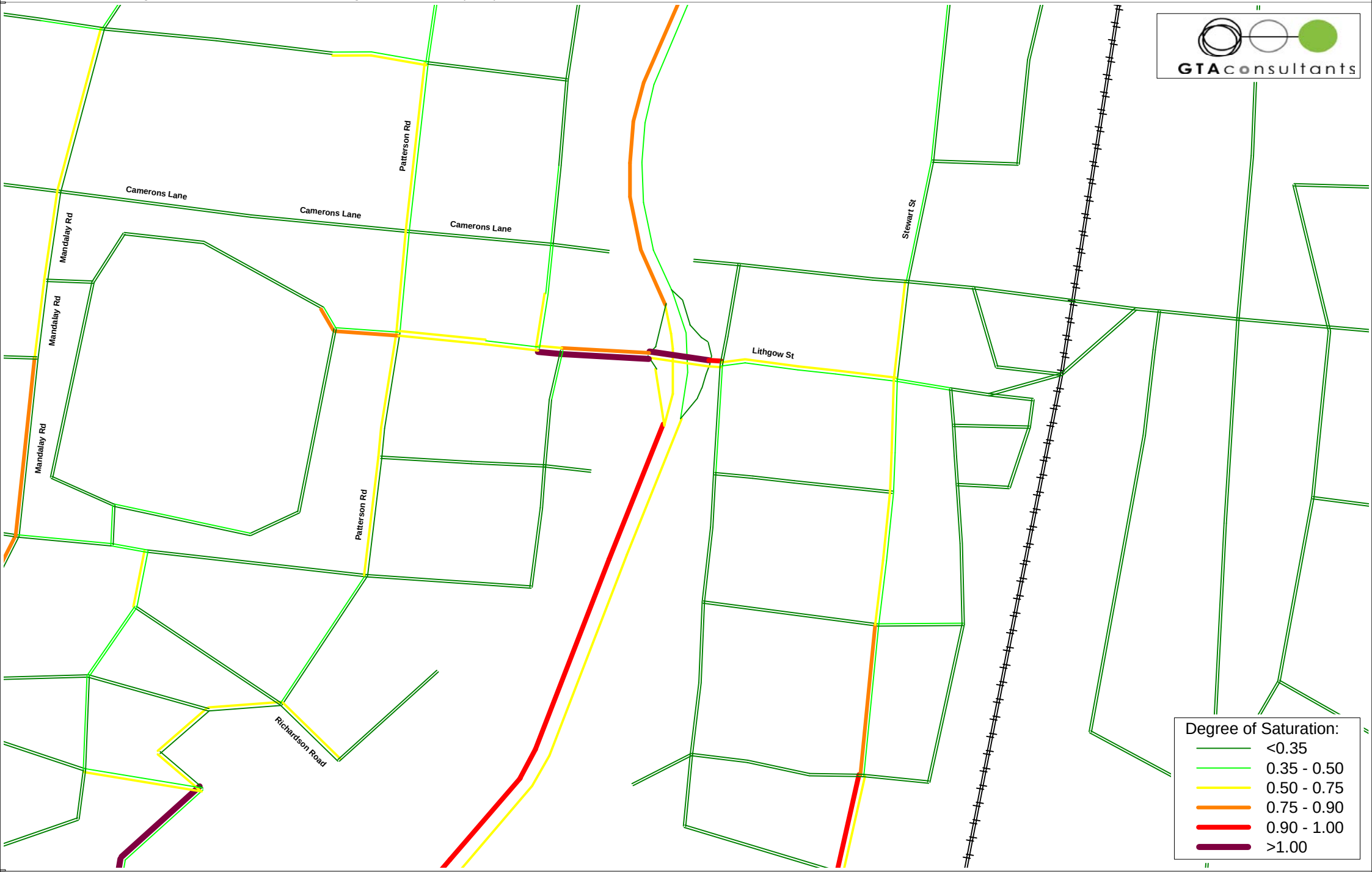
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak Total Vehicle Volume - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET

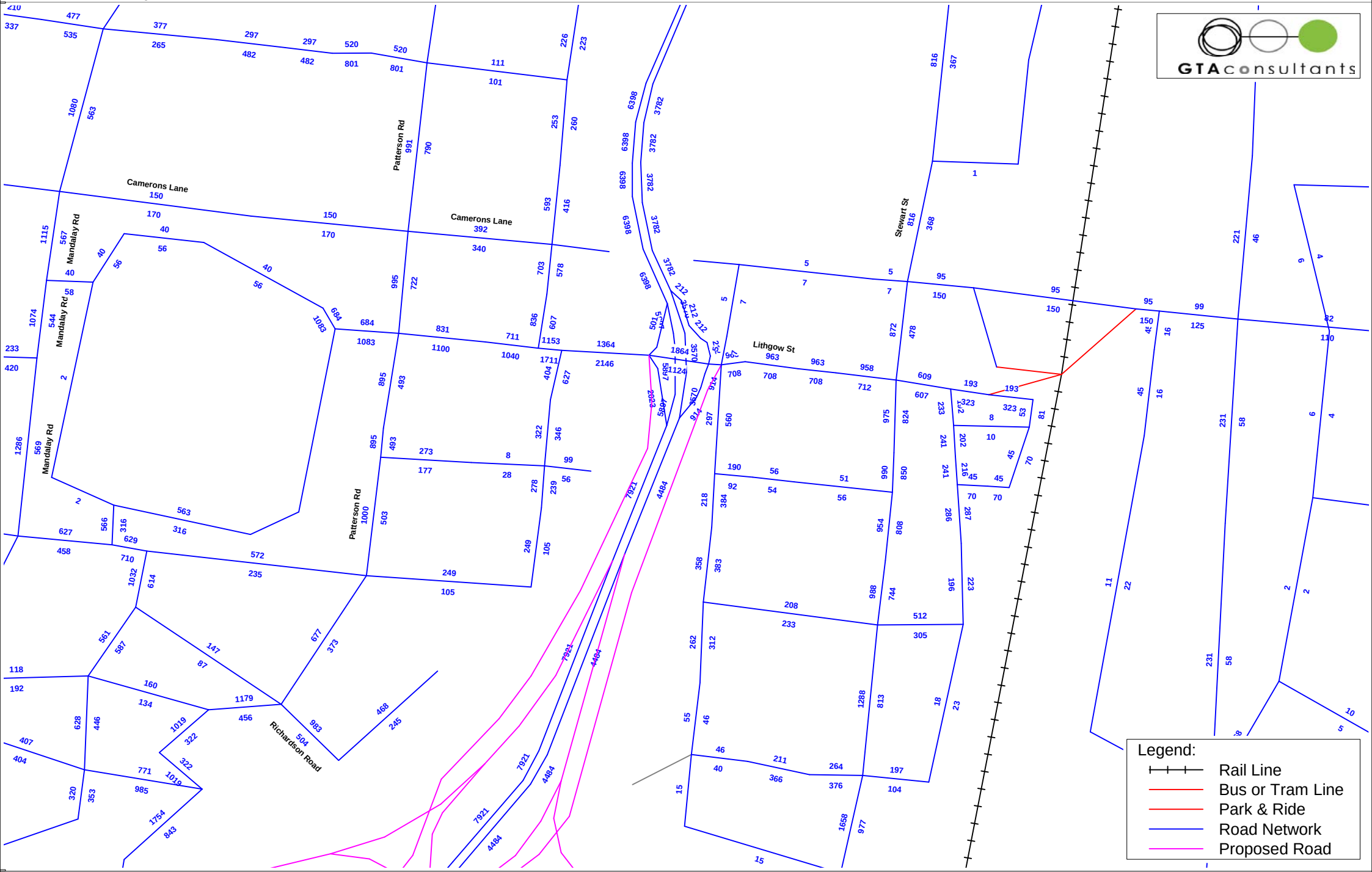
15/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak Degree of Saturation (DOS) - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
15/12/2014

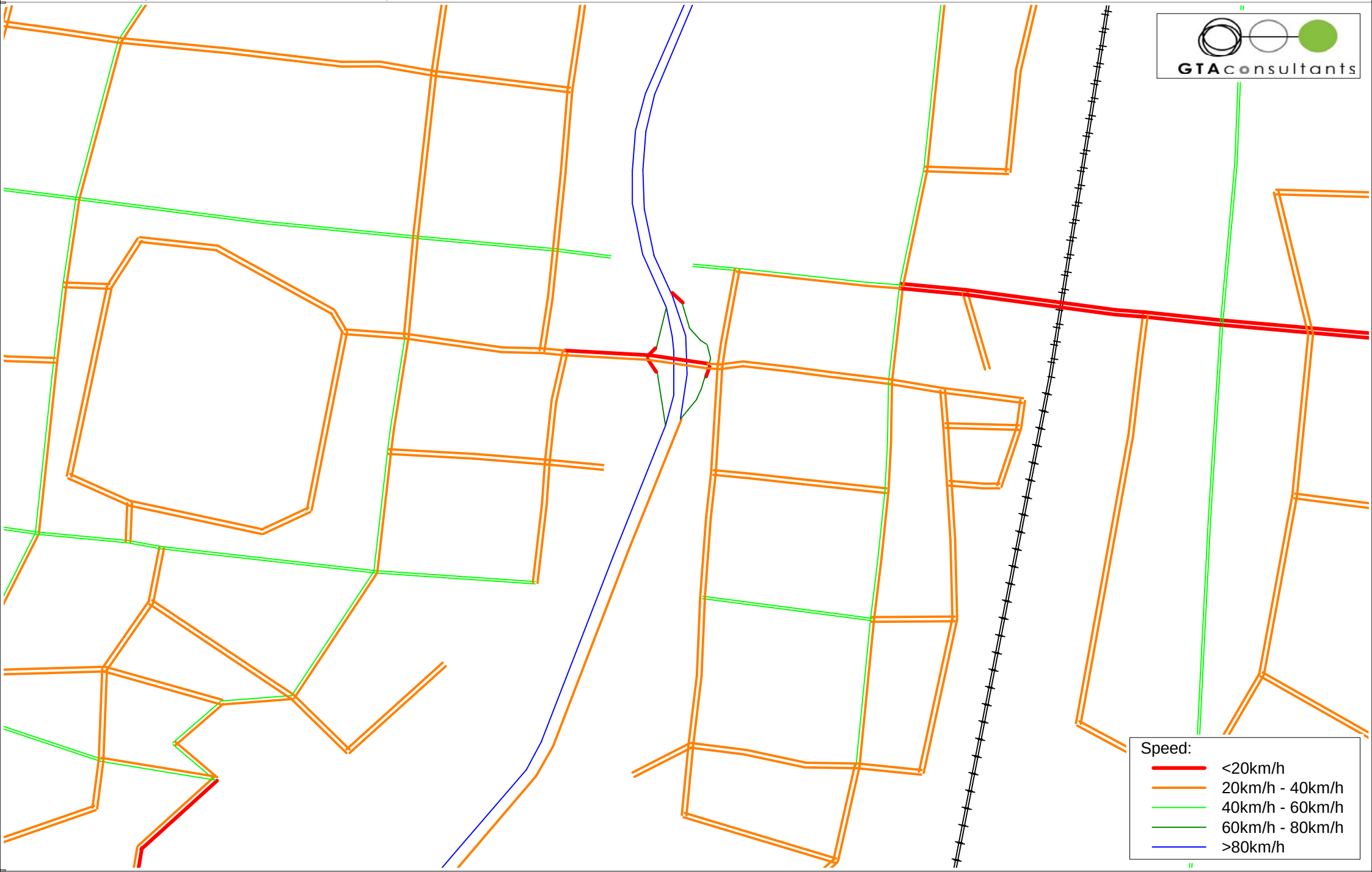
VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak Total Vehicle Volume - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
15/12/2014

cube

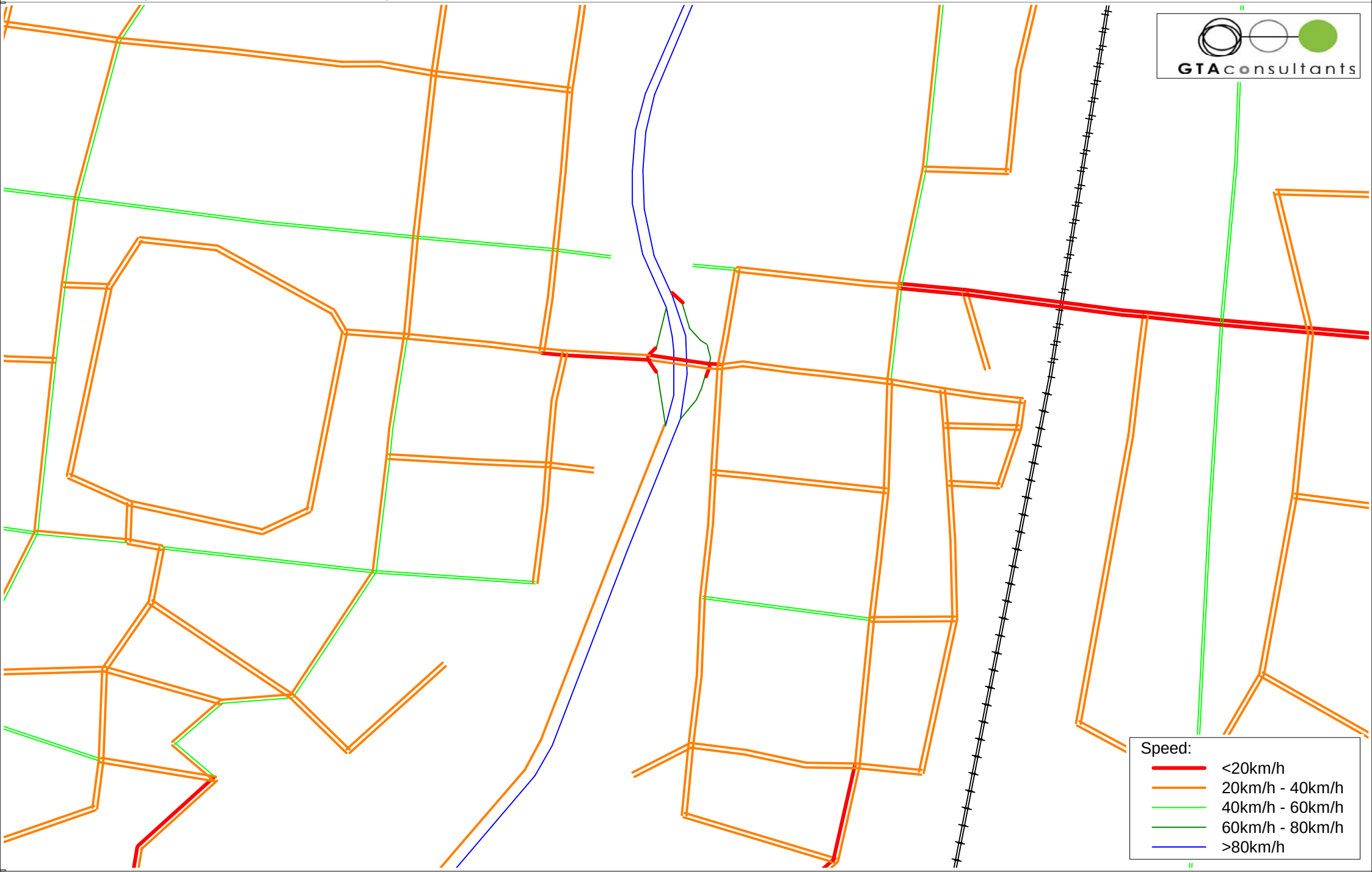
VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak Travel Speed - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
19/12/2014

