14 ROAD, RAIL, AIR AND PUBLIC TRANSPORT

A traffic and transport assessment of the Queensland Curtis LNG (QCLNG) Project's LNG Component, comprising a LNG processing and export facility, has been undertaken by Halcrow Pacific Pty Ltd (trading as Halcrow MWT) and Environmental Resources Management (Australia) Pty Ltd (ERM). A copy of the Halcrow Road Impact Assessment (RIA) study is provided in *Appendix 5.15.*[1]

This chapter provides a summary of the RIA study and additional transport assessment undertaken as a requirement of the Environmental Impact Statement (EIS) Terms of Reference (TOR). This chapter does not address shipping or marine transport aspects of the QCLNG Project. These are addressed in *Volume 5, Section 15.*

14.1 DESCRITPION OF PROJECT ENVIRONMENTAL OBJECTIVES

The Project environmental objective for road, rail, air and public transport is: to ensure that use of roads, rail and other transport infrastructure does not impact on ecological health, public amenity or safety of those who use or are in proximity to transport infrastructure.

14.2 ASSUMPTIONS

The RIA study modelled 44 potential scenarios to determine possible impacts of the Project and how these could be minimised with changes in Project design, with the aim of ensuring that the safety of local and state road and rail is maintained or enhanced during the life of the Project.

These scenarios comprise a reference case with assumptions of workforce size and transport demand, a number of construction camp options, and various transport logistics scenarios incorporating a number of bridge and road options connecting Curtis Island with Gladstone City.

For the purposes of traffic modelling (using SIDRA), and to model a "worst case" scenario, the model assumed a design peak construction workforce of 2,000 personnel from Day 1 of construction commencing in 2010.

Following the completion of the RIA, a number of the key assumptions were refined. These are described in *Table 5.14.1*.

1 Halcrow MWT (2009) *Queensland Curtis LNG Project EIS – Traffic and Transport Impact Assessment*

Table 5.14.1 RIA Original and Refined Assumptions

Original Assumptions[2]	Refined Assumptions[3]
1. 2,000 personnel for the Train 1 and 2 construction phase	1. 1,500 personnel for the Train 1 and 2 construction phase;
2. Fortnightly rotation assumption of 10 days on/4 days off	2. Nine days on a fortnight (i.e. five days on/two days off, then four days on/three days off, being 90 hours per fortnight). Some night shift and weekend work as schedule requires;
3. Hybrid Construction Camp Option D all non-local personnel residing in the camp	3. Hybrid Construction Camp Option D all non-local personnel residing in the camp (i.e. 30 per cent of total workforce);
4. Anticipated pipeline movements are: • Dawson Highway – 168 trucks/day[4] for 167 days; and • Gladstone-Mt Larcom Road – 54 trucks/day[5] for 21 days;	4. Gladstone Port for the receipt of 260 km of 42" pipe in 18 m lengths, three lengths/truck – equates to on average 20 trucks/day[6,7]. On average 1.08 km/day of pipe moved over 25-day duration, equating to 10-11 month pipe transportation. Transport of 25 km of pipe/ship/month, total 11 ships on average by end 2011;
5. Operations Phase Train 1 and 2 – 104 personnel, and Train 3 130 personnel; and	5. Operations Phase Train 1 and 2 – 76 personnel, and Train 3 – 100 personnel.
6. Train 1 and 2 construction arrive/depart from Auckland Point; with alternatives modelled including scenarios for Train 2 and 3 construction arrive/depart from Alf O'Rourke Drive.	6. Trains 1, 2 and 3 - all construction personnel arrive/depart from Auckland Point Construction Terminal, and operations personnel arrive/depart from the Operations Terminal to be located at the end of Alf O'Rourke Drive, behind RG Tanna Coal Terminal.

These refined assumptions are important considerations when reviewing the RIA. The RIA as modelled reflects a "worst case" scenario and demonstrates there is significant "headroom" factored into the RIA with a consequential reduction of 195 light vehicles/day and an equivalent of 135 heavy vehicles/day for 167 days associated with pipe transport on the Gladstone state- and council-controlled road networks.

The proposed mitigation measures (e.g. four intersection upgrades and pavement monetary contributions) are also based on the "worst case scenario" and are not reflective of the refined assumptions mentioned above.

2 Used in RIA model.

3 Not used in RIA model but covered by original assumptions.

4 Trucks/day does not equate to truck movements.

5 Trucks/day does not equate to truck movements.

6 Trucks/day does not equate to truck movements.

7 Original assumption for pipe transport of a total equivalent of 175 heavy vehicles/day for 167 days. A reduction in calculated pipe volume and number of trucks required under refined assumption equates to on average 20 trucks/day over 25 day duration, over 10-11-month period for pipe transportation up to 2011. This equates to significantly less heavy vehicle movements over a longer duration (i.e. equivalent to a 77 per cent reduction in heavy vehicles between the original and refined assumption).

14.3 METHODOLOGY

The traffic study included as *Appendix 5.15* relates exclusively to the Project's LNG Facility, and *Appendix 5.16*[8] contains a detailed description of the RIA and micro-simulation methodologies used.

Consultation with the Department of Main Roads (DMR) and Gladstone Regional Council (GRC) was undertaken during the initial phases of the RIA. Based on the agreement between these parties, the assessment has included:

- link analysis for the elements described in*Table 5.14.2*
- intersection analysis for each location and task described in *Table 5.14.3*
- pavement impact analysis for the links identified in *Table 5.14.4.*

In relation to the use, planning and design of strategic port land, and marine-based transport options, regular and ongoing consultations have been held with Gladstone Ports Corporation (GPC).

In relation to road and bridge options, regular and ongoing consultations have also been held with the Coordinator-General and key state agencies.

The assessment has been undertaken with due consideration of the following reference resources:

- *Guidelines for Assessment of Road Impacts of Development* (GARID) (DMR, 2006)
- Road Planning and Design Manual (RPDM) (DMR, 2006)
- Pavement Design Manual (PDM) (DMR, 2005)
- Roads and Transport Standard (GRC, 2005)
- Transport Infrastructure Policy (GRC, 2002).

Table 5.14.2 Link Assessment

Assessment Task	Geographic Study Area
Link Impact Assessment • Without and with LNG Facility components • During both construction and operational phases • For two road connection options between Curtis Island and Gladstone	Bruce Highway: • north of Gladstone-Mt Larcom Road • Gladstone-Mt Larcom Road to Calliope River-Targinie Road • Calliope River-Targinie Road to Dawson Highway • south of Dawson Highway Gladstone-Mt Larcom Road: • Bruce Highway to Calliope River-Targinie Road • Calliope River-Targinie Road to Landing Road

8 Halcrow MWT (2009) *Queensland Curtis LNG Project EIS – Microsimulation Assessment*

Assessment Task	Geographic Study Area
• For three construction camp options to be located on Curtis Island or within Gladstone	• Landing Road to Reid Road • Reid Road to Red Rover Road • Red Rover Road to Blain Drive • Blain Drive to Dawson Highway Dawson Highway: • Bruce Highway to Don Young Drive • Don Young Drive to Phillip Street • Phillip Street to Blain Drive • Blain Drive to Glenlyon Street

Table 5.14.3 Intersection Assessment

Assessment Task	Geographic Study Area
Intersection Analysis • Without and with LNG Facility components • During both construction and operational phases • For two road connection options between Curtis Island and Gladstone • For three construction camp options to be located on Curtis Island or within Gladstone	Intersections: • Bruce Highway/Dawson Highway • Bruce Highway/Calliope River-Targinie Road • Bruce Highway/Gladstone-Mt Larcom Road • Gladstone-Mt Larcom Road/Calliope River-Targinie Road • Gladstone-Mt Larcom Road/Landing Road • Hanson Road/Reid Road • Hanson Road/Red Rover Road • Hanson Road/Blain Drive/Alf O'Rourke Drive • Glenlyon Street/William Street • Glenlyon Street/Gladstone Port Access Road/Railway Street • Glenlyon Street/Dawson Highway/Bramston Street • Glenlyon Street / Herbert Street/Tennis Centre Access • Glenlyon Street/Tank Street • Bramston Street/Goondoon Street • Port Access Road/Mark Fenton Drive/Hopper Road/Tug Berth Access Road • Dawson Highway/Blain Drive/Herbertson Street • Dawson Highway/Philip Street / Shopping Centre Access • Dawson Highway/Don Young Drive

Table 5.14.4 Pavement Assessment

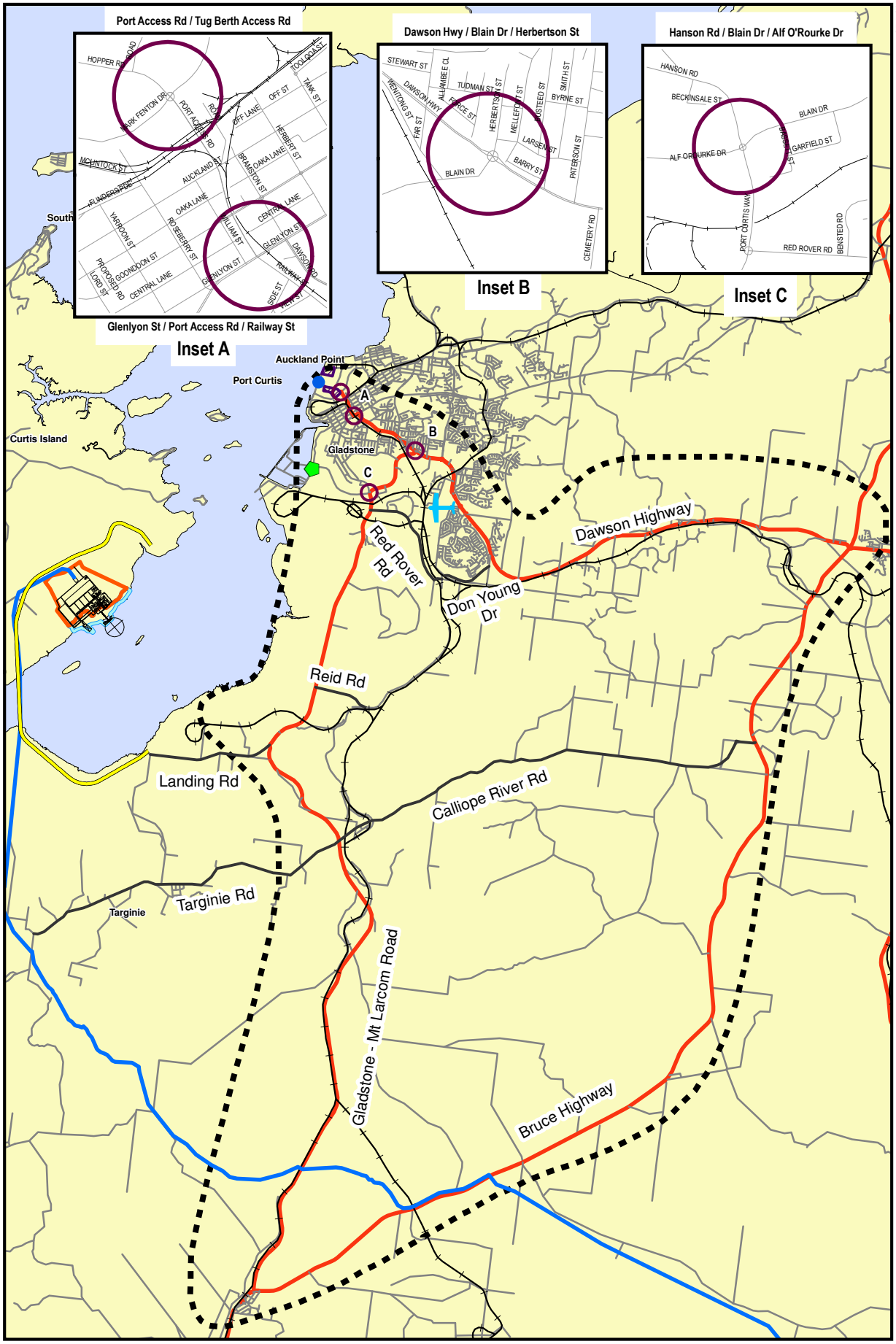
Assessment Task	Geographic Study Area
Pavement Impact Assessment • Without and with LNG Facility components • During both construction and operational phases • For two road connection options between Curtis Island and Gladstone • For three construction camp options to be located on Curtis Island or within Gladstone	Bruce Highway: • north of Gladstone-Mt Larcom Road • Gladstone-Mt Larcom Road to Calliope River-Targinie Road • Calliope River-Targinie Road to Dawson Highway • south of Dawson Highway Gladstone-Mt Larcom Road: • Bruce Highway to Calliope River-Targinie Road • Calliope River-Targinie Road to Landing Road • Landing Road to Reid Road • Reid Road to Red Rover Road • Red Rover Road to Blain Drive • Blain Drive to Dawson Highway Dawson Highway: • Bruce Highway to Don Young Drive • Don Young Drive to Phillip Street • Phillip Street to Blain Drive • Blain Drive to Glenlyon Street

The geographic study area and state- and council-controlled road links described in this section are shown on *Figure 5.14.1.*

14.4 EXISTING ENVIRONMENT

14.4.1 Existing Road Network

The Project's LNG processing and exporting facility is proposed to be located on the western side of Curtis Island as shown in *Figure 5.14.1*, within the Curtis Island Industry Precinct (CIIP) of the state government's Gladstone State Development Area (GSDA). At present, vehicular access to Curtis Island is provided by vehicular ferry departing from Gladstone Marina and arriving at South End. No road connection between the mainland and the CIIP exists.



QUEENSLAND CURTIS LNG
A BG Group business

ERM
Environmental Resources Management Australia Pty Ltd

Project	Queensland Curtis LNG Project		
Client	QGC - A BG Group business		
Drawn	GB	Volume 5	Figure 5.14.1
Approved	GB	File No: 0086165b_EIS_TR_GIS001_F5.14.1	
Date	06.03.09	Revision 2	

Title: **Road Impact Assessment Study Area: State Controlled and Council Controlled Road Links**

The construction phase laydown and pre-assembly area (Area 1), and car park and personnel assembly area (Area 2) is to be located on approximately 11.5 ha of GPC strategic port land at Auckland Point (refer *Volume 2,Chapter 13)*. Pipe laydown areas (Areas 3 and 4) are to be located on approximately 12.0 ha, and two new access roads (Access Road 1 -approximately 670 m in length, and Access Road 2 – approximately 190 m, with a total approximate area of 0.85 ha).

The operational phase workforce will mobilise to and from a new terminal to be constructed on an area behind RG Tanna wharf, at the end of Alf O'Rouke Drive, adjacent to the Gladstone Marina.

The key state- and council-controlled road links which provide access to the Project site during construction and operational phases are described in *Table 5.14.5* and are shown in *Figure 5.14.1*.

Table 5.14.5 Key State-controlled and Council-controlled Road Links

Road	Description
Bruce Highway	The Bruce Highway is a fully sealed bitumen road which provides connectivity for the major urban centres along the eastern coastline of Queensland. Forming part of the national highway network, the Bruce Highway runs from Brisbane to Cairns and is generally a two-lane undivided roadway with 1 m to 1.5 m sealed shoulders in rural areas. In urban areas and at major intersections (such as at Gladstone-Mt Larcom Road, Calliope River - Targinie Road and the Dawson Highway) the roadway form is of a higher standard and incorporates separation through raised or painted medians. The posted speed limit is generally 100 kph except in urban areas, where posted speed limits can drop down to 60 kph.
Gladstone-Mt Larcom Road	Gladstone-Mt Larcom Road is the northernmost access road that provides connectivity between Gladstone and the Bruce Highway. It forms part of the state strategic road network and is generally a two-lane undivided sealed cross-section with a posted speed limit of 100 kph. As Gladstone-Mt-Larcom Road extends eastward from Landing Road, it becomes Hanson Road. Hanson Road then becomes Glenlyon Road, south of Roseberry Street.
Dawson Highway	The Dawson Highway is part of the state highway network and provides connectivity for the predominantly mining townships between Gladstone and Springsure. The link is generally a two -lane undivided cross section, with a 100 kph posted speed limit west of Don Young Drive. The part of the Dawson Highway which passes through the urban areas of Gladstone is referred to as Dawson Road, and the road form for this section is generally a four lane divided roadway with a posted speed limit of 60 kph.
Calliope River Targinie Road	Calliope River Targinie Road extends from Phillipies Landing Road in the north and the Bruce Highway in the south. It is a sealed two-way, single-lane rural cross section north of Gladstone Mt Larcom Road. To the south of Gladstone-Mt Larcom Road, the road becomes fully sealed with a two-lane undivided cross-section. The posted speed limit is generally 100 kph, except in built-up areas, where the posted speed limit drops down to 60 kph. Adjoining land uses are largely rural residential, although a small parcel of land at Yarwun has been developed at a higher residential density.

Road	Description
Landing Road	Landing Road is a sealed two-lane undivided road which extends from Gladstone-Mt Larcom Road to the port at Fisherman's Landing. The posted speed limit along this link is 80 kph. Adjoining allotments are mostly rural residential, with the exception of some industrial development (such as Cement Australia), proximate to the port site in the north.
Reid Road	Reid Road is a sealed two-lane undivided council-controlled road link with a posted speed limit of 60-70 kph. Abutting land uses are primarily industrial and include rail yards, a water treatment plant and the ORICA chemical plant.
Blain Drive	Blain Drive is a sealed two-lane undivided road which connects Hanson Road with Dawson Road. It is currently classified as a Sub Arterial Road in the GRC Transport Infrastructure Policy. Abutting land uses along Blain Drive are predominantly industrial in the north, with some residential development in the south, proximate to Dawson Road.
Glenlyon Street	Glenlyon Street is the council-controlled portion of road which continues from Hanson Road and Gladstone-Mt Larcom Road in the west. It passes through the Gladstone central district and is generally a four-lane divided roadway. It also provides access to the Gladstone Port through the connection with Port Access Road. Glenlyon Street is classified as a Major Urban Collector in the GRC Transport Infrastructure Policy. Consistent with its hierarchical classification, intersection treatments are mostly signalised within the section bound by Lord Street and the Dawson Highway.
Red Rover Road/Don Young Drive	Red Rover Road and Don Young Drive are currently sealed two-lane undivided roads which connect Hanson Road to the Dawson Highway. They are currently classified as Sub Arterial Roads in the GRC Transport Infrastructure Policy. Similar to Blain Drive, adjoining land uses are predominantly industrial in the north. Don Young Drive also provides access for higher density residential development in the south for the neighbouring suburb of Clinton.

14.4.2 Background Traffic Volumes

14.4.2.1 Traffic Volumes

Weekly summary reports were supplied by DMR for the following sites:

- Dawson Highway, 150 m south of Park Street (coverage count, Oct 2007)
- Dawson Highway, west of Penda Avenue (coverage count, Sept 2007)
- Gladstone–Benaraby Road, 400 m south-east of the Dawson Highway (coverage count, Nov 2007)
- Dawson Highway, 250 m west of Breslin Street (coverage count, Dec 2007).

In addition to the above, Annual Average Daily Traffic (AADT)[9] segments reports were also supplied by DMR. The information has been summarised and included in *Table 5.14.6.*

Table 5.14.6 Summary of AADT Segment Reports

Segment Start	Segment End	Length km	AADT veh/day
Bruce Highway (from south to north)			
Gladstone-Benaraby Road intersection	500 m south of Dawson Highway	11.58	4,556
500 m south of Dawson Highway	25m north of Calliope River	33.83	3,450
25 m north of Calliope River	Hut Creek (north of Ambrose)	39.91	5,051
Gladstone - Mt Larcom Road (from east to west)			
Glenlyon Street/Dawson Highway intersection	200 m north of Lord Street	1.345	8,631
200 m north of Lord Street	50 m south of Auckland Creek	1.913	6,052
50 m south of Auckland Creek	500 m south of Red Rover Road	1.367	8,931
500 m south of Red Rover Road	1 km north of Calliope River	7.667	6,161
1 km north of Calliope River	150 m north of Yarwun Road	19.848	2,934
Dawson Highway (north to south)			
Glenlyon Street/Gladstone Mt Larcom Road	150 m south of Park Street	1.498	12,708
150 m south of Park Street	250 m west of Breslin Street	0.74	19,222
250 m west of Breslin Street	250 m north of Paterson Street	0.892	24,308
250 m north of Paterson Street	Police Creek (Auckland Creek)	1.261	28,614
Police Creek (Auckland Creek)	west of Penda Avenue	0.788	22,079
West of Penda Avenue	450 m west of Chapman Drive	5.117	2,435
450 m west of Chapman Drive	250 m west of Chamberlain Road	8.754	4,787
250 m west of Chamberlain Road	200 m east of Drynan Drive	2.7	5,308

AusTraffic conducted intersection counts for all the assessable intersections in the study area. The counts were conducted on Thursday, 6 November, 2008 and were recorded for the period between 6:00 am to 9:00 am and 3:30 pm and 6:30 pm. This information has been summarised and included in *Appendix 5.15*.

9 AADT figures are for the year 2007. AADT is the Annual Average Daily Traffic assessed as the total volume of traffic recorded at a specific road location taken over a calendar year and divided by the number of days in that year.

14.4.2.2 Peak Period

Recent traffic count data that was obtained for this study has been analysed. From the information provided, the peak periods have been taken to be 7:45 am to 8:45 am and 4:15 pm to 5:15 pm.

