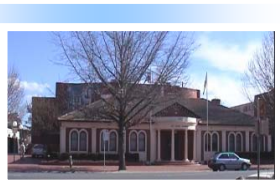
QueanbeyanCityCouncil

GOOGONG AND TRALEE TRAFFIC STUDY (2031)



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Googong and Tralee
Traffic Study (2031)

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Googong and Tralee
Traffic Study (2031)

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1. EXECUTIVE SUMMARY

The Technical Working Group proposed a number of road and intersection improvements to offset the possible network deficiencies as a result of the developments. Many of these improvements were proposed to directly improve a road or intersection suffering from a poor level of service. However, several new routes were also proposed as a means of creating additional capacity thereby relieving areas of congestion.

The major Queanbeyan improvements proposed for analysis are shown below.

2031 Major Network Improvements	
Links	4L Old Cooma (Googong – Edwin Land Parkway)
	4L Old Cooma (Edwin Land Parkway – Southbar)
	4L Monaro St (Atkinson – Queens Bridge)
	2L Edwin Land Parkway Extension (Jerrabomberra – Old Cooma)
	2L Ellerton Extension (Ellerton – Edwin Land Parkway)
	2L Dunns Creek (Old Cooma – Monaro)
	2L Northern Bypass (Bungendore - Yass - Canberra)
Intersections	Old Cooma / Edwin Land Parkway
	Tompsitt / Edwin Land Parkway / Jerrabomberra
	Tompsitt / Jerrabomberra New Link
	Cooma / Rutledge / Lowe
	Cooma / Fergus
	Cooma / Thornton / Barracks Flat
	Lanyon / Southbar
	Lanyon / Canberra
	Bungendore / Yass
	Bungendore / Atkinson
	Yass / Aurora
	Farrer / Cameron
	Lanyon / Tompsitt

Numerous additional small changes to minor intersections were also looked at to reduce delay.

Inherent in this analysis is the policy of not having any part of the Queanbeyan network operating at worse than LOS D in 2031. This level of service allows for some general degradation of the overall network without significant localised increases in delay. It also allows some movements at intersections to operate at a worse level of service so long as the overall level of service was maintained at LOS D or better.

The above major link improvements were grouped into 12 project options which included any combination of the above improvements in order to assess the relative benefits of the works. The following shows the link improvements included in each of the 12 options.

Initial Project Options							
Option	**4 Lane Old Cooma Road**	**2 Lane ELP Extension**	**4 Lane ELP Extension**	**2 Lane Ellerton Extension**	**2 Lane Dunns Creek**	**4 Lane Dunns Creek**	**2 Lane Northern Bypass**
001	✓	✓		✓	✓		✓
002	✓	✓			✓		✓
003	✓	✓		✓	✓		
004	✓	✓					✓
005	✓	✓		✓			
CIC 1A		✓					
CIC 1B	✓		✓				
CIC 2		✓			✓		
CIC 3		✓		✓			
CIC 4		✓		✓	✓		
VBC 5		✓		✓		✓	
VBC 6	✓	✓		✓		✓	

Each of these 12 project options were analysed using the transportation model developed for Queanbeyan. After examining the results of the computer analysis, it became clear that a number of these options either did not fulfil the role intended, did not improve the future network deficiencies or were too expensive.

Options that included the Northern Bypass were not proceeded with. The Roads and Traffic Authority (RTA) advised that alignment issues made the bypass too expensive at this time. The benefits gained by the traffic diversion were currently insufficient to warrant any project including the Northern Bypass.

The four laning of the Edwin Land Parkway Extension from Jerrabomberra to Old Cooma Rd produced no difference in traffic flow when compared to the two lane version. This therefore produced no real benefit to the network for the additional expense and was not proceeded with.

Options that did not include the four laning of Old Cooma Rd were also eliminated. The level of congestion along Old Cooma Rd as a result of the Googong development required four laning in order to maintain a suitable level of service during peak periods. No alternative roading project reduced flow along the two lane Old Cooma Rd alignment sufficiently to maintain the suitable level of service.

Options involving the construction of the Dunns Creek link were also eliminated. The Dunns Creek link between the Tralee and Googong developments was seen as being a useful inclusion in the future Queanbeyan network but would not likely be required in the current 2031 planning horizon. The ability of the Dunns Creek link to reduce traffic flow along Old Cooma Rd and the Edwin Land Parkway Extension was seen by the Technical Working Group as being valuable in the future but could not be justified at this time.

This process eliminated all but Project Option 005. It was also concluded that a variation of Project Option CIC 1B should also be included in further analysis. Project Option CIC 1B was to include the four laning of Old Cooma Rd and the two lane extension of the Edwin Land Parkway.

These two remaining Options 05B and CIC 1B were analysed in depth using the Queanbeyan model. In both options all intersections that were found to be operating at LOS E or F were modified until they maintained an LOS D level.

Additional testing was undertaken for each of the options with the Monaro Hwy, south of Lanyon Dr, increased to six lanes and Pialligo Ave increased to four lanes. These tests showed that increasing the capacity of these roads made little difference to the flow of traffic within Queanbeyan.

The Option CIC 1B variation was included in the final analysis to determine if it was possible to produce a future network option that did not require the Ellerton Rd Extension. One of the main reasons for the Ellerton Extension was to reduce the traffic flow along both Cooma St corridor and improve its projected level of service back to LOS D.

A number of additional improvements were proposed for Cooma St so that the Ellerton Rd Extension was not needed. These improvements involved modified intersection lay-outs for intersection along Cooma St and the installation of clearways during peak periods. Clearways would enable the introduction of four lanes of traffic along Cooma St between Rutledge St and Southbar Rd. Whilst the Option CIC 1B variations produced the desired result of LOS D along Cooma St it was expected to come at a cost to local residential amenity.

Option 05B was preferred as being the final 2031 improvement works project option.

The costs associated with these improvement works are attributable to the developments that take place up to 2031. This study concluded that the flow to and from each development would be tracked in the model which allowed the Technical Working Group to see how much traffic from each development went along or through each improvement in the preferred Project Option.

The relativity of each development's flow through an improvement creates the relative contribution that each development should make to the cost of the improvement.

To simplify this process and help identify contributions, the developments were grouped as follows:

- Googong Development (GOG)
- South Jerrabomberra - Tralee, SE Jerrabomberra and Tralee Station Developments (SJ)
- HQJOC (HQJ)
- All other development (DEV)
- Other Queanbeyan Users (QUE)

Flows from each of the five groups (DEV, GOG, SJ, HQJ, QUE) were modelled separately for both the 2031 AM and PM Peaks. The period volumes were combined so that the total peak period volume was used in the apportionment calculations. The percentage relativity of each group's flows was used in apportioning the cost of each improvement work. It should be noted that the following volumes do not include ACT traffic using the links and intersections.

Only the Edwin Land Parkway Extension and the Ellerton Extension projects had costs apportioned to existing Queanbeyan residents as these two projects offered additional

benefits to residents. All other link and intersection works were apportioned to GOG, SJ, HQJ and DEV only, as they were being constructed to repair disbenefits to existing Queanbeyan users produced by these developments.

The following table details the volumes and relative proportion of the combined flows from each development along each of the improvement links.

2031 Improvement Link Flows (AMP+PMP)						
Location	**GOG**	**SJ**	**HQJ**	**DEV**	**QUE**	**Total**
4L Old Cooma (Googong to ELP)	4404	297	51	365		5117
4L Old Cooma (ELP to Southbar)	2514	169	16	260		2959
4L Monaro (Alkinson to Bridge)	144	258	303	296		1001
2L ELP Ext (Jerrabomberra – Old Cooma)	1004	513	53	127	701	2398
2L Ellerton Extension	868	41	97	91	249	1346
Location	**GOG**	**SJ**	**HQJ**	**DEV**	**QUE**	**Total**
4L Old Cooma (Googong to ELP)	86%	6%	1%	7%		100%
4L Old Cooma (ELP to Southbar)	85%	6%	1%	9%		100%
4L Monaro (Alkinson to Bridge)	14%	26%	30%	30%		100%
2L ELP Ext (Jerrabomberra – Old Cooma)	42%	21%	2%	5%	29%	100%
2L Ellerton Extension	64%	3%	7%	7%	18%	100%

As indicated earlier, both the 2L Ellerton Extension and the Edwin Land Parkway Extension improvements have been apportioned to include a contribution from existing Queanbeyan residents. These new improvements are being implemented as a result of congestion and Level of Service issues elsewhere in the network. As these proposed roads have also been included in Council planning maps for many years, the apportionment of costs is therefore being calculated differently.

These links will provide a potential benefit to the existing Queanbeyan residents and QCC considers it reasonable to include the flow from existing residents in calculating the apportionment of cost.

The following table details the volumes and relative proportion of the combined flows from each development through each of the improvement intersections.

2031 Improvement Intersection Flows (AMP+PMP)						
Location	**GOG**	**SJ**	**HQJ**	**DEV**	**QUE**	**Total**
Cooma/ELP	4386	513	111	423		5433
Tompsitt/ELP/Jerrabomberra	823	1879	13	103		2818
Tompsitt/New Link	738	2564	40	91		3433
Cooma/Rutledge/Lowe	798	32	42	186		1058
Cooma/Fergus	1243	24	37	236		1540
Cooma/Thornton/Barracks Flat	2484	128	21	391		3024
Lanyon/Southbar	624	1095	160	249		2128
Lanyon/Canberra	861	847	200	429		2337
Monaro/Atkinson	157	259	407	715		1538
Monaro/Yass/Bungendore	880	228	911	839		2858
Yass/Aurora	594	39	390	575		1598
Farrer / Cameron					2611	2611
Lanyon / Tompsitt					3834	3834
Location	**GOG**	**SJ**	**HQJ**	**DEV**	**QUE**	**Total**
Cooma/ELP	81%	9%	2%	8%		100%
Tompsitt/ELP/Jerrabomberra	29%	67%	0%	4%		100%
Tompsitt/New Link	21%	75%	1%	3%		100%
Cooma/Rutledge/Lowe	75%	3%	4%	18%		100%
Cooma/Fergus	81%	2%	2%	15%		100%
Cooma/Thornton/Barracks Flat	82%	4%	1%	13%		100%
Lanyon/Southbar	29%	51%	8%	12%		100%
Lanyon/Canberra	37%	36%	9%	18%		100%
Monaro/Atkinson	10%	17%	26%	46%		100%
Monaro/Yass/Bungendore	31%	8%	32%	29%		100%
Yass/Aurora	37%	2%	24%	36%		100%
Farrer / Cameron					100%	100%
Lanyon / Tompsitt					100%	100%

An initial analysis was undertaken to determine a simple timing of the improvements. This analysis involved creating the expected 2021 land use for Queanbeyan and ACT based on available details of development construction rates. The 2006-2021 increase in households, jobs, cars and population was estimated from data provided and used to create AM and PM Peak models of traffic in Queanbeyan in 2021.

The poor levels of service shown in some areas indicate where improvements need to be implemented by 2021 and therefore cannot wait until 2031. The following tables indicate the likely construction timing of each of the proposed improvement works.

Link Improvement Timing		
Location	**By 2021**	**By 2031**
4L Old Cooma (Googong to ELP)		✓
4L Old Cooma (ELP to Southbar)		✓
4L Monaro (Alkinson to Bridge)	✓	
2L ELP Extension (Jerrabomberra – Old Cooma)	✓	
2L Ellerton Extension	✓	

Intersection Improvement Timing		
Location	**By 2021**	**By 2031**
Cooma/ELP	✓	
Tompsitt/ELP/Jerrabomberra		✓
Tompsitt/New Link		✓
Cooma/Rutledge/Lowe		✓
Cooma/Fergus		✓
Cooma/Thornton/Barracks Flat		✓
Lanyon/Southbar		✓
Lanyon/Canberra	✓	
Monaro/Atkinson	✓	
Monaro/Yass/Bungendore		✓
Yass/Aurora		✓
Farrer / Cameron	✓	
Lanyon / Tompsitt	✓	

2. INTRODUCTION

The purpose of this report is to identify and measure the improvements needed to the 2031 network to return it to a similar Level of Service to that currently provided in the 2009 network.

One of the objectives of the Queanbeyan Transportation Plan study was to identify when and where transport network improvements should occur in the Queanbeyan transport network between 2006 and 2031. An earlier reports detailed the current 2009 transport deficiencies and the future 2031 deficiencies. These will be briefly summarised in this report but for a full and detailed view of both current and projected deficiencies please refer to the "**Queanbeyan Current Situation Transport Report – June 2008**" and the "**Queanbeyan Future Transport Report Stage 1 – June 2008**".

3. PURPOSE OF THIS REPORT

In 2008 Queanbeyan Council commissioned Gabites Porter to create a transportation model of the Queanbeyan LGA based on the 2006 Census Land Use and traffic flows. This model has been used to analyse the current transport situation in Queanbeyan as well as analyse, test and optimise a number of 2031 future land use and infrastructure scenarios.

A Technical Working Group comprising representatives from Queanbeyan City Council, Roads and Traffic Authority, Gabites Porter, Village Building Company and Canberra Investment Corporation was formed to identify network improvement works needed to address deficiencies in both the existing and future Queanbeyan road network. In addition, this group attempted to address the equitable division of developer contributions needed to address those deficiencies.

The maintenance of a suitable level of road network performance is vital to ensure the continued safe and efficient movement of people and goods throughout Queanbeyan. Degraded intersection and road operation results in bottle-necks to traffic movement. The flow-on effects of this is reduced road safety, significant travel delay, traffic diversion onto residential roads and the loss of local amenity. To maintain the prosperity of the local community, it is important to keep the Queanbeyan transportation network operating at a good level of efficiency.

This report highlights the methods used in this study and the results of the analysis on the Queanbeyan road network.

4. BACKGROUND

4.1 Summary of the Model

Table 1 provides a brief overview of the Googong and Tralee Traffic Study (2031) model.

Summary of the Googong and Tralee Traffic Study (2031) Model	Table 1
Element	**Comment**
Geographic Coverage	The study area covered the entire Queanbeyan LGA area.
Model Coverage	The model extends past the ACT / NSW boundary into ACT and includes all of Canberra. This extension was created so as to more properly model the interaction between the two cities.
Periods	Traffic for each of the peak period models is reported in hourly traffic volumes. The generation models have been calibrated separately for each time period. The Queanbeyan model comprises two discrete models covering an average weekday: • Morning Peak: 0700 to 0900 (Hour reported: 0800-0900) • Evening Peak: 1600 to 1800 (Hour reported: 1700-1800)
Network Detail	The road network used is derived from a GIS representation of the road centrelines. There are around 5500 links and 2600 nodes in the Queanbeyan portion of the network and 16000 links and 7600 nodes in total within the model area.
External Traffic	The model has been validated using available local and RTA counts at external points as close as possible to the study area boundary.
Vehicle Types	Vehicle types used in the model include private cars, vans, as well as heavy (HCV) and light (LCV) commercial vehicles.
Software Platform	The model has been developed using TRACKS, which is the proprietary land use and transport planning software developed, maintained and marketed by Transportation and Traffic Systems Ltd.
Modelling Techniques	This is a standard three-step model comprising vehicle driver trip generation, distribution and assignment. The current three steps are outlined below: 1. Private/internal Trip generation. Private Trip productions are calculated from 20 Household Categories of 0, 1, 2+ employees by 0, 1, 2, 3+ cars calibrated directly from the Sydney HIS survey carried out in 1991/92 by the Transport Study Group (TSG). Trip Attractions and commercial vehicle generations are calculated from regression derived equations using the Australian and NZ Standard Classification major industry groups and again using HIS data. Existing land use data was obtained from the Australian Bureau of Statistics 2006 Census. 2. Trip distribution. Trip ends are formed into origin/destination matrices using a standard gravity model. A function of travel time is used for spatial separation. 3. Assignment. Assignment of trips to the network uses an incremental time slice process. This does not have the convergence issues associated with an equilibrium assignment, and permits intersection delays to be directly calculated during the assignment process. Intersection delays are calculated by movement using algorithms in ARR123 (SIDRA) and Tanner's queuing theory extended by Fisk and Tan, and later by Gabites Porter.

4.2 The Road Network

4.2.1 Base 2006 Road Network

The road network used in the study was obtained from QCC and ACT GIS systems and includes all roads within the Queanbeyan study area and all roads of Collector or higher status in the ACT. The road network for the entire model area is shown in **Figure 1.**

The network is a true representation of a road and distances are calculated directly from the co-ordinate data. All other components of network coding were prepared from visual inspection or from the Council's set of aerial photos, for example:

- Link lanes
- Link free flow speeds
- Approach controls
- Approach lanes

All roundabouts and priority intersections were coded into the network.

4.2.2 Base 2031 Road Network

The base future network was based upon the validation 2006 network but also included all works expected completed to the end of the year 2010. Additional changes and improvements were also made to the network based upon probable local road networks identified in Masterplans for major areas under development.

Under these criteria the following works were included in the 2031 Base network:

1. Major local network infrastructure for the Googong development area.
2. Major local network infrastructure for the South Tralee development area.
3. Simple major local network infrastructure for the North Tralee development area.
4. Four lane upgrade of Lanyon Dr from Tompsitt Dr to Monaro Hwy.
5. Construction of a roundabout at the Captains Flat / Kings Hwy intersection.
6. Construction of a flyover on Pialligo Ave at the Airport main entrance.

The Base 2031 road network for the Queanbeyan Study area is shown in **Figure 2.**

A number of Major Works Projects were included in the ACT part of the model to correctly reflect the changes expected to accommodate the increased ACT population. These upgrades included:

1. Four lane upgrade to the remaining two lane elements of the Monaro Hwy and Lanyon Dr.
2. Stage 2 of the GDE.
3. Widening of Parkes Way and Clunies Ross St with associated upgrade to the Barry Dr / Clunies Ross St intersection.

4. Four lane upgrade of Majura and Airport Rds with associated extension of Monaro Hwy over Pialligo Ave.

5. Upgrades of William Slim and Gundaroo Drives.

6. Four land upgrade of Tharwa Drive from Johnson Drive south.

7. Widening of Monaro Hwy to three lanes in each direction for 2031.

8. Major capacity increases at the Melrose and Yamba intersections with Tuggeranong Parkway.

9. Numerous improvements to numerous signalised intersections.

4.3 Land Use

4.3.1 Households and Employment Changes

The 2006 Census land use information was used for the creation of the base 2006 network.

Household data was based on CCD ex 2006 ABS census data:

- Households (number occupied on census night)
- Average vehicles available/household
- Average number of employees/household

At the workplace location jobs have been identified and located using 2006 ABS census data placed according to the Transport Data Centre Zone system and using the Australian New Zealand Standard Industry Classifications (ANZSIC) Major Divisions for all full time + part time jobs (i.e. number of people employed):

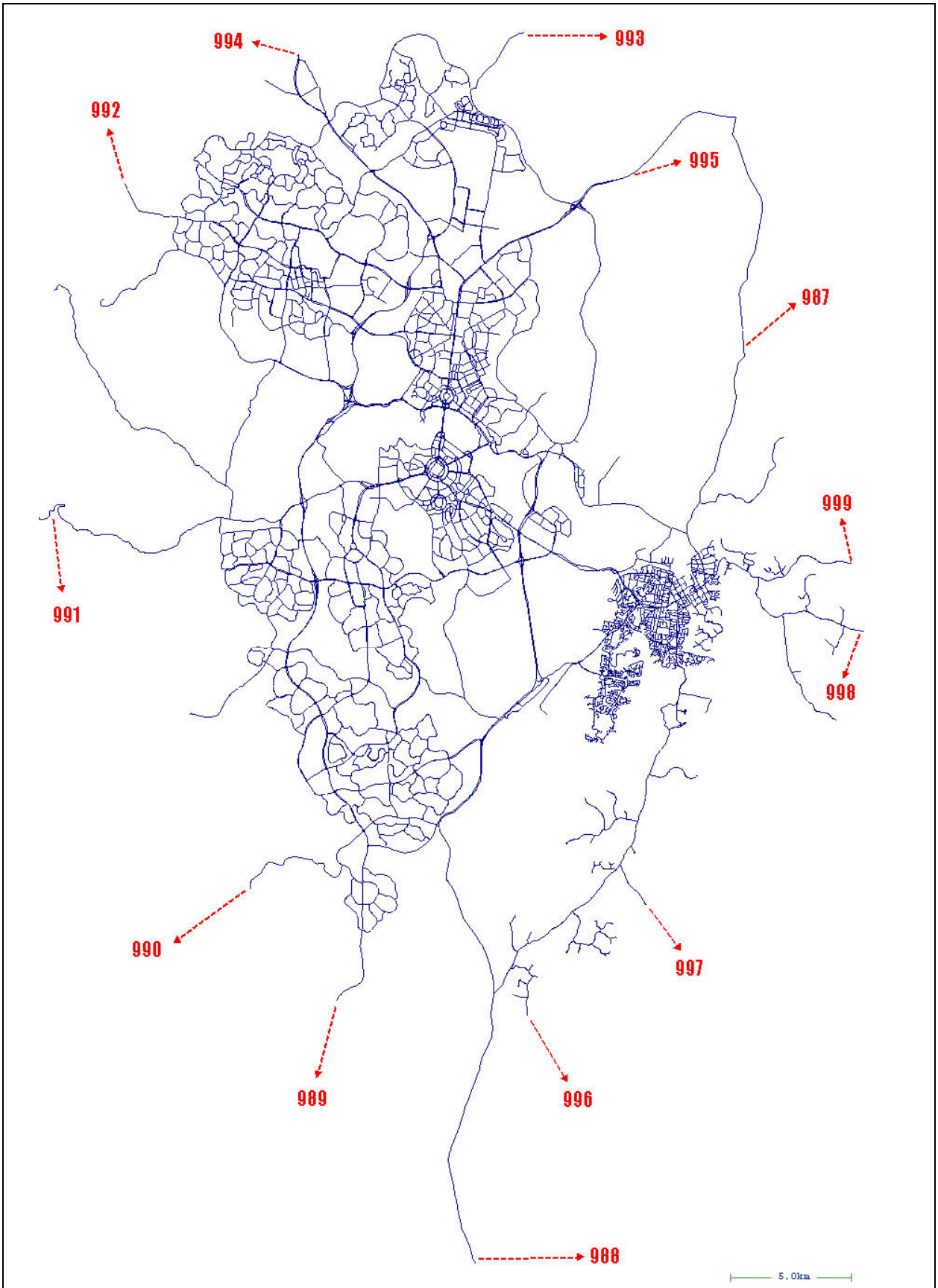
- Division C - Manufacturing
- Division F – Wholesale Trade
- Division G - Retail Trade
- Division K – Finance and Insurance
- Division O – (Health and) Community Services
- Total Jobs

Education school roll data was obtained from the rolls of private and public schools.