cube

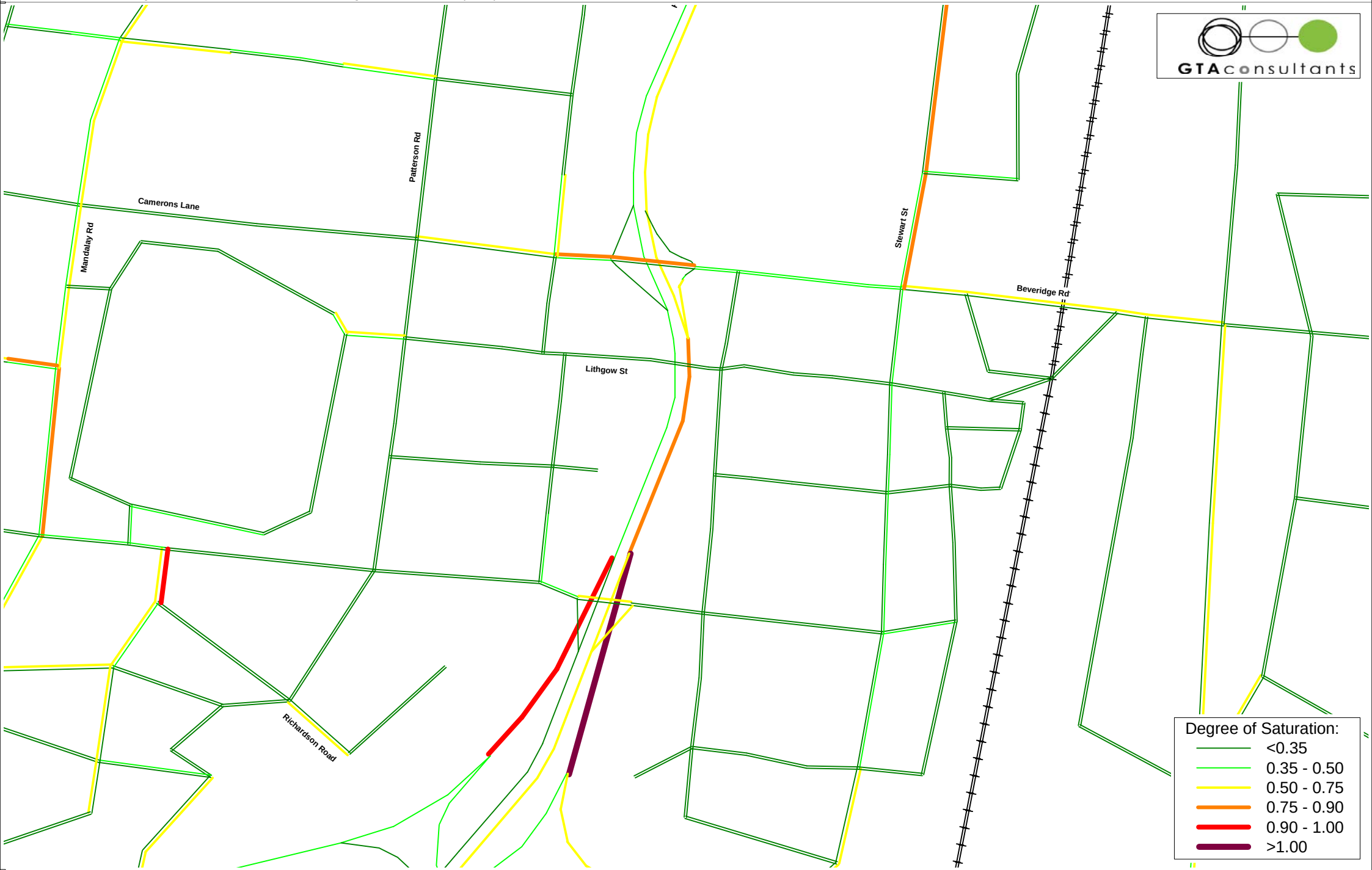
VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak Travel Speed - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
19/12/2014

cube

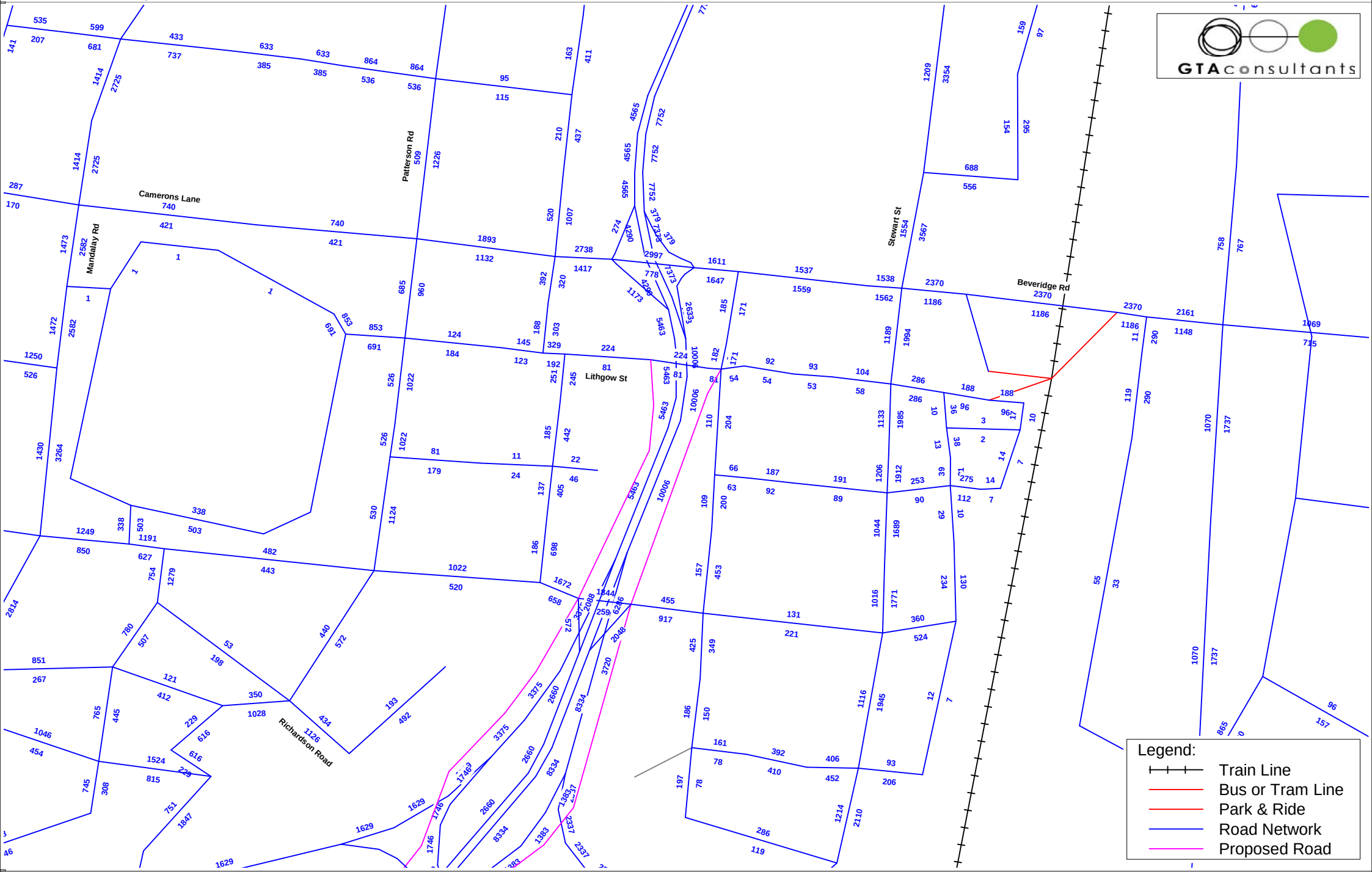
VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak Degree of Saturation (DOS) - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

VITM Northern Growth Corridor Model

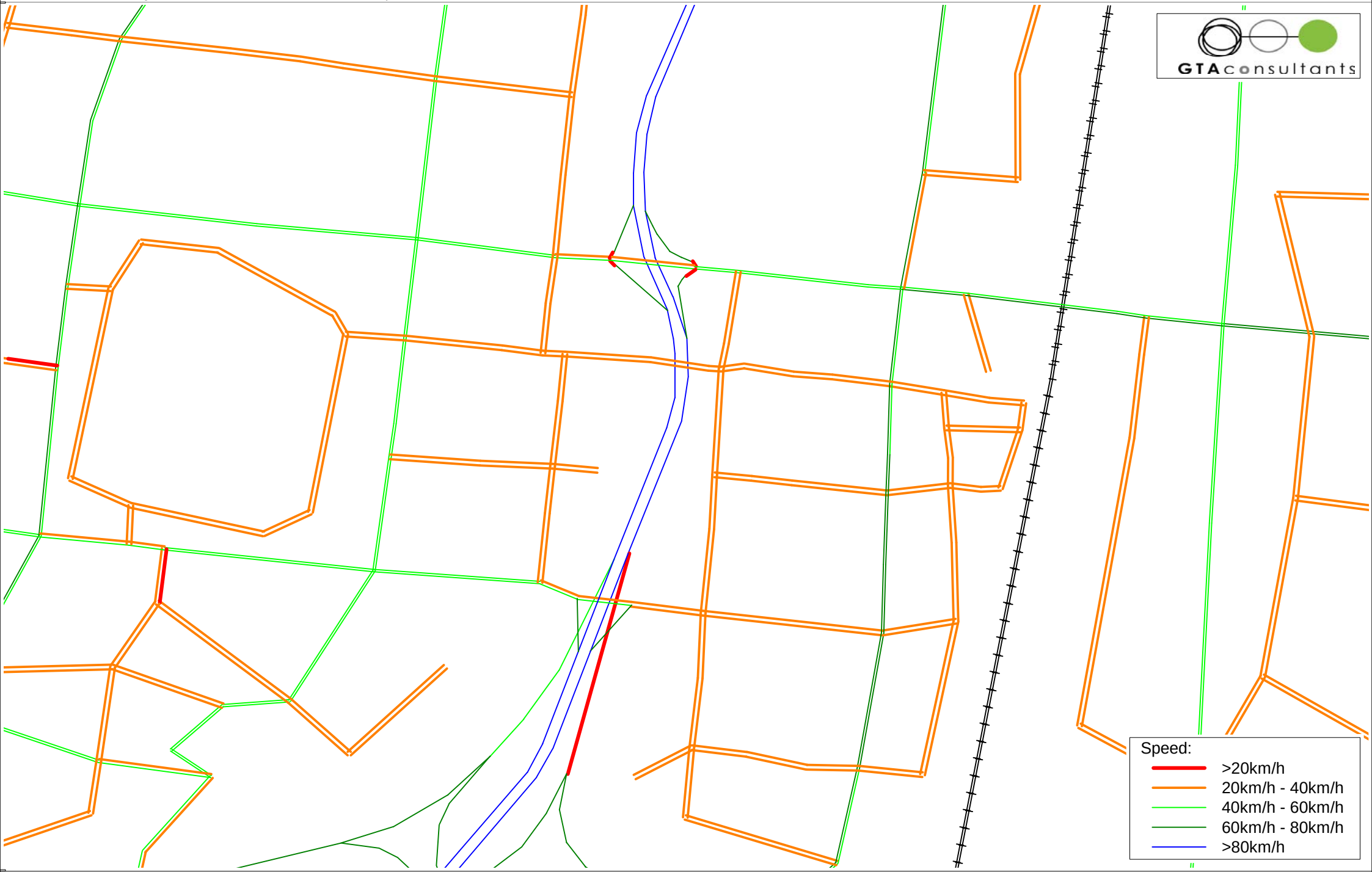
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak Total Vehicle Volume - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET

18/12/2014

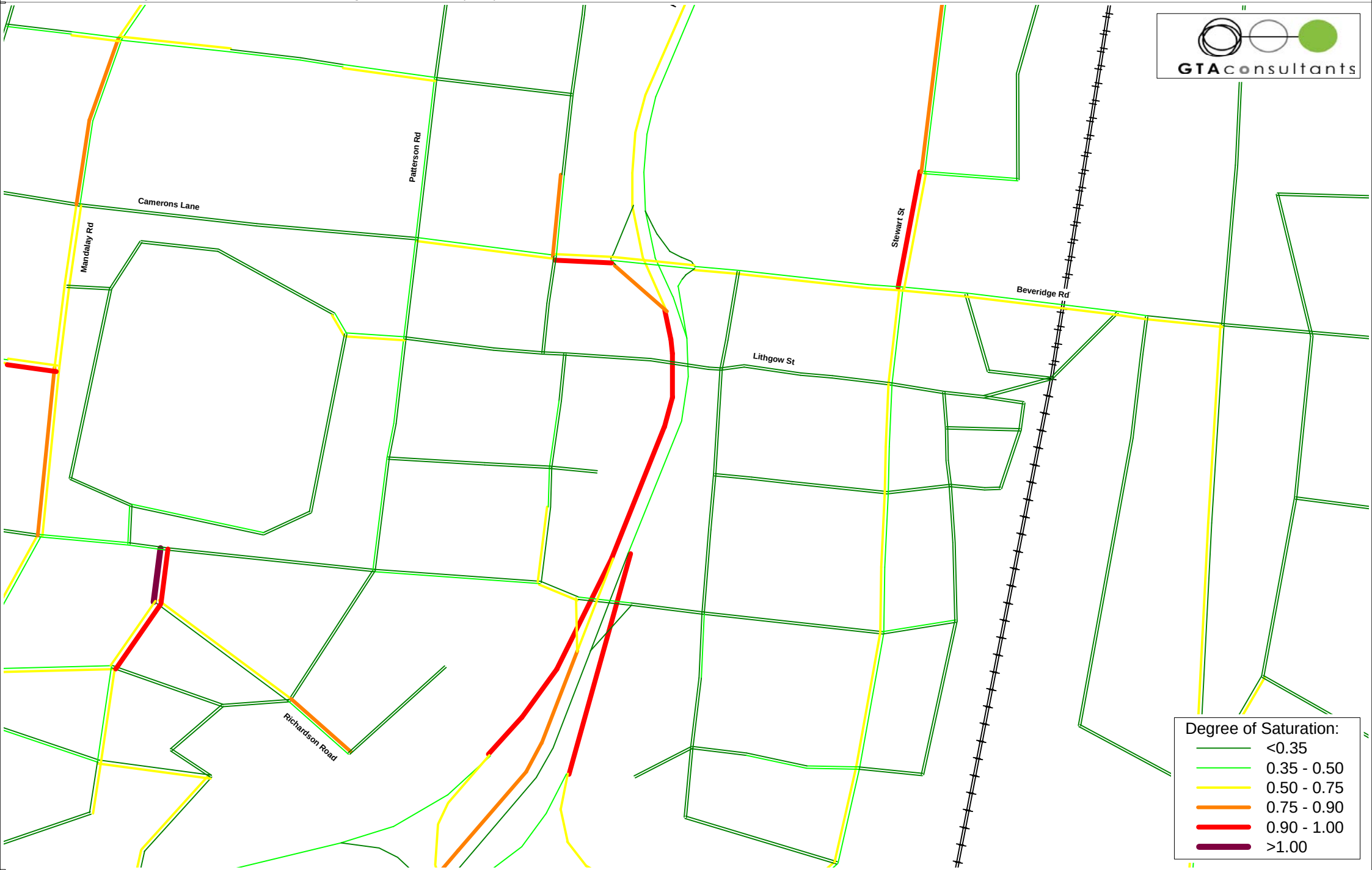
VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak Travel Speed - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
19/12/2014

cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak Degree of Saturation (DOS) - Year 2046