14.4.3 Future Road Network

There are eight officially recognised regional and local strategic transport planning documents relevant to the study area (refer *Table 5.14.7*). These documents aim to integrate transport networks and land use to facilitate the efficient movement of people and freight in the Gladstone region.

Table 5.14.7 Regional and Local Strategic Transport Planning Documents

Document	Description
Roads Implementation Program 2008-09 to 2012-13, Fitzroy Region	The Roads Implementation Program (RIP) is Main Roads' primary mechanism for delivering roads to meet current and future needs. The RIP is one of the most important capital works program for Queensland. It recognises the important role of roads in connecting people, goods and services. The RIP is a rolling five-year program of works, with firm funding for projects in the first two years and indicative funding for planning purposes over the following three years.
Gladstone Integrated Regional Transport Plan 2001-2030	The Gladstone Integrated Regional Transport Plan (GIRTP) provides an integrated 30-year transport plan prepared for the Gladstone region which considers all modes of transport. Its aim is to provide a strategic framework for the development of a high-quality, safe and efficient transport system for the Gladstone region that considers the needs of the residential population and the economic requirements of major industry and the port in a sustainable manner.
Capricornia Integrated Regional Transport Plan 2004-2030	The Capricornia Integrated Regional Transport Plan was developed by Queensland Transport and the Department of Main Roads in partnership with Fitzroy, Livingstone and Mount Morgan Shire Councils and Rockhampton City Council. The plan aims to help meet the emerging transport needs of the Capricornia region, in response to growth in population, employment and industry within the region.
Roads Connecting Queenslanders	Roads Connecting Queenslanders outlines the role of roads in linking Queensland's communities now and into the future. It frames how we can better meet the many outcomes that communities, industry and government expect from roads. Roads Connecting Queenslanders was developed within the framework of the *Transport Infrastructure Act 1994*, which requires strategies across and between transport modes. As the strategy for roads, the document ensures that road system management and infrastructure investment supports the Government's social, economic and environmental priorities.

Document	Description
Development Scheme for the Stanwell–Gladstone Infrastructure Corridor State Development Area, August 2008	The Coordinator-General recognised the need to create a designated infrastructure corridor of land between Stanwell Energy Park and the Gladstone State Development Area to house multiple underground pipelines. The corridor can accommodate up to seven underground pipelines in a single area, for uses including: raw, treated and sea water; gas; mineral slurries; and telecommunication cables. The route is approximately 90 km long and is generally 100 m wide. In specific areas where environmental, geographic and construction issues exist, the corridor may be widened for pipe separation and construction purposes.
Fitzroy & Central West Queensland – An Economic Powerhouse	The document establishes the Fitzroy and Central West region as a Centre of Enterprise enabling the region to develop significantly from its current economic position and focus on regional economic development.
The Gladstone Land, Port, Road and Rail Infrastructure Study	The Study was updated in 2007–08 in collaboration with Queensland Rail Limited and the Department of Infrastructure and Planning. The study is focused on the preservation of corridors between the port and industrial sites within the Gladstone State Development Area (GSDA) and the Central Queensland hinterland for efficient product transportation.
Kirkwood Road South Structure Plan – Summary of Investigations	A Structure Plan for the area south of the proposed Kirkwood Road. The Structure Plan identifies a preferred future land use pattern for the area south of the proposed Kirkwood Road alignment (Kirkwood Road South).

A summary of identified road network projects derived from the above transport planning documents are provided in *Table 5.14.8* and are shown in *Figure 5.14.1.*

Table 5.14.8 Proposed Network Improvements

Project	Description	Funding Status
Callemondah to Yarwun (Mt Miller Road)	Stage 1: • Red Rover Road to Reid Road (new construction) Stage 2: • Reid Road to Aldoga precinct (new construction)	$25m (not funded) $15m (not funded)
Hanson Road Duplication	Stage 1: • Gibson Street – Blain Drive • Blain Drive – Red Rover Road • Red Rover Road – Power Station Access Stage 2: • Power Station Access – Gladstone- Mount Larcom Road intersection • Gladstone- Mount Larcom Road/ Landing Road intersection – Aldoga precinct	$10.1m (not funded) $31m (not funded) $17m (not funded)

Project	Description	Funding Status
Gladstone-Mt Larcom Road/Landing Rd Intersection		$3m (not funded)
Link Road from Hanson Rd to Mt Miller Road		$4m (not funded)
Landing Road Upgrade	Stage 1: • widen and strengthen Gladstone-Mount Larcom Road to QCL Stage 2: • widen and strengthen QCL to Forest Road	$2m (not funded) $1m (not funded)
Glenlyon Road Extension – 8 km (new construction) OR Upgrading of the existing Gladstone-Benaraby Road from Kirkwood Road to Ten Mile Creek to four lanes	A new two-lane extension of Glenlyon Road from Dalrymple Drive to the southern intersection with the Gladstone Benaraby Road	$20m (not funded)
Glenlyon Road to Gladstone–Benaraby Road Link	Kirkwood Road extension	$5m (not funded)
Gladstone – Benaraby Road to four lanes between Glenlyon Road extension and the Boyne Island Road intersection (2.5 km)	Including Glenlyon Road extension intersection and upgrading of Boyne Island Road intersection	$6m (not funded)
Four-laning of the last two-lane section of Philip Street		$2m (partial indicative funding from RIP)
Glenlyon Road to four lanes between Bramston Street and Derby Street (1 km)	Includes intersection upgrade at Tank and Derby streets	$2.5m (not funded)
New two-lane section of Kirkwood Road from Dawson Highway to Glenlyon Road extension and associated intersection works	Stage 1: • middle part of new road Stage 2: • balance of new road	$3.5m (not funded) $9m (not funded)
Calliope–Targinie Road Upgrade	Stage 1: • Upgrade to two-lane bitumen standard Stage Two: • Upgrade and overlay strengthening to meet industrial traffic demand	$10m (not funded) $7m (not funded)
Upgrade Dawson Highway to four lanes	Stage 1: • Breslin Street to Blain Drive • Brifney Roundabout to Chapman Drive Stage 2: • Chapman Drive to Kirkwood Road	$4.5m (RIP Funding) $4m (not funded)

Project	Description	Funding Status
Gladstone-Mt Larcom Road	Overtaking lanes	$1.4m (not funded)
Gladstone-Benaraby Road	Shoulder widening and overtaking lanes (Gladstone-Tooloola)	$2m (RIP Funding)
Calliope Crossroads	Grade separation of the Dawson Highway and Bruce Highway Intersection	$55m (not funded)

14.4.4 *Existing and Future Rail Network*

The Gladstone Integrated Regional Transport Plan (GIRTP) recognises Gladstone has an extensive rail network, which moves a significant amount of freight, including additional freight to and from Gladstone Port. Coal rail freight volumes dominated in 2007/08, with coal exports of 54.1 million tonnes achieved at Port of Gladstone and a target coal export throughput for 2008/09 of 60.3 million tonnes.[10]

The GIRTP also emphasises the importance of the regional rail network (freight and passenger) being integrated with the overall regional transport system, particularly port facilities, the road network and land use.

The existing rail network in the vicinity of the Project is dominated by the coal trade and comprises the following:

- a north-south linkage between Brisbane and Cairns, which is termed the *North Coast Line*. This is also linked to the Blackwater system that carries thermal coal from the Central Bowen Basin to Gladstone
- the *Moura System*, which is currently a rail connection between the southern Bowen Basin and Gladstone. This system is soon to be linked to the West Moreton system via the proposed Surat Basin Rail project.

In addition to the two main rail lines there are rail connections to:

- Auckland Point area (i.e. rail balloon loop/corridor, which supports the existing Barney Point coal export facility)
- Barney Point Wharf (i.e. spur line)
- RG Tanna Coal Terminal (i.e. rail balloon loop)
- Clinton Wharf (i.e. rail balloon loop)
- NRG power station (i.e. rail balloon loop)
- QAL (i.e. spur line)
- QCL at Fisherman's Landing (i.e. rail balloon loop).

The rail network is also an important component of the state's passenger rail system. The tilt-train has two services passing through Gladstone each day.

10 Gladstone Ports Corporation Annual Report 2007/08.

The tilt-train travel time from Brisbane to Gladstone is less than six hours, and also reduced rail travel time between Gladstone and Rockhampton.

Improvements to the rail system are currently under investigation, with the most notable including:

- *Surat Basin Rail Feasibility Study* – Approximately 210 km of new railway is to be constructed between Wandoan and Banana. This new linkage will form part of the *Moura System* and is intended to complete the linkage between the *Western System* and (ultimately) the Port of Gladstone. The *Surat Basin Rail* is proposed to be an open-access railway with sufficient capacity to accommodate significant volumes of coal and freight;
- *Moura Link-Aldoga Rail Project* – This is a proposed railway line which will connect the proposed Wiggins Island Coal Terminal to the *Moura System.* The project also includes the construction of maintenance and provisioning facilities within the Gladstone State Development Area, as well as quadruplication of the *North Coast Line* from the new maintenance yard to just east of Yarwun township.

14.4.5 Existing and Future Port Facilities

Initially, development within Gladstone was stimulated by the presence of the port. Today, the port still plays a central role on the economy of the surrounding regions. The Port of Gladstone currently has seven primary wharf centres, being:

- *Boyne Wharf* – cargoes commodities such as aluminium, petroleum coke, general cargo, break bulk and liquid pitch
- *South Trees* (East and West) – cargoes alumina, caustic soda, bunker oil, bauxite and bunker coal
- *Barney Point* – cargoes coal, magnesite, bunker coal and illmenite
- *Auckland Point* – cargoes commodities such as LPG, magnesia, calcite, break bulk, grain, petroleum products, caustic soda and general cargo
- *Clinton Wharf* – cargoes coal only
- *R.G. Tanna* – coal terminal and
- *Fisherman's Landing* – cargoes bauxite, alumina, caustic soda, cement, fly ash and limestone.

The GPC 50-year Strategic Plan indicates that the harbour will be able to accommodate up to 300 million tonnes of export product in the next 50 years via a number of expansions to existing terminals.

In addition to the Port of Gladstone, a new coal terminal is proposed to be constructed on Wiggins Island. Its export capacity is earmarked to be in the order of 70 million tonnes per annum (mtpa). It is proposed to be developed in three stages.

14.4.6 Existing and Future Public Transport

14.4.6.1 Bus Passenger Services

Buslink Queensland operates a 10-route urban passenger service in Gladstone and the surrounding district. Services currently operate in Gladstone City, as well as between Gladstone and Boyne Island, Tannum Sands, Awoonga Dam, Calliope and Benaraby.

14.4.6.2 School Bus Services

Buslink transports over 1500 passengers twice daily over a radius of 50 km around Gladstone City. This service transports primary and secondary students from 30 schools across 35 routes.

Queensland Transport administers the School Transport Assistance Scheme, which provides assistance to eligible students travelling to primary and secondary schools.

Under the Queensland Transport scheme, primary school students are eligible for full subsidised school bus travel to the nearest state primary school provided they live more than 3.2 km, by the shortest trafficable route, from their permanent residence to the nearest state primary school. Similarly, high school students are eligible for full subsidised school bus travel to the nearest state primary school provided they live more than 4.8 km, by the shortest trafficable route from their permanent residence to the nearest state primary school.

Students attending non-state schools may be eligible for assistance under the Non-Government Schools Transport Assistance Scheme which is administered by the Queensland Catholic Education Commission.

14.4.6.3 Taxis

Blue & White Taxis is the service provider for taxis in the Gladstone region. The Blue & White fleet consists of 23 taxis, three of which are maxi taxis and an additional four are wheelchair accessible. They also operate a 25 seat bus during peak demand times to service the busy nightclub precinct.

Blue & White Taxis provides taxi shuttle runs during docking periods to transport sailors to amenities within Gladstone City. Gladstone Airport also provides a taxi rank for airport to Gladstone City centre services.

14.4.6.4 Pedestrian and Cycle Networks

The extent of the Gladstone region's existing pedestrian network has not been mapped. However, it comprises a range of formal and informal footpaths and shared pedestrian/cycle paths.

The GIRTP recognises Gladstone has a relatively extensive network of bicycle paths (compared with other regional centres), along major roads and through areas of open space. The existing cycle network in Gladstone City provides relatively direct links to a number of major community and shopping facilities, such as the TAFE college and the airport, and a number of major employers such as the Gladstone Power Station and the hospital.

The GIRTP Action Plan for Cycling aims to build upon the existing cycling infrastructure by updating the existing regional cycle plan to better support and promote bicycle travel as a viable, convenient and safe travel mode, and by improving recreational cycling opportunities.

14.4.7 Existing and Future Air Transport

14.4.7.1 Passenger Movements

The Gladstone Airport Development Plan 2008 (Plan) adopts an underlying growth rate of 4.5 per cent for the median range passenger forecast, around 2.5 times the long-term population growth for the Gladstone region[11].

The Plan reports the past three years have shown significantly faster growth rates of 14.8 per cent, 18.3 per cent and, on the basis of the first nine months of 2007/08, around 10 per cent.[12] In this period QantasLink substantially increased available seat capacity, firstly with the introduction of the 50-seat Dash 8-300 and then the 75-seat Q400.

The Plan indicates strong demand for business travel to and from Gladstone, with Monday morning between 7.15 am and 9.00 am as the busiest for arriving passengers, while the Friday afternoon business peak is between 4.00 pm and 6.00 pm for departing passengers and overall terminal activity.[13]

At the time of publication, the Plan also reported Virgin Blue had expressed interest in operating to Gladstone, but is currently prevented from doing so by pavement strength limitations.

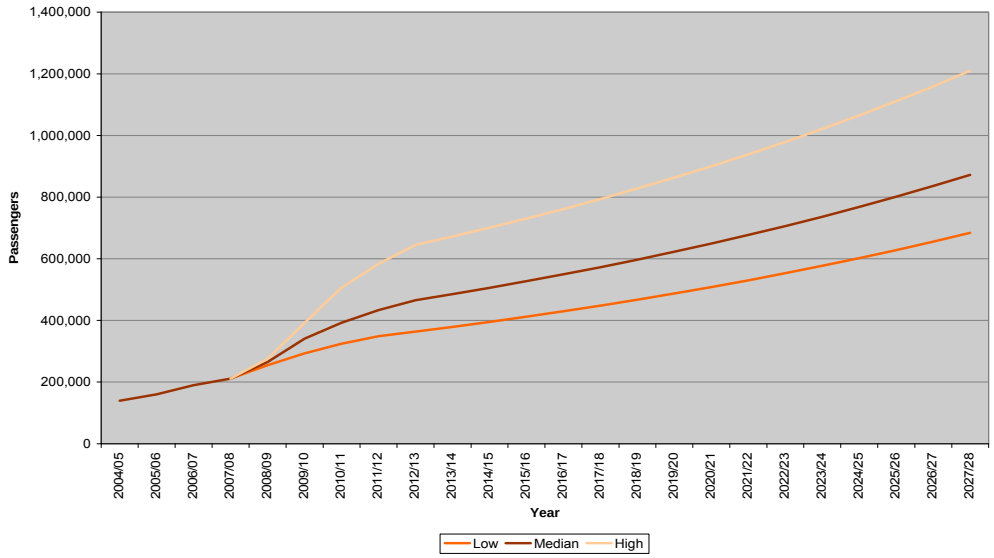
The Plan also notes the influence of major industrial expansion confirmed or planned in the Gladstone region, and recognises this will provide a further boost to the temporary or itinerant workforce which is already higher than the state average. An allowance for additional passenger demand has been factored in the Plan's low, median and high forecasts for passenger growth, as depicted in *Figure 5.14.2.*

11 Gladstone Airport Development Plan 2008.

12 Gladstone Airport Development Plan 2008.

13 Gladstone Airport Development Plan 2008.

Figure 5.14.2 Gladstone Airport Development Plan 2008 Passenger Forecasts



Source: Gladstone Airport Development Plan 2008

14.4.7.2 Aircraft Movements Forecasts

QantasLink currently provides Regular Public Transport (RPT) services to Gladstone, primarily utilising the 75-seat Q400 but with a number of services by the 50-seat Dash 8-300. This includes a combination of originating-terminating Gladstone-Brisbane flights, and flights transiting through Gladstone on north-bound services. The Plan responds to load factors, passenger growth, aircraft types/mix, and service frequency and annual movements.

The Plan is forecasting a median growth scenario of 19,260 aircraft movements by 2027/28, an increase of 60 per cent over the current year's movements.

The Plan concludes airspace and runway/taxiway capacity will not be a problem, and indicates with larger aircraft forecast to operate, airport management will need to focus on providing sufficient capacity in the apron, terminal, access road and car parking subsystems.

14.4.7.3 Kangaroo Island

An alternative Gladstone jet airport has been mooted for Kangaroo Island and reflected in the former Calliope Shire Planning Scheme.

Following various studies over the years, the Gladstone Airport Development Plan 2008 in April 2008 concluded that Kangaroo Island would remain the alternative airport site and recommends it be revisited as recommended development of the existing site is implemented and the pattern of growth becomes less volatile and more predictable.

However, in July 2008, the Coordinator-General included Kangaroo Island in the Gladstone State Development Area within a Restricted Development Precinct. The intent of this precinct is to:

- prevent the establishment of uses that may be incompatible with, adversely affect, or constrain industry establishing within the Curtis Island Industry or Targinie precincts
- provide for the establishment of essential infrastructure facilities and materials transport infrastructure within the Gladstone State Development Area to connect with surrounding transport networks and the Gladstone Port, in a manner which ensures areas of ecological significance are recognised and managed taking into account environmental values
- provide areas for open space where remnant vegetation, wetlands, waterways and areas of ecological significance can remain and where revegetation can occur.

14.5 IMPACT ASSESSMENT

A RIA study modelled potential traffic and transport impacts of construction and operation activities under 44 potential scenarios. These scenarios comprise a reference case with assumptions of workforce size and transport demand, a number of construction camp options, and various transport logistics scenarios incorporating a number of bridge/road options connecting Curtis Island with Gladstone City.

Following the completion of the RIA, a number of the key assumptions are summarised in *Table 5.14.9.*

Table 5.14.9 RIA Original and Refined Assumptions

Original Assumptions[14]	Refined Assumptions[15]
1. 2,000 personnel for the Train 1 and 2 construction phase; 2. Fortnightly rotation assumption of 10 days on/four days off; 3. Hybrid Construction Camp Option D all non local personnel residing in the camp; 4. Anticipated pipeline movements are: • Dawson Highway – 168 trucks/day[16] for 167 days; and	1. 1,500 personnel for the Train 1 and 2 construction phase; 2. Nine days on a fortnight (i.e. five days on/two days off, then four days on/three days off, being 90 hours per fortnight). Some night shift and weekend work as schedule requires; 3. Hybrid Construction Camp Option D all non-local personnel residing in the camp (i.e. 30 per cent of total workforce); 4. Gladstone Port for the receipt of 260 km of 42" pipe in 18 m lengths,

14 Used in RIA model.

15 Not used in RIA model but covered by original assumptions.

16 Trucks/day does not equate to truck movements.

Original Assumptions[14]	Refined Assumptions[15]
• Gladstone-Mt Larcom Road – 54 trucks/day[17] for 21 days; 5. Operations Phase Train 1 and 2 – 104 personnel, and Train 3 130 personnel; and 6. Train 1 and 2 construction arrive/depart from Auckland Point; with alternatives modelled including scenarios for Train 2 and 3 construction arrive/depart from Alf O'Rourke Drive.	three lengths/truck – equates to on average 20 trucks/day[18].[19] On average 1.08 km/day of pipe moved over 25 day duration, equating to 10-11 month pipe transportation. Transport of 25 km of pipe/ship/month, total 11 ships on average by end 2011; 5. Operations Phase Train 1 and 2 – 76 personnel, and Train 3 – 100 personnel. 6. Trains 1, 2 and 3 - all construction personnel arrive/depart from Auckland Point Construction Terminal, and operations personnel arrive/depart from the Operations Terminal to be located at the end of Alf O'Rourke Drive, behind RG Tanna Coal Terminal.

The hybrid Construction Camp Option D used in the RIA model most closely resembles the revised workforce transport assumptions in that it provides for daily ferry commuting by the Gladstone workforce.

The refined assumptions should be considered in context when reviewing the RIA and mitigation measures. The original assumptions reflect a "maximum" or "worst case" scenario, and the revised assumptions are less than, and are covered by the original assumptions.

For the purposes of SIDRA modelling and to model a "worst case" scenario, the model assumed a design peak construction workforce of 2,000 personnel from Day 1 of construction commencing in 2010.

The overall effect of the refinements in the workforce transport assumptions is that the gross volume of daily traffic in Gladstone increases. However, the actual impacts of the project could potentially be less under the new assumptions due to the broader distribution of origin-destination pairs across the greater Gladstone network during the critical traffic generating periods.

Based on the refined assumptions there is significant "headroom" factored into the RIA with a consequential reduction of 195 light vehicles/day[20] and an equivalent 77 per cent reduction in heavy vehicles between the original and

17 Trucks/day does not equate to truck movements.

18 Trucks/day does not equate to truck movements.

19 Original assumption for pipe transport of a total equivalent of 175 heavy vehicles/day for 167 days. A reduction in calculated pipe volume and number of trucks required under refined assumption equates to on average 20 trucks/day over 25 day duration, over 10-11 month period for pipe transportation up to 2011. This equates to significantly less heavy vehicle movements over a longer duration (i.e. equivalent to a 77 per cent reduction in heavy vehicles between the original and refined assumption).