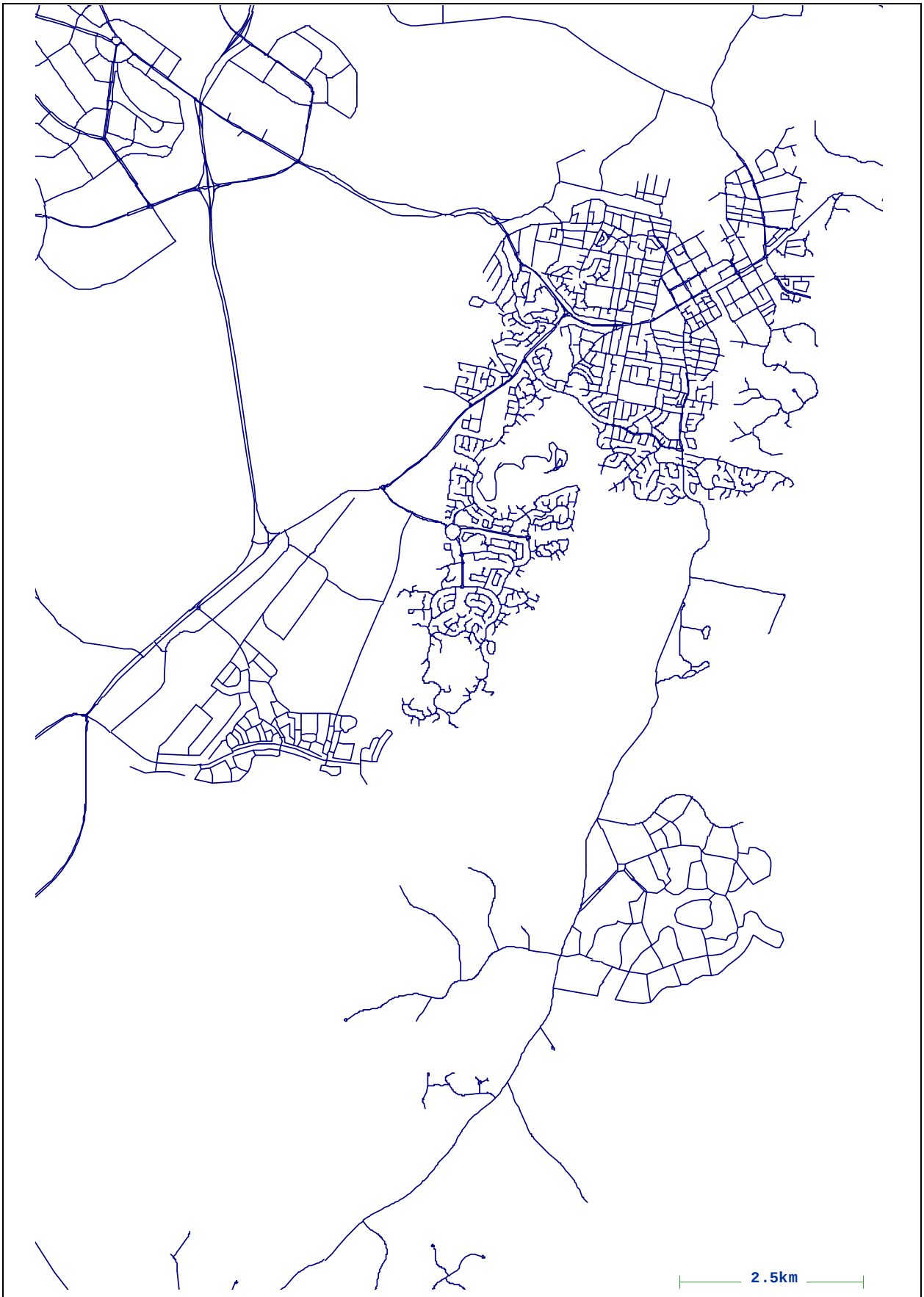
For household data the procedure followed was to extract the data at CCD level from the Census Community Profile, and then allocate each CCD to either a single model zone or multiple zones based on CCD size.

Understanding how land use activity changes over time is crucial to understanding how traffic will change. The CCD land use projections were based on the ACT and Queanbeyan City Council supplied data for changes in household construction and employment distribution from 2006-2031 and available details of the proposed housing release areas throughout the area.

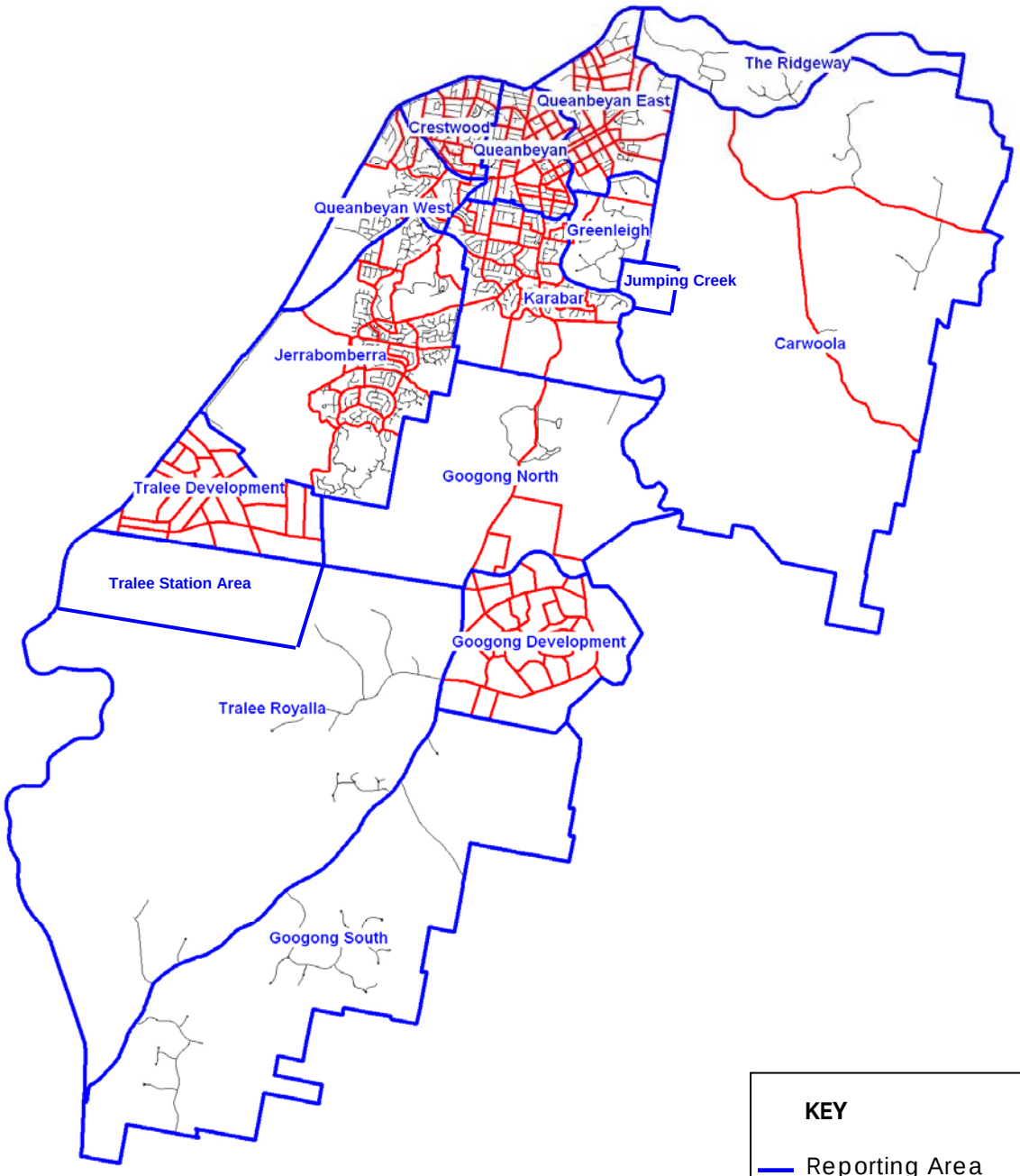
The 2031 future land use data was grouped into reporting areas for ease of distribution and understanding. These areas are shown in **Figure 3**.



Googong and Tralee Traffic Study (2031)	**Road Network**	**Figure 1**
Gabites Porter Consultants		



Googong and Tralee Traffic Study (2031)	**2031 Queanbeyan Road Base Network with Development**	**Figure 2**
Gabites Porter Consultants		



Googong and Tralee Traffic Study (2031)	**Reporting Areas and Zones**	**Figure 3**
Gabites Porter Consultants		

5. EXISTING 2009 NETWORK DEFICIENCIES

The level of traffic used in the 2009 modelling is calculated from land use data which focuses on Queanbeyan and includes the number of dwellings, vehicles, school rolls, employment and job distribution. All of this data has been extracted from the 2006 census data. A computer model of Queanbeyan has been created and tested against traffic counts and it replicates the economic and environmental conditions that exist in 2009.

The 2009 land use covers both the Queanbeyan and Canberra LGAs so that the interaction between the two areas can be correctly taken into account. The Queanbeyan study area however is bordered on the west and south by the ACT-NSW border and in the east as far as the Wanna Wanna Nature Reserve. The Queanbeyan study area of the model is divided into sub areas to form a zone system. The Queanbeyan study area consists of 255 zones but the total model consists of 999 zones representing Queanbeyan and the ACT.

5.1 2009 Land Use

The details of the 2009 model and the following existing network results are included in the "**Queanbeyan Current Situation Transport Report – June 2008**".

A summary of the 2009 deficiency results follows.

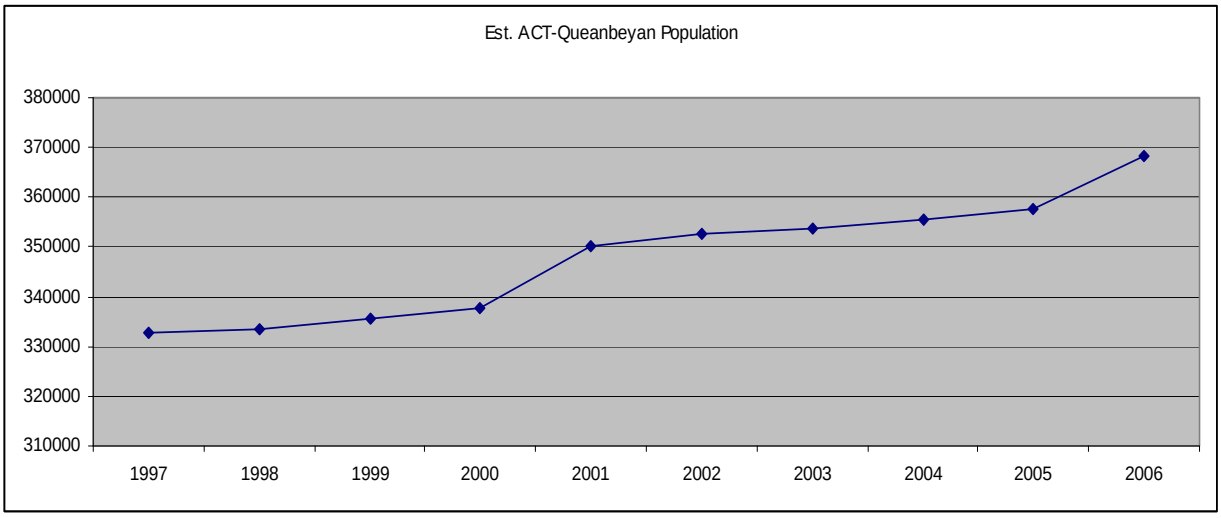
The road network used in the study was obtained from QCC and ACT GIS systems and includes all roads within Queanbeyan and all roads of Collector or higher status in the ACT. The modelled road network can be seen in **Figure 1**.

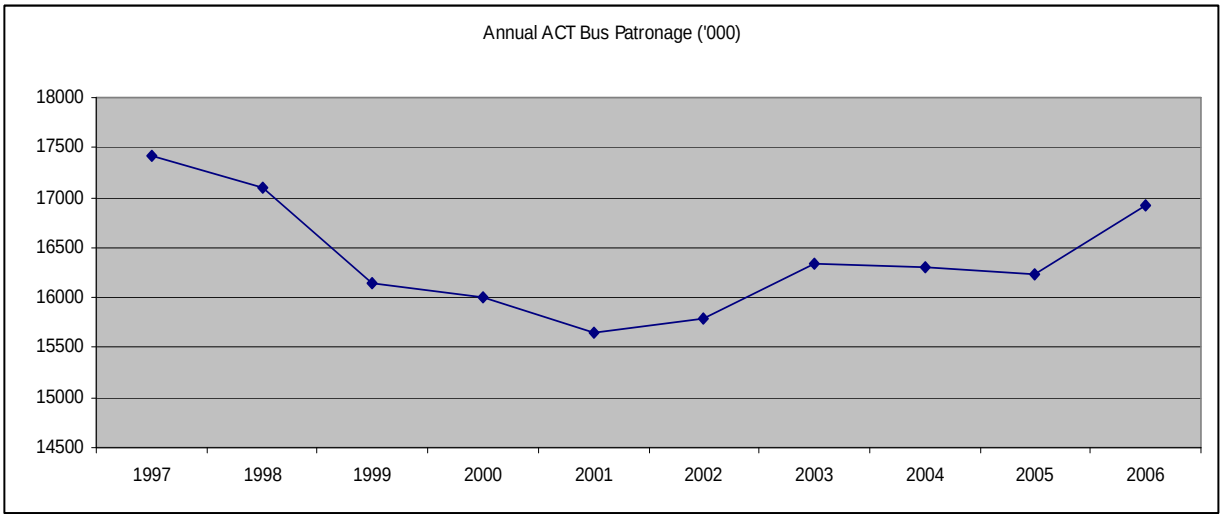
Table 2 summarises the land use used in the study areas.

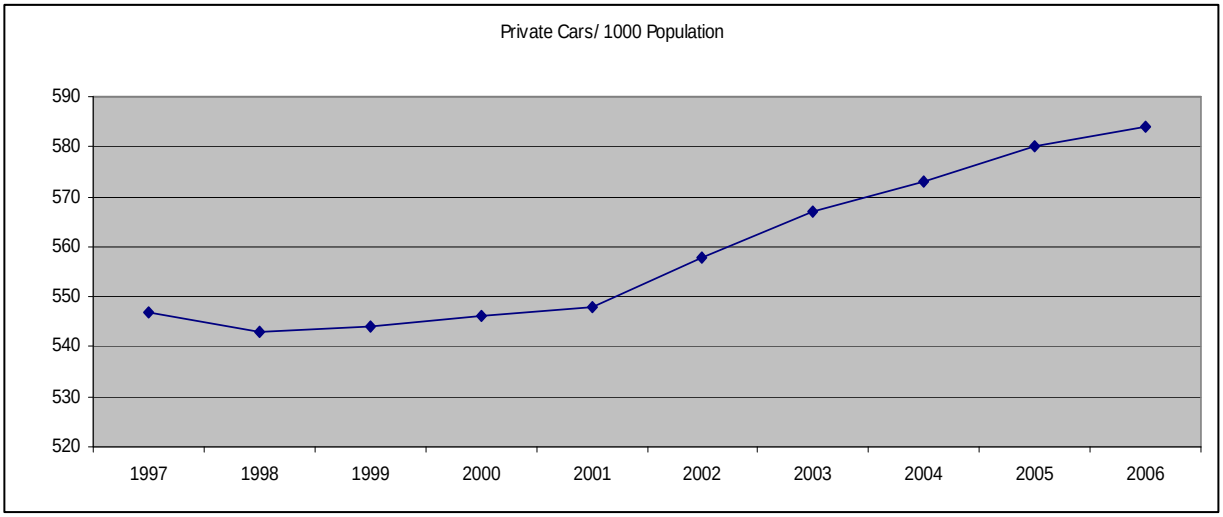
2009 Model Land Use		Table 2
Land use	**Queanbeyan Only**	**Total Queanbeyan and ACT**
Households	14,131	134,652
Employees	19,072	192,318
Employees per HH	*1.350*	*1.428*
Vehicles	22,365	211,049
Vehicles per HH	*1.583*	*1.567*
Primary School Roll	2,645	29,034
Secondary School Roll	1,415	35,036
Tertiary Roll	300	38,350
Retail Jobs	2,120	22,401
Finance Jobs	1,848	22,378
Community Jobs	1,658	20,083
Manufacturing Jobs	2,532	22,765
Other Jobs	1,422	95,822
Total Jobs	9,610	183,255

The 2009 environment, upon which the model is based, shows that the population of the ACT-Queanbeyan area is increasing along with car ownership. However, the rate of increase in car ownership appears to be decreasing while bus patronage, in the ACT for people with activity there, appears to be increasing from a low in 2001.

The following charts give an indication of the 2006 environment upon which the Queanbeyan model is based and how it relates to the decade preceding it.







The 2006 Census indicates that 6.4% of people with employment in the ACT use some form of public transport. However, the same data indicates that only 1.0% of people with employment in Queanbeyan use public transport. Public transport services in Queanbeyan are therefore underutilised.

The operational efficiency of public transport during Morning Peak period has been analysed and whilst service coverage and travel time are generally very good the service frequency and hours of operation are lagging behind.

5.2 2009 Network Operation

The modelled traffic results shown in **Table 3** show how the network performs in the AM and PM peak periods.

2009 Model Traffic Indicators **Table 3**

Traffic Activity Indicator	Queanbeyan Study Area	ACT-Queanbeyan Model Area
	2006 - Morning Peak	
Vehicle Kilometres (km)	66,616	981,940
Link Vehicle Minutes (min)	68,800	988,010
Link Mean Running Speed (kph)	58.1	59.6
Vehicles subject to Intersection Delay	151,119	1,321,127
Total Vehicle Intersection Delay (min)	16,628	374,548
Intersection Delay per Vehicle (sec)	6.6	17.0
Total Vehicle Trips	13,956	124,549
Network Total Vehicle Minutes (min)	85,428	1,362,558
Network Mean Network Speed (kph)	46.8	43.2
Average Trip Distance (km)	7.92	7.92
Average Trip Time (min)	10.54	10.54
	2006 - Evening Peak	
Vehicle Kilometres (km)	72,993	1,010,122
Link Vehicle Minutes (min)	76,348	994,741
Link Mean Running Speed (kph)	57.4	60.9
Vehicles subject to Intersection Delay	174,178	1,372,531
Total Vehicle Intersection Delay (min)	18,809	347,822
Intersection Delay per Vehicle (sec)	6.5	15.2
Total Vehicle Trips	15,649	130,843
Network Total Vehicle Minutes (min)	95,157	1,342,563
Network Mean Network Speed (kph)	46.0	45.1
Average Trip Distance (km)	7.73	7.73
Average Trip Time (min)	10.05	10.05

Modelling of the Queanbeyan road network revealed relatively few significant deficiencies in 2009. The majority of problem intersections and roads occur outside Queanbeyan in the ACT. These deficiencies are generally reported as reductions in Level of Service

Level of Service (LOS) is a subjective measure of the way in which a network is operating. It is a concept developed by US engineers and has been generally adopted internationally. It is being used in this study to measure the performance of both roads and intersections. LOS is reported as the average over the entire peak hour

and may therefore be better than the absolute worst LOS that occurs for small periods during the hour.

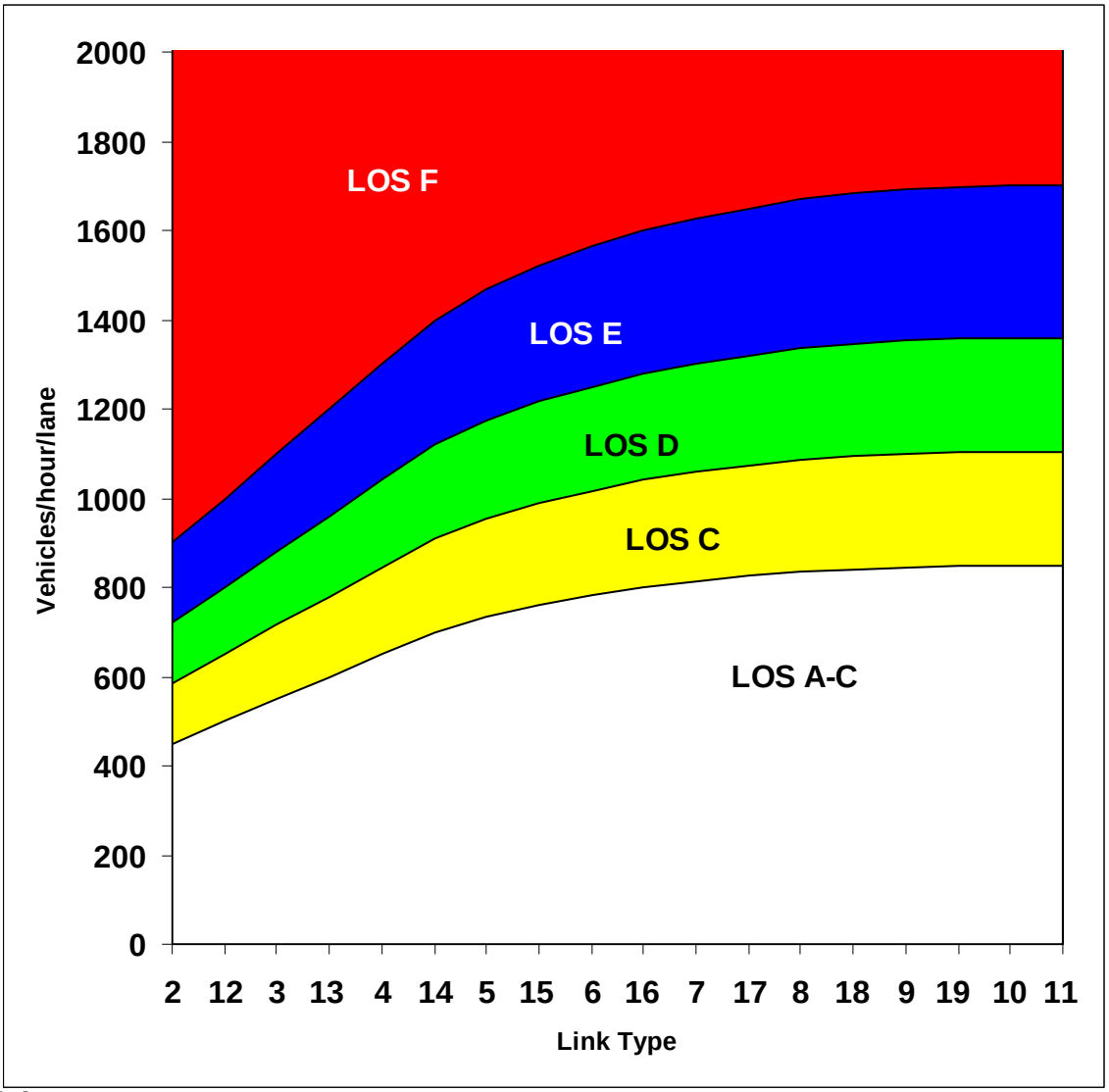
This study focuses on LOS F, E and D with particular attention paid to the two worst conditions of LOS F and E. **Table 4** describes the conditions that can occur for each level of service.

Level of Service Indicators				Table 4
LOS	AustRoads Description	HCM LOS criteria		
		Link (vehicles per hour)	Intersection (average delay/veh)	
			Priority	Signal/Rotary
LOS F	Forced flow. The amount of traffic approaching a point exceeds that which can pass it. Flow break-downs occur, and queuing and delays occur.	In excess of **900-1700** depending on link type	50 sec	80 sec
LOS E	Traffic volumes are at or close to *capacity and there is virtually no freedom* to select desired speed and to manoeuvre within the traffic stream. Flow is unstable and *minor disturbances within the traffic stream will cause break-downs in operation*.	Between **720-1360** depending on link type	35 sec	55 sec
LOS D	Approaching unstable flow where *all drivers are severely restricted* in their freedom to select desired speed and to manoeuvre within the traffic stream. The general level of *comfort and convenience is poor* and small increases in traffic flow will cause operational problems.	Between **585-1105** depending on link type	25 sec	35 sec

Figure 4 shows how Link LOS varies depending on link type. It shows that the higher the vehicle volume and the lower the free speed the worse the LOS becomes. Link types are defined as follows:

- Link type 1 equates to road speeds of 10km/hr
- Link type 2 and 12 equate to road speeds of 20km/hr and 25km/hr
- Link type 3 and 13 equate to road speeds of 30km/hr and 35km/hr
- Link type 4 and 14 equate to road speeds of 40km/hr and 45km/hr
- Link type 5 and 15 equate to road speeds of 50km/hr and 55km/hr
- Link type 6 and 16 equate to road speeds of 60km/hr and 65km/hr
- Link type 7 and 17 equate to road speeds of 70km/hr and 75km/hr
- Link type 8 and 18 equate to road speeds of 80km/hr and 85km/hr
- Link type 9 and 19 equate to road speeds of 90km/hr and 95km/hr
- Link type 10 and 11 equate to road speeds of 100km/hr and 110km/hr
- Link type 20 equates to road speeds of 105km/hr

This present day Level of Service provides a measure by which future network performance and deficiencies can be assessed given knowledge and experience of current conditions.