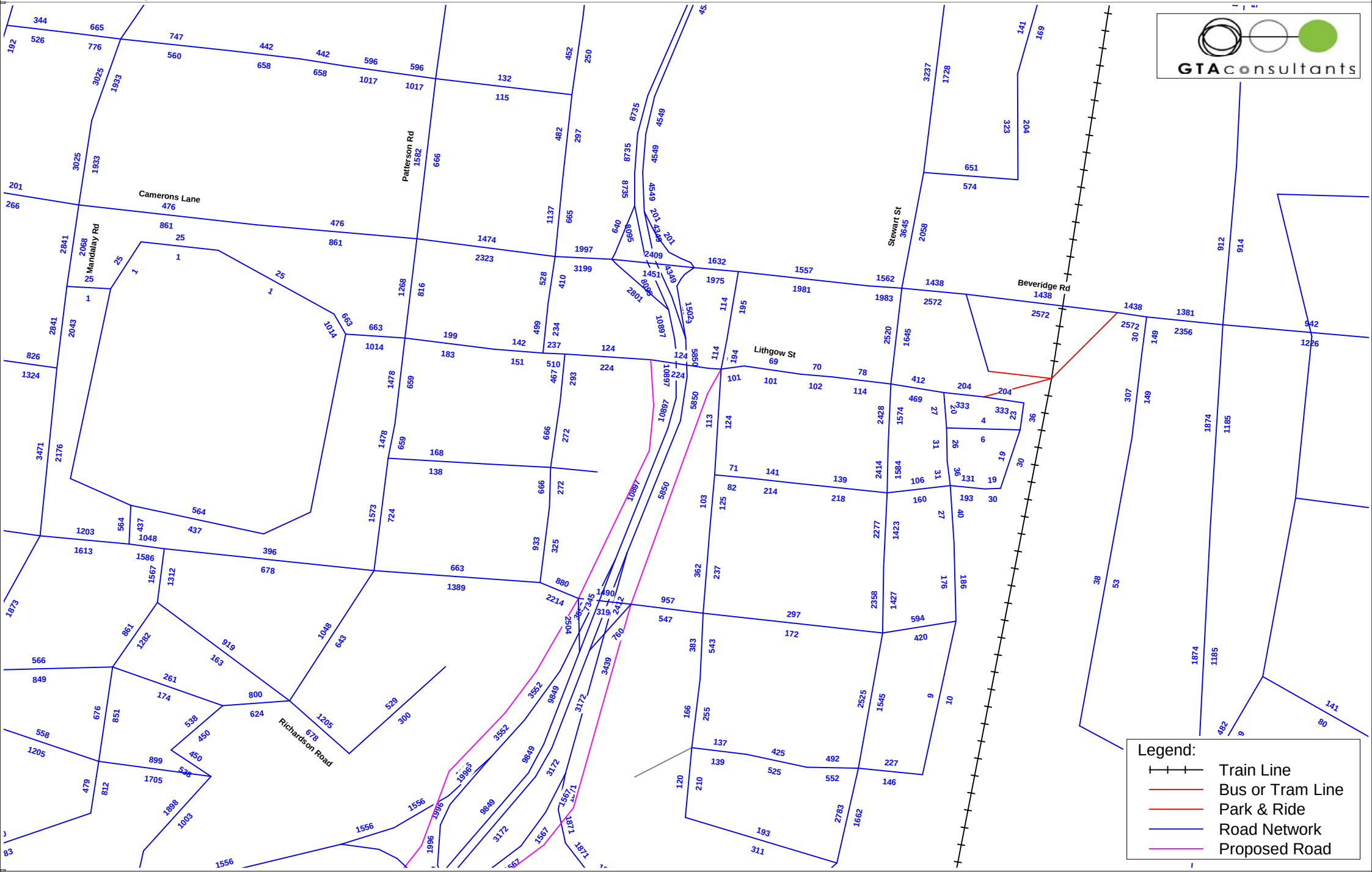


M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

cube

VITM Northern Growth Corridor Model

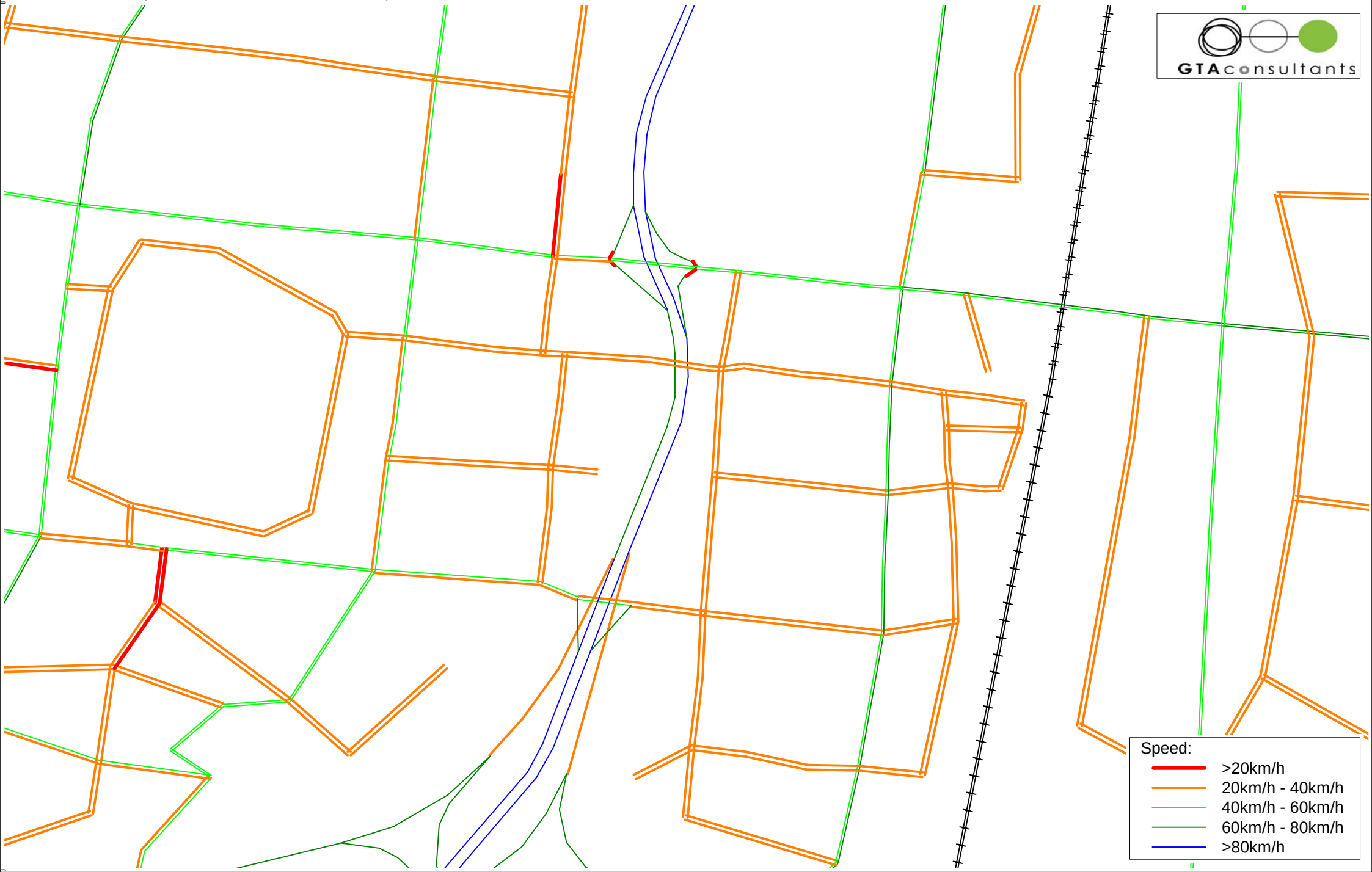
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak Total Vehicle Volume - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET

18/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak Travel Speed - Year 2046



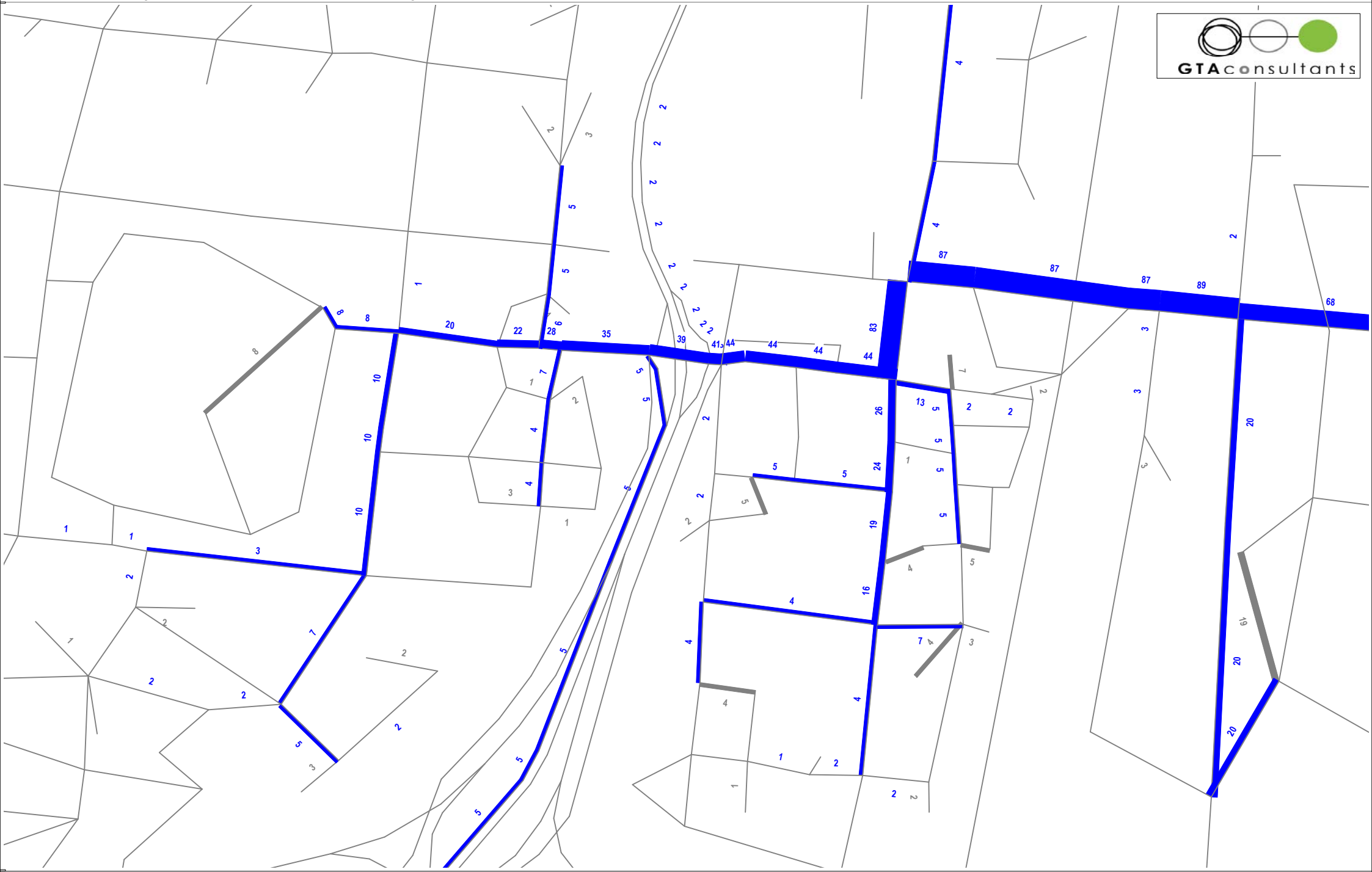
M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
19/12/2014

cube

Appendix C

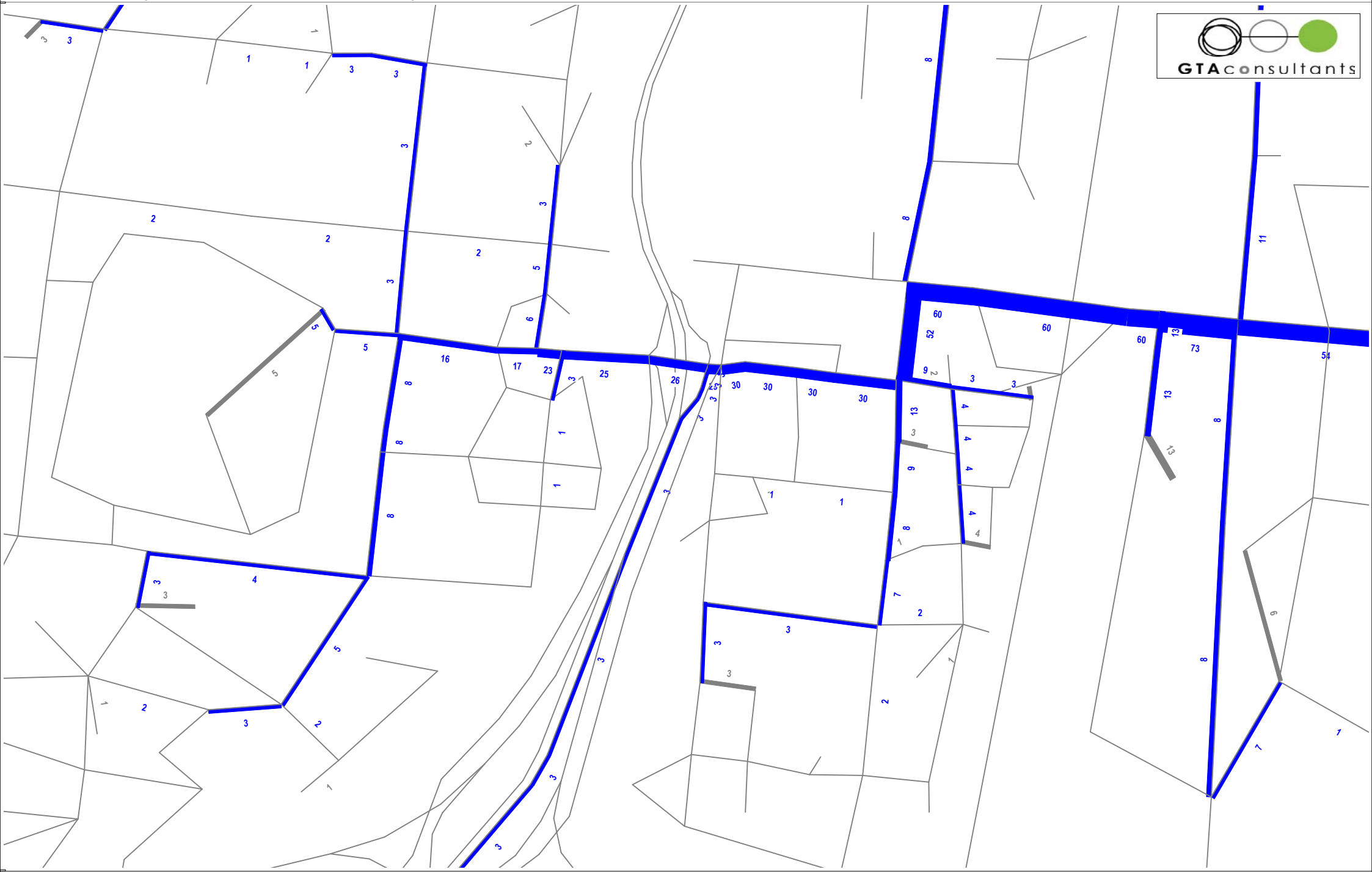
Interim (2026) Select Link Analysis for Modelled Scenarios

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Beveridge Rd EB - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
16/12/2014
cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Beveridge Rd WB - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
16/12/2014
cube

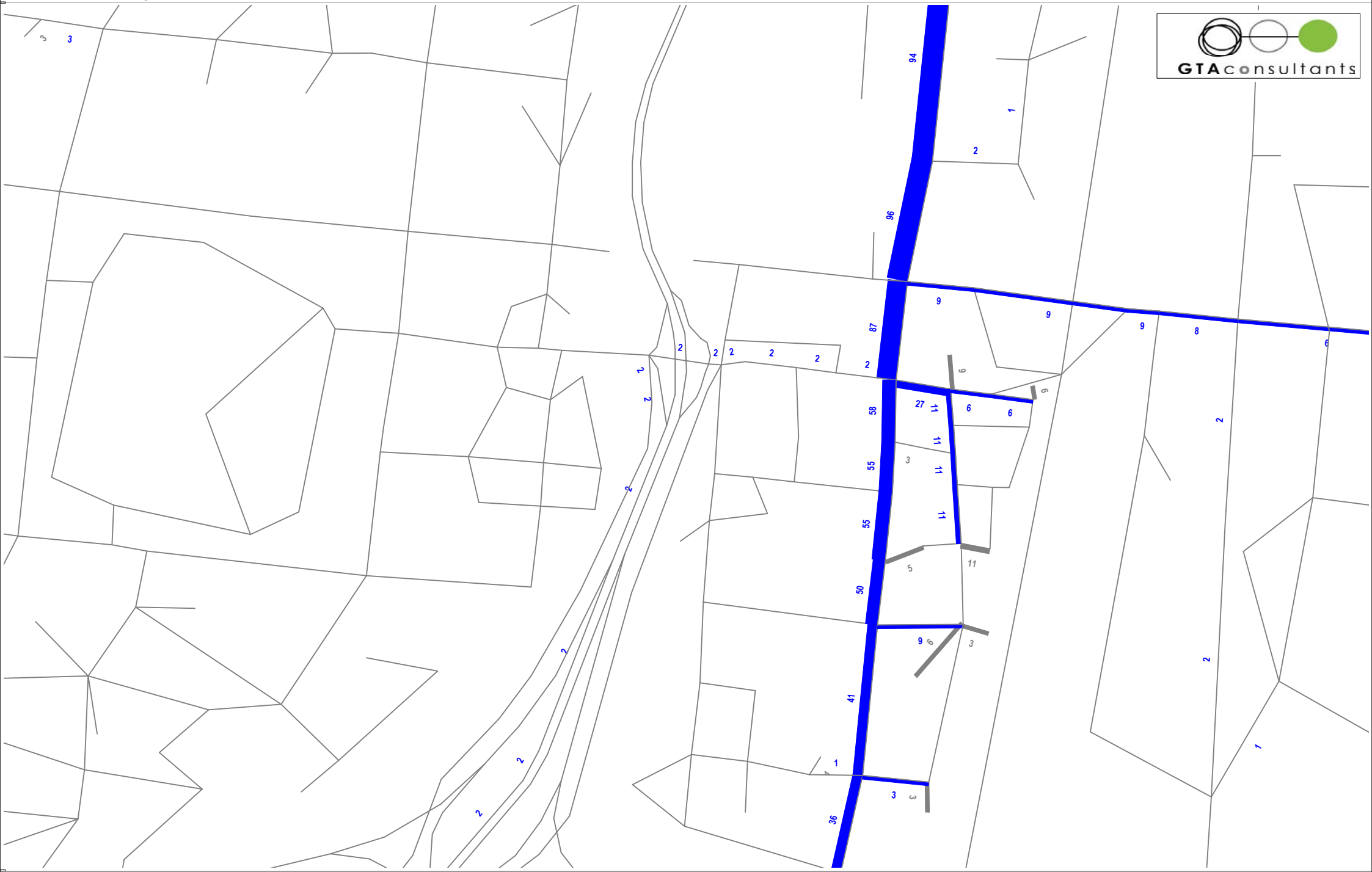
VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Lithgow St EB - Year 2026