20 Original assumption 900 person imported workforce with demand for 390 vehicles. A 50 per cent reduction in the imported workforce from 900 to 450 persons under refined assumption equates to a demand for 195 vehicles, a reduction of 195 light vehicles.

refined assumption[21] associated with pipe transport on the Gladstone state-and council-controlled road networks. Consequently, it is expected pavement impact on state-controlled roads and volumes through modelled intersections will also be significantly reduced under the refined assumptions.

14.5.1 Background

14.5.1.1 Light Vehicle Demands

Light vehicle demands at the start/end of each daily shift and at the start/end of each fortnightly shift are indicated in *Table 5.14.10* and *Table 5.14.11* for Train 1 and 2. These tables apply to the original assumptions of 2,000 peak workforce, with 1,100 Gladstone workers commuting morning and afternoon daily for Construction Camp D. For the construction camp A and B scenarios 1,950 employees will be transported back to Gladstone daily.

Table 5.14.10 Peak Daily Generation – LNG Train 1 & 2 Construction

Period	Camp Option A	Camp Option B	Camp Option C	Camp Option D[22]
AM Peak	741 veh/hr 34 bus/hr	741 veh/hr 34 bus/hr	None	733 veh/hr
PM Peak	741 veh/hr 34 bus/hr	741 veh/hr 34 bus/hr	None	733 veh/hr
Daily	1482 veh/day 68 bus/day	1482 veh/day 68 bus/day	None	1467 veh/day

21 Original assumption for pipe transport of a total equivalent of 175 heavy vehicles/day for 167 days. A reduction in calculated pipe volume and number of trucks required under refined assumption equates to on average 20 trucks/day over 25 day duration, over 10-11 month period for pipe transportation up to 2011. This equates to significantly less heavy vehicle movements over a longer duration (i.e. equivalent to a 77 per cent reduction in heavy vehicles between the original and refined assumption).

22 Shaded text encompasses the Project reference case.

Table 5.14.11 Peak Fortnightly Generation – LNG Train 1 & 2 Construction

Period	Camp Option A	Camp Option B	Camp Option C	Camp Option D[23]
AM Peak (Shuttle Bus)	741 veh/hr 34 bus/hr	741 veh/hr 34 bus/hr	550 veh/hr 5 bus/hr	1124 veh/hr 9 bus/hr
AM Peak (No Shuttle Bus)[24]	741 veh/hr 34 bus/hr	741 veh/hr 34 bus/hr	631 veh/hr	1300 veh/hr
PM Peak (Shuttle Bus)	1029 veh/hr 52 bus/hr	1029 veh/hr 52 bus/hr	581 veh/hr 5 bus/hr	1124 veh/hr 9 bus/hr
PM Peak (No Shuttle Bus)	1195 veh/hr 34 bus/hr	1195 veh/hr 34 bus/hr	666 veh/hr	1300 veh/hr
Daily (Shuttle Bus)	1770 veh/day 86 bus/day	1770 veh/day 86 bus/day	1134 veh/day 10 bus/day	1857 veh/day 9 bus/day
Daily (No Shuttle Bus)	1936 veh/day 68 bus/day	1936 veh/day 68 bus/day	1300 veh/day	2033 veh/day

Light vehicle demands at the start/end of each daily shift and at the start/end of each fortnightly shift are indicated in *Table 5.14.12* and *Table 5.14.13* for Train 3 (indicatively in 2018).

Table 5.14.12 Daily Generation – LNG Train 3 Construction - 2018

Period	Camp Option A	Camp Option B	Camp Option C	Camp Option D[25]
AM Peak	371 veh/hr 16 bus/hr	371 veh/hr 16 bus/hr	None	367 veh/hr
PM Peak	371 veh/hr 16 bus/hr	371 veh/hr 16 bus/hr	None	367 veh/hr
Daily	742 veh/day 32 bus/day	742 veh/day 32 bus/day	None	733 veh/day

23 Shaded text encompasses the Project reference case.

24 No shuttle bus refers to no airport shuttle to Gladstone or Rockhampton airports. All values are relevant to the critical AM, PM or daily period

25 Shaded text encompasses the Project reference case.

Table 5.14.13 Fortnightly Generation – LNG Train 3 Construction - 2018

Period	Camp Option A	Camp Option B	Camp Option C[26]	Camp Option C[27]	Camp Option D[28]
AM Peak (Shuttle Bus)	371 veh/hr 16 bus/hr	371 veh/hr 16 bus/hr	279 veh/hr 2 bus/hr	567 veh/hr 5 bus/hr	562 veh/hr 5 bus/hr
AM Peak (No Shuttle Bus)[29]	371 veh/hr 16 bus/hr	371 veh/hr 16 bus/hr	320 veh/hr	650 veh/hr	650 veh/hr
PM Peak (Shuttle Bus)	515 veh/hr 26 bus/hr	515 veh/hr 26 bus/hr	310 veh/hr 2 bus/hr	567 veh/hr 5 bus/hr	562 veh/hr 5 bus/hr
PM Peak (No Shuttle Bus)	598 veh/hr 16 bus/hr	598 veh/hr 16 bus/hr	355 veh/hr	650 veh/hr	650 veh/hr
Daily (Shuttle Bus)	886 veh/day 42 bus/day	886 veh/day 42 bus/day	567 veh/day 6 bus/day	567 veh/day 6 bus/day	929 veh/day 5 bus/day
Daily (No Shuttle Bus)	969 veh/day 32 bus/day	969 veh/day 32 bus/day	650 veh/day	650 veh/day	1017 veh/day

14.5.1.2 Heavy Vehicle Demands

LNG Facility

Heavy vehicle demands relating to the construction of the LNG Facility Train 1 and 2 for the peak construction period are indicated in *Table 5.14.14.*

Table 5.14.14 LNG Train 1 and 2 Heavy Vehicle Demand Construction

Materials and Goods	Quantity
Cement	1 truck per day
Waste	7 truck per day at peak for 3-4 months
Fuel	1 truck per day
Refrigerated food and dry goods	1 truck per day
Water	1 truck per day for the first 12 months of construction

26 Denotes traffic generation for Construction Camp C without Road Bridge.

27 Denotes traffic generation for Construction Camp C with Road Bridge.

28 Shaded text encompasses the Project reference case.

29 No shuttle bus refers to no airport shuttle to Gladstone or Rockhampton airports airport shuttle. All values are relevant to the critical AM, PM or daily period.

Heavy vehicle movement is anticipated associated with the clearing of vegetation from the LNG Facility site. Impact analysis was not undertaken as it is expected that impacts resulting from this activity would be less than those imposed during peak construction. The clearing of vegetation is to be conducted during the first six-month period when only 50 personnel are required. The cumulative total of these vehicle movements will be far less than that generated during peak construction, when the original modelled 2,000 personnel are required. As the RIA addresses the impact of the Project during the peak construction phase, it also covers the transport impact resulting from the clearing of vegetation.

The use of a single barge-mounted reverse osmosis plant with power source on Curtis Island to generate 400-500 cubic metres of water for soil conditioning will reduce heavy vehicle demands on the local road network by an equivalent of 25-30 water tankers (i.e. semi-trailer) per day.

Heavy vehicle demands for the LNG Facility Train 3 construction have been assumed to be the same as for Trains 1 and 2 above.

To be conservative and cover "worst case" impact, these trips were assumed to occur during the commuter peak. In reality the Project will manage the trips to lessen impact.

Pipeline Transport

Pipe delivery is to begin in late 2010, with the pipeline to be fully constructed by 2013. Pipe for the Gladstone/Curtis Island component of the Project will arrive by ship at the Port of Gladstone and the mainland section will traverse the existing road network via the Port Access Road and either Gladstone-Mt Larcom Road or the Dawson Highway.

Under the original assumption (refer to *Table 5.14.15*) delivered pipe would be used for the following components:

- Main Pipe Line 1
- Collection Lateral
- Upstream Infrastructure Corridor (UIC).

Heavy vehicle movement volumes were based on the "worst case" original assumption that all three pipelines would be constructed concurrently. This has been utilised for the RIA as representing the original critical construction scenario. It assumed that if the pipelines were constructed consecutively rather than concurrently, the number of truck movements per day would decrease, but the number of construction days would increase.

Table 5.14.15 RIA Original and Refined Assumptions

Original Assumptions[30]	Refined Assumptions[31]
Anticipated pipeline movements are: • Dawson Highway – 168 trucks/day for 167 days; and • Gladstone-Mt Larcom Road – 54 trucks/day[32] for 21 days.	Gladstone Port for the receipt of 260 km of 42" pipe in 18 m lengths, three lengths/truck – equates to on average 20 trucks/day[33].[34] On average 1.08 km/day of pipe moved over 25 day duration, equating to 10-11 month pipe transportation. Transport of 25 km of pipe/ship/month, total 11 ships on average by end 2011.

However, under the refined assumption (refer to *Table 5.14.15*) 260 km of 18 m lengths of pipe will be offloaded from 11 ships over 11 months, and temporarily placed at the designated Auckland Point pipe laydown area. On average 1.08 km/day of pipe will be transported, with three lengths/truck, on average 20 trucks/day over a 25-day duration. Within a 10-11 month period all pipe transport in the Gladstone area will be completed by 2011.

Transportation of pipe for the balance of the Project will be via Port of Brisbane for 140 km of pipeline and 220 km of Collection Header. This is further addressed in *Volume 4, Chapter 13.*

The refined assumption results in a 77 per cent reduction in heavy vehicles associated with pipe transportation across the Gladstone state- and council-controlled road network than originally modelled in the RIA. Consequently, it is expected pavement impact on state-controlled roads will also be significantly reduced under the refined assumptions.

14.5.1.3 Traffic Demands during Operations

Traffic demands during the operations phase are provided below in *Table 5.14.16.*

Table 5.14.16 Operations – Traffic Demands

Traffic Generation Period	Train 1 and 2 combined	All 3 Trains
Peak Generation	70 veh/hr	88 veh/hr
Daily Generation	140 veh/day	176 veh/day

30 Used in RIA model.

31 Not used in RIA model but covered by original assumptions.

32 Trucks/day does not equate to truck movements.

33 Trucks/day does not equate to truck movements.

34 Original assumption for pipe transport of a total equivalent of 175 heavy vehicles/day for 167 days. A reduction in calculated pipe volume and number of trucks required under refined assumption equates to on average 20 trucks/day over 25 day duration, over 10-11 month period for pipe transportation up to 2011. This equates to significantly less heavy vehicle movements over a longer duration (i.e. equivalent to a 77 per cent reduction in heavy vehicles between the original and refined assumption).

14.5.1.4 *Traffic Assessment Scenarios*

The scenarios considered for impact assessment purposes have had regard to project staging (construction and operation of Trains 1, 2 and 3), two bridge approach road options, no bridge and four construction camp options.

Bridge approach road Option 1 is the east-west alignment connecting with Phillipies Land Road, while bridge approach road Option 2 is the proposed north-south alignment running parallel with the coastline.

Since the construction of the Curtis Island-Gladstone bridge/road may not proceed, an additional connectivity option was considered. This involves water-based transport with the proposed construction terminal at Auckland Point and operations terminal at the end of Alf O'Rourke Drive, behind RG Tanna coal terminal.

Future year scenarios include the year of opening for construction and operations and then a subsequent 10-year design horizon. Estimated traffic volumes for each future year scenario are based on historical growth rates and expected growth within the region (refer *Section 14.5.1.5).*

The traffic assessment for the reference case corresponds with Scenario 3d, 11, 15d, 19 and 23.

Based on the assumed Project timelines and the requirements stipulated with GARID, the scenarios assessed are as indicated in *Table 5.14.17.*

Table 5.14.17 Traffic Assessment Scenarios

Scenario / Year	No Dev	Construction			Operation			Road Option	Camp Option
		Train 1	Train 2	Train 3	Train 1	Train 2	Train 3		
Scenario 1 (Base) / 2008	■							N/A	N/A
Scenario 2 (Future without development)/ 2010	■							N/A	N/A
Scenario 3a (Construction Train 1 & 2, Camp Option A)/ 2010		■	■					N/A	A
Scenario 3b (Construction Train 1 & 2, Camp Option B) / 2010		■	■					N/A	B
Scenario 3c (Construction Train 1 & 2, Camp Option C)/ 2010		■	■					N/A	C
Scenario 3d (Construction Train 1 & 2, Camp Option D) / 2010[35]		■	■					N/A	D
Scenario 4 (Future without development) / 2013	■							N/A	N/A
Scenario 5a (Construction Train 1, Operation Train 1, Bridge/Road 1, Camp A)/ 2013			■		■			1[36]	A

35 Shaded text encompasses the Project reference case.

36 Bridge approach road Option 1 is the east-west alignment connecting with Phillipies Land Road

Scenario / Year	No Dev	Construction		Operation		Road Option	Camp Option
Scenario 5b (Construction Train 1, Operation Train 1, Bridge/Road 1, Camp B)/2013		■		■		1	B
Scenario 5c (Construction Train 1, Operation Train 1, Bridge/Road 1, Camp C)/ 2013		■		■		1	C
Scenario 5d (Construction Train 1, Operation Train 1, Bridge/Road 1, Camp D)/ 2013		■		■		1	D
Scenario 6a (Construction Train 1, Operation Train 1, Bridge/Road 2, Camp A)/2013		■		■		2[37]	A
Scenario 6b (Construction Train 1, Operation Train 1, Bridge/Road 2, Camp B) / 2013		■		■		2	B
Scenario 6c (Construction Train 1, Operation Train 1, Bridge/Road 2, Camp C)/ 2013		■		■		2	C
Scenario 6d (Construction Train 1, Operation Train 1, Bridge/Road 2, Camp D) / 2013		■		■		2	D
Scenario 7a (Construction Train 1, Operation Train 1, No Bridge/Road, Camp A) / 2013		■		■		No Bridge[38]	A
Scenario 7b (Construction Train 1, Operation Train 1, No Bridge/Road, Camp B) / 2013		■		■		No Bridge	B
Scenario 7c (Construction Train 1, Operation Train 1, No Bridge/Road, Camp C) / 2013		■		■		No Bridge	C
Scenario 7d (Construction Train 1, Operation Train 1, No Bridge/Road, Camp D) / 2013		■		■		No Bridge	D
Scenario 8 (Future without development)/ 2014	■					N/A	N/A
Scenario 9 (Operation Train 1 & 2, Bridge/Road 1)/ 2014				■	■	1	N/A
Scenario 10 (Operation 1 & 2, Bridge/Road 2)/ 2014				■	■	2	N/A
Scenario 11 (Operation 1 & 2, No Bridge)/ 2014[39]				■	■	No Bridge	N/A
Scenario 12 (Future without development)/ 2018	■					N/A	N/A
Scenario 13a (Construction Train 3, Operation Train 1 & 2, Bridge/Road 1, Camp A) / 2018			■	■	■	1	A

37 Bridge approach road Option 2 is the proposed north-south alignment running parallel with the coastline

38 As construction of the Curtis Island-Gladstone bridge/road may not proceed, an additional connectivity option was considered. This involves water-based transport with the proposed construction terminal at Auckland Point and operations terminal at the end of Alf O'Rourke Drive, behind R.G. Tanna coal terminal.

39 Shaded text encompasses the Project reference case.

Scenario / Year	No Dev	Construction			Operation			Road Option	Camp Option
Scenario 13b (Construction Train 3, Operation Train 1 & 2, Bridge/Road 1, Camp B) / 2018		■	■	■				1	B
Scenario 13c (Construction Train 3, Operation Train 1 & 2, Bridge/Road 1, Camp C) / 2018		■	■	■				1	C
Scenario 13d (Construction Train 3, Operation Train 1 & 2, Bridge/Road 1, Camp D)/ 2018		■	■	■				1	D
Scenario 14a (Construction Train 3, Operation Train 1 & 2, Bridge/Road 2, Camp A)/ 2018		■	■	■				2	A
Scenario 14b (Construction Train 3, Operation Train 1 & 2, Bridge/Road 2, Camp B) / 2018		■	■	■				2	B
Scenario 14c (Construction Train 3, Operation Train 1 & 2, Bridge/Road 2, Camp C) / 2018		■	■	■				2	C
Scenario 14d (Construction Train 3, Operation Train 1 & 2, Bridge/Road 2, Camp D)/ 2018		■	■	■				2	D
Scenario 15a (Construction Train 3, Operation Train 1 & 2, Road, No Bridge , Camp A) / 2018		■	■	■				No Bridge	A
Scenario 15b (Construction Train 3, Operation Train 1 & 2, Road, No Bridge , Camp B) / 2018		■	■	■				No Bridge	B
Scenario 15c (Construction Train 3, Operation Train 1 & 2, Road, No Bridge , Camp C) / 2018		■	■	■				No Bridge	C
Scenario 15d (Construction Train 3, Operation Train 1 & 2, Road, No Bridge , Camp D) / 2018[40]		■	■	■				No Bridge	D
Scenario 16 (Future without development) / 2021	■							N/A	N/A
Scenario 17 (Fully operational, Bridge/Road 1)/ 2021					■	■	■	1	N/A
Scenario 18 (Fully operational, Bridge/Road 2) / 2021					■	■	■	2	N/A
Scenario 19 (Fully operational, No Bridge/Road)/ 2021					■	■	■	No Bridge	N/A
Scenario 20 (Future without development) / 2031	■							N/A	N/A
Scenario 21 (10 yr design horizon of full operations, Bridge/Road 1)/ 2031					■	■	■	1	N/A
Scenario 22 (10 yr design					■	■	■	2	N/A

40 Shaded text encompasses the Project reference case.

Scenario / Year	No Dev	Construction	Operation			Road Option	Camp Option
horizon of full operations, Bridge/Road 2) / 2031							
Scenario 23 (10 yr design horizon of full operations, No Bridge/Road) / 2031[41]			■	■	■	No Bridge	N/A

14.5.1.5 *Background Traffic Growth*

AADT[42] segment reports were supplied by DMR for the major roads and highways in the vicinity of the study area. Analysis of the historical traffic data indicated that the following growth rates were observed over the period between 1997 and 2007:

Rural Roads

- Bruce Highway – 4 per cent
- Gladstone Mt Larcom Road – 6 per cent
- Dawson Highway – 5 per cent

Urban Roads

- Gladstone-Mt Larcom Road – 3 per cent
- Dawson Highway – 2 per cent

Based on the information presented above, an annual growth of 5 per cent and 3 per cent has been adopted for rural and urban roads, respectively.

14.5.1.6 *Traffic Volumes – State-Controlled Network*

The growth rates have been applied as a compounding annual growth to the existing traffic volumes.

Table 5.14.18 is a summary of future link volumes for each of the design years.

Table 5.14.18 Future Link Volumes -State-Controlled Network

Description	2010	2013	2014	2018	2021	2031
Bruce Highway (from south to north)						
Gladstone-Benaraby Road intersection to 500 m south of Dawson Highway	5,190	5,915	6,180	7,355	8,380	12,950
500 m south of Dawson Highway to 25 m north of Calliope River	3,930	4,480	4,680	5,570	6,350	9,810
25 m north of Calliope River to Hut Creek (North of Ambrose)	5,755	6,560	6,850	8,155	9,290	14,360

41 Shaded text encompasses the Project reference case.

42 AADT is the Annual Average Daily Traffic assessed as the total volume of traffic recorded at a specific road location taken over a calendar year and divided by the number of days in that year.

Description	2010	2013	2014	2018	2021	2031
Gladstone-Mt Larcom Road (from east to west)						
Glenlyon Street/Dawson Highway intersection to 200 m north of Lord Street	9,460	10,360	10,680	12,065	13,220	17,930
200 m north of Lord Street to 50 m south of Auckland Creek	6,630	7,265	7,490	8,460	9,270	12,570
50 m south of Auckland Creek to 500 m south of Red Rover Road	9,785	10,720	11,055	12,485	13,680	18,550
500 m south of Red Rover Road to 1 km north of Calliope River	7,290	8,620	9,115	11,400	13,490	23,605
1 km north of Calliope River to 150 m north of Yarwun Road	3,470	4,105	4,340	5,430	6,420	11,240
Dawson Highway (from north to south)						
Glenlyon Street/Gladstone-Mt Larcom Road to 150 m south of Park Street	13,445	14,220	14,490	16,620	16,525	19,940
150 m south of Park Street to 250 m west of Breslin Street	20,335	21,510	21,920	23,630	25,000	30,155
250 m west of Breslin Street to 250 m north of Paterson Street	25,715	27,205	27,720	29,880	31,610	38,135
250 m north of Paterson Street to Police Creek (Auckland Creek)	30,270	32,025	32,630	35,175	37,210	44,890
Police Creek (Auckland Creek) to West of Penda Avenue	23,360	24,710	25,180	27,140	28,710	34,640
West of Penda Avenue to 450 m west of Chapman Drive	7,080	8,3050	8,760	10,840	12,720	21,675
450 m west of Chapman Drive to 250 m west of Chamberlain Road	5,620	6,590	6,950	8,600	10,095	17,200
250 m west of Chamberlain Road to 200 m east of Drynan Drive	6,230	7,310	7,710	9,540	11,190	19,070

14.5.1.7 *Traffic Volumes – Council-Controlled Network*

Future traffic volumes on the council-controlled network have been calculated using the above mentioned growth rates and summarised in *Appendix 5.15.*

14.5.2 Link Analysis

14.5.2.1 Overview

The impact analysis presented in this section is based upon the principles defined within GARID. In particular, the following reference holds the general directive as to how impacts are assessed:

"In general, Main Roads considers a development's road impacts to be insignificant if the development generates an increase in traffic on state-controlled roads (SCR) of no more than 5 per cent of existing levels… Traffic operation impacts need to be considered for any section of SCR where the construction or operational traffic generated by the development equals or exceeds 5 per cent of the existing AADT on the road section, intersection movements or turning movements."