	LINK TYPE																	
LOS BAND (Veh/Lane/Hour	2	12	3	13	4	14	5	15	6	16	7	17	8	18	9	19	10	11
LOS C	450	500	550	600	650	700	734	760	782	760	814	825	835	841	846	849	850	850
LOS D	585	650	715	780	845	910	954	988	1016	988	1058	1073	1085	1093	1100	1104	1105	1105
LOS E	720	800	880	960	1040	1120	1175	1216	1250	1216	1302	1320	1335	1346	1354	1358	1360	1360
LOS F	900	1000	1100	1200	1300	1400	1467	1520	1563	1520	1627	1650	1669	1682	1692	1698	1700	1700

Googong and Tralee Traffic Study (2031)	**HCM Link LOS Criteria (Vehicles per Lane per Hour)**	**Figure 4**
Gabites Porter Consultants		

The figures in **Appendix 1 – 2009 Base Scenario** show the existing 2009 AM and PM peak period modelled traffic volumes and the operational LOS. The parts of Queanbeyan under most stress are centred on the Tompsitt Dr / Lanyon Dr roundabout, Tompsitt Dr / Jerrabomberra Dr Roundabout and the Canberra Ave / Lanyon Dr roundabout with some approaches suffering LOS D. Queens Bridge also drops to LOS D in the PM Peak.

It must be remembered that these results are the average results for each peak hour and that short periods within each hour may operate at levels of service worse than the average.

6. 2031 NATURAL GROWTH ANALYSIS

To determine how the 2031 network will be operating in the future and therefore what improvement works are needed to maintain the current network efficiency, the study had to firstly determine what growth will naturally occur and secondly what additional growth will occur as a result of developments.

The expected growth in Queanbeyan traffic between 2006 and 2031 comes from a number of sources, namely:

- Growth in Queanbeyan households
- Growth in Queanbeyan car ownership
- Growth in ACT households
- Growth in ACT car ownership
- Development outside the immediate area

Natural growth (things beyond the scope of Section 94 contributions) comes from a combination of growth in ACT households/car ownership, Queanbeyan car ownership and the construction of additional households that do not require contributions to be made. No other housing development is included in this part of the analysis.

For the purposes of this study, QCC staff have indicated that 30 Queanbeyan infill housing sites form part of the natural growth as they can be built on as of right.

The Queanbeyan analysis of natural growth included the expected 2031 ACT housing and employment, the 2031 expected change in Queanbeyan car ownership and the additional 30 infill households. This use was modelled on the 2031 base network that included planned Queanbeyan and ACT infrastructure changes.

At this stage no large scale housing developments are included in the analysis. This therefore creates a 2031 future base condition to which later development impacts can be compared. Additional future network deficiencies as a result of developments can be readily highlighted and developer contributions apportioned.

6.1 2031 Natural Growth Network Operation

The figures in **Appendix 2 – 2031 Do Minimum – Natural Growth** show the 2031 Future AMP and PMP modelled traffic volumes and levels of service as a result of this natural growth.

Clearly, the only area of the network that is expected to need attention is the Lanyon/Tompsitt intersection (LOS E). This intersection improvement is required as a result of expected natural growth in Queanbeyan and therefore is the responsibility of the QCC.

The Monaro/Cameron intersection may need attention with respect to right turning vehicles from Cameron.

7. 2031 DEVELOPMENT GROWTH ANALYSIS

7.1 2031 Full Development Land Use

Having determined how the Queanbeyan network will be operating in 2031 after natural growth, the study also needed to take into account the additional residential developments that will occur in various areas. These developments are known as "green field" developments as they will be constructed in areas where little or no existing infrastructure exists. In addition to these green field developments, additional infill housing throughout the existing Queanbeyan urban area has been included.

The Headquarters Joint Operations Command (HQJOC) establishment has also been included in the analysis as the daily employment related flows to and from HQJOC are substantial and have an impact on the central Queanbeyan network.

The additional housing developments and their sizes used in the full 2031 analysis are shown in **Table 5**.

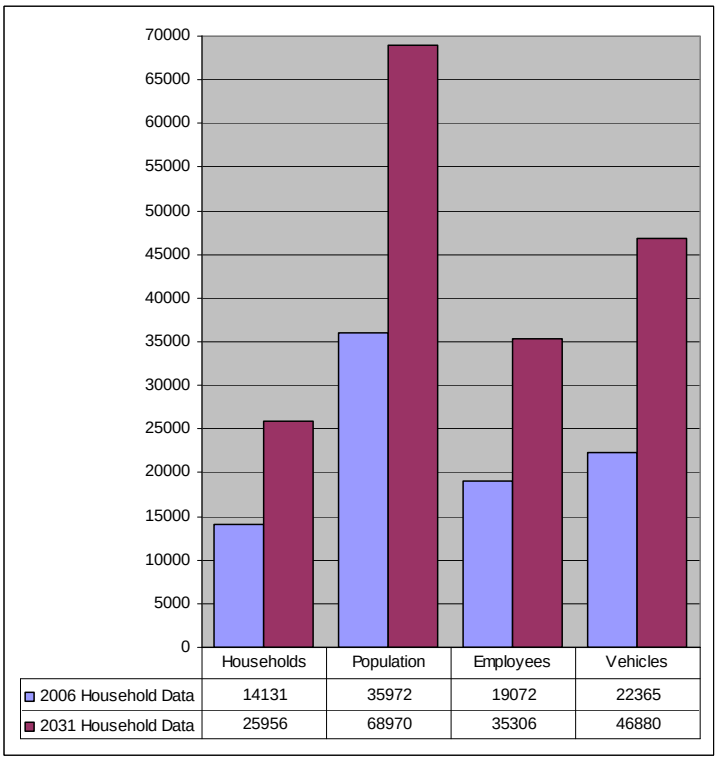
Proposed 2031 Housing Development	Table 5
Reporting Area	**Households**
Additional Queanbeyan Infill	785
The Ridgeway	3
Rural Tralee	131
Carwoola	89
Greenleigh	3
Tralee Development	1924
Googong Development	5550
Rural Googong	93
Tralee Station Area	941
Jerrabomberra SE	1820
Jumping Creek	300
Total	**11639**

Table 6 and **Table 7** are summaries of the 2006 and 2031 land use data used in the model.

Queanbeyan Land Use Change 2006-2031				Table 6
Land Use Categories	**Description of Land Use Categories**	**Code**	**2006**	**2031**
Residential	Total Households	(HH)	14,131	25,956
	Employees per HH		1.35	1.36
	Total Population		35,972	68,970
Employment	Retail Trade	RET	2,120	3,526
	Finance	FIN	1,848	2,412
	Community	COM	1,658	2,449
	Manufacturing	MAN	2,532	4,576
	Other	OTH	1,422	3,305
	Total Jobs	TOT	9,610	16,268
Education	Primary rolls	PRI	2,645	5,451
	Secondary School rolls	SCH	1,415	4,344
	Tertiary rolls	TER	300	300
Vehicles	Total Vehicles		22,365	46,880
	Vehicles per Household		1.583	1.808

ACT/Queanbeyan Model Land Use Change 2006-2031				Table 7
Land Use Categories	**Description of Land Use Categories**	**Code**	**2006**	**2031**
Residential	Total Households	(HH)	134,652	186,468
	Employees per HH		1.428	1.435
	Total Population		356,632	498,740
Employment	Retail Trade	RET	22,401	41,139
	Finance	FIN	22,378	37,075
	Community	COM	20,083	28,999
	Manufacturing	MAN	22,765	22,288
	Other	OTH	95,822	128,637
	Total Jobs	TOT	183,255	257,051
Education	Primary rolls	PRI	29,034	33,506
	Secondary School rolls	SCH	35,036	33,734
	Tertiary rolls	TER	38,350	55,570
Vehicles	Total Vehicles		211,049	328,124
	Vehicles per Household		1.567	1.760

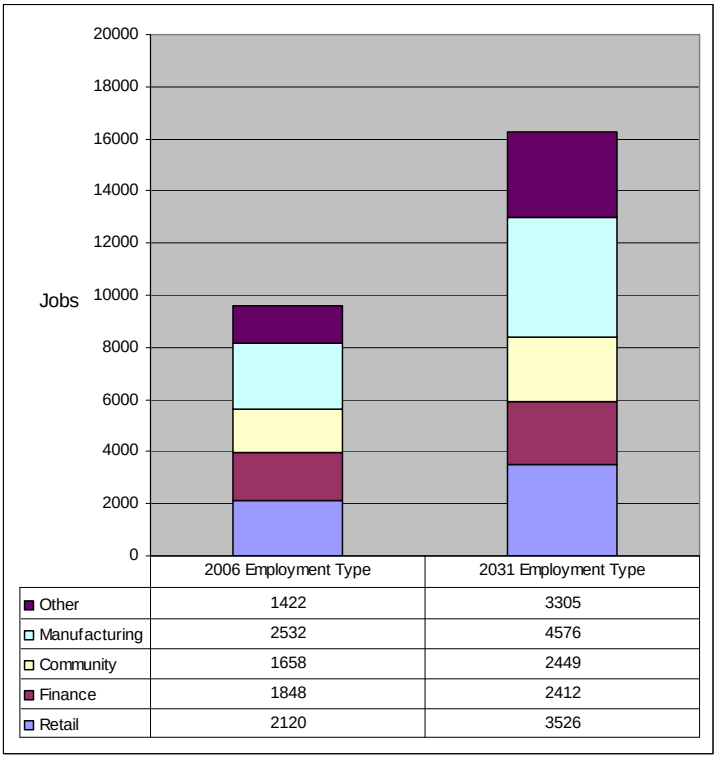
Figure 5 and **Figure 6** show graphically the changes in Queanbeyan land use used in the model between 2006 and 2031 as a result of natural growth and additional housing development. **Figure 7** and **Figure 8** show graphically the changes in land use for the entire ACT/Queanbeyan area used in the model for 2006 and 2031.



	Households	Population	Employees	Vehicles
2006 Household Data	14131	35972	19072	22365
2031 Household Data	25956	68970	35306	46880

Figure 5

Changes In Queanbeyan Household Composition 2006-2031

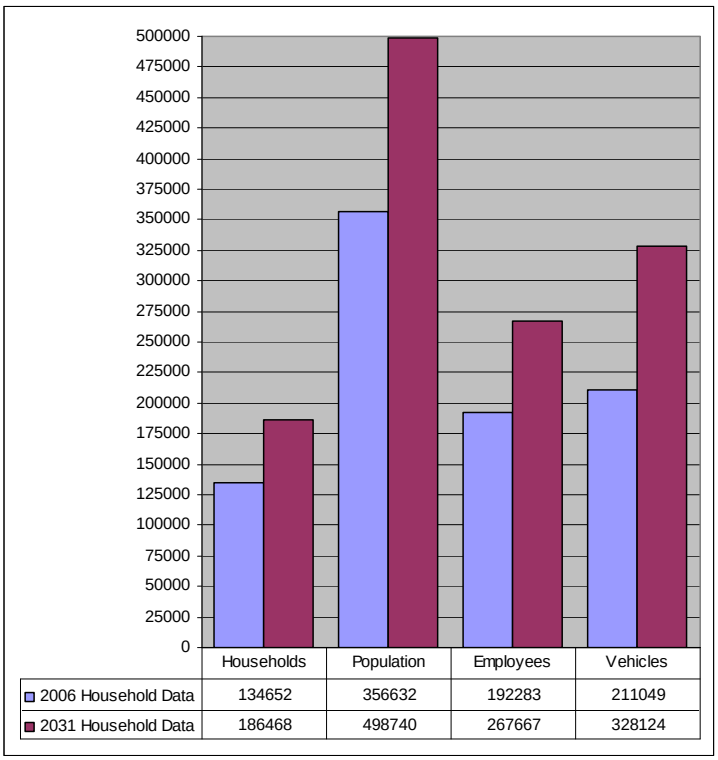


	2006 Employment Type	2031 Employment Type
Other	1422	3305
Manufacturing	2532	4576
Community	1658	2449
Finance	1848	2412
Retail	2120	3526

Figure 6

Changes In Queanbeyan Employment Composition 2006-2031

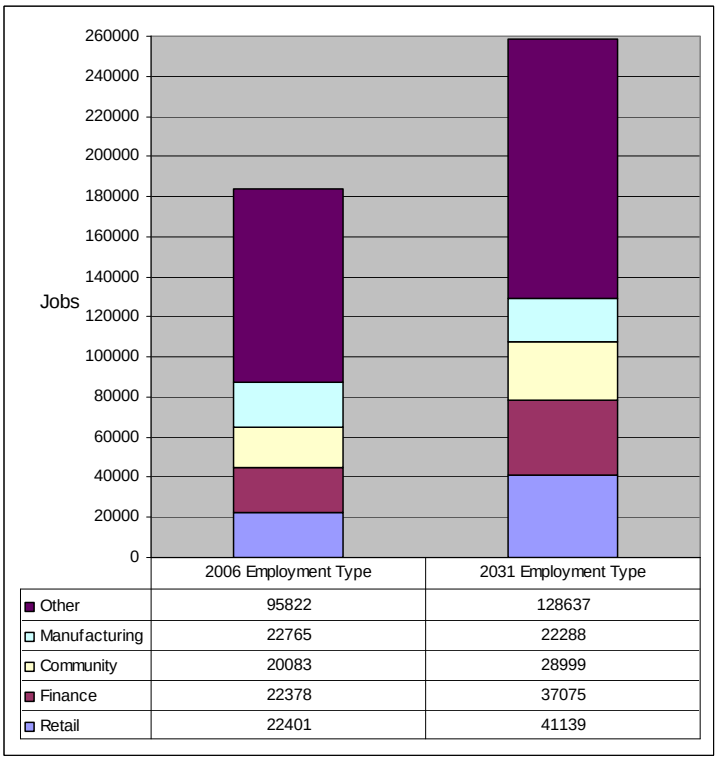
The number of households and their size will increase approximately 85% over the next 25 years. Vehicle ownership will however increase by approximately 110% as a result of more vehicles being available to new households.



	Households	Population	Employees	Vehicles
2006 Household Data	134652	356632	192283	211049
2031 Household Data	186468	498740	267667	328124

Figure 7

Changes In All ACT/Queanbeyan Household Composition 2006-2031



	2006 Employment Type	2031 Employment Type
Other	95822	128637
Manufacturing	22765	22288
Community	20083	28999
Finance	22378	37075
Retail	22401	41139

Figure 8

Changes In All ACT/Queanbeyan Employment Composition 2006-2031

7.2 Vehicles per household

The standard projection model assumes there would be an increase in global vehicles/1000 population for the foreseeable future. The 2006 Census rate was recorded for the ACT/Queanbeyan area at 584 vehicles per 1000 population.

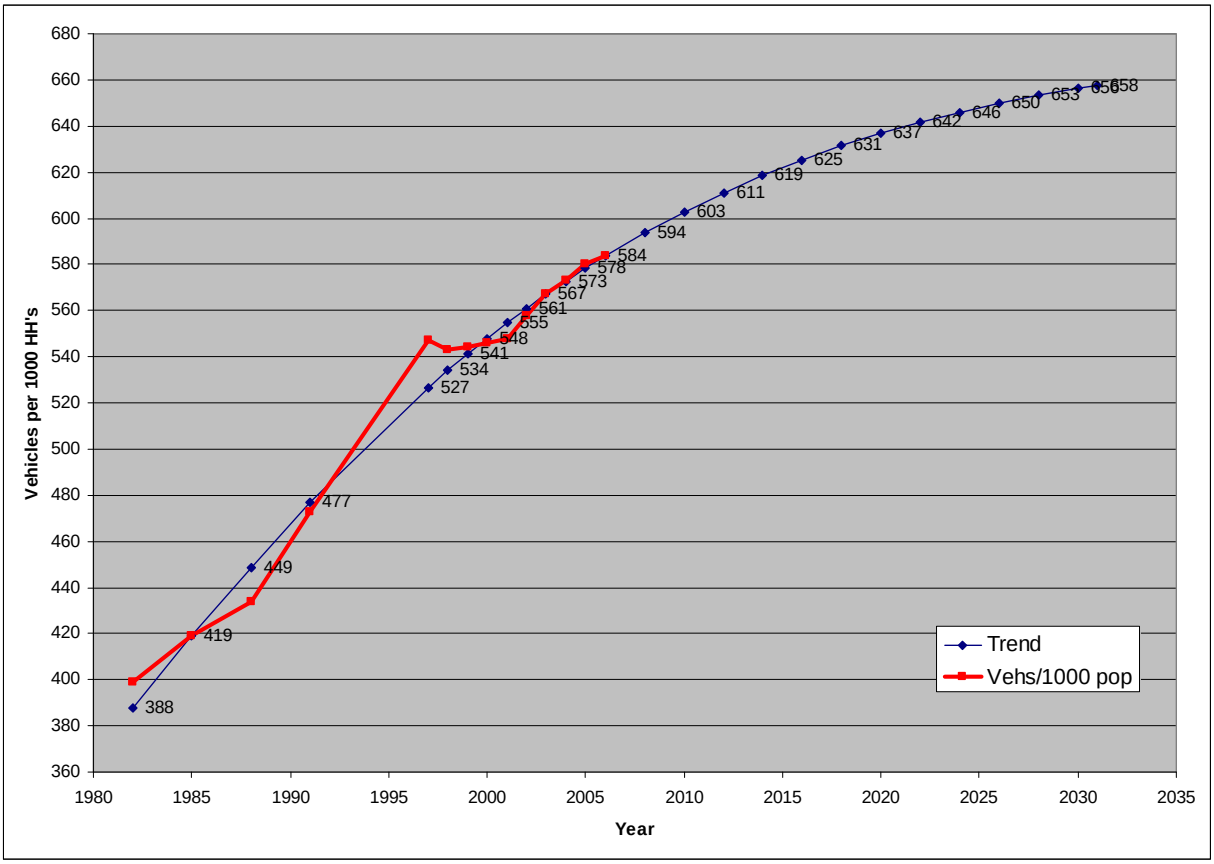
However, the determination of the level of future household car availability is dependent on many factors:

- Price of vehicles
- Price of fuel
- Use of hybrid vehicles
- Use of alternative fuels
- More fuel efficiency
- The change in ownership from large fuel inefficient vehicles to smaller fuel efficient vehicles.
- Availability of alternative means of transport

Rather than assume a simple linear growth in car availability an analysis was undertaken of the historic change in car availability in the ACT/Queanbeyan area. **Figure 9** shows the historic change in vehicle availability of the ACT/Queanbeyan area and the projected future change in vehicle availability based on a reducing rate of increasing car ownership. The plot expresses availability in the form of vehicles per 1000 population and is asymptotic to 680 vehicles per 1000 population.

The corresponding number of vehicles per household has been calculated based on household and population projections for 2016 and 2026 and are shown in **Table 8**.

ACT/Queanbeyan Projections of Vehicle/People Ratios		Table 8
	2006	**2031**
Vehicles	211,049	328,124
Vehs/1000 Pop	584	658
Vehs/HH	1.567	1.760



Googong and Tralee Traffic Study (2031)	**Change in Vehicle Availability**	**Figure 9**
Gabites Porter Consultants		

7.3 2031 Full Development Network Operation

Adding the additional development to the natural growth results in a significant increase in vehicle flow throughout Queanbeyan. This increased flow results in an increase in travel throughout the network and a corresponding increase in delay along roads and through intersections.

The modelled traffic results shown in **Table 9** show how the 2031 future network is expected to perform in the AM and PM peak periods without any improvements.

2031 Base Queanbeyan Traffic Activity Indicators			Table 9
Traffic Activity Indicator	**Morning Peak**		
	2006	**2031 Base**	**% Difference**
Vehicle Kilometres (km)	73,692	152,010	+106%
Link Vehicle Minutes (min)	74,726	171,850	+130%
Link Mean Running Speed (kph)	59.2	53.1	-10%
Vehicles subject to Intersection Delay	156,608	263,945	+69%
Total Vehicle Intersection Delay (min)	17,086	48,782	+186%
Intersection Delay per Delayed Vehicle (sec)	6.5	11.1	+71%
Total Vehicle Trips	13,956	28,538	+104%
Network Total Vehicle Minutes (min)	91,811	220,632	+140%
Network Mean Network Speed (kph)	48.2	41.3	-14%
Average Trip Distance (km)	7.92	7.93	+0%
Average Trip Time (min)	10.54	13.21	+25%
	Evening Peak		
	2006	**2031 Base**	**% Difference**
Vehicle Kilometres (km)	80,001	160,570	+101%
Link Vehicle Minutes (min)	81,724	182,773	+124%
Link Mean Running Speed (kph)	58.7	52.7	-10%
Vehicles subject to Intersection Delay	176,835	300,836	+70%
Total Vehicle Intersection Delay (min)	19,028	60,952	+220%
Intersection Delay per Delayed Vehicle (sec)	6.5	12.2	+88%
Total Vehicle Trips	15,649	29,251	+87%
Network Total Vehicle Minutes (min)	100,752	243,726	+142%
Network Mean Network Speed (kph)	47.6	39.5	-17%
Average Trip Distance (km)	7.73	7.49	-3%
Average Trip Time (min)	10.05	11.80	+17%

These results indicate that Queanbeyan will experience significant increases in vehicle kilometres travelled and total trips. The increase in travel causes increases in delay at intersections and slowing travel along routes. A significant 220% increase in total intersection delay will occur during the PMP as more vehicles are being delayed with PMP average delay is expected to be nearly than 12 seconds.

The mean link speed is still expected to be over 53kph in the AMP and PMP. The incidence of intersection delay only drops the mean operating speed from 48kph down to 41kph in the AMP and 39kph in the PMP.

Modelling of the 2031 future road network with this additional traffic shows that there will be a significant degradation in the level of service of a number of intersections and roads throughout Queanbeyan. The figures in **Appendix 3 – 2031 Base Network** show the traffic volumes expected and the operational level of service for the future 2031 AM and PM peak periods.

Clearly, the parts of Queanbeyan under most stress are as follows:

- Old Cooma Rd from the Googong development to Southbar Rd
- Cooma St from Southbar to Rutledge
- Queens Bridge
- Parts of Yass Rd
- Numerous intersections along Lanyon Dr, Canberra Ave, Bungendore Rd, Cooma St and Southbar Rd are all expected to experience a significant degrading in level of service (E and F) during both peak traffic periods.

8. REQUIRED NETWORK IMPROVEMENTS

8.1 2031 Network Improvements

The Technical Working Group proposed a number of road and intersection improvements to offset the possible network deficiencies as a result of the developments. Many of these improvements were proposed to directly improve a specific road or intersection, **Appendix 3**, suffering from a poor level of service. However, several new routes were also proposed as a means of creating additional capacity in certain areas and thereby relieving areas of congestion.

Inherent in this analysis is the policy of not having any part of the Queanbeyan network operating at worse than LOS D in 2031. This policy comes from the Technical Working Group's belief that since the current network is operating at LOS D or better, so should the future network after additional development.

This level of service allows for some general degradation of the overall network without significant localised increases in delay. It also allows some movements at intersections to operate at a worse level of service so long as the overall level of service was maintained at LOS D or better.

A number of intersection and link improvements were proposed to remove the areas of the 2031 future network that were operating at LOS E or F so that LOS D was maintained throughout the Queanbeyan network.

The major Queanbeyan improvements proposed for analysis are shown in **Table 10**.

