MIDSON traffic pty ltd

Department of State Growth

New Bridgewater Bridge – Traffic Impact Assessment

November 2021

ENGINEERS AUSTRALIA

PROFESSIONAL ENGINEER OF THE YEAR
INDIVIDUAL AWARDS
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1. Introduction

1.1 Background

Midson Traffic were engaged by the Department of State Growth to prepare a traffic impact assessment for the New Bridgewater Bridge Project.

The existing Bridgewater Bridge spans the Derwent River between Granton and Bridgewater. It connects Brooker Highway, Lyell Highway and Midland Highway. It forms a critical component of the transport and freight link between the northern and southern regions of Tasmania. It consists of a causeway for approximately 700 metres from the southern shore and a steel bridge with a central lifting span for navigation.

1.2 Traffic Impact Assessment (TIA)

A traffic impact assessment (TIA) is a process of compiling and analysing information on the impacts that a specific development proposal is likely to have on the operation of roads and transport networks. A TIA should not only include general impacts relating to traffic management, but should also consider specific impacts on all road users, including on-road public transport, pedestrians, cyclists and heavy vehicles.

This TIA has been prepared in accordance with the Department of State Growth (DSG) publication, *Traffic Impact Assessment Guidelines*, August 2020. This TIA has also been prepared with reference to the Austroads publication, *Guide to Traffic Management,* Part 12: *Traffic Impacts of Developments*, 2019.

Land use developments generate traffic movements as people move to, from and within a development. Without a clear understanding of the type of traffic movements (including cars, pedestrians, trucks, etc), the scale of their movements, timing, duration and location, there is a risk that this traffic movement may contribute to safety issues, unforeseen congestion or other problems where the development connects to the road system or elsewhere on the road network. A TIA attempts to forecast these movements and their impact on the surrounding transport network.

This TIA has been prepared in accordance with the requirements of the Tasmanian Planning Commission's 'New Bridgewater Bridge Major Project Assessment Criteria', 2021.

This TIA also addresses the relevant clauses from the Road and Railway Assets Code of the following Planning Schemes:

- Glenorchy Interim Planning Scheme, 2015
- Derwent Valley Interim Planning Scheme, 2013
- Tasmanian Planning Scheme - Brighton, 2021

1.3 Statement of Qualification and Experience

This TIA has been prepared by an experienced and qualified traffic engineer in accordance with the requirements of the Department of State Growth's, *Traffic Impact Assessment Guidelines*, August 2020, as well as the scope of the transport related matters under Section 4.2 of the Assessment Criteria.

The TIA was prepared by Keith Midson. Keith's experience and qualifications are briefly outlined as follows:

- 25 years professional experience in traffic engineering and transport planning.
- Master of Transport, Monash University, 2006
- Master of Traffic, Monash University, 2004
- Bachelor of Civil Engineering, University of Tasmania, 1995
- Engineers Australia: Fellow (FIEAust); Chartered Professional Engineer (CPEng); Engineering Executive (EngExec); National Engineers Register (NER)

1.4 Project Scope

The project scope of this TIA is outlined as follows:

- Review of the existing road environment in the vicinity of the site and the traffic conditions on the road network.
- Provision of information on the proposed development with regards to traffic movements and activity.
- Identification of the traffic generation potential of the proposal with respect to the surrounding road network in terms of road network capacity.
- Traffic implications of the proposal with respect to the external road network in terms of traffic efficiency and road safety.
- An assessment of how the Project encourages cycling, walking and public transport.
- An assessment of how the Project minimises any adverse effects on the safety and efficiency of the road and rail network and uses dependent on it including the matters set out in Assessment Criteria 4.2.2.
- An assessment of how the safety and efficiency of the road, rail and public transport network can be managed during construction as set out in Assessment Criteria 4.2.3.

1.5 Study Area

The study area includes the Bridgewater Bridge (causeway and bridge structure), primary approaches to the Bridge (Brooker Highway, Lyell Highway, Boyer Road, Gunn Street, Midland Highway), as well as other key roads (including Black Snake Road, East Derwent Highway and Main Road).

The general study area and surrounding road network is shown in Figure 1.

Figure 1 Subject Site & Surrounding Road Network

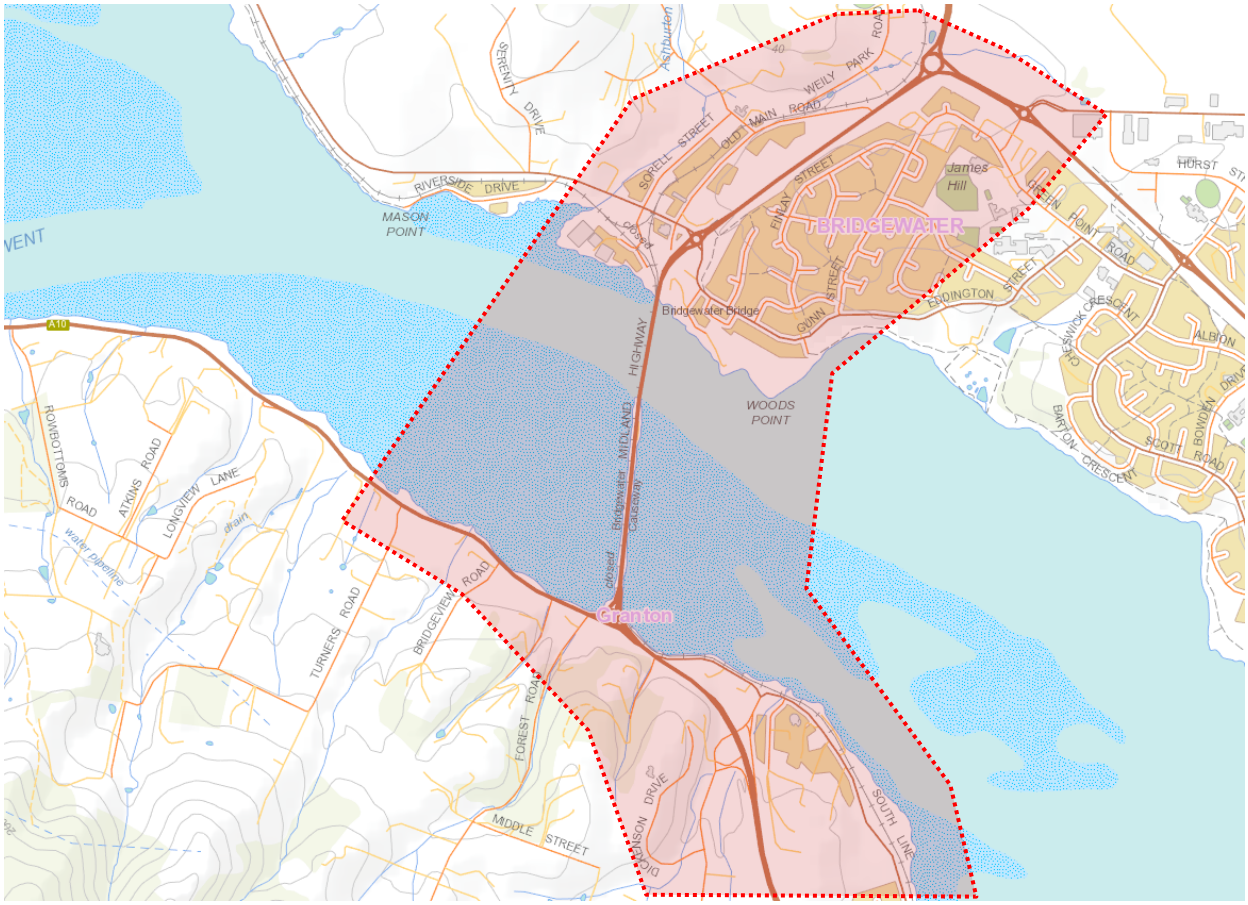


Image Source: LIST Map, DPIPWE

1.6 Reference Resources

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

- Tasmanian Planning Scheme, New Bridgewater Bridge Major Project Assessment Criteria, 2021 (Assessment Criteria)
- Glenorchy Interim Planning Scheme, 2015 (GIPS)
- Derwent Valley Interim Planning Scheme, 2013 (DVIPS)
- Tasmanian Planning Scheme - Brighton, 2021 (TPSB)
- Austroads, *Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections*, 2021 (Austroads 4A)
- Austroads, *Guide to Traffic Management, Part 2, Traffic Theory*, 2020 (Austroads Part 2)
- Austroads, *Guide to Traffic Management, Part 3, Transport Studies and Analysis Methods*, 2020 (Austroads Part 3)
- Austroads, *Guide to Traffic Management, Part 12*: *Traffic Impacts of Developments*, 2019 (Austroads Part 12)
- Department of State Growth, *Traffic Impact Assessment Guidelines*, 2020
- New Bridgewater Bridge Reference Design, 2020

1.7 Definitions and Abbreviations

The abbreviations used in this report are summarised in Table 1.

Table 1 Glossary of Terms

Abbreviation	Definition
AADT	Annual Average Daily Traffic – daily traffic volume over design year
AM	Morning Peak Period (8:00am to 9:00am)
DoS	Degree of Saturation (ratio of measured flow to calculated capacity)
DVIPS	Derwent Valley Interim Planning Scheme
EB	Eastbound
ECI	Early Contractor Involvement
FFS	Free Flow Speed
GIPS	Glenorchy Interim Planning Scheme
HCM	Highway Capacity Manual
km	Kilometres
Km/h	Kilometres per hour
ln	Lane (component of carriageway)
Ln	Lane (part of road name)
LOS	Level of Service
m	Metres
mi/h	Miles per hour
NB	Northbound
pc	Passenger Car
pc/ln/h	Passenger Car per lane per hour
Rd	Road
s	Seconds
SB	Southbound
SISD	Safe Intersection Sight Distance
St	Street
TIA	Traffic Impact Assessment
TMP	Traffic Management Plan
TPSB	Tasmanian Planning Scheme - Brighton
veh	Vehicle
vpd	Vehicles per day
vph	Vehicles per hour
WB	Westbound

2. Existing Conditions

2.1 Transport Network

For the purposes of this report, the transport network relevant to the assessment within the study area consists of the following:

State Highways (Department of State Growth) -

- Brooker Highway
- Lyell Highway
- Midland Highway
- Boyer Road
- East Derwent Highway

Council Roads -

- Black Snake Road (Glenorchy City Council)
- Main Road (Glenorchy City Council)
- Forest Road (Derwent Valley Council)
- Gunn Street (Brighton Council)
- Old Main Road (Brighton Council)

Each of these roads are detailed in the following sections.

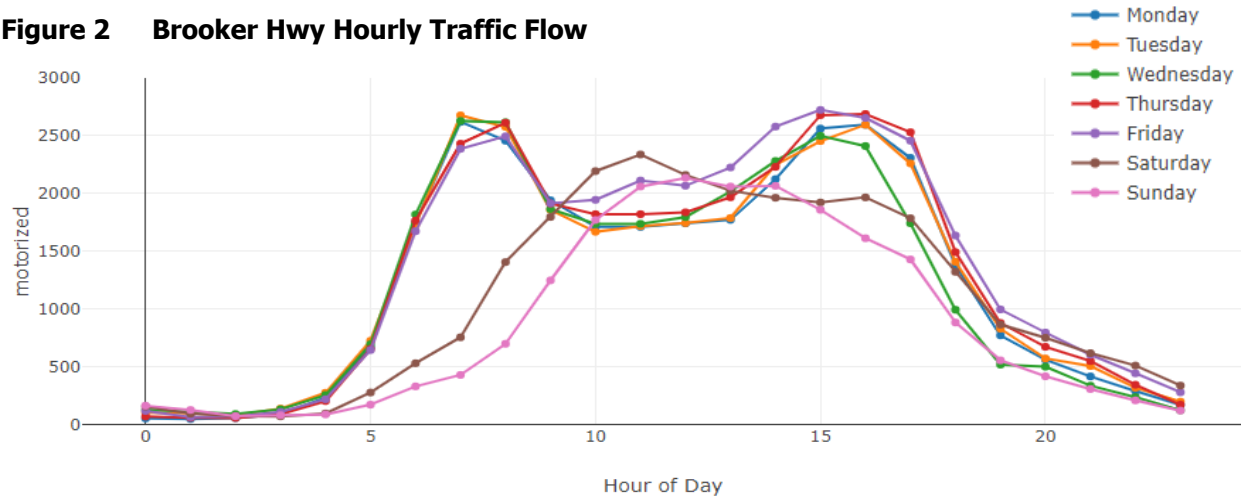
2.1.1 Brooker Highway

The Brooker Highway is a Category 1 road that connects between Hobart and the Bridgewater Bridge in Granton. It forms part of the National Land Transport Network that plays an important role in connecting Hobart to the Midland Highway and the Lyell Highway to the north.

Within the study area the Brooker Highway is a four-lane divided carriageway, reducing to three lanes (one northbound and two southbound) near the Lyell Highway roundabout. The speed limit reduces from 100-km/h to 80-km/h on the approach to the Black Snake Road interchange, then to 60-km/h on the approach to the Lyell Highway roundabout.

The Brooker Highway carries approximately 28,000 vehicles per day south of the Black Snake Road interchange. The hourly traffic flow distribution of Brooker Highway, south of the Bridgewater Bridge is shown in Figure 2.

Figure 2 Brooker Hwy Hourly Traffic Flow



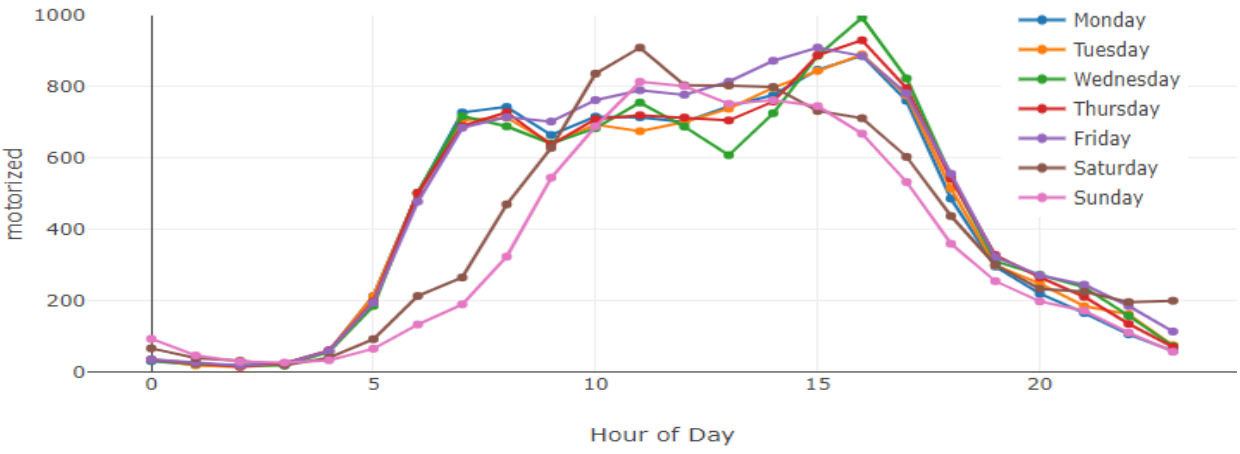
2.1.2 Lyell Highway

Lyell Highway is classified as a Category 2 road under the Department of State Growth's road hierarchy. It provides connection between areas of New Norfolk and the Derwent Valley with Brooker Highway and the Midland Highway. Traffic volumes within the study area are 9,500 vehicles per day.

Lyell Highway connects to the Brooker Highway and Midland Highway at a large diameter roundabout. Within the subject site the Lyell Highway is a two-lane undivided carriageway with a speed limit of 80-km/h reducing to 60-km/h near the Brooker Highway/ Lyell Highway/ Midland Highway roundabout.

The hourly distribution of traffic flow on Lyell Highway north of the Bridgewater Bridge is shown in Figure 3.

