MIDSON traffic pty ltd

West Tamar Council

Exeter Traffic Study – Options Analysis

October 2022

ENGINEERS AUSTRALIA

PROFESSIONAL ENGINEER OF THE YEAR
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1. Introduction

1.1 Background

Midson Traffic were engaged by West Tamar Council to undertake a comprehensive transport study of the town of Exeter. A Structure Plan was prepared for Exeter in 2014.

This report provides a technical assessment of the traffic impacts associated with known and potential land use development within Exeter and provides recommendations for the Exeter network to ensure safe and efficient transport for all road users.

1.2 Project Objectives

This report aims to assess the traffic impacts associated with increasing residential densities between Exeter and Blackwell.

The objectives of this study are set out as follows:

- An assessment of the impact of increasing residential densities between Exeter and Blackwall:
  - → Based on two growth scenarios to be provided by Council.
  - → Makes recommendations about the preferred alignment of a road the links Glen Ard Mohr Road with Gravelly Beach Road (possibly via Stony Brook Road or continuation of Glen Ard Mohr Road).
  - → Assesses the impact of providing a road connection between Glen Ard Mohr Road and Gravelly Beach Road.
  - → The impact of the above on Gravelly Beach Road and Main Road intersections with Glen Ard Mohr Road.
- An assessment of a new road that provides a connection to Murray Street from the Frankford Road/ Main Road Intersection with a link to Wildmore Crescent:
  - → Preferred alignment of the road, width of the road reserve required and whether an intersection with Frankford Road / Main Road is appropriate.
  - → The impacts on relevant intersections associated with these proposed road modifications.
- Provision of recommendations based on the above for treatments (if required) in Main Road at the Glen Ard Mohr Road and Frankford Road intersections.

1.3 Exeter

Exeter is a small Tasmanian town located approximately 10 kilometres north of Legana on the West Tamar Highway.

Exeter is positioned at the junction of two major highways: the West Tamar Highway and Frankford Road. The turn off to the Batman Highway is located approximately 9.4 kilometres north of the Frankford Road junction. Exeter is therefore strategically placed in the transport network and plays an important role

agriculturally due to its central position within a large rural area. Surrounding agricultural industries include dairy & beef, orchards, fruit, and sheep.

The town has a primary school, high school, various services, and retail shops along the West Tamar Highway corridor, as well as various side roads. Exeter is essentially a small strip shopping centre between Glen Ard Mohr Road and Frankford Road. Strip shopping centres generally develop on a road corridor over time and rely on passing trade.

The changes in population of Exeter and surrounds between 2006 and 2021 is summarised in Figure 1.

The study area associated with the Exeter Traffic Study is shown in Figure 1.

Figure 1 Study Area

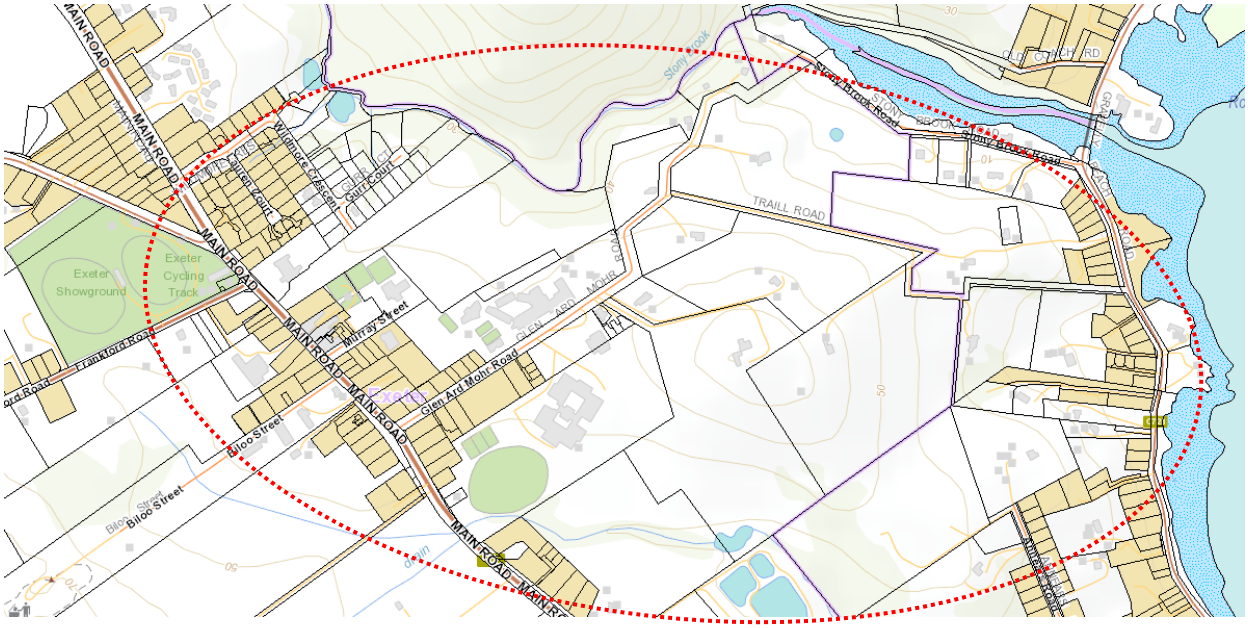


Image Source: LIST Map, DPIPWE

Table 1 Population (place of usual residence) 2006 to 2021

Location	Year			
	2006	2011	2016	2021
Exeter	338	389	387	446
Gravelly Beach	536	561	567	641
Blackwell		306	270	303
Lanena	615	313	320	343
TOTAL	**1,489**	**1,569**	**1,544**	**1,733**

Source: Australian Bureau of Statistics, Census of Population and Housing, 2006, 2011, 2016 & 2021 (Usual residence data) included in the Basic/ General Community Profiles

Notes:

** In 2006, Blackwall was part of the Lanena SLA. Between 2006 and 2011 Census the Exeter SLA reduced from 3.9sq km to 3.2sq km and Gravelly Beach increased from 5.1sq km to 6sq km. The overall size of the combined structure plan area changed from 13.7 sq km to 13.8 sq km between 2006 and 2011.*

1.4 Previous Studies

There have been several key studies undertaken in Exeter in recent years. This report provides additional analysis and detail for several recommendations arising from the 2015 Exeter Traffic Study.

The previous studies relevant to this report are detailed in the following sections.

1.4.1 Exeter Structure Plan

The Exeter Structure Plan was completed in 2014. The Structure Plan was developed to guide future development of Exeter for 20 years. It lays the foundation for regulatory zoning and the development or subdivision process. It also assists in determining the nature and location of public places such as parks and community centres.

The Exeter Structure Plan was guided by several key strategic documents that included:

- Regional Land Use Strategy (RLUS)
- Greater Launceston Plan
- West Tamar Council Strategic Plan 2009-2014
- West Tamar Interim Planning Scheme, 2013

1.4.2 2015 Exeter Traffic Study

A report titled 'Exeter Traffic Study' was prepared by Midson Traffic in 2015. The study investigated the various recommendations of the Exeter Structure Plan and tested their implications on traffic flow and road safety. The findings of this report supported the recommendations of the Structure Plan and provided additional detail for implementation over the next twenty years.

The key recommendations of the report were as follows:

- Two roundabouts were proposed. These were located at the Main Road/ Glen Ard Mohr Road junction and the junction of Main Road/ Frankford Road.
- A link road was recommended between Glen Ard Mohr Road and Gravelly Beach Road.
- A link road was recommended between Murray Street and Main Road/ Frankford Road.
- Improved pedestrian crossing facilities along the Main Road corridor.
- Implementation of a new park at the corner of Biloo Street and Main Road.

1.4.3 Exeter Traffic Study Options Report

GHD prepared a study titled "Exeter Traffic Study – Options Report" in October 2019. The aim of the study was to review potential options and improvements in Exeter to manage conflicts between the various road users with competing priorities.

The report focussed on the analysis of specific traffic management options, which included:

- Roundabout at the Main Road/ Frankford Road intersection.
- Roundabout at the Main Road/ Glen Ard Mohr Road intersection.
- Channelised right turn treatments at the Main Road/ Frankford Road intersection.
- Threshold treatments in Main Road.
- Installation of bicycle lanes along Main Road.
- Pedestrian crossing facilities along Main Road.
- Installation of a centre median treatment along Main Road.

The GHD report concluded that the following options be considered for further design and investigation:

- Installation of roundabouts at the Main Road/ Frankford Road and Main Road/ Glen Ard Mohr Road junctions.
- Installation of entry thresholds in Main Road near Frankford Road and Glen Ard Mohr Road.
- Installation of additional kerb outstand crossing treatments throughout Main Road.
- Formalisation of on-street parking arrangements.

1.5 References

The following references were used in the preparation of this report:

- Tasmanian Planning Scheme – West Tamar, 2021 (Planning Scheme)
- Austroads, *Guide to Traffic Management,* Part 12: *Traffic Impacts of Developments*, 2019
- Austroads, *Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections*, 2021
- Austroads, *Guide to Road Design, Part 4B, Roundabouts*, 2021
- Department of State Growth, *Traffic Impact Assessment Guidelines*, 2020
- Roads and Maritime Services NSW, *Guide to Traffic Generating Developments*, 2002 (RMS Guide)
- Roads and Maritime Services NSW, *Updated Traffic Surveys,* 2013 (Updated RMS Guide)
- Midson Traffic, Exeter Traffic Study, 2015
- GHD, Exeter Traffic Study Options Report, 2019

1.6 Glossary of Terms

The key terms and abbreviations used in this report are summarised in Table 2.

Table 2 Abbreviations Summary

Abbreviation	Description
ABS	Australian Bureau of Statistics
AADT	Average Annual Daily Traffic
AM	Morning Peak Period (typically 8:00am to 9:00am)
Crs	Crescent
ERC	Exeter Recreation Centre
ESP	Exeter Structure Plan
HV	Heavy Vehicle
km/h	Kilometres Per Hour
L	Left turn
LOS	Level of Service
m	Metres
MR	Main Road
p.a.	Per Annum
PM	Evening Peak Period (typically 5:00pm to 6:00pm)
R	Right turn
Rd	Road
s	Seconds
SIDRA	Signalised Intersection Design and Research Aid
St	Street
T	Through movement
vpd	Vehicles Per Day
vph	Vehicles Per Hour

2. Existing Conditions

2.1 Transport Network

Exeter is essentially a small 'linear' town primarily fronting onto the West Tamar Highway. A number of side roads connect to West Tamar Highway through Exeter providing connectivity to various land uses in the surrounding area.

The transport network relevant to this study consists of the following roads:

- West Tamar Highway/ Main Road
- Frankford Road
- Glen Ard Mohr Road
- Murray Street
- Wildmore Crescent
- Gravelly Beach Road
- Traill Road
- Stony Brook Road

These roads are detailed in the following sections.

2.1.1 West Tamar Highway/ Main Road

West Tamar Highway is part of the state owned road network. It connects between Launceston and Beauty Point along the western side of the Tamar River providing access to a large number of townships in the West Tamar region, including Legana, Exeter, Beaconsfield and Beauty Point.

South of Exeter, West Tamar Highway is predominantly a two-lane rural highway through winding and rolling terrain. Recently the Department of State Growth upgraded the section of the Highway near Bradys Lookout to include three lanes with a central wire rope median to improve safety and overtaking opportunities.

South of Legana, the West Tamar Highway is a four-lane, two-way arterial road having been upgraded to dual carriageway between Legana and Riverside. Through Legana and north of Legana, the Highway is a two-lane, two-way road with overtaking lanes at regular intervals.

West Tamar Highway is classified as a Category 3, Regional Access Road, under DSG's State Road Hierarchy 2006. Regional Access Roads are of strategic importance to regional and local economies. While heavy freight vehicles use them, the level of use is below that of Regional Freight Roads.

Figure 2 Main Road

2.1.2 Glen Ard Mohr Road

Glen Ard Mohr Road provides connectivity to a predominantly residential catchment, as well as two schools. It is currently a dead-end road, with a bus turning circle provided at its sealed eastern end. A narrow unsealed section continues east and provides access to a number of properties.

Glen Ard Mohr Road at the intersection with Main Road is shown in Figure 3.

Figure 3 Glen Ard Mohr Road at Main Road

2.2 Murray Street

Murray Street provides connectivity to the Exeter Memorial Hall, as well as a number of commercial and residential properties along its relatively short length.

The ERC car park is located at Murray Street's eastern end.

Figure 4 Murray Street

2.2.1 Frankford Road

Frankford Road is a state highway that connects between Exeter at its eastern end and Harford (at the Chapel Road junction) at its western end. It provides regional connectivity between West Tamar and Devonport, servicing rural towns within the region.

Frankford Road has a traffic volume of approximately 2,600 vehicles per day. It has a relatively high proportion of heavy vehicle traffic, in the order of 16.5%.

Figure 5 Frankford Road at Main Road Junction

2.2.2 Wildmore Crescent

Wildmore Crescent is a local street that services a small residential catchment. It connects to Main Road at a T-junction to the north of the Frankford Road junction. Several cul-de-sacs connect to Wildmore Crescent along its length.

Traffic volumes are estimated to be in the order of 600 vehicles per day. The general urban speed limit of 50-km/h is applicable to Wildmore Crescent.

2.2.3 Gravelly Beach Road

Gravelly Beach Road connects between Deviot Road at its northern end and Main Road at its southern end. It provides a major collector road function for foreshore areas of Gravelly Beach and Exeter. Within Exeter Gravelly Beach Road carries approximately 2,500 vehicles per day, with a peak of approximately 250 vehicles per hour.

2.2.4 Traill Road

Traill Road is an unsealed access road that services a small number of residential properties. It connects to Glen Ard Mohr Road and terminates approximately 650 metres to the east. It has an unsealed pavement width of approximately 4 metres and a road reservation width of approximately 9.5 metres.

Traffic volumes are estimated to be less than 50 vehicles per day.

2.2.5 Stony Brook Road

Stony Brook Road is a local access road that services a small residential catchment located adjacent to Stony Brook. It connects at a T-junction at Gravelly Beach Road adjacent to the Stony Brook bridge.

Stony Brook Road has a unsealed pavement width of approximately 4 metres and a corridor width of approximately 10.5 metres.

The traffic volume of Stony Brook Road is estimated to be less than 50 vehicles per day.

2.3 Traffic Volume Data

2.3.1 Traffic Volume Overview

A summary of the traffic volumes within the key road network within the study area are provided in Table 3.