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
17/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Lithgow St WB - Year 2026

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
17/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Stewart St N NB - Year 2026



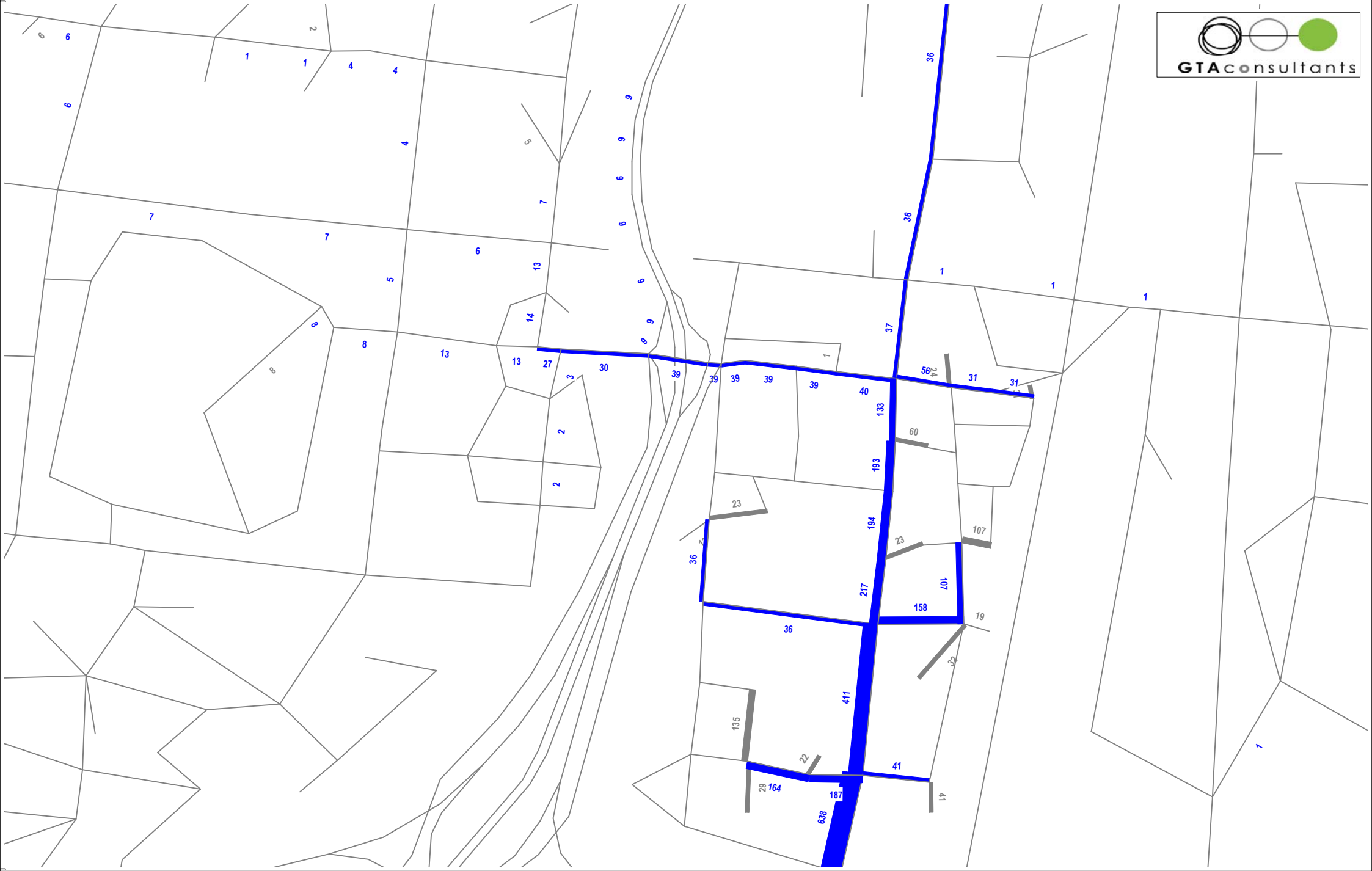
M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
16/12/2014

cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Stewart St N SB - Year 2026

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
16/12/2014
cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Stewart St NB - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
16/12/2014

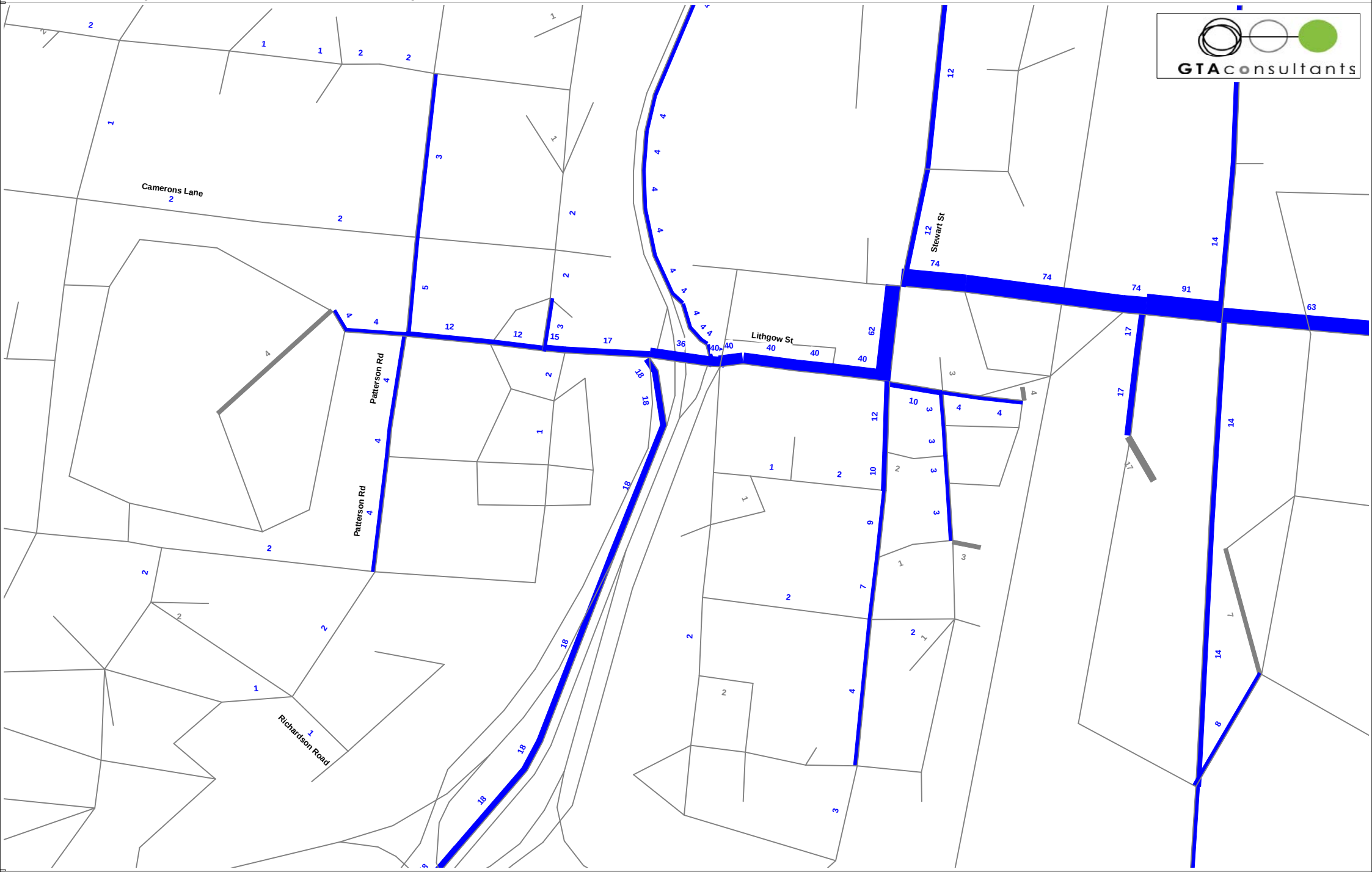
cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Stewart St SB - Year 2026

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
16/12/2014

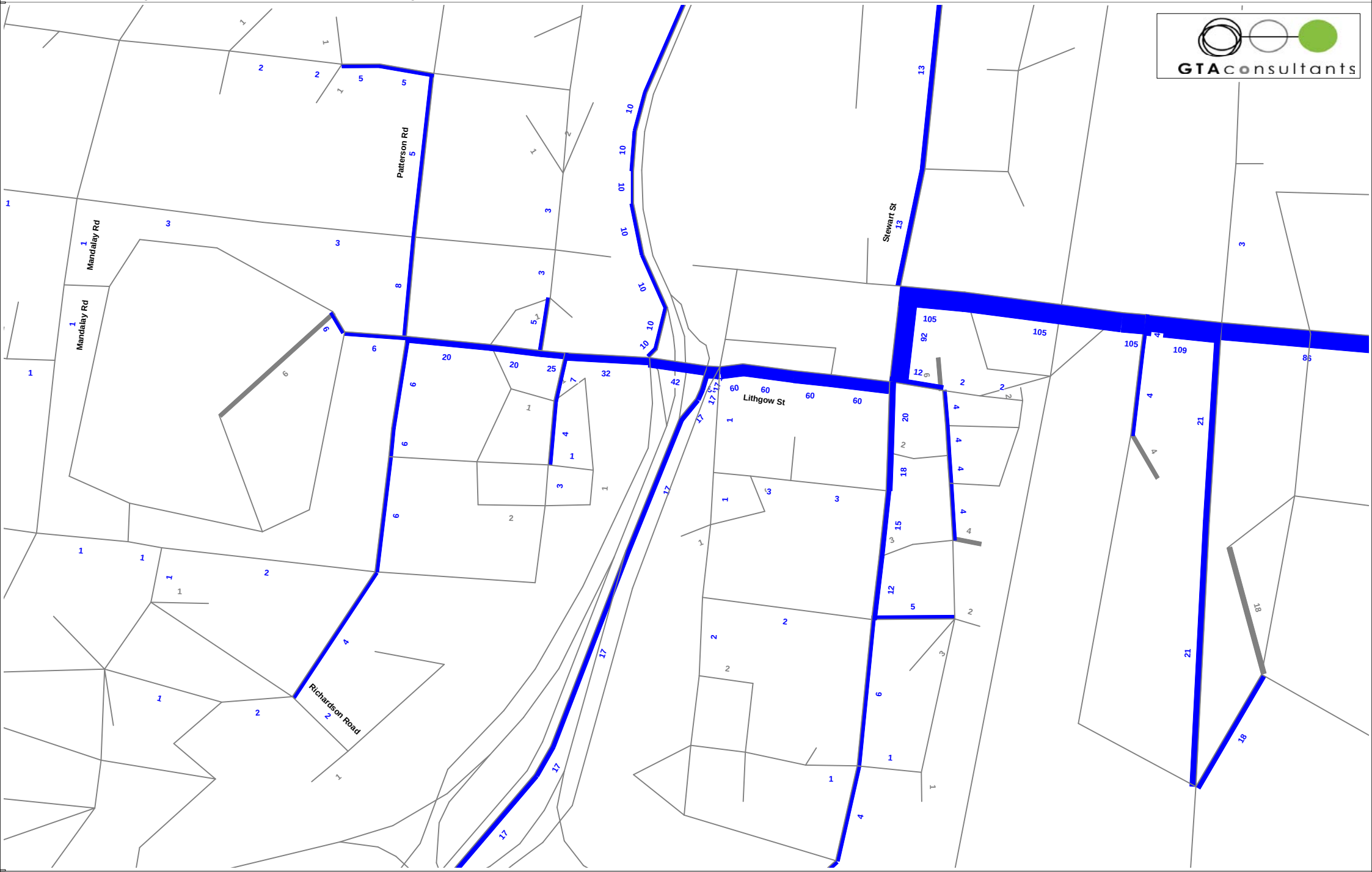
cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Beveridge Rd EB - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
17/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Beveridge Rd WB - Year 2026



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
17/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Lithgow St EB - Year 2026

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
17/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Lithgow St WB - Year 2026

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
17/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Stewart St N NB - Year 2026

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
17/12/2014

cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Stewart St N SB - Year 2026

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
17/12/2014

cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Stewart St NB - Year 2026

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
17/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Stewart St SB - Year 2026

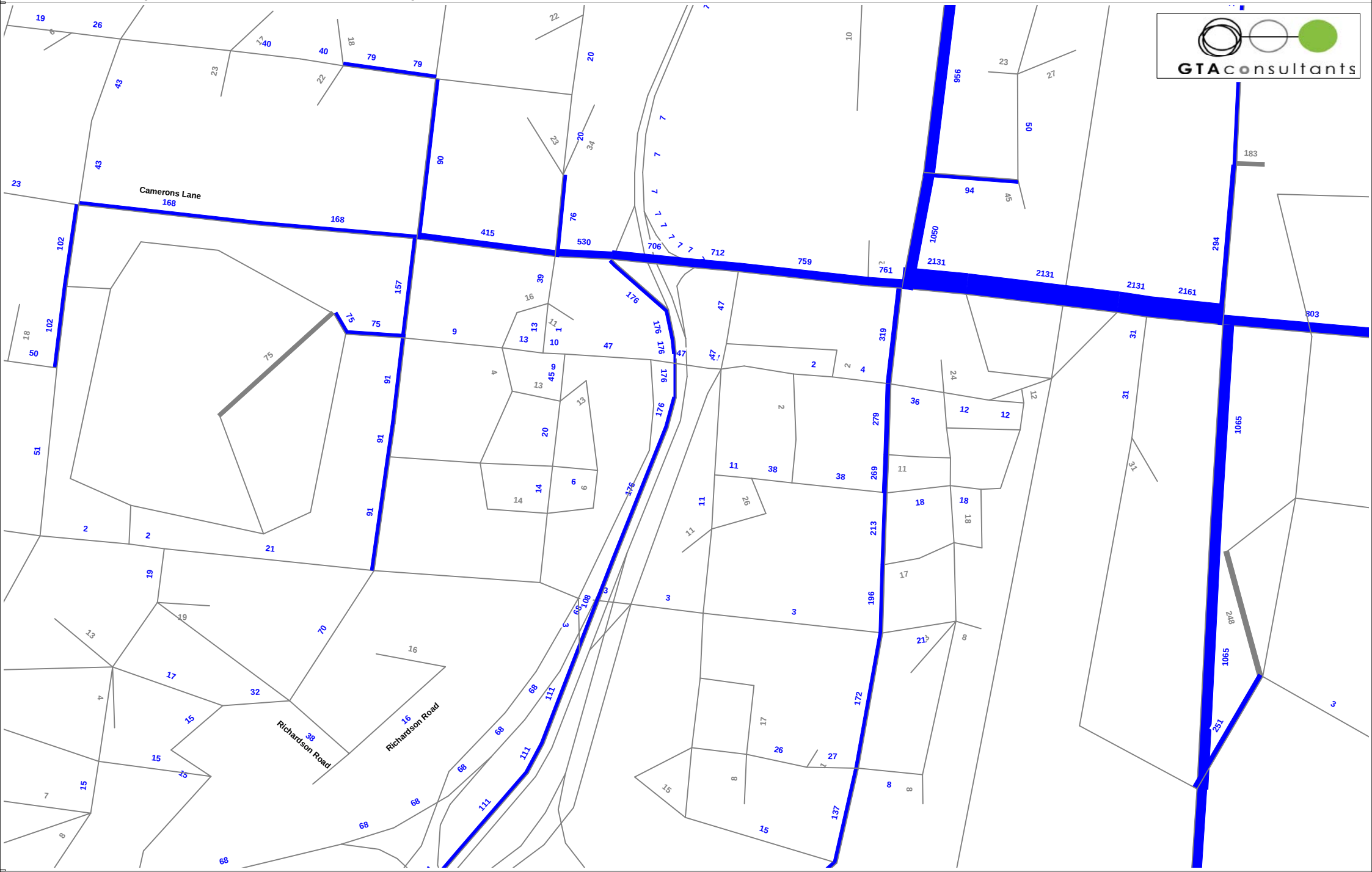
M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2026_V2\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2026_V2.NET
17/12/2014