Figure 3 Lyell Highway Hourly Traffic Flow

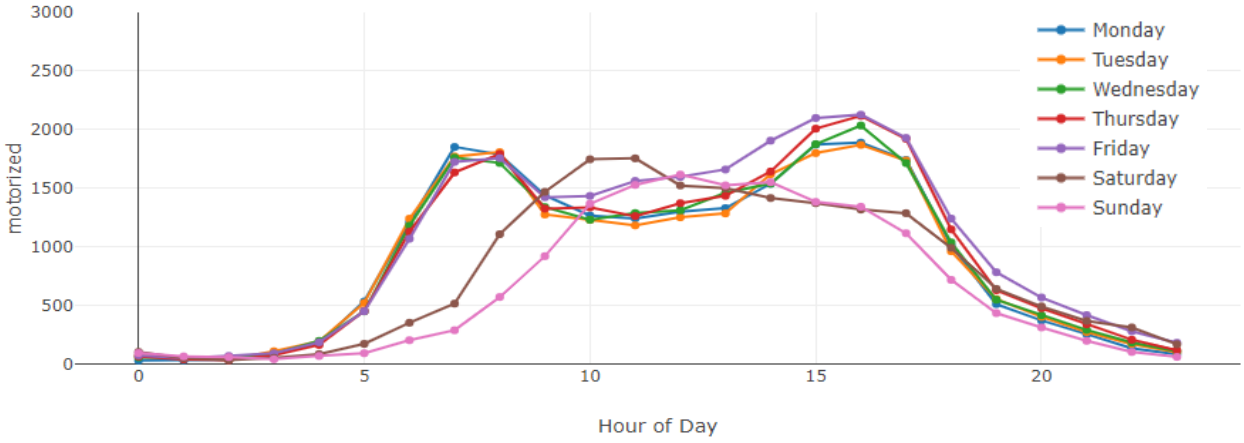


2.1.3 Midland Highway

Midland Highway is classified as a Category 1 road under the Department of State Growth's road hierarchy, forming a key component of the National Highway in Tasmania. The Midland Highway connects between the Bridgewater Bridge and Launceston.

Within the study area, the Midland Highway has a posted speed limit of 80-km/h. The Midland Highway carries approximately 20,000 vehicles per day near the subject site. The hourly distribution of traffic flow on Midland Highway, north of East Derwent Highway is shown in Figure 4.

Figure 4 Midland Highway Hourly Traffic Flow



2.1.4 Boyer Road

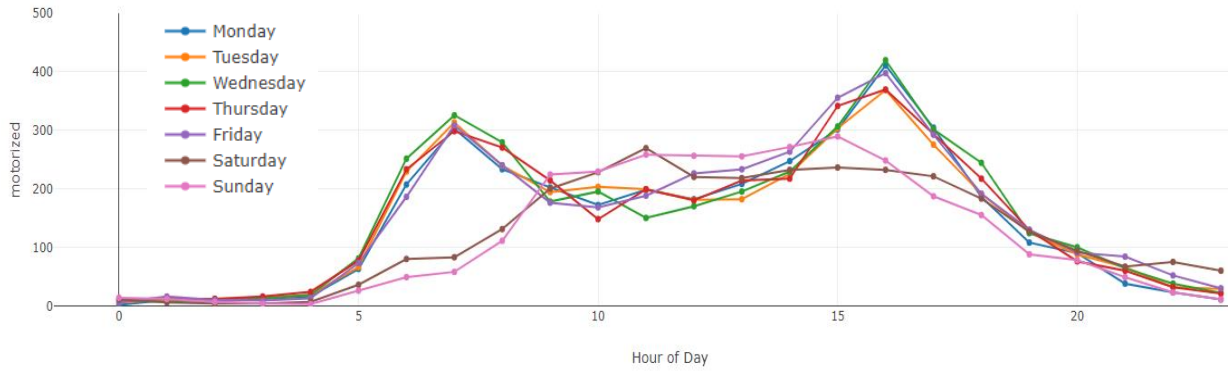
Boyer Road is a Category 5 State Growth owned road that connects between the Midland Highway in Bridgewater and Rocks Road in New Norfolk along the eastern shore of the Derwent River. Under the Tasmanian Road Hierarchy, Boyer Road is categorised as an "Other Road".

Boyer Road connects to Old Main Road at a small diameter roundabout with a mountable central island. A railway level crossing is located in Boyer Road north of the subject site. The railway crossing is controlled by lights.

Boyer Road currently carries 3,300 vehicles per day[1] near the subject site, with a peak flow of approximately 400 vehicles per hour (PM peak). The hourly distribution of traffic flow on Boyer Road west of Sorell Street is shown in Figure 5.

[1] Department of State Growth traffic data, November 2018

Figure 5 Boyer Road Hourly Traffic Flow

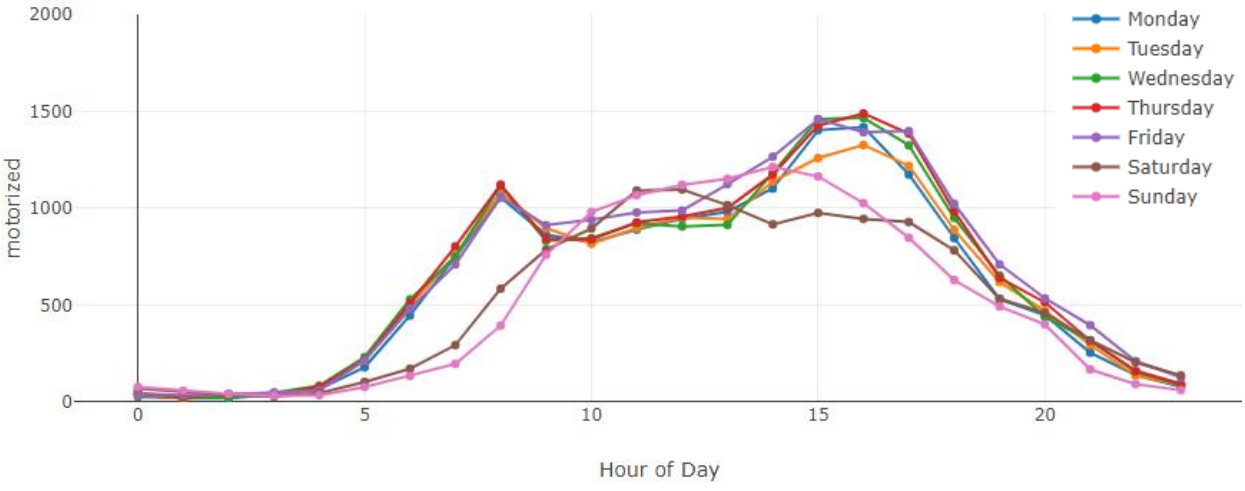


2.1.5 East Derwent Highway

East Derwent Highway is a Category 3 'Regional Access Road' under State Growth's Tasmanian State Road Hierarchy, 2007. Regional Access Roads are of strategic importance to regional and local communities and economies. They link towns and regions to Category 1 and 2 roads and provide an important freight task role (although to a lesser extent to Category 1 and 2 roads). It carries approximately 11,500 vehicles per day (State Growth traffic data).

The posted speed limit of East Derwent Highway is 80-km/h. The hourly distribution of traffic flow on East Derwent Highway south of Midland Highway is shown in Figure 6.

Figure 6 East Derwent Highway Hourly Traffic Flow



2.1.6 Black Snake Road

Black Snake Road is a minor collector road that services a local rural and residential catchment area. Traffic volumes have increased in recent years due to residential subdivision.

2.1.7 Main Road

Main Road is an arterial road that connects between Moonah at its southern end and the Black Snake Road interchange at its northern end. It provides an important collector road function for the various residential, commercial and industrial areas within the Glenorchy municipality that it connects to.

Within the study area, Main Road services a large residential catchment area of Granton and Goulds Lagoon.

2.1.8 Forest Road

Forest Road is a minor collector road that services a small local rural and residential catchment area. It is connects to Lyell Highway at its northern end, with the junction located immediately west of the Bridgewater Bridge roundabout.

2.1.9 Gunn Street

Gunn Street is a minor collector road that connects between the Midland Highway and Green Point Road. It provides residential access to the catchment area of Green Point and Bridgewater. Gunn Street connects to Midland Highway at a roundabout.

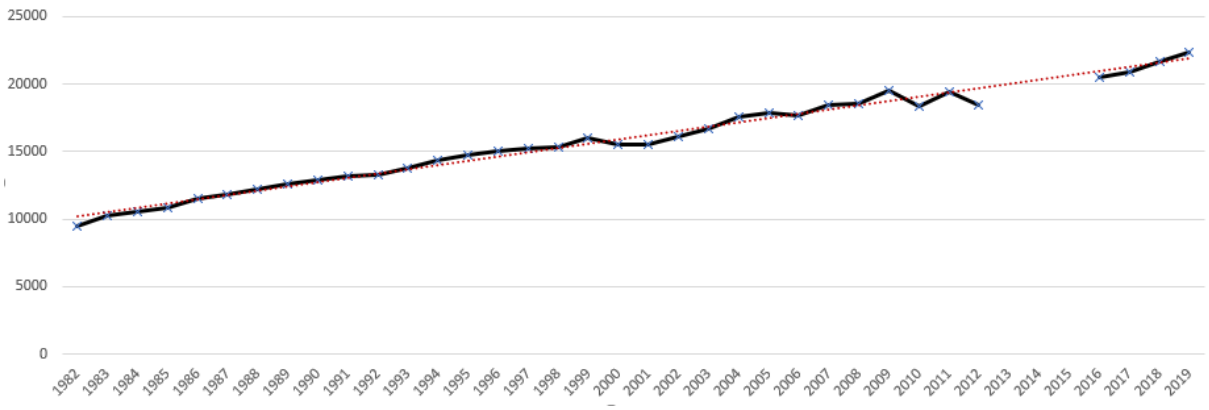
2.1.10 Old Main Road

Old Main Road is a local collector road that once formed part of the Midland Highway corridor through the Glenorchy municipality. It now serves as access to residential and commercial properties for a short length to the north of the Midland Highway. Traffic volumes are very low, in the order of 300 vehicles per day near the study area.

2.2 Bridgewater Bridge Traffic Growth

Figure 7 provides historic volumes between 1982 to 2019. The traffic growth appears to be relatively consistent with an average of 2.3% per annum (compound growth).

Figure 7 Bridgewater Bridge Historic Traffic Growth



2.3 Existing Pedestrian Network

The existing bridge structure provides a footpath on the eastern side of the causeway/ bridge. This consists of an informal unsealed verge on the causeway and a separated footpath on the bridge. The footpath track becomes narrow and obstructed towards the southern end of the causeway. This effectively results in a discontinuous footpath over the causeway.

A pedestrian footpath connects between Brooker Highway and Lyell Highway along the southern side of the roundabout. There are no pedestrian facilities connecting to the causeway.

At the northern end of the bridge, the footpath connects to a path that connects to Gunn Street. A pedestrian overpass is provided at the northern approach to the Midland Highway/ Boyer Road/ Gunn Street roundabout. The overpass provides pedestrian connectivity between Boyer Road and Gunn Street.

2.4 Existing Cycling Network

The existing bridge and causeway infrastructure has no provision for separated or off-road cycling. Cyclists must utilise the road carriageway.

The existing railway tracks provide a hazard for cyclists. Signage has been installed to require cyclists to dismount prior to crossing the tracks.

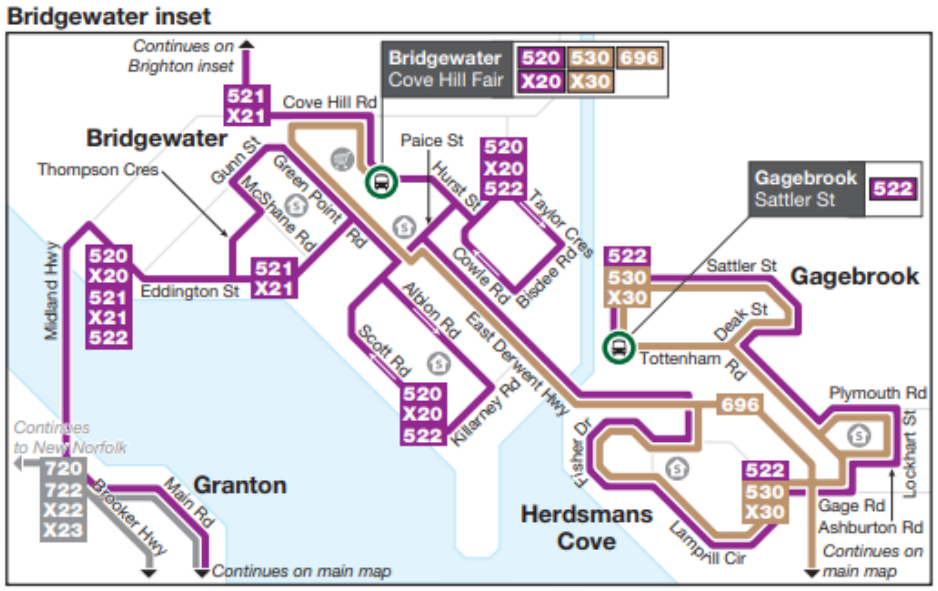
2.5 Public Transport

There are a number of public transport services that utilise the bridge infrastructure (including the interchanges and approaches). The routes are categorised into key routes as follows:

- New Norfolk services
- Bridgewater/ Brighton services

An overview of the relevant bus services are show in Figure 8 and detailed in the following sections.

Figure 8 Metro Tasmania Bus Services



2.5.1 New Norfolk Services

Derwent Valley Link operate regular services to New Norfolk. The services operate between Hobart and New Norfolk utilising the Brooker Highway and Lyell Highway.

Services operate typically on an hourly basis throughout the day, with half-hourly services during peak periods.

2.5.2 Bridgewater/ Brighton Services

Public transport services to Bridgewater and Gagebrook are operated by Metro Tasmania. Bus services operate between Hobart and Brighton, travelling through Bridgewater, Gagebrook and Brighton utilising Brooker Highway, Midland Highway and Gunn Street.

Services operate typically on an hourly basis throughout the day, with half-hourly services during peak periods.

2.6 Route Choice

Origin-Destination surveys were undertaken in April 2021 to determine the travel demands through the study area. The origin-destination surveys were conducted during the AM and PM peak periods on Thursday 29th April 2021.

The origin-destination survey matrices for the AM and PM peak periods are summarised in Appendix A.

The key routes through the study area, as determined by the origin-destination surveys are summarised as follows:

AM Peak –

- Midland Highway to Brooker Highway 16.4% of all movements
- Midland Highway to East Derwent Highway 11.2% of all movements
- Lyell Highway to Brooker Highway 10.9% of all movements
- East Derwent Highway to Brooker Highway 10.4% of all movements
- Brooker Highway to Lyell Highway 6.6% of all movements
- East Derwent Highway to Midland Highway 6.4% of all movements

PM Peak –

- Midland Highway to Brooker Highway 12.1% of all movements
- East Derwent Highway to Midland Highway 11.8% of all movements
- Brooker Highway to Midland Highway 11.3% of all movements
- Brooker Highway to Lyell Highway 10.5% of all movements
- Midland Highway to East Derwent Highway 6.8% of all movements
- Lyell Highway to Brooker Highway 6.0% of all movements

2.7 Road Safety Performance

Crash data can provide valuable information on the road safety performance of a road network. Existing road safety deficiencies can be highlighted through the examination of crash data, which can assist in determining whether traffic generation from the proposed development may exacerbate any identified issues.

The Department of State Growth maintain a database of all crashes that are reported to Tasmania Police. This includes all crashes that involve injury and all property damage crashes that have been reported (noting that not all crashes that result in property damage are reported). Crash data was obtained from the Department of State Growth for a five-year period between 1st January 2015 and 31st December 2020 for all roads within the study area.

The key findings of the crash data are summarised as follows:

Crashes reported on Bridge Structure (bridge and causeway, excluding roundabouts at each end)

- A total of 27 crashes were reported.
- Severity. 1 crash involved serious injury; 1 crash involved minor injury; 2 crashes involved first aid at the scene; 23 crashes involved property damage only.
- Time of day. 20 crashes were reported between 8:00am and 6:00pm. 3 crashes were reported prior to 8:00am; and 4 crashes were reported after 6:00pm. Afternoon crashes were dominant, with 12 crashes reported between 1:00pm and 6:00pm.
- Day of week. There were no clear crash trends by day of week. The highest crash rates were reported on Fridays (6 crashes), followed by Mondays and Sundays (5 crashes each). The lowest crash rates were Saturdays and Tuesdays (2 crashes each).
- Key crash types. Rear-end collisions was the most dominant crash type (9 crashes total), followed by 'other-curve' and 'side-swipe' (4 crashes each).
- Crash locations. The distribution of crashes was relatively evenly spread throughout the corridor, with some clusters located at the two roundabouts at each end of the corridor (assessed separately). The crash locations are shown in Figure 9.
- Vulnerable road users. No crashes involved vulnerable road users (pedestrians, cyclists or motorcyclists).