Table 3 Traffic Volume Summary

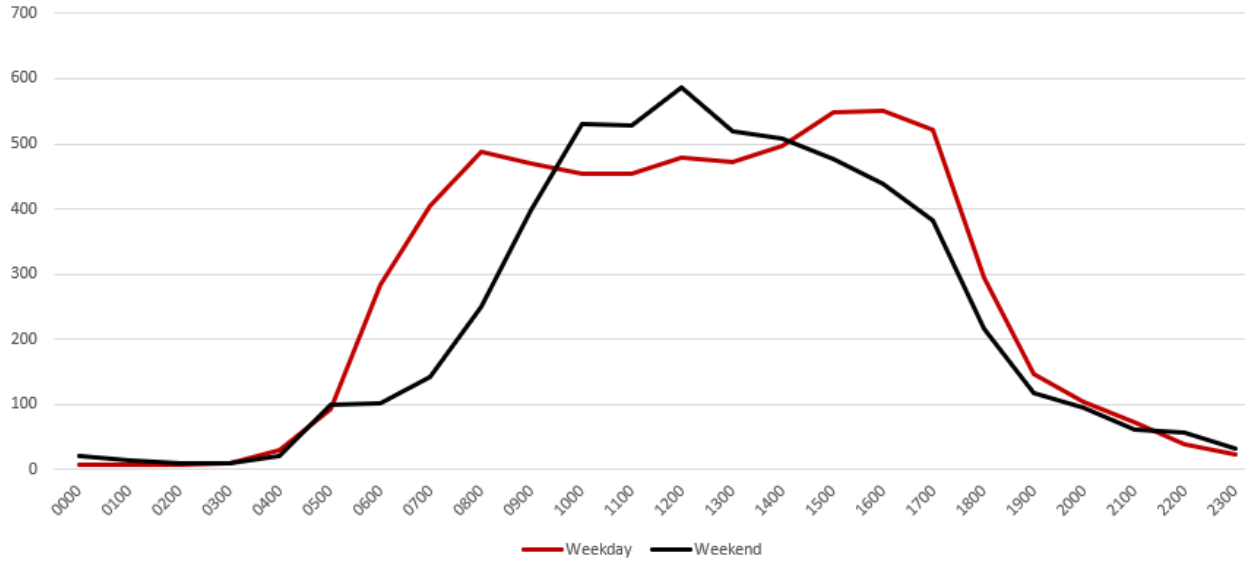
Road	Date of Survey	AADT	Peak Flow	%HV
West Tamar Hwy, Glen Ard Mohr Rd to Frankford Rd	2021	6,983 vpd	554 vph 4pm-5pm	13.0%
West Tamar Hwy, north of Frankford Rd	2021	3,521 vpd	380 vph 4pm-5pm	17.5%
Frankford Road, west of West Tamar Hwy	2021	2,568 vpd	293 vph 3pm-4pm	16.5%
Glen Ard Mohr Rd near West Tamar Hwy	October 2014	744 vpd	337 vph 8am-9am	0.6%
Murray St near West Tamar Hwy	October 2014	327 vpd	68 vph 4pm-5pm	0.7%
Gravelly Beach Rd near West Tamar Hwy	October 2013	2,337 vpd	250 vph	0.5%

2.3.2 West Tamar Highway

2021 traffic data was obtained from the Department of State Growth for West Tamar Highway south of the Glen Ard Mohr intersection. The West Tamar Highway average hourly flows for weekdays and weekends is shown in Figure 6.

It can be seen that peak flows are similar in magnitude between weekdays and weekends, with weekday flow being relatively consistent between 8:00am and 5:00pm (showing two commuter peaks).

Figure 6 West Tamar Highway Hourly Traffic Flow



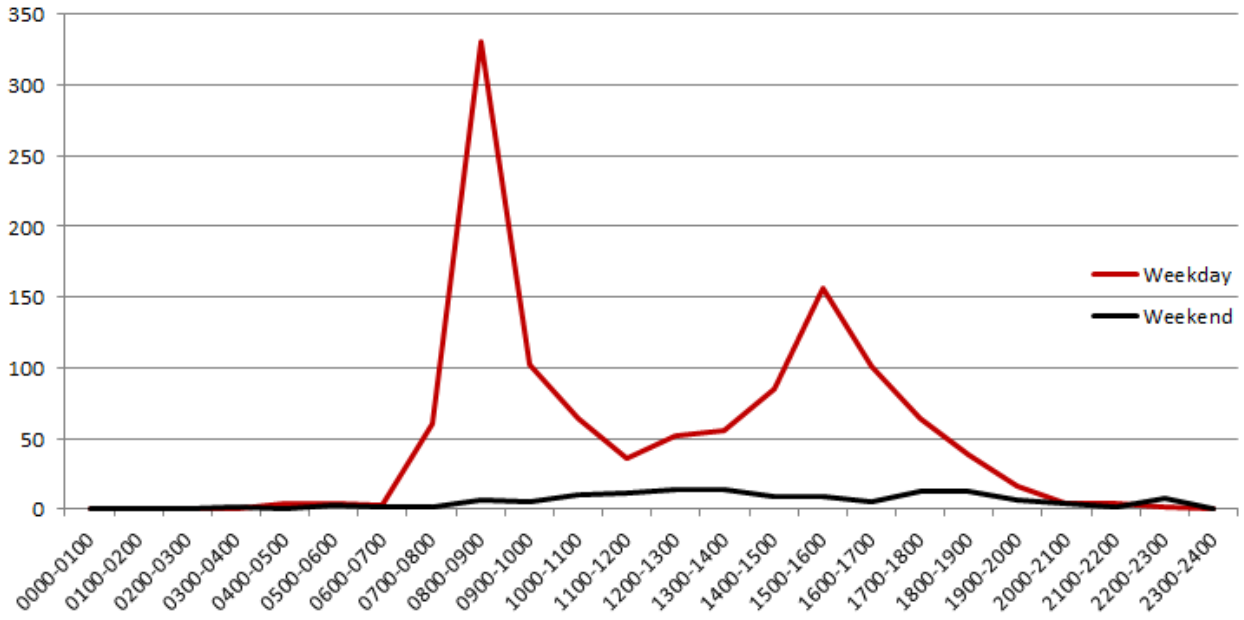
2.3.3 Glen Ard Mohr Road

Traffic survey data for Glen Ard Mohr Road was obtained from November 2014. The average hourly flows for weekdays and weekends are shown in Figure 7. Traffic volumes are unlikely to have changed significantly since 2014 as Glen Ard Mohr Road is a dead-end street with no recent land use development.

It can be seen that hourly traffic volumes increase by a factor of approximately 10 on weekdays compared to weekends. This is mostly due to school traffic flow (as well as commuter traffic from residents along the street). The morning drop-off and afternoon pick-up periods clearly dominate the traffic flow during weekday periods.

The weekday morning peak is between 8:00am and 9:00am, with up to 350 vehicles per hour. The weekday afternoon peak is more than half this amount, but extends over several hours. The weekend hourly flows are reasonably steady during daylight hours, typically in the order of 10 to 15 vehicles per hour.

Figure 7 Glen Ard Mohr Road Hourly Traffic Flow



2.4 Traffic Growth

Changes in traffic volume on key roads was examined between the 2015 traffic study and the most recent available data to understand the traffic growth within the study area. It is important to understand the background traffic growth of the arterial roads through the study area in order to model and plan potential infrastructure changes.

West Tamar Highway has experienced very little traffic growth in the decade between 2011 and 2021. The overall traffic growth is less than 1% per year (compound growth). This is shown in Figure 8.

Similarly, Frankford Road has also experienced almost no traffic growth between 2007 and 2021. The overall traffic growth has been 0.2% between these years (noting a decrease between 2007 and 2017). This is shown in Figure 9.

Figure 8 West Tamar Highway Traffic Volumes by Year

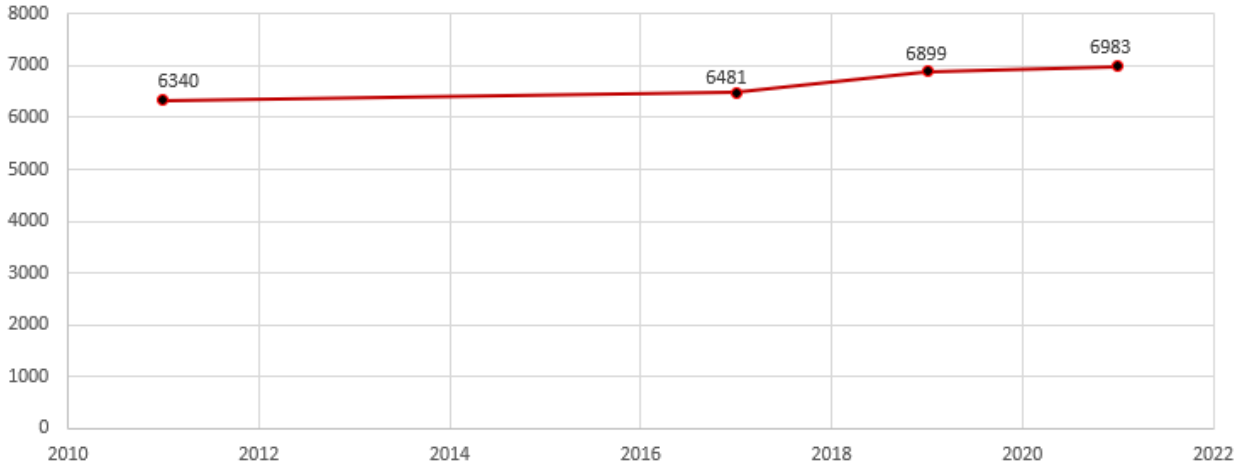
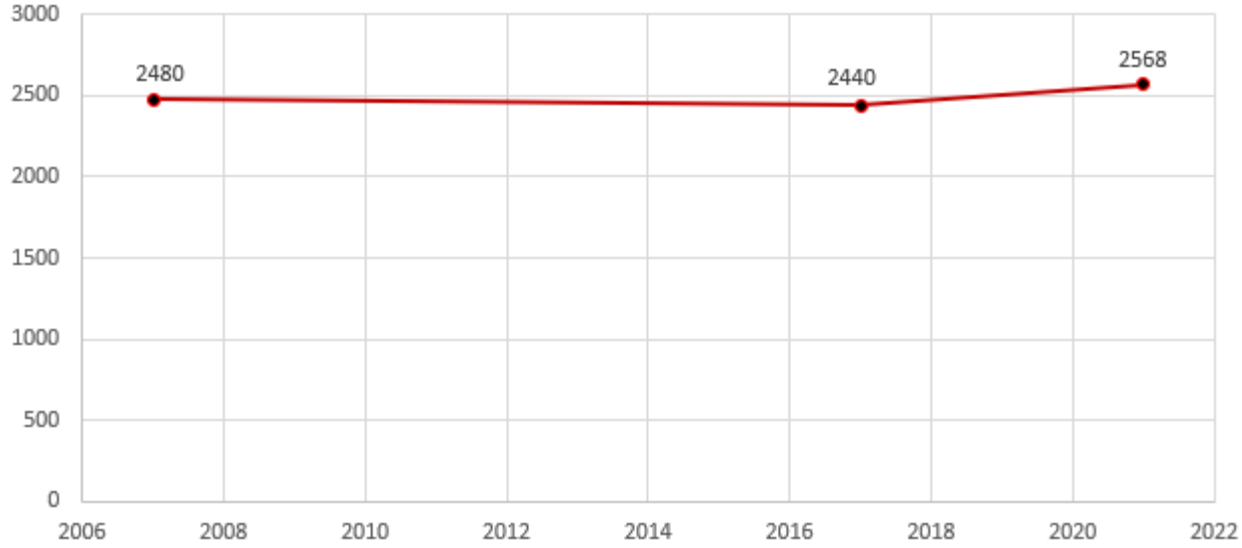


Figure 9 Frankford Road Traffic Volumes by Year



2.5 Road Safety Performance

Available crash data for all crashes reported to Tasmania Police was sourced from the Department of State Growth for the study area between 1st January 2017 and 31st May 2022. Crash data can provide valuable information on the road safety performance of a road network.

The findings of the crash data is summarised as follows:

- A total of 32 crashes were reported during this time.
- Severity. 3 crashes involved serious injury; 2 crashes involved minor injury; 3 crashes involved first aid at the scene; 24 crashes involved property damage only.
- Time of day. The majority of crashes were reported between 7:00am and 7:00pm (30 crashes). 1 crash was reported prior to 7:00am and 1 crash was reported after 7:00pm. Crashes were relatively evenly distributed during typical business hours, with no dominant peaks. The crash rate was slightly higher between 10:00am and 5:00pm.
- Day of week. Weekday crashes were dominant. 7 crashes were reported on Mondays and Wednesdays; 5 crashes were reported on Thursdays; 4 crashes were reported on Tuesdays and Saturdays; 3 crashes were reported on Sundays; 2 crashes were reported on Fridays. Crashes by day of week is shown in Figure 10.
- Crash types. 10 crashes involved 'other-manoeuvring' collisions; 4 crashes involved 'right-rear' collisions at intersections; 3 crashes involved 'emerging-from-driveway-or-lane'; and various other crash types with no clear crash trend. A full summary of crash types is shown in Figure 11. 'Other-manoeuvring' crashes are considered typical of crashes in high conflict areas such as shopping centres.
- Crash locations. 3 crashes were reported at the Frankford Road intersection; 2 crashes were reported at the Biloo Street intersection; 2 crashes were reported at the Murray Street intersection; 12 crashes were reported at midblock locations on Main Road; 9 crashes were reported in 'off-road' locations.
- Vulnerable road users. 2 crashes involved pedestrians (both at midblock locations, 1 resulting in minor injury and 1 resulting in first aid); 1 crash involved a motorcycle (Frankford Road resulting in serious injury). No crashes involved bicycles.

It is noted that a general increase in crashes has occurred since the preparation of the 2015 Exeter Traffic Study. The increased crashes appear to have occurred in Main Road in midblock locations.

The most recent 5-year assessment period noted a higher crash rate involving injury compared to the 5-year period assessed in the 2015 Traffic Study. Two pedestrian crashes have occurred in the most recent 5-year period, compared to no crashes in the 5-year assessment of the 2015 Traffic Study. The higher crash rate may be indicative of increased activity within the Exeter centre (increased population as shown in Table 1; and associated higher traffic volumes and increased pedestrian and parking manoeuvres within the centre).

The crash rates are considered relatively low and the crash history does not indicate that there are any specific road safety deficiencies in the Exeter transport network.