cube

Appendix D

Ultimate (2046) Select Link Analysis for Modelled Scenarios

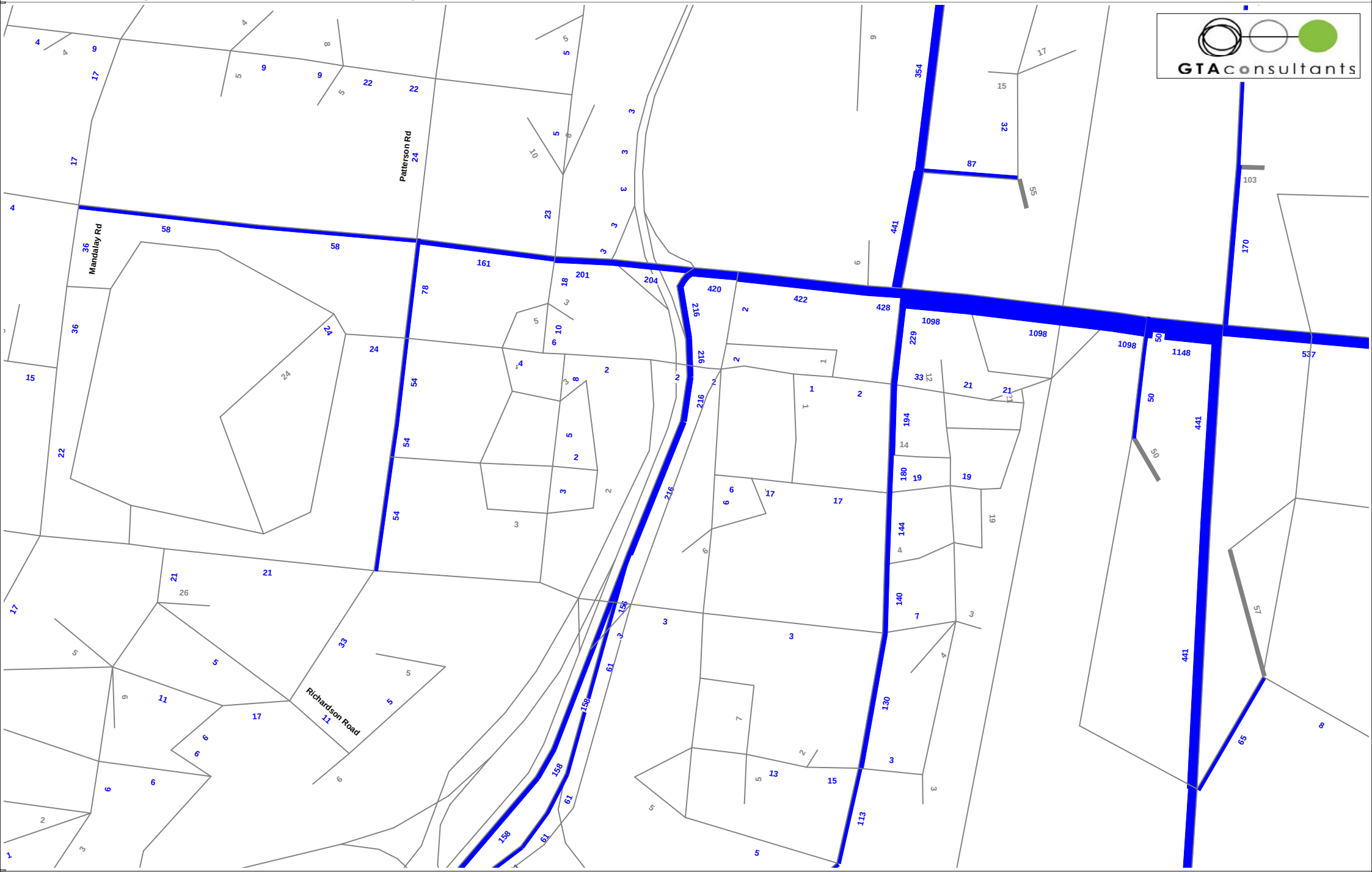
VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Beveridge Rd EB - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

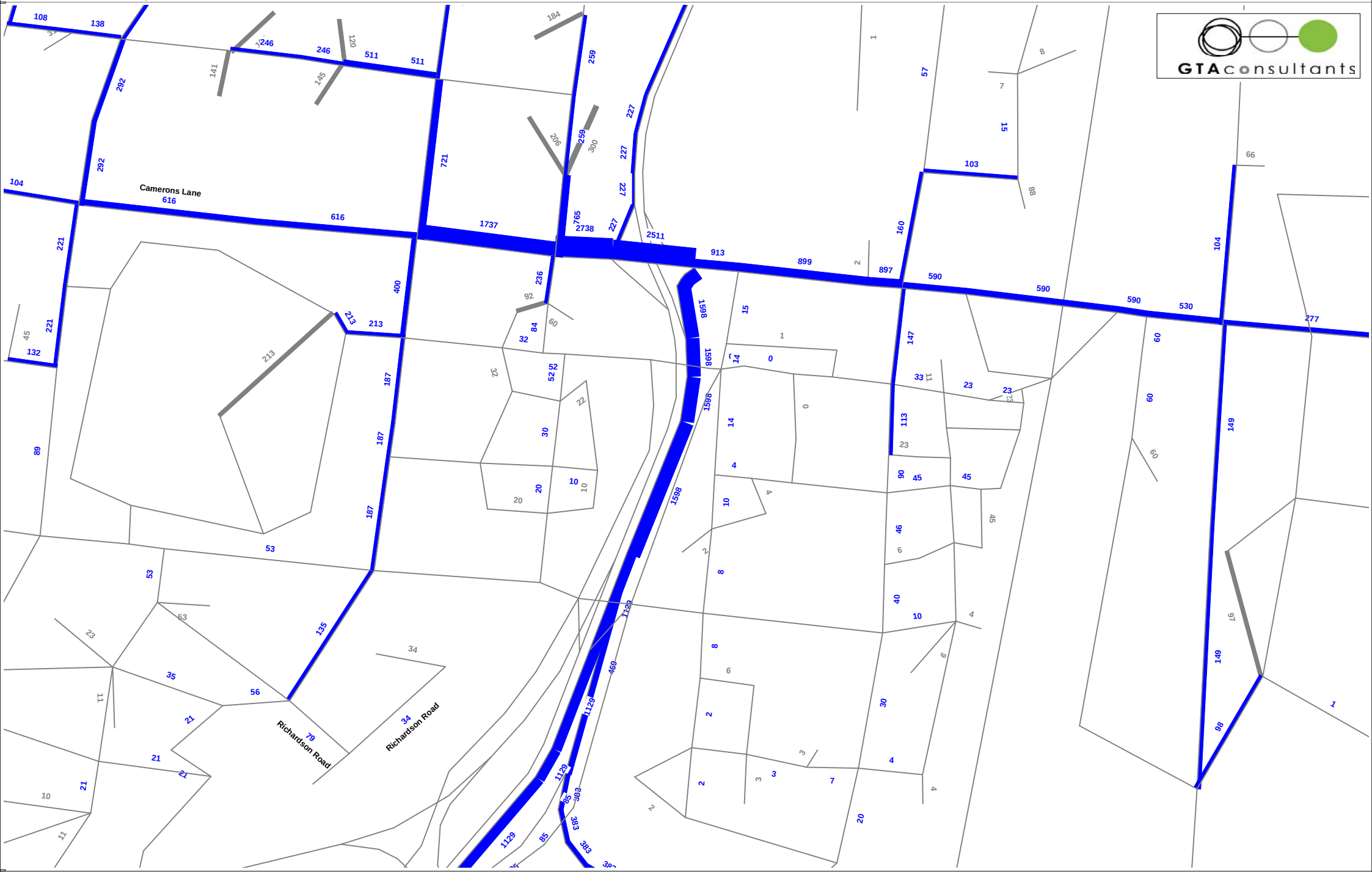
cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Beveridge Rd WB - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Camerons Lane EB - Year 2046



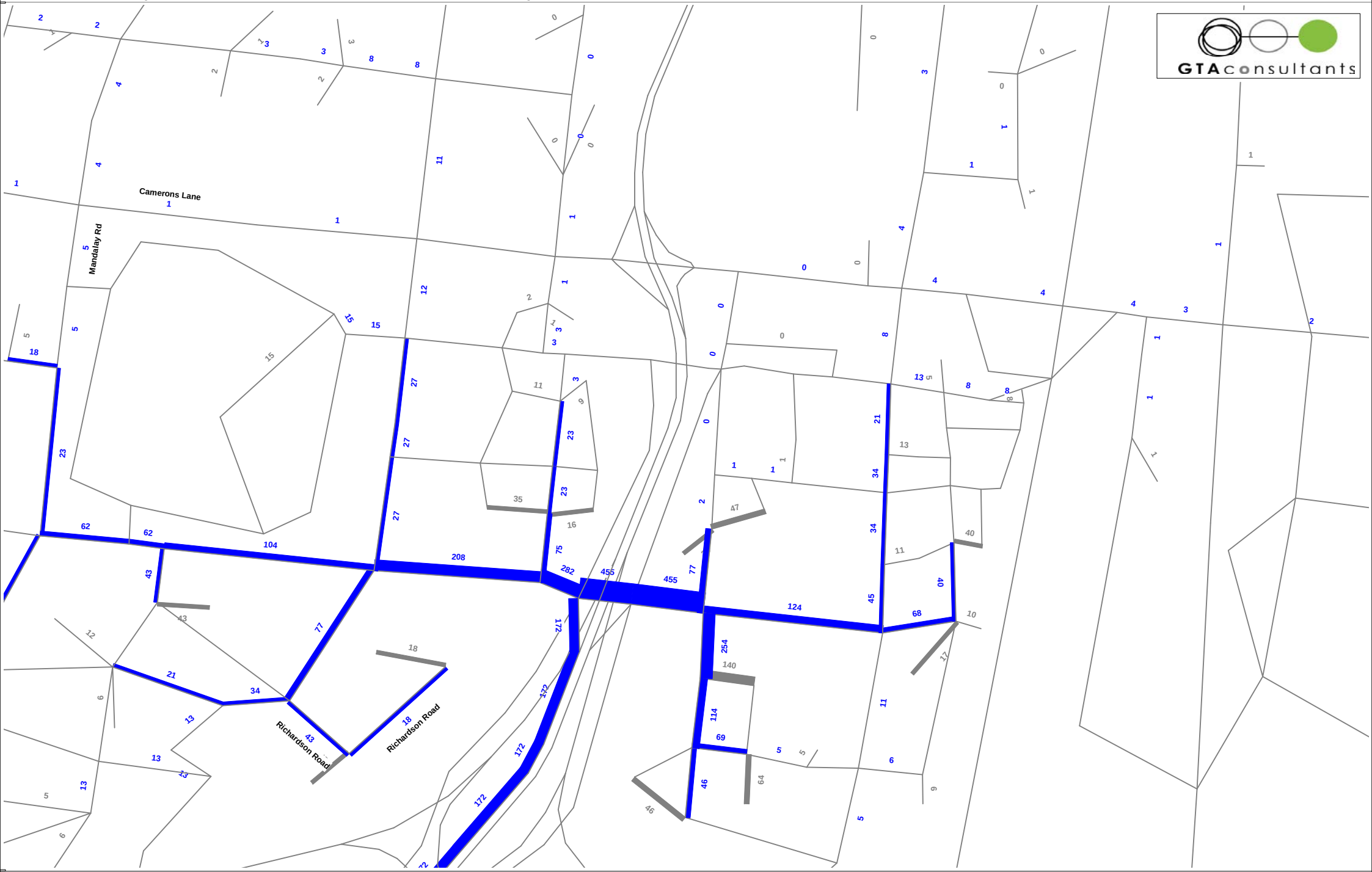
M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Camerons Lane WB - Year 2046

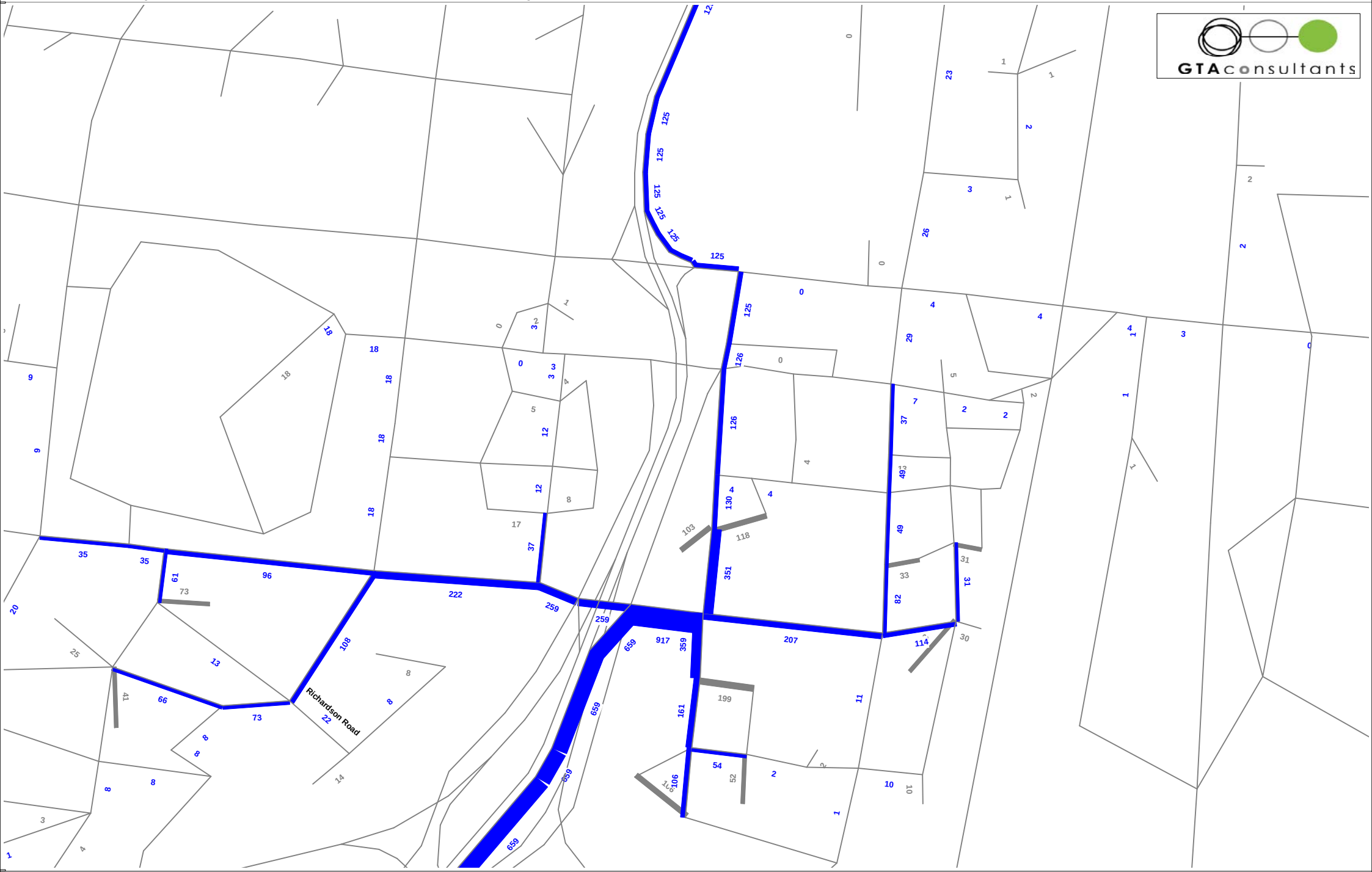
M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Rankin St East of Interchange EB - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Rankin St East of Interchange WB - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Rankin St West of Interchange EB - Year 2046