2031 Major Network Improvements	Table 10
Links	4L Old Cooma (Googong – Edwin Land Parkway)
	4L Old Cooma (Edwin Land Parkway – Southbar)
	4L Monaro St (Atkinson – Queens Bridge)
	2L Edwin Land Parkway Extension (Jerrabomberra – Old Cooma)
	2L Ellerton Extension (Ellerton – Edwin Land Parkway)
	2L Dunns Creek (Old Cooma – Monaro)
	2L Northern Bypass (Bungendore - Yass - Canberra)
Intersections	Old Cooma / Edwin Land Parkway
	Tompsitt / Edwin Land Parkway / Jerrabomberra
	Tompsitt / Jerrabomberra New Link
	Cooma / Rutledge / Lowe
	Cooma / Fergus
	Cooma / Thornton / Barracks Flat
	Lanyon / Southbar
	Lanyon / Canberra
	Bungendore / Yass
	Bungendore / Atkinson
	Yass / Aurora

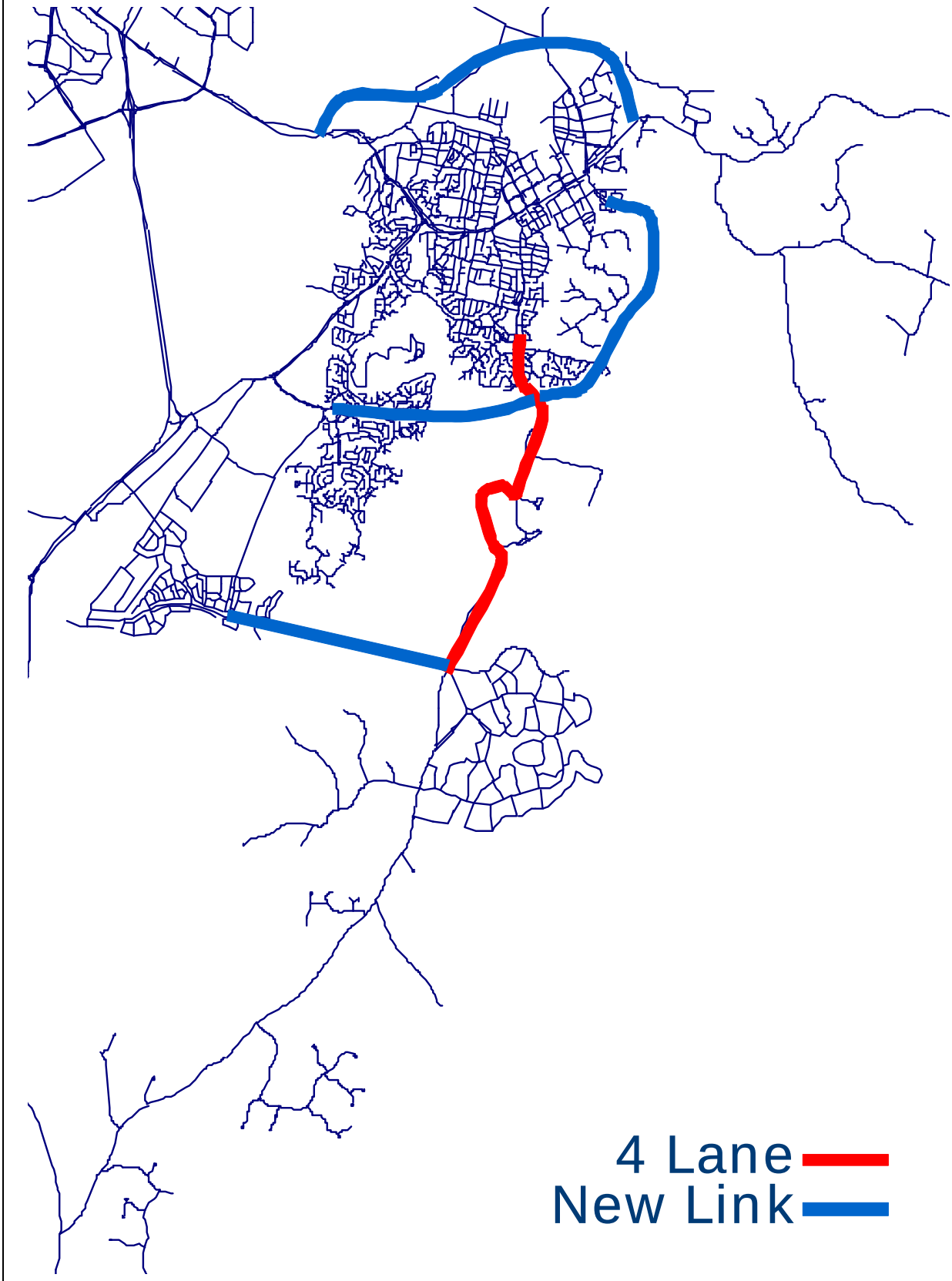
Numerous additional small changes to minor intersections were also looked at to reduce delay on some low volume movements.

8.2 2031 Network Improvement Options

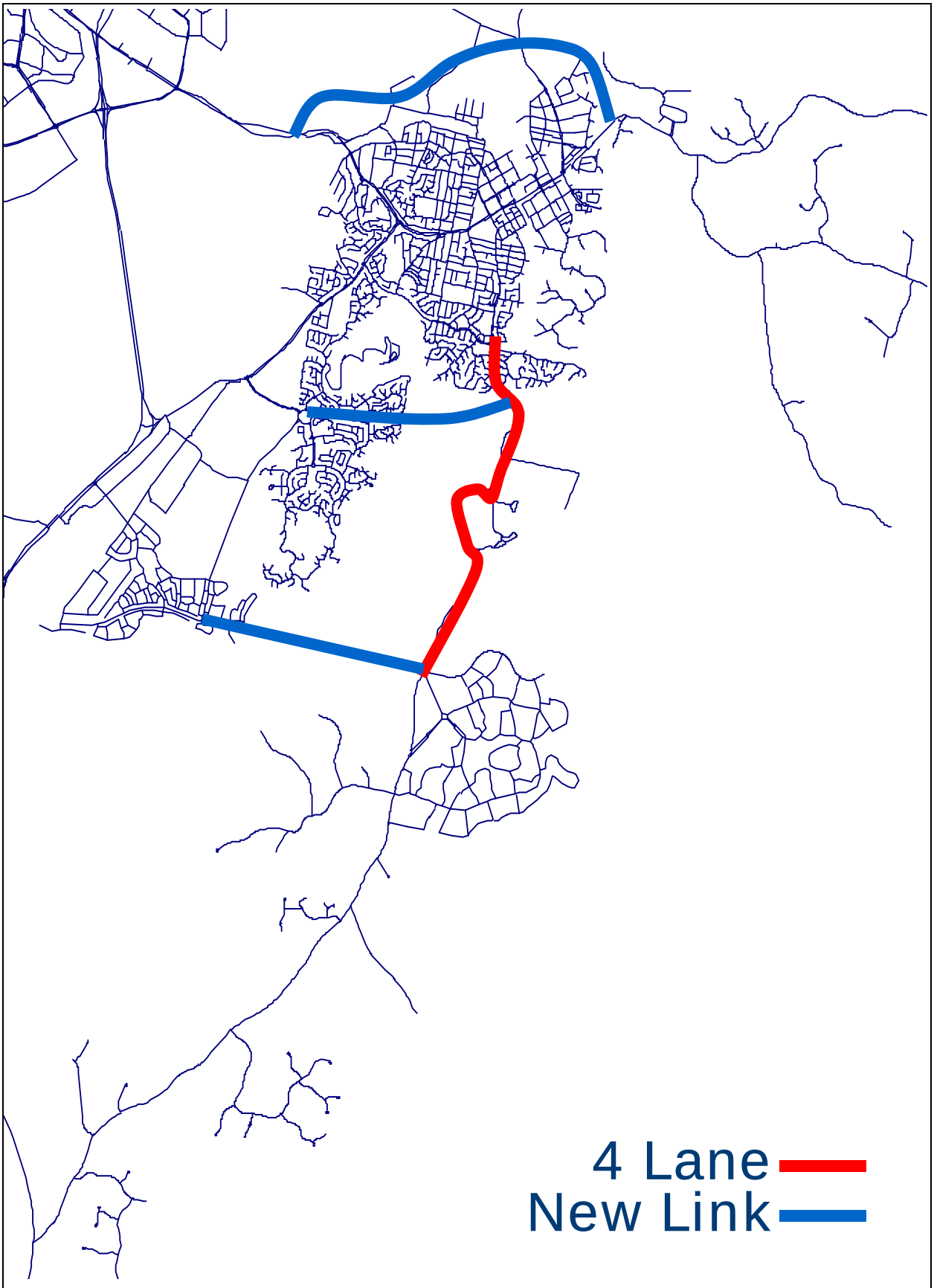
Initially the above major link improvements were combined into 12 project options which included any combination of the above improvements in order to assess the relative benefits of the works. **Table 11** shows the link improvements included in each of the 12 options.

Initial Project Options							Table 11
Option	**4 Lane Old Cooma Road**	**2 Lane ELP Extension**	**4 Lane ELP Extension**	**2 Lane Ellerton Extension**	**2 Lane Dunns Creek**	**4 Lane Dunns Creek**	**2 Lane Northern Bypass**
001	✓	✓		✓	✓		✓
002	✓	✓			✓		✓
003	✓	✓		✓	✓		
004	✓	✓					✓
005	✓	✓		✓			
CIC 1A		✓					
CIC 1B	✓		✓				
CIC 2		✓			✓		
CIC 3		✓		✓			
CIC 4		✓		✓	✓		
VBC 5		✓		✓		✓	
VBC 6	✓	✓		✓		✓	

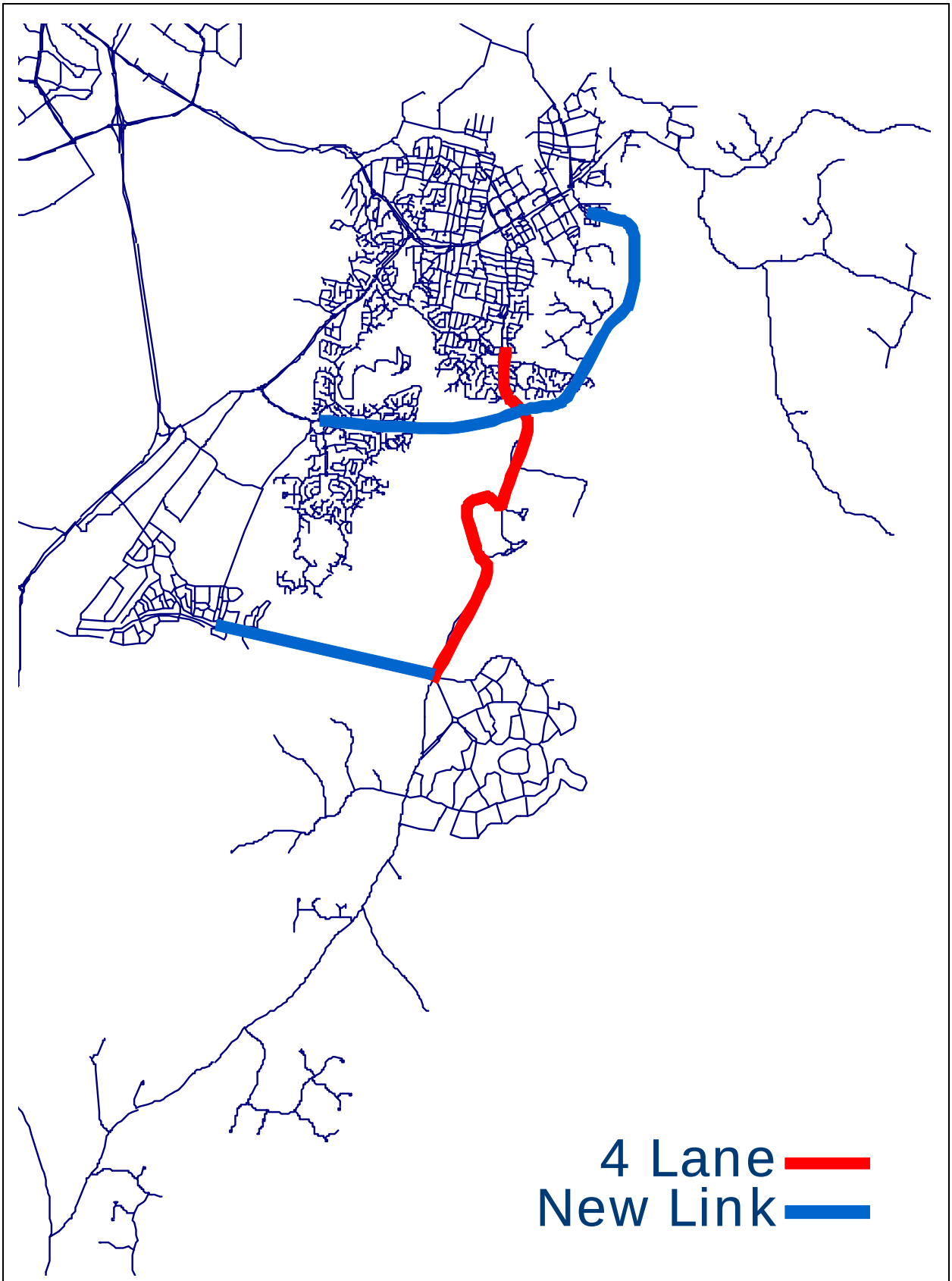
These project options are shown in **Figure 10** to **Figure 21**.



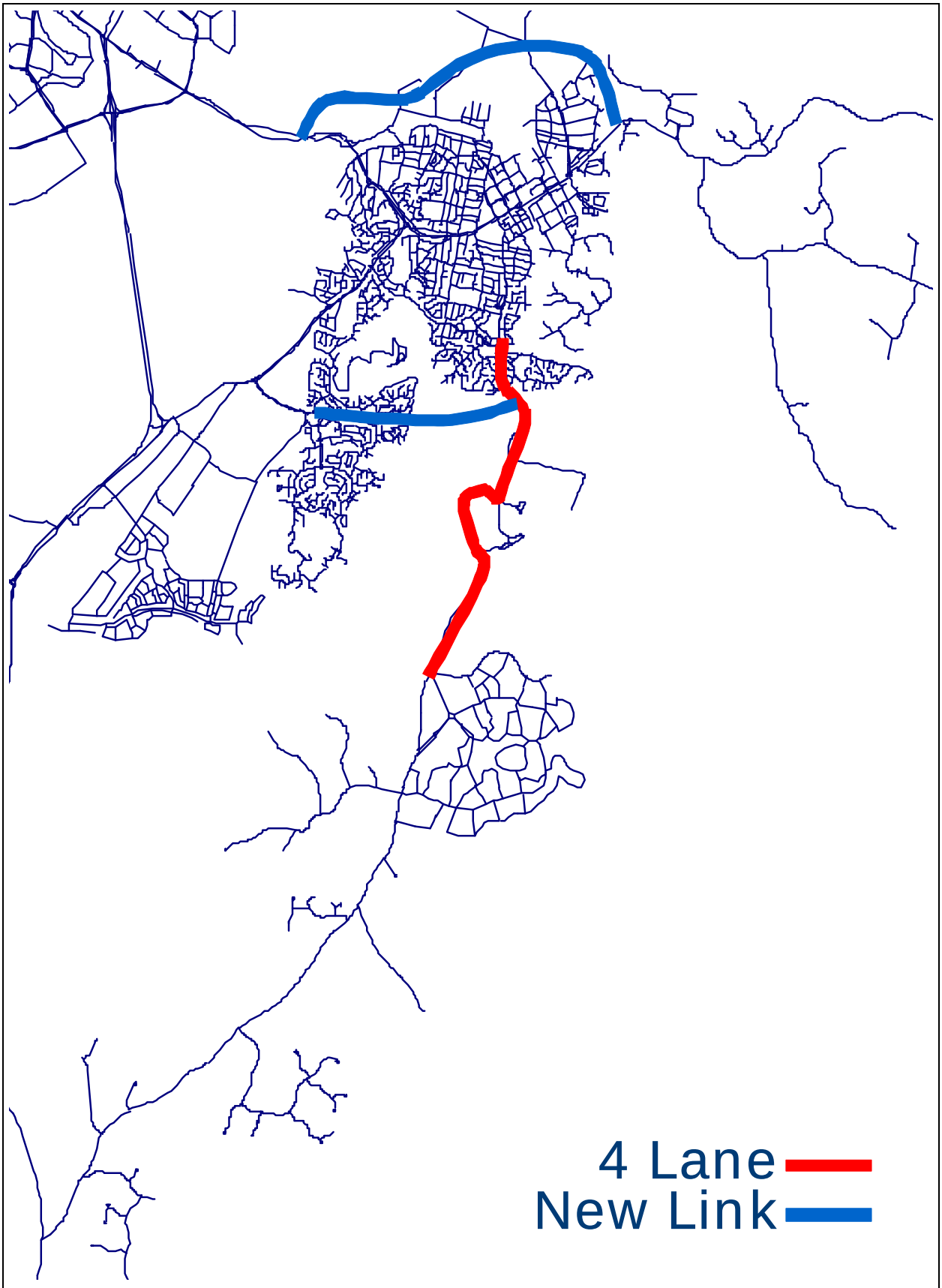
Googong and Tralee Traffic Study (2031)	**2031 Proposed Project Option Improvement 001**	**Figure 10**
Gabites Porter Consultants		



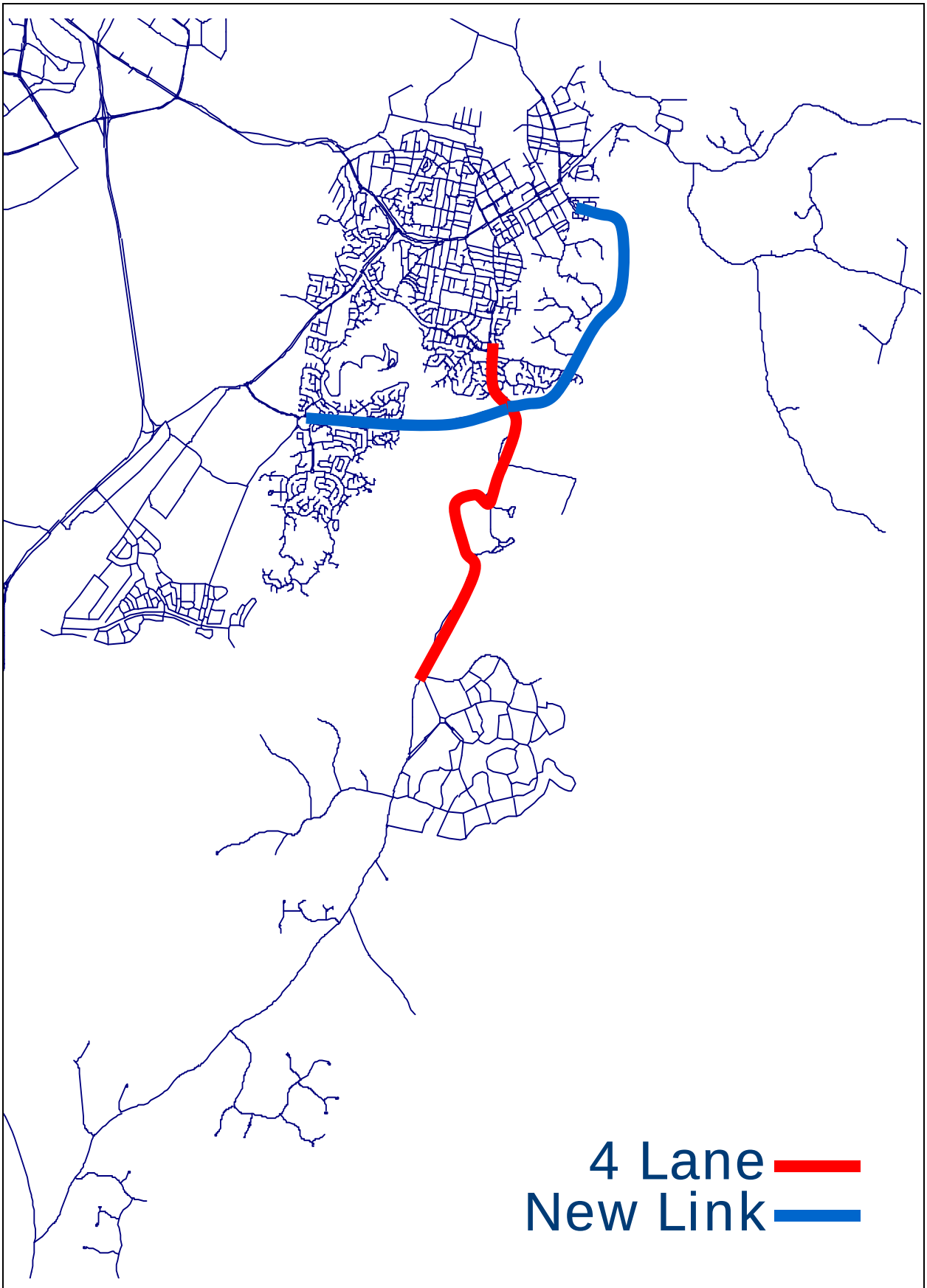
Googong and Tralee Traffic Study (2031)	**2031 Proposed Project Option Improvement 002**	**Figure 11**
Gabites Porter Consultants		



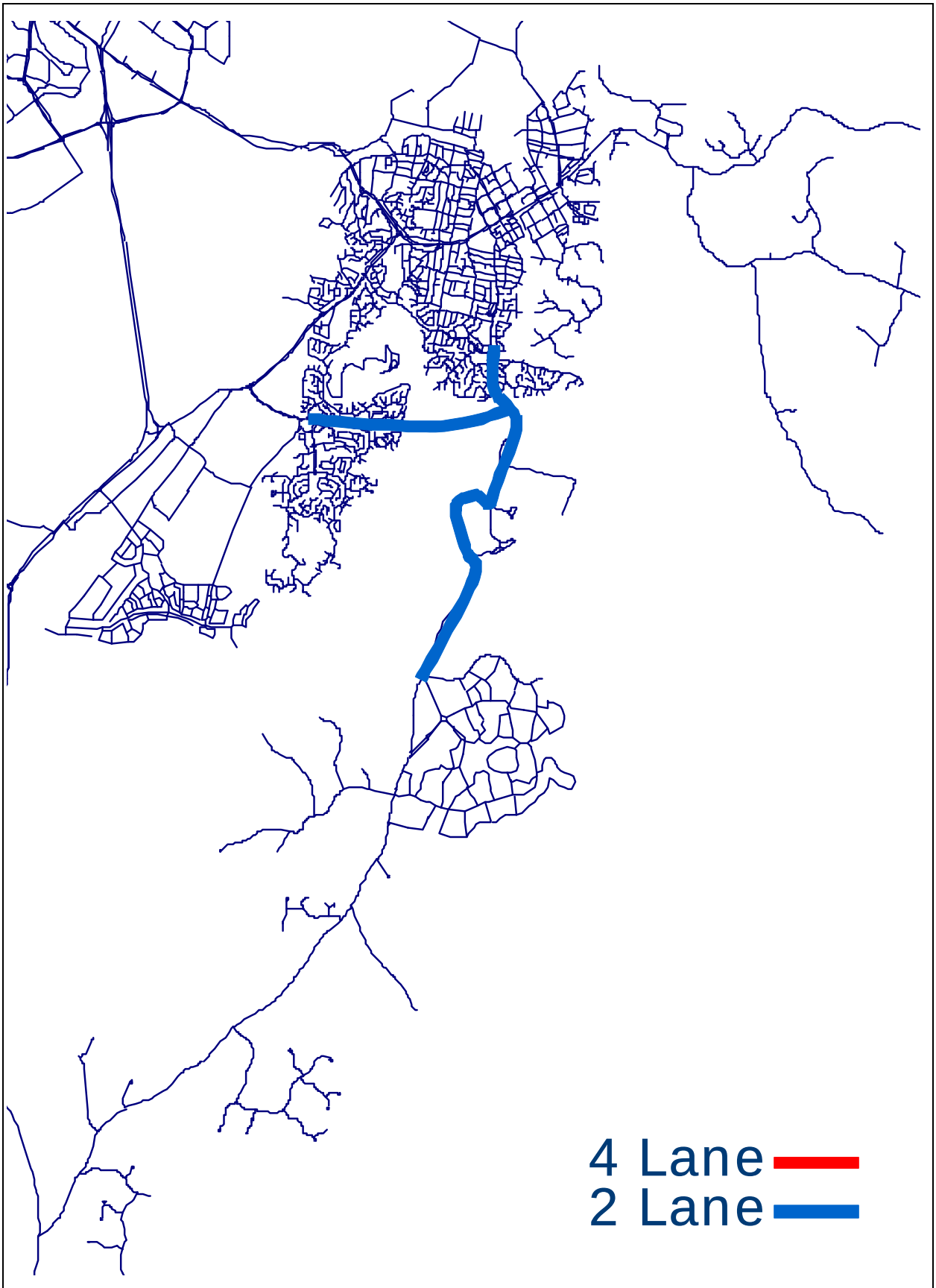
Googong and Tralee Traffic Study (2031)	**2031 Proposed Project Option Improvement 003**	**Figure 12**
Gabites Porter Consultants		