Crashes reported at Lyell Hwy/ Brooker Hwy/ Midland Hwy roundabout

- A total of 12 crashes were reported at the roundabout during this timeframe.
- Severity. 2 crashes involved minor injury; 1 crash involved first aid at the scene; 9 crashes involved property damage only.
- Time of day. The majority of crashes were reported between 8:00am and 6:00pm (10 crashes). 1 crash was reported prior to 8:00am and 1 crash was reported after 6:00pm.
- Day of week. There were no clear crash trends by day of week. The highest crash rates were reported on Fridays (4 crashes), followed by Tuesdays and Sundays (2 crashes each). All other days reported 1 crash each.

- Key crash types. No clear crash trends were noted by crash type. 3 crashes involved 'rear-end' collisions; 2 crashes involved 'lane-side-swipe' collisions.
- Crash locations. The crashes were relatively evenly disbursed at the intersection, with crashes occurring at each approach leg of the roundabout. The crash locations are shown in Figure 9.
- Vulnerable road users. 1 crash involved a motorcycle. This crash occurred at 9:30pm on Thursday 24th November 2016. The crash involved the motorcycle losing control on the carriageway, resulting in minor injury.

Crashes reported at Black Snake Road interchange

- A total of 16 crashes were reported at the interchange during this timeframe.
- Severity. 7 crashes involved minor injury; 2 crashes involved first aid at the scene; 7 crashes involved property damage only.
- Time of day. The majority of crashes were reported between 8:00am and 6:00pm (12 crashes). 2 crashes were reported prior to 8:00am and 2 crashes were reported after 6:00pm.
- Day of week. Weekday crashes were dominant (average 3.0 crashes per weekday, compared to 0.5 crashes per weekend day). 4 crashes were reported on Wednesdays; 3 crashes reported on Mondays, Tuesdays and Fridays; 2 crashes reported on Thursdays; 1 crash on a Saturday and no crashes on Sundays.
- Key crash types. 6 crashes involved 'rear-end' collisions; 4 crashes involved 'left-rear' collisions.
- Crash locations. The crashes were all located on the Brooker Highway corridor. The crash locations are shown in Figure 10.
- Vulnerable road users. 1 crash involved a pedestrian. The crash occurred at 10:30pm on Monday 9th February 2015. The crash involved a pedestrian being struck whilst crossing and resulted in property damage only.

Crashes reported at the Midland Hwy/ Boyer Rd/ Gunn St roundabout

- A total of 17 crashes were reported during this timeframe.
- Severity. 2 crashes involved minor injury; 2 crashes involved first aid at the scene; 13 crashes involved property damage only.
- Time of day. The majority of crashes were reported between 8:00am and 6:00pm (14 crashes). No crashes were reported prior to 8:00am and 3 crashes were reported after 6:00pm.
- Day of week. No clear crash trend was noted by time of day. 4 crashes were reported on Saturdays; 3 crashes were reported on Mondays, Tuesdays and Thursdays; 2 crashes reported on Fridays and Sundays; no crashes were reported on Wednesdays.
- Key crash types. 4 crashes involved 'rear-end' collisions; 3 crashes involved 'cross-traffic' collisions.

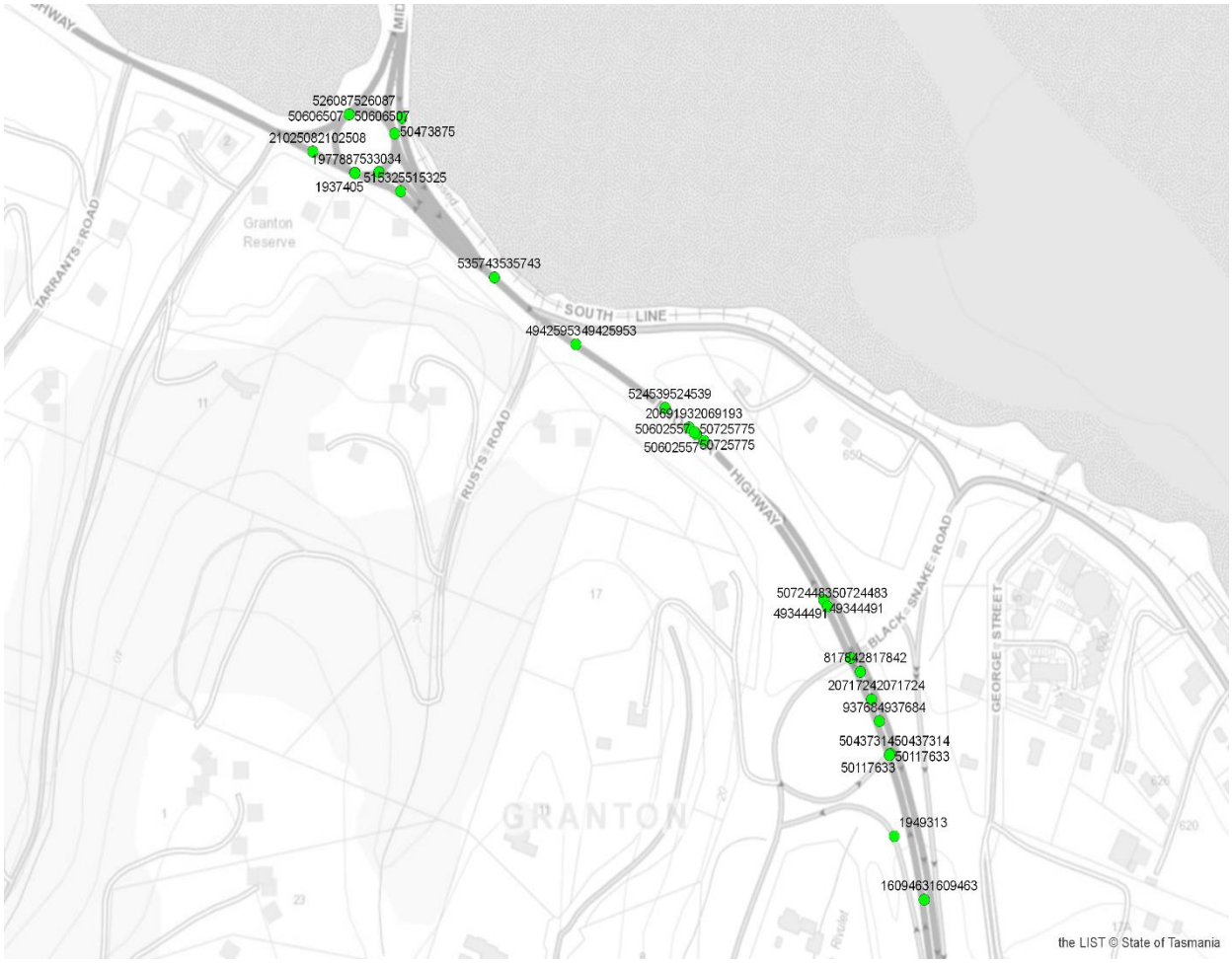
- Crash locations. The majority of crashes were reported on the Midland Highway approaches to the roundabout. The crash locations are shown in Figure 9.
- Vulnerable road users. 1 crash involved a motorcycle. This crash occurred at 11:40am on Saturday 30th January 2016. The crash involved a 'cross-traffic' collision resulting in Minor injury.

The crash data is considered relatively typical for a high-volume urban highway with a combination of grade separated interchange and roundabouts. The dominant crash trends of 'rear-end' collisions is likely to be due to queuing on the approaches to the roundabouts (noting the crashes at the Black Snake Road interchange are typically north of the junction on the approach to the Lyell Highway roundabout).

Figure 9 Crash Locations – Bridge/ Midland Hwy Corridor

Source: Department of State Growth

Figure 10 Crash Locations – Brooker Hwy Corridor



Source: Department of State Growth

Figure 11 Crash Locations – Lyell Hwy Corridor

Source: Department of State Growth

3. New Bridge Design

3.1 New Bridge Design Requirements

The proposed new bridge design involves the decommissioning of the existing 2-lane bridge/ causeway structures and replacing with a new bridge with grade separated interchanges.

The Project is scheduled to commence construction in mid-2022 with completion by the end of 2024.

The key design requirements associated with the new bridge include:

1. The project will provide a new river crossing between the Brooker Highway and Midland Highway, including connections to the Lyell Highway.
2. The new bridge will have a minimum design speed of 80km/h.
3. The new bridge will include two lanes in each direction.
4. The project will include the grade separation of the Lyell Highway Junction at Granton and Black Snake Road at Granton.
5. The new bridge will have a minimum airdraft clearance consistent with the navigable clearance under the Bowen Bridge.
6. The new bridge will include a shared path for pedestrians and cyclists.
7. The new bridge will include safety screens and barriers.
8. The new bridge will not preclude the future use of the existing rail corridor.

Two specific designs have been developed and assessed. These include the Reference Design and the Chosen Design. The Reference Design was prepared as a practical example that met the fundamental design criteria. The Chosen Design was the preferred bridge design that will be the basis for construction. This TIA has investigated the Reference Design in detail, as this was the design that was available at the time of preparation of this report.

3.2 Reference Design

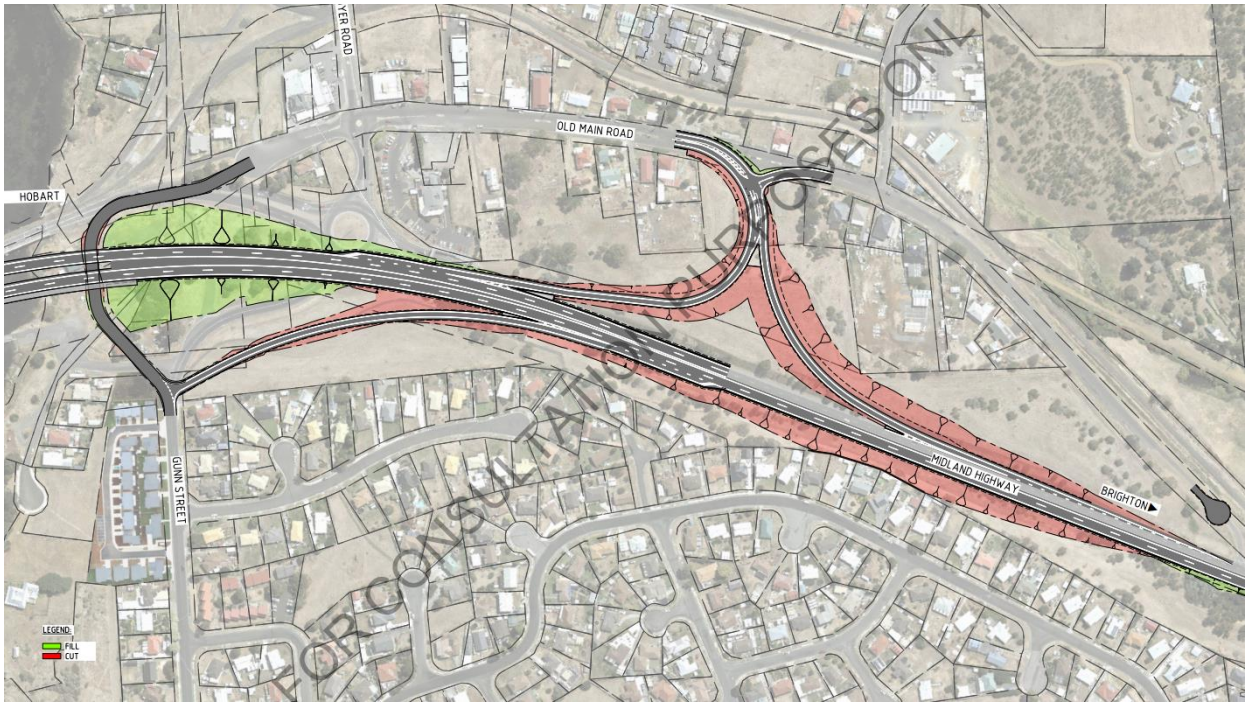
The Reference Design of the New Bridge is shown in Figure 12. The southern and northern interchanges are shown in Figure 13 and Figure 14.

It is noted that the Reference Design for the new Bridgewater Bridge was developed as an example of what may be built to achieve the Project's design requirements within budget. The construction of the new bridge will be undertaken through Early Contractor Involvement (ECI) process that will utilise the Chosen Design. The Chosen Design differs from the Reference Design investigated in this report in several minor respects. It is important to note that the Chosen Design, or any future design, must adhere to the key design requirements listed in Section 3.1 above.

Figure 12 New Bridge Reference Design - Overview

Figure 13 New Bridge Reference Design – Southern Interchange

Figure 14 New Bridge Reference Design – Northern Interchange



3.2.1 Reference Design Intersections/ Interchanges

The design of the New Bridgewater Bridge and the immediate surrounding network includes a number of interchanges and intersections. These are summarised in Table 2.

Table 2 Reference Design Intersection Summary

Junction Location	Intersection Type	Comments
Southern Interchange	Grade separated interchange. Roundabouts at each side of the interchange.	Southern interchange will remove the existing roundabout at the Brooker Hwy/ Lyell Hwy/ Midland Hwy junction. Interchange will incorporate movements from Lyell Hwy, Brooker Hwy, Main Rd and Black Snake Rd junction.
Northern Interchange	Grade separated interchange. On and off ramps with Gunn Street extending beneath bridge corridor.	Northern interchange will remove the existing roundabout at Midland Hwy/ Boyer Rd/ Gunn St. The Reference Design interchange does not directly cater for southbound movements from Lyell Hwy or Gunn St. These manoeuvres are catered for elsewhere in the network via East Derwent Hwy/ Midland Hwy roundabout. The Chosen Design incorporates a southbound on-ramp from Boyer to Bridge.
East Derwent Hwy/ Midland Hwy	Roundabout	No changes are proposed for the existing roundabout.
Forest Rd/ Lyell Hwy	T-junction	The Forest Road and Tarrants Road junctions proposed to utilise existing right turn lanes.
Tarrants Road/ Lyell Hwy	T-junction	

The need for a south bound on-ramp connection has been reviewed by the project team following feedback from the broader community and key stakeholders on the project's reference design.

Based on this review, and discussions with stakeholders, options for providing this connection more directly have been included in the Chosen Design in the form of a southbound on-ramp.

3.3 Chosen Design

The Chosen Design was selected as the preferred design through an Early Contractor Involvement (ECI) process. The Chosen Design differs from the Reference Design investigated in this report in several minor respects. The key differences are summarised in Table 3.

The general layout design plans of the Chosen Design are provided in Appendix B.

Table 3 Reference and Chosen Design Comparisons

Issue	Reference Design	Chosen Design	Comments
Northern Interchange – Boyer Rd southbound access	The Reference Design does not provide a southbound on-ramp from Boyer Rd to the Bridge. This requires the movement to detour via East Derwent Hwy/ Midland Hwy roundabout.	The Chosen Design incorporates a southbound on-ramp from Boyer Road to the Bridge.	The Chosen Design improves traffic flow for southbound movements from Boyer Road.
Southern Interchange – general arrangements	The Reference Design incorporates two roundabouts at each side of the interchange. Two northbound lanes access Lyell Highway – one lane from each roundabout.	The Chosen Design only incorporates one roundabout at the eastern side of the interchange. One northbound lane accesses Lyell Hwy from the western side of the interchange. The junctions of Black Snake Rd and Lyell Hwy are separated.	Both interchange designs have similar performance in terms of efficiency.
Northern Interchange – general arrangements	The Reference Design does not incorporate Boyer Rd southbound on-ramp (as noted above).	The Chosen Design incorporates a southbound on-ramp for Boyer Road (as noted above).	Both designs are very similar in terms of geometry and intersection layouts, with the key difference being the Boyer Road southbound on-ramp.