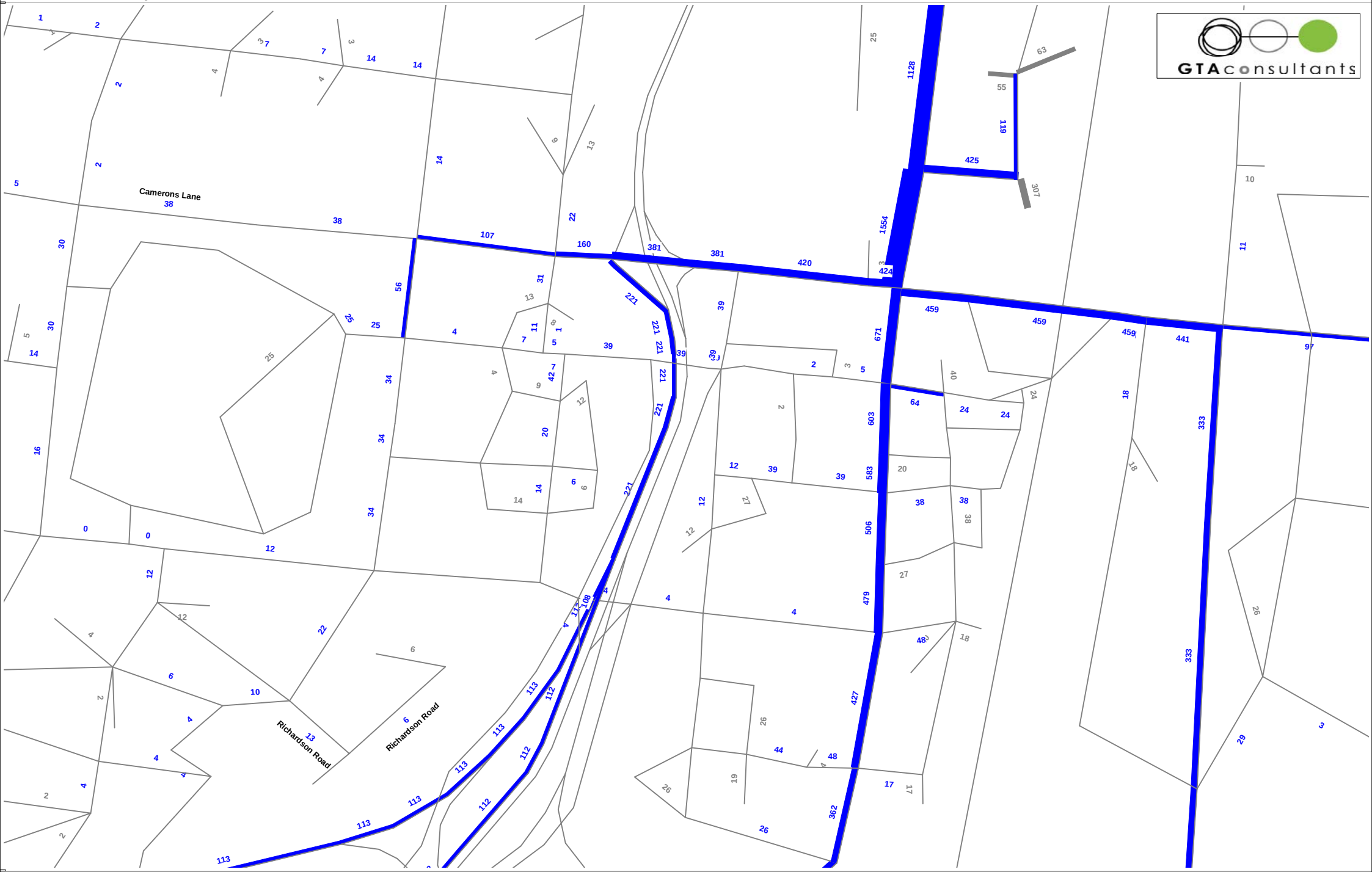
M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Rankin St West of Interchange WB - Year 2046

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Stewart St N NB - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

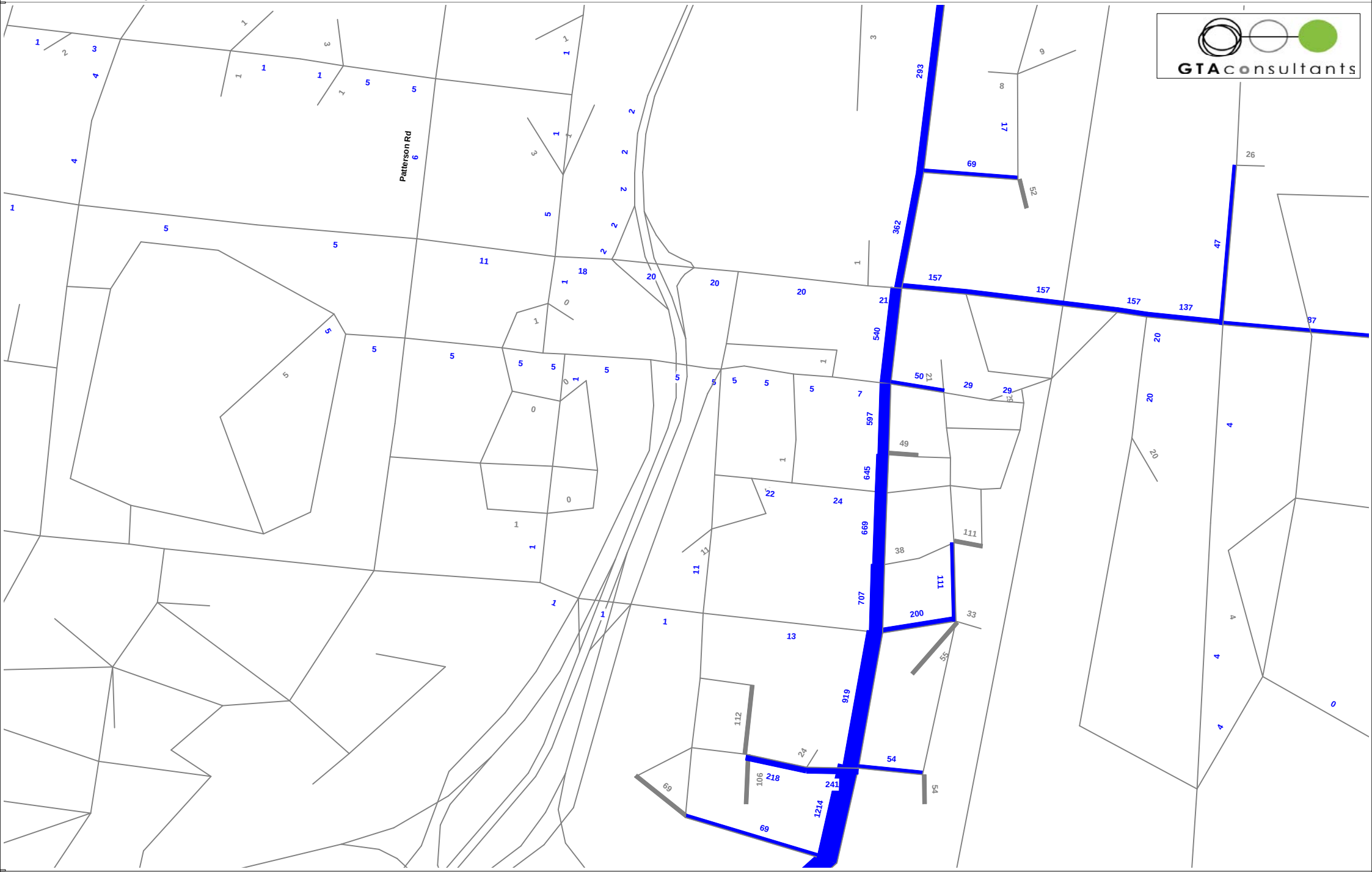
cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Stewart St N SB - Year 2046

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Stewart St NB - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

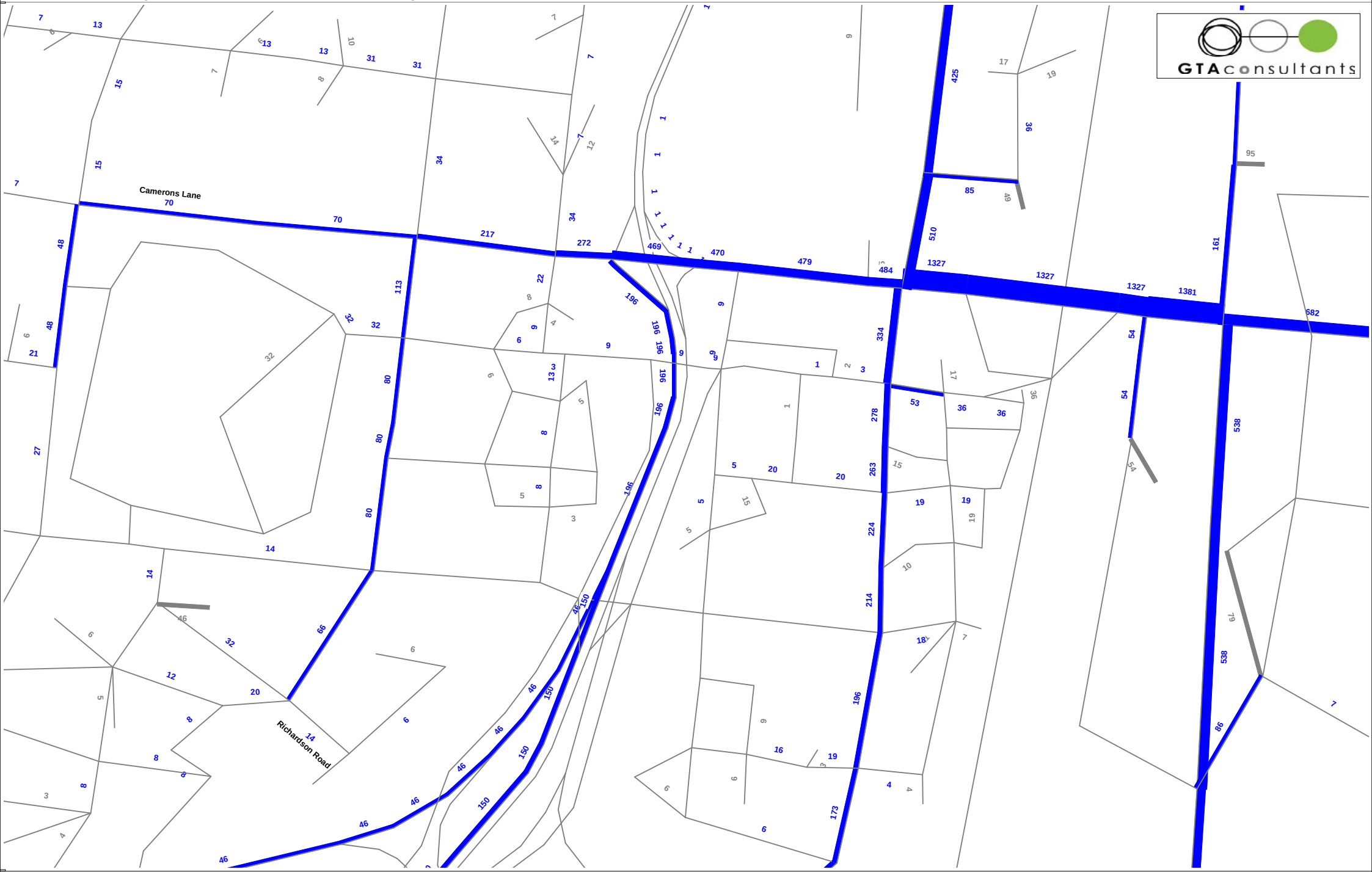
cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs AM Peak SLA Stewart St SB - Year 2046

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_AM_HWY_AM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Beveridge Rd EB - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Beveridge Rd WB - Year 2046

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Camerons Lane EB - Year 2046

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

cube

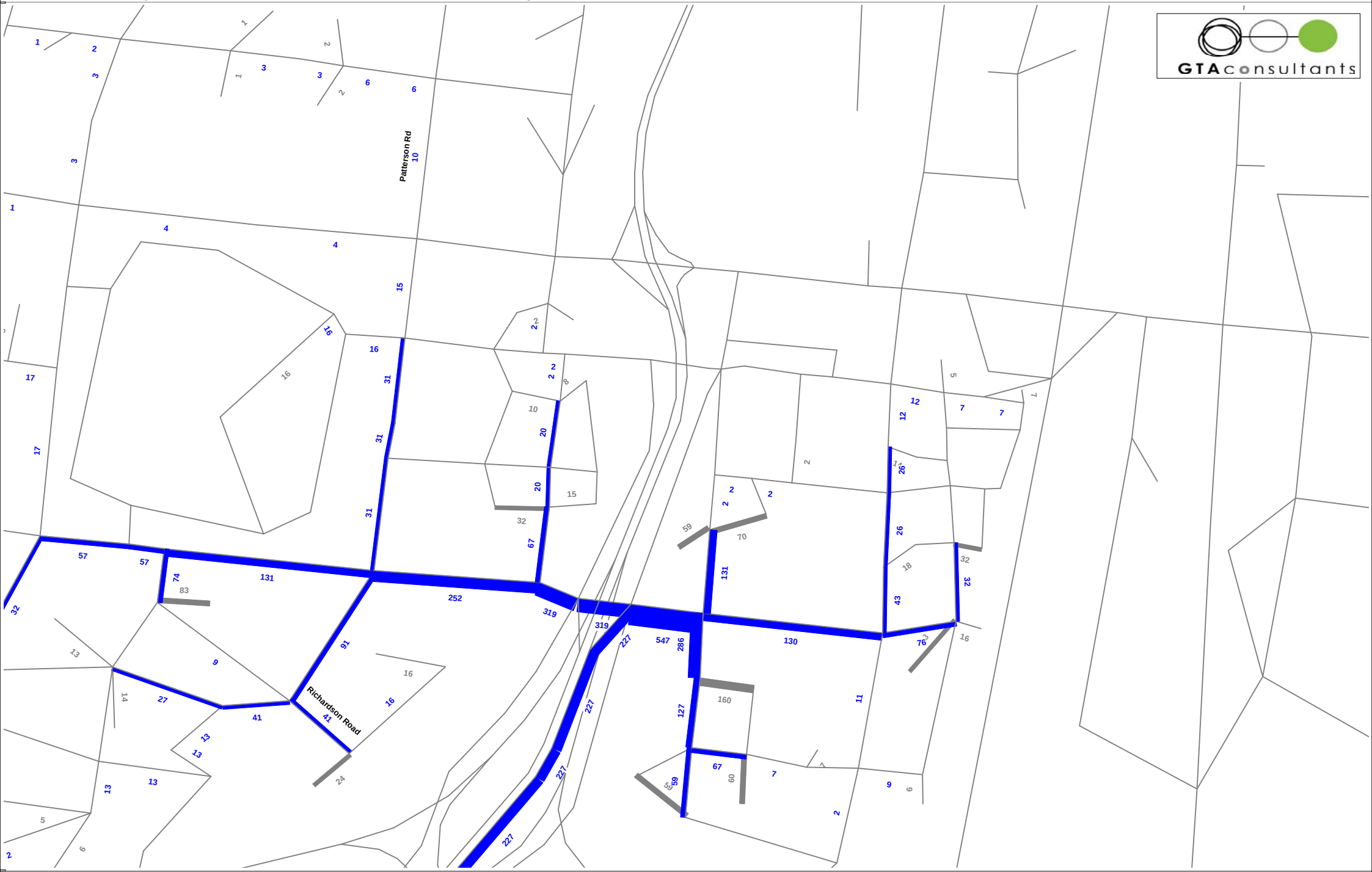
VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Camerons Lane WB - Year 2046

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Rankin St East of Interchange EB - Year 2046

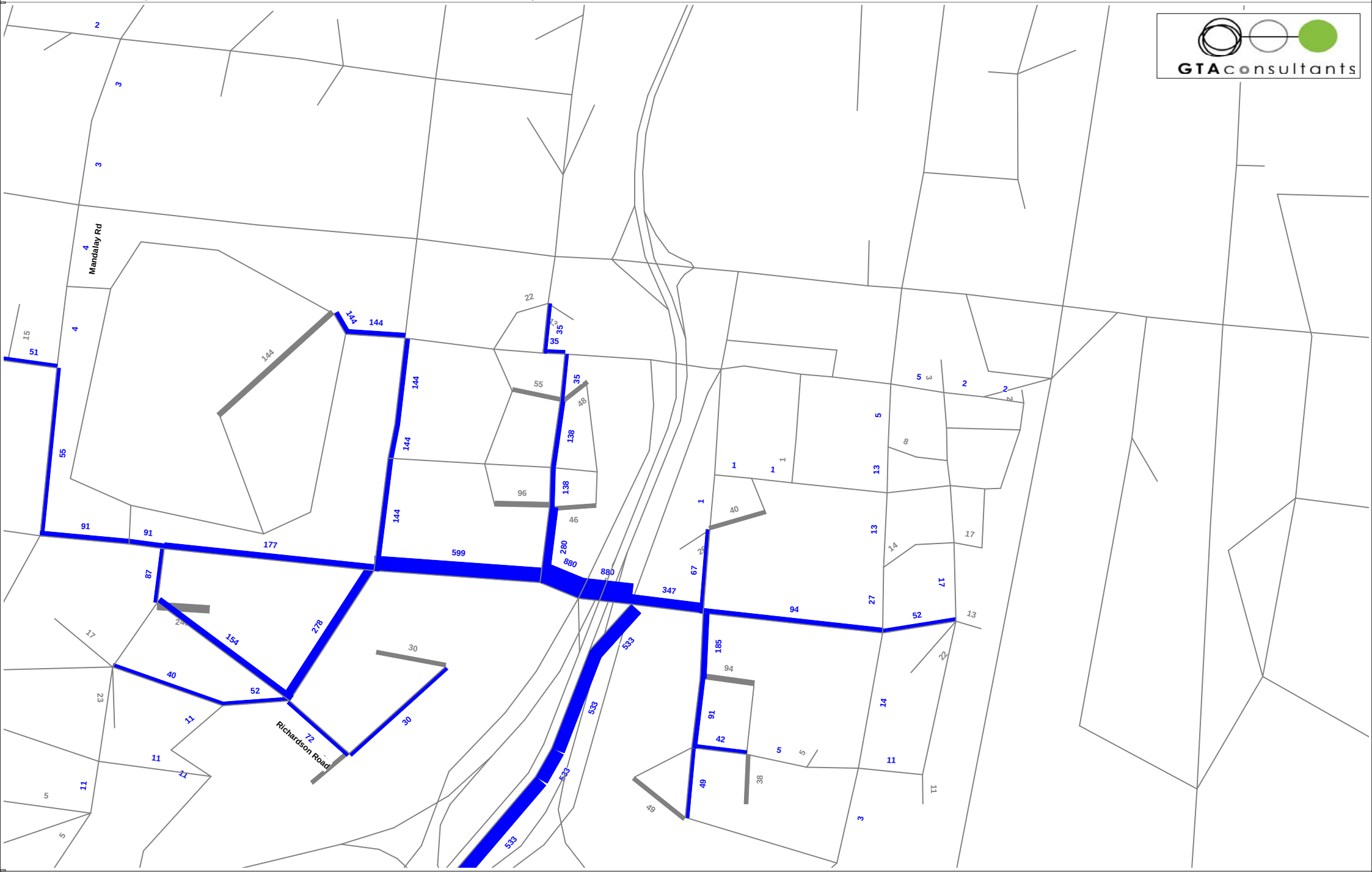
M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Rankin St East of Interchange WB - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Rankin St West of Interchange EB - Year 2046