Figure 10 Crashes by Day of Week

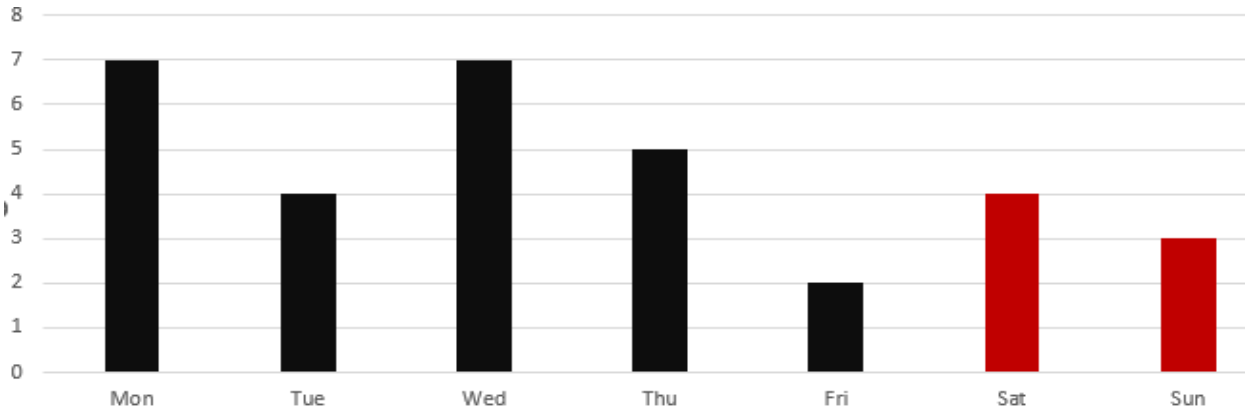
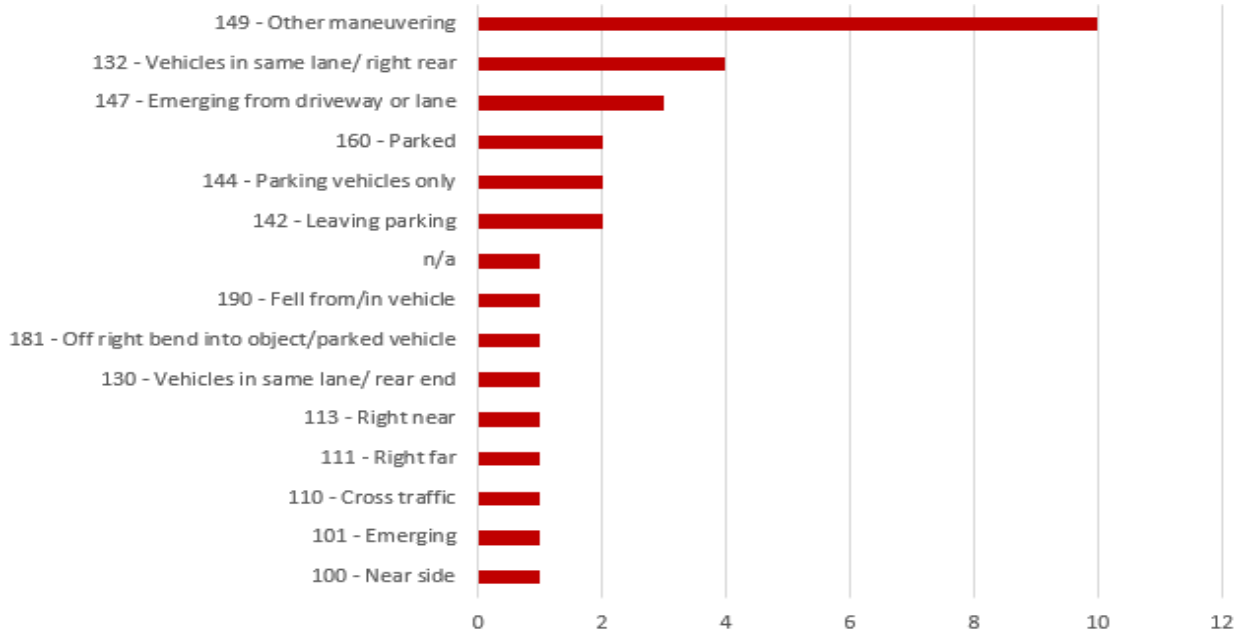


Figure 11 Crash Types



2.6 Freight Task

The two state highways that connect to Exeter (West Tamar Highway and Frankford Road) are strategically important freight routes for the region. The West Tamar Highway carries freight between Launceston to and from Batman and Frankford Highways. In terms of freight task, West Tamar Highway plays a lesser role than East Tamar Highway for north/ south freight movements along the Tamar corridor.

Frankford Road provides an important freight link between Bass Highway and Bell Bay (connecting with West Tamar Highway, Batman Highway and East Tamar Highway).

The primary freight task for West Tamar Highway and Frankford Road are the movement of forestry and agricultural products within the region.

Data from the Department of State Growth indicates that West Tamar Highway south of Glen Ard Mohr Road carries approximately 13.0% heavy vehicles per day (2021 data). This equates to approximately 907 heavy vehicles per day.

Frankford Road west of Main Road carries approximately 16.5% heavy vehicles (2021 data). This equates to approximately 424 heavy vehicles per day.

2.7 Public Transport

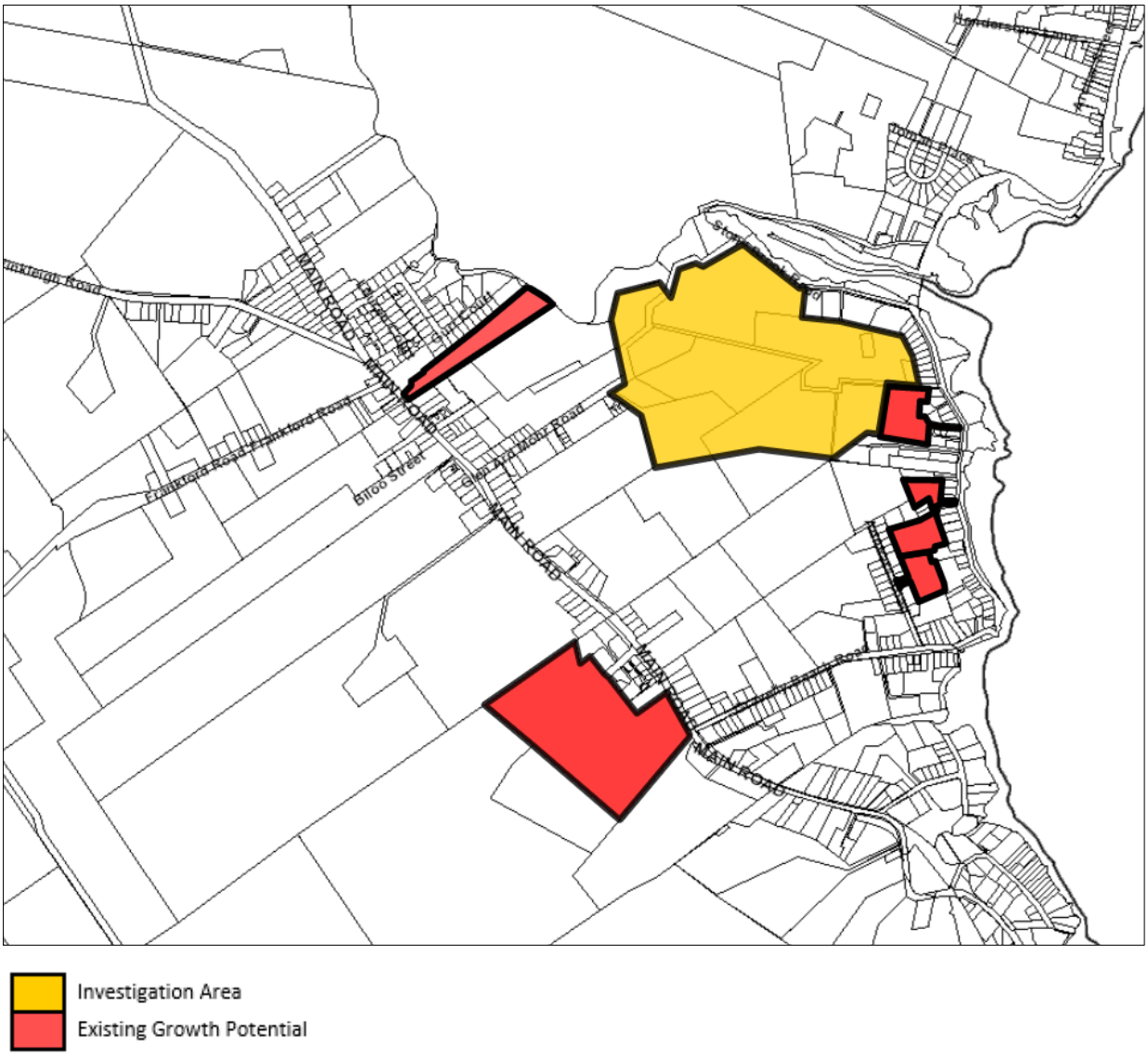
The public bus services for the West Tamar region is operated by Manions' Coaches. They run two regular bus routes between Launceston, Legana, Exeter and other towns in the West Tamar area.

3. Future Land Use & Traffic Generation

3.1 Land Use Development

Future land use development scenarios were provided by Council. Through the application of the Exeter Structure Plan, the areas that will have future land use development are shown in Figure 12.

Figure 12 Growth Areas



This report deals with the potential traffic generation associated with the 'Investigation Area', as well as land located along the Main Road corridor as shown in Figure 12. This area currently consists of large lots that can potentially be redeveloped at a higher density. Three different growth scenarios have been considered for future land use development in Investigation Area, located between Glen Ard Mohr Road and Gravelly Beach Road:

- Current Situation – this includes potential development for sites that are already zoned but not yet developed.
- Scenario 1 – Medium growth scenario
- Scenario 2 – High growth scenario

The development of this area will require an appropriate link road to be connected between Glen Ard Mohr Road and Gravelly Beach Road. The detailed assessment of this link road corridor is provided in Section 4.1.

The traffic generation of the resulting land use development utilising the link road (when fully developed) would be between 300 and 600 vehicles per day for Scenarios 1 and 2 respectively. The peak traffic flow is likely to be between 30 and 60 vehicles per hour for Scenarios 1 and 2 respectively. The traffic generation associated with this area will be distributed between Main Road and Gravelly Beach Road.

Potential land development of land located east of Main Road near the Frankford Road junction will have the following traffic generation:

- Land east of Main Road near hotel. Approximately 20 lots, daily generation of 160 vpd, peak 16 vph.
- Land opposite Glen Ard Mohr Road. Approximately 40 lots, daily generation 320 vpd, peak 32 vph.

4. Transport Network Modifications

4.1 Glen Ard Mohr Rd to Gravelly Beach Rd Link

The Exeter Structure Plan recommended a road connection between Glen Ard Mohr Road and Gravelly Beach Road. This link will facilitate traffic generation associated with residential land use development (as outlined in Section 3.1), as well as redistribute traffic currently utilising Glen Ard Mohr Road between Main Road and Gravelly Beach Road (Glen Ard Mohr Road is currently only accessible via Main Road).

Glen Ard Mohr Road consists of a sealed section between Main Road and Exeter Primary School. North of the school, Glen Ard Mohr Road has an unsealed surface and provides access to several residential properties, as well as Traill Road and Stony Brook Road. A turning circle is provided towards the north-eastern end of Glen Ard Mohr Road, which enables buses to turn at the school and return to Main Road. The turning circle is shown in Figure 13.

Without significant land acquisition, there are two key routes that are considered to be viable to connect Glen Ard Mohr Road to Gravelly Beach Road. These utilise and upgrade either Stony Brook Road or Traill Road. The road corridors are shown in Figure 14.

The Stony Brook Road corridor is a logical extension of the Glen Ard Mohr Road corridor and has an existing junction arrangement at the Gravelly Beach Road. The existing corridor width of Glen Ard Mohr Road to its junction with Stony Brook Road is 20 metres. The corridor width of Stoney Brook Road is approximately 10.5 metres. The alignment of Glen Ard Mohr Road consists of several bends, that would result in some tight road curves. Stony Brook Road has a relatively straight alignment between Glen Ard Mohr Road and Gravelly Beach Road, with some minor curves along its length.

The Traill Road corridor consists of two straight sections connected by a series of sharp bends that skirt around existing property boundaries. Traill Road is discontinuous towards the Gravelly Beach Road end. The road itself is narrow and unsealed along its length. It is noted that the unsealed road does not follow the exact alignment of the road corridor, with a 'short-cut' created at the acute angle located within the property of 44 Glen Ard Mohr Road.

A summary of the technical assessment of the two corridors is provided in Table 4.

Figure 13 Glen Ard Mohr Rd Turning Area

Figure 14 Glen Ard Mohr Rd Connector Corridor Options

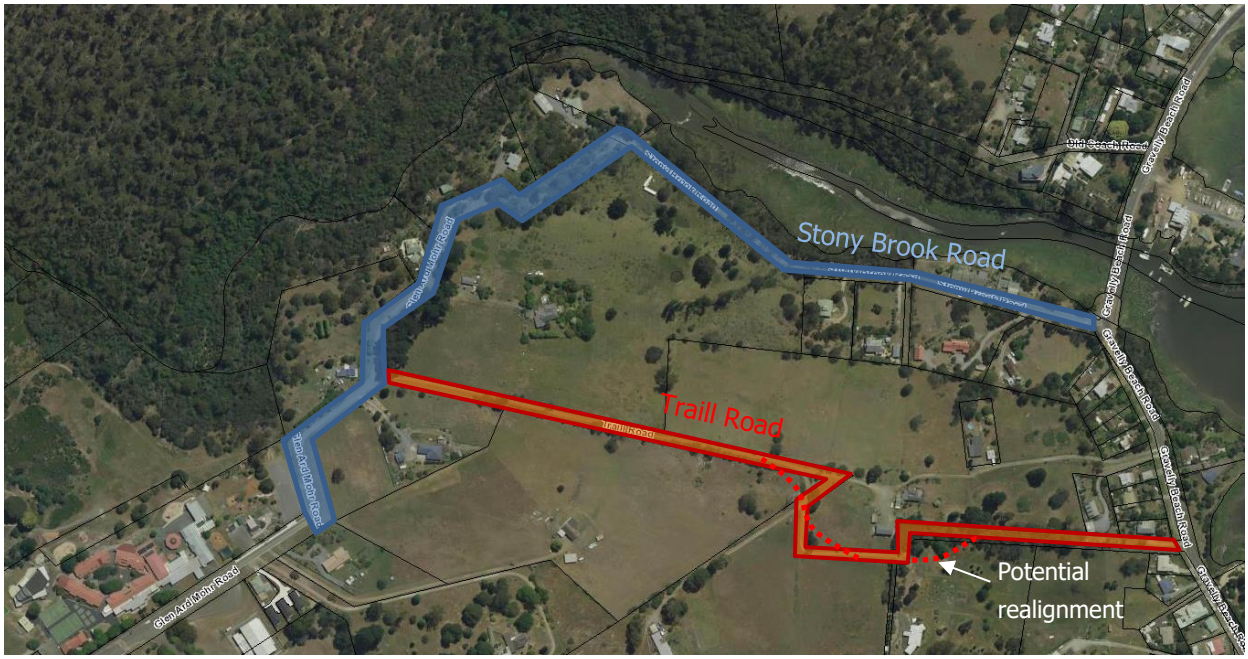


Image Source: LIST Map, DPIPWE

Table 4 Glen Ard Mohr to Gravelly Beach Road Options Summary

	Stony Brook Rd	Trail Rd
Route Length (school car park to Gravelly Beach Rd)	1.06 kilometres	1.05 kilometres
Corridor Width	Glen Ard Mohr Road: 20 metres width for approximately 550 metres Stony Brook Road: 10.5 metres width for approximately 510 metres	Glen Ard Mohr Road: 20 metres width for approximately 170 metres. Traill Road: 9.5 metres width for approximately 880 metres.
Vertical terrain	Approximately 18% maximum grade towards the northern end of Glen Ard Mohr Road.	Approximately 11% grade towards Gravelly Beach Road.
Horizontal geometry	Route consists of several curves along its length.	Route has relatively straight alignment with a short section of tight curves. Some realignment of corridor is required.
Junctions	Stony Brook Road has an existing road junction with Gravelly Beach Road. No other road junctions are located along the route. Junction located close to Stony Brook bridge. The installation of right turn lanes are not possible if required in future.	Traill Road does not have an existing road junction at Gravelly Beach Road, but has two existing driveways that occupy the corridor width at the junction location. No other road junctions are located along the route. There is sufficient road width in Gravelly Beach Road to provide a right turn lane if required in future.
Land acquisition requirements	Little to no land acquisition required.	Little land acquisition required. Some alignment adjustments may require boundary adjustments key locations.
Sight distance at Gravelly Beach Road	Acceptable: Approximately 150 metres in both directions along Gravelly Beach Road.	Acceptable: Approximately 160 metres to the north and 150 metres to the south along Gravelly Beach Road.
Other considerations	Difficult to widen existing corridor width of Stony Brook Road.	The junction of Traill Road with Gravelly Beach Road has a utility pole that would require relocation.