4. Traffic Impacts

4.1 Trip Assignment

The construction of the new Bridgewater Bridge will not fundamentally alter existing traffic flow patterns. Existing routes will continue to operate, linking the primary routes of Midland Highway, Brooker Highway, and Lyell Highway in a broad regional context, as well as providing important local connectivity to areas such as Bridgewater, Boyer Road and Granton. The existing trip patterns are detailed in Section 2.6.

The proposed design will alter the traffic flows at the interchanges at each approach to the bridge. The new Bridge infrastructure will also increase the traffic capacity of the corridor. The existing infrastructure is approaching capacity, particularly at the Brooker Highway/ Lyell Highway/ Midland Highway roundabout. Under existing conditions over time, as traffic flows increase, traffic will increasingly utilise alternative routes (such as Bowen Bridge/ East Derwent Highway). The new bridge will therefore increase traffic capacity thus increasing the attractiveness of the Bridgewater Bridge corridor in preference to the East Derwent Highway corridor.

At the northern interchange, the construction of the New Bridgewater Bridge will alter traffic flows in the following ways:

- Bridge – Midland Highway. Traffic between the Bridge and the Midland Highway in both directions will be uninterrupted flow.
- Northern Interchange. Southbound traffic entering from Gunn Street or Boyer Road must utilise Gunn Street and the East Derwent Highway, or undertake a U-Turn at the East Derwent Highway roundabout. Both routes will increase traffic loading on the East Derwent Highway/ Midland Highway roundabout.

At the southern interchange, the construction of the new Bridgewater Bridge will alter traffic flows in the following ways:

- Brooker Highway – Midland Highway. Traffic between Brooker Highway and Midland Highway in both directions will be uninterrupted flow.
- Lyell Highway. Access to Lyell Highway from Brooker Highway will be via a northbound off-ramp that connects to a new roundabout at the Black Snake Road intersection. Access to Lyell Highway from Midland Highway will be via a southbound off-ramp connecting to a new roundabout at the Main Road junction.
- Black Snake Road. Black Snake Road will connect to a new roundabout that forms the western component of a grade separated interchange. The northern approach to the roundabout will provide a new one-way northbound link to the Lyell Highway
- Main Road. Main Road will connect to a new roundabout that forms the eastern component of a grade separated interchange. The north-eastern approach to the roundabout will provide a new two-way link to the Lyell Highway.

4.2 Traffic Flows

The proposed bridge replacement will alter traffic flows at key components of the network.

The traffic flows on the network as a result of the proposed new bridge are summarised in Table 4.

Table 4 2021 Traffic Flows on Network – New Bridge

Link	AADT	AM Peak Flow	PM Peak Flow	Comments
Bridgewater Bridge	26,600 vpd	1,920 vph	2,050 vph	Two-way flow
Lyell Hwy	9,700 vpd	720 vph	920 vph	Two-way flow
Brooker Hwy northbound off-ramp	6,000 vpd	450 vph	750 vph	One-way flow
Brooker Hwy northbound on-ramp	2,800 vph	300 vph	200 vph	One-way flow
Brooker Hwy southbound off-ramp	2,500 vpd	150 vph	200 vph	One-way flow
Brooker Hwy southbound on-ramp	5,000 vpd	600 vph	350 vph	One-way flow
Midland Hwy southbound off-ramp	1,000 vpd	100 vph	200 vph	One-way flow
Midland Hwy northbound off-ramp	3,500 vpd	150 vph	300 vph	One-way flow
Midland Hwy northbound on-ramp	1,000 vpd	150 vph	200 vph	One-way flow
Old Main Rd north of Boyer Rd	4,500 vpd	250 vph	350 vph	Two-way flow
Gunn St extension	2,000 vpd	150 vph	150 vph	Two-way flow

4.3 SIDRA Traffic Modelling Overview

Intersection Analysis software, SIDRA Intersection (Akcelik and Associates), was used to determine the likely performance impacts at key intersections as a result of the changes to the traffic flow on 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.

The key outputs of the SIDRA modelling are defined as follows:

- Average delay for all vehicles (s)

  The average delay in seconds for all vehicles taking into account how many vehicles are performing each manoeuvre and the average delay for that movement.

- Worst movement average delay (s)

  The average delay in seconds for all vehicles undertaking the movement with the highest average delay.

- 95th percentile queue length (m)

  The queue length in metres not exceeded 95% of the time for the lane with the highest queue length.

- Average level of service

  The average level of service for all vehicles taking into account how many vehicles are performing each manoeuvre and the level of service for that movement.

  Level of service is a representation of average delay and describes the quality of traffic service in terms of 6 levels with level of service A (LOS A) representing the best operating condition (i.e. at or close to free flow) and level of service F (LOS F) representing the worst (i.e. forced flow).

  In general, the target level of service in an urban environment such as the subject site is level of service D (LOS D).

- Worst movement level of service

  The level of service for all vehicles undertaking the movement with the worst level of service.

The LOS measurement criteria used in SIDRA modelling is summarised in Table 5.

Table 5 Level of Service Criteria

LOS	Roundabout Average Delay per vehicle (s/veh)	Give Way Average Delay per vehicle (s/veh)	LOS Description
LOS A	< 10	d < 10	Good operation, ideal flow conditions
LOS B	10 < d < 20	10 < d < 15	Good operation with acceptable delays and spare capacity
LOS C	20 < d < 35	15 < d < 25	Satisfactory operating conditions.
LOS D	35 < d < 50	25 < d < 35	Operating near capacity. Generally accepted limit for urban peak periods.
LOS E	50 < d <70	35 < d < 50	At capacity.
LOS F	70 < d	50 < d	Forced flow conditions.

SIDRA models were developed for forecast intersection movements in 2041, as well as future turning movements as a result of traffic flow changes associated with the construction of the new Bridgewater Bridge.

SIDRA models were not developed beyond 2041 (20 years) due to the uncertainty of predicting traffic flow patterns over such a long period of time. This is consistent with accepted industry practice. It is noted that 2041 modelling of the Reference Design resulted in a high level of service (refer to sections 4.3.5 and 4.3.6). This provides a high level of confidence that the new Bridgewater bridge will accommodate future traffic flows for the extent of its lifespan.

The key interchanges of the new Bridgewater Bridge act independently due to the relatively long distances between them. The intersections associated with the interchanges of the new Bridgewater Bridge were therefore modelled independently.

4.3.1 Existing Models – Brooker Hwy/ Lyell Hwy/ Bridge

SIDRA models were constructed using current traffic data for 2021 AM and PM conditions on the existing infrastructure at the Brooker Highway/ Lyell Highway/ Midland Highway roundabout. These SIDRA models are summarised in Table 6 and Table 7.

It can be seen that the roundabout currently operates at an acceptable level of service during the AM peak but is operating at LOS-F during the PM peak. Unstable queues currently form on the Lyell Highway and Brooker Highway approaches during the PM Peak period, with extensive delays occurring as a result.

Table 6 AM 2021 Brooker Hwy/ Lyell Hwy/ Bridge SIDRA Summary

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	Distance m
East: Brooker Hwy								
5	T	208	4.3	0.172	4.0	LOS A	1.0	6.9
6	R	913	9.2	0.539	11.9	LOS B	5.1	38.2
Approach		1121	8.3	0.539	10.5	LOS B	5.1	38.2
North: Bridgewater Bridge								
7	L	1177	7.5	0.668	4.7	X	X	X
9	R	91	11.9	0.094	13.5	LOS B	0.6	4.6
Approach		1267	7.8	0.668	5.3	LOS A	0.6	4.6
West: Lyell Hwy								
10	L	125	5.4	0.173	11.1	LOS B	1.3	9.2
11	T	445	1.6	0.469	10.0	LOS A	4.6	32.3
Approach		571	2.4	0.469	10.2	LOS B	4.6	32.3
All Vehicles		2959	6.9	0.668	8.2	LOS A	5.1	38.2

X: Not applicable for Continuous movement.

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

Table 7 PM 2021 Brooker Hwy/ Lyell Hwy/ Bridge SIDRA Summary

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	Distance m
East: Brooker Hwy								
5	T	585	0.8	0.448	4.3	LOS A	3.4	23.7
6	R	1454	4.3	1.063	76.6	LOS E	98.4	713.9
Approach		2039	3.3	1.063	55.9	LOS E	98.4	713.9
North: Bridgewater Bridge								
7	L	1174	4.0	0.650	4.6	X	X	X
9	R	134	2.6	0.110	12.3	LOS B	0.7	4.9
Approach		1307	3.9	0.650	5.4	LOS A	0.7	4.9
West: Lyell Hwy								
10	L	54	6.3	0.189	23.5	LOS C	1.9	13.7
11	T	280	1.3	0.850	91.3	LOS F	17.3	122.4
Approach		334	2.1	0.850	80.4	LOS F	17.3	122.4
All Vehicles		3680	3.4	1.063	40.2	LOS D	98.4	713.9

X: Not applicable for Continuous movement.

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

4.3.2 Existing Models – Midland Hwy/ Boyer Rd/ Gunn St

SIDRA models were constructed using current data for 2021 AM and PM conditions on the existing infrastructure at the Midland Highway/ Gunn Street/ Boyer Road roundabout. These SIDRA models are summarised in Table 8 and Table 9 for the 2021 AM and PM peaks respectively.

Table 8 AM 2021 Midland Hwy/ Boyer Rd/ Gunn St SIDRA Summary

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	Distance m
South: Midland Hwy								
1	L	74	10.0	0.247	6.4	LOS A	1.5	11.7
2	T	547	10.0	0.247	5.2	LOS A	1.5	11.7
3	R	86	4.9	0.247	12.0	LOS B	1.5	11.2
Approach		707	9.4	0.247	6.1	LOS A	1.5	11.7
East: Gunn St								
4	L	122	7.8	0.221	9.1	LOS A	1.0	7.4
5	T	25	4.2	0.221	8.0	LOS A	1.0	7.4
6	R	4	0.0	0.221	14.8	LOS B	1.0	7.4
Approach		152	6.9	0.221	9.1	LOS A	1.0	7.4
North: Midland Hwy								
7	L	6	16.7	0.336	7.1	LOS A	2.3	16.9
8	T	789	7.1	0.336	5.7	LOS A	2.3	16.9
9	R	104	8.1	0.336	12.8	LOS B	2.2	16.2
Approach		900	7.3	0.336	6.5	LOS A	2.3	16.9
West: Boyer Rd								
10	L	51	8.3	0.247	7.9	LOS A	1.0	7.6
11	T	22	19.0	0.247	7.1	LOS A	1.0	7.6
12	R	139	3.0	0.247	13.6	LOS B	1.0	7.6
Approach		212	6.0	0.247	11.5	LOS B	1.0	7.6
All Vehicles		1971	7.9	0.336	7.1	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

Table 9 PM 2021 Midland Hwy/ Boyer Rd/ Gunn St SIDRA Summary

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	Distance m
South: Midland Hwy								
1	L	174	3.0	0.379	6.5	LOS A	2.7	19.5
2	T	811	5.2	0.379	5.4	LOS A	2.7	19.5
3	R	103	2.0	0.379	12.4	LOS B	2.6	18.9
Approach		1087	4.5	0.379	6.2	LOS A	2.7	19.5
East: Gunn St								
4	L	88	2.4	0.153	7.7	LOS A	0.6	4.6
5	T	35	3.0	0.153	6.8	LOS A	0.6	4.6
6	R	5	0.0	0.153	13.6	LOS B	0.6	4.6
Approach		128	2.5	0.153	7.7	LOS A	0.6	4.6
North: Midland Hwy								
7	L	11	10.0	0.234	6.8	LOS A	1.5	10.8
8	T	471	5.4	0.234	5.5	LOS A	1.5	10.8
9	R	154	5.5	0.234	12.6	LOS B	1.4	10.3
Approach		635	5.5	0.234	7.2	LOS A	1.5	10.8
West: Boyer Rd								
10	L	81	5.2	0.306	8.5	LOS A	1.4	10.0
11	T	39	10.8	0.306	7.6	LOS A	1.4	10.0
12	R	112	1.9	0.306	14.3	LOS B	1.4	10.0
Approach		232	4.5	0.306	11.2	LOS B	1.4	10.0
All Vehicles		2082	4.7	0.379	7.2	LOS A	2.7	19.5

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

4.3.3 Future Base Models – Brooker Hwy/ Lyell Hwy/ Bridge

Future base models were developed utilising existing traffic flows for each approach to the roundabout and applying a uniform 2.3% per annum compound growth rate to the year 2041.

It can be seen that the existing roundabout will operate at an unacceptable level of service 'F' during both the AM and PM peak periods. The PM peak results in both the Brooker Highway and Lyell Highway approaches experiencing significant delays and queues.

Table 10 AM 2041 Brooker Hwy/ Lyell Hwy/ Bridge SIDRA Summary

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
East: Brooker Hwy								
5	T	298	4.6	0.244	4.4	LOS A	1.5	11.1
6	R	1304	10.2	0.814	13.0	LOS B	12.5	95.2
Approach		1602	9.1	0.814	11.4	LOS B	12.5	95.2
North: Bridgewater Bridge								
7	L	1856	7.9	1.056	28.2	X	X	X
9	R	142	13.3	0.146	13.5	LOS B	0.9	7.3
Approach		1998	8.3	1.056	27.1	LOS C	0.9	7.3
West: Lyell Hwy								
10	L	182	5.8	0.534	34.6	LOS C	6.0	44.4
11	T	649	1.6	1.562	572.9	LOS F	173.6	1232.2
Approach		832	2.5	1.562	455.0	LOS F	173.6	1232.2
All Vehicles		4432	7.5	1.562	101.7	LOS F	173.6	1232.2

X: Not applicable for Continuous movement.

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

Table 11 PM 2041 Brooker Hwy/ Lyell Hwy/ Bridge SIDRA Summary

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
East: Brooker Hwy								
5	T	837	0.8	0.672	5.4	LOS A	6.8	48.0
6	R	2077	4.5	1.492	459.0	LOS F	463.0	3366.0
Approach		2914	3.4	1.492	328.7	LOS F	463.0	3366.0
North: Bridgewater Bridge								
7	L	1849	4.2	1.026	16.2	X	X	X
9	R	211	2.5	0.178	12.6	LOS B	1.2	8.4
Approach		2060	4.0	1.026	15.8	LOS B	1.2	8.4
West: Lyell Hwy								
10	L	79	6.7	0.293	25.0	LOS C	2.9	21.7
11	T	408	1.3	1.313	380.1	LOS F	85.2	602.7
Approach		487	2.2	1.313	322.6	LOS F	85.2	602.7
All Vehicles		5461	3.5	1.492	210.1	LOS F	463.0	3366.0

X: Not applicable for Continuous movement.

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

4.3.4 Future Base Models – Midland Hwy/ Boyer Rd/ Gunn St

Future base models were developed utilising existing traffic flows for each approach to the roundabout and applying a uniform 2.3% per annum compound growth rate to the year 2041.

It can be seen that the existing roundabout will continue to operate at an acceptable level of service under forecast 2041 traffic flow conditions (LOS A and B for all approaches during the AM and PM peak periods).

