Broome Traffic Study

Shire of Broome

001 | 2

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Contents

1. Introduction

1.1 Purpose of the Study

Jacobs has been commissioned by the Shire of Broome (the Shire) to undertake a district level traffic study to identify the network improvements required up until the years 2031 and 2051. This information will then be used to make a recommendation with respect to rates for a Development Contribution Plan (DCP).

1.2 Scope of Work

The Shire of Broome (the Shire) is located in the north-west Kimberley Region of Western Australia, 2,200 kilometres north of Perth. The study area is the Broome townsite, which has a population of approximately 14,000 persons and covers a land area of approximately 5,300 hectares (refer to **Figure 1.1**). A traffic model will be developed for the study area. It will consider future traffic demand associated with the planned new development (particularly in the northern part of Broome), the corresponding predicted population growth and the infrastructure required for facilitating this growth. The model will be used to recommend infrastructure improvements to accommodate the expected growth for two design year horizons i.e. 2031 and 2051.

To assist in the fair and equitable distribution of the costs associated with the burden of providing this additional infrastructure, a developer contribution scheme will be provided. Jacobs understands that ultimately the study is required to generate a rate to be applied per expected traffic unit generated.

This traffic study is structured as follows:

- Chapter 1 - Introduction;
- Chapter 2 – Background;
- Chapter 3 - Model development;
- Chapter 4 - Future year analysis (for 2031);
- Chapter 5 - Future year analysis (for 2051);
- Chapter 6 – Recommended Pedestrian Facilities;
- Chapter 7 – Formulating the contribution methodology;
- Chapter 8 - Conclusion and provision of recommendations;

Figure 1.1: Study area (image sourced from Google Maps16/03/2016).

Source: Google Maps, February 2016

2. Background

2.1 Traffic Data

The Shire nominated the roads it particularly wished to have included in the traffic study and the model. Therefore, the peak hour figures for the purpose of this report were determined from traffic count surveys undertaken within the study area by the Shire and Main Roads WA (MRWA) provided to us by the Shire. (Refer to **Table** 2.1). This dataset indicated that the dominant peak hour for within the study area is 4.00pm to 5.00pm

As shown in **Table** 2.1 below the average ratio of peak hour traffic volumes over daily traffic volumes is about **8%**.

Table 2.1: Traffic data for the study area

Road	Location	Direction	PM peak - vph (Average Mon-Fri)	Daily - vpd (Average Mon-Fri)	Peak over Daily ratio	Date of data	Source of data
Broome Road	North of Tanami Road	Both directions	225	2920	8%	March 2016	Tube Counts Data
Cable Beach Road East	Northwest of Reid Road	Both directions	890	9700	9%	May 2014	Tube Counts Data
	West of Port Drive	Both directions	930	9500	10%	May 2014	Tube Counts Data
Cable Beach Road West	West of Gubinge Road	Both directions	390	4100	10%	May 2014	Tube Counts Data
Frederick Street	West of Herbert Street	Both directions	1130	13900	8%	August 2015	Tube Counts Data
Gantheaume Point Road	South of Gubinge	Westbound	110	760	14%	June 2014	Tube Counts Data
Gubinge Road	South of Gantheaume Point Road	Both directions	320	3200	10%	July 2015	Tube Counts Data
Guy Street	East of Herbert Street	Eastbound	250	3100	8%	December 2014	Tube Counts Data
Hamersley Street	North of Napier Terrace	Northbound	440	4700	9%	July 2015	Tube Counts Data
	South of Barker Street	Both directions	510	6000	9%	September 2015	Tube Counts Data
Herbert Street	North of Guy Street	Northbound	60	740	8%	December 2014	Tube Counts Data
Jigal Drive	South of Gubinge Road	Southbound	230	2530	9%	August 2015	Tube Counts Data
Port Drive	North of Reid Road	Both directions	810	9350	9%	September 2015	Tube Counts Data
	South of Archer Street	Both directions	180	2140	8%	March 2016	Tube Counts Data
	South of DeCastile Street	Southbound	50	829	6%	March 2016	Tube Counts Data
	North of Archer Street	Southbound	345	4290	8%	March 2016	Tube Counts Data
Reid Road	West of Cable Beach Road East	Both directions	250	2600	10%	July 2015	Tube Counts Data
Sanctuary Road	East of Cable Beach Road West	Eastbound	120	3200	4%	August 2014	Tube Counts Data

Road	Location	Direction	PM peak - vph (Average Mon-Fri)	Daily - vpd (Average Mon-Fri)	Peak over Daily ratio	Date of data	Source of data
Old Broome Road	North of Sandpiper Avenue	Northbound	360	3740	9%	August 2016	Tube Counts Data
Banu Avenue	East of Gubinge Road	Both directions	100	1110	5%	March 2016	Tube Counts Data
Macpherson Street	At Entrance to the Airport	Eastbound	37	820	7%	March 2016	Tube Counts Data
Sandpiper Avenue	200m West of Old Broome Road	Eastbound	210	3180	9%	May 2015	Tube Counts Data
Hamersley Street	North of Napier Terrace	Northbound	440	4670	8%	July 2015	Tube Counts Data
Blackman Street Link	West of Blackman Street	Both directions	140	1750	5%	September 2015	Tube Counts Data
De Marchi	South of Gubinge	Both Directions	50	490	6%	June 2014	Tube Counts Data
DeCastilla	East of McDaniel Road	Both Directions	14	244	7%	April 2014	Tube Counts Data
Frangipani Drive	North of Millington Rd	Both Directions	16	145	12%	May 2014	Tube Counts Data
	West Lulfitz Drive	Both Directions	13	110	20%	May 2014	Tube Counts Data
Garnboorr Lane	West Bin Salik	Both Directions	30	150	9%	December 2014	Tube Counts Data
Haas Street	West of Hamersley Street	Eastbound	23	260	11%	January 2016	Tube Counts Data
Kavite Road	West of Port Drive	Both directions	8	70	7%	April 2014	Tube Counts Data
Kerr Street	East Tang Street	Eastbound	8	190	7%	February 2015	Tube Counts Data
Lorikeet Drive	East of Sanderling Drive	Westbound	90	645	10%	August 2015	Tube Counts Data
Magabala Road	North of Gubinge Road	Both directions	290	2910	10%	September 2015	Tube Counts Data
McDaniel Road	South of Archer Street	Southbound	30	580	3%	June 2015	Tube Counts Data
	North of Archer	Northbound	2	80	8%	May 2015	Tube Counts Data

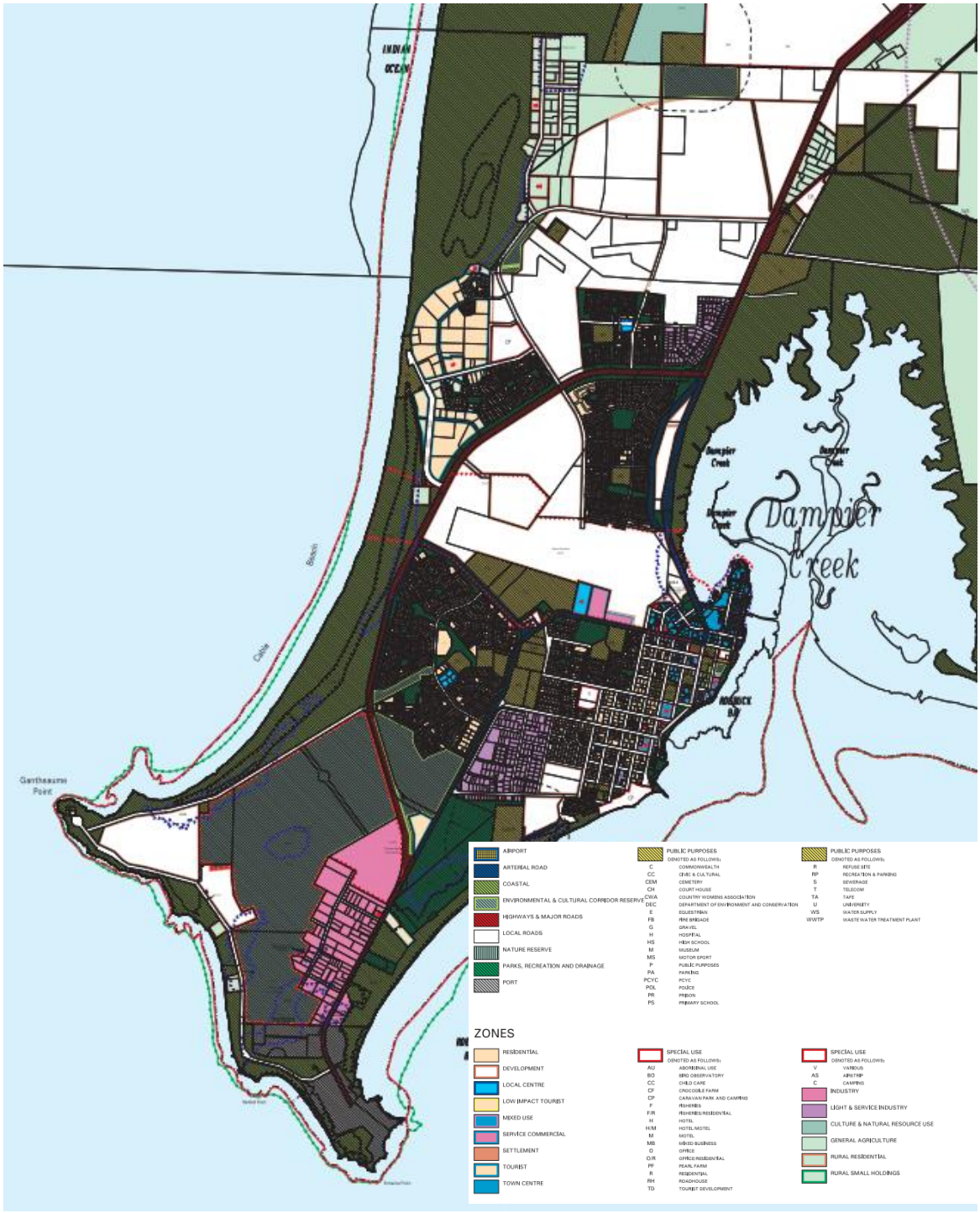
Road	Location	Direction	PM peak - vph (Average Mon-Fri)	Daily - vpd (Average Mon-Fri)	Peak over Daily ratio	Date of data	Source of data
Napier Terrace	East of Hamersley Street	Westbound	280	3310	7%	July 2015	Tube Counts Data
Robinson Street	North of Anne Street	Northbound	90	1230	5%	July 2015	Tube Counts Data
Povah Road	South Block	Northbound	3	65	3%	June 2014	Tube Counts Data
	North Block	Northbound	3	100	14%	June 2014	Tube Counts Data
Sanderling Drive	North Sandpiper Avenue	Northbound	230	1640	10%	May 2015	Tube Counts Data
Sayonara Road	North of Gubinge Road	Both directions	140	1390	8%	May 2014	Tube Counts Data
Weld Street	South of Frederick Street	Both directions	80	1050	9%	April 2014	Tube Counts Data
Woods Drive	-	Westbound	50	560	9%	October 2014	Tube Counts Data

2.2 Future Development Projects

The Shire of Broome Local Planning Scheme No. 6 map depicts some areas zoned for development within the study area.

The existing and proposed land uses within the study area are shown in **Figure** 2.1 below.

Figure 2.1: Shire of Broome Local Planning Scheme Map



Source: Shire of Broome Local Planning Scheme No.6, November 2012

Jacobs has used public documents to identify the type of development proposed in each area and the Shire of Broome Officers have provided the likely timing for each development. This information is necessary to determine which developments need to be accounted for in the 2031 future year analysis and those which need to be accounted for 2051 future year analysis.

Developments that are likely to proceed within the study area by 2031 or 2051 are described below and mapped in **Figure** 2.2.

- **Western Triangle and the remainder of Roebuck Estate:** This is a residential development and is expected to be completed by 2031.

- **Airport Development Plan:** There is potential for the airport to be relocated and the area redeveloped for commercial and residential purposes. By 2031, the commercial part of this development is likely to be partially completed. If the airport relocation proceeds, then it is possible that the residential development may have occurred by 2051.

- **Broome North Blue Haze Industrial Area Extension:** Traffic modelling for the Blue Haze Industrial Area Extension was undertaken in 2010 by Uloth and Associates. The area is expected to expand by an additional 60,750 square metres of Gross Floor Area by 2031. The current light industrial area generates around 1,300 vehicle trips per day, and the extension is estimated to generate a further 3,950 vehicle trips per day.

- **Broome North, south of Fairway Drive:** This residential subdivision is expected to be completed by 2031. In 2014 Riley Consulting assessed the western portion of this area (known as LDP3) for potential traffic impacts. For a residential yield of 857 lots, it was estimated that 7,900 vehicle movements per day would be generated. It recommended that the intersection of Fairway Drive, Sanctuary Road and Tanami Drive should be controlled by a roundabout.

- **Broome North, north of Fairway Drive:** The further expansion of this residential subdivision is expected to be completed by 2051.

- **Yawuru Residential Subdivision:** This residential development is expected to be completed by 2031.

- **Yawuru Industrial Subdivision:** This development is expected to be completed by 2031. In 2014 Riley Consulting was commissioned to assess the traffic impact that this development could have on the existing road network. It was estimated that the development would generate an additional 2,400 vehicle movements per day, but it was found that the existing road network had sufficient capacity, and the level of service would be unlikely to be impacted. A condition of subdivision approval requires the developer to contribute to the upgrading of the intersection of McDaniel Road and Archer Street.

- **Wilderness Retreat:** This area at the southern end of Gantheaume Point Road is expected to be developed as an eco-tourism retreat by 2031. In 2013 Riley Consulting assessed the traffic impact this development could have on the existing road network. It was estimated that the development would generate up to 240 vehicle movements per day and that current levels of service are not likely to be affected.

Figure 2.2: Development in Broome until 2051 (image sourced from Google Maps 16/03/2016).

Source: Google Maps, February 2016

2.2.1 Existing Road Network within the Study Area

The following provides description of the road hierarchy as per Liveable Neighbourhood Guidelines (January 2009): -

Integrator arterials: have various functions which include: carrying traffic efficiently, facilitating pedestrian activity, permitting access to public transport routes and providing development frontage for adjacent properties. There are normally few trucks on this category of road. On-street bike lanes or separate dual-use paths are normally required. There are two classifications: -

- **Integrator Arterial A routes** are located outside of activity centres and do not provide direct access to adjacent developments. Access to the residential and home-based business uses are to be provided along service roads. In the activity centres, on-street parking should be provided, rather than service roads. Furthermore, the speed limit may be 60km/h and traffic volumes along these roads are expected to be between 10000-25000 vehicles per day (vpd). Outside of activity centres the speed limit would be approximately 70km/h and traffic volumes are expected to be between 15000-35000 vpd.

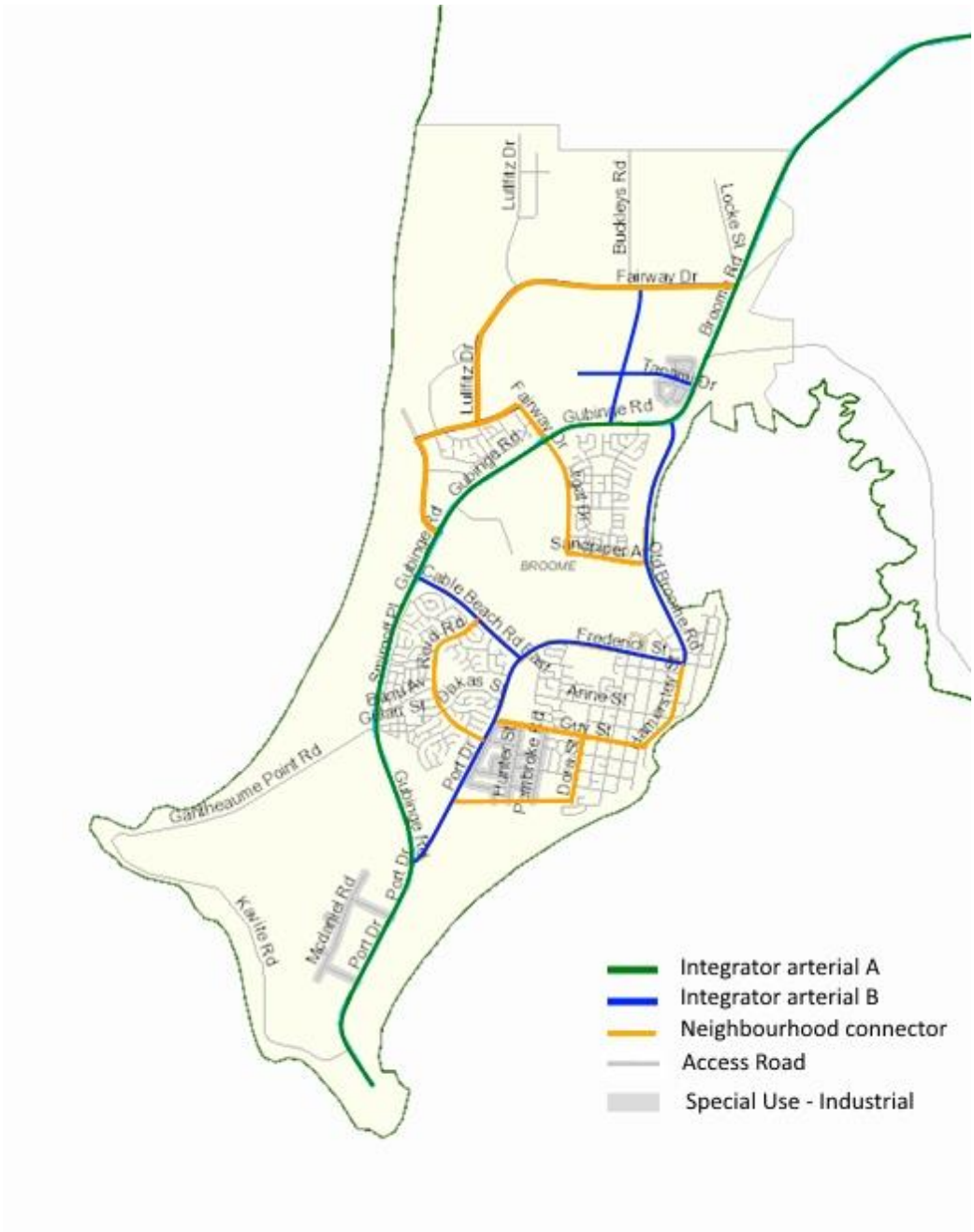
- **Integrator Arterial B routes** are suitable for pedestrian-based retail streets while still allowing for movement of vehicles. Access to residential frontage can be provided via service roads. Outside of activity centres a speed limit of 60km/h, and desirable maximum traffic volumes of 7000-15000vpd can be expected. Volumes up to 20000 vpd can be permitted if designed to manage traffic at intersections and facilitating buses and parking. Within activity centres, a speed limit of between 40-50km/h and a decrease in traffic volumes to 15000 vpd can be expected.

Neighbourhood Connector: These roads link neighbourhoods and are deliberately designed to calm traffic and discourage through traffic. They mainly have residential frontage and provide access to higher order arterial roads, sometimes at signal controlled intersections. Pedestrians are facilitated, and bus routes may pass along neighbourhood connectors. These streets spread the local traffic load and permit access to neighbourhood centres and local streets. A divided neighbourhood connector can carry 7000 vpd and may also have additional features such as stormwater infiltration swales. An undivided neighbourhood connector can carry only 3000 vpd. The speed limit for neighbourhood connectors is 50km/h.

Access Roads: These streets have low traffic volumes and speeds, as needed for the abutting land use and are the predominant street type used in residential areas. On-street parking is permitted, and pedestrian and bike movement is facilitated. Traffic behaviour can be constrained by the street length, by the road treatment and by the presence of street trees. A volume of up to 3000 vpd is expected, and the speed limit should be 50km/h or less.

Figure 2.3 shows the hierarchy of the roads within the study is based on the Liveable Neighbourhood Road Classification terminology.

Figure 2.3 : Classification of the Roads within the Study Area



Source: MRWA mapping information system as a base, April 2014, modified by Jacobs.

Descriptions of the key roads in the network are described below:

Broome Road consists of a two-lane two-way undivided carriageway approximately 7m wide kerb to kerb. The posted speed limit on Broome Road varies along a different section of the roads. Outside Broome Townsite the posted speed limit is 110km/h which reduces to 90 km/h and then 60 km/h close to Chinatown. Broome Road connects to the Great North Highway to the north-west of the Broome Townsite, which is outside the study area. Broome Road continues southwards to Chinatown. South of the Gubinge Road this road is known as Old Broome Road.