It is considered that either the Stony Brook Road or Traill Road corridors are suitable for formalising the connection between Glen Ard Mohr Road and Gravelly Beach Road. On balance, the use of Traill Road is the preferred route as future subdivision of land can accommodate a wider corridor with improved alignment. The use of Traill Road also provides improved connectivity for future subdivision by providing a central road link, rather than alignment of Stony Brook Road that traverses around the perimeter of the subdivision area.

The corridor width of Stony Brook Road is constrained by existing property boundaries and is not considered appropriate for upgrading to cater for increased traffic.

The design of the link road should incorporate the following design features[1]:

- Corridor width 18 metres
- Sealed road width 8.9 metres
- Junction at Gravelly Beach Road T-Junction

It is noted that Traill Road's corridor width is constrained to approximately 14 metres near Gravelly Beach Road. This is similar to the corridor width of Stoney Brook Road at its junction with Gravelly Beach Road and still facilitates a 8.9 metres pavement width as well as footpaths on both sides of the road.

4.2 Murray St to Wildmore Crs Link

The Structure Plan recommended the provision of a new link road between Murray Street and the Frankford Road/ Main Road junction through the northern portion of The Exeter Hotel car park. It is also possible to connect the link road to Wildmore Crescent. This results in two new roads connected by a T-junction. It should also be noted that the junction priority of the resulting intersection could also be between the link connecting between Frankford Road and Murray Street, with the Wildmore Crescent link being the minor leg.

An indicative alignment of the link road connecting to the Main road/ Frankford Road intersection is shown in Figure 15.

The aim of the link road is to reduce the pressure on Murray Street as the only current access to the Hall. Access to the Hall will be improved via direct access from Frankford Road and the northern approach of West Tamar Highway via a new roundabout. The connection to Wildmore Crescent also provides alternative access and improved connectivity to the town centre for residential subdivision areas north of Frankford Road.

The link road will also enable vehicle circulation around the shopping areas and provide access to more parking areas. The design of the new link road would need to carefully consider the revised access configuration of the Hotel, as well as additional parking opportunities along the new road's length.

[1] LGAT Tasmanian Standard Drawings, May 2020 – 'Local Through Road' classification requirements.

The traffic modelling of the link road is factored into the analysis of the proposed roundabout at Main Road/ Frankford Road.

The design of the link road should incorporate the following design features[2]:

- Corridor width 20.0 metres
- Sealed road width 11.0 metres
- Junction with Frankford Road/ Main Rd Roundabout
- New junction connecting Murray St, Wildmore Crs and Main Rd T-junction or roundabout

As well as increasing accessibility and circulation for existing parking, the 11.0 metre road width will facilitate additional on-street parking on both sides of the road, thus increasing parking supply within the Town Centre.

It is noted that the link road can facilitate residential development to the east of the Wildmore Crescent/ Main road link.

The connection of the link road to the Main Road/ Frankford Road junction will necessitate modifications to the Tavern's car park. Specifically, some of the car park will be required to be relocated elsewhere (to the east of the Tavern), and a new access to the car park should be connected to the link road.

Figure 15 Indicative Murray St to Wildmore Crs Link via Frankford Rd Junction

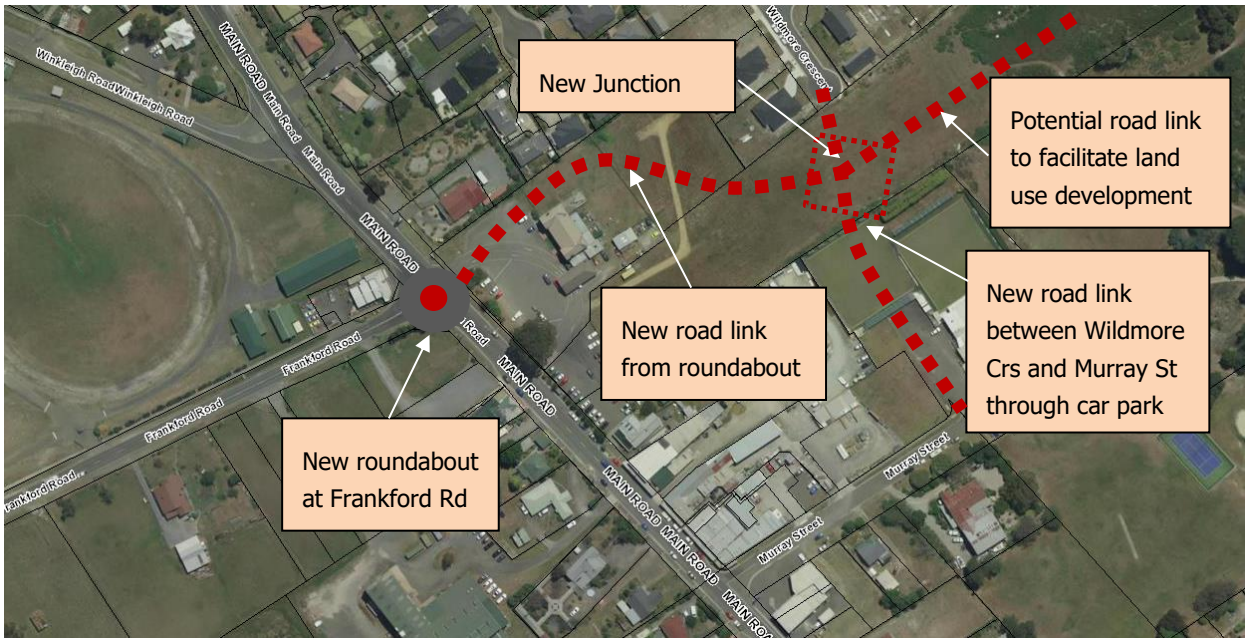


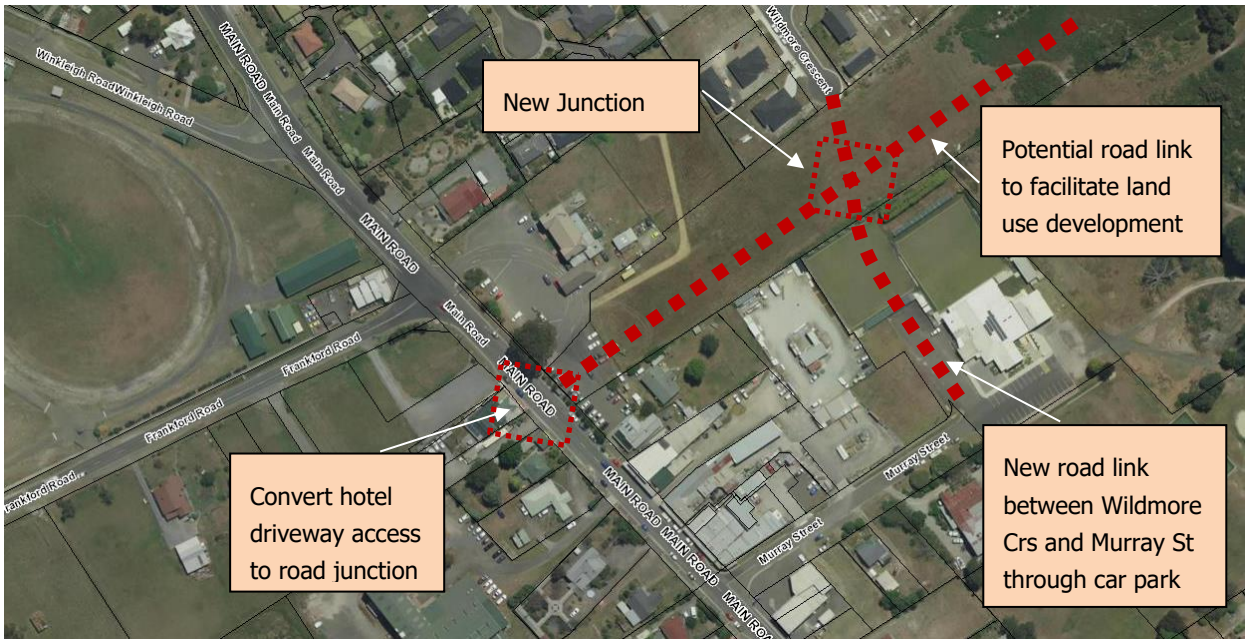
Image Source: LIST Map, DPIPWE

[2] LGAT Tasmanian Standard Drawings, May 2020 – 'Collector Through Road' classification requirements.

It is noted that a road link is also possible along the southern side of the Hotel, adjacent to the boundary with 120 Main Road. A link road in this location would facilitate land use development between Main Road and Stony Brook but provides a lower level of connectivity and circulation within the network. This concept converts the Hotel driveway access to a new T-junction on Main Road between Frankford Road and Murray Street.

This link road concept is shown in Figure 16

Figure 16 Indicative Murray St to Wildmore Crs Link via Main Rd Junction



5. Traffic Analysis

Correction:
Surveys were undertaken on Tuesday 28 June 2022

5.1 Turning Movement Surveys

Turning movement surveys were undertaken at three key junctions within the study area on 18th June 2022 during the morning and afternoon peak periods. The turning movement surveys were located as follows:

- Main Road/ Frankford Road
- Main Road/ Murray Street
- Main Road/ Glen Ard Mohr Road

The turning movements are summarised in Figure 17 and Figure 18 for the AM and PM peak periods respectively.

Figure 17 AM Peak Key Junction Turning Movement Surveys

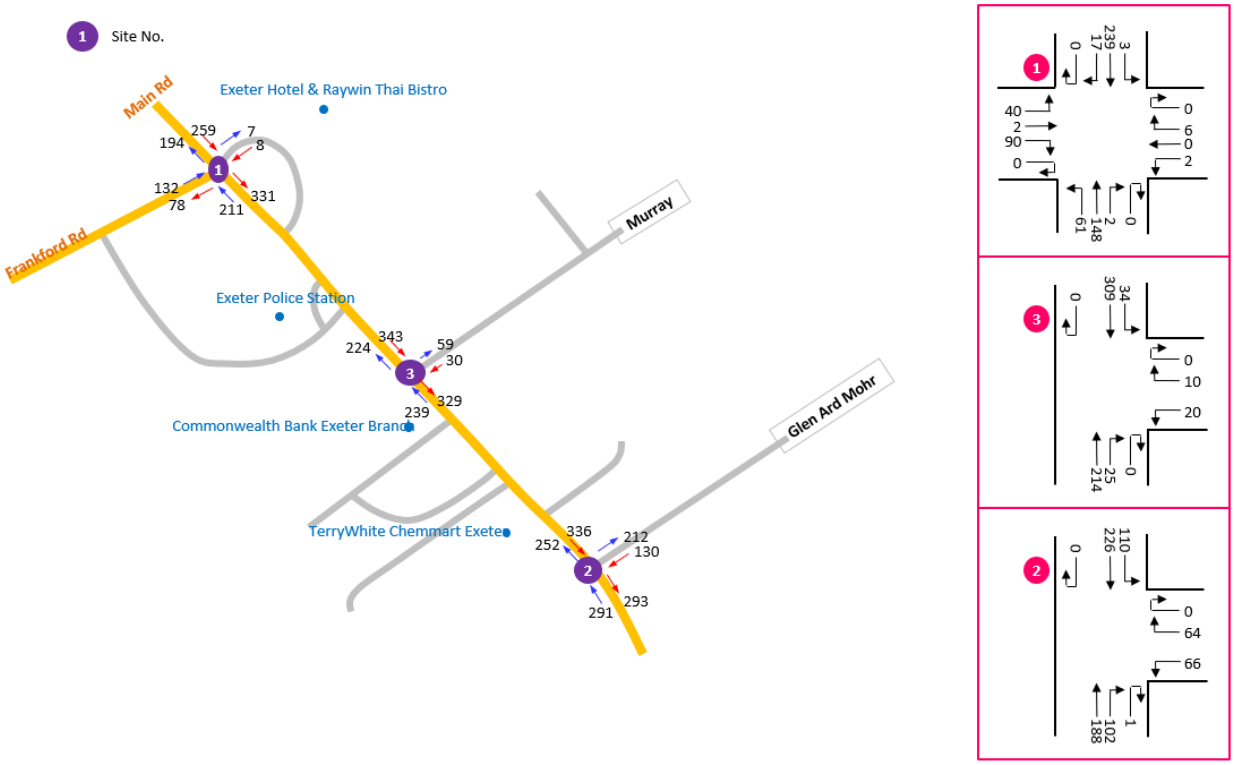
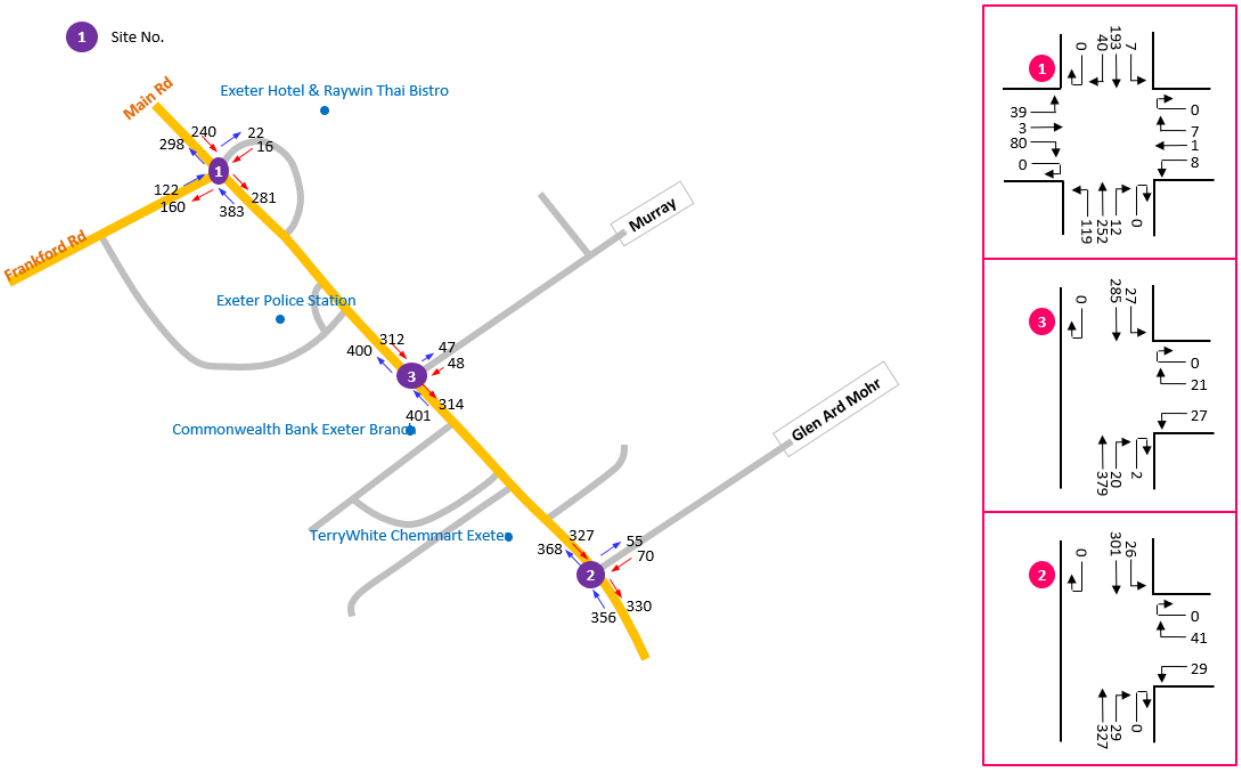


Figure 18 PM Peak Key Junction Turning Movement Surveys



5.2 Traffic Generation and Background Traffic Growth

Traffic flow within and through Exeter will increase as a result of land use development within Exeter and background traffic growth on the arterial roads that connect to Exeter.