Table 12 AM 2041 Midland Hwy/ Boyer Rd/ Gunn St SIDRA Modelling

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: Midland Hwy								
1	L	106	9.9	0.378	6.8	LOS A	2.8	21.2
2	T	776	11.1	0.378	5.6	LOS A	2.8	21.2
3	R	129	4.9	0.378	12.5	LOS B	2.7	20.1
Approach		1012	10.2	0.378	6.6	LOS A	2.8	21.2
East: Gunn St								
4	L	177	8.3	0.483	14.3	LOS B	2.9	21.5
5	T	39	5.4	0.483	13.2	LOS B	2.9	21.5
6	R	6	16.7	0.483	20.4	LOS C	2.9	21.5
Approach		222	8.1	0.483	14.3	LOS B	2.9	21.5
North: Midland Hwy								
7	L	8	25.0	0.547	8.3	LOS A	4.6	34.4
8	T	1156	7.7	0.547	6.9	LOS A	4.6	34.4
9	R	152	8.3	0.547	14.4	LOS B	4.5	33.9
Approach		1316	7.8	0.547	7.8	LOS A	4.6	34.4
West: Boyer Rd								
10	L	74	8.6	0.432	9.5	LOS A	2.2	16.4
11	T	28	22.2	0.432	8.8	LOS A	2.2	16.4
12	R	212	3.0	0.432	15.3	LOS B	2.2	16.4
Approach		314	6.0	0.432	13.3	LOS B	2.2	16.4
All Vehicles		2863	8.5	0.547	8.5	LOS A	4.6	34.4

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

Table 13 PM 2041 Midland Hwy/ Boyer Rd/ Gunn St SIDRA Modelling

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	Distance m
South: Midland Hwy								
1	L	264	3.2	0.622	7.4	LOS A	5.8	42.4
2	T	1211	5.5	0.622	6.6	LOS A	5.9	43.2
3	R	159	2.0	0.622	13.9	LOS B	5.9	43.2
Approach		1634	4.8	0.622	7.5	LOS A	5.9	43.2
East: Gunn St								
4	L	136	2.3	0.306	9.3	LOS A	1.5	10.7
5	T	56	1.9	0.306	8.3	LOS A	1.5	10.7
6	R	8	0.0	0.306	15.1	LOS B	1.5	10.7
Approach		200	2.1	0.306	9.2	LOS A	1.5	10.7
North: Midland Hwy								
7	L	16	6.7	0.391	7.5	LOS A	2.9	21.6
8	T	703	5.5	0.391	6.3	LOS A	2.9	21.6
9	R	231	5.5	0.391	13.6	LOS B	2.7	20.1
Approach		949	5.5	0.391	8.1	LOS A	2.9	21.6
West: Boyer Rd								
10	L	121	6.1	0.649	13.7	LOS B	4.3	31.3
11	T	57	9.3	0.649	12.8	LOS B	4.3	31.3
12	R	173	1.8	0.649	19.5	LOS B	4.3	31.3
Approach		351	4.5	0.649	16.4	LOS B	4.3	31.3
All Vehicles		3134	4.8	0.649	8.8	LOS A	5.9	43.2

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

4.3.5 Southern Interchange Modelling

The Southern interchange of the Reference Design was modelled. Lane widths and configuration of the intersections associated into Southern Interchange were consistent with the Reference Design.

The southern grade separated interchange will consist of the following key components:

- Grade separation, with Brooker Highway overhead having continuous flow.
- Western interchange roundabout connecting Black Snake Road with the northbound on and off-ramps of the Brooker Highway and a one-way connector road to Lyell Highway.
- Eastern interchange roundabout connecting Main Road with the southbound on and off ramps of the Brooker Highway.
- Connector road between the eastern and western roundabouts. The connector road will be located beneath the Brooker Highway.

These components are shown in Figure 13. The forecast traffic flows associated with the southern interchange are summarised in Table 14 and Table 15 for the western and eastern roundabouts respectively.

Table 14 Southern Interchange, Western Roundabout Traffic Movements

		Black Snake Rd			Brooker Off-Ramp			Connector Rd		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
AM Peak	Cars	23	112	33	24	156	40	137	35	5
	Trucks	1	5	1	1	9	2	9	2	1
	TOTAL	**24**	**117**	**34**	**25**	**165**	**42**	**146**	**37**	**6**
PM Peak	Cars	19	62	15	67	465	40	63	117	5
	Trucks	1	3	1	4	4	2	4	3	1
	TOTAL	**20**	**65**	**16**	**71**	**469**	**42**	**67**	**120**	**6**

Table 15 Southern Interchange, Eastern Roundabout Traffic Movements

		Main Rd		Lyell Hwy Extension		Connector Rd	
		Thru	Right	Left	Thru	Thru	Right
AM Peak	Cars	108	12	40	376	85	5
	Trucks	6	1	1	5	2	0
	TOTAL	**114**	**13**	**41**	**381**	**87**	**5**
PM Peak	Cars	58	7	13	250	51	5
	Trucks	3	1	0	5	2	1
	TOTAL	**61**	**8**	**13**	**255**	**53**	**6**

SIDRA modelling of the southern interchange roundabouts indicates that all approaches will operate at LOS A or B during both peaks through to 2041.

4.3.6 Northern Interchange Modelling

The Northern Interchange of the Reference Design was modelled. Lane widths and configuration of the intersections associated into Northern Interchange were consistent with the Reference Design.

The northern grade separated interchange will consist of the following key components:

- Grade separation, with Midland Highway overhead having continuous flow.
- Gunn Street extending beneath Midland Highway, connecting to Old Main Road.
- Northbound on and off-ramps connecting to Old Main Road.
- Southbound off-ramp connecting to Gunn Street.

These components are shown in Figure 14. The forecast traffic flows associated with the northern interchange are summarised in Table 16 and Table 17.

SIDRA modelling of the northern interchange junctions indicates that all approaches will operate at LOS A or B during both peaks through to 2041.

Table 16 Northern Interchange – Northbound Ramp Movements

		Midland Hwy	Old Main Rd
		Left	Left
AM Peak	Cars	144	116
	Trucks	11	9
	TOTAL	**155**	**125**
PM Peak	Cars	212	80
	Trucks	10	4
	TOTAL	**222**	**84**

Table 17 Northern Interchange – Gunn St Ramp

		Midland Hwy Ramp		Gunn St North	
		Left	Right	Thru	Thru
AM Peak	Cars	8	91	60	75
	Trucks	1	8	3	4
	TOTAL	**9**	**99**	**63**	**79**
PM Peak	Cars	20	159	31	110
	Trucks	2	8	1	6
	TOTAL	**22**	**167**	**32**	**116**

4.4 Travel Time Analysis

4.4.1 Brooker Highway – Midland Highway Corridor Travel Time Analysis

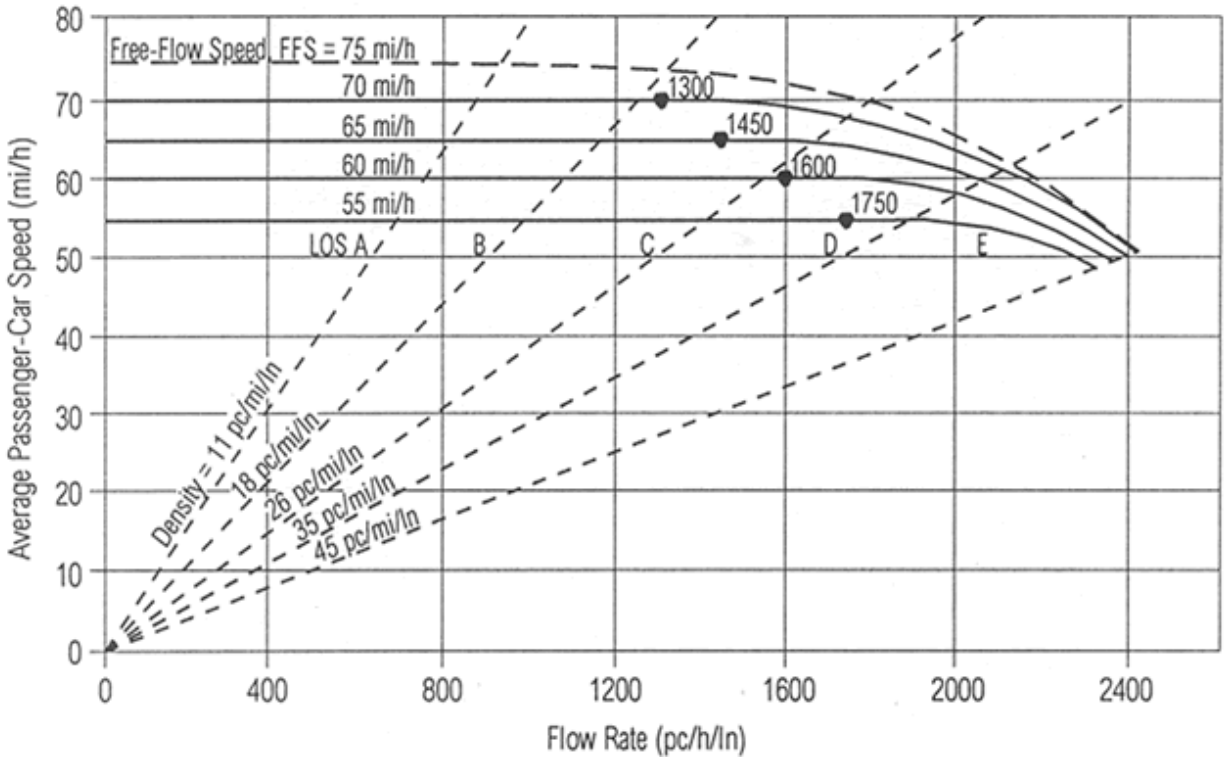
Travel times were modelled on the Midland Highway/ Brooker Highway corridor between the Granton Interchange and Boyer Road.

Congestion effects were modelled into the travel time assessments based on the peak directional flow, therefore the travel times relate to the peak directional flow. The basic relationship between speed and

demand flow for various design speeds per lane is shown in Figure 15. This was extracted from the Highway Capacity Manual (HCM). This speed/ flow model assumes no impact on operating speed from factors such as lane changing, on and off-ramp interference, etc. It can be seen that, based on the peak hour flows provided in Section 4.2, that free flow speeds are likely to prevail under future traffic flow conditions (without impacts associated with lane changing and interchange entry and exit manoeuvres).

The bridge design was assessed against the peak directional flow (peak direction only both morning and afternoon peak hours, assuming equal flow in each lane) to determine the likely speed under future traffic loading conditions. Minor impacts associated with lane manoeuvring (lane changing and interchange interaction) have been assumed. The travel time summary for each of the options is provided in Table 18 (as measured from East Derwent Highway to Granton Interchange). Note that travel times for the existing bridge infrastructure includes intersection delays at the roundabouts at each end (Lyell Highway/ Brooker Highway and Gunn Street/ Boyer Road). In 2041, delays associated with the Lyell Highway/ Brooker Highway roundabout create unstable flow conditions due to capacity being reached.

Figure 15 HCM Speed Flow Diagram



Metric Conversions: 75mi/h = 121km/h; 70mi/h = 113km/h; 65mi/h = 105km/h; 60mi/h = 97km/h; 50mi/h = 80km/h

The travel times factored to 2021 traffic conditions are summarised as follows:

- Freeflow conditions, northbound 144 seconds
- Freeflow conditions, southbound 128 seconds
- AM peak, northbound 191 seconds
- AM peak, southbound 141 seconds (2.4 minutes)
- PM peak, northbound 456 seconds (7.6 minutes)
- PM peak, southbound 141 seconds (2.4 minutes)

The travel times, based on future traffic growth factored to 2041 traffic conditions are summarised as follows:

- AM peak, northbound 222 seconds (3.7 minutes)
- AM peak, southbound 159 seconds (2.7 minutes)
- PM peak, northbound 1,644 seconds (27.4 minutes)
- PM peak, southbound 153 seconds (2.6 minutes)

It can be seen that traffic conditions deteriorate significantly in 2041 during the PM peak period. The Granton roundabout performs at level of service 'F' for both the Brooker Highway and Lyell Highway approaches with unstable queues and extreme delays.

The New Bridge design will increase capacity through the provision of four-lanes (two lanes in each direction) as well as the removal of intersection delays associated with the Lyell Highway/ Brooker Highway and Midland Highway/ Boyer Road/ Gunn Street roundabouts.

The travel times associated with the New Bridge are summarised as follows:

- AM peak, northbound 99 seconds (1.7 minutes)
- AM peak, southbound 99 seconds (1.7 minutes)
- PM peak, northbound 99 seconds (1.7 minutes)
- PM peak, southbound 99 seconds (1.7 minutes)

The comparison of travel times along the Brooker Highway/ Midland Highway corridor for 2021 and 2041 timeframes for both peaks is summarised in Table 18.

Table 18 2021 & 2041 Travel Time Comparisons

Option	Travel Time (seconds)		Difference (seconds)		Comments
	Northbound	Southbound	Northbound	Southbound	
Existing free-flow conditions	144	128			
Existing AM 2021	191	141	+47	+13	Compared to freeflow
Existing PM 2021	456	141	+312	+13	Compared to freeflow
Existing AM 2041	222	159	+78	+31	Compared to freeflow
Existing PM 2041	1,644	153	+1,500	+25	Compared to freeflow
New AM 2021	99	99	-91	-43	Compared to existing 2021
New PM 2021	99	99	-357	-43	Compared to existing 2021
New AM 2041	99	99	-122	-60	Compared to existing 2041
New PM 2041	136*	99	-1,508	-55	Compared to existing 2041

* *Note queues for the PM peak under the existing causeway and bridge in 2041 conditions extend approximately 3.3km south of the Granton roundabout. The travel times of the new bridge include this additional distance travelled for direct comparison purposes.*

4.4.2 Other Key Route Travel Time Assessments

The travel time assessment undertaken in Section 4.4.1 covers key routes, including Brooker Highway to Midland Highway and East Derwent Highway (and vice versa). The origin-destination surveys identified other key routes highlighted in Section 2.6.

Routes involving Lyell Highway have relatively high traffic flow demands during peak periods and therefore were assessed in terms of travel time variation compared to existing conditions. The Lyell Highway connection to Brooker Highway and Midland Highway will be converted from a large diameter roundabout to a grade separated interchange at the Brooker Highway. This will increase the travel distance for two key routes as follows:

- Lyell Highway to Midland Highway. Additional distance of approximately 1.6-km. Includes travel through the eastern and western roundabouts at the southern junction, and a merge onto the

Brooker Highway. The freeflow travel time increase is approximately 100 seconds compared to existing conditions. During peak periods, the elapsed time for the complete manoeuvre will be 120 seconds.

Under existing conditions, the current roundabout experiences stop line and in-queue delays of up to 60 seconds during the PM peak period. Delays will progressively increase to 410 seconds in 2041. The increased travel distance will therefore increase travel times by approximately 1 minute under current traffic flow conditions (due to increased distance travelled), and will reduce travel times by 5 minutes under 2041 traffic flow conditions (due to reduced congestion associated with the New Bridge Design).

- Boyer Road to Brooker Highway. The Reference Design does not provide a direct connection between Boyer Road and Midland Highway southbound (noting that a northbound on-ramp is provided). These movements are catered for indirectly via a U-turn manoeuvre at the East Derwent Highway roundabout, or via Gunn Street and East Derwent Highway. Both of these manoeuvres rely on the existing roundabout at East Derwent Highway/ Midland Highway.

  The routes will effectively increase travel times from Boyer Road to the Bridge structure by approximately 2 minutes under current traffic flow conditions. SIDRA models of the Reference Design East Derwent Highway/ Midland Highway roundabout were tested during AM and PM forecast peaks. These models include all traffic utilising Gunn Street/ Left Turn at East Derwent Highway; all traffic performing a U-Turn at the East Derwent Highway roundabout; and a combination of these two. The traffic modelling indicates that in a 10-year timeframe, the changes in traffic flow at the roundabout will not have any significant adverse impacts on vehicle delays, queues or level of service at the roundabout.

  The need for a south bound on-ramp connection has been reviewed by the project team following feedback from the broader community and key stakeholders on the project's reference design. Based on this review, and discussions with stakeholders, a south bound on ramp is now included in the Chosen Design. The new southbound on-ramp will improve travel times for all southbound Boyer Road movements (Brooker Highway, Lyell Highway and Main Road destinations). The relatively low volumes on this route will not result in any queue or delay issues.

Another key route, Lyell Highway to Brooker Highway will be relatively unaffected in terms of travel distance or travel time. This route will require the negotiation of a small roundabout at the eastern end of the southern interchange, then a long ramp and merge onto the Brooker Highway. During peak times travel times will be lower as this route will not have to give way to northbound bridge traffic (as it currently does at the existing roundabout).

4.5 Sight Distance

It is a design requirement that all junctions associated with the Project are designed to comply with Austroads design criteria. This includes sight distance requirements at junctions (reference Austroads 4A). The sight distance requirements at key junctions are summarised in Table 19.

The minimum sight distance criteria that must be provided at each junction is the Safe Intersection Sight Distance (SISD). SISD is the minimum sight distance which should be provided on the major road at any intersection. SISD is measured along the carriageway from the approaching vehicle to the conflict point; the line of sight having to be clear to a point 7.0 m (5.0 m minimum) back along the side road from the conflict point. It provides sufficient distance for a driver of a vehicle on the major road to observe a vehicle on a minor road approach moving into a collision situation (e.g. in the worst case, stalling across the traffic lanes), and to decelerate to a stop before reaching the collision point.