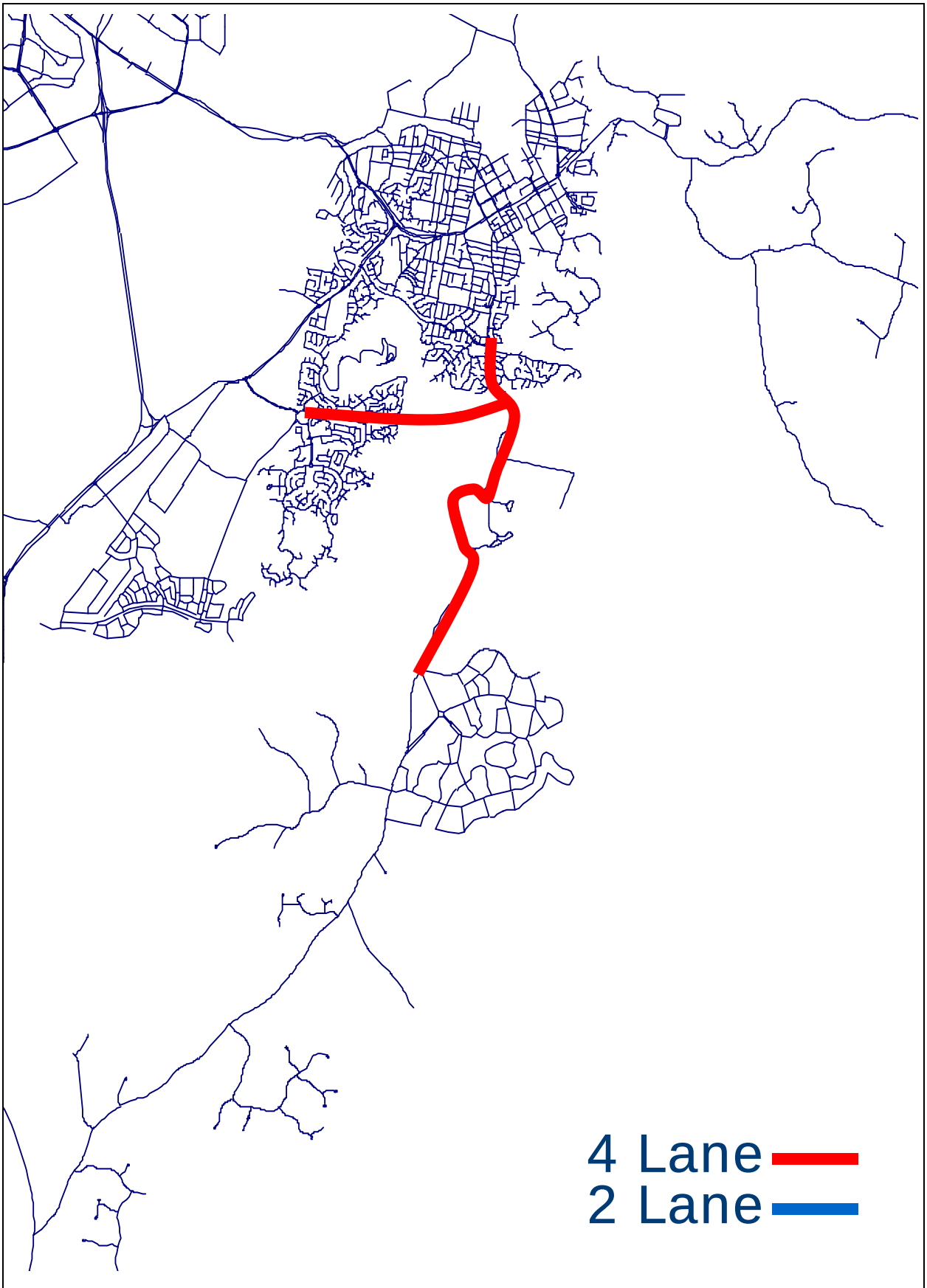
Googong and Tralee Traffic Study (2031)	**2031 Proposed Project Option Improvement 004**	**Figure 13**
Gabites Porter Consultants		



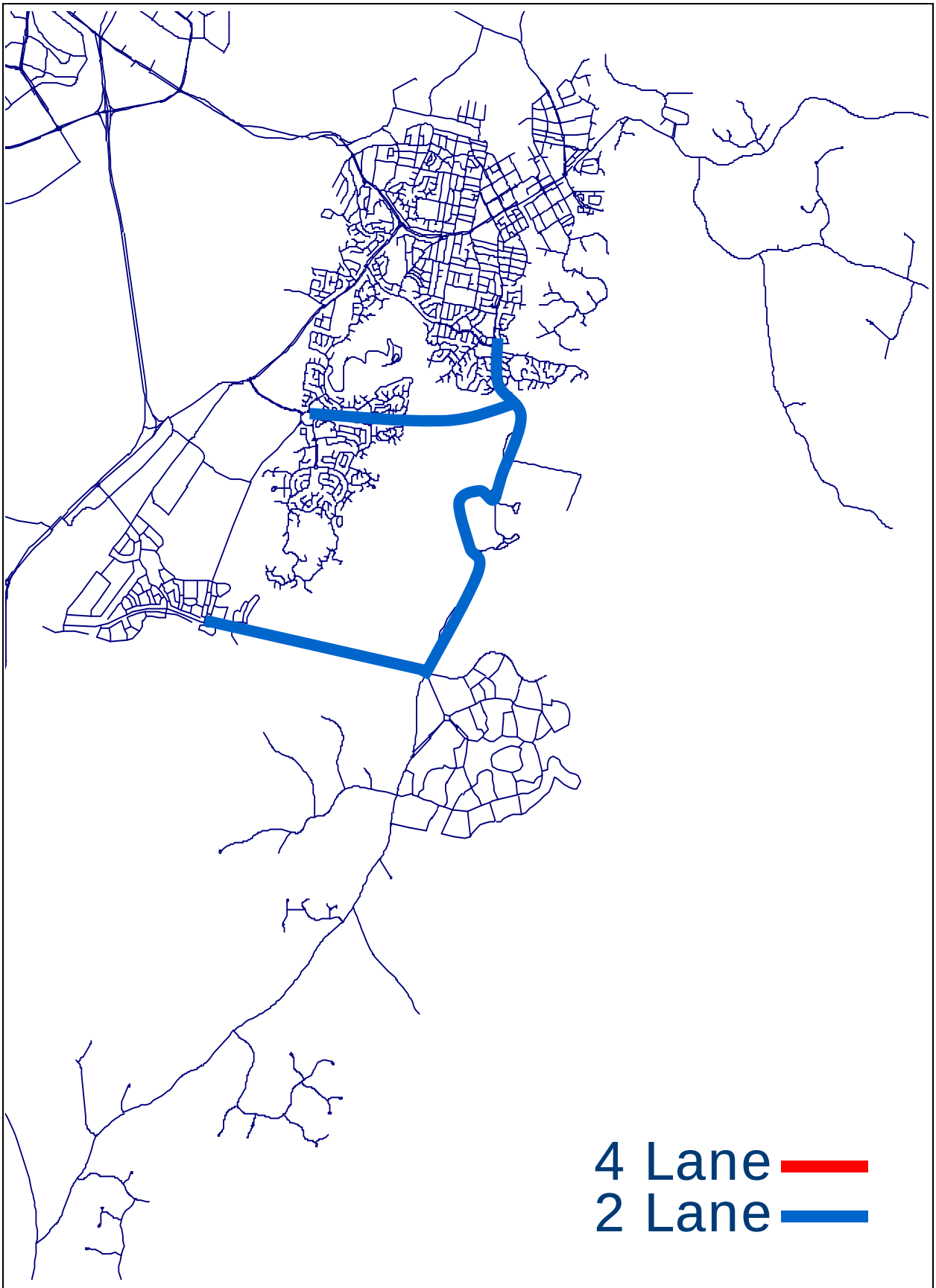
Googong and Tralee Traffic Study (2031)	**2031 Proposed Project Option Improvement 005**	**Figure 14**
Gabites Porter Consultants		



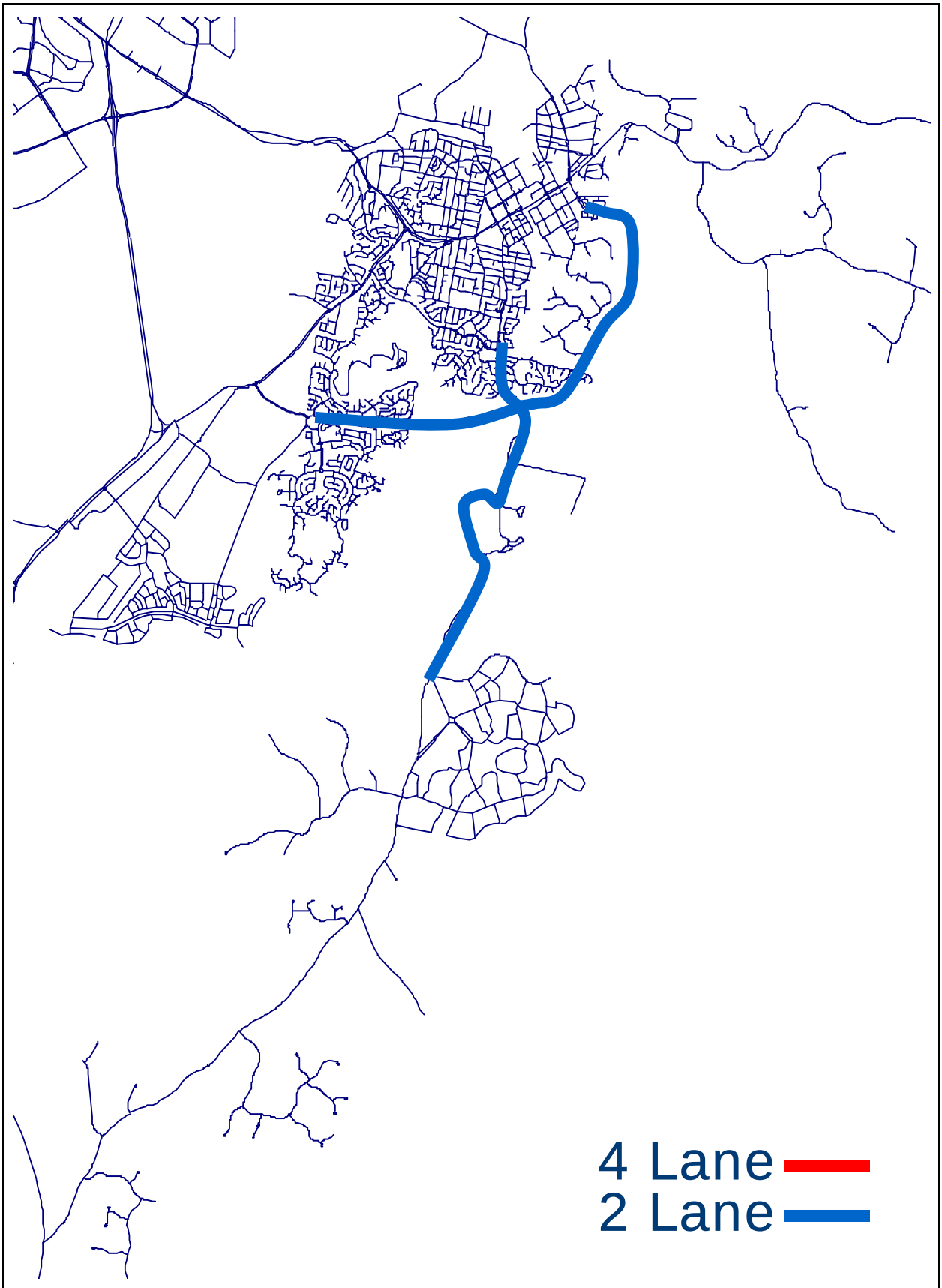
Googong and Tralee Traffic Study (2031)	**2031 Proposed Project Option Improvement CIC 1A**	**Figure 15**
Gabites Porter Consultants		



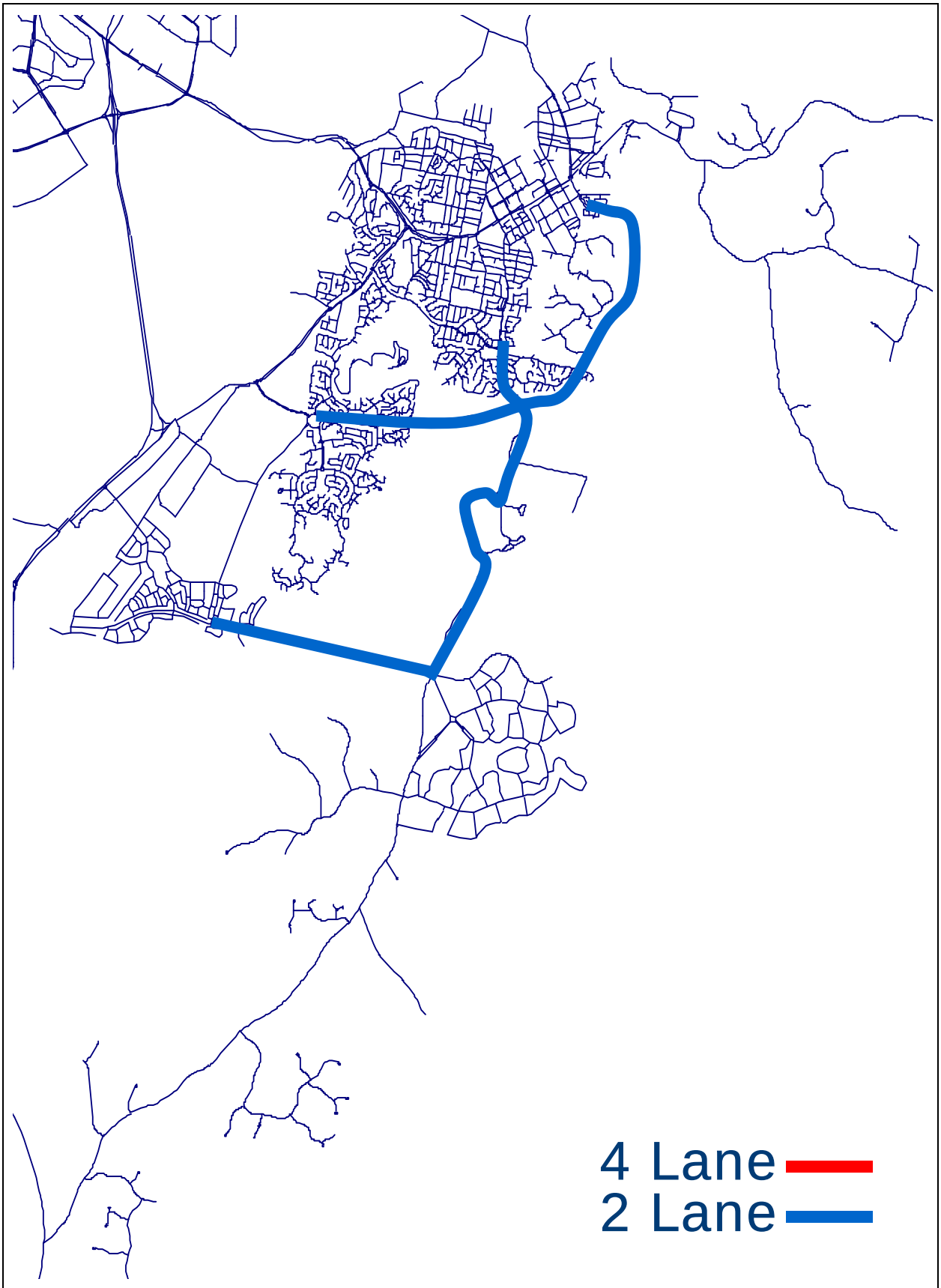
Googong and Tralee Traffic Study (2031)	**2031 Proposed Project Option Improvement CIC 1B**	**Figure 16**
Gabites Porter Consultants		



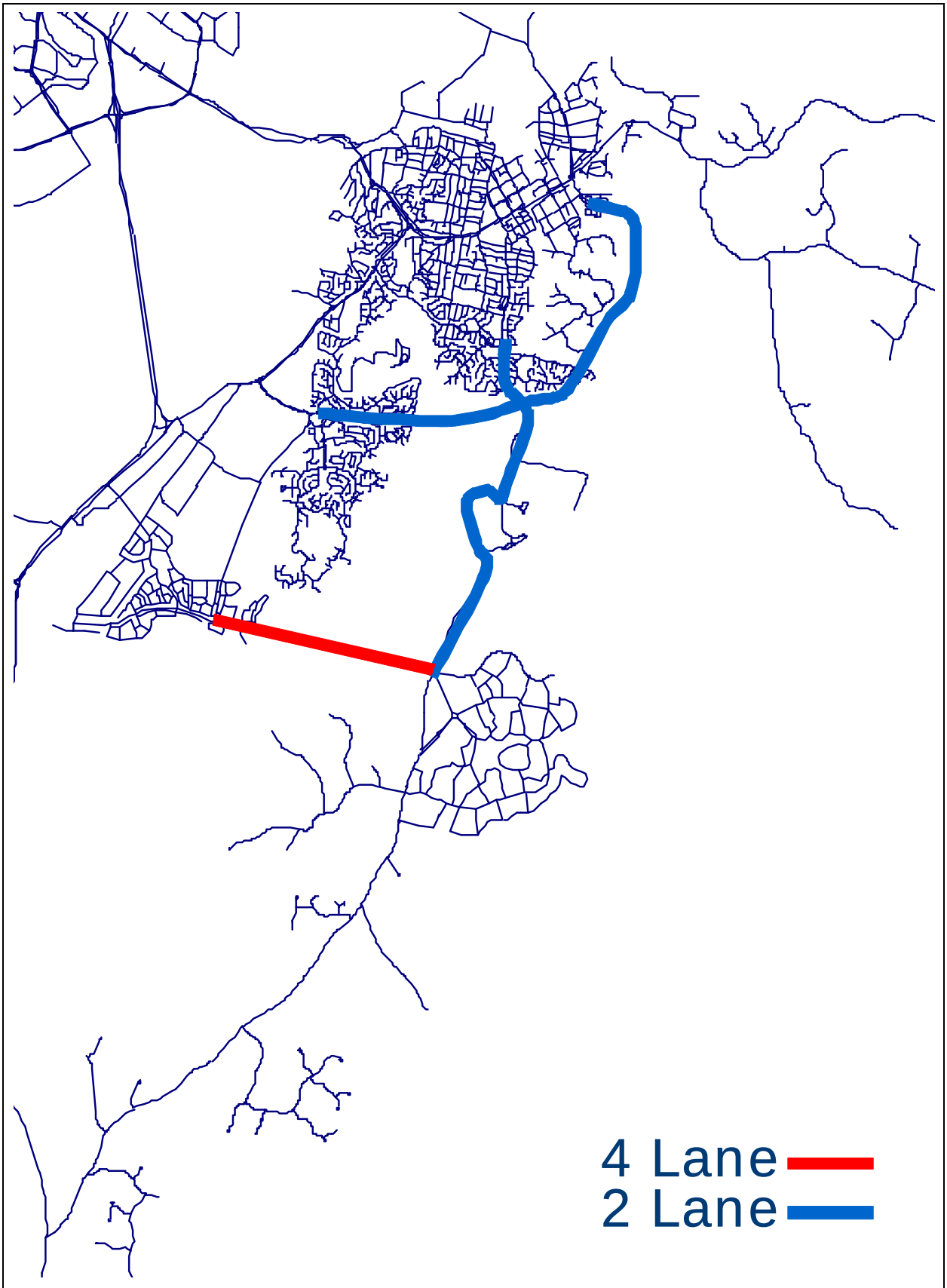
Googong and Tralee Traffic Study (2031)	**2031 Proposed Project Option Improvement CIC 2**	**Figure 17**
Gabites Porter Consultants		



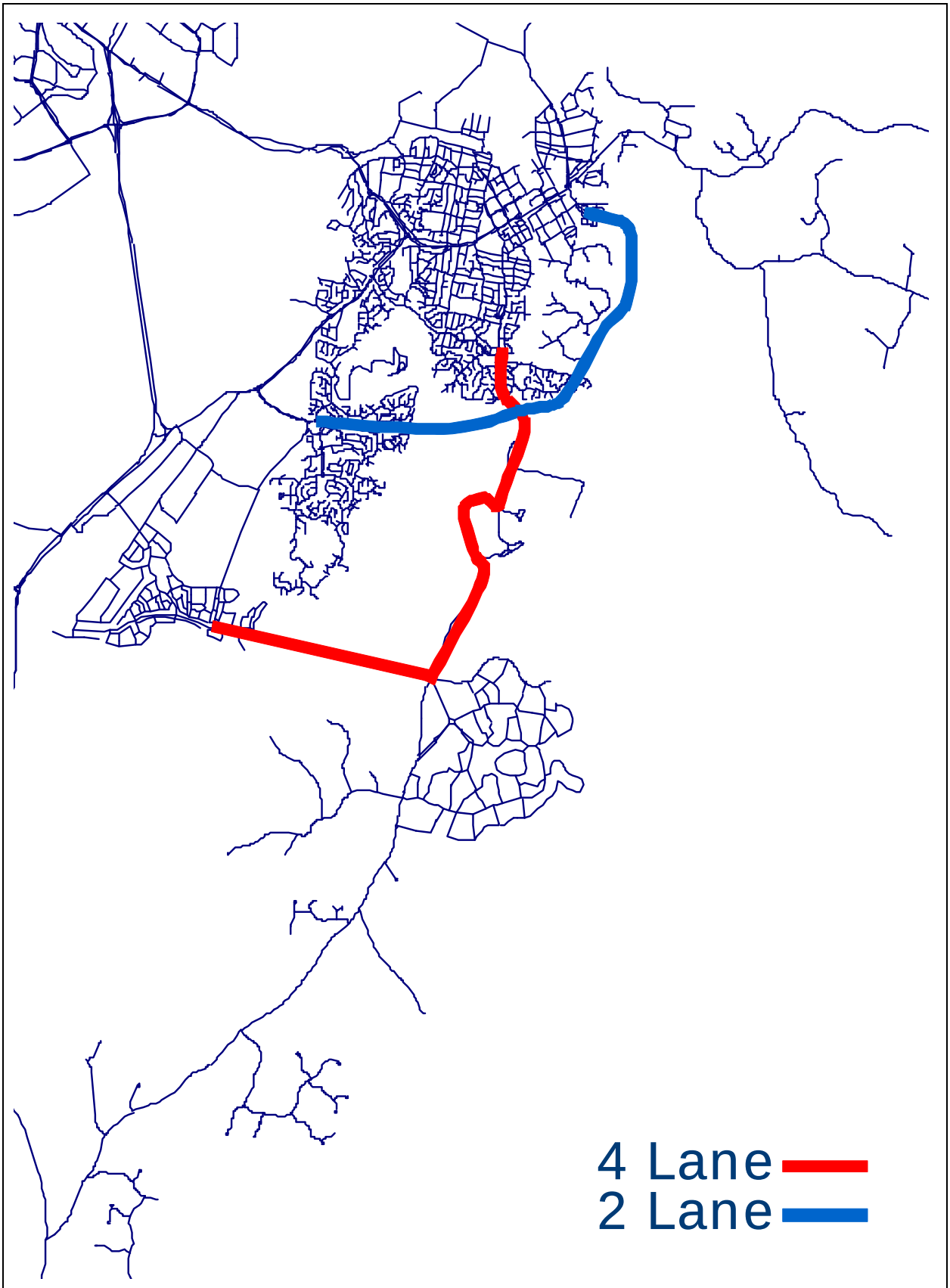
Googong and Tralee Traffic Study (2031)	**2031 Proposed Project Option Improvement CIC 3**	**Figure 18**
Gabites Porter Consultants		



Googong and Tralee Traffic Study (2031)	**2031 Proposed Project Option Improvement CIC 4**	**Figure 19**
Gabites Porter Consultants		



Googong and Tralee Traffic Study (2031)	**2031 Proposed Project Option Improvement VBC 5**	**Figure 20**
Gabites Porter Consultants		



Googong and Tralee Traffic Study (2031)	**2031 Proposed Project Option Improvement VBC 6**	**Figure 21**
Gabites Porter Consultants		

Each of these 12 project options were analysed using the transportation model developed for Queanbeyan. The projected 2031 traffic volumes and level of service results are shown in **Appendix 4 – 2031 Full Development Options AM Peak** and **Appendix 5 – 2031 Full Development Options PM Peak**.