Section 2.3.2 highlighted the relatively low historic growth rates in Main Road (West Tamar Highway) and Frankford Road over the last decade. A compound growth rate of 1.0% per annum has been assumed for future background traffic growth. This has been assumed on the basis that development and investment in Exeter will attract traffic from the surrounding region.

The implementation of the Exeter Structure Plan will also generate traffic from land use within the study area. The traffic generation associated with two development scenarios (Scenarios 1 and 2 as outlined in Section 3.1) within the study area is summarised in Section 3.1.

5.3 Intersection Modelling

Traffic modelling was undertaken using SIDRA Intersection software for key intersections within the study area.

SIDRA uses complex analytical traffic models coupled with iterative approximation technique to provide estimates of capacity and performance of intersections. SIDRA is endorsed as a modelling tool by Austroads.

One of the key SIDRA outputs is an indication of level of service (LOS) at intersections. The LOS concept describes the quality of traffic service in terms of 6 levels, with level of service A (LOS A) representing the best operating condition (ie. at or close to free flow) and level of service F (LOS F) representing the worst (i.e. forced flow). Other key outputs of SIDRA include movement delay and 95th percentile queue lengths[3].

The level of service method used in the modelling is the Delay method, where level of service is based solely on average movement delay, including geometric delay, as summarised in Table 5.

The following intersections were modelled:

- Main Road/ Frankford Road
- Main Road/ Glen Ard Mohr Road
- Main Road/ Murray Street
- Gravelly Beach Road/ Glen Ard Mohr Extension (Traill Road)

These intersections were modelled for AM and PM peak periods for 2022, 2032 and 2042 scenarios. The detailed SIDRA modelling summaries of each of these scenarios is provided in Appendices A, B, C and D. The reporting tables for SIDRA modelling undertaken in this report have included the LOS colour coding provided in Table 5 for quick reference.

Table 5 SIDRA LOS Performance standards

Level of Service	Signals and Roundabouts	Sign Control (Give Way & Stop)
A	$d \leq 10$	$d \leq 10$
B	$10 < d \leq 20$	$10 < d \leq 15$
C	$20 < d \leq 35$	$15 < d \leq 25$
D	$35 < d \leq 55$	$25 < d \leq 35$
E	$55 < d \leq 80$	$35 < d \leq 50$
F	$80 < d$	$50 < d$

[3] This is the queue length not exceeded 95% of the time

The lowest target level of service considered acceptable for an urban environment is LOS D, which corresponds to a maximum delay of 55 seconds for signals and roundabouts and 35 seconds for give-way controlled intersections. LOS E and F represent the junction operating at capacity, with forced flow conditions. Being a small regional town, a target of LOS C is considered appropriate for intersections in Exeter.

5.4 Main Road/ Frankford Road

The intersection of Main Road/ Frankford Road is a T-junction that also incorporates a car park access opposite Frankford Road. The existing junction layout is shown in Figure 19.

SIDRA modelling was undertaken at the intersection for the following scenarios for the AM and PM peak periods:

- 2022 existing conditions
- 2032 traffic conditions with the intersection infrastructure unaltered.
- 2042 traffic conditions with the intersection infrastructure unaltered.
- 2032 traffic conditions with the intersection modified to a 30m diameter roundabout and the car park access modified to a road connection.
- 2042 traffic conditions with the intersection modified to a 30m diameter roundabout and the car park access modified to a road connection.

The detailed SIDRA modelling outputs are provided in Appendix A.

Existing traffic movements at the junction were obtained by surveys undertaken in June 2022 (refer to Figure 17 and Figure 18). Future traffic forecast conditions were calculated using the following assumptions:

- Background traffic growth of all roads will be 1.0% per annum compound growth.
- Traffic generation of the key areas will be in accordance with the maximum lot yield associated with the implementation of the Draft Exeter Structure Plan. The traffic generation of these areas is provided in Section 3.1.

Figure 19 Main Road/ Frankford Road Junction

Image Source: LIST Map, DPIPWE

The results of the SIDRA modelling are summarised in Table 6. Table 6

It can be seen that the existing junction layout will continue to perform at an acceptable level of service until 2042 (LOS C). Whilst this is a good outcome from a traffic performance perspective, the junction is operating as a four-way give-way junction which have relatively poor road safety performance compared to T-junctions or roundabouts. The increased traffic utilising the intersection would therefore likely result in increased crashes at this location noting that three crashes have been reported at this junction in the past five years, making it the highest crash location within the study area.

The installation of the roundabout improved the level of service of the junction significantly, with LOS A for all approaches in 2032 and 2042. The roundabout also facilitates the proposed road link that connects between Wildmore Crescent and Murray Street. The roundabout is therefore strongly recommended at the Main Road/ Frankford Road junction to facilitate the Murray Street connector link road, improve traffic performance, and improve road safety.

It was also noted that the modelling indicated that some delays occurred for right turning traffic entering the Tavern in 2032 and 2042. In practice there is sufficient room for vehicles to pass a propped vehicle turning right, thereby reducing the actual delays for this approach.

Table 6 Main Rd/ Frankford Rd SIDRA Modelling Summary

Scenario	Worst approach average delay (s)	Worst approach 95th percentile queue length (m)	Worst approach LOS
Existing Layout 2022 AM	16.2s Frankford Rd approach	12.6m Main Rd north approach	LOS C Frankford Rd
Existing Layout 2022 PM	15.9s Frankford Rd approach	11.9m Main Rd north approach	LOS C Frankford Rd
Existing Layout 2032 AM	19.7s Frankford Rd approach	19.3m Frankford Rd approach	LOS C Frankford Rd & Tavern
Existing Layout 2032 PM	19.2s Frankford Rd approach	13.4m Frankford Rd approach	LOS C Frankford Rd
Existing Layout 2042 AM	22.8s Frankford Rd approach	25.2m Frankford Rd approach	LOS C Frankford Rd & Tavern
Existing Layout 2042 PM	23.3s Frankford Rd approach	18.9m Frankford Rd approach	LOS C Frankford Rd & Tavern
Roundabout 2032 AM	13.5s Tavern approach	13.7m Main Rd north approach	LOS A all approaches
Roundabout 2032 PM	13.1s Frankford Rd approach	16.2m Main Rd north approach	LOS A all approaches
Roundabout 2042 AM	13.8s Tavern approach	15.2m Main Rd north approach	LOS A all approaches
Roundabout 2042 PM	13.3s Frankford Rd approach	18.8m Main Rd south approach	LOS A all approaches

5.4.1 Alternative Link from Main Road

As noted in Section 4.2, an alternative link road can be constructed to connect to Main Road immediately north of 170 Main Road. This link would connect to Main Road as a T-junction, rather than at the Frankford Road junction.

This potential link road will likely carry less traffic than a connection to a roundabout connection at Frankford Road. Traffic modelling of this potential junction with Main Road was not undertaken in this report, however it is noted that the performance of a T-junction at this location is likely to have a similar

performance to the Murray Street connection (with high LOS in 2032 and 2042). The analysis of the Main Road/ Murray Street junction is provided in Section 5.6.

5.5 Main Road/ Glen Ard Mohr Road

The intersection of Main Road/ Glen Ard Mohr Road is a T-junction with Main Road having priority. A central turn lane median has been installed in Main Road, acting as a channelised right turn lane for Glen Ard Mohr Road, as well as other driveway accesses near the junction. The existing junction layout is shown in Figure 20.

SIDRA modelling was undertaken at the intersection for the following scenarios for the AM and PM peak periods:

- 2022 existing conditions
- 2032 traffic conditions with the intersection infrastructure unaltered.
- 2042 traffic conditions with the intersection infrastructure unaltered.
- 2032 traffic conditions with the intersection modified to a 30m diameter roundabout.
- 2042 traffic conditions with the intersection modified to a 30m diameter roundabout.

The detailed SIDRA Modelling outputs for this intersection are provided in Appendix B.

Existing traffic movements at the junction were obtained by surveys undertaken in June 2022 (refer to Figure 17 and Figure 18). Future traffic forecast conditions were calculated using the following assumptions:

- Background traffic growth of all roads will be 1.0% per annum compound growth.
- Traffic generation of the key areas will be in accordance with the maximum lot yield associated with the implementation of the Draft Exeter Structure Plan. The traffic generation of these areas is provided in Section 2.4.
- The connection of Glen Ard Mohr Road to Gravelly Beach Road will result in 60% of traffic generated by future subdivision will access Main Road (balance of 40% will access Gravelly Beach Road).

Figure 20 Main Road/ Glen Ard Mohr Road Junction

Image Source: LIST Map, DPIPWE

The results of the SIDRA modelling for this intersection are summarised in Table 7. It can be seen that the existing junction layout will continue to perform at an acceptable level of service until 2032 (LOS C). The existing layout of the intersection deteriorates to LOS D by 2042. LOS D during peak periods is considered acceptable for urban junctions, however LOS C is desirable in a rural context.

The roundabout performed at a high level of service (LOS B) with minimal delays and queues in 2032 and 2042. The roundabout provides a more efficient access to Glen Ard Mohr Road and will cater for the expected traffic growth associated with the road's proposed connection to Gravelly Beach Road.

Table 7 Main Rd/ Glen Ard Mohr Rd SIDRA Modelling Summary

Scenario	Worst approach average delay (s)	Worst approach 95th percentile queue length (m)	Worst approach LOS
Existing Layout 2022 AM	18.1s Glen Ard Mohr Rd approach	12.2m Glen Ard Mohr Rd approach	LOS C Glen Ard Mohr Rd
Existing Layout 2022 PM	16.0s Glen Ard Mohr Rd approach	4.8m Glen Ard Mohr Rd approach	LOS C Glen Ard Mohr Rd
Existing Layout 2032 AM	24.6s Glen Ard Mohr Rd approach	26.0m Glen Ard Mohr Rd approach	LOS C Glen Ard Mohr Rd
Existing Layout 2032 PM	19.4s Glen Ard Mohr Rd approach	8.6m Glen Ard Mohr Rd approach	LOS C Glen Ard Mohr Rd
Existing Layout 2042 AM	30.8s Glen Ard Mohr Rd approach	36.0m Glen Ard Mohr Rd approach	LOS D Glen Ard Mohr Rd
Existing Layout 2042 PM	23.1s Glen Ard Mohr Rd approach	11.7m Glen Ard Mohr Rd approach	LOS C Glen Ard Mohr Rd
Roundabout 2032 AM	10.3s Glen Ard Mohr Rd approach	16.9m Main Rd north approach	LOS B Glen Ard Mohr Rd
Roundabout 2032 PM	10.6s Glen Ard Mohr Rd approach	15.2s Main Rd south approach	LOS B Glen Ard Mohr Rd
Roundabout 2042 AM	10.4s Glen Ard Mohr Rd approach	19.2m Main Rd north approach	LOS B Glen Ard Mohr Rd
Roundabout 2042 PM	11.0s Glen Ard Mohr Rd approach	17.5s Main Rd south approach	LOS B Glen Ard Mohr Rd

5.6 Main Road/ Murray Street

The intersection of Main Road/ Murray Street is a T-junction with Main Road having priority. The existing junction layout is shown in Figure 21.

SIDRA modelling was undertaken at the intersection for the following scenarios for the AM and PM peak periods:

- 2022 existing conditions
- 2032 traffic conditions with the intersection infrastructure unaltered.

- 2042 traffic conditions with the intersection infrastructure unaltered.

The detailed SIDRA modelling outputs for this intersection are provided in Appendix C.

Existing traffic movements at the junction were obtained by surveys undertaken in June 2022 (refer to Figure 17 and Figure 18). Future traffic forecast conditions were calculated using the following assumptions:

- Background traffic growth of all roads will be 1.0% per annum compound growth.
- Traffic generation of the key areas will be in accordance with the maximum lot yield associated with the implementation of the Draft Exeter Structure Plan. The traffic generation of these areas is provided in Section 2.4.

Figure 21 Main Road/ Murray Street Junction

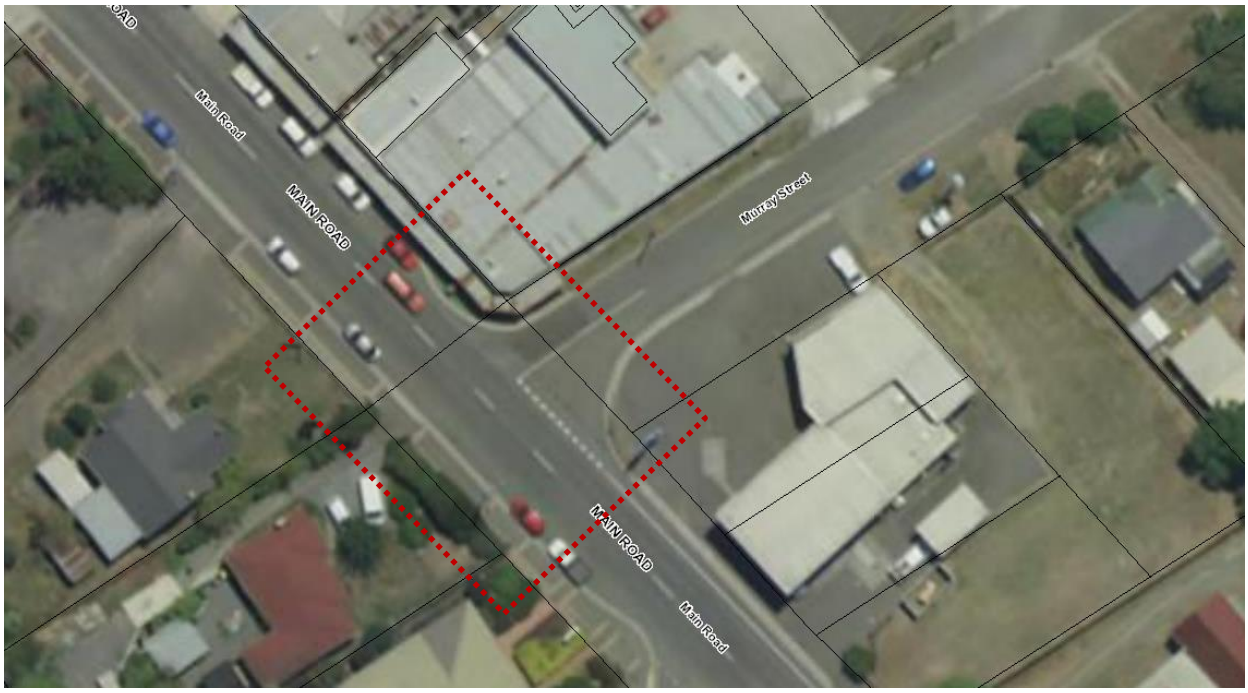


Image Source: LIST Map, DPIPWE

The results of the SIDRA modelling for this intersection are summarised in Table 8. It can be seen that the existing junction layout will continue to perform at an acceptable level of service until 2042 (LOS C).