Table 19 Sight Distance Requirements

Junction	SISD Requirement	Comments
Southern Interchange (eastern and western roundabouts)	114m	Roundabouts at the southern interchange are within a 60-km/h design speed environment. The design of the overpass abutments is critical to ensuring sufficient sight distance along the connector road between both roundabouts.
Southern interchange northbound and southbound on-ramps	181m	Merges are within an 80-km/h environment.
Northern northbound on-ramp	181m	Merge is within an 80-km/h environment.

4.6 Pedestrian and Cyclist Impacts

A pedestrian and shared use path across the bridge and for both the northern and southern interchanges has been incorporated into the chosen design. The overall layout of the shared paths has been developed to minimise the number of conflict points between pedestrians, cyclists and vehicles.

The shared path at the northern interchange off the bridge splits and provides connection via two separate paths allowing users to head west towards Old Main Road, or east towards the residential area of Bridgewater. A road crossing at Gunn Street provides a connection with existing paths in the area and holding rails and are provided to where paths intersect with roads. A footpath is incorporated into the design, commencing at Hayton Place and Brayton Court it runs parallel with the Midland Highway and the southbound off-ramp towards Gunn Street.

The shared path at the southern interchange separates from the main alignment immediately off the southern bridge abutment and the path curves toward the Lyell Highway northbound on-ramp and runs parallel with this road for approximately 75 metres and then splits toward the Lyell Highway on-ramp and off-ramp. There is a crossing point on the Lyell Highway connector road to allow access to the Granton

Reserve area. A pedestrian only path runs adjacent to the Lyell Highway connector road in a southerly direction towards Main Road. An additional length of pedestrian footpath is provided towards the Black Snake Road/ Lyell Highway intersection.

The Project will encourage cycling, walking and the use of public transport in accordance with the requirements of the Assessment Criteria. Fully segregated pedestrian and cycle paths are not commonly used in Tasmania. Unlike in some other Australian states, cycling on footpaths is legal in Tasmania and bicycle riders of any age may ride on a footpath in unless such a use is prohibited.

The New Bridgewater Bridge Project includes a three-metre-wide shared path for cyclists and pedestrians, which will encourage greater active travel for local communities and encourage people to walk and cycle in a safe environment, with clear separation from motor vehicle traffic.

The proposed pedestrian and cyclist paths associated with the project are shown in Figure 16 and Figure 17 for the southern and northern interchanges respectively. A 3.0 metre wide shared pedestrian/ cyclist path is proposed along the eastern side of the bridge.

The shared paths and footpaths will provide greatly improved accessibility for pedestrians and cyclists both across the river and throughout the connecting transport network. As identified in Section 2.3, the cross-river connectivity for pedestrians is currently not available. The existing lack of separated, off-road cycling infrastructure (as noted in Section 2.4) results in cyclists being required to share the road carriageway.

The paths connecting along Lyell Highway, Black Snake Road, Main Road, and Gunn Street will provide connectivity between residential and commercial catchment areas and the new bridge infrastructure for pedestrians and cyclists.

In addition to the shared path, confident cyclists will also have the opportunity to travel on the road.

The provision of a shared path on the new bridge meets the broad objectives of the Tasmanian Government's *Positive Provision Policy for Cycling Infrastructure*, and will improve accessibility, safety and travel times for pedestrians and cyclists alike.

The decision to incorporate a shared path into the project rather than a separated path is in line with the relevant Austroads specifications, including Section 5.1.4 *Shared Paths* of the *Guide to Road Design, Part 6A: Paths for Walking and Cycling (AG-RD06A-17)* and Section 7.2 of the *Cycling Aspects of the Austroads Guides (AP-G88-17).*

Including a segregated cycle path and pedestrian path would add significant cost to the Project, which is not considered to be warranted based on Australian standards, particularly in a location that does not attract high volumes of pedestrians and cyclists.

DDA accessibility has been incorporated in the shared path for the chosen design including:

- A longitudinal grade from the high point of the bridge over the navigational channel of approximately 1% to the southern abutment and approximately 2% to the northern bridge abutment.
- A cross fall of 2% on the bridge.

- Interchange ramps include a grade of 1:14 as per Australian Standards, AS1428.1, 2009 with handrails on both sides and 1.2m long level landings every 9 metres.

Figure 16 Pedestrian and Cyclist Paths – Southern Interchange

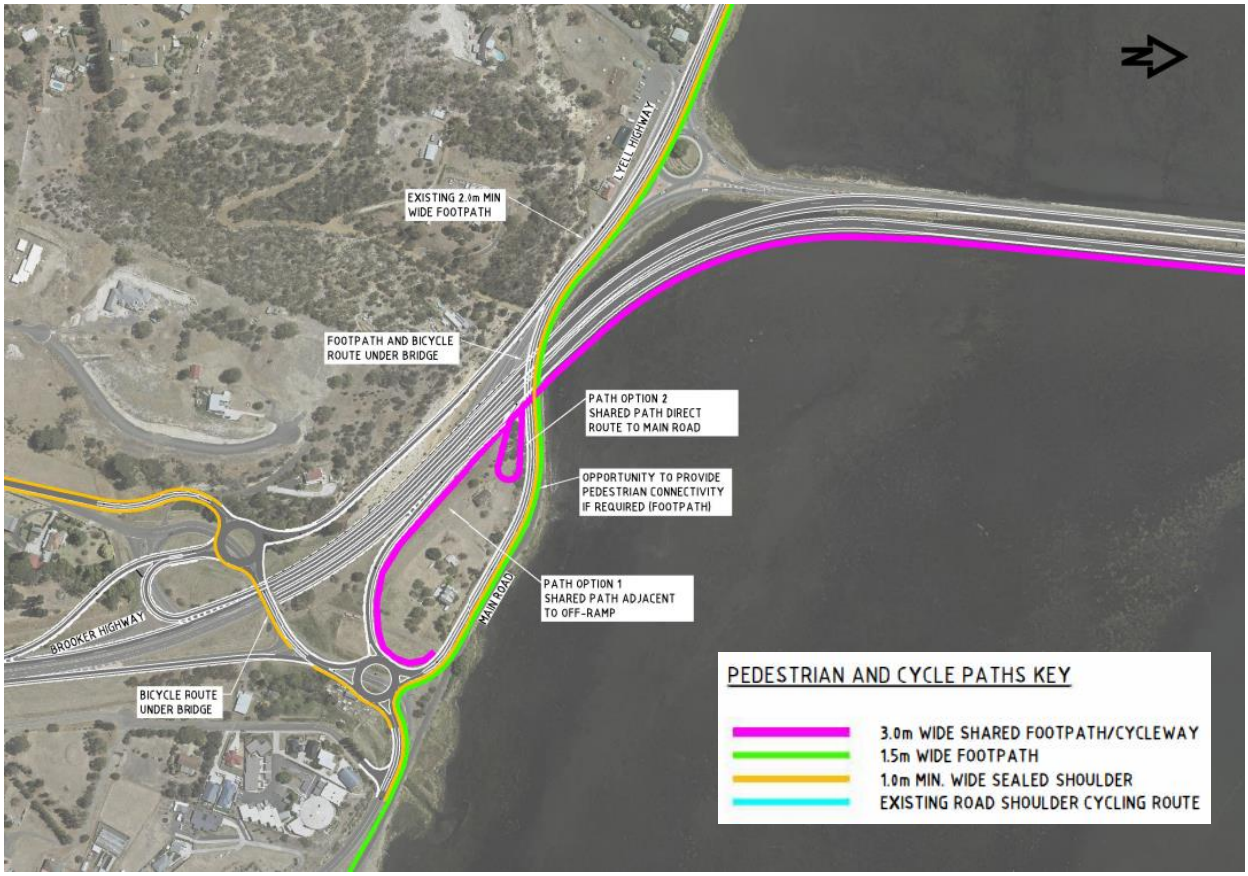
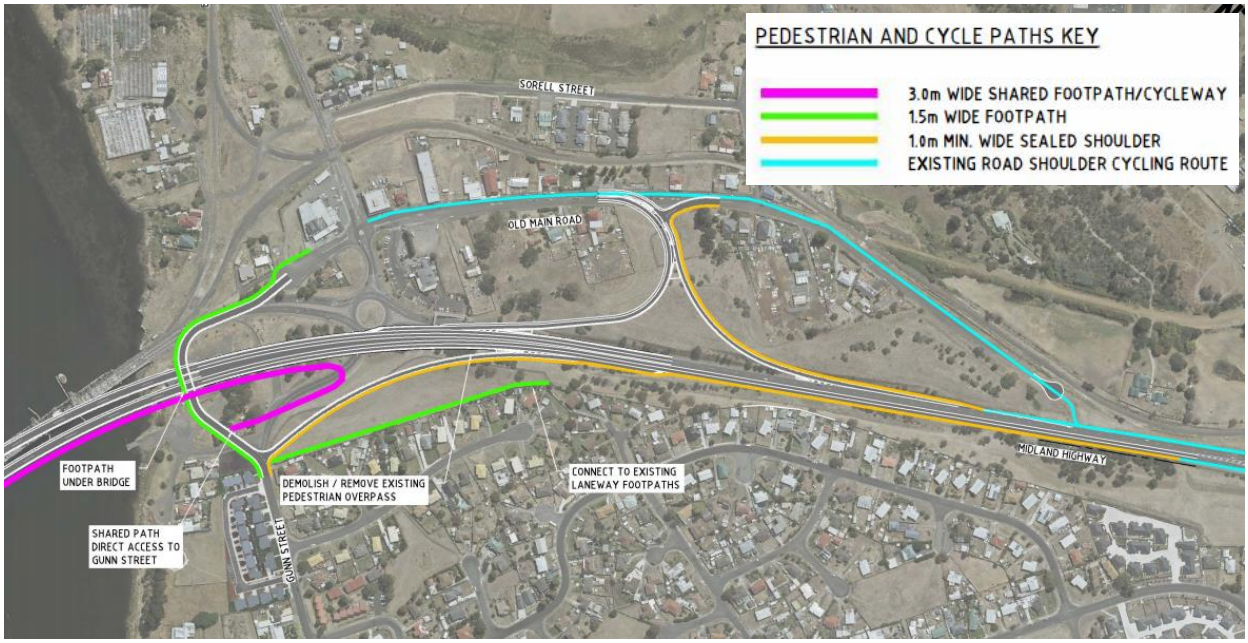


Figure 17 Pedestrian and Cyclist Paths – Northern Interchange



4.7 Public Transport Impacts

Bus priority lanes and measures are typically considered on key public transport corridors with high bus frequency in order to achieve reliable travel times for public transport or at locations such as intersections with congestion which affect bus travel time reliability. They may require additional road space or reallocation of road space.

The Midland Highway and the Bridgewater bridge are not key public transport corridors and do not currently have a high public transport frequency.

The proposed increase from the current single lane crossing to two lanes in each direction, as well as an increased speed limit from 60km/h to 80km/h and removal of bottle necks will adequately address the current and predicted traffic volumes. The proposal will provide significant travel time savings for vehicles and public transport users and will reduce congestion.

Widening the bridge to provide capacity for bus priority lanes in addition to the proposed two traffic lanes in each direction would significantly increase project cost. The forecast traffic volumes and forecast frequency of public transport services on the bridge do not warrant inclusion of dedicated bus priority lanes.

The new bridge will provide significant improvements for the routes that utilise the bridge structure (Brooker Highway to Midland Highway and vice versa). This is due to the travel time savings that the new bridge will provide for this route. The travel time improvements associated with this route are outlined in Section 4.4.

It is noted that bus stops will need to be relocated off the Highway corridor as a result of the New Bridge Design.

The travel time improvements associated with the Project will result in travel time reliability improvements for bus services utilising the Bridge. Improved travel time reliability for buses is likely to make public transport a more attractive transport option for users in accordance with the requirements of 4.2.1 of the Assessment Criteria.

4.8 Road Safety Impacts

Road safety considerations were an integral component of the design process for the Reference Design. The Reference Design was used to by contractors to develop the Chosen Design within the guidelines of the PSTR. It is a requirement for the successful contractor to undertake Road Safety Audits are part of the detail design and construction stage of the project.

The Project is likely to result in crash reductions as shown in Table 20. The crash reduction analysis was based on crash reduction factors provided by Austroads, noting the following:

- The conversion of the Brooker Highway/ Lyell Highway/ Bridge roundabout to a grade separated interchange will result in no net change in crashes due to the transfer of movements to two new roundabouts and merges associated with the southern interchange design.
- The provision of four lanes through the bridge corridor connecting between Brooker Highway and Midland Highway will result in a reduction of lane-change and rear-end collisions associated with the reduction of merge and diverge movements.
- Reduction of crashes at the Midland Highway/ Gunn Street/ Boyer Road junction due to the conversion of the roundabout to grade separation.
- Relatively minor reduction of minor injury crashes is largely attributed to the relatively low incidence of historic injury crashes within the study area.

Table 20 Road Safety Impacts of Project

Location	Existing Infrastructure			New Bridge Project		
	Total crashes	Minor injury crashes	Serious injury crashes	Total crashes	Minor injury crashes	Serious injury crashes
Lyell/ Brooker/ Midland	12	2	0	12	2	0
Bridge corridor	27	1	1	12	0	1
Black Snake Rd Interchange	16	7	0	16	5	0
Boyer/ Midland/ Gunn	17	2	0	11	1	0
TOTAL	**72**	**12**	**1**	**51**	**8**	**1**
TOTAL/ Year	14.4	2.4	0.2	10.2	1.6	0.2

The crash reduction is estimated to be 4.2 less crashes per year compared to existing conditions. Injury crashes are estimated to reduce by 0.8 crashes per year compared to existing conditions.

4.9 Project Construction Impacts

Construction of the Project will take approximately 2½ years. Traffic flow must be maintained at an acceptable level during this period.

The Assessment Criteria 4.2.3 stipulates:

> *"Provide an assessment of how potential impacts during construction can be managed to minimise any adverse impacts on the safety and efficiency of the road, rail, public transport, pedestrian and cycle network, and the uses dependent on them, having regard to:*
>
> *(a) a description of how traffic, including public transport, will be managed during construction;*
>
> *(b) impacts on the operation of surrounding uses, such as, businesses and residential; and*
>
> *(c) measures to mitigate adverse impacts*

Construction activities must not significantly adversely impact on the safety and efficiency of the road, rail, public transport, pedestrian and cyclist network. This will require that all modes of transport are catered for and that property access (commercial and residential) is maintained during the construction phase.

The traffic management associated with the construction phase of the project will be the responsibility of the contractor. The following key construction methods are considered to be critical to achieving the requirements of Assessment Criteria 4.2.3:

- Maintaining at least 1 lane of traffic flow in each direction at all times.
- Construction of the majority of the bridge structure whilst maintaining traffic flow on the existing causeway/ bridge infrastructure.
- Transferral of all or part (2 lanes or 4 lanes) of traffic flow onto new bridge structure using temporary detours whilst construction of the northern and southern interchanges are under construction.
- Utilising existing road corridors (such as Main Road) as detour routes whilst interchanges are under construction.
- Where possible a construction speed limit of 60-km/h should be provided to minimise travel delays through or past the construction site.
- Advanced warning signage placed on the southern approach to the Bowen Bridge on the Brooker Highway (prior to Elwick Road junction) and Midland Highway on the northern approach to the East Derwent Highway roundabout to provide a detour route and reduce traffic flow through the construction site.
- Any changes to railway infrastructure can be made without disruption to services as no rail services are currently operational within the Project area.

The contractor will be required to prepare a detailed Traffic Management Plan for each key stage of construction of the Project. The TMP for all stages of the construction must be prepared in accordance with Australian Standards, AS1742.3:2019.

4.10 Planning Scheme Road and Railway Assets Code Assessment

The Project is classified as 'development' under the Land Use Planning and Approvals Act 1993 ("the construction or carrying out of works" – this includes transport infrastructure). The relevant clauses contained in the Road and Railway Assets Code of the three municipal areas within the study area were therefore investigated as useful references to guide assessment of the relevant matters that arise under the Assessment Criteria.