Travel summary statistics, shown in **Table 12** and **Table 13,** were obtained for each Option so that a direct comparison of the overall impacts could be compared. This comparison would help in determining the relative merits of each option.

Travel Summaries of the Modelled Queanbeyan Option for 2031 – Part 1							Table 12
	Variable	BASE	001	002	003	004	005
2031 AM PEAK	Total Vehicle Kilometres	152010	146399	145956	147077	149283	150354
	Total Vehicle Minutes	220632	200542	205729	204193	211198	207534
	Vehicles subject to I/S Delay	263945	245647	250831	262613	248552	264992
	Total Vehicle I/S Delay (mins)	48782	39517	43099	40514	43889	40461
	I/S Delay per delayed veh (secs)	11.1	9.7	10.3	9.3	10.6	9.2
2031 PM PEAK	Total Vehicle Kilometres	160570	155403	154741	155700	159167	160108
	Total Vehicle Minutes	243726	215708	220082	220556	222397	223534
	Vehicles subject to I/S Delay	300836	279419	285442	290978	285890	295117
	Total Vehicle I/S Delay (mins)	60952	43034	45595	45255	46453	46056
	I/S Delay per delayed veh (secs)	12.2	9.2	9.6	9.3	9.7	9.4

Travel Summaries of the Modelled Queanbeyan Option for 2031 – Part 2									Table 13
	Variable	BASE	C1A	C1B	C02	C03	C04	V05	V06
2031 AM PEAK	Total Vehicle Kilometres	152010	149584	149787	146407	150123	146959	146399	147055
	Total Vehicle Minutes	220632	239646	211998	214069	234080	207558	200542	203002
	Vehicles subject to I/S Delay	263945	268539	264007	264676	268151	263535	245647	262361
	Total Vehicle I/S Delay (mins)	48782	52146	42914	44865	51497	42914	39517	40020
	I/S Delay per delayed veh (secs)	11.1	11.7	9.8	10.2	11.5	9.8	9.7	9.2
2031 PM PEAK	Total Vehicle Kilometres	160570	159637	159469	154889	159726	155597	155468	155685
	Total Vehicle Minutes	243726	254830	227766	230377	251840	223973	220254	217922
	Vehicles subject to I/S Delay	300836	300776	300847	298963	296579	293103	292685	292163
	Total Vehicle I/S Delay (mins)	60952	61482	48277	51336	58743	48257	46542	44664
	I/S Delay per delayed veh (secs)	12.2	12.3	9.6	10.3	11.9	9.9	9.5	9.2

8.3 Option Elimination

After examining the results of the analysis, it became clear that a number of these options either did not fulfil the role intended, did not improve the future network deficiencies or were too expensive.

Options 001, 002 and 004 which included the Northern Bypass were not proceeded with. The Northern Bypass successfully diverted traffic around the busy Queanbeyan CBD and therefore reduced congestion issues along Monaro St. However, the Roads and Traffic Authority (RTA) advised that alignment issues made the bypass too expensive at this time. The benefits gained by the traffic diversion were currently insufficient to warrant any project including the Northern Bypass.

A comparison of the volumes along the Edwin Land Parkway Extension between Option C1A and other options indicated that the four laning of the Edwin Land Parkway Extension from Jerrabomberra to Old Cooma Rd produced no difference in traffic flow when compared to a two lane version. This therefore produced no real benefit to the network for the additional expense and was not proceeded with.

Options CIC 1A, CIC 2, CIC 3, CIC 4 and VBC 5 which did not include the four laning of Old Cooma Rd were also eliminated. The level of congestion along Old Cooma Rd as a result of the Googong development requires four laning in order to maintain a suitable level of service during peak periods. No alternative roading project reduced flow along the two lane Old Cooma Rd alignment sufficiently to maintain the suitable level of service. Whilst options that included Dunns Creek reduced the flow along Old Cooma Rd they did not do so sufficiently to reduce volumes to LOS D level.

Options 001, 002, 003, CIC 4, VBC 5 and VBC 6 which involving the construction of the Dunns Creek link were also eliminated. The Dunns Creek link between the Tralee and Googong developments was seen by the Technical Working Group as being a useful inclusion in the future Queanbeyan network but would not likely be required within the current 2031 planning horizon. The ability of the Dunns Creek link to reduce traffic flow along Old Cooma Rd and the Edwin Land Parkway Extension was seen as being valuable in the future but could not be justified at this time.

The four laning of the Dunns Creek link as shown in Options VBC 5 and VBC 6 made no difference to the volume of traffic expected to use the link and was therefore believed to be required some years after the construction of the two lane link.

This process eliminated all but Project Option 005. Discussion within the Technical Working Group concluded that variations in a number of the other Project Options should also be included in further analysis for both comparison purposes and because a number of options contained elements that showed promise.

8.4 Initial Shortlisted Options

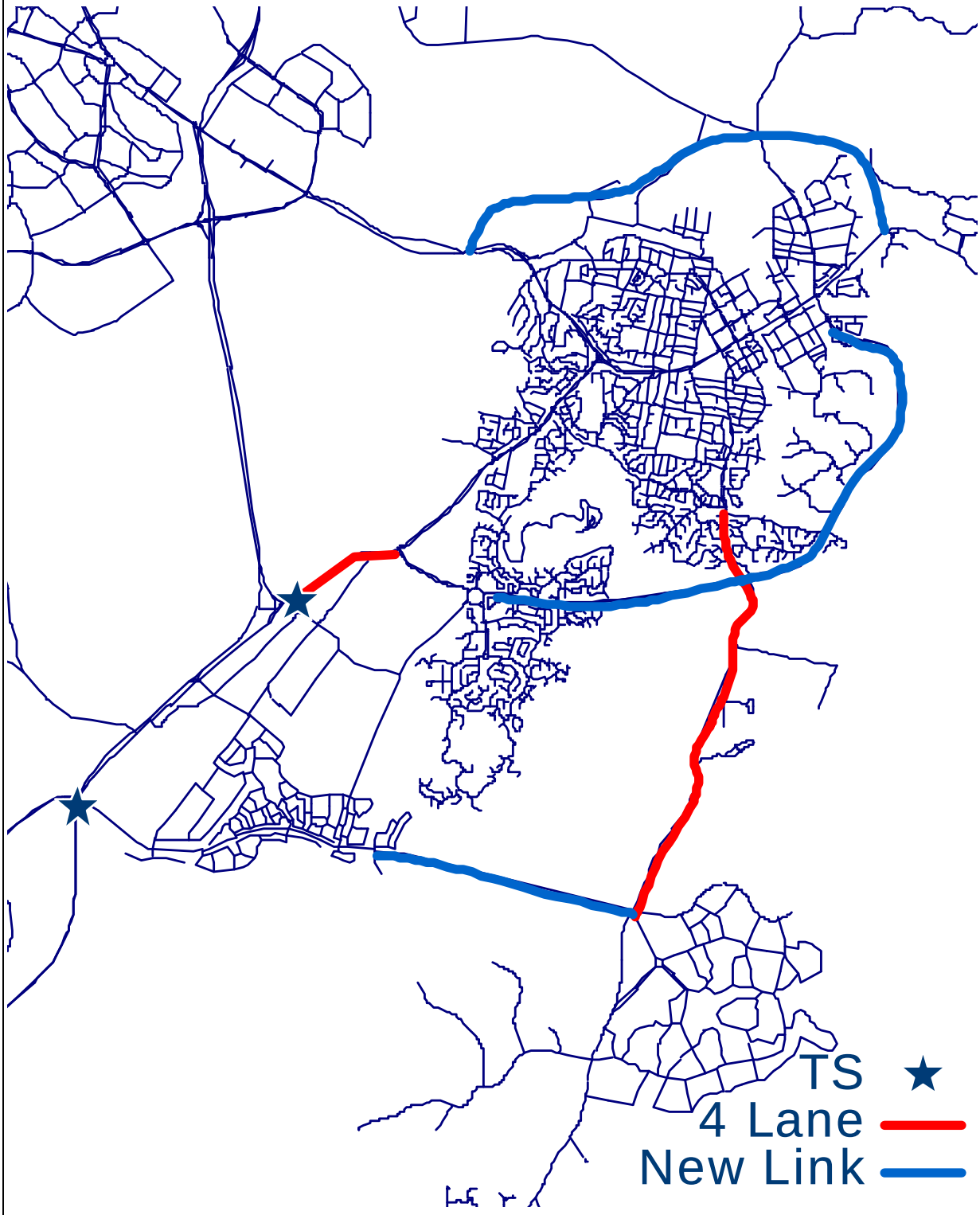
Six shortlisted options were carried forward into a more detailed analysis where intersection improvements were included with the link improvements so that an attempt was made to eliminate all link and intersection deficiencies.

The modified options analysed were as follows:

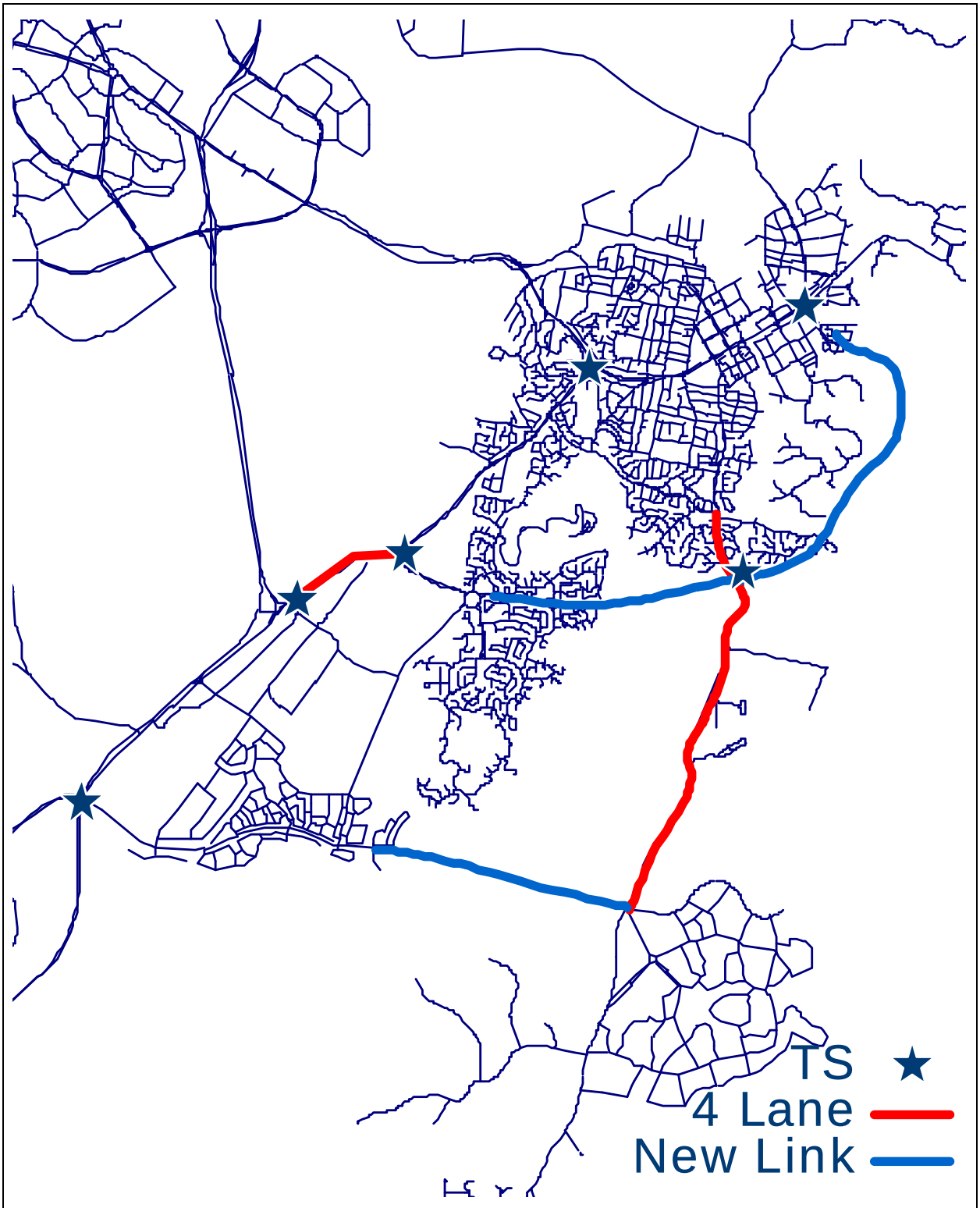
- Option 01A – Option 001 with improvements installed at Isabella / Monaro and Shepherd / Lanyon in the ACT to reduce possible capacity constraints in the area.
- Option 03A – Option 003 with improvements installed at Isabella / Monaro and Shepherd / Lanyon in the ACT to reduce possible capacity constraints in the area. Queanbeyan intersection improvements included:
    - Lanyon / Tompsitt
    - Lanyon Canberra
    - Bungendore / Atkinson
    - Old Cooma / Edwin Land Parkway Extension

- Option 05A – Option 005 with improvements installed at Isabella / Monaro and Shepherd / Lanyon in the ACT to reduce possible capacity constraints in the area. Queanbeyan intersection improvements included:
    - Lanyon / Tompsitt
    - Lanyon Canberra
    - Bungendore / Atkinson
    - Old Cooma / Edwin Land Parkway Extension
- Option CBA – Option CIC 1A with Southbar Rd four laned from Cooma St to Lanyon Rd. It also included improvements installed at Isabella / Monaro and Shepherd / Lanyon in the ACT to reduce possible capacity constraints in the area. Queanbeyan intersection improvements included:
    - Lanyon / Tompsitt
    - Lanyon Canberra
    - Bungendore / Atkinson
    - Old Cooma / Edwin Land Parkway Extension
- Option CBB – Option CIC 1B with Southbar Rd four laned from Cooma St to Lanyon Rd. It also included improvements installed at Isabella / Monaro and Shepherd / Lanyon in the ACT to reduce possible capacity constraints in the area. Queanbeyan intersection improvements included:
    - Lanyon / Tompsitt
    - Lanyon Canberra
    - Bungendore / Atkinson
    - Old Cooma / Edwin Land Parkway Extension
- Option C2A – Option CIC 2 with improvements installed at Isabella / Monaro and Shepherd / Lanyon in the ACT to reduce possible capacity constraints in the area. Queanbeyan intersection improvements included:
    - Lanyon / Tompsitt
    - Lanyon Canberra
    - Bungendore / Atkinson
    - Old Cooma / Edwin Land Parkway Extension

These initial shortlisted options are shown in **Figure 22** to **Figure 27.**



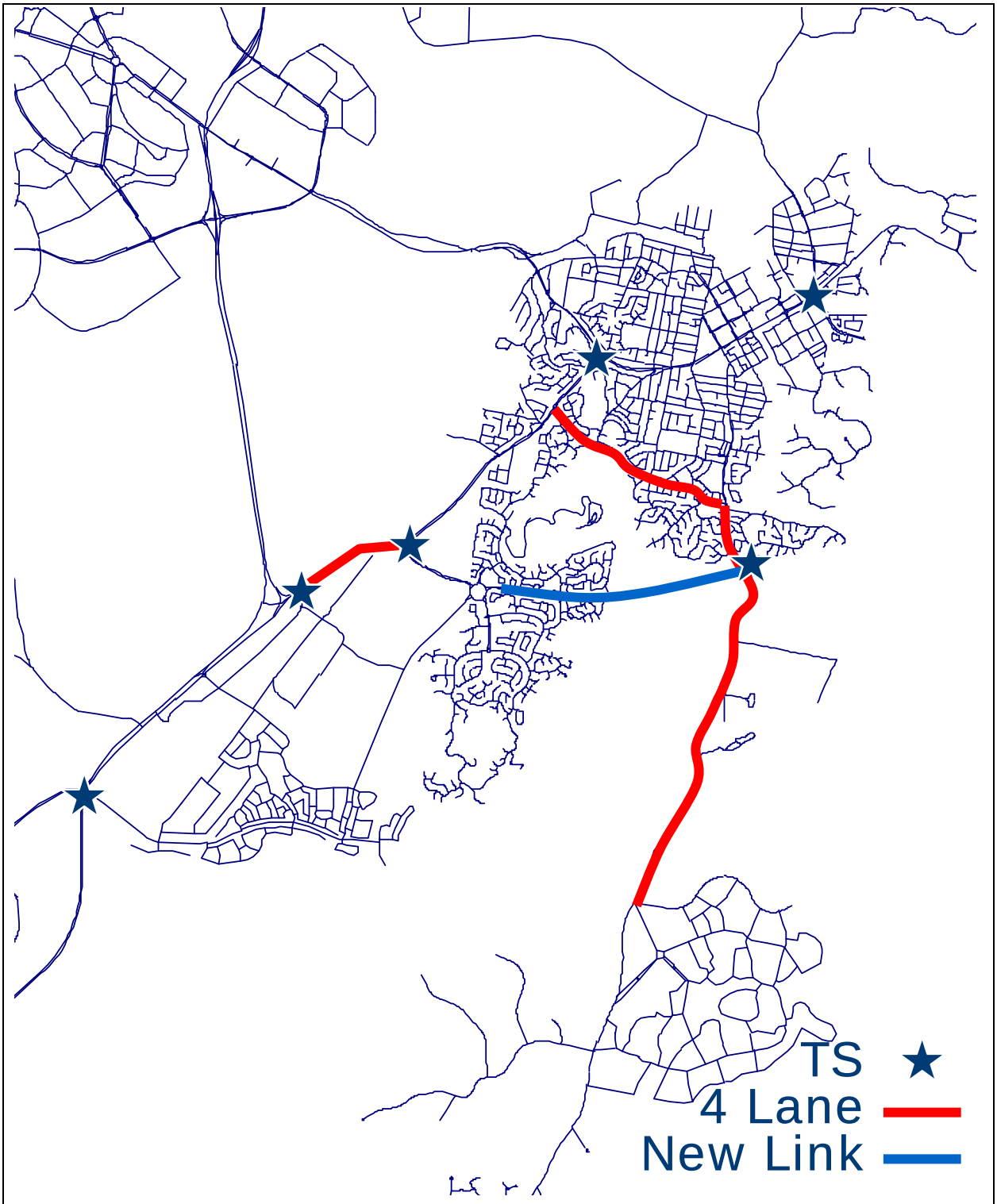
Googong and Tralee Traffic Study (2031)	**2031 Shortlisted Project Option Improvement 01A**	**Figure 22**
Gabites Porter Consultants		



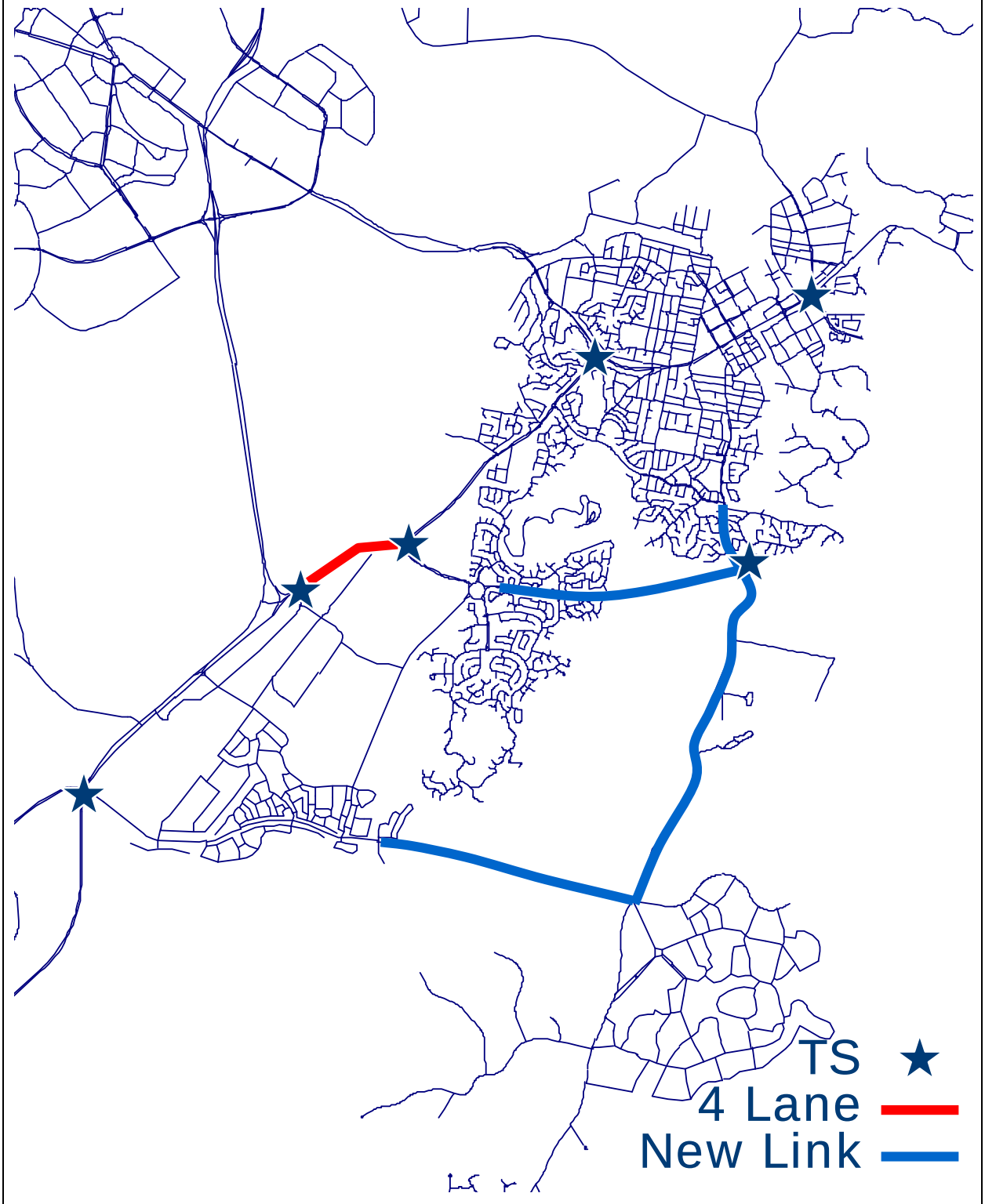
Googong and Tralee Traffic Study (2031)	**2031 Shortlisted Project Option Improvement 03A**	**Figure 23**
Gabites Porter Consultants		

Googong and Tralee Traffic Study (2031)	**2031 Shortlisted Project Option Improvement 05A**	**Figure 24**
Gabites Porter Consultants		

Googong and Tralee Traffic Study (2031)	**2031 Shortlisted Project Option Improvement CBA**	**Figure 25**
Gabites Porter Consultants		



Googong and Tralee Traffic Study (2031)	**2031 Shortlisted Project Option Improvement CBB**	**Figure 26**
Gabites Porter Consultants		



Googong and Tralee Traffic Study (2031)	**2031 Shortlisted Project Option Improvement C2A**	**Figure 27**
Gabites Porter Consultants		

Each of these Shortlisted Project Options were analysed using the transportation model with intersection configurations altered to provide the best result for deficient intersections. This was an iterative process that involved progressively making changes to intersections until intersection operation resulted in an overall LOS of D or better.