Sandpiper Avenue consists of a two-lane two-way undivided carriageway approximately 7.5m wide kerb to kerb. The posted speed limit on Sandpiper Avenue is currently 50km/h. Sandpiper Avenue provides a connection between Broome Road and Residential Areas to the west of Broome Road.

Magabala Road consists of a two-lane two-way divided carriageway approximately 14m wide kerb to kerb. The posted speed limit on Magabala Road is currently 50km/h.

Gubinge Road consists of a two-lane two-way partially divided carriageway approximately 10m wide kerb to kerb. The posted speed limit on Gubinge Road is currently 70km/h. Gubinge Road provides a connection between Broome Road and Port Drive.

Port Drive consists of a two-lane two-way partially divided carriageway, approximately 8m wide kerb to kerb. Port Drive connects to Gubinge Road and continues towards the south-east to the port. The posted speed limit on Port Drive is currently 70km/h which reduced to 60 km/h on the approach to the port.

Cable Beach Road East consists of a two-lane two-way undivided carriageway, with the width varied between approximately 10m to 16m from the edge of the seal. The posted speed limit on Cable Beach Road East is currently 60km/h.

Cable Beach Road West consists of a two-lane two-way undivided carriageway, with the width of approximately 10m from the edge of the seal. The posted speed limit on Cable Beach Road West is currently 70km/h and drops to 50km/h.

Frederick Street consists of a two-lane two-way undivided carriageway, approximately 8m wide kerb to kerb. The posted speed limit on Frederick Street is currently 50km/h.

Guy Street consists of a two-lane two-way undivided carriageway, approximately 9m wide kerb to kerb. The posted speed limit on Guy Street is currently 60km/h.

Hamersley Street consists of a two-lane two-way undivided carriageway, approximately 9m wide kerb to kerb. The posted speed limit on Hamersley Street is currently 50km/h.

Reid Road consists of a two-lane two-way partially divided carriageway, approximately 8m wide kerb to kerb. The posted speed limit on Reid Road is currently 50km/h.

Sanctuary Road consists of a two-lane two-way partially divided carriageway, approximately 6m wide kerb to kerb. The posted speed limit on Sanctuary Road is currently 50km/h.

Fairway Drive consists of a two-lane two-way carriageway, partially sealed and approximately 8m wide kerb to kerb. The posted speed limit on Fairway Drive is currently 80km/h which goes down to 60 km/h Fairway Drive is currently partially sealed.

Tanami Drive consists of a two-lane two-way partially divided carriageway, with the width varied between 10m to 32m wide kerb to kerb. The posted speed limit on Tanami Drive is currently 50km/h

Jigal Drive consists of a two-lane two-way partially divided carriageway, approximately 7m from the edge of the seal. The posted speed limit on Jigal Drive is currently 50km/h

2.2.2 Existing Pedestrian and Cyclist Facilities

There is no current bike plan for the Shire of Broome. Footpaths with the width of about 2m have been provided on at least one side of most sections of the roads within the study area.

2.2.3 Existing Intersections within the Study Area

Currently, all the intersections within the study area are either roundabout or priority controlled.

The intersection of Broome Road/ Gubinge Road (**Figure** 2.4) is a 3-way priority controlled intersection. At this intersection, Gubinge Road provides a 100m right turn pocket on the western approach and Broome Road provides an 110m left turn pocket on the eastern approach, and a 40m left turn slip lane on the southern approach. The intersection is controlled by MRWA.

Figure 2.4: Existing Intersection of Gubinge Road/ Broome Road

Source: Google Maps, April 2016

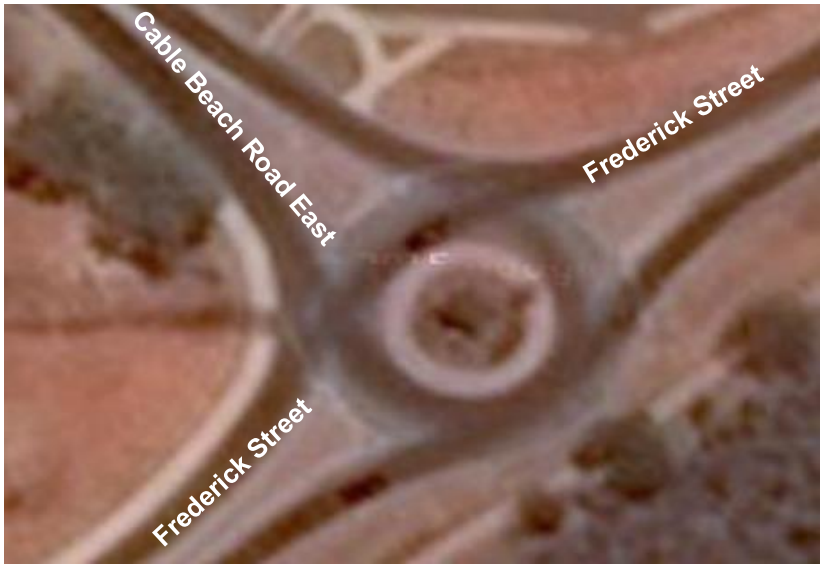
Intersection of Gubinge Road/Jigal Drive/ Fairway Drive (**Figure** 2.5) is roundabout controlled with one circulation lane. The central island is approximately 50m in diameter. The intersection is controlled by MRWA.

Figure 2.5 : Existing Intersection of Gubinge Road/Jigal Drive/Fairway Drive

Source: Google Maps, April 2016

Intersection of Cable Beach Road East/ Frederick Street (**Figure** 2.6) is roundabout controlled with one circulation lane and a central island of approximately 15m in diameter. At this intersection, all approaches provide a single entry and exit lane.

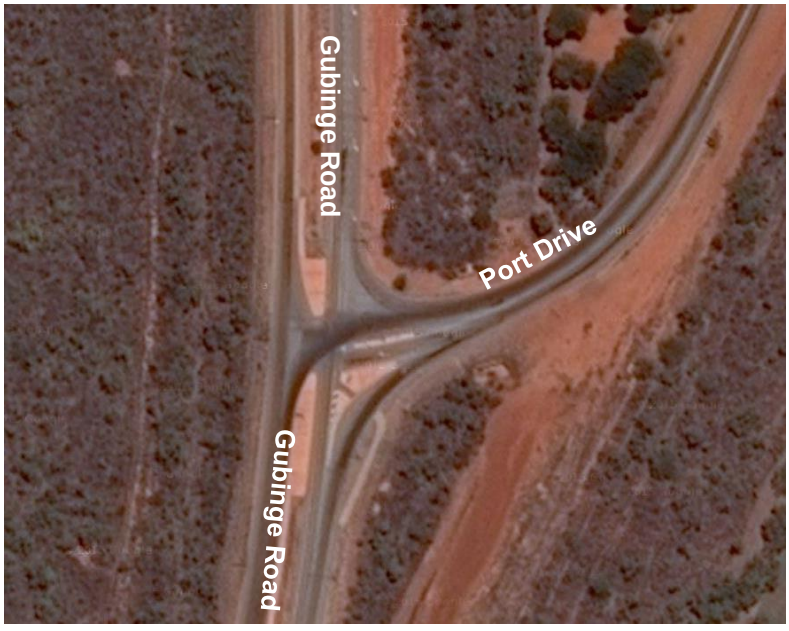
Figure 2.6 : Existing Intersection of Cable Beach Road East/Frederick Street



Source: Google Maps, April 2016

Intersection of Port Drive/ Gubinge Road (**Figure** 2.7) is a 3-way priority controlled intersection. At this intersection, Gubinge Road provides an approximately 130m left turn slip lane on the northern approach. Port Drive provides an approximately 115m right turn pocket on the southern approach, and an approximately 75m left turn slip lane on the eastern approach. The intersection is controlled by MRWA.

Figure 2.7 : Existing Intersection of Port Drive/Gubinge Road



Source: Google Maps, April 2016

Intersection of Port Drive/ Guy Street (**Figure** 2.8) is a 3-way priority controlled intersection. At this intersection, Guy Street provides an approximately 30m left turn slip lane on the eastern approach. Port Drive provides a 55m left turn slip lane on the northern approach and a 50m right turn pocket on the southern approach.

Figure 2.8 : Existing Intersection of Port Drive/Guy Street

Source: Google Maps, April 2016

Intersection of Broome Road / Sandpiper Avenue (**Figure** 2.9) is roundabout controlled with one circulation lane and a central island which is approximately 20m in diameter. At this intersection all the approaches provide one entry and one exit lane.

Figure 2.9 : Existing Intersection of Broome Road/Sandpiper Avenue

Source: Google Maps, April 2016

Intersection of Hamersley Street/ Frederick Street (**Figure** 2.10) is roundabout controlled with one circulation lane and a central island which is approximately 17m in diameter. At this intersection all the approaches provide one entry and one exit lane.

Figure 2.10 : Existing Intersection of Hamersley Street/Frederick Street

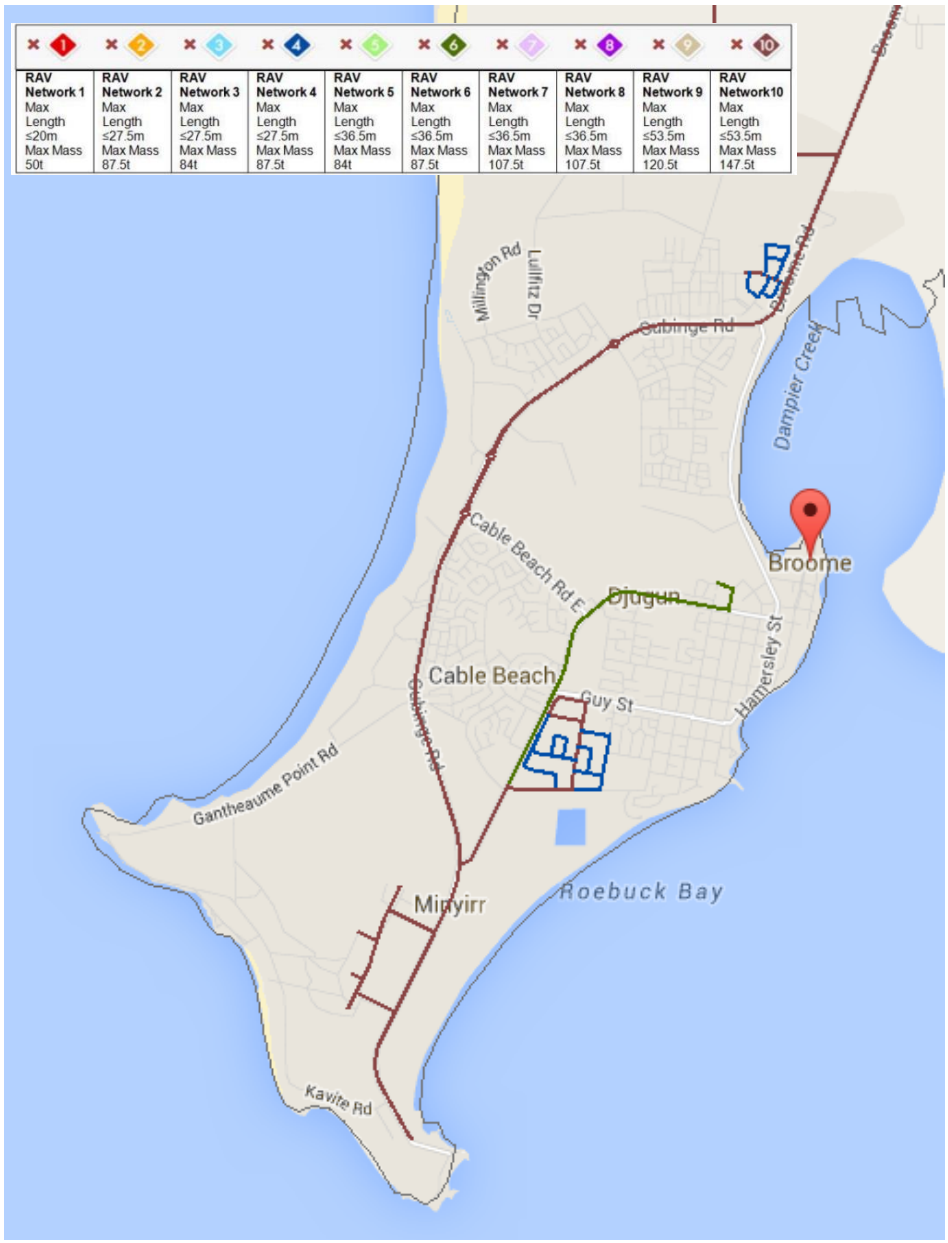
Source: Google Maps, April 2016

2.3 Access for Heavy Vehicles

Based on the MRWA Restricted Access Vehicles (RAV) maps and as shown in **Figure** 2.11, the following categories of vehicles are restricted to the following roads in the study area:

- Category 10 vehicles (RAV 10 - 53.5m long truck) and below are allowed to operate primarily on Broome Road, Gubinge Road and Port Drive as well as a few access roads;
- Category 6 vehicles (RAV 6 - 36.5m long truck) and below are allowed to operate on Port Drive and Frederick Street to the airport.; and
- Category 4 vehicles (RAV 4 - 27.5m long truck) and below are allowed to operate on the access roads within the industrial areas east of Port Drive and west of Broome Road.

Figure 2.11 : MRWA Restricted Access Vehicles Map of the Study Area



Source: MRWA Restricted Access Vehicles Map, April 2014

3. Base Model Development

3.1 Assessment Scenarios

The assessment scenarios that have been modelled are described as below:

- **2016 base scenario**:
  - Base 2016 scenario: Existing 2016 traffic demand on the existing layouts of the roads and intersection of the study area.
- **2031 (interim) scenario**:
  - 2031 do-minimum scenario: The 2031 do-minimum scenario model was based upon the 10 years Forward Capital Works Program (February 2016) as well as the local development plans for development planned to be developed by 2031, sourced from the Shire of Broome; and
  - 2031 do-something: The road layout in this scenario is similar to the road network developed for the 2031 do-minimum scenario with all other improvements identified and including the extension of Gray Street from Chinatown to Broome Road.
- **2051 (ultimate) scenario**:
  - 2051 do-minimum without airport relocation scenario: This includes all land uses excluding the airport redevelopment and all the network improvements up to and including those recommended by 2031 do-something scenario;
  - 2051 do-something without airport relocation scenario: The road layout in this scenario is similar to the road network developed for 2051 do-minimum without airport relocation scenario with all other improvements identified.
  - 2051 do-minimum with airport relocation scenario: This includes all land uses including the airport redevelopment and all the network improvements up to and including those recommended by 2031 Do-something scenario; and
  - 2051 do-something with airport relocation scenario: The road layout in this scenario is similar to the road network developed for the 2051 do-minimum with airport relocation scenario with all other improvements identified.

Details of full proposed improvements are provided in **Sections 4 and 5**.

3.2 Base Network

A mesoscopic traffic network model representing the existing land uses within the study area has been developed for Broome townsite using the PTV VISUM traffic modelling software package for the PM peak hour. The VISUM model developed is capable of assessing the operational performance of the existing and future road network and land use options within the study area.

Mesoscopic models cover broad areas and include details of some of the intersections within the network and accurately reflect expected intersection traffic operations. Mesoscopic models can use an equilibrium assignment but may also include the ability to dynamically model route choices. Mesoscopic modelling can be lane-based or link-based (depending on the level of detail required and software employed) and can use a dynamic (where paths change throughout the model period) or a fixed stochastic assignment technique (RMS Guidelines, February 2013).

The approach to the road network coding and model zones are described in the following sub-sections.

3.2.1 Road Network

The capacity of the roads within the study area has been defined based on the information provided in Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis (Austroads, 2013) and shown in Table 3.1. The capacity is defined as the maximum amount of traffic that the road can carry during a given period under the prevailing roadway, environmental, traffic and control conditions.

Table 3.1 : Road Capacity

Type	Capacity per lane
Uninterrupted flow	1800
Interrupted flow	900

Source: Austroads Guide to Traffic Management Part 3 (Austroads 2013)

3.2.2 Delineation of zones in the traffic model

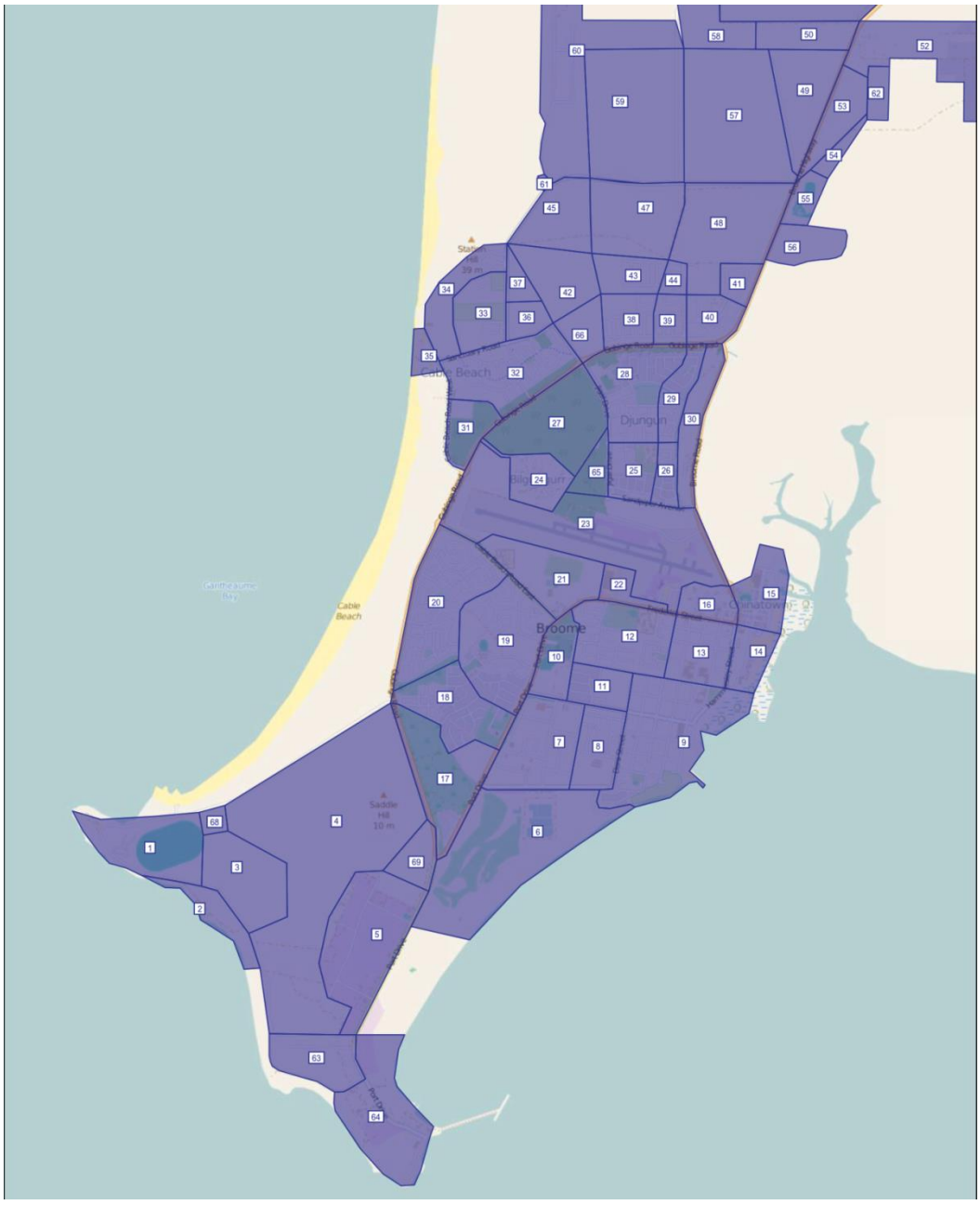
In order to create a traffic model, the study area is broken down into smaller sub-areas, termed “Zones”. Zones in a traffic model are not commensurate with zones in a planning scheme, although homogeneity of land use is one consideration when delineating zones for a traffic model. Other considerations include the presence of physical barriers (such as highways or rivers), the size of the population living in a zone, the type of transport alternatives under consideration (cars, commercial vehicles, trucks, public transport, cycling, walking), as well as the type of development patterns/urban design in an area.