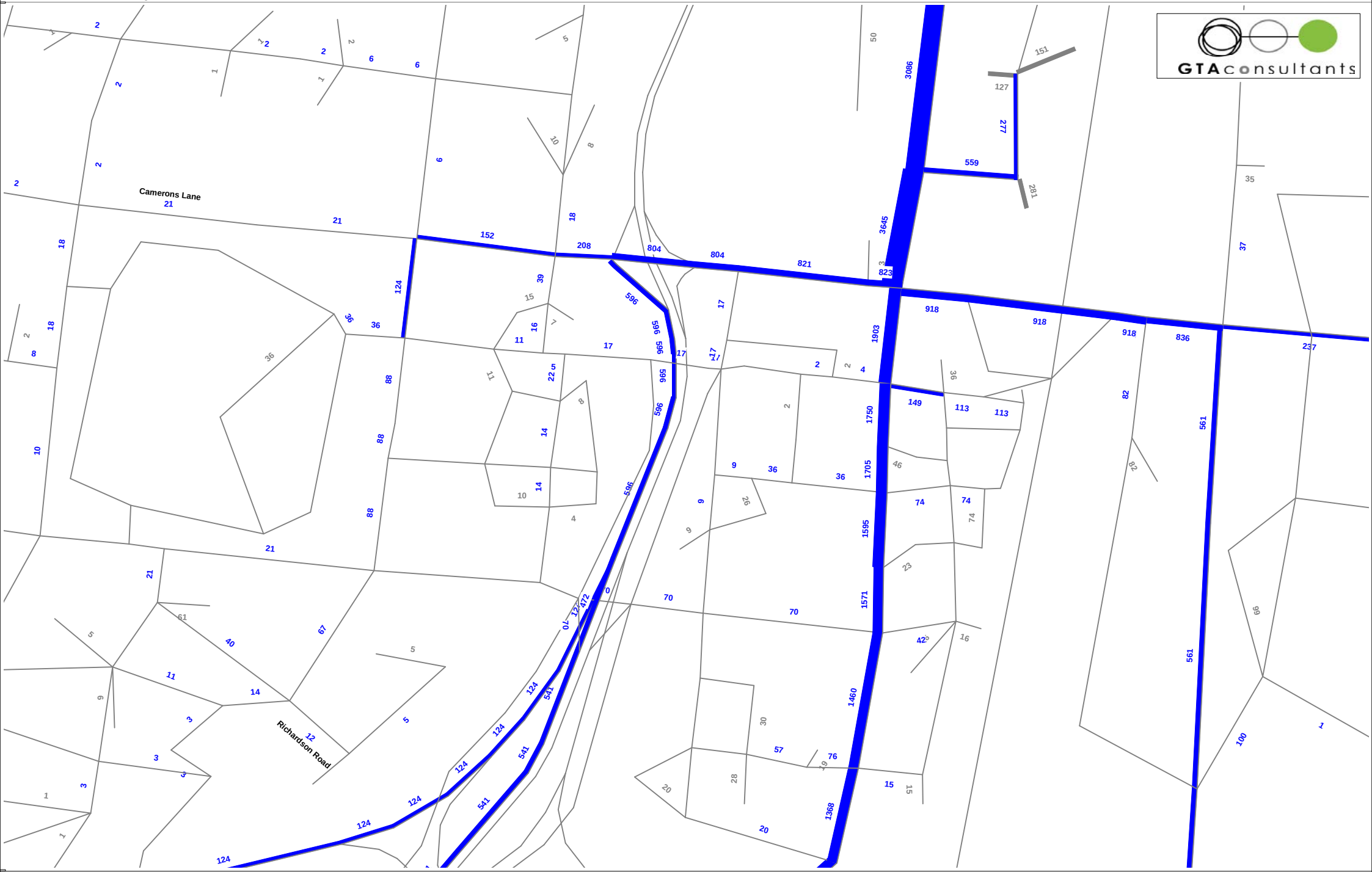


M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Rankin St West of Interchange WB - Year 2046

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Stewart St N NB - Year 2046



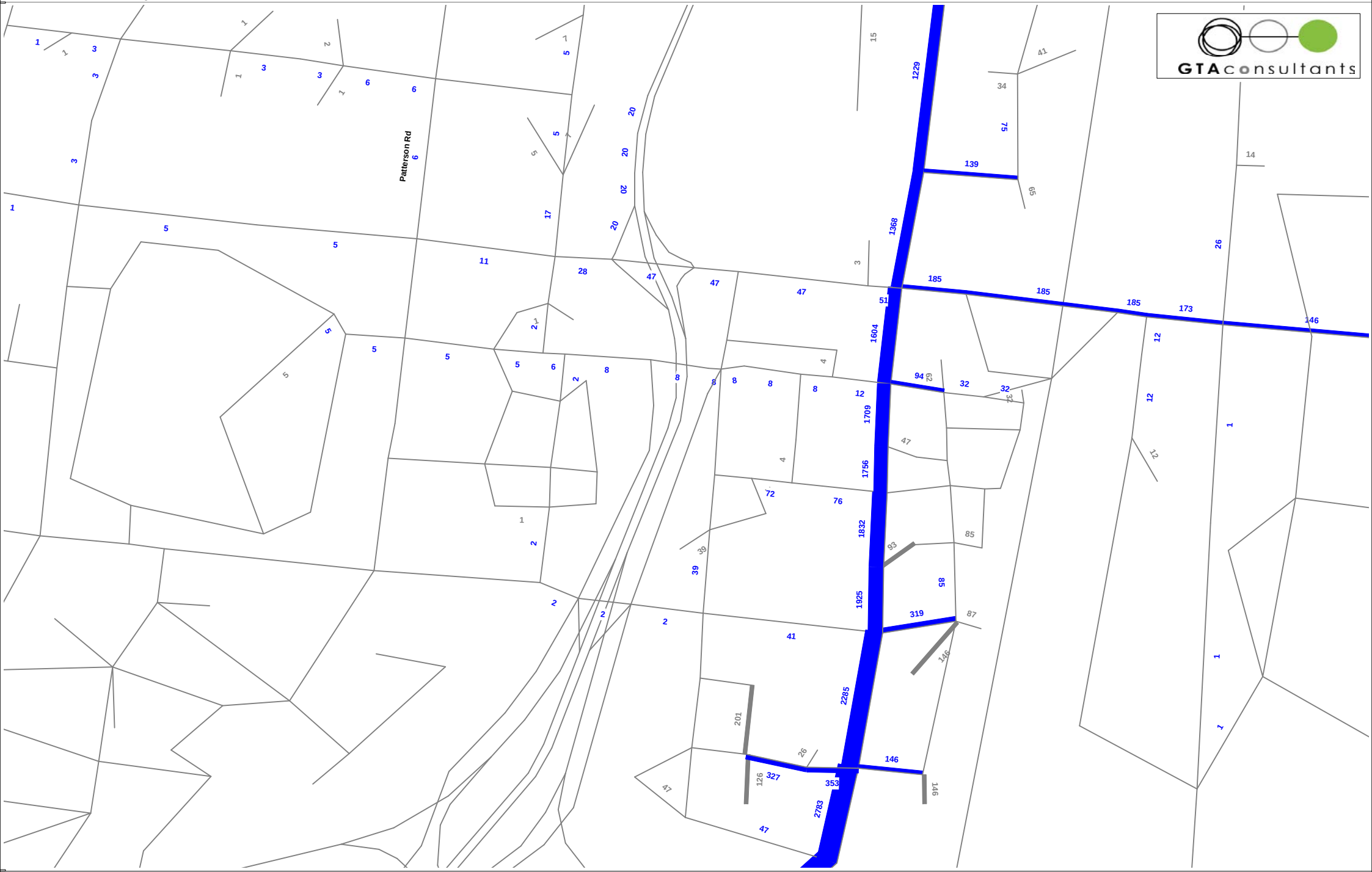
M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Stewart St N SB - Year 2046

M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

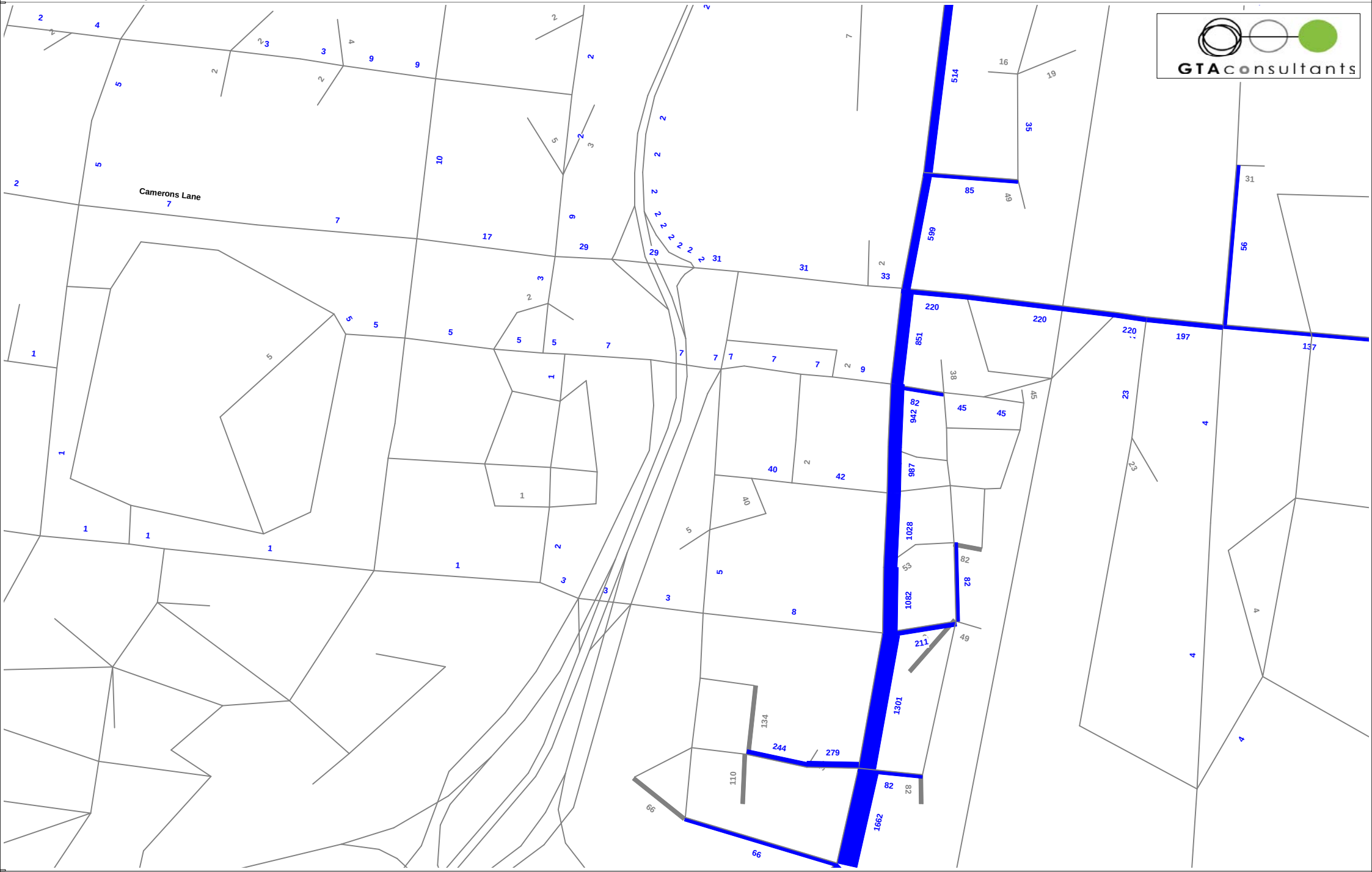
cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Stewart St NB - Year 2046



M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014
cube

VITM Northern Growth Corridor Model
15M1263000 - Beveridge Central PSP - 2 Hrs PM Peak SLA Stewart St SB - Year 2046



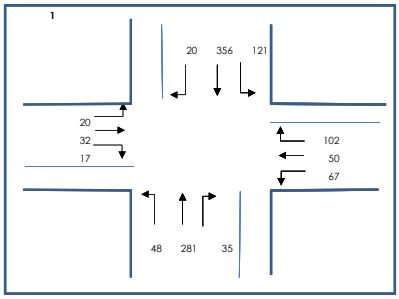
M:\VITM\VITM2012_V120110 GAA NGC\Base\M15_1263000\Y2046_V4\SLA_PM_HWY_PM_AFTERTRIPASSIGN_Base.M15_1263000.Y2046_V4.NET
18/12/2014

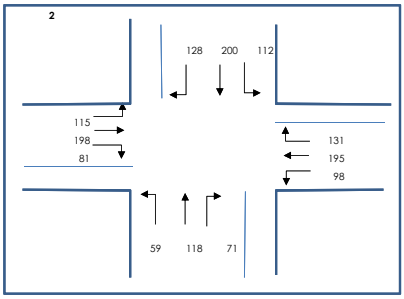
cube

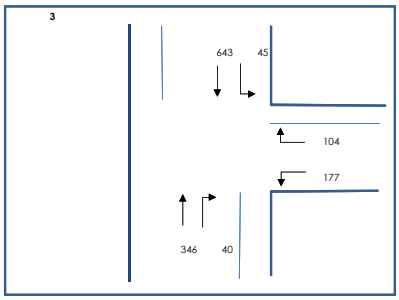
Appendix E

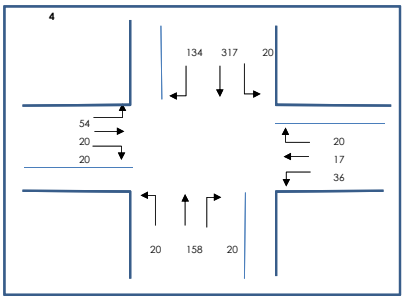
Peak Hour Intersection Turning Movements