The increase in development traffic is expressed as a proportion of existing traffic to observe whether the triggers of GARID are met.

Link analysis was conducted for the following links and sections:

- Bruce Highway – from Gladstone-Mt Larcom Road to the Dawson Highway
- Gladstone-Mt Larcom Road – from Bruce Highway to Dawson Highway; and
- Dawson Highway – from Bruce Highway to Glenlyon Road (Glenlyon Gladstone-Mt Larcom Road).

14.5.2.2 Link Analysis Impact Assessment

The results show that the greatest impacts are expected during the construction periods. During the operational phases, increases are less than 5 per cent and therefore indicate that impacts are likely to be negligible-to-minor.

Bruce Highway

The only impacted section along the Bruce Highway within the study area is for the section between Calliope River-Targinie Road and the Dawson Highway. This section is currently an uninterrupted two-lane two-way rural road with a daily capacity of 7,070 Passenger Car Equivalents (PCUs) per day.

Considering future year volumes for the road section, all two-way daily volumes are less than the capacity of the current roadway form. Therefore upgrade works are not required.

Gladstone-Mt Larcom Road

All sections of Gladstone-Mt Larcom Road experience development generated increases of equal to or more 5 per cent of existing daily traffic. Required link configurations for each of the impacted future design years considered "with" and "without" shuttle bus scenarios.

Gladstone-Mt Larcom Road is an uninterrupted two-lane two-way rural road from the Bruce Highway through to Gibson Street, which is the intersection to the north of Blain Drive. North of Gibson Street it widens to a divided four-lane urban arterial road with interrupted flow. Daily link capacities are 7,070 PCUs per day for the rural section and 25,330 PCUs per day for the urban section.

The assessment concluded that upgrades are required for the Gladstone-Mt Larcom Road section between Reid Road to Blain Drive. For the condition without the proposed development, the following link configurations are required:

Reid Road to Red Rover Road

- 2013 - Undivided four- lane, two- way road - Rural
- 2018 - Undivided four lane, two-way road - Rural

Red Rover Road to Blain Drive

- 2013 - Undivided four- lane, two- way road - Rural
- 2018 - Divided four-lane, two-way road - Rural

As for the future road network upgrades, these sections have already been earmarked for improvements. These two sections form part of the works required under Stage 1 of the Hanson Road duplication.

The link configurations required for the "with development" scenarios are as follows:

Reid Road to Red Rover Road

- 2013 - Undivided four-lane, two-way road - Rural
- 2018 - Undivided four-lane, two-way road - Rural

Red Rover Road to Blain Drive

- 2013 - Undivided four-lane, two-way road - Rural
- 2018 - Undivided four-lane, two-way arterial road – Urban

Modelling indicated providing an airport shuttle bus does not affect the required road configuration.

A comparison of the "with" and "without" development scenarios for 2013 and 2018 (i.e. reference "without" development conditions of Scenario 4 and 12,

versus the "with" development condition of Scenario 5a through to 7d for 2013 and Scenario 13a through to Scenario 15d for 2018) shows that the development does not trigger additional works for the Reid Road to Red Rover Road section. For the Red Rover Road to Blain Drive section, additional works are not triggered under the 2013 design year but are triggered for the 2018 design year. As a result of the proposed development, it was concluded Gladstone-Mt Larcom Road between Red Rover Road and Blain Drive should be upgraded from a rural divided four-lane, two-way road to an urban undivided four-lane two-way arterial road.

Dawson Highway

Impact assessment was undertaken on two sections of the Dawson Highway, being:

- Bruce Highway to Don Young Drive
- Don Young Drive to Phillip Street.

The Bruce Highway to Don Young Drive section is an uninterrupted two-lane, two-way rural road. The daily capacity of the road section is 7,070 PCUs per day. Given the future year volumes, upgrade works are not required.

The Don Young Drive to Phillip Street section is a two-lane, two-way uninterrupted road south of Chapman Drive, which then widens to a four-lane, two-way rural divided road all the way through to Phillip Street. Daily capacities for these road sections are 7,070 and 12,730 PCUs per day. Given the future year volumes, upgrade works are also not required.

14.5.2.3 Link Analysis Summary

Link analysis was conducted for the following links and sections:

- Bruce Highway: from Gladstone–Mt Larcom Road to the Dawson Highway
- Gladstone-Mt Larcom Road: from Bruce Highway to Dawson Highway
- Dawson Highway: from Bruce Highway to Glenlyon Road (Glenlyon Gladstone-Mt Larcom Road).

Table 5.14.19 is a summary of the link analysis results, which are relevant to Construction Camp Option D under a no-bridge scenario. This condition encompasses the reference case.

Table 5.14.19 Link Analysis Summary

State Controlled Road	Link Capacity (PCU/day)[43]	Current % Used	Project[44] Impact %	Upgrade Needed Yes/No
Bruce Highway				
North of Gladstone-Mt Larcom Road	7070 PCUs/day	71%	<5%	No
Gladstone-Mt Larcom Rd to Calliope River-Targinie Road	7070 PCUs/day	71%	<5%	No
Calliope River-Targinie to Dawson Highway	7070 PCUs/day	49%	<5%	No
South of Dawson Highway	7070 PCUs/day	64%	<5%	No
Gladstone-Mt Larcom Road[45]				
Bruce Highway to Calliope-Targinie Road	7070 PCUs/day	41%	6%	No
Calliope River-Targinie Road to Landing Road	7070 PCUs/day	41%	6%	No
Landing Road to Reid Road	7070 PCUs/day	41%	6%	No
Reid Road to Red Rover Road	7070 PCUs/day	87%	<5%	No
Red Rover Road to Blain Drive	7070 PCUs/day	126% (Future road upgrade has already been identified by Gladstone Regional Council)	<5%	Yes triggered for 2018 design year. Upgrade from rural divided four-lane, two-way road to urban undivided four-lane, two-way arterial road for all camp options under Bridge/Road option 1 or 2. No upgrade is required for the no bridge scenario.[46]
Blain Drive to Dawson Highway	25330 PCUs/day	28%	20%	No
Dawson Highway				
Bruce Highway to Don Young Drive	7070 PCUs/day	69%	6%	No
Don Young Drive to Phillip Street[47]	7070 and 12730 PCUs/day	51%	6%	No
Phillip Street to Blain Drive	12730 PCUs/day	113%	<5%	Yes, but not as a result of the development proposal
Blain Drive to Glenlyon Street	12730 PCUs/day	69%	<5%	No

43 Passenger car equivalents.

44 Project impact is reported for the critical traffic generating year, which is the combined construction of Train 1 and 2 in 2013 (i.e. Scenario 3).

45 Gladstone-Mt Larcom Road is an uninterrupted two-laneway rural road from the Bruce Highway through to Gibson Street, which is the intersection to the north of Blain Drive. North of Gibson Street widens to a divided four-lane urban arterial road with interrupted flow. Daily link capacities are 7070 PCUs/day for the rural section and 25330 PCUs/day for the urban section.

46 Shaded text encompasses the reference case (i.e. no bridge scenario).

47 Don Young Drive to Phillip Street section is a two-lane two-way uninterrupted road south of Chapman Drive, which then widens to a four-lane two-way rural divided road through to Phillip Street.

14.5.3 Intersection Analysis

14.5.3.1 Overview

SIDRA analyses have been undertaken for all locations where development generated traffic increases anticipated volumes by equal to or more than 5 per cent of any intersection movement. The assessment considered each of the 23 traffic scenarios at each of the following 18 locations:

- Bruce Highway/Dawson Highway
- Bruce Highway/Calliope River-Targinie Road
- Bruce Highway/Gladstone-Mt Larcom Road
- Gladstone-Mt Larcom Road/Calliope River-Targinie Road
- Gladstone-Mt Larcom Road/Landing Road
- Hanson Road/Reid Road
- Hanson Road/Red Rover Road
- Hanson Road/Blain Drive/Alf O'Rourke Drive
- Glenlyon Street/William Street
- Glenlyon Street)/Gladstone Port Access Road/Railway Street
- Glenlyon Street/Dawson Highway/Bramston Street
- Glenlyon Street/Herbert Street/Tennis Centre Access
- Glenlyon Street/Tank Street
- Bramston Street/Goondoon Street
- Port Access Road/Mark Fenton Dr / Hopper Road / Tug Berth Access Road
- Dawson Highway/Blain Drive / Herbertson Street
- Dawson Highway/Philip Street / Shopping Centre Access
- Dawson Highway/Don Young Drive.

The intersection analysis was based on a "without shuttle bus" scenario as this is the critical condition in terms of number of vehicles added onto the road network.

14.5.3.2 Intersection Analysis Impact Assessment

SIDRA analysis has been undertaken for all affected intersections. The results of the impact analyses, the SIDRA intersection performance tables and intersection layouts are presented in *Appendix 5.16.*

Bruce Highway/ Dawson Highway

For priority controlled intersections, a degree of saturation (DOS) of less than

0.80 is considered acceptable. The intersection is expected to perform with acceptable DOS for the 2010 and 2013 "without development" conditions. Generally, the intersection is also expected to operate with adequate service under additional development loading for these years. However there are a few cases where a DOS of 0.80 is exceeded. These are:

AM Peak

- Scenario 5c & 5d
- Scenario 6c & 6d
- Scenario 7d.

PM Peak

- Scenario 3b
- Scenario 5a & 5b
- Scenario 6a & 6b
- Scenario 7a & 7b.

It should be noted none of these scenarios is the QCLNG Project Reference Case.

Although the practical absorption capacity has been reached for the above cases, it is noted that the average delay does not exceed 25 seconds for any condition.

The SIDRA results for the 2018 "without development" design horizon indicate that the intersection is expected to operate above the practical capacity in the afternoon peak, and above the theoretical capacity in the morning peak. This condition worsens with the inclusion of additional development traffic and anticipated DOS could increase up to 1.159 in the 2018 morning peak.

Given that the intersection is not anticipated to operate within capacity limitations under a "without development" scenario, further SIDRA analysis for the ''with shuttle bus" condition has not been undertaken.
Although development generated traffic will be reduced with the use of shuttle buses, intersection operations cannot improve to acceptable levels.

Bruce Highway/ Calliope River Targinie Road

Analysis results indicate that the intersection is expected to operate within acceptable service parameters for all design horizons. The degree of saturation is well below the practical absorption capacity for priority controlled intersections (i.e. DOS<0.8) and the average delay is less than 10 seconds for all conditions.

Bruce Highway/ Gladstone-Mt Larcom Road

The SIDRA results indicate that the intersection is expected to operate adequately with the presence of the proposed development. The maximum

degree of saturation is 0.737, which occurs during the afternoon peak of Scenario 13a. Anticipated average delays are not expected to exceed 15 seconds for any of the impacted design horizon.

Gladstone-Mt Larcom Road/ Calliope River Targinie Road

Analysis results suggest that the intersection will be able to operate within acceptable service criteria for all "without development" conditions, except for Scenario 20 AM Peak; 2031 "without development". The DOS for this scenario and year is expected to reach 1.250.

In terms of the "with development" intersection operations, significant impacts are expected with the addition of Road Bridge Option 2 (Phillipies Landing Road extension). Anticipated operations degrade considerably for the 2013 peak periods (Scenario 6a – 6d). The condition improves slightly for Scenario 14c and 14d due to decreased development loadings, however, anticipated DOS still exceeds the theoretical capacity of 1.0.

The SIDRA results indicate that when shuttle buses are provided to and from the airport, this does not reduce generated traffic to levels where intersection performance becomes acceptable.

Further analysis of scenarios 14c and 14d was not required, as the traffic volumes are based from the same distribution as scenarios 6c and 6d. Given that scenarios 14c and 14d simply represent reduced volumes from scenarios 6c and 6d, any intersection form deemed appropriate for scenarios 6c and 6d will be adequate for scenarios 14c and 14d.

Gladstone-Mt Larcom Road / Landing Road

The SIDRA results indicate that the intersection operates adequately under the 2013 and 2018 "without development" scenarios. This condition changes, however, with the potential implementation of either road bridge option. Under the 2013 "with development" scenario, anticipated volumes could exceed available capacity up to seven times if a do-nothing scenario proceeds. The results for the shuttle bus scenario indicate that this projection does not improve significantly, even with the reduction in development generated traffic.

The recommended intersection layouts for scenarios 5a – 6d are applicable to the 13a–14d scenarios as the same traffic distribution is shared between the two design horizons. Since scenarios 13a-4d simply represent reduced volumes from scenario 5a through to 6d, any intersection form deemed appropriate for scenario 5a-6d will also be adequate for scenario 13a-14d.

For the 2021 design horizon, the SIDRA results indicate that the intersection is not expected to provide acceptable service conditions, even without the presence of the proposed development. The DOS for scenario 16 show that the practical absorption capacity of 0.8 is exceeded in the afternoon peak, whilst the theoretical capacity of 1.0 is exceeded in the morning peak. The condition worsens for the 2031 design horizon.

Hanson Road/ Reid Road

Analysis results indicate that the intersection is expected to operate slightly above its practical absorption capacity in the afternoon peak of 2010. By 2018, "without development" intersection performance is anticipated to degrade to a DOS above two.

Given that the intersection is not anticipated to operate within capacity limitations under a "without development" scenario, further SIDRA analysis for the ''with shuttle bus" condition has not been undertaken. Although development generated traffic will be reduced with the use of shuttle buses, intersection operations cannot improve to acceptable levels.

Hanson Road/ Red Rover Road

Analysis results suggest that the intersection is anticipated to operate satisfactorily under 2010, 2013 and 2018 "without development" conditions. This condition changes however, with the potential implementation of either road bridge option. With the presence of the road bridge, DOS reaches up to 1.254 in the afternoon peak of 2013 and 1.063 in the afternoon peak of 2018. The results of the "with shuttle bus" scenario show that although performance is improved slightly with the reduced traffic generation, anticipated performance still exceeds acceptable criteria.

Hanson Road/Blain Drive/Alf O'Rourke Drive

For roundabouts, a degree of saturation (DOS) of less than 0.85 is considered acceptable. The intersection is expected to perform with acceptable DOS for the 2010 and 2013 "without development" conditions. However, intersection performance under 2013 "with development" traffic loading degrades to unacceptable levels and remedial solutions are necessary.

The SIDRA results for the 2018 "without development" design horizon indicate that the intersection is expected to operate above the practical capacity in the afternoon peak. This condition worsens with the inclusion of additional development traffic and anticipated DOS could increase up to 2.701 without the use of shuttle buses.

Further analysis of the required intersection form at 2018 was not required as the intersection form that is deemed adequate for scenarios 5a to 7d was also considered appropriate for 2018 traffic loadings.

Glenlyon Street/William Street

Analysis results indicate that the intersection is expected to operate within acceptable service parameters for all design horizons. The degree of saturation is well below the practical absorption capacity for priority controlled intersections (i.e. DOS<0.8) and the average delay is less than five seconds for all conditions.

Glenlyon Street/Gladstone Port Access Road/Railway Street

The results indicate that the existing intersection form is able to provide acceptable service conditions without the presence of the proposed development in 2010 and 2013. This however, is not the case under all "with development" scenarios, and this condition does not improve with the implementation of shuttle buses. Therefore remedial works will be required.

Glenlyon Street/Dawson Highway/Bramston Street

The SIDRA results indicate that the intersection is already operating at its theoretical capacity. Therefore any increase in volumes would further exacerbate the situation.

Given that the intersection is not anticipated to operate within capacity limitations under a "without development" scenario, further SIDRA analysis for the ''with shuttle bus" condition has not been undertaken. Although development-generated traffic will be reduced with the use of shuttle buses, intersection operations cannot improve to acceptable levels.

Glenlyon Street/Herbert Street/Tennis Centre Access

Analysis results indicate that the intersection is expected to operate within acceptable service parameters for all design horizons. The degree of saturation is well below the practical absorption capacity for priority controlled intersections (i.e. DOS<0.8) and the average delay is less than five seconds for all conditions.

Glenlyon Street/Tank Street

The SIDRA results indicate that the intersection is already operating at its theoretical capacity, therefore any increase in volumes would further exacerbate the situation.

Given that the intersection is not anticipated to operate within capacity limitations under a "without development" scenario, further SIDRA analysis for the ''with shuttle bus" condition has not been undertaken.

Although development-generated traffic will be reduced with the use of shuttle buses, intersection operations cannot improve to acceptable levels.

Port Access Road/Mark Fenton Drive/Hopper Road/Tug Berth Access Road

The analysis results indicate that the intersection is anticipated to operate within satisfactory service criteria for all scenarios with the exception of scenario 3. Additional SIDRA analyses have been completed for the airport shuttle scenario and the results indicate that the intersection is still anticipated to operate above the practical absorption capacity for roundabouts (i.e. 0.85).

Dawson Road/Blain Drive/Herbertson Street

The results of the analysis suggest that the existing intersection form is able to provide adequate service for 2010, 2013 and 2018 "without development" conditions. This is not the case however, for "with development" conditions in 2013 for both bridge/road options and anticipated DOS in the afternoon peak slightly exceeds the practical absorption capacity of 0.85 for roundabouts. It is noted, however, that anticipated delays still do not exceed 20 seconds for any of the bridge/road scenarios in 2013.

Intersection performance for the "with development" scenario with no road bridge (i.e. water transport is utilised from a jetty at the end of Alf O'Rourke Drive) indicates that performance is well beyond acceptable conditions and anticipated average delays are either close to or exceed one minute.

Dawson Highway/Phillip Street/Shopping Centre Access

The Dawson Highway/Phillip Street/Shopping Centre Access is a signalised roundabout with metered approaches on Phillip Street, the southern approach of the Dawson Highway and at the shopping centre access. The meter on the Phillip Street approach operates during the morning peak hour and the other two approaches at the Dawson Highway and at the shopping centre access operate during the afternoon peak.

The SIDRA results are for the existing intersection layout but without roundabout metering. SIDRA is able to approximate intersection performance through a series of iterations involving analysis of performance "with" and then "without" the meter. However, this intersection has been selected to be part of additional micro-simulation analysis. As micro-simulation will yield a far more accurate result, further analysis using SIDRA has not been completed. The results of the micro-simulation are presented in *Appendex 5.16.*

The results indicate that without roundabout metering, the intersection is not expected to provide acceptable service conditions.

Dawson Highway/Don Young Drive

Analysis results indicate that the intersection is expected to operate within acceptable service parameters for all design horizons with the exception of scenario 7b in the afternoon peak. Recalculation of intersection operations with the inclusion of the airport shuttle, however, brings anticipated intersection operations back to acceptable levels. Therefore, upgrade works at this intersection are not required, provided that the airport shuttle service is in operation in 2013 for Construction Camp Option D.

14.5.3.3 Intersection Analysis Summary

The intersections in *Table 5.14.20* required further investigation so that anticipated impacts can be mitigated through appropriate remedial works. The layouts corresponding with each of the intersections in *Table 5.14.20* that are required in order to provide adequate servicing conditions at the future design years are examined in further detail in *Section 14.5.4*.

Table 5.14.20 Intersection Analysis Summary

Intersection	Scenarios[48]
Bruce Highway/Dawson Highway	12
	13a, 13b, 13c, 13d
	14a, 14b, 14c, 14d
	15a, 15b, 15d
Gladstone-Mt Larcom Road/Calliope River-Targinie Road	6a, 6b, 6c, 6d
	20, 22
Gladstone-Mt Larcom Road/Landing Road	5a, 5b, 5c, 5d
	6a, 6b, 6c, 6d
	20, 21
Hanson Road/Reid Road	12
	13a, 13b, 13c, 13d
	14a, 14b, 14c, 14d
Hanson Road/Red Rover Road	5a, 5b, 5c, 5d
	6a, 6b, 6c, 6d
Hanson Road/Blain Drive/Alf O'Rourke Drive	5a, 5b, 5c, 5d
	6a, 6b, 6c, 6d
	7a, 7b, 7c, 7d
Glenlyon Street/Gladstone Port Access Road/Railway Street	3a, 3b, 3c, 3d
Glenlyon Street/Dawson Highway/Bramston Street	4
	5a, 5b, 5c, 5d
	6a, 6b, 6c, 6d
	7a, 7b, 7c, 7d
Glenlyon Street/Tank Street	4
	5a, 5b, 5c, 5d
	6a, 6b, 6c, 6d
Port Access Rd/Mark Fenton Dr/Hopper Rd/Tug Berth Access Rd	3d
Dawson Highway/Blain Drive/Herbertson Street	7a, 7b, 7c, 7d
	13a, 13c, 13d
	14a, 14c, 14d

The traffic assessment for the reference case corresponds with scenario 3d, 11, 15d, 19 and 23.

14.5.4 Intersection Form

14.5.4.1 Overview

This section presents all the intersection layouts based on the scenarios contained in *Table 5.14.20* that are required in order to provide adequate servicing conditions at the future design years. Intersections forms reflecting

48 Shaded areas encompass reference case, corresponding with Scenario 3d, 11, 15d, 19 and 23.

"with development" and "without development" are shown.