4.10.1 Glenorchy City Council

The Project will alter the intersections of Black Snake Road/ Brooker Highway and Main Road/ Brooker Highway.

Black Snake Road

The Acceptable Solution A3 of Clause E5.5.1 of GIPS states "*The annual average daily traffic (AADT) of vehicle movements, to and from a site, using an existing access or junction, in an area subject to a speed*

limit of 60km/h or less, must not increase by more than 20% or 40 vehicle movements per day, whichever is the greater".

In this case the Project will not directly alter traffic flows on Black Snake Road west of the new interchange. The Acceptable Solution A3 of Clause E5.5.1 of the Planning Scheme is met.

Brooker Highway

The Acceptable Solution A1 of Clause E5.5.1 of the Planning Scheme states "*The annual average daily traffic (AADT) of vehicle movements, to and from a site, onto a category 1 or category 2 road, in an area subject to a speed limit of more than 60km/h, must not increase by more than 10% or 10 vehicle movements per day, whichever is the greater*".

The Project will alter traffic flows by transferring Lyell Highway traffic onto the southern interchange. This will increase traffic flow beyond 10% of existing flows. The Acceptable Solution A1 of Clause E5.5.1 of the Planning Scheme is therefore not met at the Brooker Highway junction.

The Performance Criteria P1 of Clause E5.5.1 of the Planning Scheme states:

> *"Any increase in vehicle traffic to a category 1 or category 2 road in an area subject to a speed limit of more than 60km/h must be safe and minimise any adverse impact on the efficiency of the road, having regard to:*
>
> *(a) the increase in traffic caused by the use;*
>
> *(b) the nature of the traffic generated by the use;*
>
> *(c) the nature of the road;*
>
> *(d) the speed limit and traffic flow of the road;*
>
> *(e) any alternative access to a road;*
>
> *(f) the need for the use;*
>
> *(g) any traffic impact assessment; and*
>
> *(h) any written advice received from the road authority".*

The following is relevant with respect to the Project:

a. Increase in traffic. The increase in traffic at the Brooker Highway junctions of the southern interchange of the project is likely to be in the order of 6,000 vehicles per day (inclusive of Brooker Highway to Lyell Highway and Lyell Highway to Midland Highway movements transferred to the southern interchange). This traffic is a redistribution of traffic movements that are currently focussed at the Brooker Highway/ Lyell Highway/ Bridge roundabout. The southern interchange arrangement can cater for the redistribution of traffic flows whilst maintaining an acceptable level of service, whereas the existing roundabout is approaching capacity.

b. Nature of traffic. The nature of traffic using the interchange will not alter from the existing use of the Highway.

c. Nature of road. The nature of the Highway and the roads connecting to the southern interchange will not alter.

d. Speed limit and traffic flow of road. Brooker Highway has a posted speed limit of 60-km/h at the location of the southern interchange. The speed limit will be increased to 80-km/h as a result of the Project. The traffic flow is 29,000 vehicles per day. The traffic flow and speed limit associated with the Project is compatible with the construction of a grade separated interchange.

e. Alternative access. No alternative access is considered necessary. The redistribution of traffic at the interchange reduces serious traffic congestion that is currently experienced elsewhere in the network by removing the Brooker Highway/ Lyell Highway/ Bridge roundabout.

f. Need for use. The southern interchange is a critical component in the construction of the Project. The need for the Project itself has been clearly demonstrated for various reasons as outlined in the Major Project Impact Statement.

g. Traffic impact assessment. This report documents the findings of a traffic impact assessment.

h. Road authority advice. As the Department of State Growth has procured this report and the State Roads Division within the Department of State Growth has subsequently reviewed this report, the advice of the road authority is that it accepts the statements included in this Traffic Impact Assessment.

Based on the above assessment, the Project meets the requirements of Performance Criteria P1 of Clause E5.5.1 of GIPS for the southern interchange component connecting to the Brooker Highway.

Main Road

The Acceptable Solution A3 of Clause E5.5.1 of GIPS states "*The annual average daily traffic (AADT) of vehicle movements, to and from a site, using an existing access or junction, in an area subject to a speed limit of 60km/h or less, must not increase by more than 20% or 40 vehicle movements per day, whichever is the greater*".

In this case the Project will rely on the redevelopment of the section of Main Road north of the existing Brooker Highway interchange to provide connectivity with Lyell Highway. This will increase traffic flows greater than 20% of existing movements. The Acceptable Solution A3 of Clause E5.5.1 of GIPS is therefore not met.

The Performance Criteria P3 of Clause E5.5.1 of GIPS states:

> *"Any increase in vehicle traffic at an existing access or junction in an area subject to a speed limit of 60km/h or less, must be safe and not unreasonably impact on the efficiency of the road, having regard to:*
>
> *(a) the increase in traffic caused by the use;*
>
> *(b) the nature of the traffic generated by the use;*

(c) the nature and efficiency of the access or the junction;

(d) the nature and category of the road;

(e) the speed limit and traffic flow of the road;

(f) any alternative access to a road;

(g) the need for the use;

(h) any traffic impact assessment; and

(i) any written advice received from the road authority".

The following is relevant with respect of Main Road:

a. Increase in traffic. The increase in traffic at the Main Road junctions of the southern interchange of the project is likely to be in the order of 6,000 vehicles per day (inclusive of Lyell Highway to Brooker Highway movements and Lyell Highway to Midland Highway movements transferred to the southern interchange). This traffic is a redistribution of traffic movements that are currently focussed at the Brooker Highway/ Lyell Highway/ Bridge roundabout. The southern interchange arrangement can cater for the redistribution of traffic flows whilst maintaining an acceptable level of service, whereas the existing roundabout is approaching capacity.

b. Nature of traffic. The nature of traffic using the interchange will not alter from the existing use of the Highway.

c. Nature of road. The nature of the Highway and the roads connecting to the southern interchange will not alter.

d. Speed limit and traffic flow of road. Main Road has a posted speed limit of 60-km/h at the location of the southern interchange. The traffic flow is currently less than 1,000 vehicles per day north of the interchange. The traffic flow and speed limit associated with the Project is compatible with the construction the eastern junction of the southern interchange.

e. Alternative access. No alternative access is considered necessary. The redistribution of traffic at the interchange reduces serious traffic congestion that is currently experienced elsewhere in the network by removing the Brooker Highway/ Lyell Highway/ Bridge roundabout.

f. Need for use. The southern interchange is a critical component in the construction of the Project. The need for the Project itself has been clearly demonstrated for various reasons as outlined in the Major Projects Impact Statement.

g. Traffic impact assessment. This report documents the findings of a traffic impact assessment.

h. Road authority advice. As the Department of State Growth has procured this report and the State Roads Division within the Department of State Growth has subsequently reviewed this report, the advice of the road authority is that it accepts the statements included in this Traffic Impact Assessment.

Based on the above assessment, the Project meets the requirements of Performance Criteria P3 of Clause E5.5.1 of GIPS for the southern interchange component connecting to Main Road.

Sight Distance Requirements

The Acceptable Solution A1 of Clause E5.6.4 of GIPS states "*sight distances at an access or junction must comply with the Safe Intersection Sight Distances shown in Table E5.1*".

All junctions will be designed in accordance with Austroads requirements. The Austroads SISD requirements outlined in Table 19 exceed the SISD values required in Table E5.1 of the Planning Scheme. When designed in accordance with Austroads SISD requirements, the Acceptable Solution A1 of Clause E5.6.4 of GIPS is met.

4.10.2 Derwent Valley Council

The transport infrastructure modifications within the Derwent Valley Council area include the removal of the Brooker Highway/ Lyell Highway/ Bridge roundabout and modifications to the Lyell Highway/ Rust Road junction.

The Rust Road/ Lyell Highway junction will not fundamentally be altered from existing conditions (ie. it is not a new road junction). The Project itself will also not fundamentally alter traffic flows at the junction. The general requirements of E5.0, Road and Railway Assets Code of DVIPS are therefore met.

Sight Distance Requirements

The Acceptable Solution A1 of Clause E5.6.4 of DVIPS states "*sight distances at an access or junction must comply with the Safe Intersection Sight Distances shown in Table E5.1*".

All junctions will be designed in accordance with Austroads requirements. Table E5.1 requires 105 metres of sight distance at the Rust Road intersection with Lyell Highway. The available sight distance at the junction along Lyell Highway will exceed this value, therefore the Acceptable Solution A1 of Clause E5.6.4 of DVIPS is met.

4.10.3 Brighton City Council

The transport infrastructure modifications within the Brighton Council area include the removal of the Midland Highway/ Boyer Road/ Gunn Street roundabout, the construction of the new northbound on and off-ramps on the Midland Highway, and the construction of the new southbound off-ramp on the Midland Highway.

The Acceptable Solution A1.1 of Clause C3.5.1 of TPSB states "*For a category 1 road or a limited access road, vehicular traffic to and from the site will not require: (a) a new junction; (b) a new vehicle crossing; or (c) a new level crossing*".

The Project will remove the existing roundabout at Midland Highway/ Boyer Road/ Gunn Street and create three new junctions on the Midland Highway (northbound on and off-ramps and southbound off-ramp). The Project does not meet the requirements of Acceptable Solution A1.1 of Clause C3.5.1 of TPSB.

The Performance Criteria P1 of Clause 3.5.1 of the Planning Scheme states:

> *"Vehicular traffic to and from the site must minimise any adverse effects on the safety of a junction, vehicle crossing or level crossing or safety or efficiency of the road or rail network, having regard to:*
>
> *(a) any increase in traffic caused by the use;*
>
> *(b) the nature of the traffic generated by the use;*
>
> *(c) the nature of the road;*
>
> *(d) the speed limit and traffic flow of the road;*
>
> *(e) any alternative access to a road;*
>
> *(f) the need for the use;*
>
> *(g) any traffic impact assessment; and*
>
> *(h) any advice received from the rail or road authority".*

The following is relevant with respect of the Project:

a. Increased traffic. The Project will not fundamentally increase traffic in its own right. The design will redistribute traffic that would previously have utilised the Midland Highway/ Boyer Road/ Gunn Street roundabout.

b. Nature of traffic. The nature of traffic using the interchange will not alter from the existing use of the Highway.

c. Nature of road. The nature of the Highway and the roads connecting to the southern interchange will not alter.

d. Speed limit and traffic flow of road. The existing speed limit of Midland Highway at the roundabout is 60-km/h. This will be increased to 80-km/h. Traffic flow on the Midland Highway at the interchange is 22,000 vehicles per day. The traffic flow and speed limit associated with the Project is compatible with the grade separated construction the northern interchange.

e. Alternative access. No alternative access is considered necessary. The redistribution of traffic at the interchange reduces localised traffic congestion that is currently experienced elsewhere in the network by removing the Midland Highway/ Boyer Road/ Gunn Street roundabout.

f. Need for use. The southern interchange is a critical component in the construction of the Project. The need for the Project itself has been clearly demonstrated for various reasons as outlined in the Major Project Impact Statement.

g. Traffic impact assessment. This report documents the findings of a traffic impact assessment.

h. Road authority advice. As the Department of State Growth has procured this report and the State Roads Division within the Department of State Growth has subsequently reviewed this report, the

advice of the road authority is that it accepts the statements included in this Traffic Impact Assessment.

Based on the above assessment, the development meets the requirements of Performance Criteria P1 of Clause C3.5.1 of TPSB.

5. Assessment Criteria Assessment Summary

The Development Assessment Panel have prepared Assessment Criteria for the New Bridgewater Bridge Major Project. This report has investigated the traffic and road safety aspects of the Project in accordance with relevant standards and guidelines. This report has analysed the Reference Design in detail. The construction of the new bridge will be undertaken through Early Contractor Involvement (ECI) process that will utilise the Chosen Design. The Chosen Design differs from the Reference Design investigated in this report in several minor respects. The Chosen Design is considered to be a refinement and improvement of the Reference Design and therefore the findings of this report are considered relevant.

Of relevance to this report are sections 4.2.1, 4.2.2 and 4.2.3 of the Assessment Criteria. These are outlined as follows:

4.2.1 – Provide an assessment of how the use and development encourages cycling, walking and public transport.

4.2.2 – Safety and efficiency of the road and rail network

Provide a traffic impact assessment that provides details of how use and development minimises any adverse effects on the safety and efficiency of the road and rail network and uses dependent upon it, including consideration of:

(a) safety and efficiency for vehicles, public transport and strategic freight movement, such as speed limit, traffic flow and public access;

(b) safety of junctions, vehicle crossings and level crossings;

(c) any alternative vehicle crossing or level crossing;

(d) safety and efficiency for pedestrians and cyclists;

(e) any change in access arrangements of an existing use;

(f) connectivity between new and existing parts of the network;

(g) any change in the connectivity of the network;

(h) measures to minimise any adverse effects; and

(i) any advice regarding a new vehicle crossing or level crossing from a road or rail authority.

4.2.3 Safety and efficiency of the road, rail and public transport network during construction

Provide an assessment of how potential impacts during construction can be managed to minimise any adverse impacts on the safety and efficiency of the road, rail, public

transport, pedestrian and cycle network, and the uses dependent on them, having regard to:

(a) a description of how traffic, including public transport, will be managed during construction;

(b) impacts on the operation of surrounding uses, such as, businesses and residential; and

(c) measures to mitigate adverse impacts.

Each of these elements of the Assessment Criteria are addressed within the main body of this TIA and summarised in the following sections.

5.1 Cycling, Walking and Public Transport

5.1.1 Walking and cycling

In accordance with the requirements of Section 4.2.1 of the Assessment Criteria, the Project will incorporate pedestrian and cyclist paths as shown in Figure 16 and Figure 17 for the southern and northern interchanges respectively. A 3.0 metre wide shared pedestrian/ cyclist path is proposed along the eastern side of the bridge.

The shared paths and footpaths included with the Project will provide greatly improved accessibility for pedestrians and cyclists both across the river and throughout the connecting transport network. No pedestrian facilities currently exist across the existing causeway structure. The existing lack of cycling infrastructure (highlighted in Section 2.4) results in cyclists being required to share the road carriageway. This will result in obvious accessibility and safety benefits for walking and cycling modes of transport as a result of the Project.

The paths connecting along Lyell Highway, Black Snake Road, Main Road, and Gunn Street will also provide connectivity between residential and commercial catchment areas and the new bridge infrastructure for pedestrians and cyclists.

5.1.2 Public transport

The new bridge will provide significant improvements for the public transport routes that that utilise the bridge structure (Brooker Highway to Midland Highway and vice versa). This is due to the travel time savings that the new bridge will provide for this route. The travel time improvements associated with this route are outlined in Section 4.4.

Bus routes between Brooker Highway and Lyell Highway will also have improved travel times and travel time reliability through the removal of serious congestion that currently occurs as a result of the Brooker Highway/ Lyell Highway/ Bridge roundabout.

The travel time improvements associated with the Project will result in travel time reliability improvements for bus services utilising the Bridge.

5.2 Safety and Efficiency of Road and Railway Network

5.2.1 Road Safety

The Project will provide road safety benefits as outlined in Section 4.8. The crash reduction is estimated to be 4.2 less crashes per year compared to existing conditions. Injury crashes are estimated to reduce by 0.8 crashes per year compared to existing conditions.

5.2.2 Efficiency

The Project will provide significant transport efficiency improvements in the network. This will be through the provision of four continuous lanes connecting between Brooker Highway and Midland Highway and the removal of two roundabouts along the route. The existing infrastructure results in serious congestion that will deteriorate to unacceptable levels over the next decade due to traffic growth.

Travel time improvements associated with the Project are outlined in Section 4.4.

5.3 Construction Impacts

The construction phase of the Project will take approximately 2½ years. Traffic flow must be maintained at an acceptable level during this period. The construction impacts associated with the development are outlined in Section 4.9.

The PSTR does not explicitly discuss maximum delays associated with works. The PSTR does refer to Department of State Growth specifications and in Std Section 160, it prescribes a max 8 minute delay (associated with unplanned works) and maximum delay of 15 minute delays (where advanced notice is provided). It would be expected that contractors will attempt to minimise traffic delays during peak periods.