The model demand zoning system for Broome was coded in a fine level of detail to include external load-in points to the network and access points to significant trip generators; this is shown in Figure 3.1. The model contains 69 zones in total, of which 1 zone represents external entry/ exit points to the network and 68 zones represent internal origins/ destinations within the study area. The boundary of each zone is defined by the existing major roads and type of land uses determined by the Shire of Broome Local Planning Scheme No.6 map. In order to avoid any confusion between the modelling zone and planning zone, this report will hereafter refer to a traffic modelling zone as “catchment.”

It is noted that the 69 catchments represent the full development of the Study area and it is not limited to the catchments that contain developed land.

Traffic data is then loaded into the network during the simulation run to represent vehicle movements within the modelled road network. Vehicles travels either within or between catchments on the available routes and it is the impact of this travel on the road network that a model aims to study.

Figure 3.1 : VISUM Base Scenario Traffic Model Catchments Map



3.2.3 Traffic Generation

The input to the model is an origin-destination matrix which was developed based on the developed areas and land uses within the study area.

Trip generation rates are based on the Guide to Traffic Generating for Developments by RMS NSW, February 2013, and Trip Generation 9th Edition (Institute of Transport Engineers, 2011) documents and were adjusted to represent the current pattern within the study area. Trip generation rates, as well as the directional split proportion for the major land uses included in this study, are summarised in Table 3.2 below.

Table 3.2 : Trip Generation Rates and directional split (After Calibration)

Trip Generation Rates					
	Unite	PM Peak Hour	Daily Trip Rate*	Inbound	Outbound
Residential	per Dwelling	1.105	13.81	63%	37%
Local Centre/Town Centre/Mixed Use	per 100 sq.m GFA	6.07	75.88	48%	52%
Industrial	per 100 sq.m GFA	0.57	7.13	17%	83%
Light & Service Industry	per 100 sq.m GFA	1.04	13.00	12%	88%
Service Commercial	per 100 sq.m GFA	0.5	6.25	25%	75%
Tourist - Caravan park/camping	per 100 sq.m GFA	0.05	0.63	49%	51%
Port	per 100 sq.m GFA	0.32	4.00	73%	27%

*PM peak trip rates have been factored up to calculate daily trip rates by the ratio of PM peak traffic counts over daily traffic counts indicated earlier in **Section 2.1**

It is noted that the trip generation rate used for the purpose of this study is higher than the rate provided within the RTA and ITA trip generation manuals. During the calibration process, the trip generation rates extracted from the mentioned manuals was adjusted to match the value of the modelled traffic with the observed traffic (Refer to **Section 3.2.6**). In particular, it should be noted that the residential trip generation rate was adjusted from 1 to 1.105 trips per dwelling to allow the model to match the higher counts observed consistently across the whole network. This is within a reasonable level given the low availability of other travel data.

The trips generated by the land uses within each catchment were calculated (the zoning system was described earlier in **Section 3.2.2**). Following this, an origin-destination demand matrix was generated. It will be used as an input into the model.

3.2.4 Traffic Distribution

The total trips generated by each catchment will be divided into two groups: -

- Residential: it is assumed that a tourist will have the same travel pattern as a resident during the PM peak hour and therefore this group includes all residential dwellings and tourist accommodation.
- Non- residential: this group includes all the non-residential developments including industrial, commercial, local and town centre and mixed uses.

The outbound trips from the residential land uses are distributed to the other catchments based on the ratio of the non-residential outbound trip of each catchment over the total number of outbound trips of the non-residential catchments.

The inbound residential trips from the non-residential catchments to the residential catchments will then be distributed based on the ratio of the outbound trips of the non-residential areas within each catchment to the overall number of non-residential outbound trips.

3.2.5 Traffic Assignment

As described earlier in **Section 3**, the traffic assignment has been undertaken by using the Equilibrium assignment within VISUM.

Equilibrium assignment will start with allocating trips to the shortest path available between the two zones. The model will approach equilibrium if travellers between two catchments could not reduce travel time by using any other available path.

3.2.6 Calibration and Validation

Model calibration and validation were undertaken to confirm that the operation of the model is in line with expectation.

The model calibration exercise involved comparisons between modelled and observed traffic count data. The GEH statistic was used during the calibration of the model to compare the difference between observed flow and assigned flow on a link or for a turning movement. The GEH statistic is calculated using **Equation** 3.1**.**

$$GEH = \sqrt{\frac{(E-V)^2}{\frac{E+V}{2}}} \qquad 3.1$$

Where:

E = simulated flow

V = actual flow

Comparisons between the modelled and observed flow are made using the GEH statistic as it is able to cope with a broad range of traffic flows. For example, a difference of 100 vehicles per hour is significant in a flow of 200 vehicles per hour, but it is insignificant in a flow of thousands of vehicles per hour.

The Base scenario model demands were calibrated to 27 link count movements across the study area for the PM peak hours. A comparison of the key observed traffic volumes and the modelled equivalence has been undertaken, and the GEH statistic has been used to calculate the comparability. A GEH value of 5 or less is considered to be acceptable when 85% of the modelled count locations have a GEH of less than 5.

In our final calibrated model more than 85% of the count locations have a GEH value of 5 or less as summarised in **Table** 3.3. The comparisons of the key observed traffic volumes are shown in **Table** 3.4.

Table 3.3 : Summary of the total GEH Values

Time Period	Modelled flows within GEH= 5	Modelled flows within GEH =10
PM peak	85%	100%

Table 3.4 : GEH Statistic for Individual Link Flows - 2016 Base Scenario

Count Location	Modelled Traffic Volume	Observed Traffic Volume	GEH
Cable Beach Road East west of Port Drive WB	824	864	1.4
Frederick Street west of Herbert Street WB	903	677	8.1
Frederick Street west of Herbert Street EB	646	591	2.2
Cable Beach Road East west of Port Drive EB	616	550	2.7
Cable Beach Road East south-east of Reid Road WB	619	527	3.8
Cable Beach Road East south-east of Reid Road EB	442	478	1.7
Hamersley Street north of Napier Terrace NB	282	194	5.7
Port drive north of Archer Street NB	347	417	3.6
Port Drive north of Reid Road NB	234	227	0.5
Port Drive north of Reid Road SB	283	397	6.2
Hamersley Street 95m south of Barker Street NB	309	388	4.2
Old Broome Road 230m north Sandpiper Avenue SB	318	375	3.1
Cable Beach Road West west of Gubinge Road WB	278	318	2.3
Sandpiper Avenue west of Old Broome Road EB	289	288	0.1
Hamersley Street 95m south of Barker Street SB	116	216	7.8
Old Broome Road 230m north Sandpiper Avenue NB	288	286	0.1
Cable Beach Road West west of Gubinge Road EB	335	281	3.1
Guy Street east of Herbert Street EB	222	266	2.8
Jigal Drive south of Gubinge Road SB	221	246	1.6
Port Drive north of Archer Street SB	240	231	0.6
Gubinge Road north of Gantheaume Point Road SB	269	216	3.4
Gantheaume Point Road south of Gubinge Road WB	270	210	3.9
Sanctuary Drive east of Cable Beach Road West EB	139	184	3.5
Reid Road NB	98	160	5.5
Herbert Street north of Guy Street NB	136	139	0.2
Reid Road SB	108	129	1.9
Gubinge Road north of Gantheaume Point Road NB	169	116	4.5

The model validation process involves a comparison of model outputs to data that has not been used in the model calibration, i.e. the observed traffic data that is not used in model calibration. The purpose of validation is to measure the differences in the accuracy of the trip estimation in the other parts of the network that have not been used in the calibration process. Table 3.5 highlights the validation comparison exercise. The table shows that of the links not used in the calibration, only one exceeds a GEH of 10 this being on Port Drive south of Archer Street.

Table 3.5 : Validation Report

Count Location	Modelled Traffic Volume	Observed Traffic Volume	GEH
Old Broome Road 230m north of Sandpiper Avenue	335	423	4.5
Port Drive south of Archer Street NB	122	244	9.0
Banu Avenue 130m east of Gubinge Road EB	24	97	9.4
Port Drive south of Archer Street SB	238	94	11.2
Banu Avenue 130m east of Gubinge Road WB	162	87	6.7
Macpherson Street at entrance to airport EB	75	68	0.8

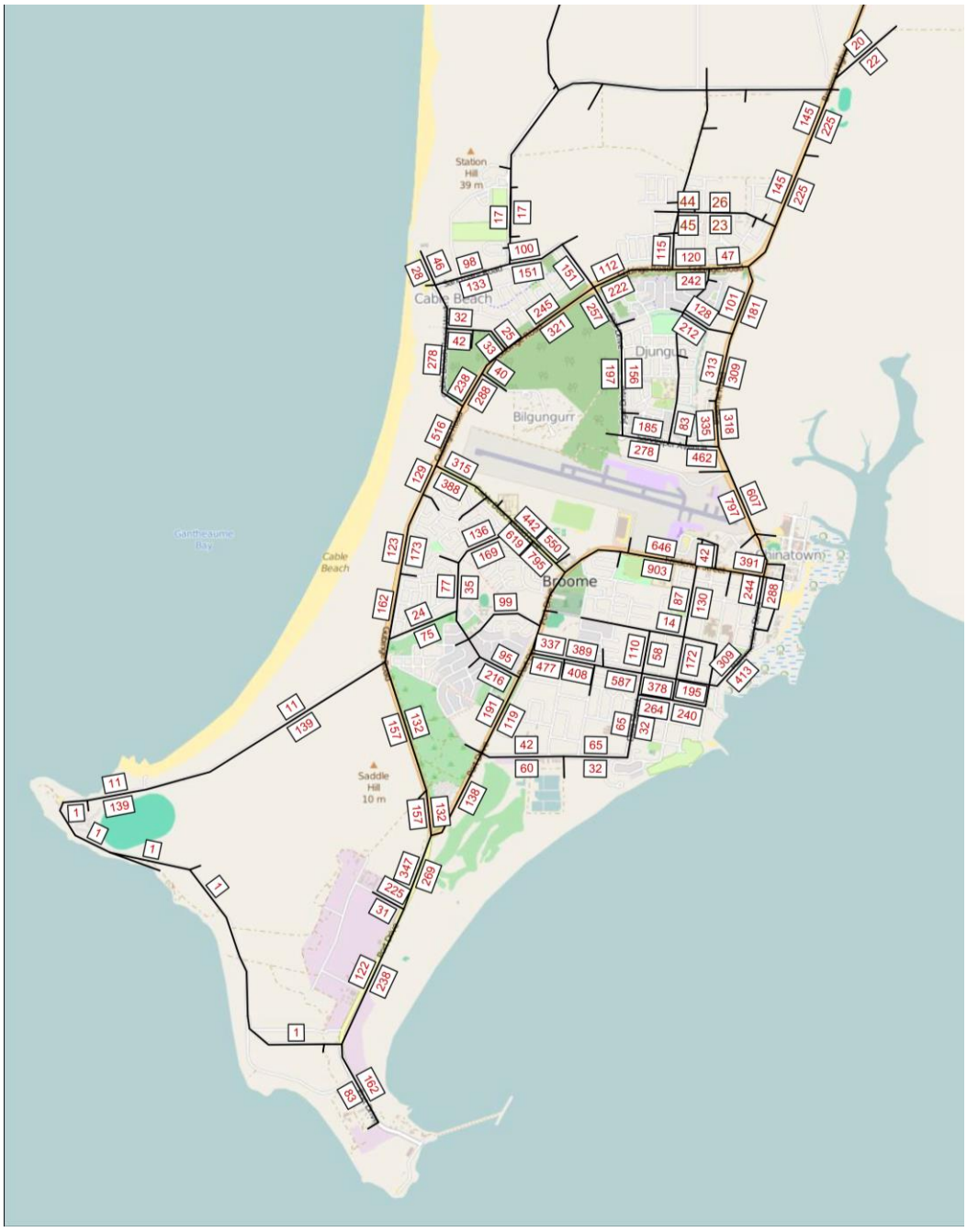
3.3 Output Analysis

The graphical outputs of the Base 2016 scenario are provided below as a link volume plot and vehicle over capacity (v/c) ratio.

The link volume plot shows the modelled PM peak hour volume for each link in the network. A link volume plot of the base scenario is shown in **Figure** 3.2. An A3 version of this map is provided in **Appendix A**.

In the link volume plot the traffic volume for each direction is provided on the left side of the centre line.

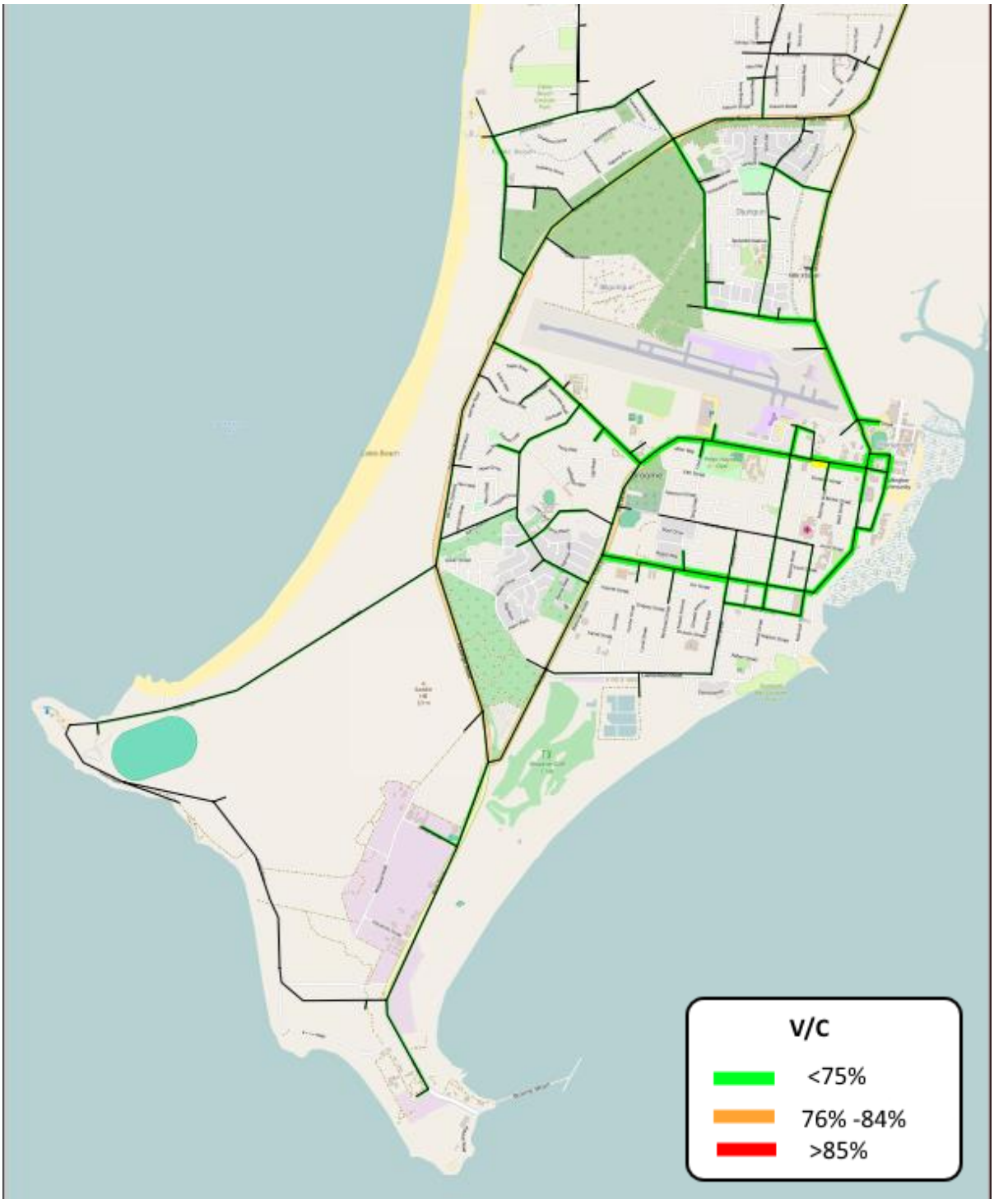
Figure 3.2 : Link Volume Plot for the Base 2016 Scenario in the PM Peak Hour



V/C ratio is a measure of capacity sufficiency and is typically measured by relating traffic volume (in the peak hour) to the road capacity. As per the advice obtained from the Shire, improvement measures should be considered for the sections of the road that operates with a V/C ratio of more than 85%. Improvement measures that can be considered for the congestion roads include upgrading the road or providing roads that operate parallel to the existing congested road and with similar function.

Figure 3.3 below is the graphical output of the vehicle over capacity ratio (V/C) of the roads within the study area in base 2016 scenario.

Figure 3.3 : Vehicle Over Capacity Ratio



As shown in **Figure** 3.3, all sections of the road within the study area are operating within acceptable level levels for the base 2016 scenario.

3.3.1 Key Intersection Assessment

VISUM is able to calculate the intersection performance indicators by using Intersection Capacity Analysis (ICA), which is based on the procedures provided in the US Highway Capacity Manual (HCM).

Table 3.7 provides the results of the intersections analysis for the 2016 base scenario model. The results of each approach are presented in terms of Level of Service, Average Delay and Degree of Saturation. Definitions of LOS, average delay and degree of saturation are provided below.

- **Level of service (LOS)** is a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. In general, there are six levels of service, designated A to F, with level of service A representing the best operating condition (i.e. free-flow) and level of service F the worst (i.e. forced or breakdown flow). LOS criteria by using delay are shown below in **Table** 3.6.

Table 3.6 : Level of Service Criteria Using Delay

	Two-way Stop-Controlled	Roundabout	Signalised
A	d ≤ 10	d ≤ 10	d ≤ 10
B	10 < d ≤ 15	10 < d ≤ 20	10 < d ≤ 20
C	15 < d ≤ 25	20 < d ≤ 35	20 < d ≤ 35
D	25 < d ≤ 35	35 < d ≤ 50	35 < d ≤ 55
E	35 < d ≤ 50	50 < d ≤ 70	55 < d ≤ 80
F	50 < d	70 < d	80 < d

Source: Austroads Guide to Traffic Management Part 3, (Austroads 2009)

- **Average Delay** is the average difference in the departure time and arrival time of all the vehicles arriving at intersection during the analysis period.

- **Degree of Saturation** of an intersection approach ranges from close to zero for very low traffic flows up to 1 for saturated flow or capacity. A degree of saturation greater than 1.0 indicates oversaturated conditions in which long queues of vehicles build up on the critical approaches. In general, the lower the degree of saturation the better the quality of traffic service.

Table 3.7 : Summary of the Intersection Analysis Results

Approach Name	LOS	Average Delay	Degree of Saturation
Intersection of Broome Road/Gubinge Road			
Broome Road (S)	A	6	0.13
Gubinge Road (W)	A	3	0.00
Broome Road (N)	A	0	0.00
Intersection of Fairway Drive and Gubinge Road			
Fairway Drive (NE)	A	6	0.23
Gubinge Road (SE)	A	7	0.28
Jigal Drive(SW)	A	6	0.25
Gubinge Road (NW)	A	5	0.11
Intersection of Cable Beach Road East/Frederick Street			
Cable Beach Road East (NW)	B	12	0.50
Frederick Street (NE)	C	23	0.67
Port Drive (SW)	B	13	0.25
Intersection of Port Drive/ Gubinge Road			
Port Drive (E)	A	5	0.15
Gubinge Road (N)	A	2	0.00
Port Drive (S)	A	0	0.13
Intersection of Port Drive/Guy Street			
Port Drive (N)	A	0	0.00
Guy Street (E)	A	9	0.38
Port Drive (S)	A	3	0.12
Intersection of Broome Road/Sandpiper Avenue			
Broome Road (N)	A	9	0.38
Sandpiper Avenue (W)	A	14	0.40
Broome Road (S)	B	9	0.36
Intersection of Hamersley Street/Frederick Street			
Hamersley Street (N)	B	13	0.45
Frederick Street (W)	A	10	0.35
Hamersley Street(S)	B	12	0.29
Frederick Street (E)	B	13	0.25

As per the initial discussion with the Shire, the acceptable level of service for the intersections capacity analysis is LOS D. As shown in **Table** 3.7 above, all the intersections within the study area are currently operating satisfactorily and the existing intersection configurations have sufficient capacity to accommodate the existing traffic demand during the PM peak hour.