It should be noted under the original assumptions the reference case requires four intersection upgrades, and the geographic location of these is shown on *Figure 5.14.1*.

- Hanson/Blain/Alf O'Rourke Drive – Upgrade works (with development, no bridge)
- Glenlyon Street/Port Access Road/Railway Street– Upgrade works (with development)
- Port Access Road/Tug Berth Access Road– Upgrade works (without development)
- Dawson Highway/Blain Drive/Herbertson Street – Upgrade works (with development).

The upgrade works under the original assumptions for each of these intersections is discussed in further detail. Under the revised assumptions, some or all of these upgrade works may not be required.

14.5.4.2 Bruce Highway/Dawson Highway

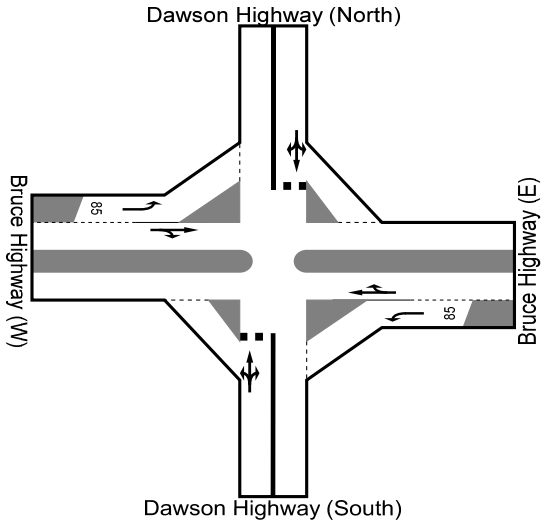
Without Development Intersection Requirements

The Bruce Highway/Dawson Highway intersection, termed the Calliope Crossroads, is currently under investigation for potential grade separation due to safety concerns with the current design. Late last year, the Federal Government provided $3 million to bring forward the planning for the intersection upgrade (which is anticipated to be completed by December 2009), and will eventually amount to a $55 million contribution towards construction.

Given the current planning, a grade separated configuration has been adopted for the analysis. While there are a number of potential options for grade separation, it is assumed that the Bruce Highway will become the grade separated portion, leaving the Dawson Highway at-grade. This is considered the most likely solution as the Bruce Highway forms part of the Auslink network.

The at-grade portion for the upgraded intersection is shown in *Figure 5.14.3* Note that the through lanes on the Bruce Highway are included for access considerations only, and the corresponding traffic flow on these through movements have been reduced to a nominal 10 vehicles per hour with a 5 per cent heavy vehicle composition.

Figure 5.14.3 Bruce Highway/Dawson Highway – Upgrade Works (Without Development)



2018 AM Peak

- DOS = 0.641
- Avg. Delay = 11.1 sec
- Back of Queue = 79 m

2018 PM Peak

- DOS = 0.572
- Avg. Delay = 10.1 sec
- Back of Queue = 51 m

With Development Intersection Requirements

The "without development" intersection configuration shown in *Figure 5.14.3* has been tested with the addition of development generated traffic. The SIDRA analysis results suggest that the intersection is expected to operate within acceptable performance parameters under the additional development generated traffic loading. Remedial works resultant from the proposed development is therefore not required.

14.5.4.3 Gladstone Mt Larcom Road/Calliope River Targinie Road

With Development Intersection Requirements at 2013

SIDRA results indicated that the Gladstone Mt Larcom Road/Calliope River Targinie Road intersection was not anticipated to operate with acceptable performance parameters under road bridge option 2 (Phillipies Landing Road extension) for all construction camp options.

For the 2013 design year, it was also shown that the intersection was expected to operate adequately without the presence of the proposed development. Therefore, the upgrade works presented in this section would be the responsibility of the proponent, should any of scenarios 6a to 6d proceed. However, scenarios 6a to 6d do not correspond with the Project reference case, and therefore this upgrade work will not be required.

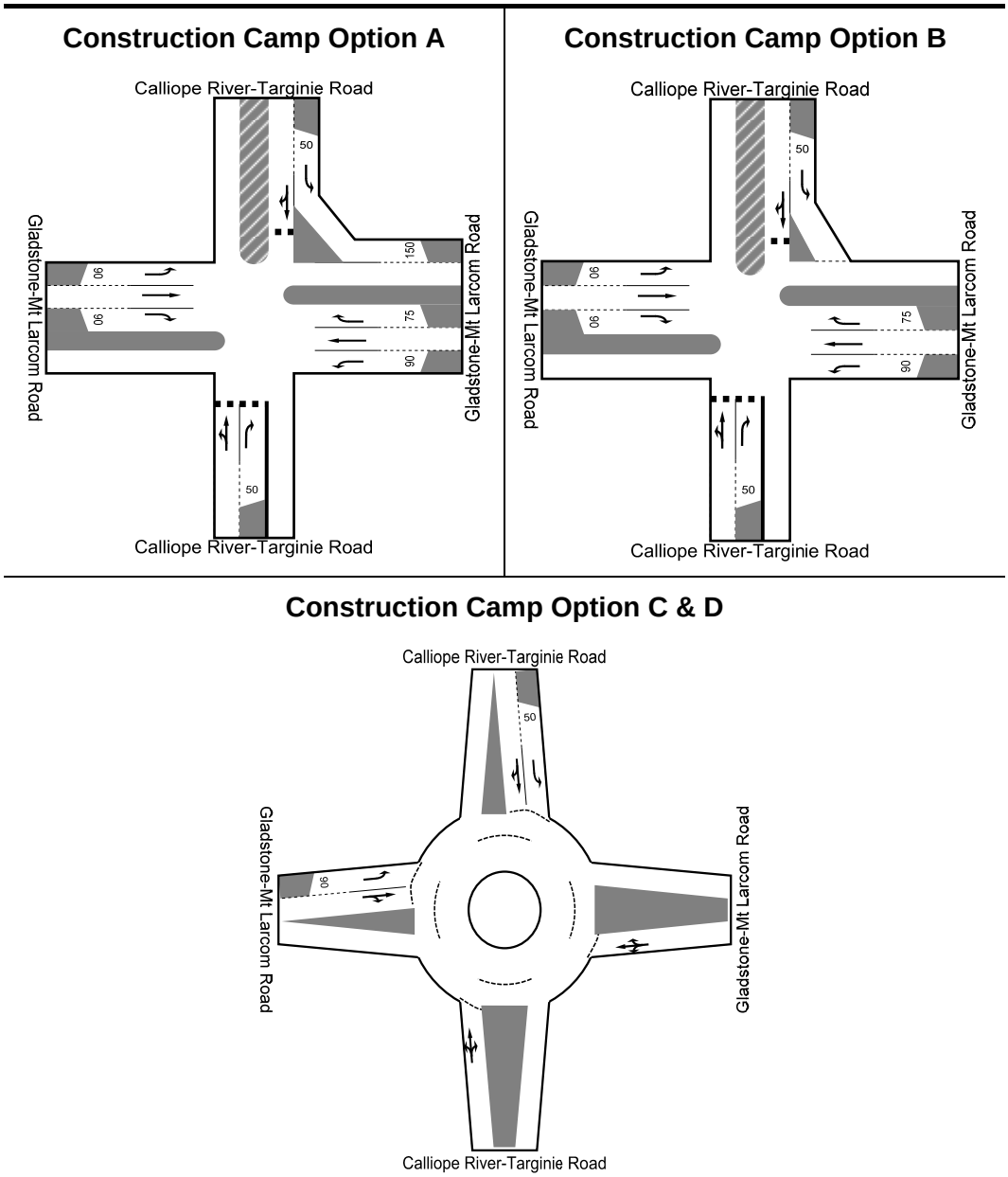
Inspection of SIDRA results indicate that the critical movements under the existing intersection form are:

- all movements at the southern approach of Calliope River-Targinie Road during the morning peak, for all construction camp options

- right-turn movement from the eastern approach at Gladstone-Mt Larcom Road during the morning peak, for construction camp options C and D
- all movements at the northern approach of Calliope River-Targinie Road during the afternoon peak, for all construction camp options.

The future year intersection forms for each construction camp option are presented in *Figure 5.14.4.*

Figure 5.14.4 Gladstone-Mt Larcom/Calliope-River Targinie – Upgrade Works (With Development)

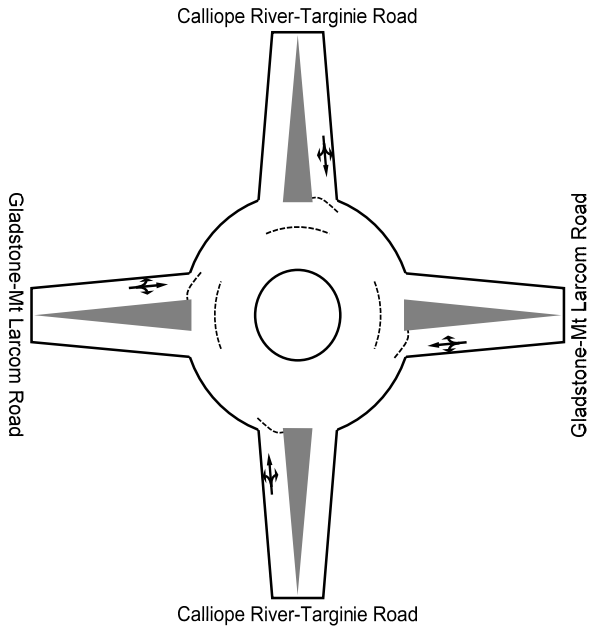


Without Development Intersection Requirements at 2031

If road bridge option 2 does not proceed, background volumes are anticipated to increase to the point where "without development" remedial works may be required in 2031. The future year intersection form is shown in *Figure 5.14.5.*

It should be noted that variations of priority controlled arrangements, similar to existing, were tested. As all tested options did not provide acceptable service conditions, upgrade to a roundabout arrangement was deemed necessary.

Figure 5.14.5 Gladstone-Mt Larcom/Calliope River-Targinie Road – Upgrade Works (Without Development)



2031 AM Peak

- DOS = 0.500
- Avg. Delay = 9.1 sec
- LOS A
- Back of Queue = 36 m

2031 PM Peak

- DOS = 0.513
- Avg. Delay = 7.7 sec
- LOS A
- Back of Queue = 39 m

With Development Intersection Requirements at 2031

The "without development" intersection configuration shown in *Figure 5.14.5* has been tested with the addition of development-generated traffic. The SIDRA analysis results suggest that the intersection is expected to operate within acceptable performance parameters under the additional development-generated traffic loading. Therefore, if road bridge option 2 does not proceed, additional works at this intersection are not required as part of the development proposal.

14.5.4.4 Gladstone-Mt Larcom Road/Landing Road

With Development Intersection Requirements at 2013

SIDRA results indicated that the Gladstone-Mt Larcom Road/Landing Road intersection was not anticipated to operate with acceptable performance parameters in 2013 for all construction camp options and both bridge options.

For the 2013 design year, the intersection was expected to operate adequately without the presence of the proposed development. Therefore, the upgrade works presented in this section would be the responsibility of the proponent, should any of scenarios 5a through to 6d proceed.

Bridge Option 1 – Landing Road Extension

Inspection of SIDRA results indicate that the critical movement under the existing intersection form is the right turn from the eastern approach at Gladstone-Mt Larcom Road, for all construction camp options during both peak periods.

Bridge Option 2 – Phillipies Landing Road Extension

For Bridge Option 2, the critical movement is the right turn into Gladstone-Mt Larcom Road (south) from Gladstone-Mt Larcom Road (west). This is the case for both peak periods.

The future year intersection forms for each construction camp option are presented in *Figure 5.14.16* and *Figure 5.14.7*. A number of priority controlled configurations were tested, however, to provide the required capacity a roundabout arrangement was deemed to be necessary.

Figure 5.14.6 Gladstone-Mt Larcom/Landing Rd – Upgrade Works (With Development, Bridge 1)

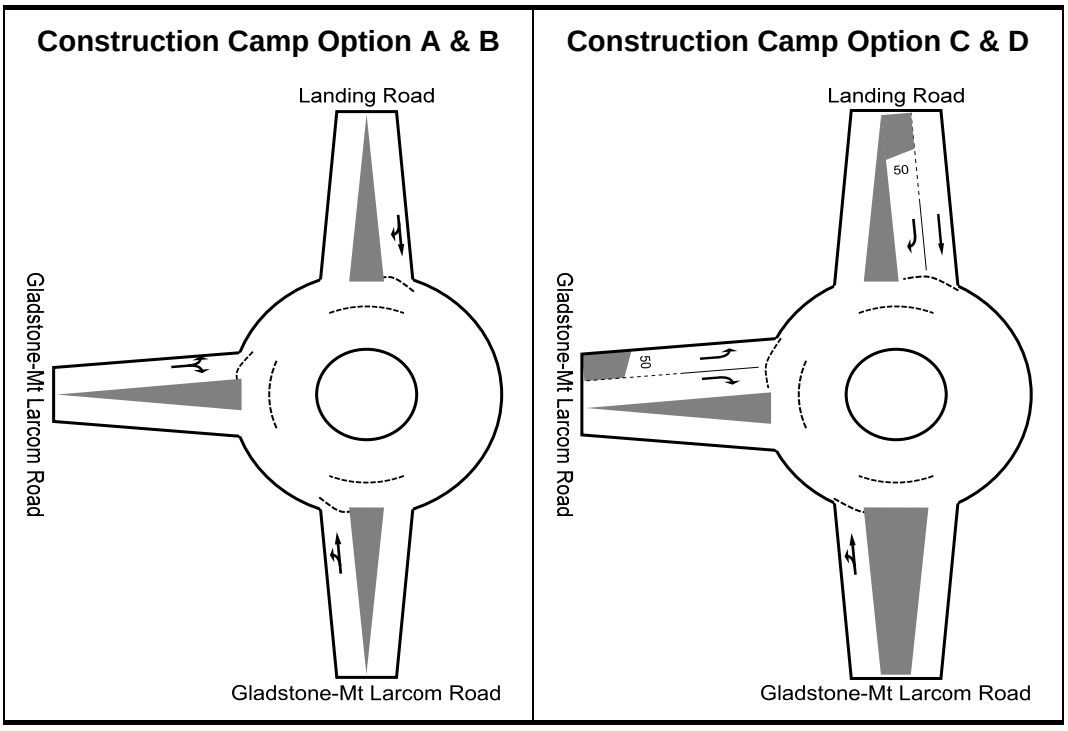
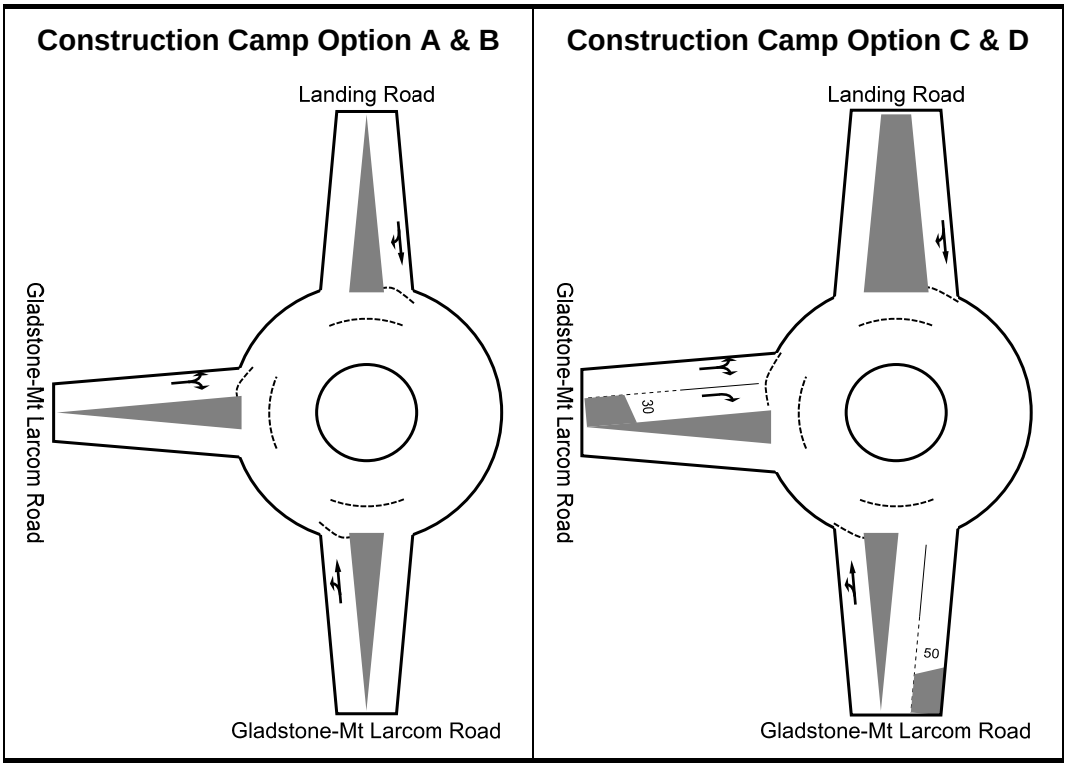


Figure 5.14.7 Gladstone-Mt Larcom/Landing Rd – Upgrade Works (With Development, Bridge 2)

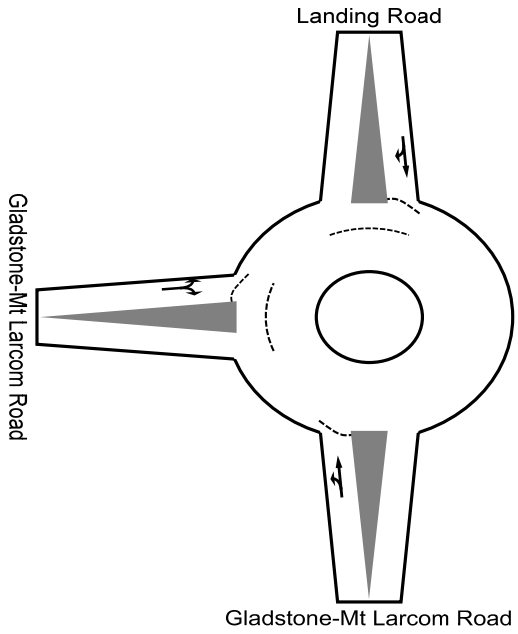


Without Development Intersection Requirements at 2031

If both bridge options do not proceed and ferry transport continues to be utilised for the transport of equipment and personnel, background volumes at the Gladstone-Mt Larcom Road/Landing Road intersection are still anticipated to increase to the point where "without development" remedial works may be required in 2021. As would be expected, this condition worsens through to 2031 and anticipated DOS could reach five times the available capacity if a "do nothing" scenario proceeds and the existing intersection form is retained.

The future year intersection form that is required to cater for 2031 predicted volumes is presented in *Figure 5.14.8*. It should be noted that various priority controlled arrangements, similar to existing, were tested. As all tested options did not provide acceptable service conditions, upgrade to a roundabout arrangement was deemed necessary.

Figure 5.14.8 Gladstone-Mt Larcom Road/Landing Road – Upgrade Works (Without Development)



2031 AM Peak

- DOS = 0.657
- Avg. Delay = 11.5 sec
- LOS B
- Back of Queue = 62 m

2031 PM Peak

- DOS = 0.677
- Avg. Delay = 9.9 sec
- LOS A
- Back of Queue = 68 m

With Development Intersection Requirements at 2031

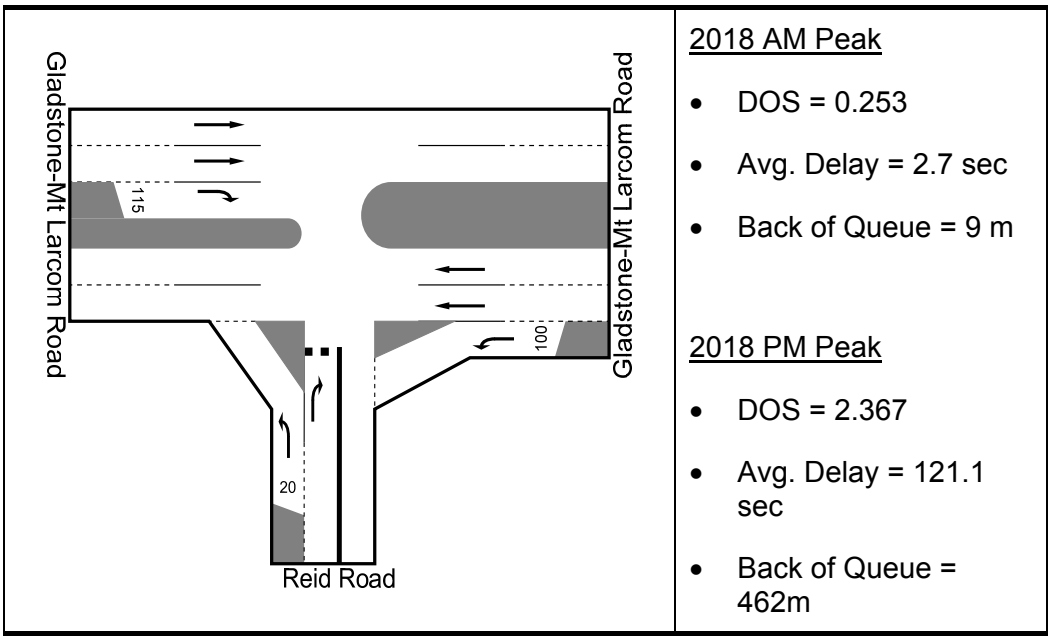
The "without development" intersection configuration shown in *Figure 5.14.8* has been tested with the addition of development-generated traffic. The analysis results suggest that the intersection is expected to operate within acceptable performance parameters under the additional development-generated traffic loading. Therefore, if neither bridge option proceeds, additional works at this intersection are not required as part of the development proposal.