The traffic management associated with the construction phase of the project will be the responsibility of the contractor. There are several key construction methods that will minimise traffic impacts throughout the construction phase. These include staging of construction of key components of the Project, use of detours (local detours and broader detours that utilise alternative river crossings) and provision for at least one lane open to traffic in each direction at all times.

The contractor will be required to prepare a detailed Traffic Management Plan for each key stage of construction of the Project. The TMP for all stages of the construction must be prepared in accordance with Australian Standards, AS1742.3:2019.

Appendix A

Origin – Destination Survey Data

Figure 18 Origin-Destination Survey Locations

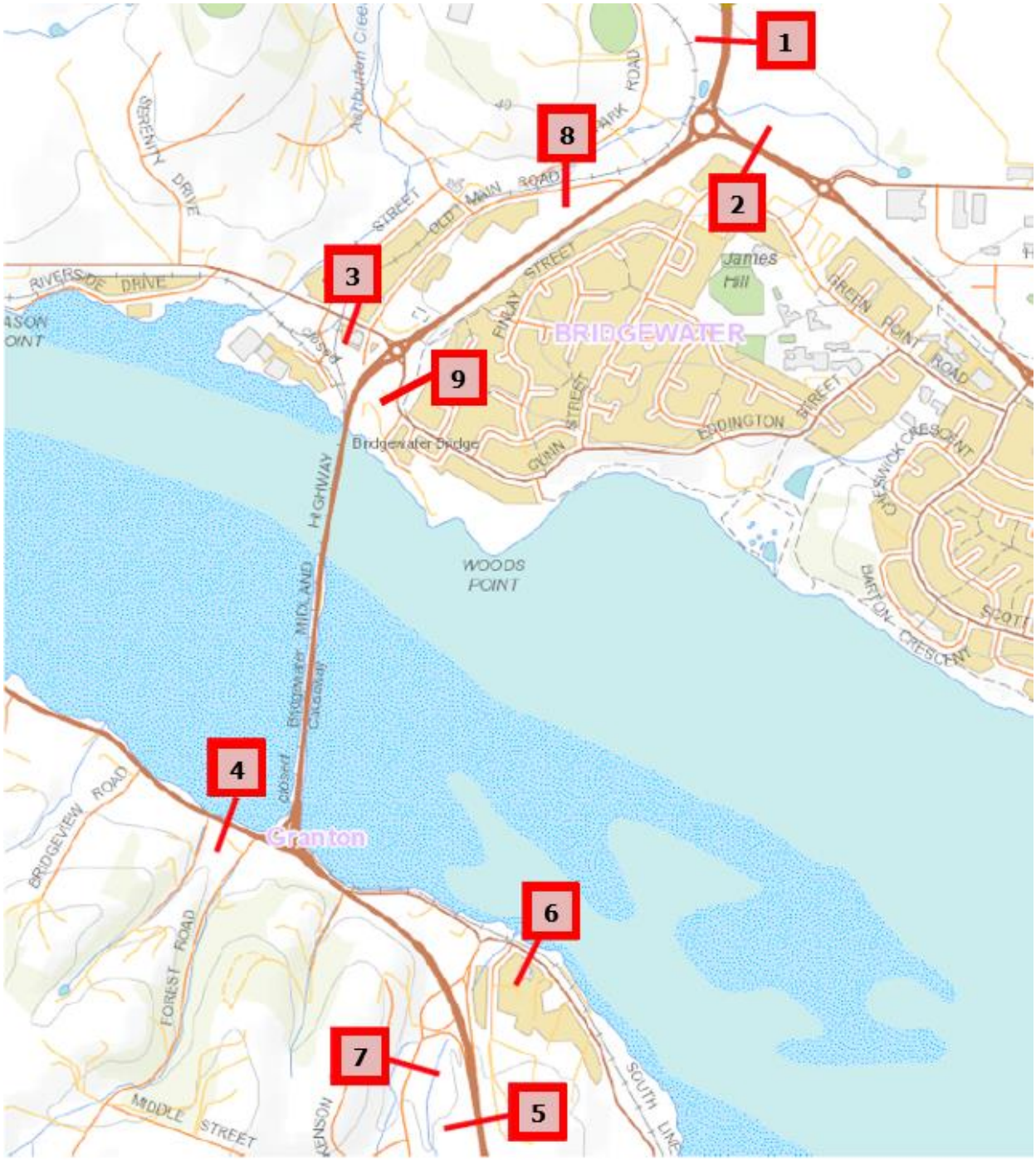


Table 21 AM Peak Origin-Destination Survey Data

AM Peak Origin Destination Survey (8:00am - 9:00am)

O-D Matches - Classification 1 - Light

Time Period 7:00 9:00	Destination Station	1N Midland Hwy	2E East Derwent Hwy	3W Boyer Rd	4W Lyell Hwy	5S Brooker Hwy	6S Main Rd	7S Black Snake Rd	8E Old Main Rd	9E Gunn St	Total
Origin Station	Volume	700	667	100	301	1366	149	16	55	152	**3506**
1S Midland Hwy	1031	11	327	26	26	452	47	2	0	67	**958**
2W East Derwent Hwy	521	179	23	24	14	190	29	3	0	9	**471**
3E Boyer Rd	185	36	36	3	0	69	7	1	2	15	**169**
4E Lyell Hwy	518	38	34	2	0	330	16	1	1	4	**426**
5N Brooker Hwy	889	265	136	18	193	4	4	8	5	28	**661**
6N Main Rd	93	30	31	5	4	8	0	1	0	3	**82**
7N Black Snake Rd	40	2	1	0	0	26	4	0	0	0	**33**
8E Old Main Rd	55	23	21	1	0	2	0	0	0	3	**50**
9W Gunn St	125	6	6	18	5	51	7	1	1	0	**95**
Total	**3332**	**584**	**609**	**79**	**237**	**1081**	**107**	**16**	**8**	**129**	**2850**

O-D Matches - Classification 2 - Heavy

Time Period 7:00 9:00	Destination Station	1N Midland Hwy	2E East Derwent Hwy	3W Boyer Rd	4W Lyell Hwy	5S Brooker Hwy	6S Main Rd	7S Black Snake Rd	8E Old Main Rd	9E Gunn St	Total
Origin Station	Volume	127	44	10	26	99	21	2	7	6	**336**
1S Midland Hwy	110	0	23	6	6	59	1	2	0	3	**97**
2W East Derwent Hwy	37	20	0	0	1	9	1	0	0	0	**31**
3E Boyer Rd	19	7	0	0	0	2	0	0	0	1	**9**
4E Lyell Hwy	28	8	0	0	0	10	6	0	0	0	**24**
5N Brooker Hwy	104	61	7	1	13	2	0	0	1	1	**85**
6N Main Rd	15	5	1	1	3	0	0	0	1	0	**11**
7N Black Snake Rd	2	0	0	0	0	0	0	0	0	0	**0**
8E Old Main Rd	7	2	3	0	0	0	0	0	0	0	**5**
9W Gunn St	7	0	0	1	0	3	1	0	0	0	**5**
Total	**322**	**103**	**34**	**8**	**23**	**82**	**8**	**2**	**2**	**5**	**262**

O-D Matches - Total Vehicles

Time Period 7:00 9:00	Destination Station	1N Midland Hwy	2E East Derwent Hwy	3W Boyer Rd	4W Lyell Hwy	5S Brooker Hwy	6S Main Rd	7S Black Snake Rd	8E Old Main Rd	9E Gunn St	Total
Origin Station	Volume	827	711	110	327	1465	170	18	62	158	**3690**
1S Midland Hwy	1141	11	350	32	32	511	48	4	0	70	**988**
2W East Derwent Hwy	558	199	23	24	15	199	30	3	0	9	**493**
3E Boyer Rd	204	43	36	3	0	71	7	1	2	16	**163**
4E Lyell Hwy	546	46	34	2	0	340	22	1	1	4	**446**
5N Brooker Hwy	993	326	143	19	206	6	4	8	6	29	**718**
6N Main Rd	108	35	32	6	7	8	0	1	1	3	**90**
7N Black Snake Rd	42	2	1	0	0	26	4	0	0	0	**33**
8E Old Main Rd	62	25	24	1	0	2	0	0	0	3	**55**
9W Gunn St	132	6	6	19	5	54	8	1	1	0	**52**
Total	**3654**	**687**	**643**	**87**	**260**	**1163**	**115**	**18**	**10**	**134**	**2983**

Table 22 PM Peak Origin-Destination Survey Data

PM Peak Origin Destination Survey (5:00pm - 6:00pm)

O-D Matches - Classification 1 - Light

Time Period 17:45 18:00	Destination Station	1N Midland Hwy	2E East Derwent Hwy	3W Boyer Rd	4W Lyell Hwy	5S Brooker Hwy	6S Main Rd	7S Black Snake Rd	8E Old Main Rd	9E Gunn St	Total
Origin Station	Volume	1085	647	299	607	1012	140	66	48	105	**3904**
1S Midland Hwy	897	22	215	64	41	386	40	3	0	11	**771**
2W East Derwent Hwy	851	374	8	91	32	156	28	5	0	7	**694**
3E Boyer Rd	147	28	32	3	2	53	3	2	1	8	**124**
4E Lyell Hwy	370	36	51	5	1	195	20	2	3	4	**313**
5N Brooker Hwy	1283	355	143	64	342	15	21	29	5	34	**974**
6N Main Rd	244	56	46	16	41	11	2	17	1	5	**190**
7N Black Snake Rd	44	2	0	1	1	22	5	2	0	0	**33**
8E Old Main Rd	48	17	14	0	0	0	0	0	0	1	**31**
9W Gunn St	89	10	5	27	4	29	3	0	0	0	**78**
Total	**3884**	**890**	**509**	**244**	**460**	**838**	**119**	**60**	**10**	**70**	**3130**

O-D Matches - Classification 2 - Heavy

Time Period 17:45 18:00	Destination Station	1N Midland Hwy	2E East Derwent Hwy	3W Boyer Rd	4W Lyell Hwy	5S Brooker Hwy	6S Main Rd	7S Black Snake Rd	8E Old Main Rd	9E Gunn St	Total
Origin Station	Volume	53	17	9	16	23	3	1	0	5	**122**
1S Midland Hwy	39	0	10	5	4	13	0	0	0	1	**32**
2W East Derwent Hwy	23	17	0	0	0	3	0	0	0	0	**20**
3E Boyer Rd	4	0	0	0	0	0	0	0	0	1	**0**
4E Lyell Hwy	9	4	1	0	0	3	1	0	0	0	**9**
5N Brooker Hwy	40	20	4	0	6	0	0	1	0	1	**31**
6N Main Rd	9	4	0	0	3	0	0	0	0	0	**7**
7N Black Snake Rd	1	0	0	0	0	0	0	0	0	0	**0**
8E Old Main Rd	0	0	0	0	0	0	0	0	0	0	**0**
9W Gunn St	5	1	0	1	0	1	0	0	0	0	**1**
Total	**125**	**45**	**15**	**5**	**13**	**19**	**1**	**1**	**0**	**3**	**99**

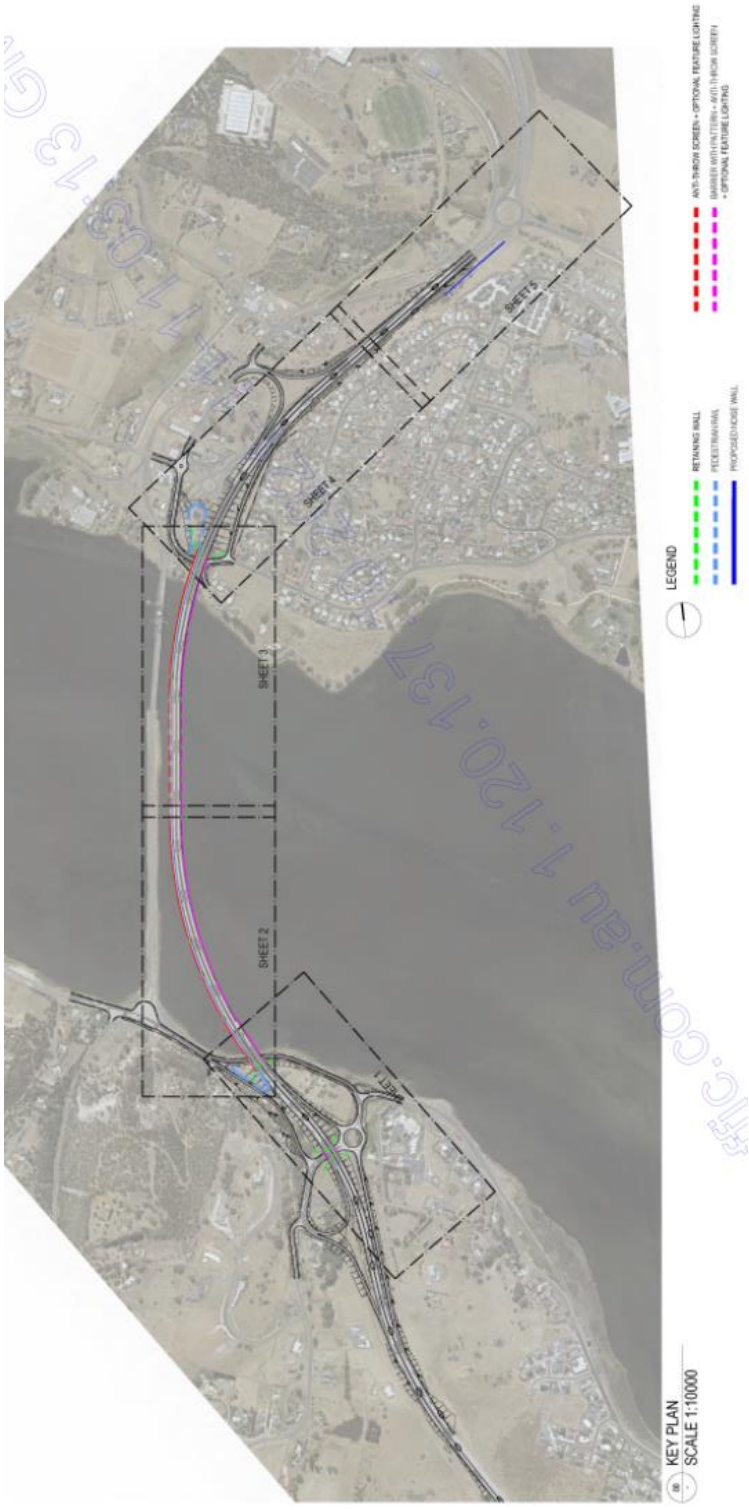
O-D Matches - Total Vehicles

Time Period 17:45 18:00	Destination Station	1N Midland Hwy	2E East Derwent Hwy	3W Boyer Rd	4W Lyell Hwy	5S Brooker Hwy	6S Main Rd	7S Black Snake Rd	8E Old Main Rd	9E Gunn St	Total
Origin Station	Volume	1138	664	308	623	1035	143	67	48	110	**4026**
1S Midland Hwy	936	22	225	69	45	399	40	3	0	12	**803**
2W East Derwent Hwy	874	391	8	91	32	159	28	5	0	7	**714**
3E Boyer Rd	151	28	32	3	2	53	3	2	1	9	**124**
4E Lyell Hwy	379	40	52	5	1	198	21	2	3	4	**322**
5N Brooker Hwy	1323	375	147	64	348	15	21	30	5	35	**1005**
6N Main Rd	253	60	46	16	44	11	2	17	1	5	**197**
7N Black Snake Rd	45	2	0	1	1	22	5	2	0	0	**33**
8E Old Main Rd	48	17	14	0	0	0	0	0	0	1	**31**
9W Gunn St	94	11	5	28	4	30	3	0	0	0	**81**
Total	**4009**	**935**	**524**	**249**	**473**	**857**	**120**	**61**	**10**	**73**	**3229**

Appendix B

Bridgewater Bridge Chosen Design Plans

Chosen Design Master Plan



Southern Interchange

Northern Interchange

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1	Keith Midson	Zara Kacic-Midson	14 July 2021
2	Keith Midson	Bryce Taplin	23 July 2021
3	Keith Midson	Frazer Read	2 August 2021
4	Keith Midson	Zara Kacic-Midson	17 September 2021
5	Keith Midson	Zara Kacic-Midson	5 November 2021
6	Keith Midson	Zara Kacic-Midson	11 November 2021