Whilst no changes are required to accommodate forecast traffic flows at the intersection, the installation of a channelised right turn lane would benefit the proposed link road between Murray Street and Wildmore Crescent.

Table 8 Main Road/ Murray Street SIDRA Modelling Summary

Scenario	Worst approach average delay (s)	Worst approach 95th percentile queue length (m)	Worst approach LOS
Existing Layout 2022 AM	15.8s Murray St approach	12.1m Main Rd south approach	LOS C Murray St
Existing Layout 2022 PM	15.5s Murray St approach	14.2m Main Rd south approach	LOS C Murray St
Existing Layout 2032 AM	16.6s Murray St approach	13.8m Main Rd south approach	LOS C Murray St
Existing Layout 2032 PM	19.7s Murray St approach	18.0m Main Rd south approach	LOS C Murray St
Existing Layout 2042 AM	17.9s Murray St approach	15.9m Main Rd south approach	LOS C Murray St
Existing Layout 2042 PM	20.9s Murray St approach	20.4m Main Rd south approach	LOS C Murray St

5.7 Gravelly Beach Road/ Traill Road

The upgrade of Traill Road was the preferred link route for the connection with Glen Ard Mohr Road. The junction of Gravelly Beach Road with Traill Road was therefore assessed in accordance with the likely traffic use of the proposed route. Traill Road does not currently formally connect to Gravelly Beach Road. The corridor connects between the properties of 175 and 177 Gravelly Beach Road. The existing layout is shown in Figure 22.

Traffic movements at the proposed junction of Gravelly Beach Road and Traill Road will consist of the following:

- Traffic generation of the potential residential lots within the Assessment Area shown in Figure 12.
- Network route changes associated with increased connectivity between Gravelly Beach Road and Main Road.

SIDRA modelling was undertaken at the intersection for the following scenarios for the AM and PM peak periods:

- 2032 traffic conditions with the intersection configured as a T-junction.
- 2042 traffic conditions with the intersection configured as a T-junction.

Note that 2022 modelling was not undertaken as the existing layout consists of two domestic driveways rather than an intersection. Modelling was undertaken on the basis that the newly constructed junction would not be operational until it had traffic associated with subdivision between Gravelly Beach Road and Glen Ard Mohr Road. It is assumed that traffic associated with all subdivision connecting to Traill Road is complete by 2032.

Future traffic forecast conditions were calculated using the following assumptions:

- Background traffic growth of all roads will be 1.0% per annum compound growth.
- Traffic generation of the key areas will be in accordance with the maximum lot yield associated with the implementation of the Draft Exeter Structure Plan. The traffic generation of these areas is provided in Section 3.1.
- The connection of Glen Ard Mohr Road to Gravelly Beach Road will result in 40% of traffic generated by future subdivision will access Gravelly Beach Road (balance of 60% will access Glen Ard Mohr Road).
- The connection of Glen Ard Mohr Road to Gravelly Beach Road will induce approximately 25% of traffic currently utilising Glen Ard Mohr Road.

Figure 22 Existing Gravelly Beach Road/ Traill Road Access

Image Source: LIST Map, DPIPWE

The results of the SIDRA modelling for this intersection are summarised in Table 9. The detailed SIDRA modelling outputs for this intersection are provided in Appendix D. The SIDRA results indicate that the T-junction will perform at a high level of service until 2042 (LOS B).

The proposed T-junction is therefore considered appropriate to cater for the forecast traffic generation associated with future subdivision of the area between Glen Ard Mohr Road and Gravelly Beach Road.

The intersection was also checked against Austroads turn lane warrants. For roads with a design speed less than 70-km/h, the turn lane warrants are reproduced in Figure 23. With right turn volumes (Gravelly Beach Road to Traill Road) peaking at 41 vehicles per hour and corresponding major road volume of approximately 214 vehicles per hour, the requirement for a Basic Auxiliary right turn lane is noted (BAR). This would require localised pavement widening to enable southbound traffic to pass a vehicle propped to turn right at the junction. This should be considered for the design as a minimum standard, with a channelised right turn lane considered to provide a high level of service and safety.

It is noted that the intersection will perform at a relatively high level of service without the installation of a BAR facility. In an urban low-speed context turn lanes are often not provided and still operate at acceptable levels of service without having significant safety issues. Channelised turn lanes are not provided at other junctions along Gravelly Beach Road (Tomah Place, Stony Brook Road, Henersons Lane and Rodmans Lane for example).

Figure 23 Austroads Warrants for Turn Lanes

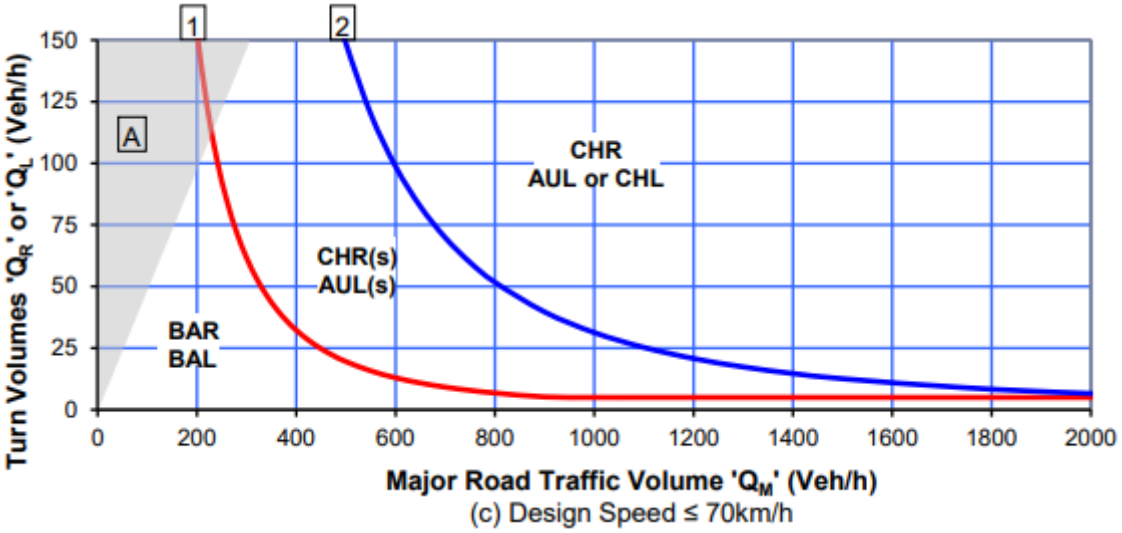


Table 9 Gravelly Beach Rd/ Traill Rd SIDRA Modelling Summary

Scenario	Worst approach average delay (s)	Worst approach 95th percentile queue length (m)	Worst approach LOS
T-Junction 2032 AM	10.6s Traill Rd approach	3.1m Gravelly Beach Rd north approach	LOS B Traill Rd
T-Junction 2032 PM	11.2s Traill Rd approach	4.2m Gravelly Beach Rd north approach	LOS B Traill Rd
T-Junction 2042 AM	10.9s Traill Rd approach	3.5m Gravelly Beach Rd north approach	LOS B Traill Rd
T-Junction 2042 PM	11.6s Traill Rd approach	4.7m Gravelly Beach Rd north approach	LOS B Traill Rd

6. Recommendations & Conclusions

This report documents the findings of an options assessment of the growth scenarios being considered as part of the review of the Exeter Structure Plan.

The Exeter Traffic Study was originally prepared in 2015. This report investigated the high level impacts of the Structure Plan and recommended various infrastructure modifications to cater for land use development over 20 years. Since the preparation of the Exeter Traffic Study some of these recommendations have been implemented (such as the Biloo Street park).

This report investigated the following key transport infrastructure options:

- The preferred alignment of a link road connecting between Glen Ard Mohr Road and Gravelly Beach Road. An assessment of the impacts associated with traffic utilising the link road on the intersections with Main Road and Gravelly Beach Road.
- The preferred alignment of a link road connecting between Murray Street and Main Road with a link to Wildmore Crescent. An assessment of the impacts associated with traffic utilising the link road on the intersections with Main Road.

The findings of the above analysis are summarised in the following sections.

6.1 Glen Ard Mohr Rd to Gravelly Beach Rd Link

The use of Traill Road is the preferred route for the connection of Glen Ard Mohr Road and Gravelly Beach Road. The use of Traill Road provides improved connectivity for future subdivision by providing a central road link, rather than alignment of Stony Brook Road that traverses around the perimeter of the subdivision area.

The design of the link road should incorporate the following design features[4]:

- Corridor width 18 metres
- Sealed road width 8.9 metres
- Junction at Gravelly Beach Road T-Junction

It is noted that Traill Road's corridor width is constrained to approximately 14 metres near Gravelly Beach Road. This is similar to the corridor width of Stoney Brook Road at its junction with Gravelly Beach Road

[4] LGAT Tasmanian Standard Drawings, May 2020 – 'Local Through Road' classification requirements.

6.2 Murray Street to Main Road Link

Two potential link routes were considered for the link between Murray Street, Wildmore Crescent and Main Road. The selection of the link will be dependent to some extent on potential development applications associated with the land through which the link road will be constructed.

6.2.1 Connection to Main Road/ Frankford Road

The Structure Plan recommended a link road be constructed between Murray Street and the Main Road/ Frankford Road junction. Access to the Hall will be improved via direct access from Frankford Road and the northern approach of West Tamar Highway via a new roundabout. The connection to Wildmore Crescent also provides alternative access and improved connectivity to the town centre for residential subdivision areas north of Frankford Road.

The link road will also enable vehicle circulation around the shopping areas and provide access to more parking areas. The design of the new link road would need to carefully consider the revised access configuration of the Hotel, as well as additional parking opportunities along the new road's length.

The traffic modelling of the link road is factored into the analysis of the proposed roundabout at Main Road/ Frankford Road.

The design of the link road should incorporate the following design features[5]:

- Corridor width 18 metres
- Sealed road width 8.9 metres
- Junction with Frankford Road/ Main Rd Roundabout
- New junction connecting Murray St, Wildmore Crs and Main Rd T-junction or roundabout

The construction of the link road to the Main Road/ Frankford Road junction will necessitate modifications to the Tavern's car park. This will involve relocation of part of the car park and the construction of an access between the car park and the link road.

6.2.2 Connection to Main Road

An alternative link road can be constructed to connect to Main Road immediately north of 170 Main Road. This link would connect to Main Road as a T-junction, rather than at the Frankford Road junction.

This potential link road will likely carry less traffic than a connection to a roundabout connection at Frankford Road. Traffic modelling of this potential junction with Main Road was not undertaken in this report, however it is noted that the performance of a T-junction at this location is likely to have a similar performance to the Murray Street connection (with high LOS in 2032 and 2042).

The construction of the link road to connect with Main Road will necessitate modifications to the Tavern's car park.

[5] LGAT Tasmanian Standard Drawings, May 2020 – 'Local Through Road' classification requirements.

6.3 Main Road/ Frankford Road Junction

The Main Road/ Frankford Road junction is a T-junction that incorporates a car park access opposite Frankford Road.

SIDRA modelling indicates that the existing junction layout will continue to perform at an acceptable level of service until 2042 (LOS C). Whilst this is a good outcome from a traffic performance perspective, the junction is effectively operating as a four-way give-way junction. Four-way intersections have relatively poor road safety performance compared to T-junctions or roundabouts. The increased traffic utilising the intersection (associated with background traffic growth and land use development in the Exeter region) would therefore likely result in increased crashes at this location. This intersection was noted as being the highest crash location within the study area.

A roundabout was modelled for all forecast years during the AM and PM peak periods. The roundabout improved the level of service of the junction significantly, with LOS A for all approaches in 2032 and 2042. The roundabout also facilitates the proposed road link that connects between Wildmore Crescent and Murray Street.

The roundabout is therefore strongly recommended at the Main Road/ Frankford Road junction to facilitate the Murray Street connector link road, improve traffic performance, and improve road safety.

6.4 Main Road/ Glen Ard Mohr Road Junction

The Main Road/ Glen Ard Mohr Road junction is a T-junction with Main Road having priority. A central turn lane median has been installed in Main Road, acting as a channelised right turn lane for Glen Ard Mohr Road, as well as other driveway accesses near the junction.

The SIDRA modelling demonstrated that the existing junction layout will continue to perform at an acceptable level of service until 2032 (LOS C). The existing layout of the intersection deteriorates to LOS D by 2042. LOS D during peak periods is considered acceptable for urban junctions, however LOS C is desirable in a rural context.

The SIDRA modelling of a proposed roundabout showed improved performance of the junction. The roundabout provided a high level of service (LOS B) with minimal delays and queues in 2032 and 2042. The roundabout provides a more efficient access to Glen Ard Mohr Road and will cater for the expected traffic growth associated with the road's proposed connection to Gravelly Beach Road.

The construction of a roundabout at the Main Road/ Glen Ard Mohr Road junction is recommended to facilitate future traffic growth associated with land use development within Exeter.

6.5 Main Road/ Murray Street Junction

The intersection of Main Road/ Murray Street is a T-junction with Main Road having priority.

The proposed link road between Murray Street and Main Road/ Frankford Road and Wildmore Crescent will increase traffic flow at the Main Road/ Murray Street intersection. No modifications are proposed for the intersection, which is generally constrained by existing buildings and road corridor width of Main Road.

The results of the SIDRA modelling indicate that the existing junction layout will continue to perform at an acceptable level of service until 2042 (LOS C).

Whilst no changes are required to accommodate forecast traffic flows at the intersection, the installation of a channelised right turn lane would benefit the proposed link road between Murray Street and Wildmore Crescent.

6.6 Gravelly Beach Road/ Traill Road

Traill Road does not currently formally connect to Gravelly Beach Road. It consists of two parallel driveway accesses that are located within the road corridor. It is recommended that the junction be upgraded to a T-junction to provide a connection to Glen Ard Mohr Road (as outlined in Section 6.1).

SIDRA modelling of the proposed intersection demonstrates that the T-junction will perform at a high level of service until 2042 (LOS B).