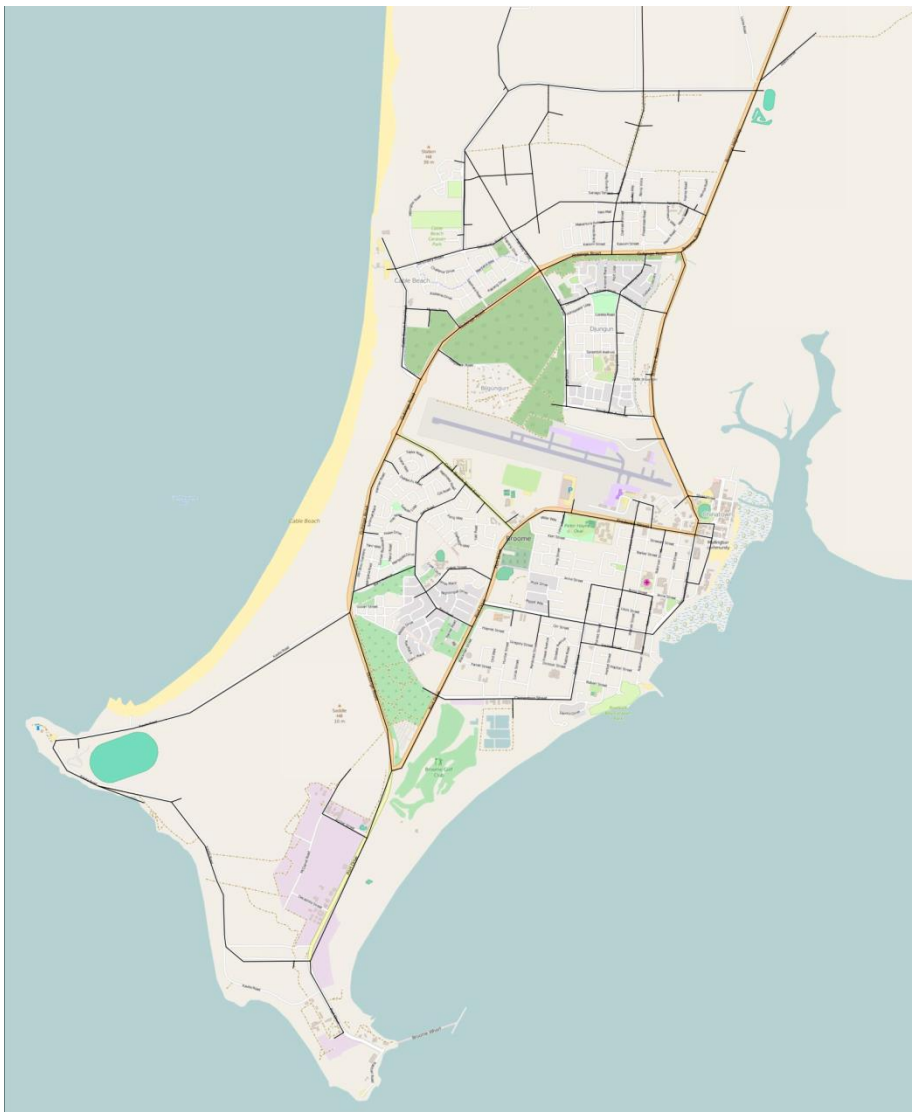
4. Future Interim Scenario Model (2031)

4.1 2031 Do-minimum Scenario Model Development

The 2031 do-minimum scenario model was based upon the 10 years Forward Capital Works Program (February 2016) as well as the local development plans for the developments planned to be developed by 2031, sourced from the Shire of Broome. The 2031 do-minimum scenario network is shown in **Figure** 4.1.

As explained earlier in **Section 2.1**, this dataset indicated that the dominant peak hour within the study area is 4.00 to 5.00 PM. Under normal traffic conditions, the school peak hour is between 2:00 to 4:00 PM, which is outside the identified PM peak period. However, as per the preference of the Shire, for the 2031 interim and 2051 ultimate scenarios the school traffic has been added to the PM peak hour background traffic. This represents the worst case situation.

Figure 4.1 : 2031 Do-minimum Scenario Network



The changes between the 2031 do-minimum model and the base 2016 model are as follows:

- Extension of Tanami Drive from Shingoro Street to Sanctuary Road;
- East-west connection between Fairway Drive and Magabala Road;
- North-south connection between Fairway Drive and Gubinge Road;
- Extension of Gray Street to Old Broome Road (It is understood that a feasibility study will be completed in 2 years. The construction of Gray Street would be undertaken as part of the Chinatown Revitalisation project, and completion of the road is expected by 2031. It should also be noted that this road improvement was analysed as part of the 2031 do-something scenario, as discussed in **Section 4.3**. The 2031 do-something scenario assessment shows that there would be no traffic congestion along this road; hence the same level of traffic operation is expected for the 2031 do-minimum scenario. For this reason, this was not modelled in 2031 do-minimum scenario); and
- Extension of Dampier Terrace to Frederick Street.

4.1.1 Road Network

The road hierarchy and posted speed limit in the future road network were implemented by using MRWA definition for roads classification.

4.1.2 Land development

The following table summarises the catchments that have been assumed to be partially or fully developed by 2031.

Table 4.1 : Catchments for 2031 Do-minimum Scenario

Zone No.	Land Use
22	Service Commercial Development
27	Yawuru Residential Development
28	Final Portions of Roebuck Estate
42	Broome North Local Development Plan No. 3
45	Broome North Local Development Plan No. 3
47	Future Broome North Local Development Plan
48	Broome North Local Development Plan No. 2
65	Western Triangle and remainder of Roebuck Estate
66	Broome North Local Development Plan No. 3
68	Eco-Tourism Resort, Gantheaume Point Road
69	Yawuru Industrial Subdivision

Figures for external growth for 2031 have been obtained from the MRWA state wide model (developed in 2001). It predicts that in 2031, from the total number of vehicles travelling on Broome Road, the proportion of external trips will be 3.15%. This proportion has been used to calculate the number of external trips travelling towards the study area during the PM peak hour. The trips generated by the planned future developments were also used to project the internal future traffic growth.

4.2 Output Analysis

4.2.1 Do-minimum 2031 Scenario

The link volume plot of the do-minimum 2031 scenario is shown in **Figure** 4.2. An A3 version of this map is provided in **Appendix A**. Roads projected to experience significant increases in traffic volumes include:

- Broome Road (from Sandpiper Avenue to Short Street) - it is expected that this would increase with new developments to the north, generating traffic between there and Chinatown.
- Cable Beach Road East and Frederick Street – similarly it is expected that there would be an increase along this corridor as a connection between Broome North and Chinatown.

Figure 4.2 : Link Volume Plot , 2031 Do-minimum Scenario

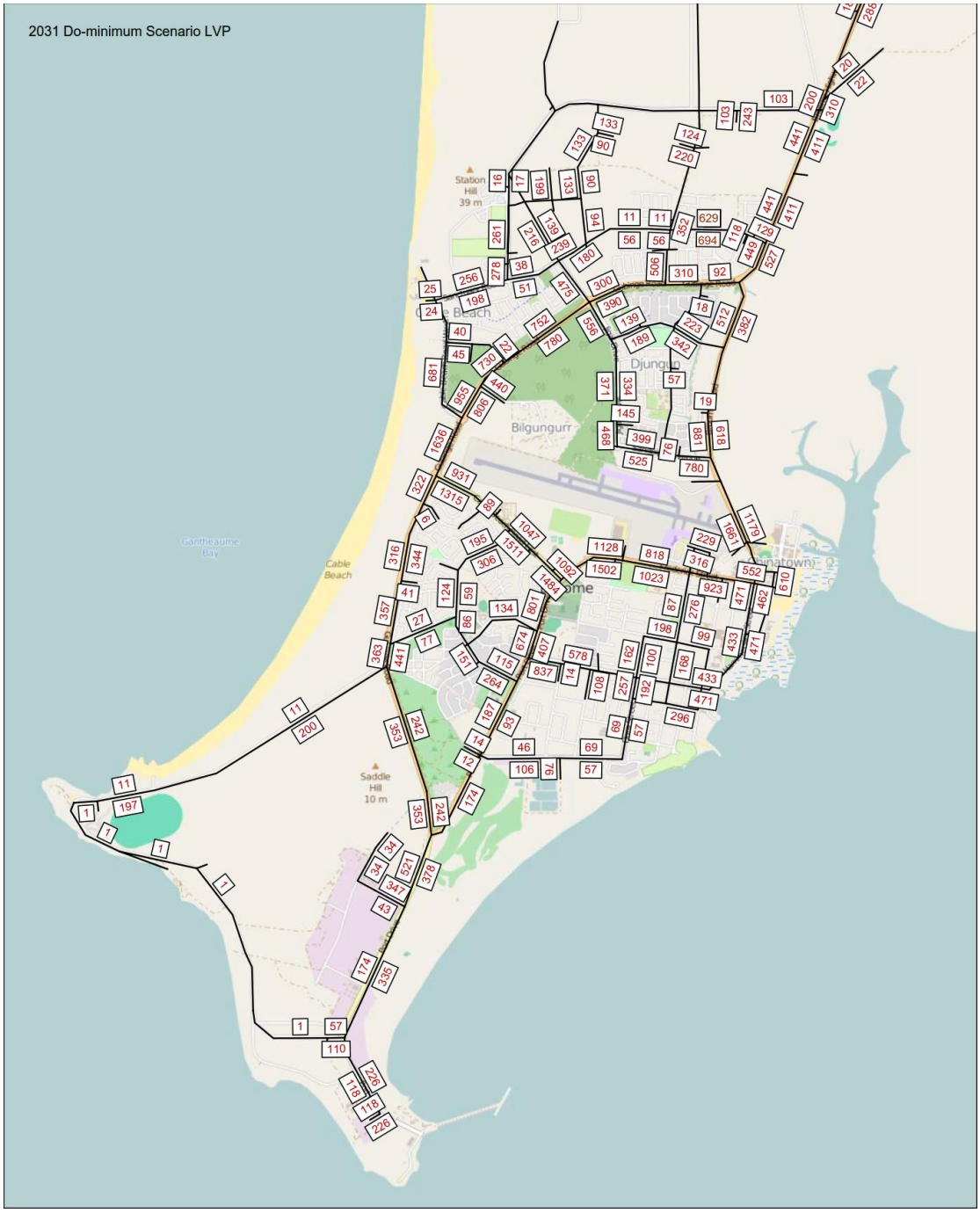
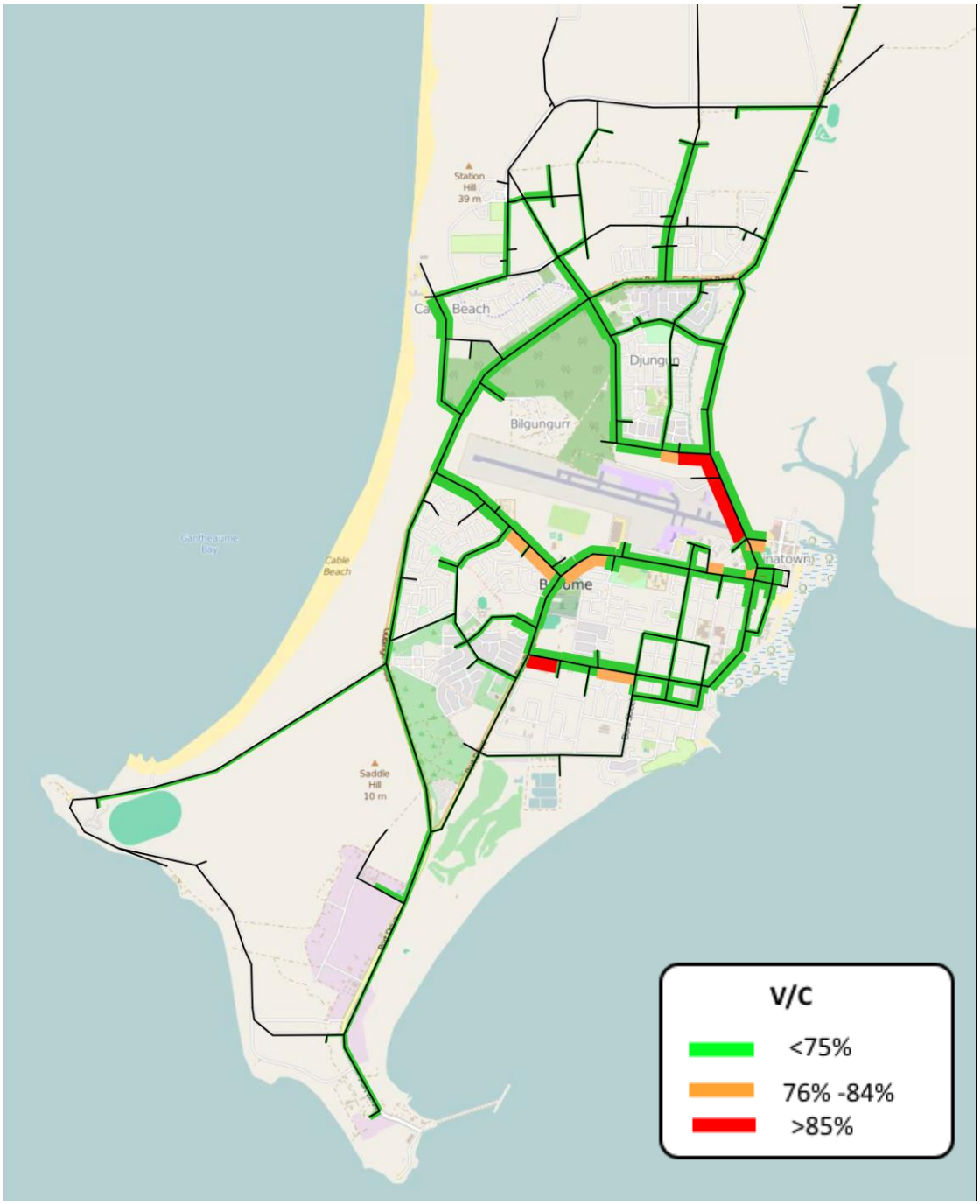


Figure 4.3 is the graphical output of the vehicle over capacity ratio (V/C) of the roads. As shown in **Figure** 4.3, all the roads, apart from the sections of the road mentioned below, are still operating within the acceptable range. The following sections of the roads are operating with V/C more than 85%:

- Sandpiper Avenue westbound between Broome Road and Sanderling Drive;
- Broome Road northbound between Sandpiper Avenue and Short Street; and
- Sections of Guy Street westbound between Port Drive and Dora Street.

Figure 4.3 : Vehicle over Capacity Ratio, 2031 Do-minimum Scenario



4.2.2 Recommended Link Improvements

Based on the above analysis, Jacobs recommends that the 2031 improvement options include (in addition to the changes provided in the Shire's 10 year Forward Capital Works Program) the following:

Broome Road

Broome Road between Short Street and Sandpiper Avenue is recommended to be upgraded from a two-lane two-way carriageway to a four-lane two-way carriageway. To incorporate this improvement, some modification

is required on the Broome Road approach with its intersection with Short Street. It is envisaged that there is adequate road space to accommodate this modification on the northern approach to this roundabout.

It should be noted that assuming the increase in background traffic follows a linear growth pattern; the existing intersection would be expected to exceed V/C of 0.85 an higher, by 2029.

Sandpiper Avenue

Sandpiper Avenue between Broome Road and Sanderling Drive is recommended to be upgraded from a two-lane, two-way carriageway to a four lanes two-way carriageway.

It should be noted that assuming the increase in background traffic follows a linear growth pattern; the existing intersection would be expected to exceed V/C of 0.85 and higher, by 2030.

Guy Street

Guy Street between Hunter Street and Port Drive is recommended to be upgraded from a two-lane two-way carriageway to a four-lane two-way carriageway.

It should be noted that assuming the increase in background traffic follows a linear growth pattern; the existing intersection would be expected to exceed V/C of 0.85 and higher, by 2028.

4.2.3 Key Intersection Assessment

Table 4.2 provides the results of the intersection analysis for the 2031 do-minimum scenario model. The results of each approach are presented in terms of Level of Service (LOS), Average Delay and Degree of Saturation.

Table 4.2 : Summary of the Intersection Analysis Results

Approach Name	Average LOS	Average Delay (S)	Degree of Saturation
Intersection of Broome Road/ Gubinge Road			
Broome Road (S)	B	15	0.62
Gubinge Road (W)	A	2	0.04
Broome Road (N)	A	0	0.00
Intersection of Fairway Drive and Gubinge Road			
Fairway Drive (NW)	A	6	0.18
Gubinge Road (NE)	A	7	0.35
Jigal Drive (SE)	A	8	0.24
Gubinge Road (SW)	A	8	0.21
Intersection of Cable Beach Road East/Frederick Street			
Cable Beach Road East (NW)	C	15	0.59
Frederick Street (NE)	F	56	0.70
Port Drive (SW)	F	61	0.62
Intersection of Port Drive/ Gubinge Road			
Port Drive (E)	A	9	0.17
Gubinge Road (N)	A	0	0.00
Port Drive (S)	A	1	0.15
Intersection of Port Drive/Guy Street			
Port Drive (N)	A	0	0.00
Guy Street (E)	F	102	1.22
Port Drive (S)	A	3	0.14
Intersection of Broome Road/Sandpiper Avenue			
Broome Road (N)	B	11	0.54
Sandpiper Avenue (W)	C	19	0.76
Broome Road (S)	A	2	0.43
Intersection of Hamersley Street/Frederick Street			
Hamersley Street (N)	A	9	0.32
Frederick Street (W)	A	8	0.26
Hamersley Street (S)	B	10	0.42
Frederick Street (E)	A	10	0.36

As indicated in Table 4.2 above:

- **Intersection of Frederick Street/ Cable Beach Road East:** The north east and south west approaches of this intersection are expected to operate at LOS F under the future 2031 do-minimum scenario traffic demand. It should be noted that assuming the increase in background traffic follows a linear growth pattern; the existing intersection would be expected to exceed LOS E by 2028.

- **Intersection of Port Drive/ Guy Street:** The eastern approach of the intersection is expected to operate at level of service F with average delays of 102 seconds. It should be noted that assuming the increase in background traffic follows a linear growth pattern; the existing intersection would be expected to exceed LOS E by 2020.

4.2.4 Recommended Intersection Improvement

Based on the above analysis, Jacobs recommends that the 2031 improvement options include (in addition to the Shire's 10 year Forward Capital Works Program) the following: -

- **Intersection of Frederick Street/ Cable Beach Road East:**
    - An additional right turn pocket to the north-east approach (Frederick Street);
    - An additional left turn pocket to the south-west approach (Port Drive); and
    - An additional exit lane to the north-west approach (Cable East Road).

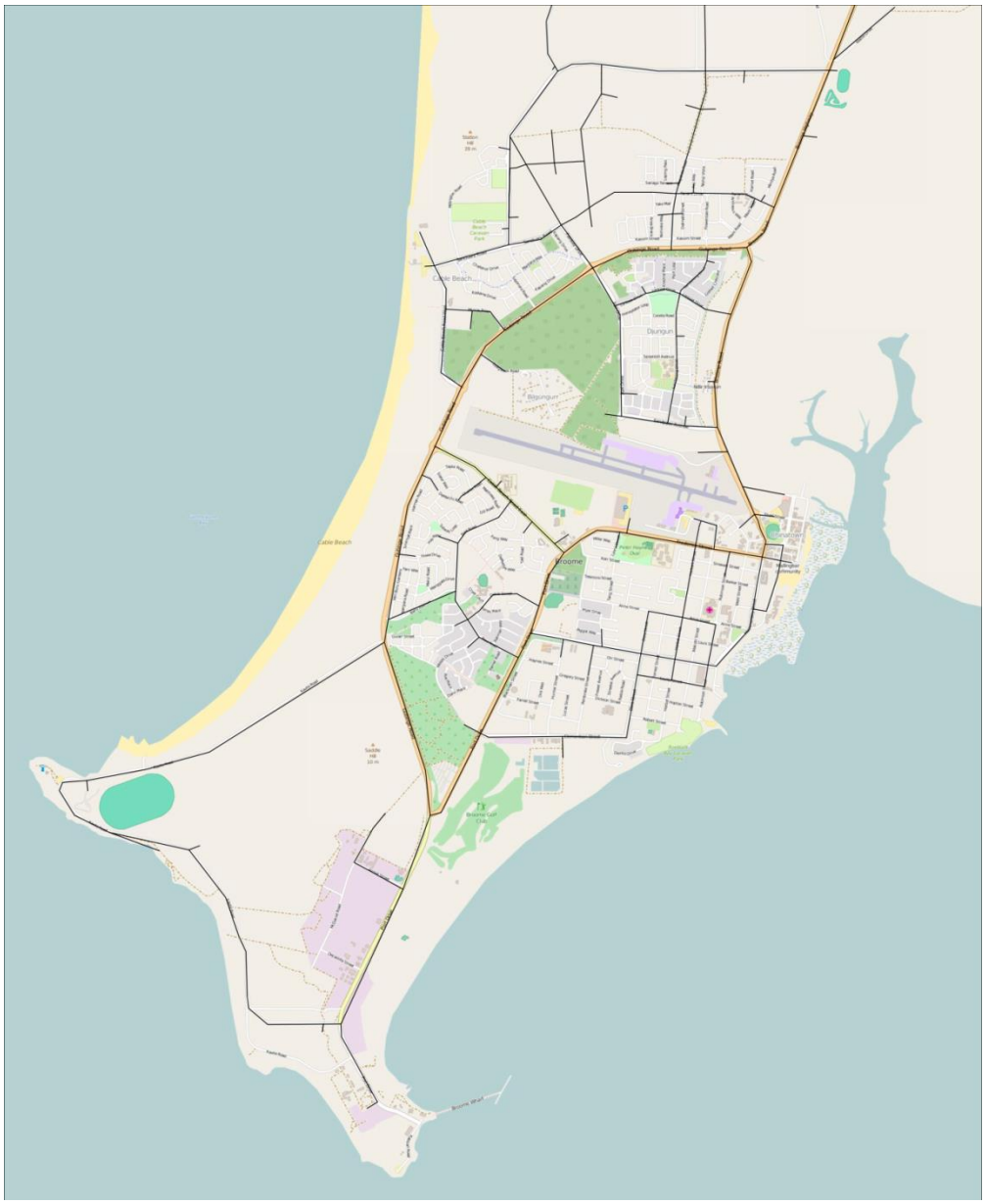
The length of the above, additional lanes have been defined as 100m each (which can be longer than the actual length required to accommodate the turning traffic), but the exact length of each of these is to be determined using SIDRA analysis and confirmed during the detail design process.