14.5.4.5 Hanson Road/Reid Road

Without Development Intersection Requirements

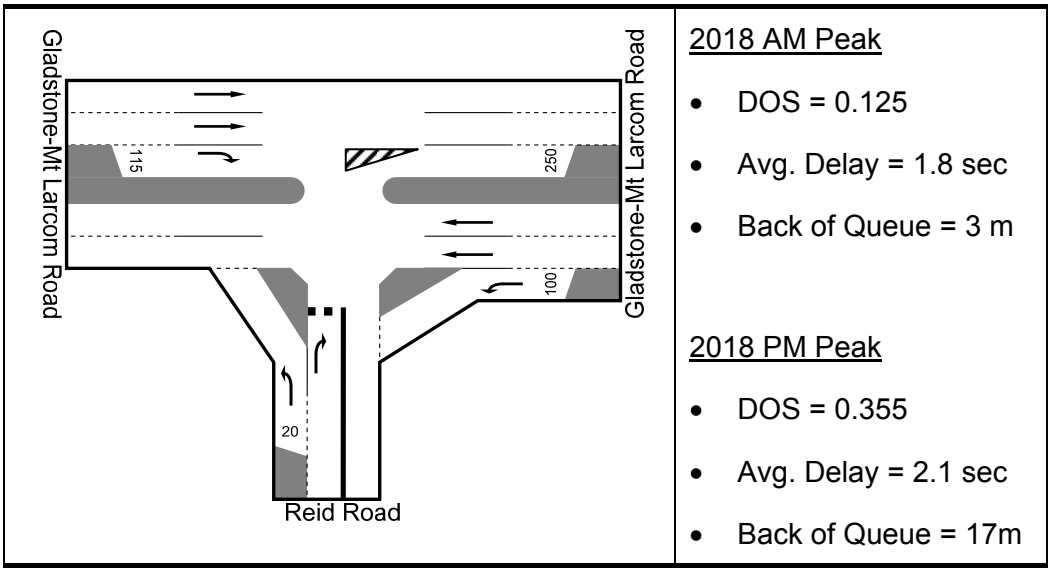
Gladstone Mt Larcom Road between Reid Road and Red Rover Road is required to be a four-lane rural cross-section. The corresponding intersection layout that would complement the midblock form is shown in *Figure 5.14.9*. The SIDRA results suggest that a layout of this standard does not provide the required capacity in the 2018 afternoon peak.

Figure 5.14.9 Hanson Rd/Reid Rd – Upgrade Works (Match Midblock)



The critical movement in the 2018 afternoon peak is the right turn from Reid Road. To improve operations for this movement a seagull arrangement can be implemented. The required intersection form is indicated in *Figure 5.14.10* below.

Figure 5.14.10 Hanson Rd/Reid Rd – Upgrade Works (Without Development)



With Development Intersection Requirements

The "without development" intersection configuration shown in *Figure 5.14.10* has been tested with the addition of development-generated traffic. The analysis results suggest that the intersection is expected to operate within acceptable performance parameters under the additional development-generated traffic loading. Therefore, further works are not required as part of the proposed development.

14.5.4.6 Hanson Road/Red Rover Road

Without Development Intersection Requirements

This intersection operates adequately without the presence of the proposed development.

With Development Intersection Requirements

SIDRA results indicated that the Hanson Road/Red Rover Road intersection was not anticipated to operate with acceptable performance parameters under both road bridge options for all construction camp options. The section between Reid Road and Blain Drive was flagged for upgrade to an undivided four-lane two-way rural road, even without the presence of the proposed development.

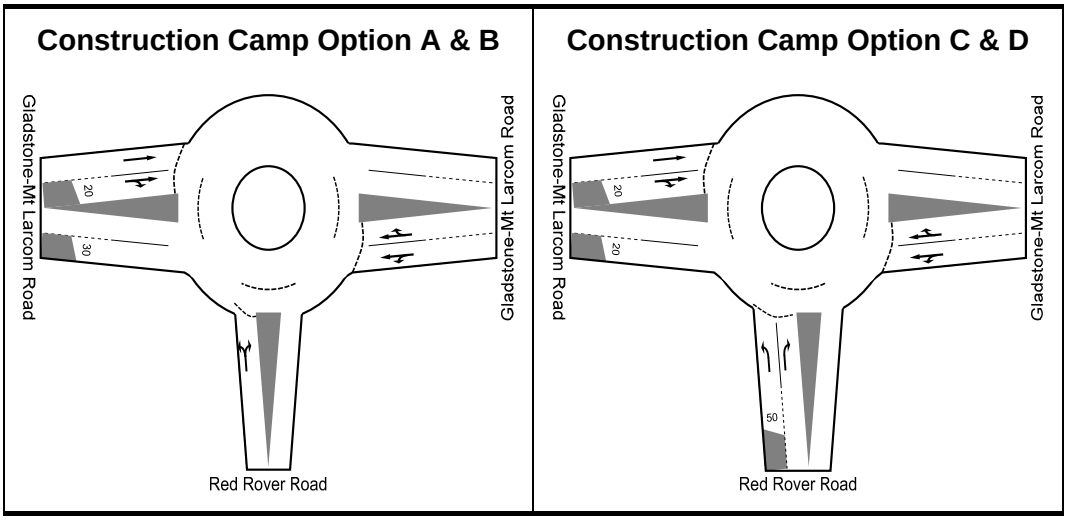
Inspection of the SIDRA results indicates that the critical movement generally occurs in the afternoon peak and are:

- the through and right turn from Gladstone-Mt Larcom Road west for all construction camp options under the scenarios including bridge option 1
- although not the critical movement over the whole day, the left and right turn from Red Rover Road also operates above the practical absorption capacity during the morning peak for Construction Camp Options C and D
- the above mentioned comments are also applicable for all construction camp options under the scenarios including bridge Option 2.

The future year intersection forms for each construction camp option are presented in *Figure 5.14.11*. The intersection forms conform to the mid-block requirements and assume that the four-laning of Hanson Road does not extend over the bridge to the west of the intersection. The additional short turning lane from Red Rover Road takes into consideration the location of the adjacent access point.

Given that the future year intersection form for Construction Camp Options A and B does not require any additional flaring beyond that to match the mid-block requirements, the proponent may not be responsible for the full cost of upgrade at the intersection. This may also be the case for Construction Camp Options C and D when considering the cost of upgrade for the Hanson Road legs.

Figure 5.14.11 Hanson Road/Red Rover Road – Upgrade Works (With Development,Bridge 1 & 2)



14.5.4.7 Hanson Road/ Blain Drive/ Alf O'Rourke Drive

Without Development Intersection Requirements

This intersection operates adequately without the presence of the proposed development, up to 2018.

With Development Intersection Requirements

With development intersection performance decreased to unacceptable levels in 2013. This conforms to the findings of the link analyses which indicated that Hanson Road, between Red Rover Road and Blain Drive required upgrading to an undivided four-lane, two-way road in 2013, even without the presence of the proposed development. This requirement increases to a divided four-lane, two-way road by 2018.

Inspection of SIDRA results under a "do nothing" arrangement indicates that the critical movements occur on the Alf O'Rourke Drive approach and the western Gladstone-Mt Larcom Road approach during the afternoon peak for both bridge options. For the scenario without the road bridge, the critical movement in the morning peak occurs on Gladstone-Mt Larcom Road west and in the afternoon peak occurs on the Alf O'Rourke Drive approach.

The future year intersection forms for each construction camp option are presented in *Figure 5.14.12* and *Glenlyon Street/Gladstone* Port Access Road/Railway Street

Without Development Intersection Requirements

This intersection operates adequately without the presence of the proposed development.

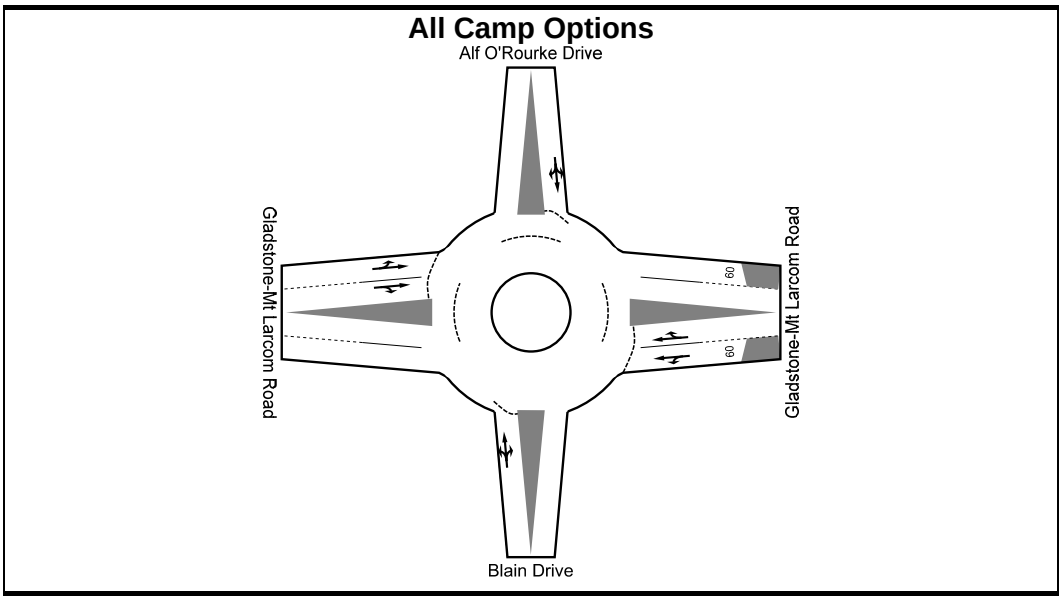
With Development Intersection Requirements

The SIDRA analysis indicated that the Glenlyon Street/Port Access Road/Railway Street intersection operates with unacceptable service parameters for all construction camp options in 2010. Inspection of SIDRA results for the existing layout indicates that the critical movements are as follows:

- right turn from the southern approach at Glenlyon Street in the morning peak
- all movements on the Port Access Road and the northern Glenlyon Street approach in the afternoon peak.

Figure 5.14.13 The intersection forms conform to the mid-block requirements and assume that the four-laning of Hanson Road does not extend over the bridges to the north and east of the intersection.

Figure 5.14.12 Hanson/Blain/Alf O'Rourke Dr – Upgrade Works (With Development, Bridge 1 & 2)



14.5.4.8 Glenlyon Street/Gladstone Port Access Road/Railway Street

Without Development Intersection Requirements

This intersection operates adequately without the presence of the proposed development.

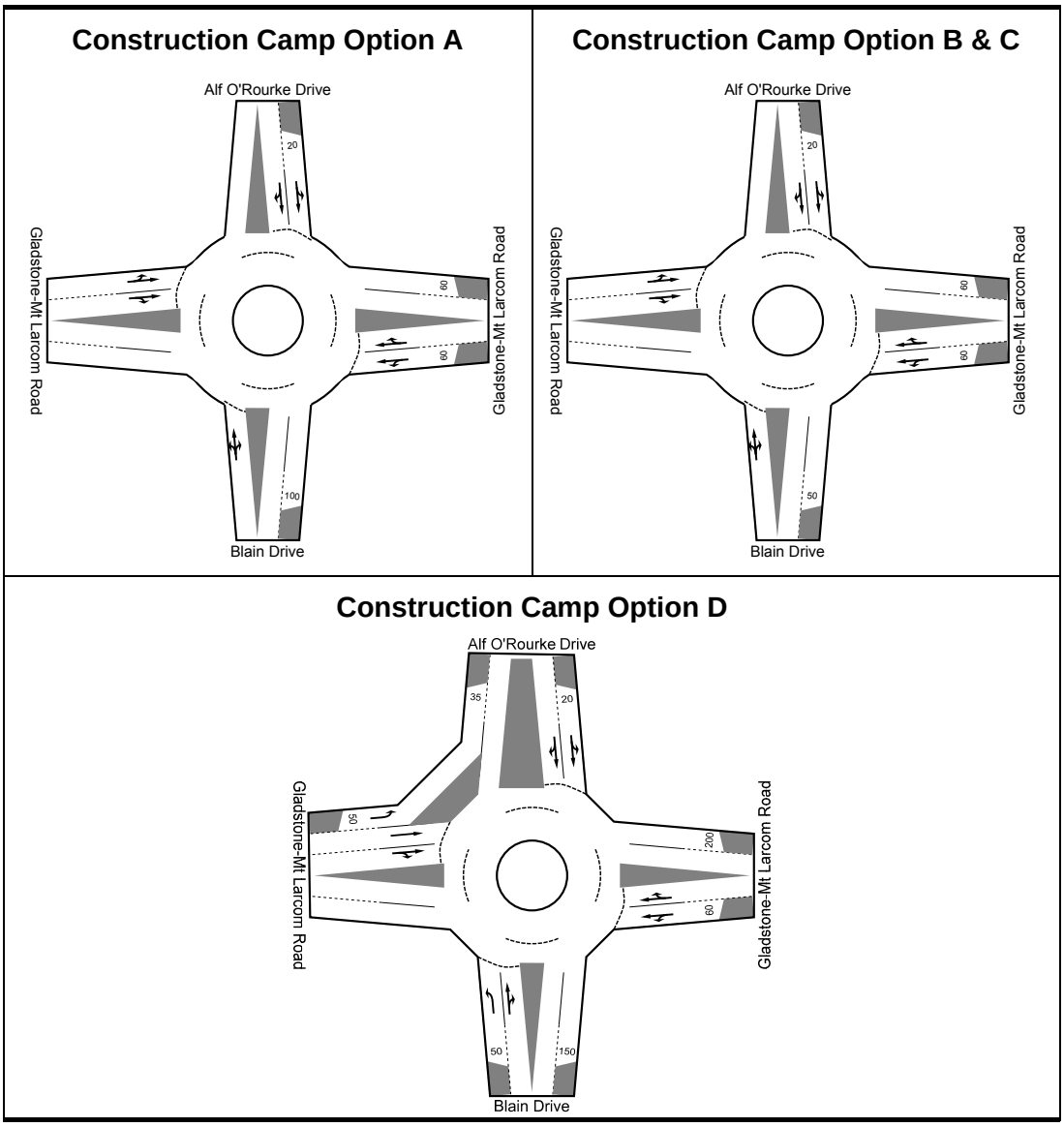
With Development Intersection Requirements

The SIDRA analysis indicated that the Glenlyon Street/Port Access Road/Railway Street intersection operates with unacceptable service parameters for all construction camp options in 2010. Inspection of SIDRA results for the existing layout indicates that the critical movements are as

follows:

- right turn from the southern approach at Glenlyon Street in the morning peak
- all movements on the Port Access Road and the northern Glenlyon Street approach in the afternoon peak.

Figure 5.14.13 Hanson/Blain/Alf O'Rourke Dr – Upgrade Works (With Development, No Bridge)



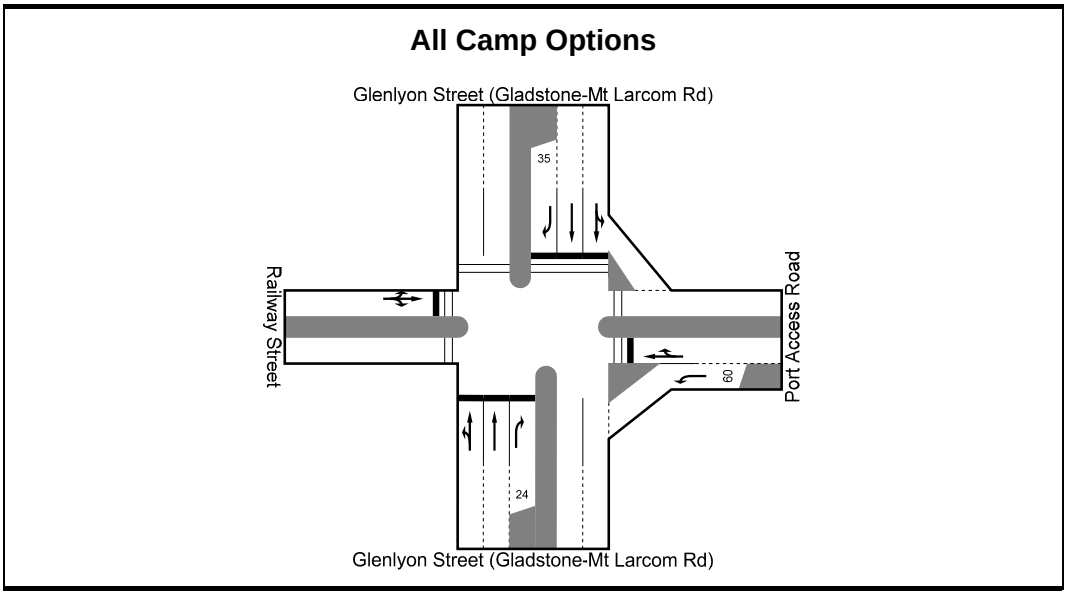
The required future year intersection form is illustrated in *Figure 5.14.14.* This layout is applicable to all proposed camp options and features the addition of a short left turn slip lane on the Port Access Road approach. In addition to this, the intersection analysis has made use of pre-timed signal phasing rather than actuated signal phasing, as a greater degree of control can be applied to the cycle timing.

The anticipated levels of DOS have been flagged as 1.00 or near 1.00 for most cases. Although this is usually cause for concern, in this case a DOS of 1.00 applies to the short turning lanes not being of sufficient length, and thus causing some overflow onto the adjacent lane. The DOS for all other lanes have been checked and these all operate with a DOS at or below the acceptable practical absorption capacity of 0.9. While it would be ideal to increase short turning lane lengths so that no excess flow occurs, this intersection has a number of potential constraints to available space. These are:

- the existing rail bridge to the south of the intersection. The distance from the right turning stop line on the southern approach to the edge of the bridge deck is approximately 30 m;
- the rail line which runs directly adjacent to Port Access Road. The available space from the existing stop line on the eastern approach to the convergence point with the rail line is approximately 75 m
- the location of the adjacent intersection to the north at William Street. The istance from the right turn stop line on the northern approach to the southern edge of the median break is approximately 30 m.

The presented layout takes these constraints into consideration.

Figure 5.14.14 Hanson Rd/Port Access Rd/Railway St– Upgrade Works (With Development)



14.5.4.9 Glenlyon Street/Dawson Highway/Bramston Street

Without Development Intersection Requirements

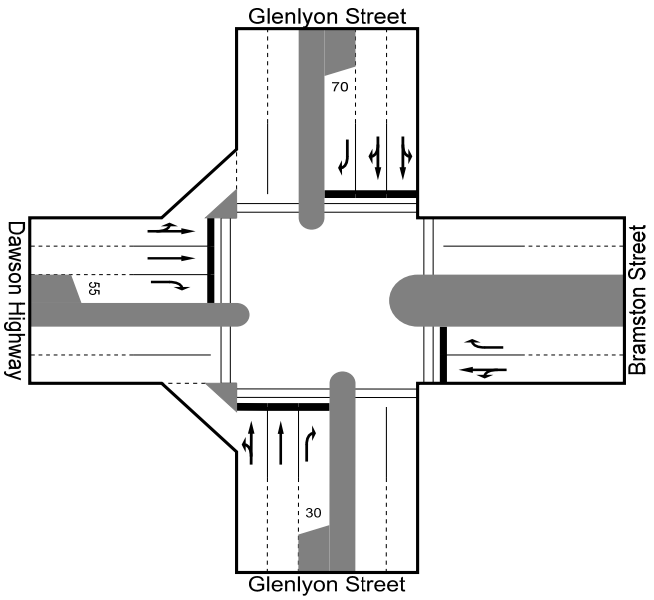
The "without development" intersection requirement is shown in *Figure 5.14.15*. The critical movement for this intersection is the right turn from the northern Glenlyon Street approach. While lengthening of the right turn slot would improve operations to ideal parameters, the presence of the rail bridge

to the north potentially creates constraints to the available length of short lane.

Therefore, the short turning lanes on the northern approach have been limited to a maximum storage of 70 m. Upgrade works include the following:

- lengthening of the short right turn lane on Glenlyon Street (north) to 70 m, from 40 m
- reconfiguration of the median-side through movement on Glenlyon Street (north) to a shared right/through lane
- reconfiguration of signal phasing and modification of actuated timing to fixed timing.

Figure 5.14.15 Glenlyon St/Dawson Hwy/Bramston St – Upgrade Works (Without Development)



2013 AM Peak

- DOS = 0.844
- Avg. Delay = 31.5 sec
- LOS C
- Back of Queue = 92 m

2013 PM Peak

- DOS = 0.824
- Avg. Delay = 38.4 sec
- LOS D
- Back of Queue = 160 m

With Development Intersection Requirements

The "without development" intersection configuration shown in *Figure 5.14.15* has been tested with the addition of development-generated traffic. The results suggest that the intersection operates within acceptable performance parameters for all scenarios with the exception of 5a, 5b, 6a and 6b. In these cases the DOS is expected to be very slightly above the practical absorption capacity of 0.9. Given that the anticipated overall LOS is still at an acceptable LOS D, it is considered that the "without development" intersection form is still adequate for scenarios 5a, 5b, 6a and 6b.