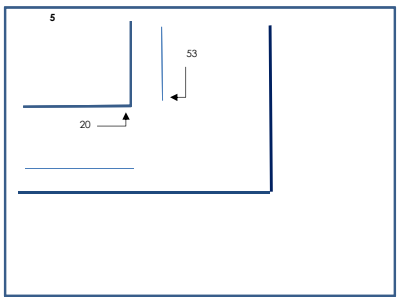
1 Hr AM 2026 Base Case Turning Movement

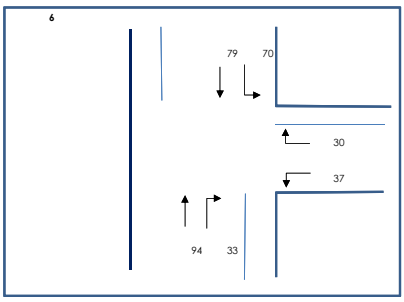


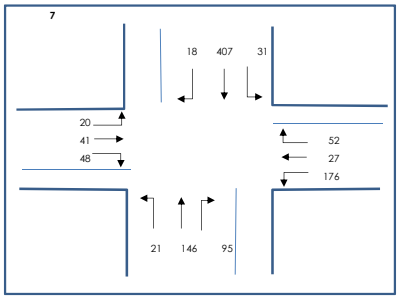


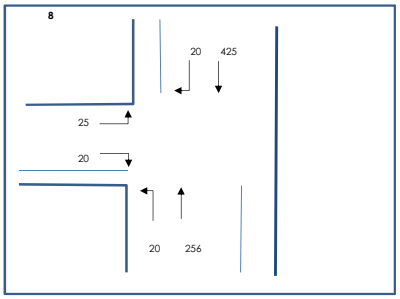


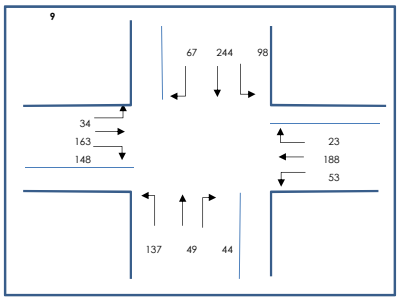


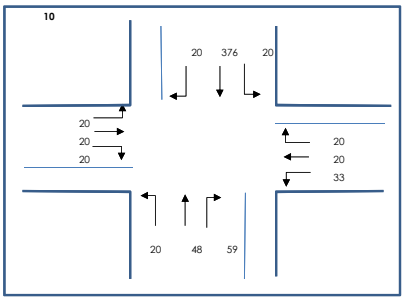


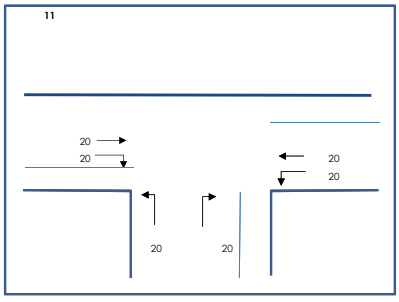




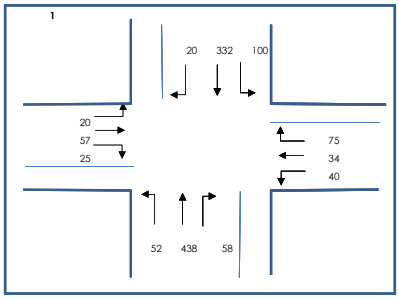


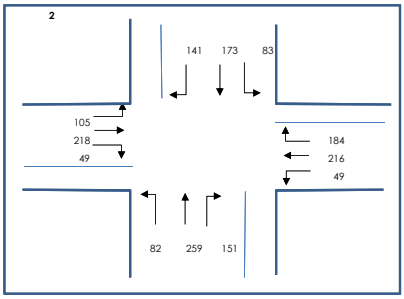


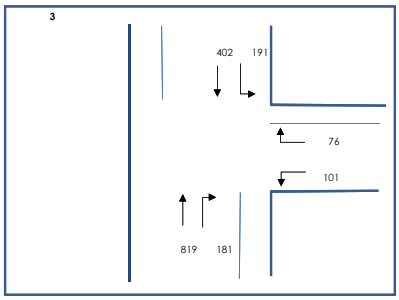


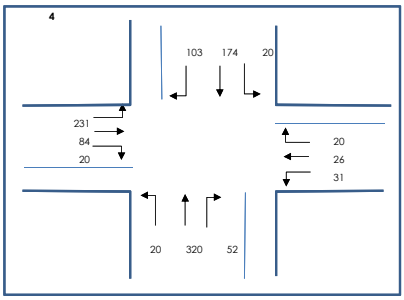


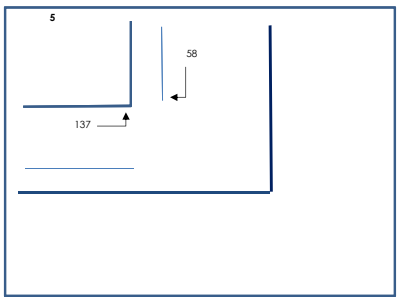
1 Hr PM 2026 Base Case Turning Movement

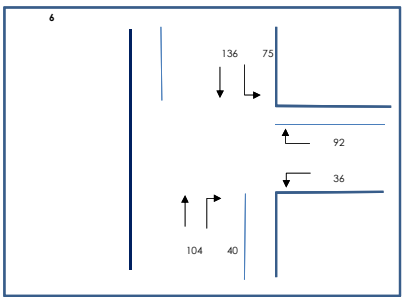


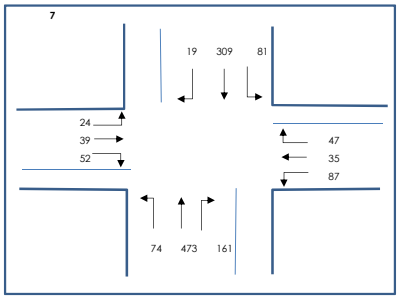


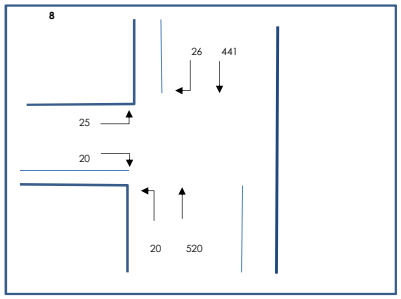


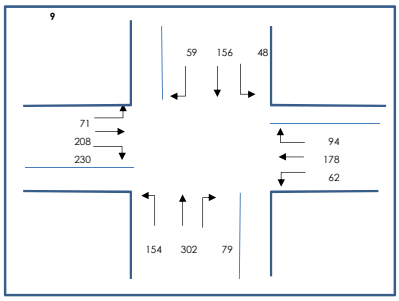


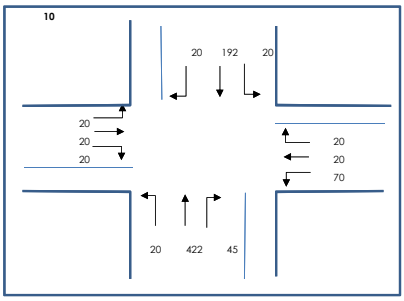


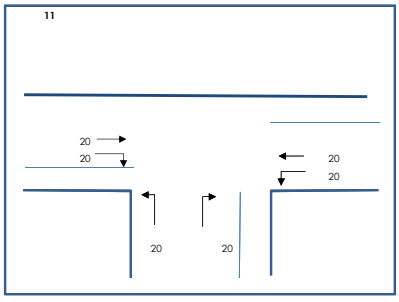




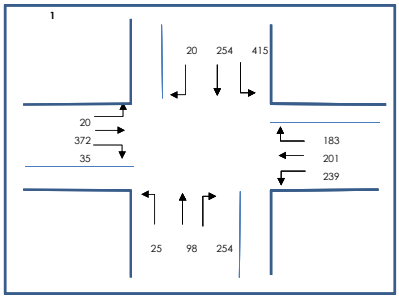


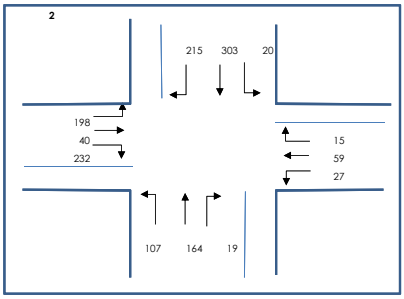


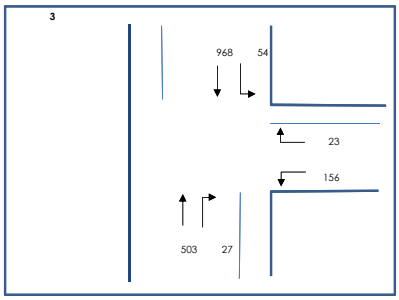


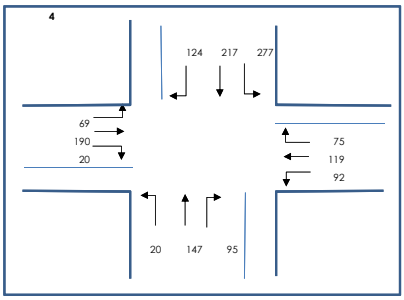


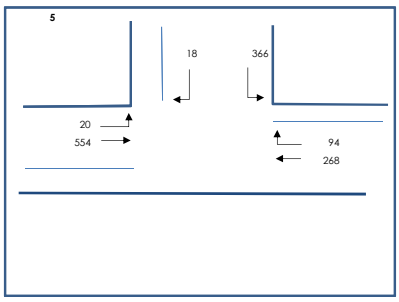
1 Hr AM 2046 Base Case Turning Movement

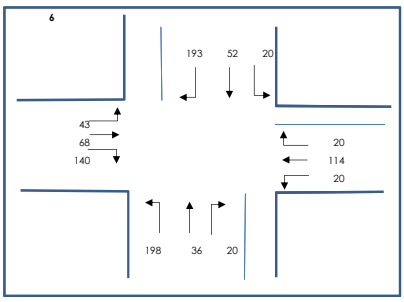


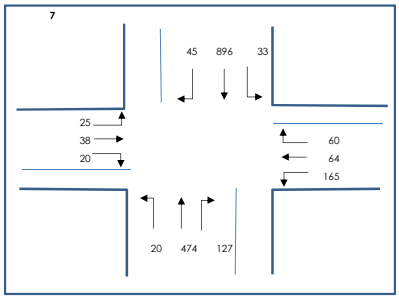


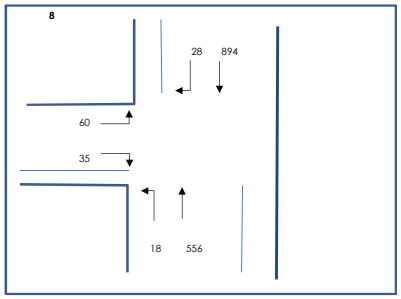


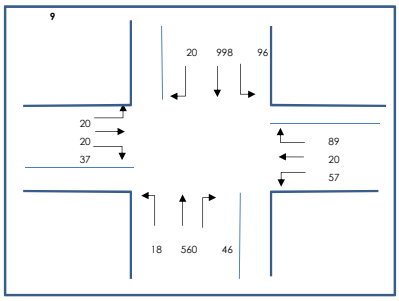


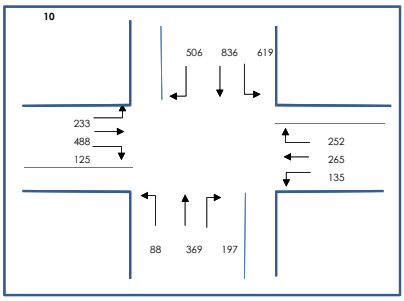


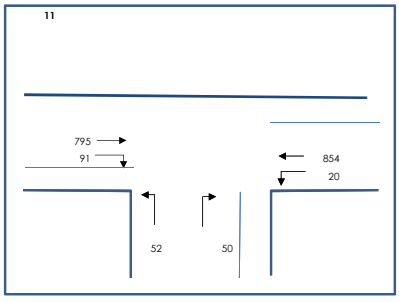




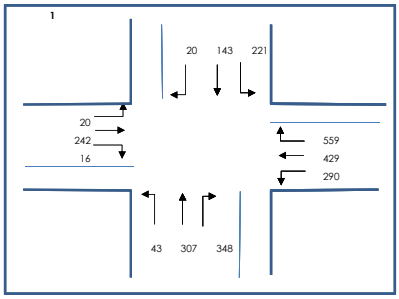


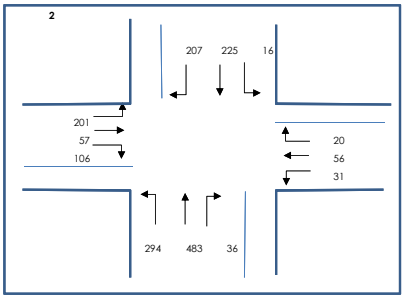


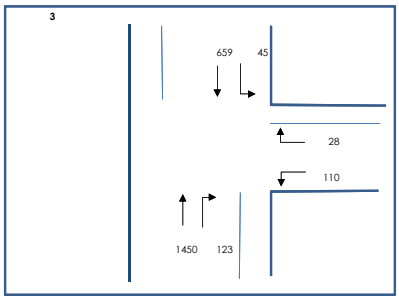


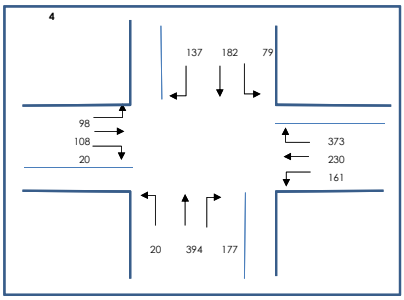


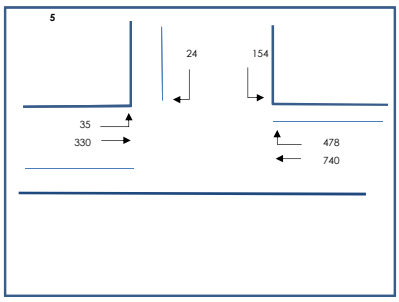
1 Hr PM 2046 Base Case Turning Movement

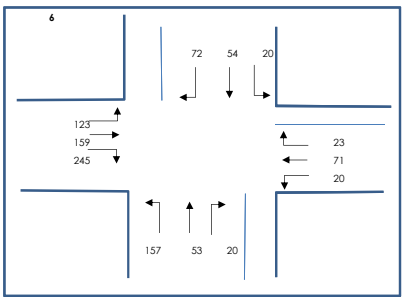


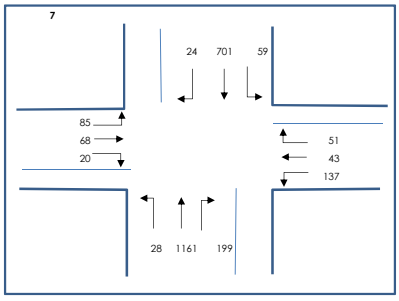


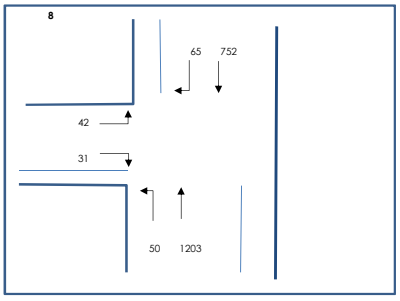


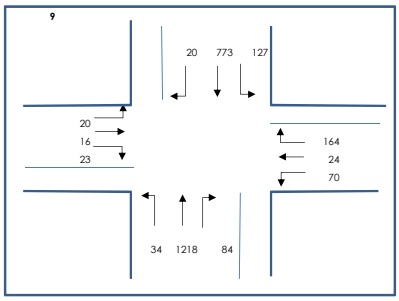


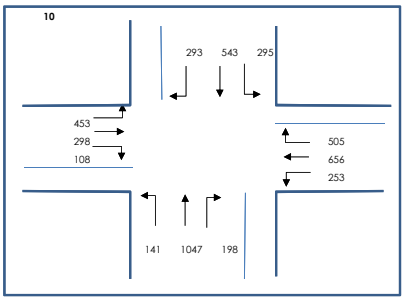


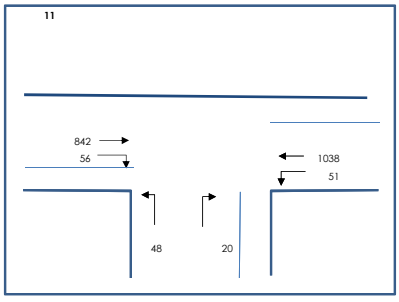












Melbourne

A Level 25, 55 Collins Street
PO Box 24055
MELBOURNE VIC 3000
P +613 9851 9600
E melbourne@gta.com.au

Brisbane

A Level 4, 283 Elizabeth Street
BRISBANE QLD 4000
GPO Box 115
BRISBANE QLD 4001
P +617 3113 5000
E brisbane@gta.com.au

Adelaide

A Suite 4, Level 1, 136 The Parade
PO Box 3421
NORWOOD SA 5067
P +618 8334 3600
E adelaide@gta.com.au

Townsville

A Level 1, 25 Sturt Street
PO Box 1064
TOWNSVILLE QLD 4810
P +617 4722 2765
E townsville@gta.com.au

Sydney

A Level 6, 15 Help Street
CHATSWOOD NSW 2067
PO Box 5254
WEST CHATSWOOD NSW 1515
P +612 8448 1800
E sydney@gta.com.au

Canberra

A Unit 4, Level 1, Sparta Building,
55 Woolley Street
PO Box 62
DICKSON ACT 2602
P +612 6243 4826
E canberra@gta.com.au

Gold Coast

A Level 9, Corporate Centre 2
Box 37, 1 Corporate Court
BUNDALL QLD 4217
P +617 5510 4800
F +617 5510 4814
E goldcoast@gta.com.au

Perth

A Level 27, 44 St Georges Terrace
PERTH WA 6000
P +618 6361 4634
E perth@gta.com.au