- **Intersection of Port Drive/ Guy Street:**
    - Based on the analysis, provision of either a roundabout or signal would improve the operation of the intersection. Results show that the roundabout operates better (LOS A at all the approaches) with the 2031 do-minimum demand. The operational cost of the roundabout is also lower than the operational cost of traffic signal. Therefore, it is recommended to provide a roundabout at this intersection.

4.3 2031 Do-something Scenario Model Development

The 2031 do-something scenario network is shown in **Figure** 4.4. The road layout in this scenario is similar to the road network developed for the 2031 Do-minimum scenario with all other improvements identified and including the extension of Gray Street from Chinatown to Broome Road has been included for analysis purposes.

Figure 4.4 : 2031 Do-something Scenario Network



The link volume plot of the Do-something 2031 scenario is shown in Figure 4.5. An A3 version of this map is provided in **Appendix A**.

Figure 4.5 : Link Volume Plot, 2031 Do-something Scenario

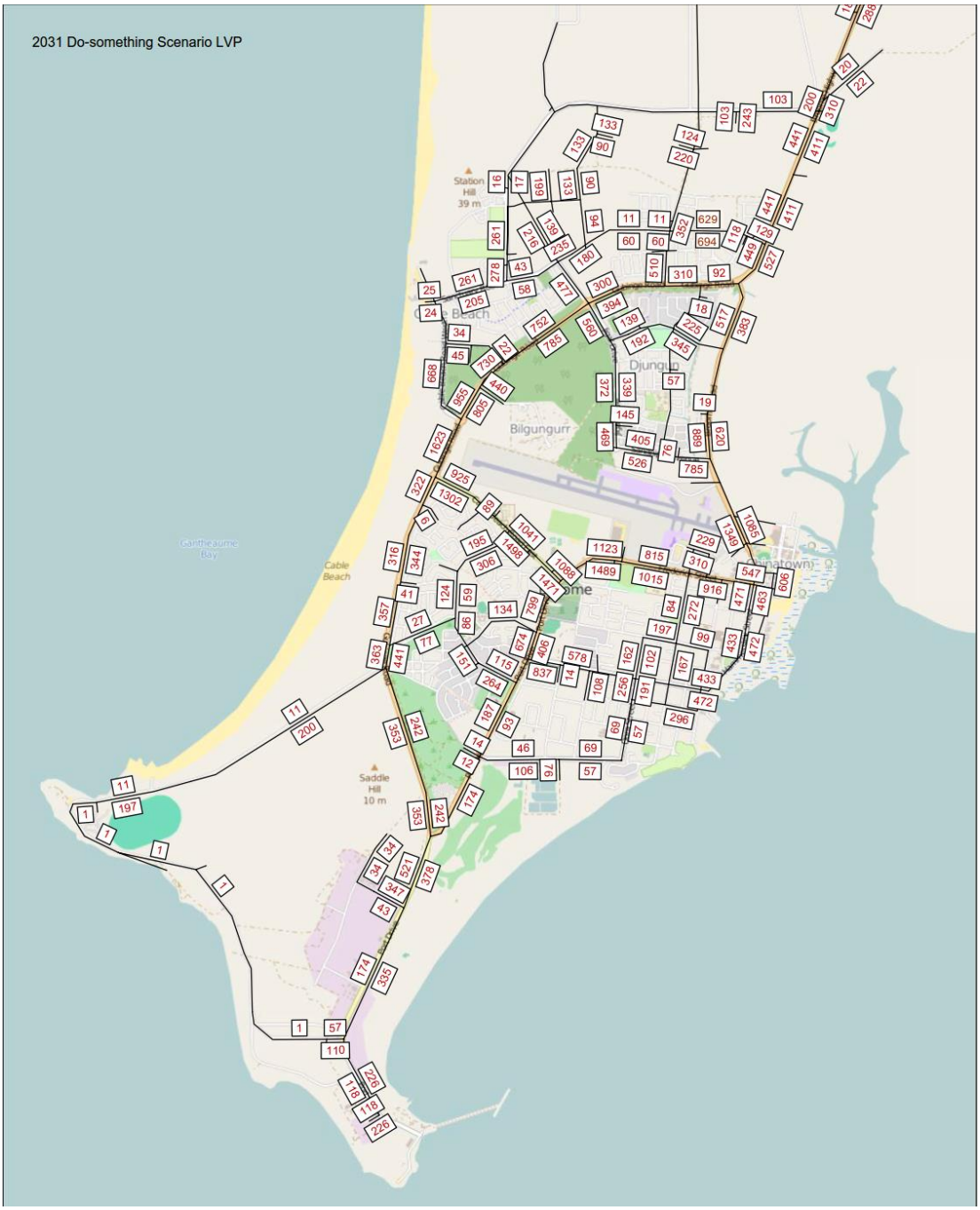
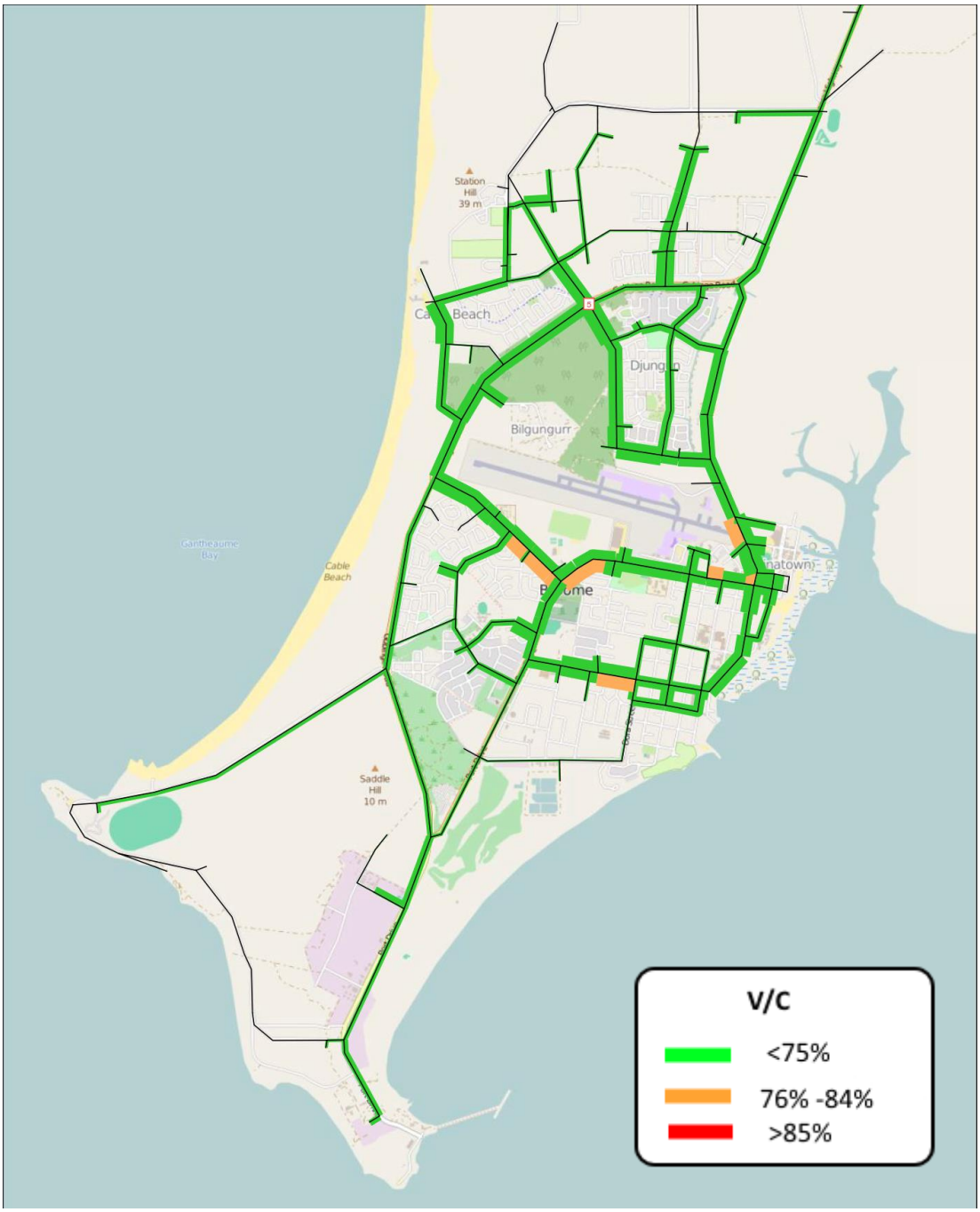


Figure 4.6 below is the graphical output of the vehicle over capacity ratio (V/C) of the roads within the study area in the 2031 Do-something scenario.

Figure 4.6 : Vehicle over Capacity Ratio, 2031 Do-something Scenario



As shown in **Figure** 4.6, all sections of the roads within the study area are operating within acceptable level levels for the 2031 Do-something scenario.

4.3.1 Key Intersections Assessment

Table 4.3 provides the results of the intersection analysis for the 2031 Do-something scenario model. The results of each approach are presented in terms of Level of Service (LOS), Average Delay and Degree of Saturation.

Table 4.3 : Summary of the Intersection Analysis Results, Future 2031 Do-something Scenario

Approach Name	LOS	Average Delay (S)	Degree of Saturation
Intersection of Broome Road/ Gubinge Road			
Broome Road (S)	B	15	0.62
Gubinge Road (W)	A	0	0.00
Broome Road (N)	A	2	0.04
Intersection of Fairway Drive and Gubinge Road			
Fairway Drive (NE)	A	7	0.60
Gubinge Road (SE)	A	8	0.47
Jigal Drive (SW)	A	8	0.37
Gubinge Road (NW)	A	6	0.36
Intersection of Cable Beach Road East/Frederick Street			
Cable Beach Road East (NW)	B	11	0.55
Frederick Street (NE)	A	7	0.35
Port Drive (SW)	B	13	0.57
Intersection of Fairway Drive/ Gubinge Road			
Port Drive (E)	A	9	0.17
Gubinge Road (N)	A	0	0.00
Port Drive (S)	A	2	0.15
Intersection of Port Drive/Guy Street			
Port Drive (N)	A	0	0.36
Guy Street (E)	A	8	0.55
Port Drive (S)	A	8	0.26
Intersection of Broome Road/Sandpiper Avenue			
Broome Road (N)	A	10	0.54
Sandpiper Avenue (W)	A	2	0.55
Broome Road (S)	B	19	0.76
Hamersley Street (N)	A	9	0.31
Frederick Street (W)	A	8	0.26
Hamersley Street (S)	B	10	0.42
Frederick Street (E)	A	10	0.35

Based on Table 4.3 above, all the intersections will operate acceptably with the identified recommended infrastructure improvements for the Future 2031 Do-something Scenario.

5. Ultimate Scenario Model (2051)

The 2051 Do-minimum scenario was coded by using the 2031 Do-something scenario model the Broome Airport Development Plan and the local development plans for the development planned to be developed by 2051 which was sourced from the Shire of Broome.

Broome International Airport is currently located north-west of Chinatown. Based on the Broome Airport Development Plan, if Broome continues to grow the airport will need to sometime in the future be relocated to a location outside the town. Until this event is realised the airport will remain at its current location. The timing of the relocation of the airport is not certain at this stage, and four scenarios have been modelled. These are: -

- Without airport relocation: This includes all land uses excluding the airport redevelopment and all the network improvements up to and including those recommended by 2031 Do-something scenario.
- With airport relocation:
    - All land uses including the airport redevelopment and all the network improvement up to and including those recommended by 2031 Do-something scenario;
    - All land uses excluding the airport redevelopment and mitigation improvements for 2051 horizon; and
    - All land uses including the airport redevelopment and mitigation improvements for 2051 horizon.

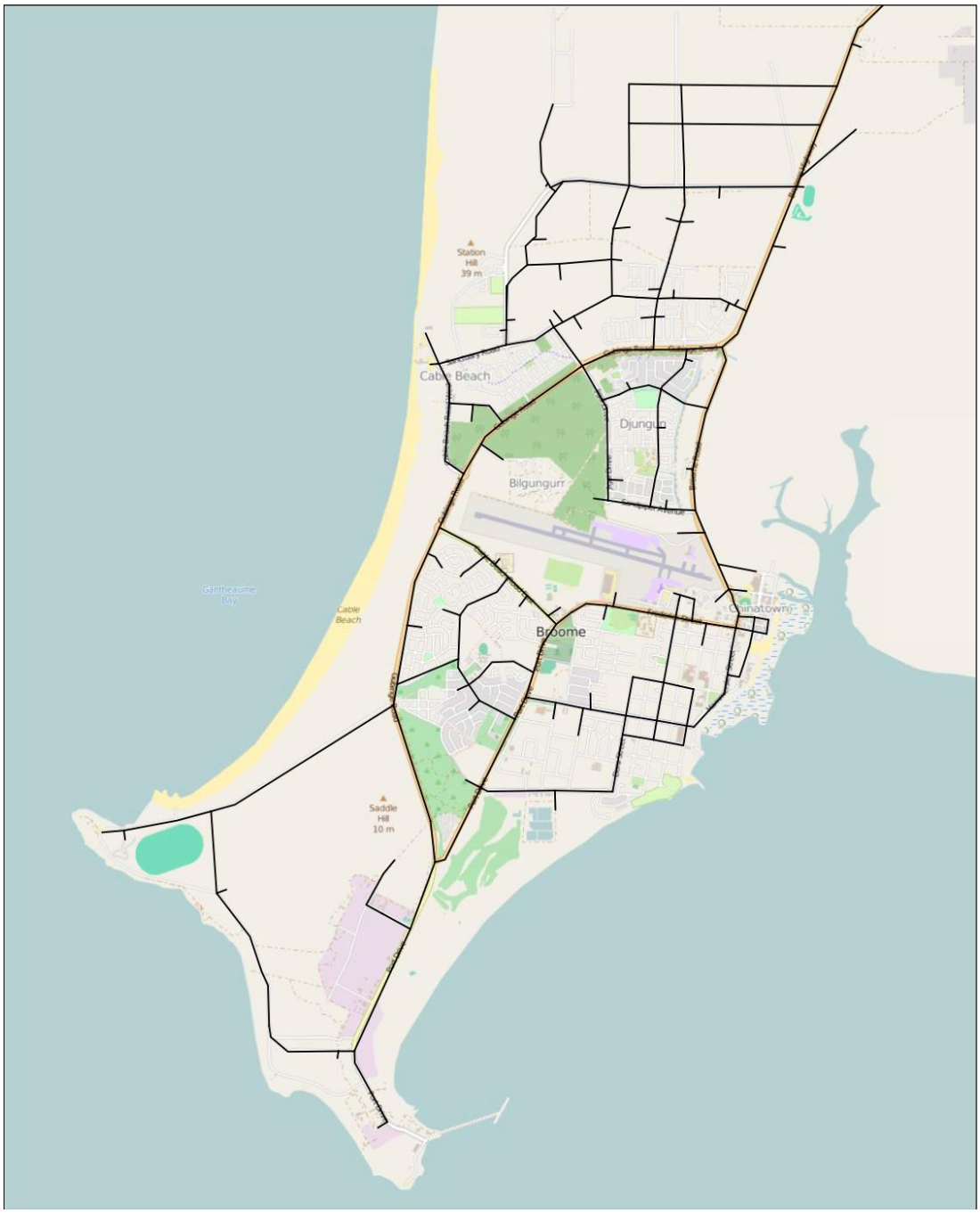
5.1 2051 Do-minimum Scenario without airport relocation

By keeping the airport at its current location, the changes to the road network would only include the following: -

- The new roads and connections within the new development area to the north of Fairway Drive

The 2051 Do-minimum scenario network is shown in **Figure** 5.1.

Figure 5.1 : 2051 Do-minimum Scenario without airport relocation Network



5.1.1 Land development

Table 5.1 summarises the catchment that will be partially or fully developed by 2051.

Table 5.1 : Catchment for 2051 Do-minimum Scenario

59	Broome North Local Development Plan
58	Broome North Local Development Plan
50	Broome North Local Development Plan
49	Broome North Local Development Plan
57	Broome North Local Development Plan

5.1.2 Output Analysis

The link volume plot of the Do-minimum 2051 without airport relocation scenario is shown in **Figure** 5.2. An A3 version of this map is provided in **Appendix A**. In general the following should be noted:

- Gubinge Road between Cable Beach Road East and Fairway Drive is projected to carry significant volumes of traffic (around 2200 vph in the peak direction). This is predominantly driven by the future development of land parcels in the north while the major trip attractors remain in the city centre which is located in the south.

- A high level of traffic is expected on Broome Road. This is as a result of the demand to travel between the north and the south parts of the study area and a lack of roads that provides connectivity and accessibility.