14.5.4.10 Glenlyon Street/Tank Street

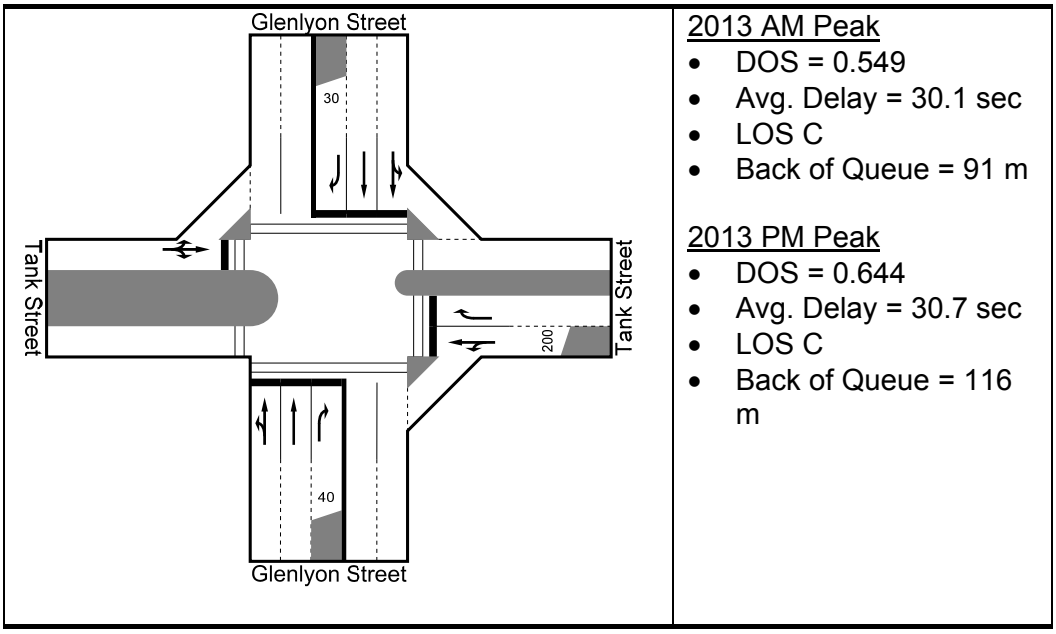
Without Development Intersection Requirements

As discussed in Section 14.4.3, Glenlyon Street between Bramston Street and

Derby Street will be upgraded to four lanes. This also includes associated intersection upgrades at Tank and Derby streets.

The 2013 "without development" intersection requirement is shown in *Figure 5.14.16.* It is similar to the existing layout except for the additional lanes on Glenlyon Street to match the four-lane mid-block cross-section discussed above. The short left/through shared slip lane on the Tank Street approach has also been extended from the existing length of approximately 20 m to the adjacent intersection at Goondoon Street. This length is approximately 200 m. The revised layout will also require minor signal reconfiguration to ensure that adequate safety is maintained at this location. In particular, the filtered right turn movements on Glenlyon Street will need to be removed.

Figure 5.14.16 Glenlyon Street/Tank Street – Upgrade Works (Without Development)



With Development Intersection Requirements

The "without development" intersection configuration shown in *Figure 5.14.16* it has been tested with the addition of development-generated traffic. The analysis results suggest that the intersection is expected to operate within acceptable performance parameters under the additional development generated traffic loading. Therefore, further works are not required as part of the proposed development.

14.5.4.11 Port Access Road/Mark Fenton Drive/Hopper Road/Tug Berth Access Road

Without Development Intersection Requirements

This intersection operates adequately without the presence of the proposed development.

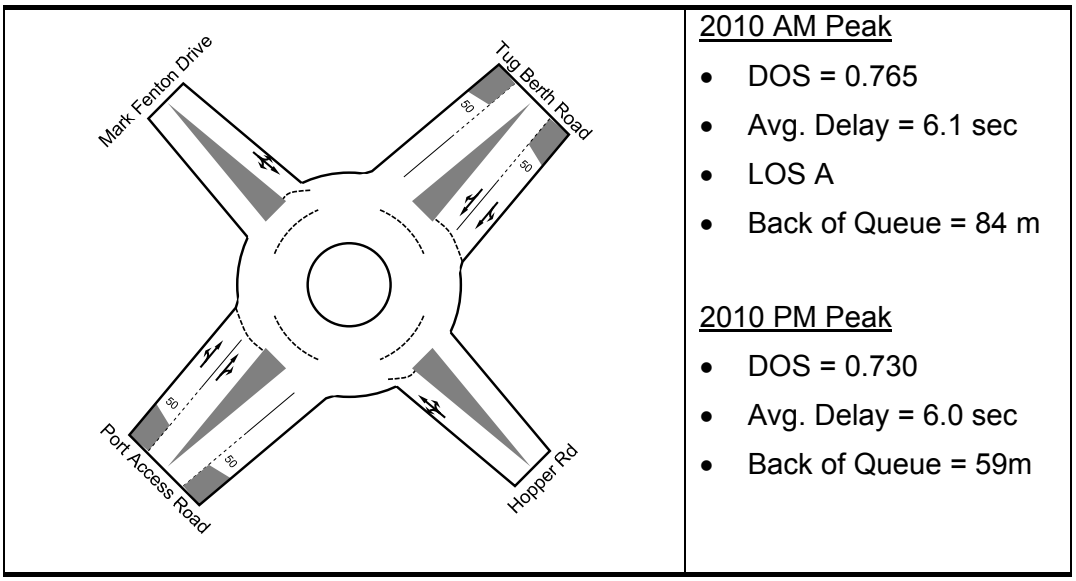
With Development Intersection Requirements

Upgrade works are required at this intersection for scenario 3d – 2010 Construction Camp Option D. For this scenario, the critical approach is the Gladstone Port Access Road in the morning peak and Tug Berth Access Road in the afternoon peak. The required intersection form is shown in *Figure 5.14.17*.

The upgrade incorporates the following:

- the addition of a 50 m shared left/through lane on the Port Access and Tug Berth Access Roads
- the provision of complementary short downstream lanes on Port Access and Tug Berth Access Road to cater for the additional through lane on the opposing approach.

Figure 5.14.17 Port Access Rd/Tug Berth Access Rd – Upgrade Works (With Development)



2010 AM Peak

- DOS = 0.765
- Avg. Delay = 6.1 sec
- LOS A
- Back of Queue = 84 m

2010 PM Peak

- DOS = 0.730
- Avg. Delay = 6.0 sec
- Back of Queue = 59m

14.5.4.12 Dawson Road/Blain Drive/Herbertson Street

Without Development Intersection Requirements

This intersection operates adequately without the presence of the proposed development.

With Development Intersection Requirements

The SIDRA analysis indicated that the Dawson Road/Blain Drive/Herbertson Road intersection operates with unacceptable service parameters for a number of "with development" scenarios. The critical operating scenarios were selected and remedial solution presented for these. The future year intersection form and corresponding SIDRA results are presented in *Figure 5.14.18*.

Inspection of SIDRA results for the existing layout indicates that the critical movement occurs in the afternoon peak and is the right turn from Blain Drive under all assessable scenarios.

Analysis results suggest that all scenarios operate with acceptable service conditions under the revised layout, with the exception of Scenario 7d in the afternoon peak. The SIDRA results for this condition indicated that the critical movement is the right turn from the northern approach at the Dawson Highway. Taking into consideration anticipated through and left turn volumes at this approach, the only option for improving operations exist with the addition of a potential short left turn slip lane from the Dawson Highway (north) into Herbertson Road (east) (refer *Figure 5.14.19*). Aerial photography indicates that the slip lane cannot be constructed without creating moderate to significant impacts on the adjacent residential property. The SIDRA results for the alternative intersection form indicate that the DOS only decreases to 0.931 with the addition of the slip lane and it is not considered appropriate to undertake the work for such a minor improvement. This is also combined with the consideration that the intersection would only operate at that DOS for one afternoon peak each fortnight, for a total period of only 3 years.

The layout presented in *Figure 5.14.18* is therefore deemed appropriate for all construction camp options.

Figure 5.14.18 Dawson Highway/Blain Dr/Herbertson St– Upgrade Works (With Development)

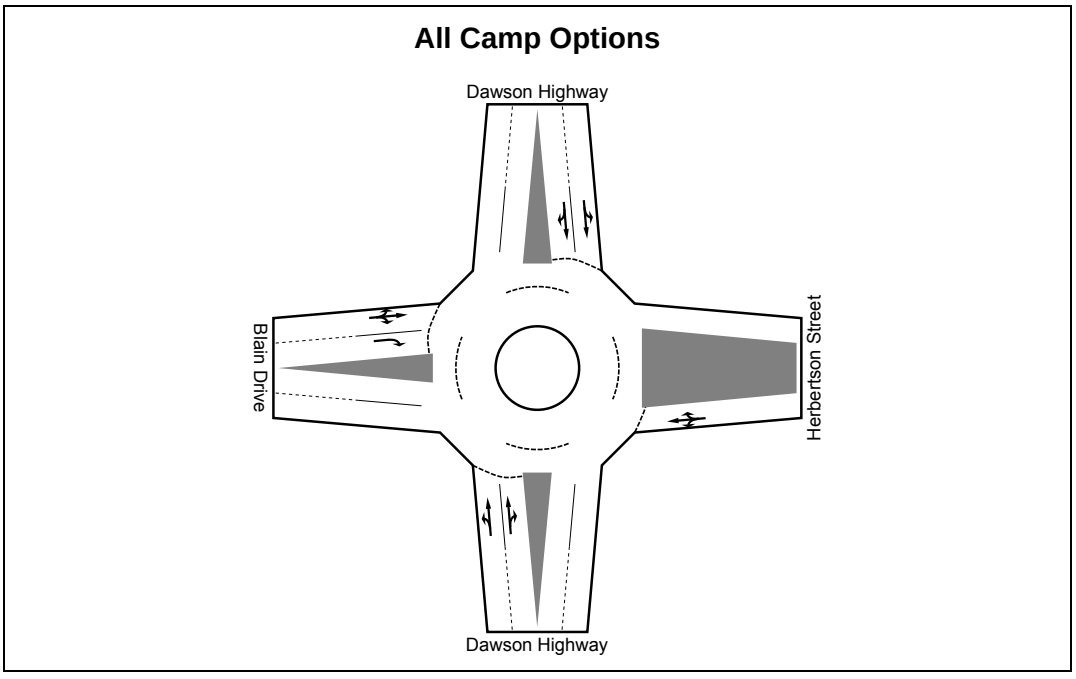
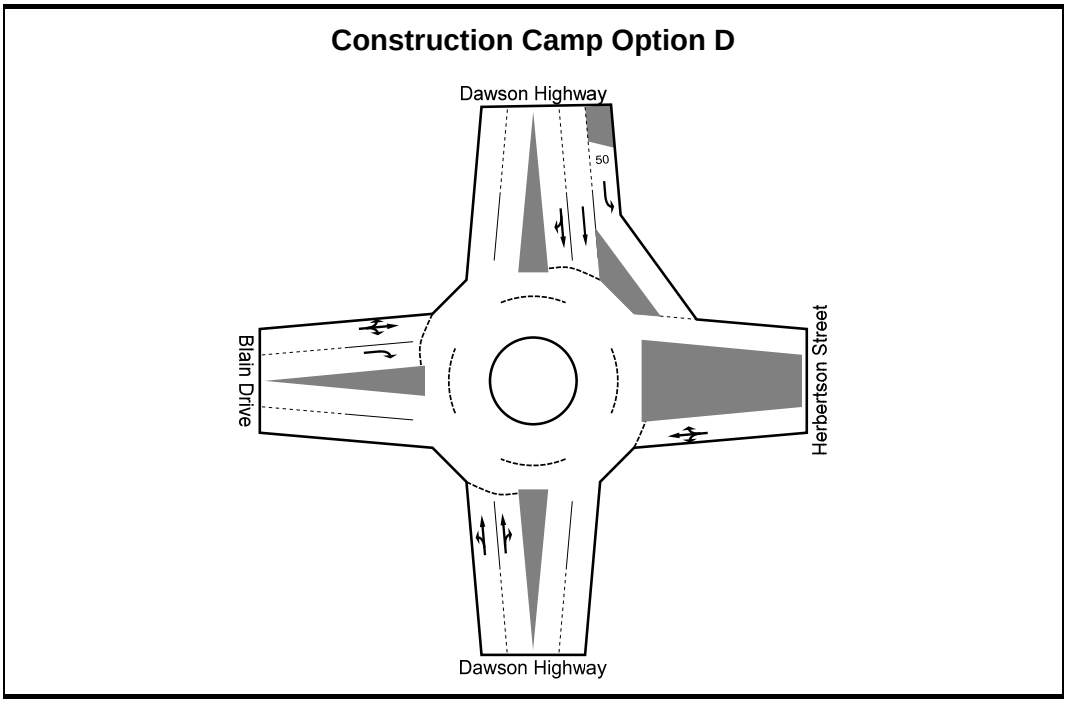


Figure 5.14.19 Dawson Highway/Blain Dr/Herbertson St– Alternative Layout



14.5.4.13 Intersection Form Summary

All the intersections and scenarios contained in *Table 5.14.20* were examined in detail. Intersections forms reflecting "with development" and "without development" and associated upgrade works were identified.

Under the original assumptions the reference case requires four intersection upgrades:

- Hanson/Blain/Alf O'Rourke Drive – Upgrade works (with development, no bridge)
- Hanson Rd/Port Access Rd/Railway St– Upgrade works (with velopment)
- Port Access Rd/Tug Berth Access Rd – Upgrade works (without development)
- Hanson Rd/Blain Dr/Herbertson St– Upgrade works (with development).

The upgrade works under the original assumptions for each of these intersections has been discussed in detail. Under the revised assumptions, some or all of these upgrade works may not be required.

14.5.5 Pavement Impact Assessment

14.5.5.1 Overview

The impact analysis presented in this section is based upon the principles defined within GARID and direct advice received from DMR.

The following reference, obtained from GARID, holds the general directive as to how impacts are assessed:

"Generally, pavement impacts need to be considered for any section of SCR where the construction or operational traffic generated by the development equals or exceeds 5 per cent of the existing Equivalent Standard Axles (ESA) on the road section."

The following sections express the increase in development ESAs as a proportion of existing ESAs to observe whether the triggers of GARID are met. DMR defines ESAs as:

"Equivalent Standard Axles is a measure defining the cumulative damaging effect to the pavement of the design traffic. It is expressed in terms of the equivalent number of 80 kN axles passing over the pavement up to the design horizon."

ESAs are generally expressed in annual terms. It is important to note that the pavement impact assessment is applicable to the heavy vehicle generation of the LNG Plant component only. Pavement impacts resulting from the transport of pipeline has been undertaken in *Volume 4, Chapter 13*.

Pavement impact analysis has been conducted for the following links and sections:

- Bruce Highway – from Gladstone-Mt Larcom Road to the Dawson Highway
- Gladstone-Mt Larcom Road – from Bruce Highway to Dawson Highway
- Dawson Highway – from Bruce Highway to Glenlyon Road (Glenlyon Gladstone-Mt Larcom Road).

14.5.5.2 Pavement Impact Assessment

The Background and Development Traffic ESA, and Heavy Vehicle Haul Routes are contained in *Appendix 5.15*. These were based on the original assumptions summarised in *Table 5.14.9*.

In summary, and based on the original assumptions, links where the increase in development-generated ESAs exceeds 5 per cent are shown in *Table 5.14.21.*

Table 5.14.21 Increase in Development Generated ESA's exceeds 5 per cent by Link

Camp	Link
Camp A	• Gladstone-Mt Larcom Road between Landing Road and Calliope River-Targinie Road; • Gladstone-Mt Larcom Road between Calliope River-Targinie Road and Quarry Road; and • Port Access Road.

Camp	Link
Camp B	• Dawson Highway between Gladstone-Mt Larcom Road to Breslin Street; • Dawson Highway between Breslin Street and Blain Drive; • Dawson Highway between Chapman Road and Harvey Road; • Dawson Highway between Harvey Road and the Bruce Highway; and • Port Access Road.
Camp C	• No Impact
Camp D	• No Impact

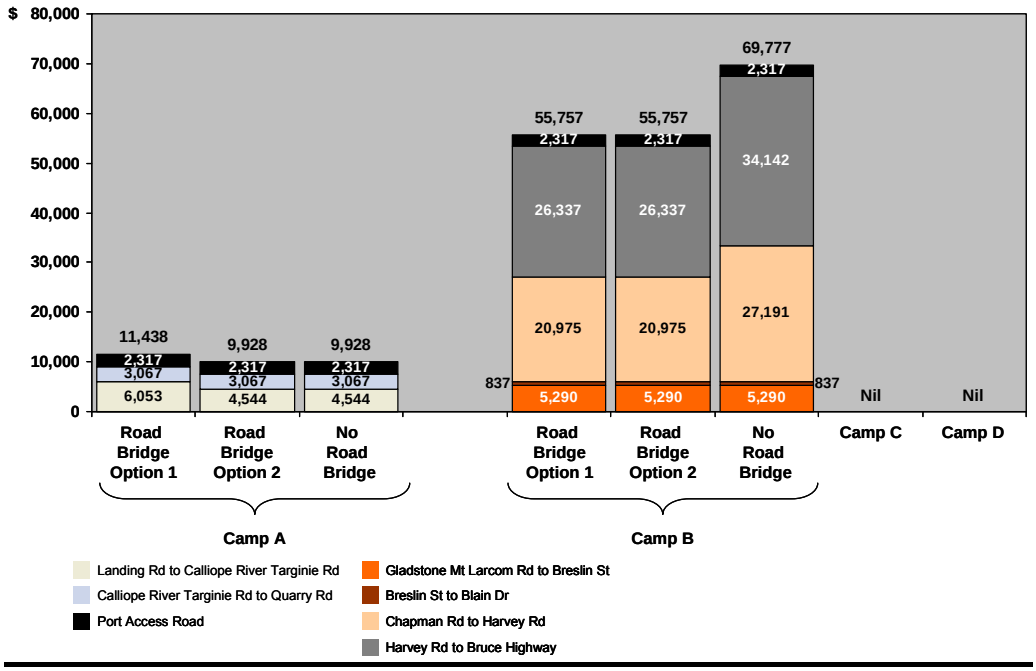
It should be noted that the refined assumptions summarised in *Table 5.14.9* will result in a further reduction in pavement impact for all camp options, including the reference case Construction Camp Option D.

14.5.5.3 *Developer Contribution for Pavements*

The methodology to calculate and input costs used within the contribution calculations, and detailed calculations are provided in *Appendix 5.15*.

Figure 5.14.20 provides a summary of maintenance contributions. These costs are the single upfront payment that is required under each impacted scenario. They are based on the present value of costs which should be paid by the proponent at the starting year of construction.

Figure 5.14.20 Summary of Developer Contribution for Pavements - Construction Camp Options A-D



Maintenance contributions are not required for either Construction Camp Options C & D.

The development proposal does not bring forward the required date for rehabilitation more than one year. Therefore, rehabilitation contributions are not required.

14.5.6 *Rail Network*

It is not intended to move any appreciable volume of freight or personnel via the QR rail network. There will be negligible use of and impact on the QR rail network or existing and proposed coal, freight or passenger services.

The grade separated Port Access Road and Tug Berth Access Road will generally be used to access Areas 1 to 4 at Auckland Point, and therefore rail safety will not be impacted or compromised by the Project.

The movement of Project personnel and materials from Areas 1 to 3 will not impact on the existing and continued use of at grade rail infrastructure, operations and maintenance, or safety in the Auckland Point locality. Access for Area 4 internal of the Auckland Point rail balloon loop will be via existing sealed roads and level crossings. The transport of pipe to and from Area 4 via existing level crossings is not anticipated to impact on rail safety.

Volume 2 Chapter 14 provides a preliminary conceptual layout for the Access Roads and Areas 1 to 4. The proposed roadworks and site preparation will be designed to ensure overland flow and road drainage do not adversely affect the continuing operation and maintenance of the Auckland Point rail balloon loop in accordance with the Queensland Urban Drainage Manual.

Areas 1 to 4 will be fenced with a 2 m-high chain wire fence to prevent access from Auckland Point rail balloon loop/corridor to the Project mainland areas.

Access to public rail reserves to allow rail maintenance activities will remain unchanged.

14.5.7 *Public Transport*

With proposed bus shuttle services from Auckland Point direct to Gladstone and Rockhampton Airports for construction personnel at the start and end of each fortnightly shift, demand on the existing Gladstone taxi fleet and other public transport such as pedestrian and cycle networks is expected to be negligible.

14.5.8 *Airport Passenger Movements*

The Site Logistics Study for the LNG Plant incorporated a time and motion study. This study identified indicative preliminary estimates of personnel

movements, and subject to where the ultimate labour force is derived from. The underlying assumptions are based on experience with large construction projects in the Gladstone region.

The study examined people movements within Gladstone under the following three scenarios:

- daily transportation during the week when 100 per cent of the Curtis Island construction personnel population return home
- daily transportation during the week when there is a construction camp on Curtis Island, with the local Gladstone population returning home
- at the end of the week (Thursday/Friday depending on the work week cycle) when people are potentially travelling out of the Gladstone area.