The projected 2031 traffic volumes and level of service results are shown in **Appendix 6 – 2031 Full Development Initial Shortlisted Options AM Peak** and **Appendix 7 – 2031 Full Development Initial Shortlisted Options PM Peak**.

AT this point in the process it became evident that several of these remaining options were not suitable. Option 01A, which included the Northern Bypass, was not proceeded with as the benefit gained by diverting traffic from the CBD was not thought to be sufficient within the planning period to warrant the cost.

Option CBA was not proceeded with as the four laning of both Edwin Land Parkway extension and Southbar Rd did not improve the LOS conditions along Cooma St sufficiently to maintain an LOS D. The four laning of Edwin Land Parkway extension also appeared to make little difference to the projected flow along the link compared to designing it as a two lane road.

Option CBB was also eliminated but was adjusted to remove the four laning along Southbar Rd and progressed to the next stage of analysis.

8.5 Intermediate Shortlisted Options

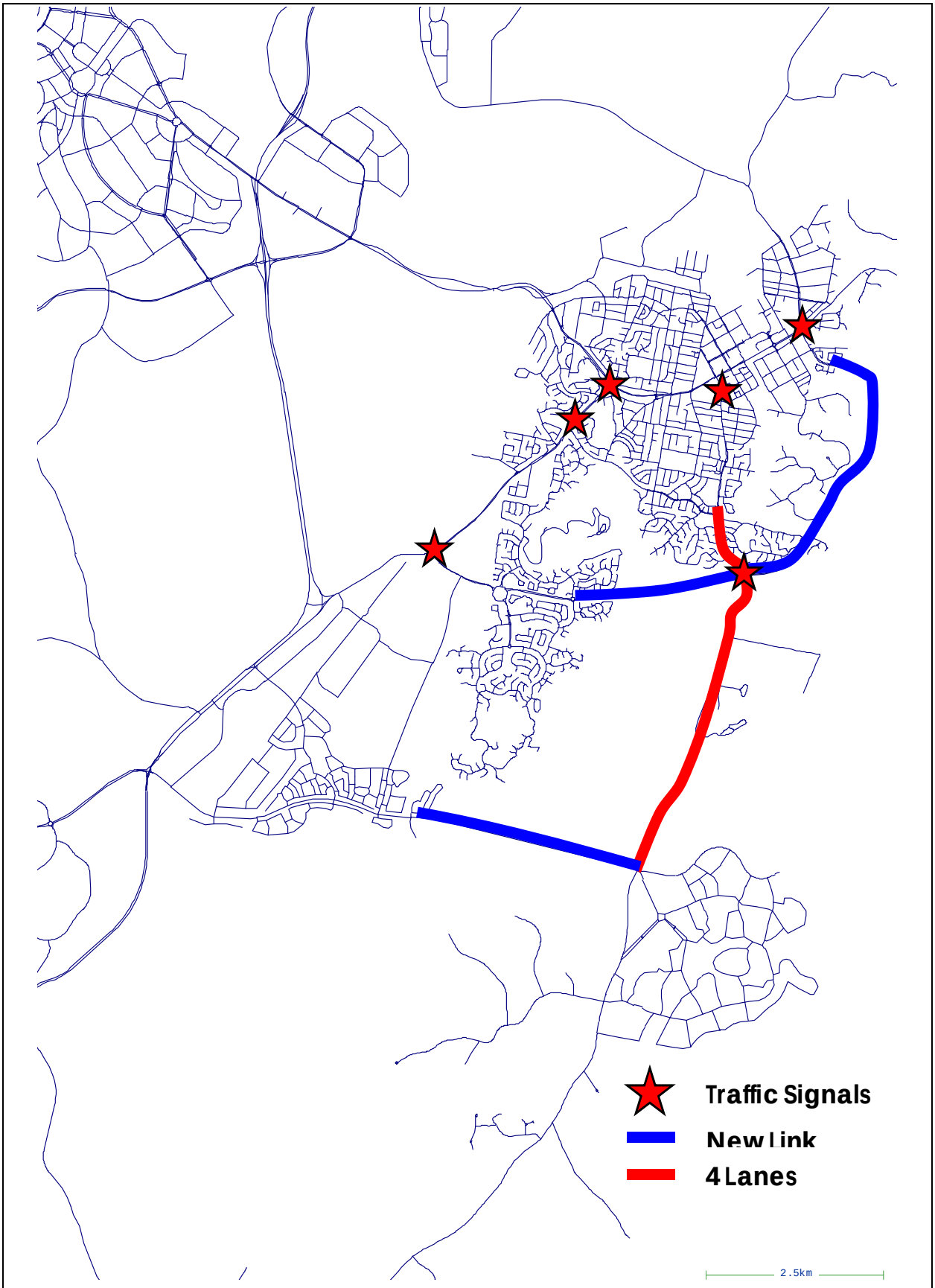
Five intermediate shortlisted options were carried forward into a more detailed analysis where intersection improvements were included with the link improvements so that every attempt was made to eliminate all link and intersection deficiencies.

The modified options analysed were as follows:

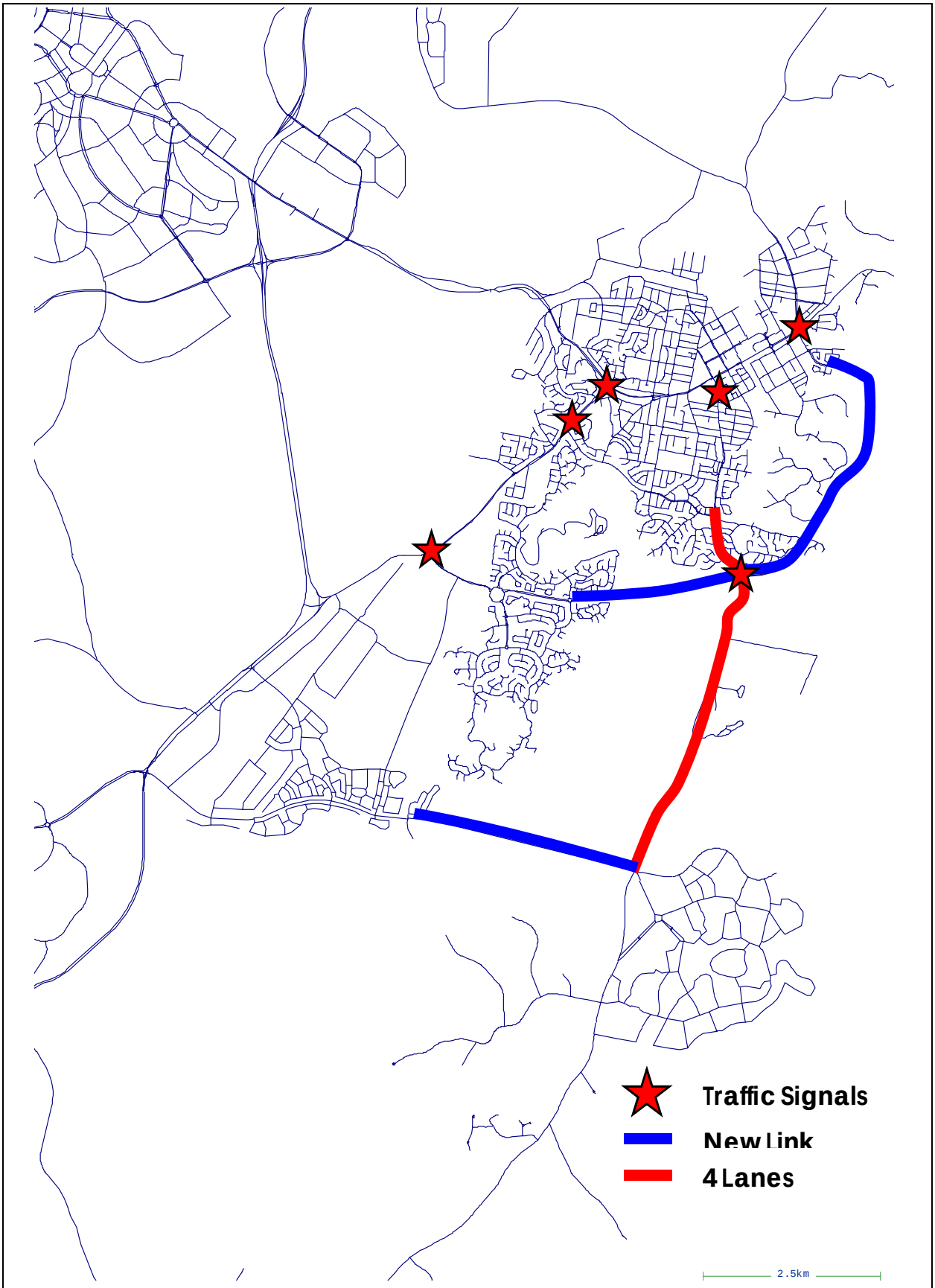
- Option 03B – Option 003/03A with east-west flyover at Old Cooma / Edwin Land Parkway, traffic signals installed at:
    - Bungendore / Yass
    - Lanyon / Tompsitt
    - Lanyon / Southbar
    - Lanyon Canberra
    - Cooma / Rutledge / Lowe
    - Old Cooma / Edwin Land Parkway Extension
- Option 03C – Option 003/03A with north-south flyover at Old Cooma / Edwin Land Parkway, traffic signals installed at:
    - Bungendore / Yass
    - Lanyon / Tompsitt
    - Lanyon / Southbar
    - Lanyon Canberra
    - Cooma / Rutledge / Lowe
    - Old Cooma / Edwin Land Parkway Extension

- Option 05B – Option 005/05B with traffic signals installed at:
    - Bungendore / Yass
    - Lanyon / Tompsitt
    - Lanyon / Southbar
    - Lanyon Canberra
    - Cooma / Rutledge / Lowe
    - Cooma / Fergus
    - Old Cooma / Edwin Land Parkway Extension
- Option CBC – Option CIC 1B / CBC with a 2 lane Edwin Land Parkway Extension, traffic signals installed at:
    - Bungendore / Yass
    - Bungendore / Atkinson
    - Lanyon / Tompsitt
    - Lanyon / Southbar
    - Lanyon Canberra
    - Cooma / Rutledge / Lowe
    - Cooma / Fergus
    - Old Cooma / Edwin Land Parkway Extension
- Option C2B – Option CIC 2 / C2A with 4 lane old Cooma Rd and 2 lane Dunns Creek, traffic signals installed at:
    - Bungendore / Yass
    - Bungendore / Atkinson
    - Lanyon / Tompsitt
    - Lanyon / Southbar
    - Lanyon Canberra
    - Cooma / Rutledge / Lowe
    - Cooma / Fergus
    - Old Cooma / Edwin Land Parkway Extension

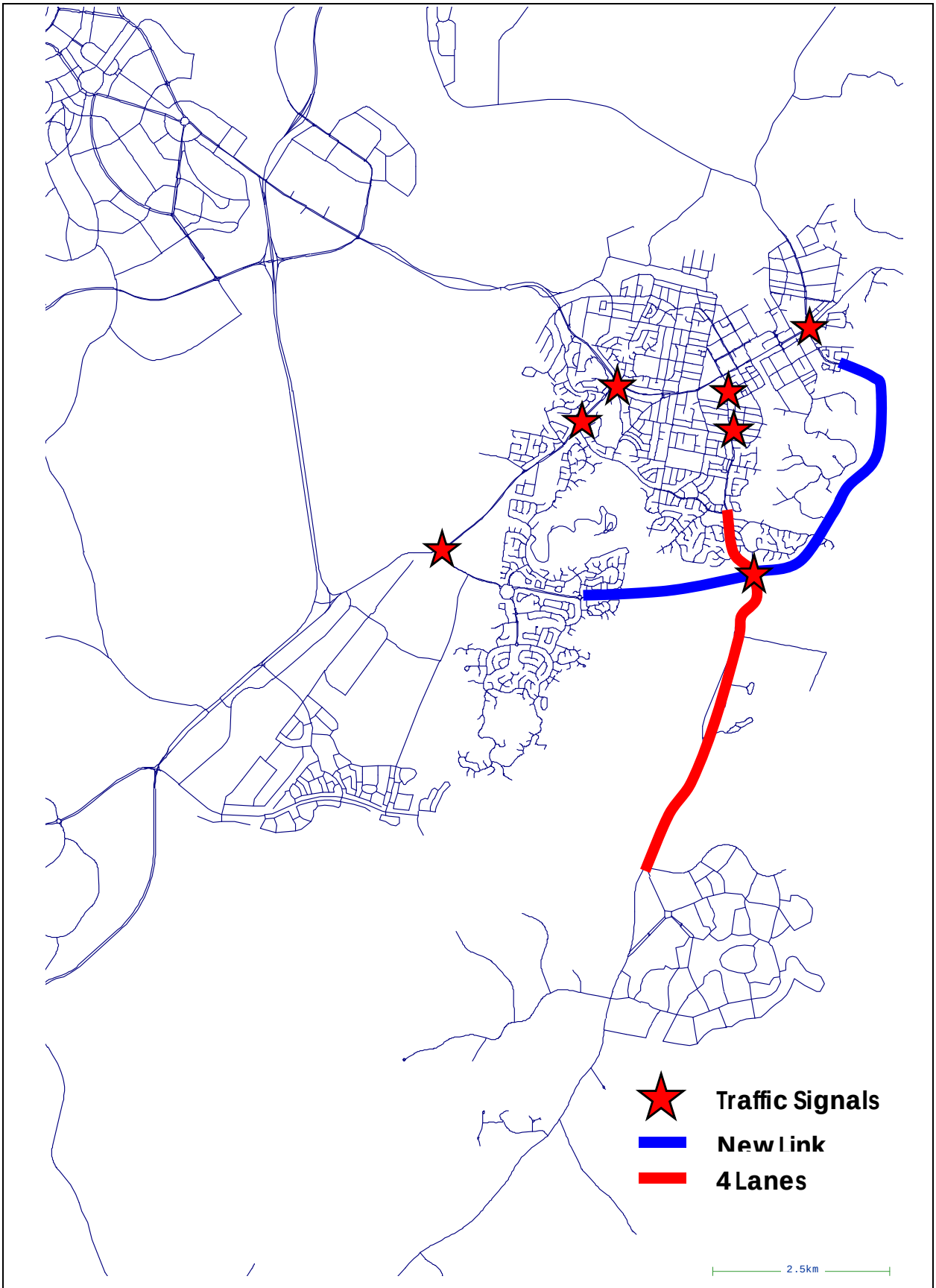
These shortlisted options are shown in **Figure 28** to **Figure 32**.



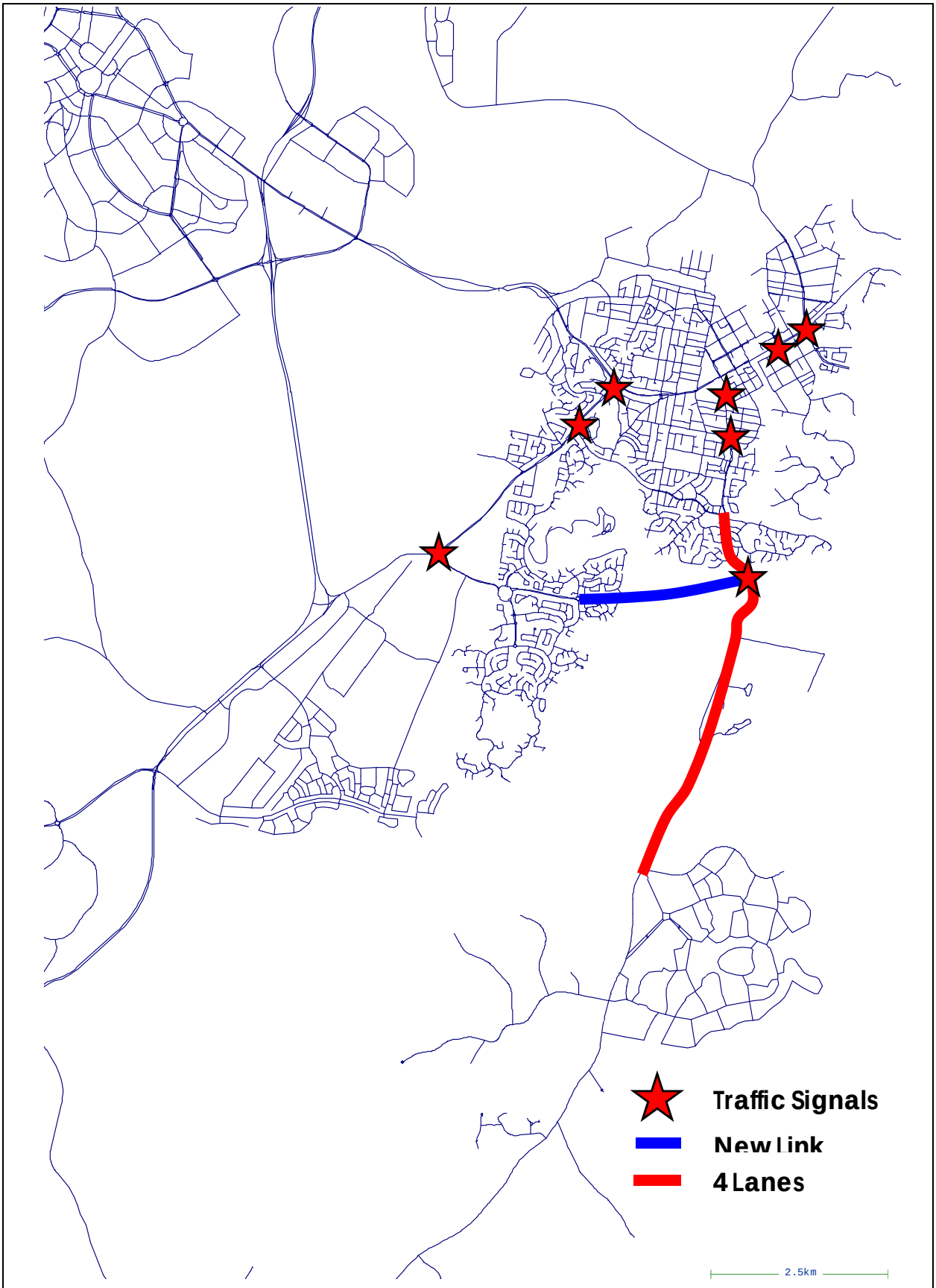
Googong and Tralee Traffic Study (2031)	**2031 Shortlisted Project Option Improvement 03B**	**Figure 28**
Gabites Porter Consultants		



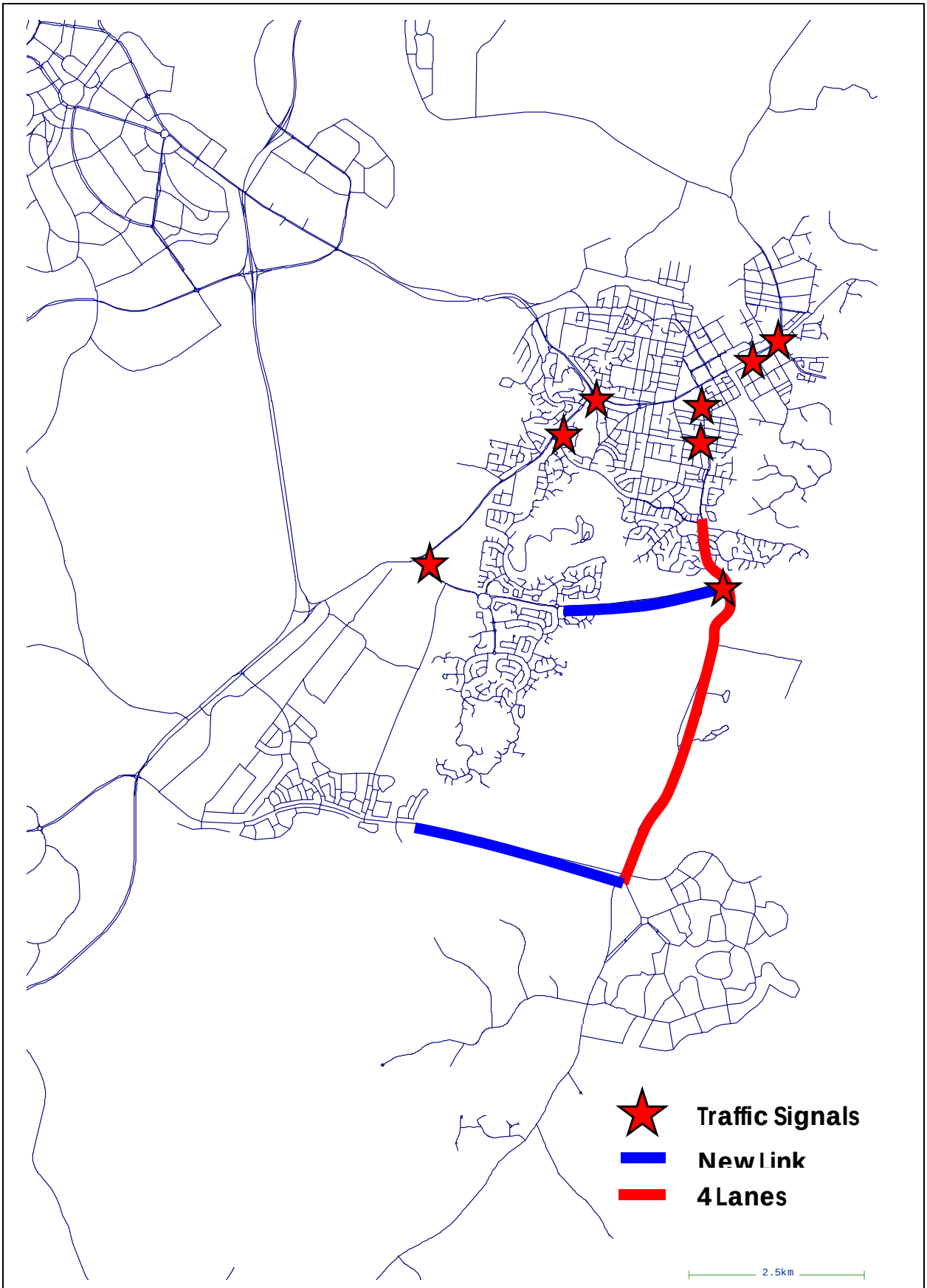
Googong and Tralee Traffic Study (2031)	**2031 Shortlisted Project Option Improvement 03C**	**Figure 29**
Gabites Porter Consultants		



Googong and Tralee Traffic Study (2031)	**2031 Shortlisted Project Option Improvement 05B**	**Figure 30**
Gabites Porter Consultants		



Googong and Tralee Traffic Study (2031)	**2031 Shortlisted Project Option Improvement CBC**	**Figure 31**
Gabites Porter Consultants		



Googong and Tralee Traffic Study (2031)	**2031 Shortlisted Project Option Improvement C2B**	**Figure 32**
Gabites Porter Consultants		

Each of these five Shortlisted Project Options were analysed using the transportation model developed for Queanbeyan. The projected 2031 traffic volumes and level of service results are shown in **Appendix 8 – 2031 Full Development Shortlisted Options AM Peak** and **Appendix 9 – 2031 Full Development Shortlisted Options PM Peak**.