Figure 5.2 : Link Volume Plot, 2051 Do-minimum without airport relocation Scenario

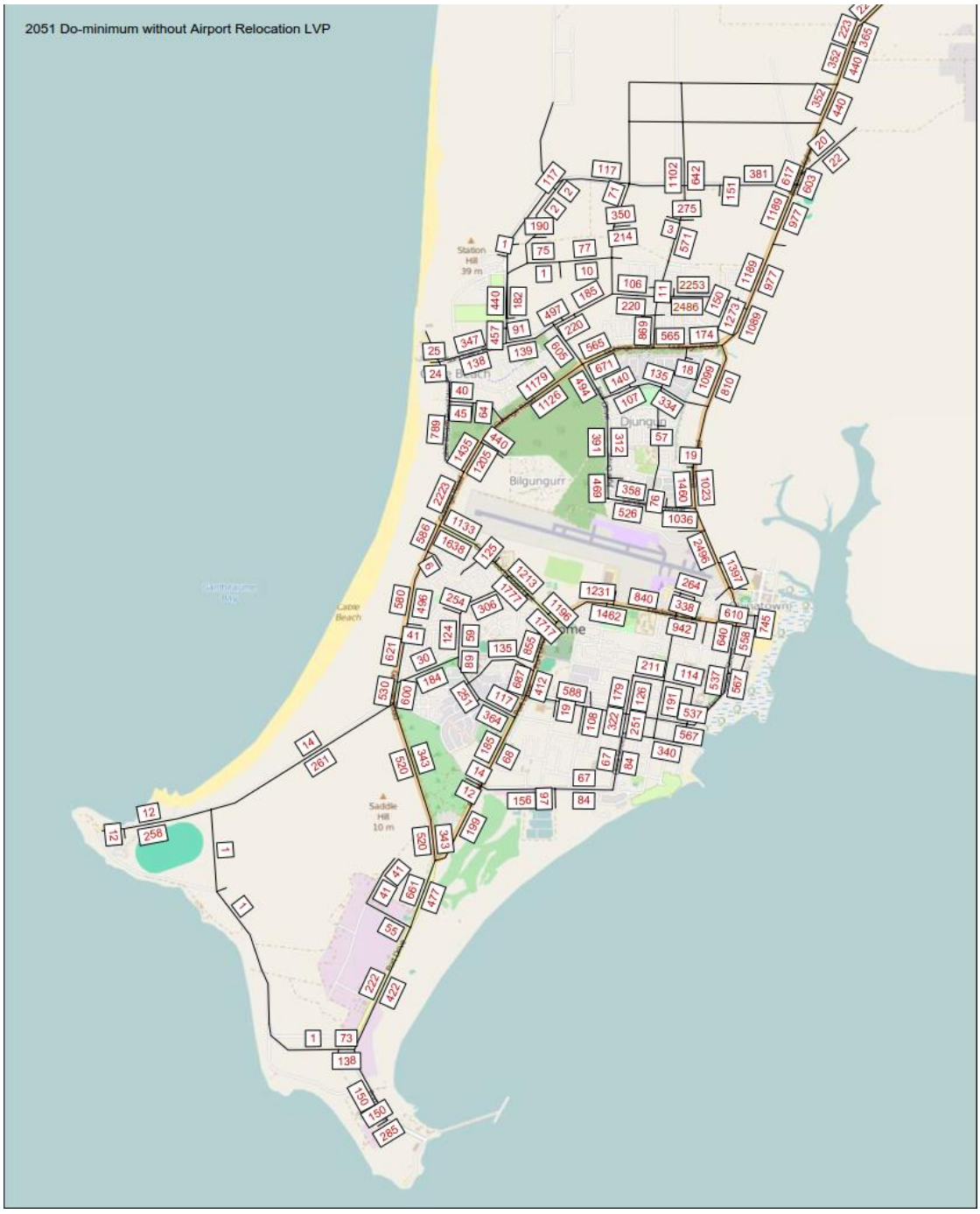
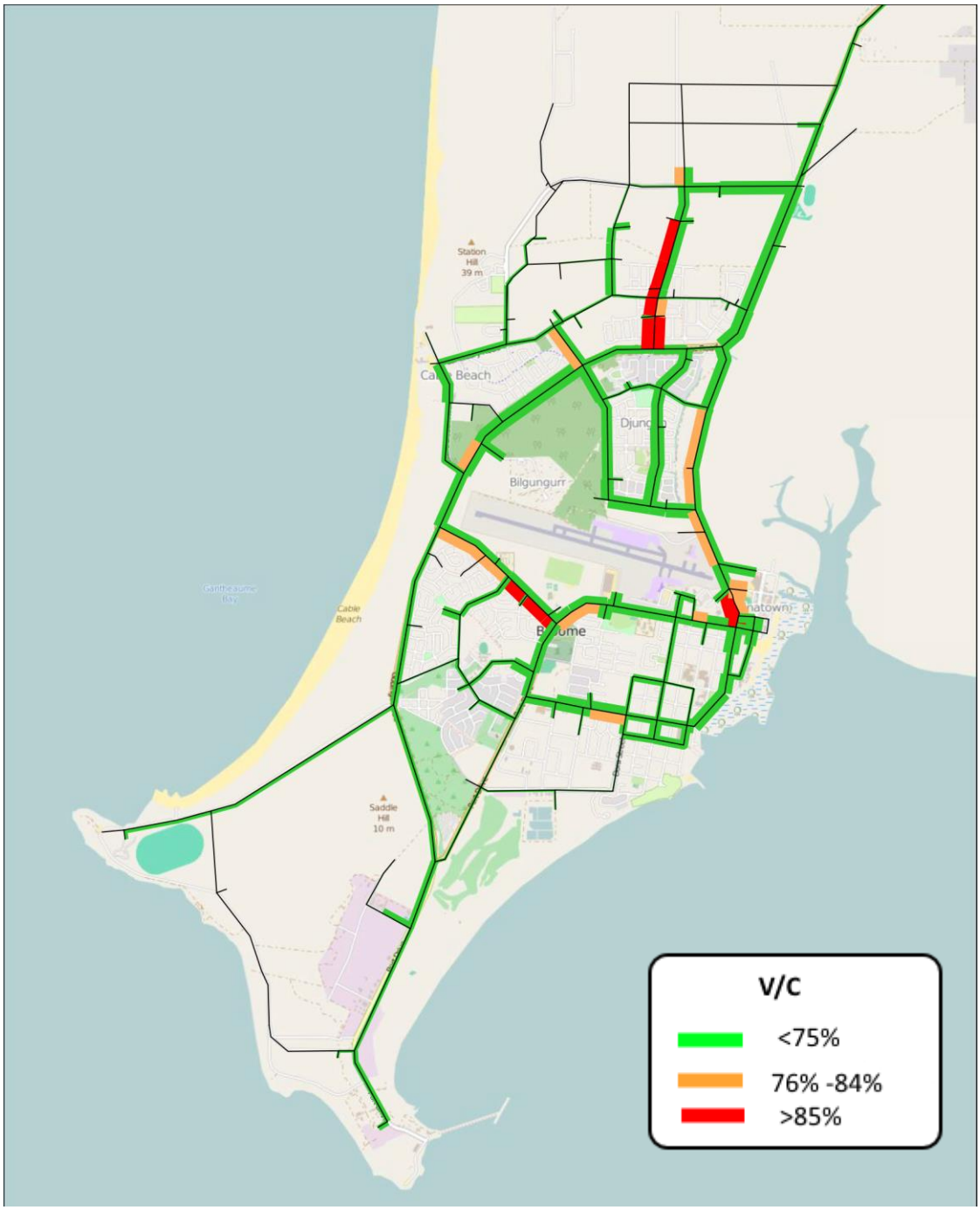


Figure 5.3 below is the graphical output of the vehicle over capacity ratio (V/C) of the road network in the study area for the 2051 Do-minimum without airport relocation scenario.

Figure 5.3 : Vehicle over Capacity Ratio, 2051 Do-minimum without airport relocation Scenario



As shown in **Figure** 5.3 above, in the future 2051 Do-minimum without airport relocation scenario, all sections of the road network are expected to operate within acceptable level except for: -

- Broome Road southbound between Frederick Street and Short Street;
- Cable Beach Road East westbound between Frederick Street and Reid Road ;
- Magabala Road northbound between Gubinge Road and Fairway Drive; and
- Magabala Road southbound between Nakamura Avenue and Gubinge Road;

5.1.3 Recommended Road Link Improvements

Based on the above Jacobs recommends that the 2051 improvement options (in addition to the improvements identified as part of the 2031 Do-something scenario) include the following: -

Broome Road

Broome Road between Short Street and Frederick Street is recommended to be upgraded from a two-lane, two-way carriageways to a four-lane two-way carriageway. As part of this improvement, some modification is required at the intersection of Broome Road/ Short Street, but considering the existing configuration of the roundabout, it is expected that the roundabout can accommodate the proposed upgrade to Broome Road.

Cable Beach Road East

Cable Beach Road East between Frederick Street and Reid Road is recommended to be upgraded from a two-lane two- way carriageway to a four-lane two- way carriageway.

Magabala Road

Magabala Road between Gubinge Road and Fairway Drive is recommended to be upgraded from a two-lane two-way carriageway to a four-lane two-way carriageway.

5.1.4 Key Intersections Assessment

Table 5.2 provides the results of the intersection analysis for the 2051 Do-minimum without airport relocation scenario model. The results of each approach are presented in terms of Level of Service (LOS), Average Delay and Degree of Saturation.

Table 5.2 : Summary of the Intersection Analysis Results – Future 2051 Do-minimum without airport relocation Scenario

Approach Name	LOS	Average Delay (S)	Degree of Saturation
Intersection of Broome Road/ Gubinge Road			
Broome Road (S)	F	496	2.05
Gubinge Road (W)	A	0	0.00
Broome Road (N)	A	0	0.00
Intersection of Fairway Drive and Gubinge Road			
Fairway Drive (NE)	B	14	0.66
Gubinge Road (SE)	B	15	0.35
Jigal Drive (SW)	C	22	0.43
Gubinge Road (NW)	B	10	0.25
Intersection of Cable Beach Road East/Frederick Street			
Cable Beach Road East (NW)	C	16	0.59
Frederick Street (NE)	A	8	0.37
Port Drive (SW)	C	17	0.75
Intersection of Fairway Drive/ Gubinge Road			
Port Drive (E)	C	15	0.35
Gubinge Road (N)	A	0	0.00
Port Drive (S)	A	1	0.17
Intersection of Port Drive/Guy Street			
Port Drive (N)	A	0	0.39
Guy Street (E)	B	11	0.65
Port Drive (S)	B	10	0.29
Intersection of Broome Road/Sandpiper Avenue			
Broome Road (N)	F	95	1.13
Sandpiper Avenue (W)	F	296	1.60
Broome Road (S)	A	6	1.78
Hamersley Street (N)	B	12	0.39
Frederick Street (W)	B	11	0.30
Hamersley Street (S)	B	15	0.61
Frederick Street (E)	B	13	0.53

As indicated in Table 5.2 above: -

- **Intersection Broome Road/Gubinge Road:** This intersection is currently configured as a three-way priority control intersection (See **Section 2.2.3**). The southern approach to this intersection (Broome Road) is expected to operate with LOS F.
- **Intersection of Broome Road/ Sandpiper Avenue:** This intersection is currently configured as a single circulating lane roundabout (See **Section 2.2.3**). The southern approach to this intersection (Broome Road) is expected to operate with LOS F.

5.1.5 Recommended Intersections Improvements

Based on the above, Jacobs recommends that the following improvement options for the 2051 Do-minimum without airport relocation scenario be considered (the result of implementing the following recommendations have been presented as 2051 Do-something without airport relocation scenario):

- **Intersection of Broome Road/ Sandpiper Avenue:**
  - Upgrading the roundabout located at the intersection of Broome Road/Sandpiper Avenue from a single to a double circulating lane with an additional right turn pocket and an additional exit lane for the northern approach.

- **Intersection of Broome Road/Gubinge Road:**

  - No treatment is required for the intersection of Broome Road/Gubinge Road for this scenario. Currently, Broome Road and Gubinge Road comprise of an approximately 9m wide median on the eastern and western approaches to this intersection. The existing median would allow a staged crossing for right turning vehicles from the Broome Road southern approach into Gubinge Road. It should be noted that the VISUM software is not capable of modelling the staged crossing movement. In reality, it is expected that the right turning vehicle would experience less delay than the results suggested in **Table 5.2** and hence is anticipated to operate at a better level of service.

- **Intersection of Gubinge Road/Magabal Road:**

  This intersection was not included in the modelled network but based on the SKM Traffic an Access report for Broome North dated 22 January 2010, this intersection needs to be upgraded to a signal control intersection to accommodate pedestrian crossing.

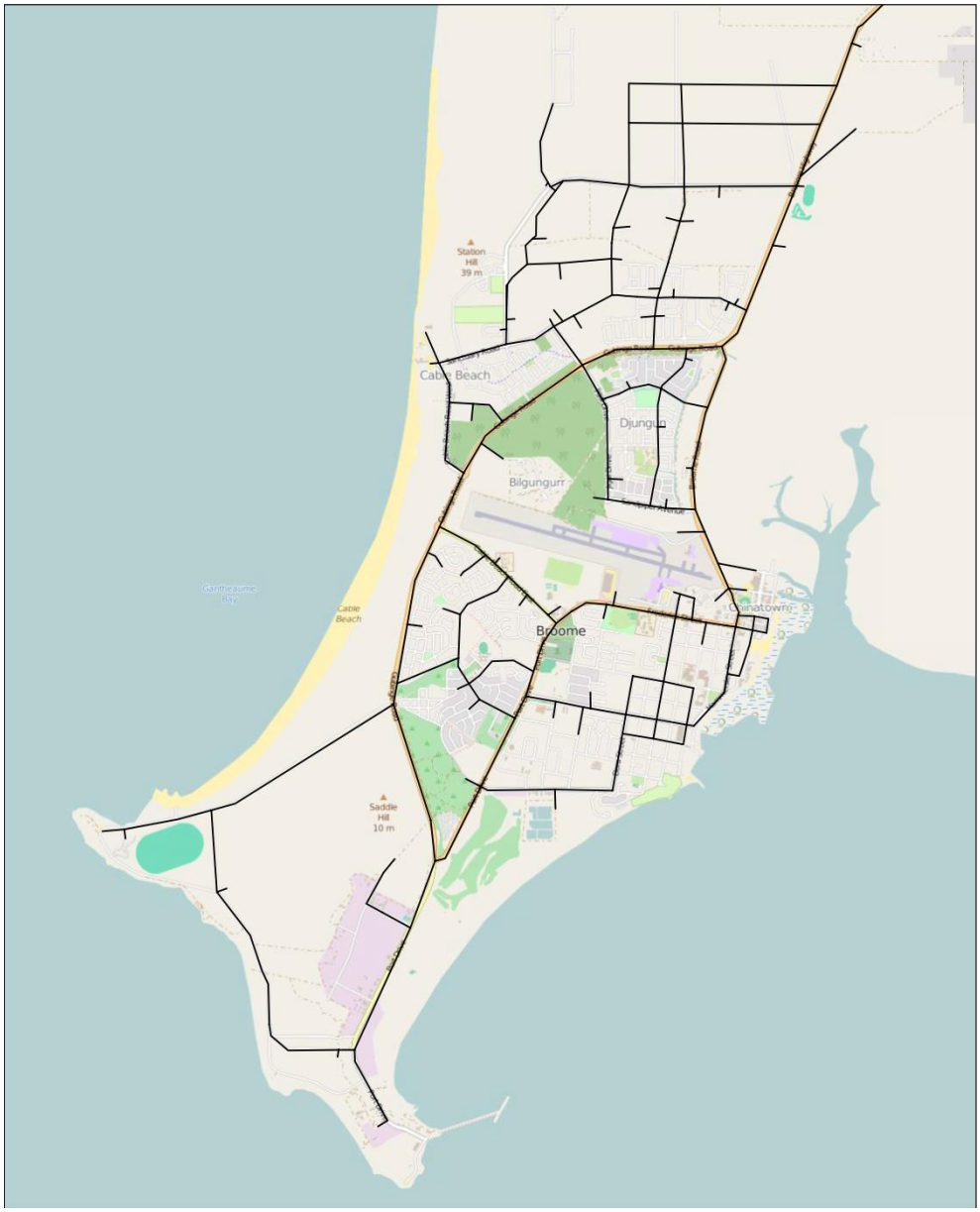
It should be noted that the traffic issues associated with Broome Road are strongly linked with lack of north-south connections. **Section 5.3** of this report indicates that the relocation of the airport and the provision of the additional connections would greatly assist in resolving these issues.

It is also noted that, Broome North Traffic and Access Report has identified that the intersection of Fairway Drive/Jigal Drive/Gubinge Road to be signalised by 2051.However, the analysis shows that there is no requirement for this from the operational prospective.

5.2 2051 Do-something without Airport Relocation Scenario Model Development

The 2051 Do-something without airport relocation scenario is based on the 2051 Do-minimum network as shown in Figure 5.4 below and incorporates the recommendations from **Section 5.1**.

Figure 5.4 : 2051 Do-something without airport relocation Scenario Network



The link volume plot of the Do-something without airport relocation 2051 scenario is shown in **Figure** 5.5. An A3 version of this map is provided in **Appendix A**.

Figure 5.5 : Link Volume Plot, 2051 Do-something without airport relocation Scenario

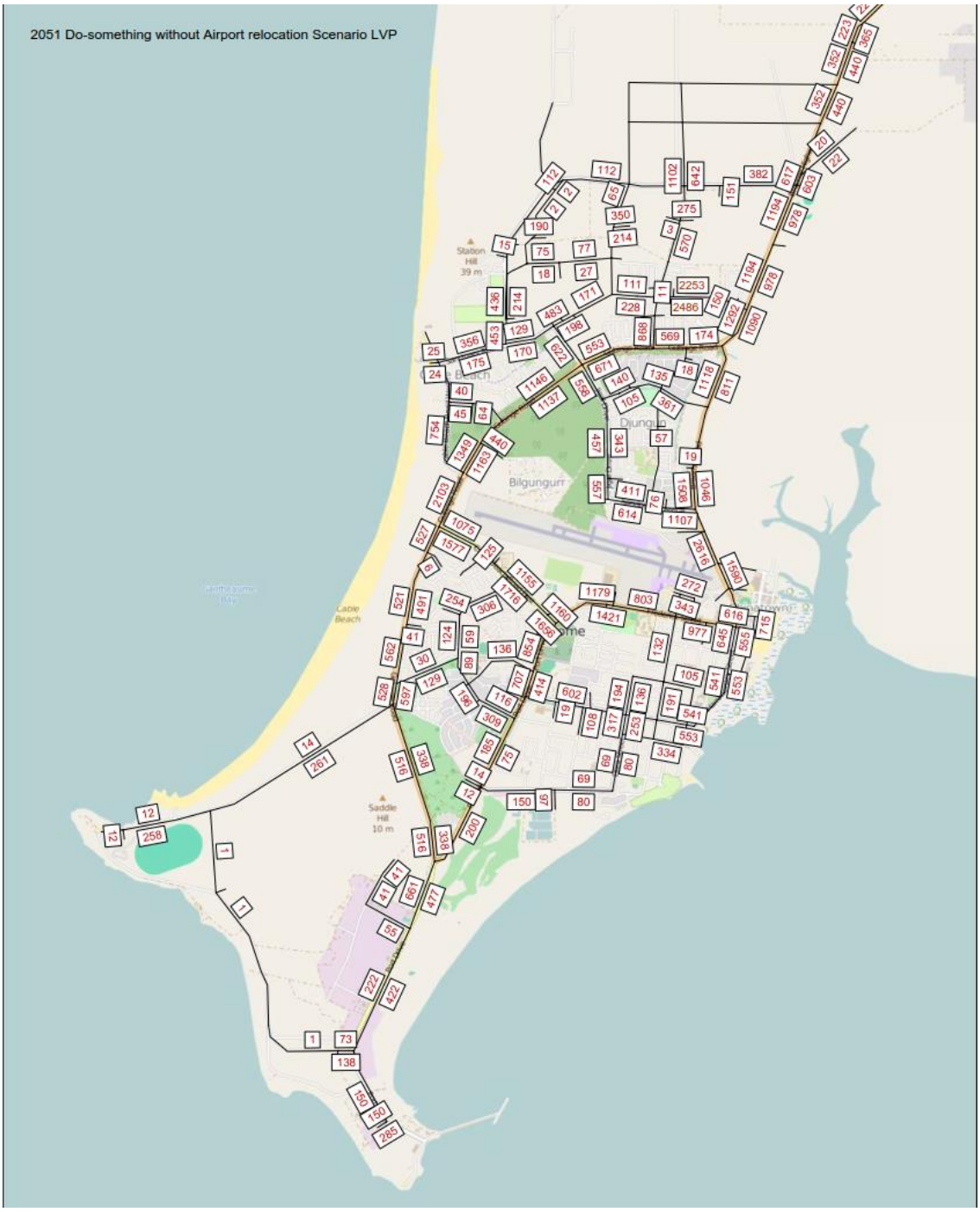
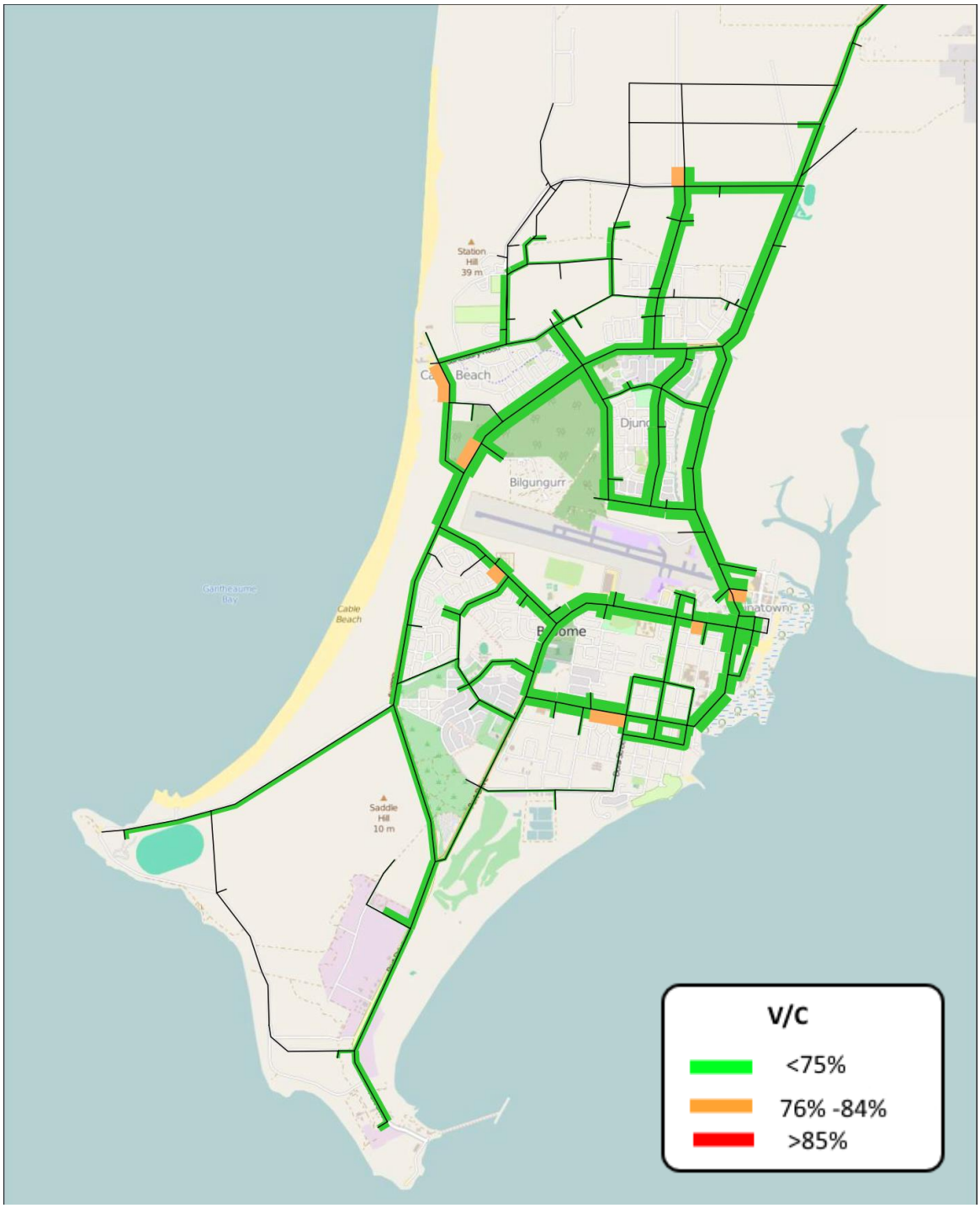


Figure 5.6 below is the graphical output of the vehicle over capacity ratio (V/C) of the road network in the study area for the future 2051 Do-something without airport relocation scenario.