The numbers for the anticipated total personnel on Curtis Island, the breakdown between craft and field non-manual (which also includes EPC management, visitors and QGC personnel) and the numbers of expatriate staff to national staff are reasonably firm. The demographics split at a regional and national level between the craft and field non-manuals has been derived from the labour availability data included within the Craft Labour Availability Report.

Based on the time and motion study using Rio Tinto Yarwun 2 expansion data to guide assumptions, it is predicted that at peak construction in month 37, approximately Q1 2013, every fortnight (i.e. every 90 hours of shift work), approximately 35 of the 1,500 construction personnel will fly in/fly out of Gladstone airport and approximately 10 personnel will fly in/fly out of Rockhampton airport. Total construction numbers will vary across a 49-month period with 1,500 personnel for approximately two months, and over 1,000 personnel for a period of approximately 20 months. Numbers of personnel passing through Gladstone and Rockhampton airports would be assumed to vary approximately in proportion to the total number of construction personnel (refer *Volume 2 Chapter 14*).

This is expected to have a minor-to-moderate impact and equate to an equivalent of an additional 50-seat Dash 8-300 service every fortnight during the peak of the construction phase (i.e. two to three months).

There will be negligible impact on the movement of freight by air.

14.5.9 Other Potential Traffic Environmental Impacts

14.5.9.1 Stormwater Drainage

Appendix 5.17[49] provides concept design layouts for the upgrade of several key intersections and associated concept stormwater upgrades to pits and

49 GHD, 2009. *Curtis Island LNG Project – Gladstone Intersection Upgrades-Concept Design Report* (unpublished report, June 2009)

pipe sizes in accordance with the Queensland Urban Drainage Manual.

Final design will include pipe and pit network calculations to demonstrate that the proposed works will not degrade road drainage as a result of the intersection upgrades or adverse effects on other properties, particularly (but not only) property downstream of the intersections.

As no noise barriers or mounds are proposed, the effect with respect to overland flow paths on to or from the road reserve will remain the same.

14.5.9.2 Weed Management

The impact of transportation of weeds and weed management mitigation measures are discussed in *Volume 5, Chapter 7*.

14.5.9.3 Vegetation Clearing in Road and Rail Reserves

Negligible vegetation clearing is expected in road and rail reserves in the Gladstone area in response to LNG Plant traffic and transport activities.

14.5.9.4 Seasonality

Private vehicle, shuttle buses and truck movements are expected to use existing sealed roads in the Gladstone area to access the sealed carpark and personnel assembly at Auckland Point. Dedicated drive-on and drive-off vehicular ferry facilities will facilitate the efficient movement of construction materials and personnel at Auckland Point and at the secure site on Curtis Island. Negligible impact is expected to road-based traffic and transport in the form of delays and disruptions associated with extreme weather events (e.g. monsoonal low), localised flooding or king tides.

14.5.9.5 Safety

All construction sites will be fenced and controlled by the EPC contractor. Access to these sites will be by authorised personnel only, and general public access and transition across construction sites will not be possible.

14.5.9.6 Dust Control

Private vehicles, shuttle buses and trucks are expected to use existing sealed roads in the Gladstone area and therefore traffic and transport is not expected to create a dust nuisance. Dust control measures specifically relating to transport are not required.

14.5.9.7 Noise

The impact of increased traffic noise is discussed in *Volume 5, Chapter 13*.

14.5.9.8 Air Quality

The main emissions of interest in terms of air pollutants from motor vehicle activity are considered to be particulate matter (fine and ultra-fine), oxides of nitrogen (NOx), carbon monoxide (CO), carbon dioxide (CO_2) and volatile organic compounds (VOCs) such as benzene, formaldehyde, and dioxins. Since the introduction of unleaded petrol in 1986 atmospheric levels of lead have decreased significantly and are no longer considered a concern.

Additionally, based on the volume and type of proposed land-based transport related activities associated with the construction and operation of the LNG Plant, potential regional and local air quality issues are not considered significant.

14.6 CUMULATIVE IMPACT

The RIA did not explicitly consider the additional volumes generated by the Gladstone Pacific Nickel project, as recently approved subject to conditions by the Coordinator-General.

However, the future year background volumes adopted within the RIA have been derived through a methodology which is consistent with the procedures discussed within GARID. This document states that the prediction of traffic flow at the future years without the development, would normally be based on a trend analysis of traffic volumes, and in some cases, future traffic growth already has some allowance for development traffic within the specified growth. This would be the case when the operational phase of the Gladstone Pacific Nickel project is considered. Therefore, the QCLNG RIA considers the cumulative impact resulting from the Gladstone Pacific Nickel project, in addition to any other potential projects which are currently known/unknown.

However, it should also be noted that the Gladstone Pacific Nickel project would generate considerable traffic volumes during the two-staged construction phase. Stage 1 of the Gladstone Pacific Nickel project is anticipated to commence in 2007 and end by mid-2010. These construction dates do not coincide with the peak construction phase for the QCLNG Project, and although construction of Trains 1 and 2 is anticipated to begin in 2010, there would be a ramp-up of construction activities which may not take place before mid-2010. Therefore, the peak construction volumes included within the QCLNG RIA for Trains 1 and 2 should not, and have not, been applied on top of the construction volumes for Stage 1 of the Gladstone Pacific Nickel project.

In terms of Stage 2 construction for the Gladstone Pacific Nickel project, peak

construction is anticipated to occur in 2014. This year coincides with the operation of Trains 1 and 2 of the QCLNG Project, which is not expected to generate significant traffic volumes. For 2014, the QCLNG Project-generated daily traffic volumes are anticipated to be in the order of 140 vehicles per day, over the entire Gladstone network.

It is concluded that although other individual project proposals have not been explicitly included, the cumulative impacts have been reasonably considered within the QCLNG Project RIA.

14.7 MANAGEMENT AND MITIGATION MEASURES

This section identifies activities that will require management to mitigate potential environmental effects as a result of the LNG Plant construction and operation.

14.7.1 Objectives

The objective of the mitigation measures is to reduce the risk of the following impacts:

- minimise traffic generation and potential traffic and transport impacts on the existing land-based state- and local-controlled transport networks in the Gladstone/Curtis Island region during both construction and operation phases
- minimise impacts on native flora and fauna in road and rail reserves and corridors
- minimise impacts on surface and ground water and soils
- minimise noise and air quality impacts associated with traffic and transport during both construction and operation phases
- minimise potential environmental harm from the transport of dangerous goods (i.e. flammable and combustible)
- minimise the number of transport access tracks and new roads
- minimise disruption and potential health and safety impacts on existing landholders, third-party infrastructure and providers.

14.7.2 Indicators and Mitigation Measures

The following mitigation measures are proposed in relation to the Transport aspects of the Project:

14.7.2.1 *Traffic and Road-Based Transport*

- Based on worst case scenario traffic volumes, concept design layouts for several key intersections have been prepared and are contained in

Appendix 5.17

- the feasibility of additional shuttle buses with supporting pick-up and set-down areas for the start and end of shift and car pooling will be considered further for the transport of construction personnel to ameliorate the need for intersection upgrades and reduce car parking demand at Auckland Point
- an additional alternative to intersection upgrades that will be considered further will be the feasibility of peak-hour local traffic management around Auckland Point for the start and end of shift to ameliorate the need for intersection upgrades
- heavy vehicles and vehicles carrying large indivisible articles designated to specified haul routes to avoid built-up and residential areas where possible (eg: Port Access Road)
- movement of large vehicles, vehicles carrying large indivisible articles, vehicle carrying Dangerous Goods (eg. 20-tonne flammable and combustible liquids) to be managed in accordance with guidelines, regulations and permits
- undertake upgrades of impacted intersections as presented in *Appendix 5.17*. Concept design layouts for intersections and associated concept stormwater upgrades to pits and pipe sizes in accordance with the Queensland Urban Drainage Manual. Final design will include pipe and pit network calculations to demonstrate that the proposed works will have a no worsening of road drainage as a result of the intersection upgrades or adverse effects on other properties, particularly (but not only) property downstream of the intersections; and

14.7.2.2 Rail

- preliminary conceptual layout for the Access Roads 1 and 2 at Auckland Point and site preparation of Areas 1 to 4 designed in accordance with the Queensland Urban Drainage Manual, to ensure overland flow and road drainage do not adversely affect the continuing operation and maintenance of the Auckland Point rail balloon loop Air Services.

14.7.2.3 Airport

- discussion with carriers to provide additional capacity services, especially for peak of construction phase.

14.8 CONCLUSIONS

14.8.1 Road Impact Assessment

The RIA for the proposed Queensland Curtis LNG Project modelled 44 potential scenarios. These scenarios comprise a reference case with assumptions of workforce size and transport demand, a number of

construction camp options, and various transport logistics scenarios incorporating a number of bridge/road options connecting Curtis Island with Gladstone City.

Following the completion of the RIA, a number of the key assumptions were refined and these are summarised in *Table 5.14.22*.

Table 5.14.22 RIA Original and Refined Assumptions

Original Assumptions[50]	Refined Assumptions[51]
1. 2,000 personnel for the Train 1 and 2 construction phase;	1. 1,500 personnel for the Train 1 and 2 construction phase;
2. Fortnightly rotation assumption of 10 days on/four days off;	2. Nine days on a fortnight (i.e. five days on/two days off, then four days on/three days off, being 90 hours per fortnight). Some night shift and weekend work as schedule requires;
3. Hybrid Construction Camp Option D all non local personnel residing in the camp;	3. Hybrid Construction Camp Option D all non-local personnel residing in the camp (i.e. 30 per cent of total workforce);
4. Anticipated pipeline movements are: • Dawson Highway – 168 trucks/day[52] for 167 days; and • Gladstone Mt Larcom Road – 54 trucks/day[53] for 21 days;	4. Gladstone Port for the receipt of 260 km of 42" pipe in 18 m lengths, three lengths/truck – equates to on average 20 trucks/day[54,55]. On average 1.08 km/day of pipe moved over 25-day duration, equating to 10-11 month pipe transportation. Transport of 25 km of pipe/ship/month, total 11 ships on average by end 2011; and
5. Operations Phase Train 1 and 2 – 104 personnel, and Train 3 130 personnel; and	5. Operations Phase Train 1 and 2 – 76 personnel, and Train 3 – 100 personnel.
6. Trains 1 and 2 construction arrive/depart from Auckland Point; with alternatives modelled including scenarios for Train 2 and 3 construction arrive/depart from Alf O'Rourke Drive.	6. Trains 1, 2 and 3 - all construction personnel arrive/depart from Auckland Point Construction Terminal, and operations personnel arrive/depart from the Operations Terminal to be located at the end of Alf O'Rourke Drive, behind RG Tanna Coal Terminal.

For the purposes of SIDRA modelling and to model a "worst case" scenario, the model assumed a design peak construction workforce of 2,000 personnel from Day 1 of construction commencing in 2010.

These refined assumptions are important considerations when reviewing the RIA. The RIA as modelled reflects a "worst case" scenario and demonstrates

50 Used in RIA model.

51 Not used in RIA model but covered by original assumptions.

52 Trucks/day does not equate to truck movements.

53 Trucks/day does not equate to truck movements.

54 Trucks/day does not equate to truck movements.

55 Original assumption for pipe transport of a total equivalent of 175 heavy vehicles/day for 167 days. A reduction in calculated pipe volume and number of trucks required under refined assumption equates to on average 20 trucks/day over 25 day duration, over 10-11 month period for pipe transportation up to 2011. This equates to significantly less heavy vehicle movements over a longer duration (i.e. equivalent to a 77 per cent reduction in heavy vehicles between the original and refined assumption).

there is significant "headroom" factored into the RIA with a consequential reduction of 195 light vehicles/day and an equivalent of 135 heavy vehicles/ day for 167 days associated with pipe transport on the Gladstone state- and council-controlled road networks.

The proposed mitigation measures (eg. intersection upgrades and pavement monetary contributions) are also based on the "worst case scenario" and are not reflective of the refined assumptions mentioned above.

The assessment was undertaken with due consideration of the procedures stipulated within the *Guidelines for Assessment of Road Impacts of Development* (DMR, 2006). Consultation with appropriate government authorities was also undertaken.

14.8.1.1 Traffic Generation

Anticipated daily trip generation for the peak fortnightly period under each of these stages under the original assumptions are as follows:

LNG Trains 1 & 2 Construction (2010 & 2013) – With Airport Shuttle

- Construction Camp D: 1,857 vehicles/day and nine bus/day

LNG Train 3 Construction (2018) – With Airport Shuttle

- Construction Camp D: 929 vehicles/day and five bus/day

Operations

- Trains 1 and 2 combined (2014):140 vehicles/day
- All three Trains (2021):176 vehicles/day

Under the revised assumptions, traffic generation is expected to be significantly less.

14.8.1.2 Road Network Improvements

The assessment of potential road network impacts based on the original assumptions indicated that a number of road network improvements may be required as a result of the proposed development.

Under the original assumptions the reference case requires the following works:

- Possible partial contribution may be required for the upgrading of the Hanson Road/Blain Drive/Alf O'Rourke Drive intersection to match the mid-block link requirement;
- An additional left turn continuous lane from Gladstone-Mt Larcom Road (west) into Alf O'Rourke Drive. A corresponding short downstream exit lane is also required on Alf O'Rourke Drive;

- An additional short turn lane is required on the northern Alf O'Rourke Drive approach. A complementing downstream short lane is required on the Blain Drive exit;
- Upgrade of the Hanson Road/Port Access Road/Railway Street intersection to include a short left turn slip lane on the eastern Port Access Road approach. Works are required for the commencement of Train 1 and 2 construction;
- Upgrade of the Port Access/Mark Fenton Drive/Hopper Road/Tug Berth Access Road intersection to incorporate additional short turning lanes on Port Access and Tug Berth Access roads. Provision of complementary short downstream lanes on these legs are also required; and
- Reconfiguration of existing lane designation on the Blain Drive approach.

Under the revised assumptions, some or all of these upgrade works may not be required. Alternatives under further consideration include:

1. the feasibility of additional shuttle buses with supporting pick-up and set-down areas for the start and end of shift and car pooling for the transport of construction personnel to ameliorate the need for intersection upgrades and reduce car parking demand at Auckland Point;
2. the feasibility of peak-hour local traffic management around Auckland Point for the start and end of shift to ameliorate the need for intersection upgrades; and
3. local routing of construction workforce private vehicles to and from Auckland Point to better distribute construction workforce private vehicles across the local network.

14.8.1.3 Contribution for Pavements

Figure 5.14.21 provides a summary of maintenance contributions. These costs are the single upfront payment that is required under each impacted scenario. They are based on the present value of costs which should be paid by the proponent at the starting year of construction.

Maintenance contributions are not required for the Project reference case with Construction Camp Option D due to the negligible pavement impact on state-controlled roads.

The Project does not bring forward the required date for rehabilitation more than one year. Therefore, rehabilitation contributions are also not required.

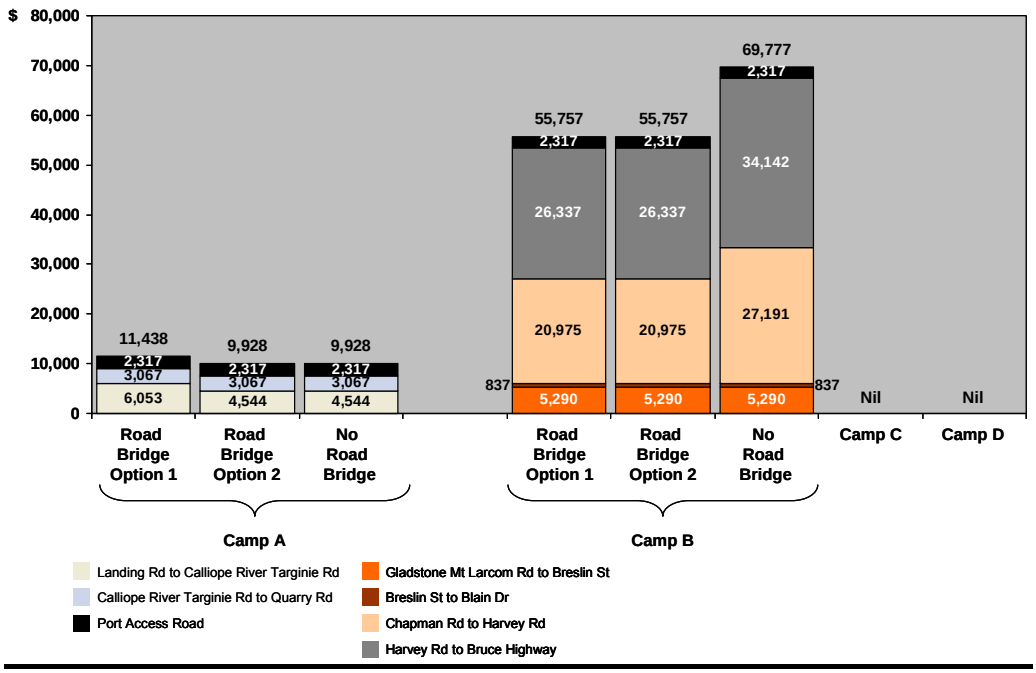
14.8.2 Rail Network

It is not intended to move any appreciable volume of freight or personnel via the QR rail network. There will be negligible use of and impact on the QR rail network or existing and proposed coal, freight or passenger services.

14.8.3 Public Transport

With proposed bus shuttle services from Auckland Point direct to Gladstone and Rockhampton airports for construction personnel at the start and end of each fortnightly shift, demand on the existing Gladstone taxi fleet and other public transport such as pedestrian and cycle networks is expected to be negligible.

Figure 5.14.21 Summary of Developer Contribution for Pavements – Construction Camp Options A-D



14.8.4 Airport Passenger Movements

Based on the time and motion study using Rio Tinto Yarwun 2 expansion data to guide assumptions, it is predicted that at peak construction in month 37, approximately Q1 2013, every fortnight (i.e. every 90 hours of shift work), approximately 35 of the 1,500 construction personnel will fly in/fly out of Gladstone airport and approximately 10 personnel will fly in/fly out of Rockhampton airport. Total construction numbers will vary across a 49 month period with 1,500 personnel for approximately two months, and over 1,000 personnel for a period of approximately 20 months. Numbers of personnel passing through Gladstone and Rockhampton airports would be assumed to vary approximately in proportion to the total number of construction personnel.

This is expected to have a minor-to-moderate impact and equate to an equivalent of an additional 50-seat Dash 8-300 service every fortnight during the peak of the construction phase (i.e. two to three months).

There will be negligible impact on the movement of freight by air.

14.8.5 Other Potential Traffic Environmental Impacts

14.8.5.1 Stormwater Drainage

Concept design layouts for intersections have been prepared (refer *Appendix 5.17*) and associated concept stormwater upgrades to pits and pipe sizes in accordance with the Queensland Urban Drainage Manual.

Final design will include pipe and pit network calculations to demonstrate that the proposed works will have a no worsening of road drainage as a result of the intersection upgrades or adverse effects on other properties, particularly (but not only) property downstream of the intersections.

As no noise barriers or mounds are proposed, the effect with respect to overland flows paths onto or from the road reserve will remain the same.

14.8.5.2 Weed Management

The impact of transportation of weeds and weed management mitigation measures are discussed in *Volume 5, Chapter 7* and *Volume 11*.

14.8.5.3 Vegetation Clearing in Road and Rail Reserves

Negligible vegetation clearing is expected in road and rail reserves in the Gladstone area in response to LNG Plant traffic and transport activities.

14.8.5.4 Seasonality

Private vehicles, shuttle buses and trucks are expected to use existing sealed roads in the Gladstone area to access the sealed carpark and personnel assembly at Auckland Point. Dedicated drive-on and drive-off vehicular ferry facilities will facilitate the efficient movement of construction materials and personnel at Auckland Point and at the secure construction site on Curtis Island. Negligible impact is expected to road-based traffic and transport in the form of delays and disruptions associated with extreme weather events (eg: monsoonal low), localised flooding or king tides.

14.8.5.5 Safety

All construction sites will be fenced and controlled by the EPC contractor. Access to these sites will be by authorised personnel only, and general public access and transition across construction sites will not be possible.

14.8.5.6 Dust Control

Private vehicle, shuttle bus and truck movements are expected to use existing

sealed roads in the Gladstone area and therefore traffic and transport is not expected to create a dust nuisance. Dust control measures specifically relating to transport are not required.

14.8.5.7 Noise

The impact of increased traffic noise is discussed in *Volume 5, Chapter 13.*

14.8.5.8 Air Quality

Based on the volume and type of proposed land-based transport related activities associated with the construction and operation of the LNG Plant, potential regional and local air quality issues are not considered significant.

14.9 CONCLUSION

A traffic and transport impact assessment indicates the proposed Queensland Curtis LNG (QCLNG) Project LNG Facility will not impact significantly on state- or local-controlled road or rail networks, or on transport infrastructure, facilities or services. All transport-related impacts associated with the LNG Facility are considered manageable, subject to outlined mitigation measures. A summary of the impacts outlined in this chapter is provided in *Table 5.14.23.*

Table 5.14.23 Summary of Impacts for Road, Rail, Air and Public Transport

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Short-term for construction phase traffic impacts. Long-term for operations phase traffic impacts
Impact extent	Local
Impact likelihood	High

Overall assessment of impact significance: minor. The proposed LNG Facility will not have a significant impact on state or local-controlled road or rail networks, or on transport infrastructure, facilities or services provided that recommended mitigation measures are implemented.