Appendix A
SIDRA Analysis Outputs
Main Road/ Frankford Road

Table 10 Main Rd/ Frankford Rd 2022 SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
1	L	64	11.5	0.129	9.8	LOS A	0.8	6.7
2	T	156	18.2	0.129	1.2	LOS A	0.8	6.7
3	R	2	0.0	0.129	9.7	LOS A	0.8	6.7
Approach		222	16.1	0.129	3.8	NA	0.8	6.7
East: Tavern Access								
4	L	2	0.0	0.020	13.2	LOS B	0.1	0.5
5	T	1	0.0	0.020	12.0	LOS B	0.1	0.5
6	R	6	0.0	0.020	13.5	LOS B	0.1	0.5
Approach		9	0.0	0.020	13.3	LOS B	0.1	0.5
North: Main Rd								
7	L	3	33.3	0.161	12.0	LOS B	1.7	12.6
8	T	252	5.9	0.161	2.6	LOS A	1.7	12.6
9	R	18	47.1	0.161	13.0	LOS B	1.7	12.6
Approach		273	8.9	0.161	3.4	NA	1.7	12.6
West: Frankford Rd								
10	L	42	32.5	0.314	16.6	LOS C	1.5	11.7
11	T	2	50.0	0.314	16.0	LOS C	1.5	11.7
12	R	95	10.0	0.314	16.0	LOS C	1.5	11.7
Approach		139	17.4	0.314	16.2	LOS C	1.5	11.7
All Vehicles		643	13.1	0.314	6.4	NA	1.7	12.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
1	L	125	2.5	0.219	9.4	LOS A	1.7	11.9
2	T	265	2.8	0.219	1.2	LOS A	1.7	11.9
3	R	14	7.7	0.219	9.9	LOS A	1.7	11.9
Approach		404	2.9	0.219	4.0	NA	1.7	11.9
East: Tavern Access								
4	L	8	0.0	0.031	12.3	LOS B	0.1	0.8
5	T	1	0.0	0.031	11.1	LOS B	0.1	0.8
6	R	7	0.0	0.031	12.6	LOS B	0.1	0.8
Approach		17	0.0	0.031	12.4	LOS B	0.1	0.8
North: Main Rd								
7	L	7	0.0	0.144	10.3	LOS B	1.1	7.6
8	T	203	2.1	0.144	2.1	LOS A	1.1	7.6
9	R	33	0.0	0.144	10.6	LOS B	1.1	7.6
Approach		243	1.7	0.144	3.5	NA	1.1	7.6
West: Frankford Rd								
10	L	41	10.3	0.285	16.0	LOS C	1.2	8.8
11	T	3	0.0	0.285	14.4	LOS B	1.2	8.8
12	R	80	0.0	0.285	15.9	LOS C	1.2	8.8
Approach		124	3.4	0.285	15.9	LOS C	1.2	8.8
All Vehicles		788	2.5	0.285	5.9	NA	1.7	11.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

PM Peak

Table 11 Main Rd/ Frankford Rd – 2032 Give Way SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
1	L	78	9.5	0.161	10.1	LOS B	1.2	9.0
2	T	204	13.9	0.161	1.6	LOS A	1.2	9.0
3	R	2	0.0	0.161	10.0	LOS B	1.2	9.0
Approach		284	12.6	0.161	4.0	NA	1.2	9.0
East: Tavern Access								
4	L	2	0.0	0.028	15.4	LOS C	0.1	0.7
5	T	1	0.0	0.028	14.2	LOS B	0.1	0.7
6	R	7	0.0	0.028	15.7	LOS C	0.1	0.7
Approach		11	0.0	0.028	15.5	LOS C	0.1	0.7
North: Main Rd								
7	L	4	25.0	0.201	11.7	LOS B	1.9	14.2
8	T	302	4.9	0.201	2.6	LOS A	1.9	14.2
9	R	31	27.6	0.201	12.2	LOS B	1.9	14.2
Approach		337	7.2	0.201	3.6	NA	1.9	14.2
West: Frankford Rd								
10	L	61	22.4	0.448	19.9	LOS C	2.5	19.3
11	T	3	33.3	0.448	19.1	LOS C	2.5	19.3
12	R	114	8.3	0.448	19.7	LOS C	2.5	19.3
Approach		178	13.6	0.448	19.7	LOS C	2.5	19.3
All Vehicles		809	10.4	0.448	7.4	NA	2.5	19.3

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
1	L	141	2.2	0.251	9.7	LOS A	2.0	14.5
2	T	308	2.4	0.251	1.4	LOS A	2.0	14.5
3	R	15	7.1	0.251	10.1	LOS B	2.0	14.5
Approach		464	2.5	0.251	4.2	NA	2.0	14.5
East: Tavern Access								
4	L	9	0.0	0.041	13.6	LOS B	0.1	1.0
5	T	1	0.0	0.041	12.3	LOS B	0.1	1.0
6	R	8	0.0	0.041	13.8	LOS B	0.1	1.0
Approach		19	0.0	0.041	13.6	LOS B	0.1	1.0
North: Main Rd								
7	L	8	0.0	0.180	10.9	LOS B	1.4	10.1
8	T	234	1.8	0.180	2.7	LOS A	1.4	10.1
9	R	47	0.0	0.180	11.2	LOS B	1.4	10.1
Approach		289	1.5	0.180	4.3	NA	1.4	10.1
West: Frankford Rd								
10	L	52	8.2	0.388	19.2	LOS C	1.9	13.4
11	T	3	0.0	0.388	17.7	LOS C	1.9	13.4
12	R	93	0.0	0.388	19.2	LOS C	1.9	13.4
Approach		147	2.9	0.388	19.2	LOS C	1.9	13.4
All Vehicles		920	2.2	0.388	6.8	NA	2.0	14.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

PM Peak

Table 12 Main Rd/ Frankford Rd – 2042 – Give Way SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
1	L	141	2.2	0.251	9.7	LOS A	2.0	14.5
2	T	308	2.4	0.251	1.4	LOS A	2.0	14.5
3	R	15	7.1	0.251	10.1	LOS B	2.0	14.5
Approach		464	2.5	0.251	4.2	NA	2.0	14.5
East: Tavern Access								
4	L	9	0.0	0.041	13.6	LOS B	0.1	1.0
5	T	1	0.0	0.041	12.3	LOS B	0.1	1.0
6	R	8	0.0	0.041	13.8	LOS B	0.1	1.0
Approach		19	0.0	0.041	13.6	LOS B	0.1	1.0
North: Main Rd								
7	L	8	0.0	0.180	10.9	LOS B	1.4	10.1
8	T	234	1.8	0.180	2.7	LOS A	1.4	10.1
9	R	47	0.0	0.180	11.2	LOS B	1.4	10.1
Approach		289	1.5	0.180	4.3	NA	1.4	10.1
West: Frankford Rd								
10	L	52	8.2	0.388	19.2	LOS C	1.9	13.4
11	T	3	0.0	0.388	17.7	LOS C	1.9	13.4
12	R	93	0.0	0.388	19.2	LOS C	1.9	13.4
Approach		147	2.9	0.388	19.2	LOS C	1.9	13.4
All Vehicles		920	2.2	0.388	6.8	NA	2.0	14.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
1	L	156	2.0	0.277	9.9	LOS A	2.3	16.7
2	T	340	2.2	0.277	1.6	LOS A	2.3	16.7
3	R	17	6.3	0.277	10.3	LOS B	2.3	16.7
Approach		513	2.3	0.277	4.4	NA	2.3	16.7
East: Tavern Access								
4	L	13	0.0	0.073	15.6	LOS C	0.3	1.8
5	T	5	0.0	0.073	14.3	LOS B	0.3	1.8
6	R	11	0.0	0.073	15.8	LOS C	0.3	1.8
Approach		28	0.0	0.073	15.4	LOS C	0.3	1.8
North: Main Rd								
7	L	9	0.0	0.202	11.4	LOS B	1.7	12.0
8	T	258	1.6	0.202	3.3	LOS A	1.7	12.0
9	R	53	0.0	0.202	11.7	LOS B	1.7	12.0
Approach		320	1.3	0.202	4.9	NA	1.7	12.0
West: Frankford Rd								
10	L	57	7.4	0.499	23.3	LOS C	2.6	18.9
11	T	6	0.0	0.499	21.8	LOS C	2.6	18.9
12	R	103	0.0	0.499	23.3	LOS C	2.6	18.9
Approach		166	2.5	0.499	23.3	LOS C	2.6	18.9
All Vehicles		1027	1.9	0.499	7.9	NA	2.6	18.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

PM Peak

Table 13 Main Rd/ Frankford Rd – 2032 – Roundabout SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
1	L	78	9.5	0.209	5.9	LOS A	1.4	10.5
2	T	204	13.9	0.209	5.0	LOS A	1.4	10.5
3	R	7	0.0	0.209	11.6	LOS B	1.4	10.5
Approach		289	12.4	0.209	5.4	LOS A	1.4	10.5
East: Tavern Access								
4	L	23	0.0	0.050	7.6	LOS A	0.3	2.1
5	T	16	0.0	0.050	6.7	LOS A	0.3	2.1
6	R	12	0.0	0.050	13.5	LOS B	0.3	2.1
Approach		51	0.0	0.050	8.7	LOS A	0.3	2.1
North: Main Rd								
7	L	11	10.0	0.263	6.4	LOS A	1.8	13.7
8	T	302	4.9	0.263	5.3	LOS A	1.8	13.7
9	R	31	27.6	0.263	12.8	LOS B	1.8	13.7
Approach		343	7.1	0.263	6.0	LOS A	1.8	13.7
West: Frankford Rd								
10	L	61	22.4	0.176	7.4	LOS A	1.1	8.3
11	T	20	5.3	0.176	6.0	LOS A	1.1	8.3
12	R	114	8.3	0.176	12.9	LOS B	1.1	8.3
Approach		195	12.4	0.176	10.5	LOS B	1.1	8.3
All Vehicles		878	9.6	0.263	7.0	LOS A	1.8	13.7

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
1	L	141	2.2	0.313	5.7	LOS A	2.3	16.2
2	T	308	2.4	0.313	4.8	LOS A	2.3	16.2
3	R	23	4.5	0.313	11.7	LOS B	2.3	16.2
Approach		473	2.4	0.313	5.4	LOS A	2.3	16.2
East: Tavern Access								
4	L	14	0.0	0.035	7.1	LOS A	0.2	1.4
5	T	12	0.0	0.035	6.2	LOS A	0.2	1.4
6	R	13	0.0	0.035	13.0	LOS B	0.2	1.4
Approach		38	0.0	0.035	8.8	LOS A	0.2	1.4
North: Main Rd								
7	L	12	0.0	0.212	5.9	LOS A	1.4	10.1
8	T	234	1.8	0.212	5.0	LOS A	1.4	10.1
9	R	47	0.0	0.212	11.9	LOS B	1.4	10.1
Approach		293	1.4	0.212	6.2	LOS A	1.4	10.1
West: Frankford Rd								
10	L	52	8.2	0.135	7.4	LOS A	0.8	5.8
11	T	3	0.0	0.135	6.2	LOS A	0.8	5.8
12	R	93	0.0	0.135	13.1	LOS B	0.8	5.8
Approach		147	2.9	0.135	10.9	LOS B	0.8	5.8
All Vehicles		951	2.1	0.313	6.6	LOS A	2.3	16.2

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.

PM Peak

Table 14 Main Rd/ Frankford Rd – 2042 – Roundabout SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
1	L	85	8.6	0.227	5.9	LOS A	1.5	11.6
2	T	223	12.7	0.227	5.1	LOS A	1.5	11.6
3	R	7	0.0	0.227	11.6	LOS B	1.5	11.6
Approach		316	11.3	0.227	5.4	LOS A	1.5	11.6
East: Tavern Access								
4	L	25	0.0	0.058	7.9	LOS A	0.4	2.5
5	T	18	0.0	0.058	7.0	LOS A	0.4	2.5
6	R	14	0.0	0.058	13.8	LOS B	0.4	2.5
Approach		57	0.0	0.058	9.0	LOS A	0.4	2.5
North: Main Rd								
7	L	13	8.3	0.286	6.4	LOS A	2.1	15.2
8	T	333	4.4	0.286	5.3	LOS A	2.1	15.2
9	R	33	25.8	0.286	12.8	LOS B	2.1	15.2
Approach		378	6.4	0.286	6.0	LOS A	2.1	15.2
West: Frankford Rd								
10	L	66	20.6	0.182	7.5	LOS A	1.1	8.6
11	T	6	16.7	0.182	6.4	LOS A	1.1	8.6
12	R	125	7.6	0.182	13.1	LOS B	1.1	8.6
Approach		198	12.2	0.182	11.0	LOS B	1.1	8.6
All Vehicles		948	8.9	0.286	7.0	LOS A	2.1	15.2

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
1	L	156	2.0	0.349	5.8	LOS A	2.6	18.8
2	T	340	2.2	0.349	4.9	LOS A	2.6	18.8
3	R	25	4.2	0.349	11.8	LOS B	2.6	18.8
Approach		521	2.2	0.349	5.5	LOS A	2.6	18.8
East: Tavern Access								
4	L	16	0.0	0.042	7.3	LOS A	0.2	1.7
5	T	14	0.0	0.042	6.4	LOS A	0.2	1.7
6	R	15	0.0	0.042	13.3	LOS B	0.2	1.7
Approach		44	0.0	0.042	9.0	LOS A	0.2	1.7
North: Main Rd								
7	L	14	0.0	0.239	6.0	LOS A	1.7	11.7
8	T	258	1.6	0.239	5.2	LOS A	1.7	11.7
9	R	53	0.0	0.239	12.0	LOS B	1.7	11.7
Approach		324	1.3	0.239	6.3	LOS A	1.7	11.7
West: Frankford Rd								
10	L	57	7.4	0.157	7.6	LOS A	1.0	7.0
11	T	7	0.0	0.157	6.5	LOS A	1.0	7.0
12	R	103	0.0	0.157	13.3	LOS B	1.0	7.0
Approach		167	2.5	0.157	11.1	LOS B	1.0	7.0
All Vehicles		1057	1.9	0.349	6.8	LOS A	2.6	18.8

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement

PM Peak

Appendix B
SIDRA Analysis Outputs
Main Road/ Glen Ard Mohr Road

Table 15 Main Rd/ Glen Ard Mohr Rd – 2022 SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	198	11.2	0.109	0.0	LOS A	0.0	0.0
3	R	108	3.9	0.111	10.4	LOS B	0.4	3.2
Approach		306	8.6	0.111	3.7	NA	0.4	3.2
East: Glen Ard Mohr Rd								
4	L	69	3.0	0.345	17.7	LOS C	1.6	12.2
6	R	67	18.8	0.345	18.6	LOS C	1.6	12.2
Approach		137	10.8	0.345	18.1	LOS C	1.6	12.2
North: Main Rd								
7	L	116	8.2	0.194	8.5	LOS A	0.0	0.0
8	T	238	8.0	0.194	0.0	LOS A	0.0	0.0
Approach		354	8.0	0.194	2.8	NA	0.0	0.0
All Vehicles		797	8.7	0.345	5.8	NA	1.6	12.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	344	3.4	0.180	0.0	LOS A	0.0	0.0
3	R	31	3.4	0.030	10.1	LOS B	0.1	0.8
Approach		375	3.4	0.180	0.8	NA	0.1	0.8
East: Glen Ard Mohr Rd								
4	L	31	3.4	0.186	15.9	LOS C	0.7	4.8
6	R	43	0.0	0.186	16.1	LOS C	0.7	4.8
Approach		74	1.4	0.186	16.0	LOS C	0.7	4.8
North: Main Rd								
7	L	27	0.0	0.180	8.2	LOS A	0.0	0.0
8	T	317	2.3	0.180	0.0	LOS A	0.0	0.0
Approach		344	2.1	0.180	0.7	NA	0.0	0.0
All Vehicles		793	2.7	0.186	2.2	NA	0.7	4.8