Figure 5.6 : Vehicle over Capacity Ratio, 2051 Do-something without airport relocation Scenario



As shown above in **Figure** 5.6, no further improvement to the road network within the study area is required.

5.2.1 Key Intersections Assessment

Table 5.3 provides the results of the intersection analysis for the 2051 Do-something without airport relocation scenario model. The results of each approach are presented in terms of Level of Service (LOS), Average Delay and Degree of Saturation.

Table 5.3 : Summary of the Intersection Analysis Results – Future 2051 Do-something without airport relocation Scenario

Approach Name	LOS	Average Delay (S)	Degree of Saturation
Intersection of Broome Road/ Gubinge Road			
Broome Road (S)	F	535	2.30
Gubinge Road (W)	A	0	0.00
Broome Road (N)	A	2	0.00
Intersection of Fairway Drive and Gubinge Road			
Fairway Drive (NE)	B	11	0.58
Gubinge Road (SE)	B	12	0.31
Jigal Drive (SW)	C	16	0.38
Gubinge Road (NW)	A	10	0.23
Intersection of Cable Beach Road East/Frederick Street			
Cable Beach Road East (NW)	C	19	0.62
Frederick Street (NE)	A	9	0.40
Port Drive (SW)	C	18	0.75
Intersection of Fairway Drive/ Gubinge Road			
Port Drive (E)	B	14	0.34
Gubinge Road (N)	A	0	0.00
Port Drive (S)	A	1	0.16
Intersection of Port Drive/Guy Street			
Port Drive (N)	A	7	0.28
Guy Street (E)	A	10	0.64
Port Drive (S)	A	9	0.38
Intersection of Broome Road/Sandpiper Avenue			
Broome Road (N)	B	11	0.56
Sandpiper Avenue (W)	C	23	0.67
Broome Road (S)	A	4	0.75
Hamersley Street (N)	B	12	0.40
Frederick Street (W)	B	11	0.31
Hamersley Street (S)	C	16	0.62
Frederick Street (E)	B	12	0.53

The analysis suggests that the improvement recommendations mitigate the identified issues under the Do-minimum without airport redevelopment. It is noted that no improvement was suggested for the intersection of Gubinge Road/Broome Road, as it was assumed that currently due to the width of the median vehicles turning right from Broome Road to Gubinge Road are able to make the turn in two stages.

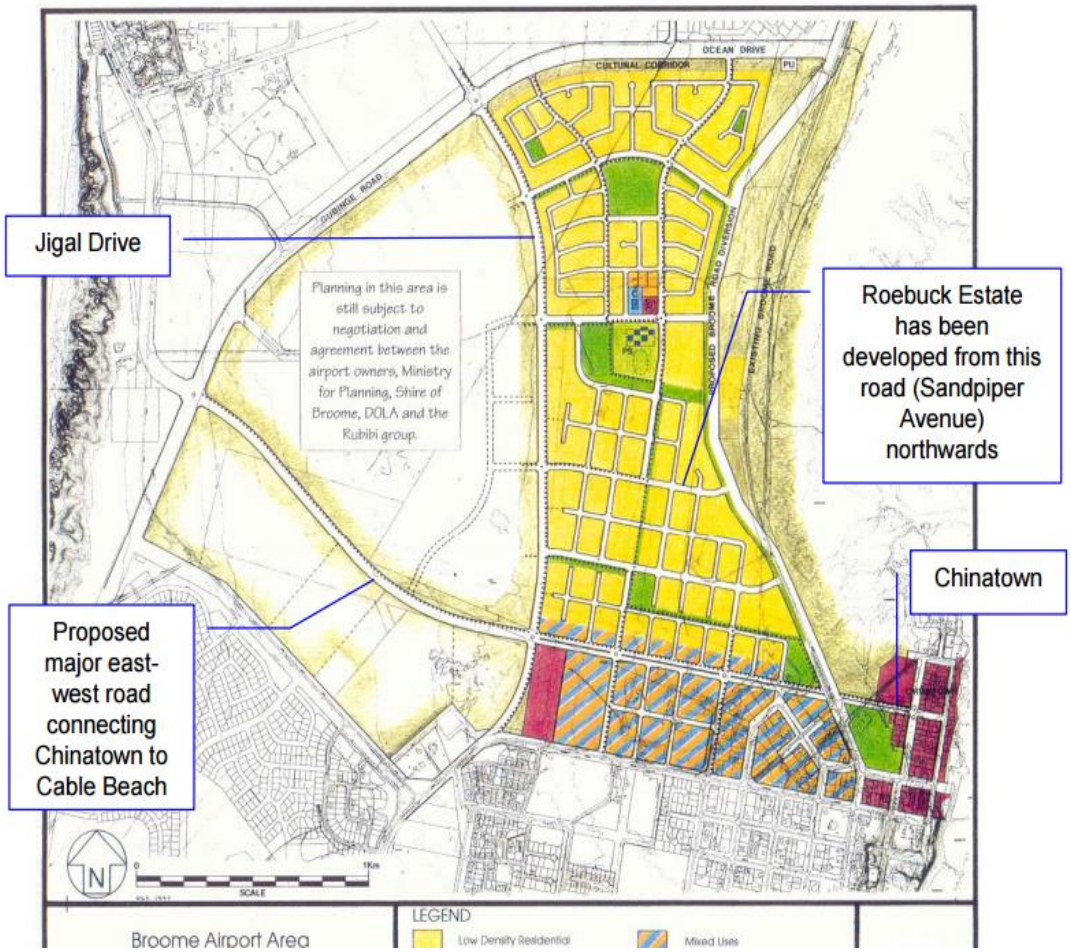
5.3 2051 Do-minimum Scenario with airport relocation

In order to develop 2051 with airport relocation scenario, the 2051 Do-minimum without airport relocation scenario model was used as a base and the road network changes expected as a result of the airport relocation and the roads in the northern area of Broome were included.

Relocating the airport will result in the following changes to the existing network (as shown in **Figure** 5.7):

- A major east-west road link between Chinatown and Cable Beach Road West;
- A north-south spine road connecting Gubinge Road and Port Drive (extension to Jigal Drive)
- The east side of the future extension of Jigal Drive would then be developed as mixed use developments and shops.

Figure 5.7 : Airport Relocation Plan



Source: Broome Airport Development Plan, February 2012

It is expected that the extra road network that would be added to the existing road network would carry the extra traffic on the roads that were defined to be congested in 2051 Do-minimum scenario.

The 2051 Do-minimum with airport relocation scenario network is shown in **Figure** 5.8.

Figure 5.8 : 2051 Do-minimum with airport relocation Scenario Network

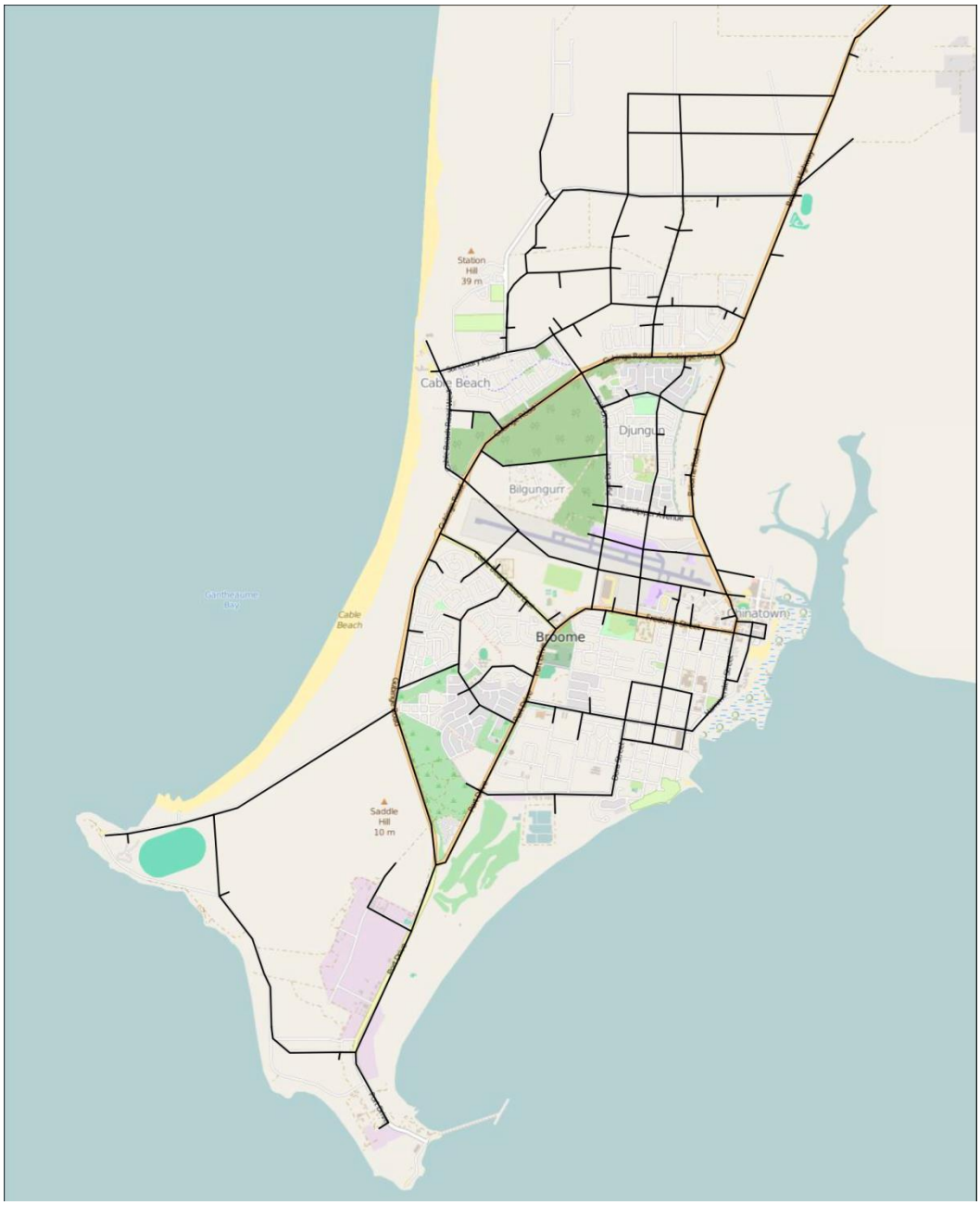


Figure 5.9 shows the link volumes for this scenario. An A3 version of this map is provided in **Appendix A**. It should be noted that:

- Broome Road carries significantly less traffic under this scenario due to the provision of the additional north-south connections which is anticipated to perform a similar function to that of Broome Road.

Figure 5.9 : Link Volume Plot, 2051 Do-minimum with airport relocation Scenario

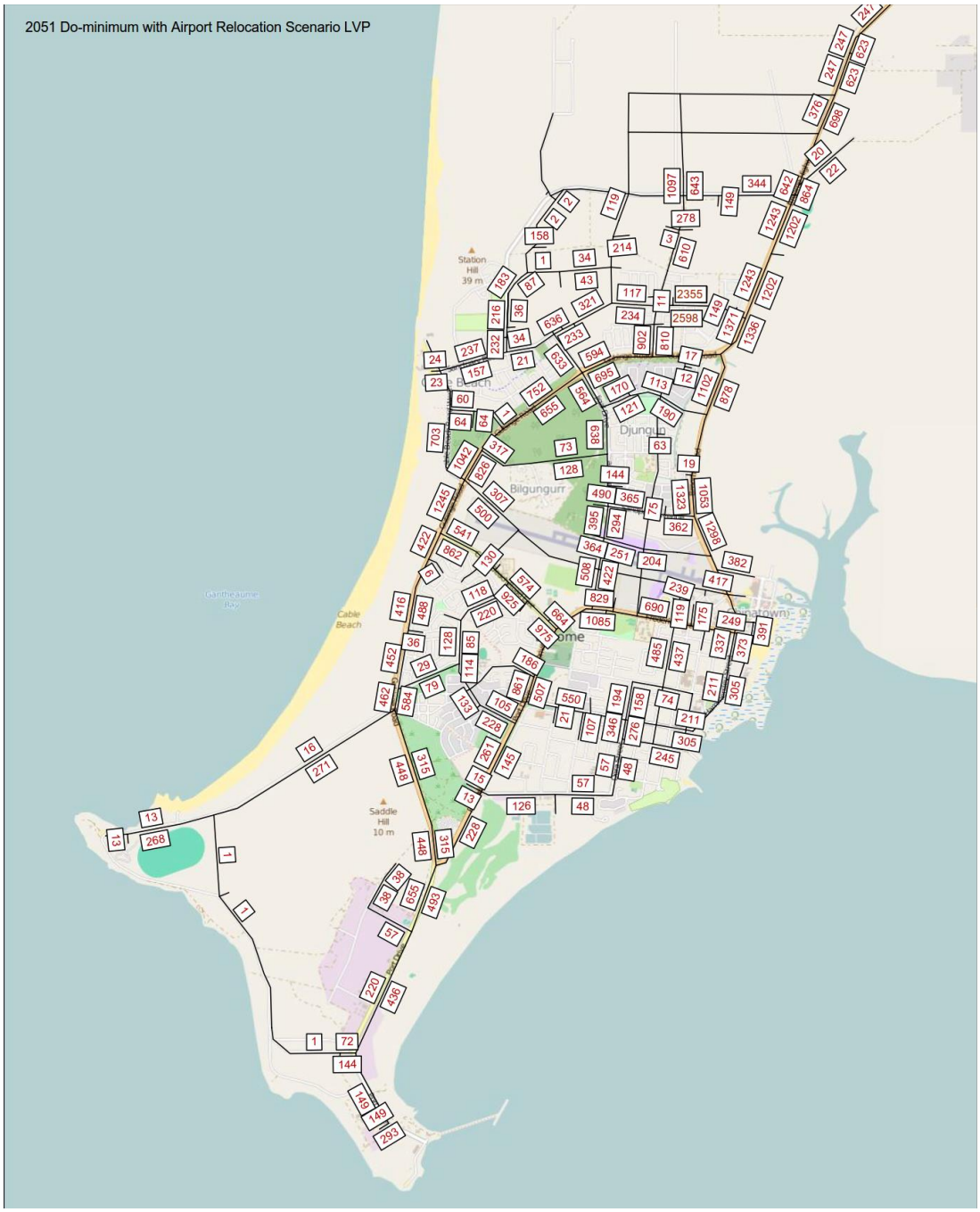
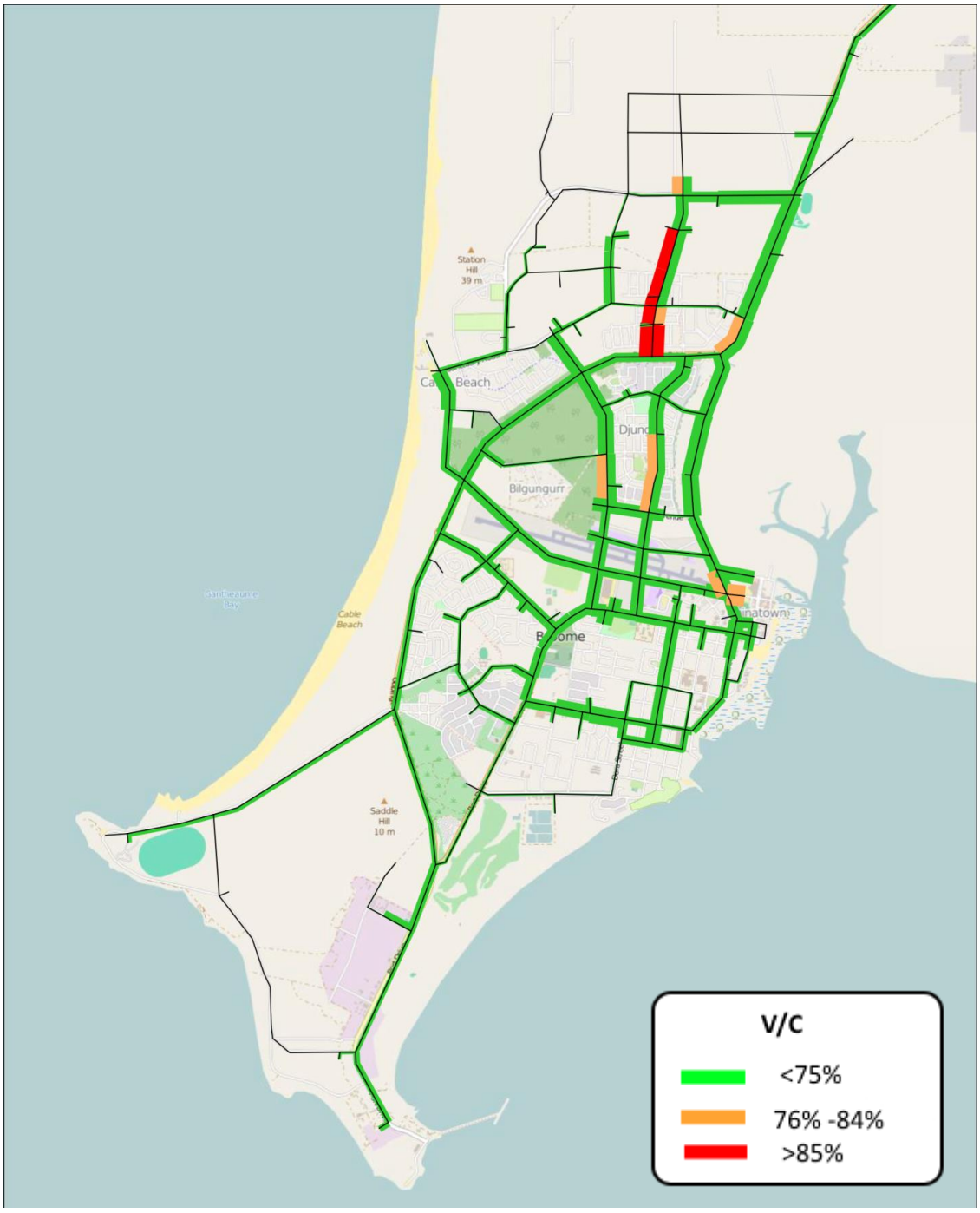


Figure 5.10 below is the graphical output of the vehicle over capacity ratio (V/C) of the road network in the study area for the 2051 Do-minimum with airport relocation scenario. All sections of the road network within the study area are expected to operate within acceptable levels except for Magabala Road from Gubinge Road to the south of Fairway Drive.