Again, travel summary statistics, shown in **Table 14** were obtained for each Shortlisted Option so that a direct comparison of the overall impacts could be compared. This comparison would help in determining the relative merits of each option.

Travel Summaries of the Modelled Queanbeyan Option for 2031						Table 14
	Variable	**03B**	**O3C**	**05B**	**CBC**	**C2B**
2031 AM PEAK	Total Vehicle Kilometres (km)	146432	146493	149751	149206	145986
	Total Vehicle Minutes (mins)	197450	197070	199790	201570	199701
	Mean Network Speed (kph)	44.5	44.6	45.0	44.4	43.9
	Total vehicles Subject to Intersection Delay	255698	255831	254754	260591	259803
	Delay per Vehicle Delayed (secs)	7.9	7.7	8.1	8.2	7.9
2031 PM PEAK	Total Vehicle Kilometres (km)	156562	156642	160387	159667	155769
	Total Vehicle Minutes (mins)	220476	219984	224720	230291	225444
	Mean Network Speed (kph)	42.6	42.7	42.8	41.6	41.5
	Total vehicles Subject to Intersection Delay	293663	294526	295717	302554	301438
	Delay per Vehicle Delayed (secs)	7.3	7.2	7.9	8.5	7.9

8.6 Shortlisted Options with Monaro Highway Upgrade

The Technical Working Group felt that the significant reduction in LOS along the Monaro Highway between Isabella Drive and Lanyon Drive by 2031 may result in a reduction in the use of the Monaro-Lanyon route. This reduction could result in a change of overall travel pattern to and from the future developments and therefore "skew" the level of service results.

To test whether this potential skewing was actually taking place in the model, the five shortlisted options were all analysed again with the Monaro Highway upgraded to a 6 lane highway with significantly more capacity. The results of this analysis are shown in **Appendix 10 – 2031 Full Development Shortlisted Options AM Peak – Monaro Highway Upgrade** and **Appendix 11 – 2031 Full Development Shortlisted Options PM Peak – Monaro Highway Upgrade.**

This analysis showed that the six laning of the Monaro Highway significantly reduced the congestion along the highway and thereby improved the projected 2031 LOS substantially. The six laning did not however make any appreciable difference to the level of traffic flow along Lanyon Drive. This indicates that whilst the existing capacity of the highway is a hindrance to the smooth and rapid movement of traffic, it is not deflecting large numbers of vehicles away from the area. This could be due to the fact that this segment of highway forms part of only a few routes between areas that have quite distinct catchments. This means that speeding up that part of the route does not provide enough "time benefit" to other vehicles to attract them onto the route.

The Technical Working Group also wanted to ensure that congestion along Pialligo Ave did not make an appreciable difference to the operation of the shortlisted Options. Additional testing was undertaken with Pialligo Ave increased to four lanes. These tests showed that increasing the capacity of these roads made little difference to the flow of traffic within Queanbeyan.

8.7 Elimination of Shortlisted Options

Analysis of the shortlist Project Options showed that Options 03B, 03C and C2B, which involved the construction of Dunns Creek, were not significantly different to those without Dunns Creek and its associated cost. As indicated earlier, the Dunns Creek link between the Tralee and Googong developments was seen as being a useful inclusion in the future Queanbeyan network but would not likely be required within the current 2031 planning horizon.

The ability of the Dunns Creek link to reduce traffic flow along Old Cooma Rd and the Edwin Land Parkway Extension however the flow reduction along Old Cooma Rd was not sufficient by 2031 to preclude the need for four lanes. This route was seen by the Technical Working Group as being valuable in the future but could not be justified at this time.

Options 03B, 03C and C2B were therefore eliminated from further analysis. See **Appendix 8** and **9** for LOS results.

In addition, Options C2B and CBC resulted in a LOS E condition applying along Cooma St from Southbar Rd to Rutledge St. The lack of the Ellerton Rd Extension caused additional traffic to travel along Cooma St to access north and east Queanbeyan.

This process eliminated all but Option 05B. Discussion within the Technical Working Group concluded that a further variation of Option CBC should also be included in further analysis. Option CBC was to include the four laning of Old Cooma Rd and the two lane extension of the Edwin Land Parkway along with a number of intersection improvements along Cooma St so as to minimize as many of the intersection issues as possible along the route.

8.8 Selection of 2031 Network

The two remaining Options 05B and CBC were again analysed in depth using the Queanbeyan model. In both options all remaining intersections that were found to be operating at LOS E or F were modified until they maintained an LOS D level. This involved all of the intersections shown in **Table 10**.

The inclusion of the Option CBC variation in the final analysis was to determine if it was possible to produce a future network option that did not require the Ellerton Rd Extension yet maintain a suitable LOS along Cooma St. One of the main reasons for the Ellerton Extension was to reduce the traffic flow along both Cooma St corridor and improve its projected level of service back to LOS D.

A number of additional improvements were proposed for Cooma St so that the Ellerton Rd Extension was not needed. These improvements involved modified intersection lay-outs for intersection along Cooma St and the installation of clearways during peak periods. Clearways would enable the introduction of four lanes of traffic along Cooma St between Rutledge St and Southbar Rd.

A series of additional analyses were undertaken for Option CBC which involved the following variations:

- Intersection modifications without clearways
- Intersection modifications with clearways
- Intersection modifications with clearways and Ellerton Dr extension
- Intersection modifications and Dunns Creek Link

The detailed local projected traffic volumes and LOS results for these analyses are included in **Appendix 12 – 05B/CBC Final Analysis – AM Peak** and **Appendix 13 – 05B/CBC Final Analysis – PM Peak** .

The level of service plots clearly show the following:

1. Implementing Cooma St intersection improvements without both clearways and the Ellerton Extension results in LOS E conditions along Cooma St and on Queens Bridge during the peak periods.

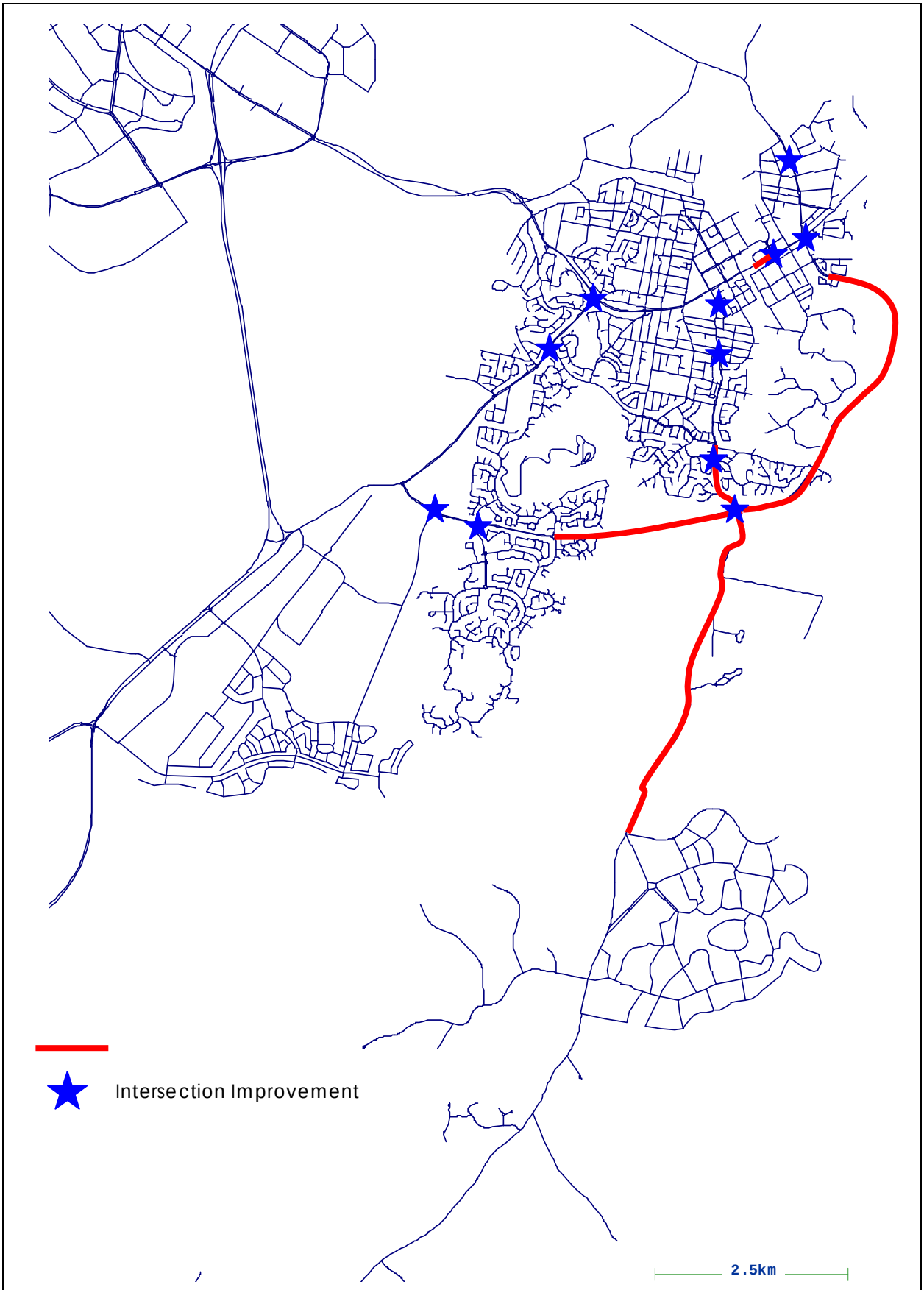
2. Implementing Cooma St intersection improvements with clearways but no Ellerton Extension results in better than LOS D conditions along Cooma St but Queens Bridge would remain LOS E during the peak periods. A number of additional side street approaches along Cooma St will be subjected to LOS E or F conditions during the PM Peak.

3. Implementing Cooma St intersection improvements with both clearways and the Ellerton Extension results in LOS D or better conditions along Cooma St and on Queens Bridge during the peak periods. No additional side street approaches along Cooma St will be subjected to worse than LOS D conditions during the PM Peak. A further improvement to the proposed intersection design for the Old Cooma / Ellerton Extension / Edwin Land Parkway intersection would be required.

4. Implementing Cooma St intersection improvements with the Dunns Creek Link results in LOS E conditions along Cooma St and Queens Bridge during the peak periods. A number of additional side street approaches along Cooma St will be subjected to LOS D or E conditions during the PM Peak. In addition, parts of Lowe St between Rutledge and Monaro would also drop to LOS E during the PM Peak.

Whilst the Option CBC variations with clearways produced the desired result of LOS D or better along Cooma St, the Technical Working Group believed it was expected to come at a cost to local residential amenity. The increased flow associated with the four lane clearways would result in greater noise and a decreased ability to access properties. Right turning from driveways into clearway conditions would be difficult at best and banned in some instances.

Option 05B was eventually preferred by the Technical Working Group as being the final 2031 improvement works project. Option 05B with its associated works is shown in **Figure 33**.



Googong and Tralee Traffic Study (2031)	**2031 Proposed Improvement Project**	**Figure 33**
Gabites Porter Consultants		

The result of the introduction of the Option 05B improvements on the 2031 AM Peak and PM Peak networks are shown in **Appendix 12 – 05B/CBC Final Analysis – AM Peak** and **Appendix 13 – 05B/CBC Final Analysis – PM Peak**. These figures show the Levels of Service for the Queanbeyan network after the proposed intersection and link improvements have been included.

Clearly, implementing Option 05B with its associated link and intersection improvements results in LOS D or better conditions along Cooma St and on Queens Bridge during the peak periods.

9. DEVELOPER CONTRIBUTIONS

As detailed in the previous sections of this report, the increases in traffic volumes and delays, over and above those caused by natural growth, are due to the additional 2031 developments detailed in **Table 5**. The works included in the preferred Proposed Improvement Project are as a direct result of those increases. Without those developments the existing network is expected to continue to operate well in 2031, as shown in **Appendix 2**.

Therefore the costs associated with these improvement works are attributable to the developments that take place up to 2031. This study investigated also how to apportion the project costs to each development so that developer contributions could be levied by the QCC. Discussion took place within the Technical Working Group as what method should be used to calculate the apportionment. It was concluded that the flow to and from each development would be tracked in the model. This tracking allowed the Technical Working Group to see how much traffic from each development went along or through each improvement in the preferred Project Option.

The relativity of each development's flow through an improvement creates the relative contribution that each development should make to the cost of the improvement.

It was also felt that as the existing community will use these new facilities they should also contribute to some degree to the cost of each improvement.

To simplify this process and help identify contributions, the developments were grouped as follows:

- Googong Development (GOG)
- South Jerrabomberra - Tralee, SE Jerrabomberra and Tralee Station Developments (SJ)
- HQJOC (HQJ)
- All other development (DEV)
- Other Queanbeyan Users (QUE)

Flows from each of the five groups (DEV, GOG, TRA, HQJ, QUE) were modelled separately for both the 2031 AM and PM Peaks. The period volumes were combined so that the total peak period volume was used in the apportionment calculations. The percentage relativity of each group's flows was used in apportioning the cost of each improvement work. It should be noted that the following volumes do not include ACT traffic using the links and intersections.

Only the Edwin Land Parkway Extension and the Ellerton Extension projects had costs apportioned to existing Queanbeyan residents as these two projects offered additional benefits to residents. All other link and intersection works were apportioned to GOG, SJ, HQJ and DEV only, as they were being constructed to repair disbenefits to existing Queanbeyan users produced by these developments.

Table 15 details the volumes and relative proportion of the combined flows from each development along each of the improvement links detailed in Table 2.

2031 Improvement Link Flows (AMP+PMP)						Table 15
Location	**GOG**	**SJ**	**HQJ**	**DEV**	**QUE**	**Total**
4L Old Cooma (Googong to ELP)	4404	297	51	365		5117
4L Old Cooma (ELP to Southbar)	2514	169	16	260		2959
4L Monaro (Alkinson to Bridge)	144	258	303	296		1001
2L ELP Ext (Jerrabomberra – Old Cooma)	1004	513	53	127	701	2398
2L Ellerton Extension	868	41	97	91	249	1346
	GOG	**SJ**	**HQJ**	**DEV**	**QUE**	**Total**
4L Old Cooma (Googong to ELP)	86%	6%	1%	7%		100%
4L Old Cooma (ELP to Southbar)	85%	6%	1%	9%		100%
4L Monaro (Alkinson to Bridge)	14%	26%	30%	30%		100%
2L ELP Ext (Jerrabomberra – Old Cooma)	42%	21%	2%	5%	29%	100%
2L Ellerton Extension	64%	3%	7%	7%	18%	100%

As indicated earlier, both the 2L Ellerton Extension and the Edwin Land Parkway Extension improvements have been apportioned to include a contribution from existing Queanbeyan residents. These new improvements are being implemented as a result of congestion and Level of Service issues elsewhere in the network. As these proposed roads have also been included in Council planning maps for many years, the apportionment of costs is therefore being calculated differently.

These links will provide a potential benefit to the existing Queanbeyan residents and QCC considers it reasonable to include the flow from existing residents in calculating the apportionment of cost.

Table 16 details the volumes and relative proportion of the combined flows from each development through each of the improvement intersections.

2031 Improvement Intersection Flows (AMP+PMP)						Table 16
Location	**GOG**	**SJ**	**HQJ**	**DEV**	**QUE**	**Total**
Cooma/ELP	4386	513	111	423		5433
Tompsitt/ELP/Jerrabomberra	823	1879	13	103		2818
Tompsitt/New Link	738	2564	40	91		3433
Cooma/Rutledge/Lowe	798	32	42	186		1058
Cooma/Fergus	1243	24	37	236		1540
Cooma/Thornton/Barracks Flat	2484	128	21	391		3024
Lanyon/Southbar	624	1095	160	249		2128
Lanyon/Canberra	861	847	200	429		2337
Monaro/Atkinson	157	259	407	715		1538
Monaro/Yass/Bungendore	880	228	911	839		2858
Yass/Aurora	594	39	390	575		1598
Farrer / Cameron					2611	2611
Lanyon / Tompsitt					3834	3834

						Table 16 Continued
Location	**GOG**	**SJ**	**HQJ**	**DEV**	**QUE**	**Total**
Cooma/ELP	81%	9%	2%	8%		100%
Tompsitt/ELP/Jerrabomberra	29%	67%	0%	4%		100%
Tompsitt/New Link	21%	75%	1%	3%		100%
Cooma/Rutledge/Lowe	75%	3%	4%	18%		100%
Cooma/Fergus	81%	2%	2%	15%		100%
Cooma/Thornton/Barracks Flat	82%	4%	1%	13%		100%
Lanyon/Southbar	29%	51%	8%	12%		100%
Lanyon/Canberra	37%	36%	9%	18%		100%
Monaro/Atkinson	10%	17%	26%	46%		100%
Monaro/Yass/Bungendore	31%	8%	32%	29%		100%
Yass/Aurora	37%	2%	24%	36%		100%
Farrer / Cameron					100%	100%
Lanyon / Tompsitt					100%	100%

10. INITIAL IMPROVEMENT TIMING

An initial analysis was undertaken to determine a simple timing of the improvements detailed in Section 9. This analysis involved creating the expected 2021 land use for Queanbeyan and ACT based on available details of development construction rates. The 2006-2021 increase in households, jobs, cars and population was estimated from data provided by QCC and ACT and used to create AM and PM Peak models of traffic in Queanbeyan in 2021.

These models show the deficiencies in the existing network that would result if the expected 2021 development was put in place without any improvements. **Appendix 14 – 2021 Base network** shows the level of service expected in Queanbeyan as a result of the 2021 developments.

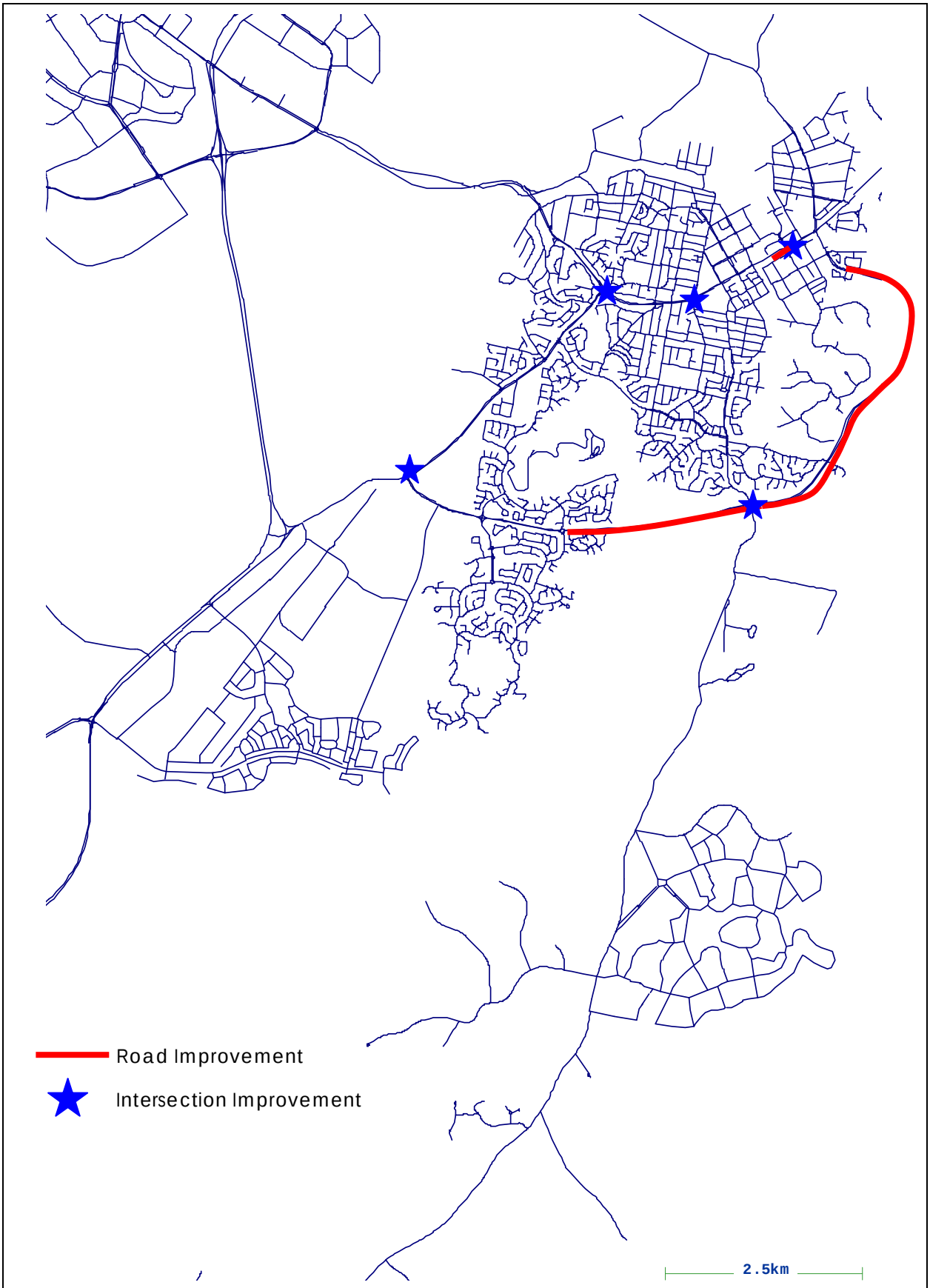
The poor levels of service shown in Appendix 14 show where improvements need to be implemented by 2021 and therefore cannot wait until 2031. **Table 17** and **Table 18** indicate the likely construction timing of each of the proposed improvement works. **Figure 34** shows the locations of the improvement works needed by 2021.

Link Improvement Timing — **Table 17**

Location	By 2021	By 2031
4L Old Cooma (Googong to ELP)		✓
4L Old Cooma (ELP to Southbar)		✓
4L Monaro (Alkinson to Bridge)	✓	
2L ELP Extension (Jerra – Old Cooma)	✓	
2L Ellerton Extension	✓	

Intersection Improvement Timing — **Table 18**

Location	By 2021	By 2031
Cooma/ELP	✓	
Tompsitt/ELP/Jerrabomberra		✓
Tompsitt/New Link		✓
Cooma/Rutledge/Lowe		✓
Cooma/Fergus		✓
Cooma/Thornton/Barracks Flat		✓
Lanyon/Southbar		✓
Lanyon/Canberra	✓	
Monaro/Atkinson	✓	
Monaro/Yass/Bungendore		✓
Yass/Aurora		✓
Farrer / Cameron	✓	
Lanyon / Tompsitt	✓	



Googong and Tralee Traffic Study (2031)	**2021 Proposed Improvement Project**	**Figure 34**
Gabites Porter Consultants		

This 2021 analysis is only a preliminary indication of timing. A more detailed analysis including confirmed development rates from all of the major developments needs to be obtained and included in the analysis. In addition, an iterative process needs to be undertaken where the proposed 2021 works are implemented and additional improvements included should problems elsewhere in the network arise.

To obtain a more detailed timeline of improvement installation, additional future years need to be analysed so that implementation can be highlighted in 5 year intervals.