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

PM Peak

Table 16 Main Rd/ Glen Ard Mohr Rd – 2032 SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	243	9.1	0.132	0.0	LOS A	0.0	0.0
3	R	124	3.4	0.139	10.9	LOS B	0.5	3.9
Approach		367	7.2	0.139	3.7	NA	0.5	3.9
East: Glen Ard Mohr Rd								
4	L	97	2.2	0.571	24.2	LOS C	3.5	26.0
6	R	103	12.2	0.571	24.9	LOS C	3.5	26.0
Approach		200	7.4	0.571	24.6	LOS C	3.5	26.0
North: Main Rd								
7	L	138	6.9	0.233	8.4	LOS A	0.0	0.0
8	T	291	6.5	0.233	0.0	LOS A	0.0	0.0
Approach		428	6.6	0.233	2.7	NA	0.0	0.0
All Vehicles		996	7.0	0.571	7.5	NA	3.5	26.0

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	395	2.9	0.206	0.0	LOS A	0.0	0.0
3	R	35	3.0	0.037	10.3	LOS B	0.1	1.0
Approach		429	2.9	0.206	0.8	NA	0.1	1.0
East: Glen Ard Mohr Rd								
4	L	43	2.4	0.298	19.3	LOS C	1.2	8.6
6	R	58	0.0	0.298	19.5	LOS C	1.2	8.6
Approach		101	1.0	0.298	19.4	LOS C	1.2	8.6
North: Main Rd								
7	L	31	0.0	0.205	8.2	LOS A	0.0	0.0
8	T	362	2.0	0.205	0.0	LOS A	0.0	0.0
Approach		393	1.9	0.205	0.6	NA	0.0	0.0
All Vehicles		923	2.3	0.298	2.8	NA	1.2	8.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

PM Peak

Table 17 Main Rd/ Glen Ard Mohr Rd – 2042 SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	266	8.3	0.144	0.0	LOS A	0.0	0.0
3	R	137	3.1	0.161	11.2	LOS B	0.6	4.5
Approach		403	6.5	0.161	3.8	NA	0.6	4.5
East: Glen Ard Mohr Rd								
4	L	106	2.0	0.689	30.5	LOS D	4.9	36.0
6	R	113	11.2	0.689	31.1	LOS D	4.9	36.0
Approach		219	6.7	0.689	30.8	LOS D	4.9	36.0
North: Main Rd								
7	L	151	6.3	0.255	8.4	LOS A	0.0	0.0
8	T	319	5.9	0.255	0.0	LOS A	0.0	0.0
Approach		469	6.1	0.255	2.7	NA	0.0	0.0
All Vehicles		1092	6.4	0.689	8.7	NA	4.9	36.0

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	435	2.7	0.227	0.0	LOS A	0.0	0.0
3	R	38	2.8	0.042	10.6	LOS B	0.2	1.1
Approach		473	2.7	0.227	0.9	NA	0.2	1.1
East: Glen Ard Mohr Rd								
4	L	47	2.2	0.380	23.0	LOS C	1.7	11.7
6	R	64	0.0	0.380	23.2	LOS C	1.7	11.7
Approach		112	0.9	0.380	23.1	LOS C	1.7	11.7
North: Main Rd								
7	L	34	0.0	0.226	8.2	LOS A	0.0	0.0
8	T	400	1.8	0.226	0.0	LOS A	0.0	0.0
Approach		434	1.7	0.226	0.6	NA	0.0	0.0
All Vehicles		1018	2.1	0.380	3.2	NA	1.7	11.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

PM Peak

Table 18 Main Rd/ Glen Ard Mohr Rd –2032 Roundabout SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	243	9.1	0.270	5.2	LOS A	2.0	14.5
3	R	124	3.4	0.270	12.0	LOS B	2.0	14.5
Approach		367	7.2	0.270	7.5	LOS A	2.0	14.5
East: Glen Ard Mohr Rd								
4	L	97	2.2	0.183	7.1	LOS A	1.2	8.6
6	R	103	12.2	0.183	13.3	LOS B	1.2	8.6
Approach		200	7.4	0.183	10.3	LOS B	1.2	8.6
North: Main Rd								
7	L	138	6.9	0.313	6.2	LOS A	2.3	16.9
8	T	291	6.5	0.313	5.3	LOS A	2.3	16.9
Approach		428	6.6	0.313	5.6	LOS A	2.3	16.9
All Vehicles		996	7.0	0.313	7.2	LOS A	2.3	16.9

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	395	2.9	0.281	4.7	LOS A	2.1	15.2
3	R	35	3.0	0.281	11.6	LOS B	2.1	15.2
Approach		429	2.9	0.281	5.3	LOS A	2.1	15.2
East: Glen Ard Mohr Rd								
4	L	43	2.4	0.092	7.2	LOS A	0.5	3.8
6	R	58	0.0	0.092	13.1	LOS B	0.5	3.8
Approach		101	1.0	0.092	10.6	LOS B	0.5	3.8
North: Main Rd								
7	L	31	0.0	0.245	5.4	LOS A	1.7	12.0
8	T	362	2.0	0.245	4.6	LOS A	1.7	12.0
Approach		393	1.9	0.245	4.6	LOS A	1.7	12.0
All Vehicles		923	2.3	0.281	5.6	LOS A	2.1	15.2

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement

PM Peak

Table 19 Main Rd/ Glen Ard Mohr Rd –2042 Roundabout SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	266	8.3	0.297	5.3	LOS A	2.2	16.4
3	R	137	3.1	0.297	12.0	LOS B	2.2	16.4
Approach		403	6.5	0.297	7.6	LOS A	2.2	16.4
East: Glen Ard Mohr Rd								
4	L	106	2.0	0.204	7.3	LOS A	1.3	9.8
6	R	113	11.2	0.204	13.4	LOS B	1.3	9.8
Approach		219	6.7	0.204	10.4	LOS B	1.3	9.8
North: Main Rd								
7	L	151	6.3	0.345	6.3	LOS A	2.6	19.2
8	T	319	5.9	0.345	5.4	LOS A	2.6	19.2
Approach		469	6.1	0.345	5.7	LOS A	2.6	19.2
All Vehicles		1092	6.4	0.345	7.3	LOS A	2.6	19.2

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	435	2.7	0.311	4.8	LOS A	2.4	17.5
3	R	38	2.8	0.311	11.7	LOS B	2.4	17.5
Approach		473	2.7	0.311	5.3	LOS A	2.4	17.5
East: Glen Ard Mohr Rd								
4	L	47	2.2	0.107	7.6	LOS A	0.6	4.5
6	R	64	0.0	0.107	13.5	LOS B	0.6	4.5
Approach		112	0.9	0.107	11.0	LOS B	0.6	4.5
North: Main Rd								
7	L	34	0.0	0.290	5.5	LOS A	2.1	14.9
8	T	431	1.7	0.290	4.6	LOS A	2.1	14.9
Approach		464	1.6	0.290	4.7	LOS A	2.1	14.9
All Vehicles		1048	2.0	0.311	5.6	LOS A	2.4	17.5

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement

PM Peak

Appendix C
SIDRA Analysis Outputs
Main Road/ Murray Street

Table 20 Main Rd/ Murray St – 2022 SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	256	11.9	0.181	2.9	LOS A	1.6	12.1
3	R	32	16.7	0.181	12.0	LOS B	1.6	12.1
Approach		287	12.5	0.181	3.9	NA	1.6	12.1
East: Murray St								
4	L	24	13.0	0.093	15.6	LOS C	0.3	2.5
6	R	13	16.7	0.093	16.1	LOS C	0.3	2.5
Approach		37	14.3	0.093	15.8	LOS C	0.3	2.5
North: Main Rd								
7	L	37	2.9	0.208	8.3	LOS A	0.0	0.0
8	T	349	6.9	0.208	0.0	LOS A	0.0	0.0
Approach		386	6.5	0.208	0.8	NA	0.0	0.0
All Vehicles		711	9.3	0.208	2.8	NA	1.6	12.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	409	2.6	0.236	2.0	LOS A	2.0	14.2
3	R	23	0.0	0.236	10.4	LOS B	2.0	14.2
Approach		433	2.4	0.236	2.4	NA	2.0	14.2
East: Murray St								
4	L	28	0.0	0.125	15.4	LOS C	0.4	3.1
6	R	22	0.0	0.125	15.6	LOS C	0.4	3.1
Approach		51	0.0	0.125	15.5	LOS C	0.4	3.1
North: Main Rd								
7	L	29	3.6	0.176	8.3	LOS A	0.0	0.0
8	T	307	2.4	0.176	0.0	LOS A	0.0	0.0
Approach		337	2.5	0.176	0.7	NA	0.0	0.0
All Vehicles		820	2.3	0.236	2.5	NA	2.0	14.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

PM Peak

Table 21 Main Rd/ Murray St – 2032 SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	280	10.9	0.201	3.3	LOS A	1.8	13.8
3	R	37	14.3	0.201	12.4	LOS B	1.8	13.8
Approach		317	11.3	0.201	4.4	NA	1.8	13.8
East: Murray St								
4	L	32	10.0	0.130	16.4	LOS C	0.4	3.4
6	R	17	12.5	0.130	16.8	LOS C	0.4	3.4
Approach		48	10.9	0.130	16.6	LOS C	0.4	3.4
North: Main Rd								
7	L	43	2.4	0.233	8.3	LOS A	0.0	0.0
8	T	392	6.2	0.233	0.0	LOS A	0.0	0.0
Approach		435	5.8	0.233	0.8	NA	0.0	0.0
All Vehicles		800	8.3	0.233	3.2	NA	1.8	13.8

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	454	2.3	0.269	2.8	LOS A	2.5	18.0
3	R	31	3.4	0.269	11.4	LOS B	2.5	18.0
Approach		484	2.4	0.269	3.4	NA	2.5	18.0
East: Murray St								
4	L	41	2.6	0.236	19.5	LOS C	0.8	6.2
6	R	32	6.7	0.236	19.9	LOS C	0.8	6.2
Approach		73	4.3	0.236	19.7	LOS C	0.8	6.2
North: Main Rd								
7	L	44	4.8	0.219	8.4	LOS A	0.0	0.0
8	T	375	2.0	0.219	0.0	LOS A	0.0	0.0
Approach		419	2.3	0.219	0.9	NA	0.0	0.0
All Vehicles		976	2.5	0.269	3.5	NA	2.5	18.0

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

PM Peak

Table 22 Main Rd/ Murray St – 2042 SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	306	10.0	0.221	3.8	LOS A	2.1	15.9
3	R	40	13.2	0.221	12.8	LOS B	2.1	15.9
Approach		346	10.3	0.221	4.9	NA	2.1	15.9
East: Murray St								
4	L	35	9.1	0.159	17.7	LOS C	0.5	4.1
6	R	19	11.1	0.159	18.1	LOS C	0.5	4.1
Approach		54	9.8	0.159	17.9	LOS C	0.5	4.1
North: Main Rd								
7	L	47	2.2	0.255	8.3	LOS A	0.0	0.0
8	T	431	5.6	0.255	0.0	LOS A	0.0	0.0
Approach		478	5.3	0.255	0.8	NA	0.0	0.0
All Vehicles		878	7.6	0.255	3.5	NA	2.1	15.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Main Rd								
2	T	500	2.1	0.297	2.9	LOS A	2.9	20.4
3	R	34	3.1	0.297	11.5	LOS B	2.9	20.4
Approach		534	2.2	0.297	3.5	NA	2.9	20.4
East: Murray St								
4	L	45	2.3	0.268	20.8	LOS C	1.0	7.2
6	R	34	3.1	0.268	21.1	LOS C	1.0	7.2
Approach		79	2.7	0.268	20.9	LOS C	1.0	7.2
North: Main Rd								
7	L	39	2.7	0.218	8.3	LOS A	0.0	0.0
8	T	379	1.9	0.218	0.0	LOS A	0.0	0.0
Approach		418	2.0	0.218	0.8	NA	0.0	0.0
All Vehicles		1031	2.1	0.297	3.7	NA	2.9	20.4

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

PM Peak

Appendix D
SIDRA Analysis Outputs
Gravelly Beach Road/ Traill Road

Table 23 Gravelly Beach Rd/ Traill Rd – 2032 SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Gravelly Beach Rd								
1	L	40	5.0	0.084	8.4	LOS A	0.0	0.0
2	T	116	5.0	0.084	0.0	LOS A	0.0	0.0
Approach		156	5.0	0.084	2.1	NA	0.0	0.0
North: Gravelly Beach Rd								
8	T	87	5.0	0.078	0.6	LOS A	0.4	3.1
9	R	39	5.0	0.078	9.3	LOS A	0.4	3.1
Approach		126	5.0	0.078	3.3	NA	0.4	3.1
West: Trail Rd								
10	L	24	5.0	0.093	10.4	LOS B	0.4	2.6
12	R	42	5.0	0.093	10.7	LOS B	0.4	2.6
Approach		66	5.0	0.093	10.6	LOS B	0.4	2.6
All Vehicles		348	5.0	0.093	4.2	NA	0.4	3.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

AM Peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Gravelly Beach Rd								
1	L	23	5.0	0.086	8.4	LOS A	0.0	0.0
2	T	139	5.0	0.086	0.0	LOS A	0.0	0.0
Approach		162	5.0	0.086	1.2	NA	0.0	0.0
North: Gravelly Beach Rd								
8	T	152	5.0	0.094	0.7	LOS A	0.6	4.2
9	R	17	5.0	0.094	9.3	LOS A	0.6	4.2
Approach		168	5.0	0.094	1.5	NA	0.6	4.2
West: Trail Rd								
10	L	13	5.0	0.060	11.0	LOS B	0.2	1.6
12	R	26	5.0	0.060	11.3	LOS B	0.2	1.6
Approach		39	5.0	0.060	11.2	LOS B	0.2	1.6
All Vehicles		369	5.0	0.094	2.4	NA	0.6	4.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

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Table 24 Gravelly Beach Rd/ Traill Rd – 2042 SIDRA

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Gravelly Beach Rd								
1	L	44	5.0	0.093	8.4	LOS A	0.0	0.0
2	T	128	5.0	0.093	0.0	LOS A	0.0	0.0
Approach		173	5.0	0.093	2.1	NA	0.0	0.0
North: Gravelly Beach Rd								
8	T	97	5.0	0.087	0.7	LOS A	0.5	3.5
9	R	43	5.0	0.087	9.4	LOS A	0.5	3.5
Approach		140	5.0	0.087	3.4	NA	0.5	3.5
West: Trail Rd								
10	L	26	5.0	0.106	10.8	LOS B	0.4	3.0
12	R	46	5.0	0.106	11.0	LOS B	0.4	3.0
Approach		73	5.0	0.106	10.9	LOS B	0.4	3.0
All Vehicles		385	5.0	0.106	4.3	NA	0.5	3.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

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Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m
South: Gravelly Beach Rd								
1	L	26	5.0	0.096	8.4	LOS A	0.0	0.0
2	T	154	5.0	0.096	0.0	LOS A	0.0	0.0
Approach		180	5.0	0.096	1.2	NA	0.0	0.0
North: Gravelly Beach Rd								
8	T	167	5.0	0.103	0.8	LOS A	0.6	4.7
9	R	18	5.0	0.103	9.4	LOS A	0.6	4.7
Approach		185	5.0	0.103	1.6	NA	0.6	4.7
West: Trail Rd								
10	L	15	5.0	0.071	11.4	LOS B	0.3	1.9
12	R	29	5.0	0.071	11.6	LOS B	0.3	1.9
Approach		44	5.0	0.071	11.6	LOS B	0.3	1.9
All Vehicles		409	5.0	0.103	2.5	NA	0.6	4.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.

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