Figure 5.10 : Vehicle over Capacity Ratio, 2051 Do-minimum with airport relocation Scenario



5.3.1 Recommended Link Improvement

On the basis of the above, Jacobs recommends that the 2051 Do-minimum with airport relocation scenario improvement options (in addition to the improvements identified as part of the 2031 Do-something scenario) includes the following: -

Magabala Road

Magabala Road between Gubinge Road and Fairway Drive is recommended to be upgraded from a two-lane two-way carriageway to a four-lane two-way carriageway.

5.3.2 Key Intersection Assessment:

Table 5.4 provides the results of the intersection analysis for the 2051 do-minimum scenario model. The results of each approach are presented in terms of Level of Service (LOS), Average Delay and Degree of Saturation.

Table 5.4 : Summary of the Intersection Analysis Results – Future 2051 Do-minimum with airport relocation Scenario

Approach Name	LOS	Average Delay (S)	Degree of Saturation
Intersection of Broome Road/ Gubinge Road			
Broome Road (S)	F	1437	4.11
Gubinge Road (W)	A	2	0.12
Broome Road (N)	A	0	0.00
Intersection of Fairway Drive and Gubinge Road			
Fairway Drive (NE)	A	9	0.38
Gubinge Road (SE)	A	9	0.26
Jigal Drive (SW)	B	12	0.31
Gubinge Road (NW)	A	7	0.22
Intersection of Cable Beach Road East/Frederick Street			
Cable Beach Road East (NW)	A	8	0.31
Frederick Street (NE)	A	5	0.34
Port Drive (SW)	A	3	0.40
Intersection of Fairway Drive/ Gubinge Road			
Port Drive (E)	B	14	0.32
Gubinge Road (N)	A	0	0.00
Port Drive (S)	A	2	0.20
Intersection of Port Drive/Guy Street			
Port Drive (N)	A	1	0.41
Guy Street (E)	B	13	0.71
Port Drive (S)	A	10	0.30
Intersection of Broome Road/Sandpiper Avenue			
Broome Road (N)	A	3	0.01
Sandpiper Avenue (W)	B	13	0.42
Broome Road (S)	C	24	0.73
Hamersley Street (N)	A	6	0.24
Frederick Street (W)	A	5	0.15
Hamersley Street (S)	A	6	0.18
Frederick Street (E)	A	7	0.25

As indicated in **Table 5.2** above, the southern approach of the:

- **Intersection of Broome Road/Gubinge Road**: this intersection is expected to operate at LOS F.

5.3.3 Recommended Intersection Improvements:

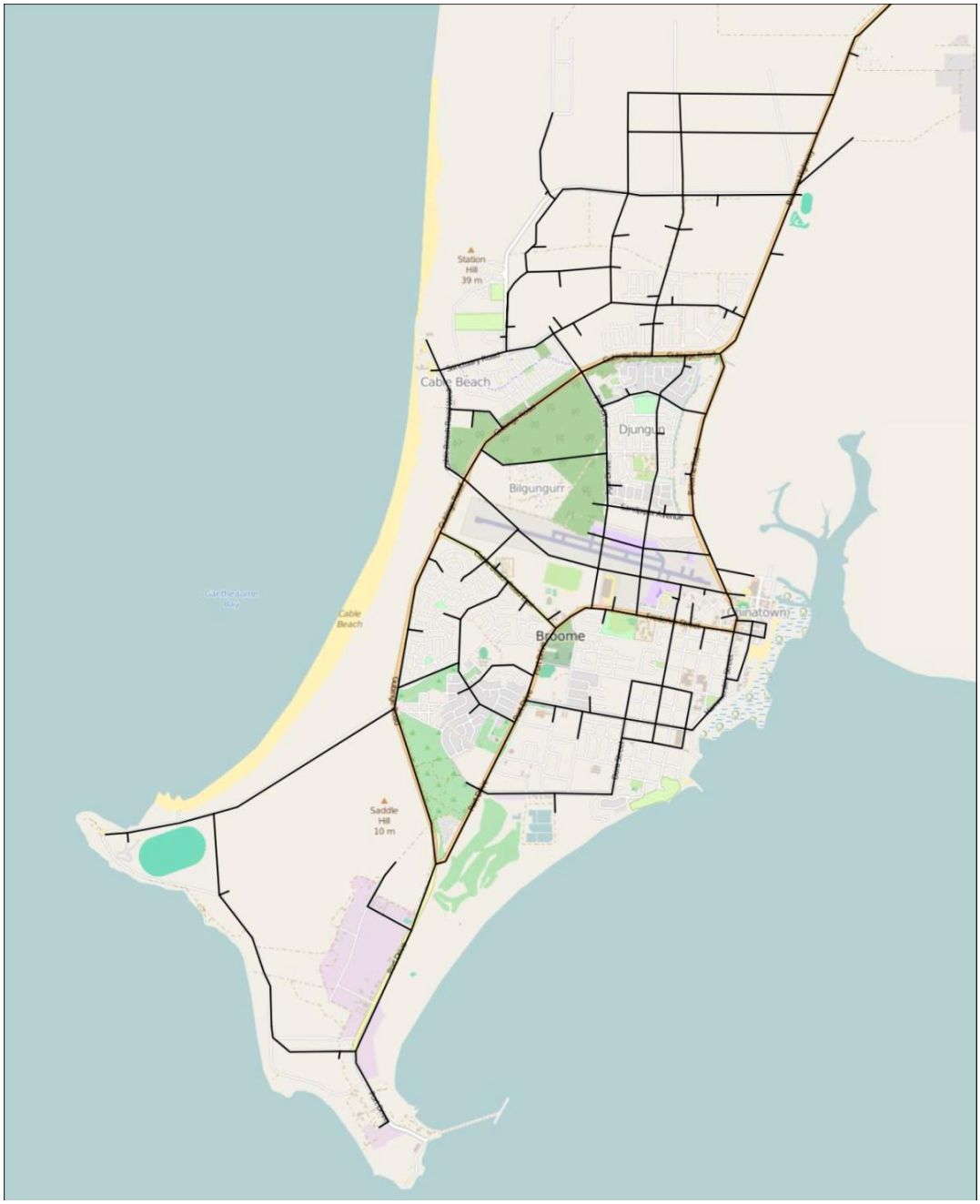
Based on the above, Jacobs recommends that the following improvement options for the 2051 Do-minimum with airport relocation scenario be considered: -

- **Intersection of Broome Road/Gubinge Road**:
    - Providing a single lane roundabout at this intersection would reduce average delays for the right turning movement from Broome Road into Broome Road East.
- **Intersection of Gubinge Road/Magabala Road:**
    - This intersection was not included in the modelled network but based on the SKM Traffic an Access report for Broome North dated 22 January 2010, this intersection needs to be upgraded to a signal control intersection to accommodate pedestrian crossing.

5.4 2051 Do-something Scenario with Airport relocation Model Development

The 2051 Do-something with airport relocation scenario was developed by using the 2051 Do-minimum with airport relocation and the improvements recommended in Section. The 2051 do-something with airport relocation scenario network is shown in **Figure** 5.11**.**

Figure 5.11 : 2051 Do-something Scenario with airport relocation Network



The link volume plot of the 2051 Do-something with airport relocation scenario is shown in **Figure** 5.12**.** An A3 version of this map is provided in **Appendix A**.

Figure 5.12 : Link Volume Plot, 2051 Do-something with airport relocation Scenario

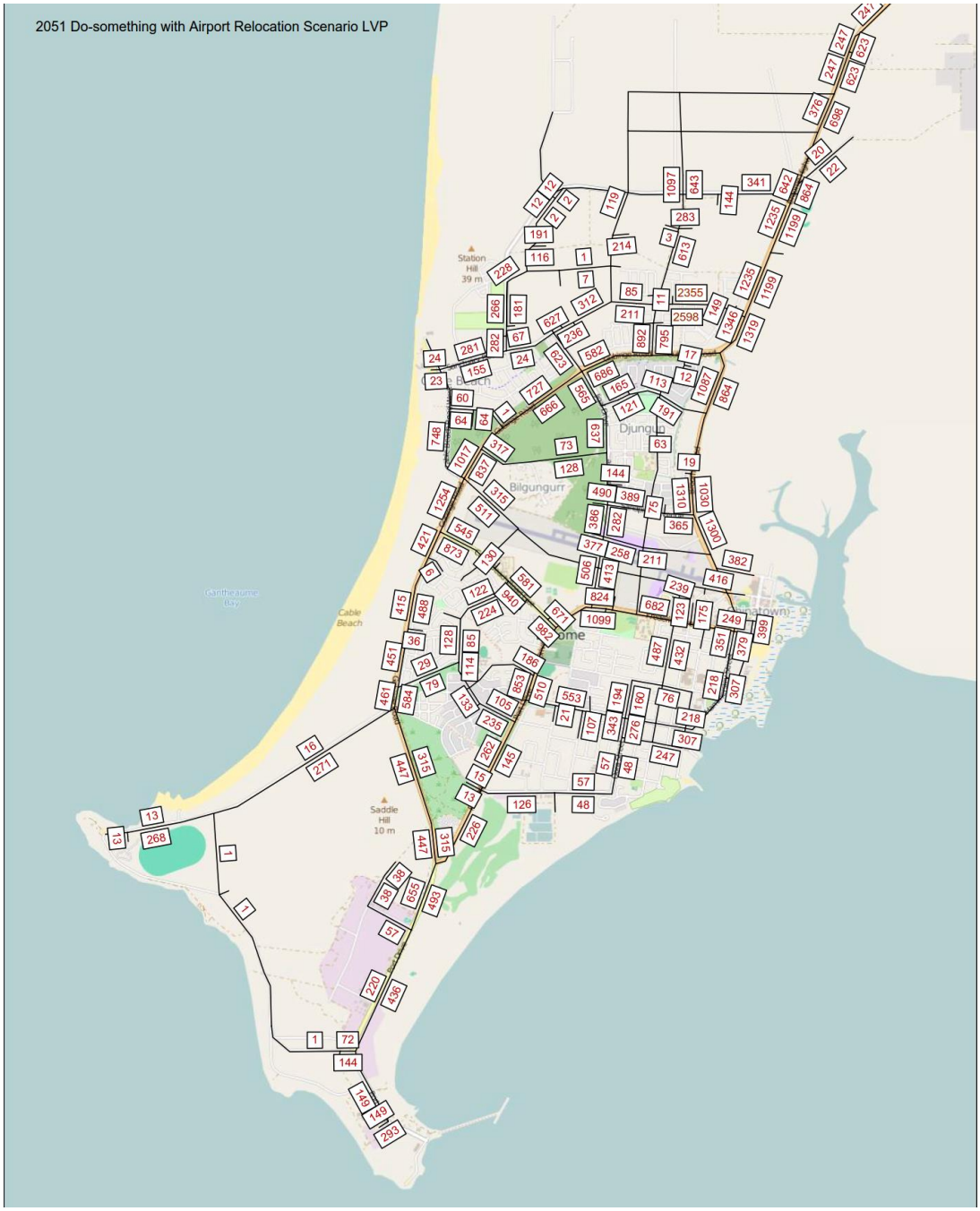
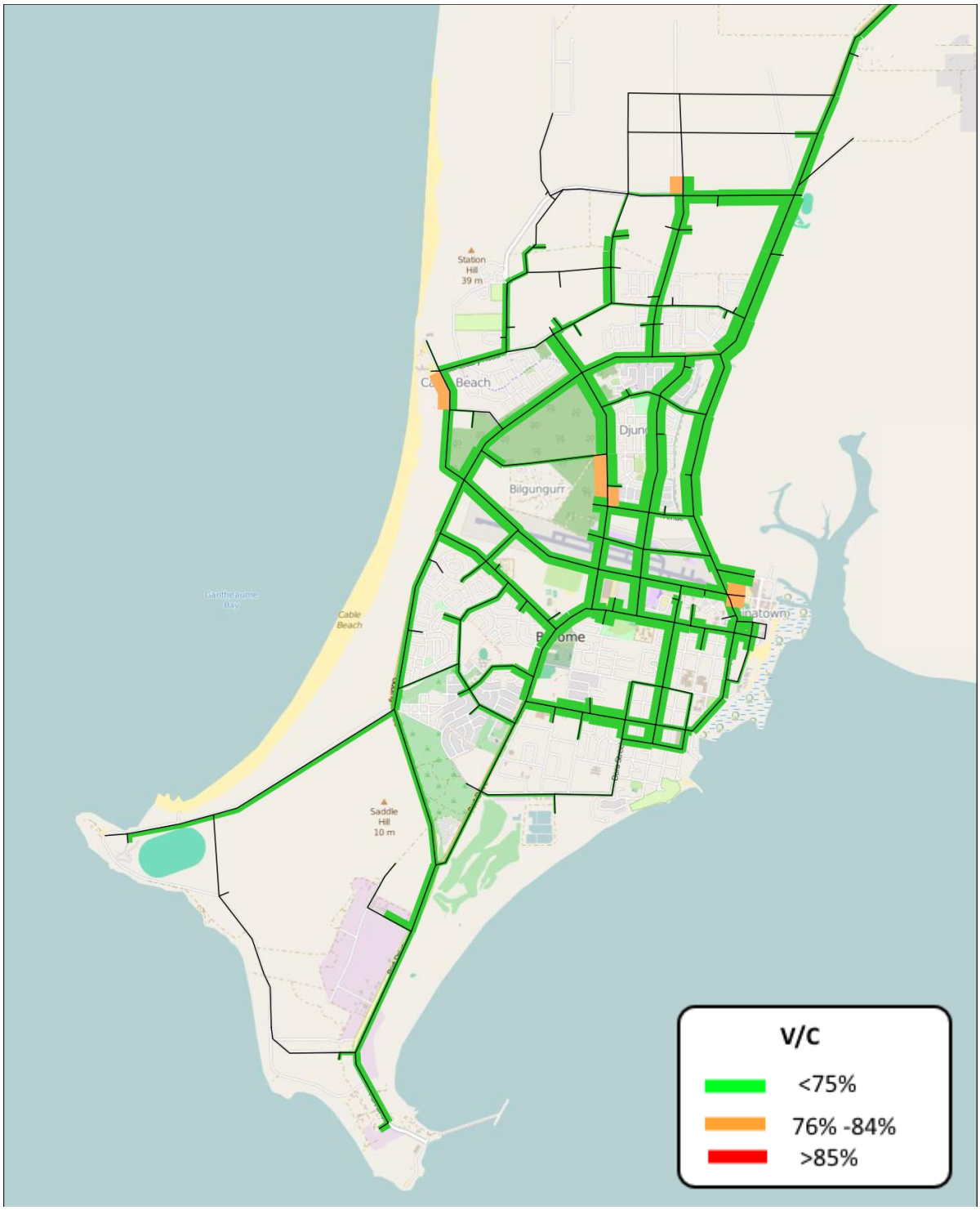


Figure 5.13 below is the graphical output of the vehicle over capacity ratio (V/C) of the road network in the study area in 2051 Do-something with airport relocation scenario.

Figure 5.13 : Vehicle over Capacity Ratio, 2051 Do-something with airport relocation Scenario



5.4.1 Key Intersections Assessment

Table 5.5 provides the results of the intersection analysis for the 2051 Do-something scenario with airport relocation model. The results of each approach are presented in terms of Level of Service (LOS), Average Delay and Degree of Saturation.

Table 5.5 : Summary of the Intersection Analysis Results – Future 2051 Do-something with airport relocation Scenario

Approach Name	LOS	Average Delay (S)	Degree of Saturation
Intersection of Broome Road/ Gubinge Road			
Broome Road (S)	D	31	0.93
Gubinge Road (W)	A	9	0.36
Broome Road (N)	A	6	0.47
Intersection of Fairway Drive and Gubinge Road			
Fairway Drive (NE)	A	9	0.39
Gubinge Road (SE)	A	9	0.24
Jigal Drive (SW)	B	11	0.28
Gubinge Road (NW)	A	7	0.24
Intersection of Cable Beach Road East/Frederick Street			
Cable Beach Road East (NW)	A	8	0.31
Frederick Street (NE)	A	5	0.35
Port Drive (SW)	A	3	0.40
Intersection of Fairway Drive/ Gubinge Road			
Port Drive (E)	B	13	0.30
Gubinge Road (N)	A	0	0.00
Port Drive (S)	A	2	0.20
Intersection of Port Drive/Guy Street			
Port Drive (N)	A	1	0.40
Guy Street (E)	B	12	0.68
Port Drive (S)	A	10	0.29
Intersection of Broome Road/Sandpiper Avenue			
Broome Road (N)	A	3	0.01
Sandpiper Avenue (W)	B	13	0.45
Broome Road (S)	A	20	0.72
Hamersley Street (N)	A	6	0.25
Frederick Street (W)	A	5	0.15
Hamersley Street (S)	A	6	0.16
Frederick Street (E)	A	7	0.25

The analysis shows that with the proposed changes all the intersections would operate satisfactorily under the 2051 Do-something with airport relocation traffic demand.

6. Recommended Pedestrian Facilities

Currently, there is a 2m wide footpath along some sections of the eastern side of Old Broome Road between Sandpiper Avenue and Short Street. The existing footpath needs to be removed as part of doubling the road. The footpath that is currently provided on the western side of Broome Road at the intersection of Broome Road/Sandpiper Avenue needs to be extended to connect to the path that is provided at the intersection of Broome Road/Short Street. It is recommended that the new path has the width of 3m to be able to function as shared path and accommodate cyclists and pedestrians. WAPC guidelines have identified the traffic volumes that would adversely impact on the safety and efficiency of pedestrians trying to cross. This is shown in **Table** 6.1 below.

Table 6.1 : Traffic volumes affecting pedestrian crossing amenity

Road cross-section	Traffic volume affecting ability of pedestrians to cross * (vehicles per hour – two way)
2 lane undivided	1100 vph
2 lane divided (or with pedestrian refuge islands)	2800 vph
4 lane undivided (without pedestrian refuge islands)	700 vph
4 lane divided (or with pedestrian refuge islands)	1600 vph

Source: WAPC Guidelines for Transport Assessment for Structure Plans

As per the information provided in the above table, a safe crossing facility should be provided in this section of the road to connect the future footpath on the western side of Broome Road to the paths along the routes connecting Broome Road to Chinatown.

7. Contribution Methodology and Unit Rate

This section covers the indicative costs of the infrastructure improvements recommended as part of the traffic analysis in the earlier sections and also recommends a contribution methodology and a cost rate per trip as generated by the new developments in the study area.

As part of this study, a number of infrastructure improvement measures have been identified as necessary to address the expected increase in traffic associated with new developments within the study area. The costs have been identified using the Shire's cost estimate spreadsheet. To assist in the fair and equitable distribution of costs associated with the burden of these additional infrastructure needs, a developer contribution methodology has been recommended.

As identified in State Planning Policy 3.6 (SPP3.6) – *Development Contributions for Infrastructure,* for this approach to be accepted, it would need to be incorporated into the local planning scheme or amendment to the local planning scheme to incorporate the plan.

7.1 Indicative Costs for Infrastructure Improvements

The Shire has provided indicative cost estimates for the infrastructure improvements recommended as part of the traffic analysis in the previous section which we have reviewed and utilised as part of this report. These are shown in **Table 7.1** below. The cost provided is based on the normal specification for road construction within the Shire. it is also noted that the cost provided is only to provide an indication of the cost that can be expected as a result of the improvements. A detailed cost analysis can only be undertaken when the concept/detailed design has been prepared.

The Shire's normal specifications to be considered during the road construction are provided below:

- 150mm compacted natural subgrade;
- 150mm imported base course;
- Applying a primer;
- Providing a 2 coat seal (14mm/7mm);
- Providing semi-mountable kerbs both sides;
- All medians to use paving as infill;
- 2m wide footpaths;
- Cultural monitors during box out for a few days depending on scale of works;
- 15% of project cost to be allocated for design, survey and project management; and
- Traffic management cost of at least $1000 a day.

The detailed cost estimate is included in **Appendix B.**

Table 7.1 : Improvement Options by 2031

Location	Improvement	Indicative Cost
Intersection of Frederick Street/Cable Beach Road East/Port Drive	Right turn pocket on the north east approach	$165,000
	Left turn pocket on the south-west approach	$310,000
	Exit lane on the north-west approach	$171,000
Broome Road from Sandpiper Avenue to Short Street	Upgrading from two way two lanes undivided carriageway to a four-lane two-way divided carriageway	$23,000,000
Sandpiper Avenue from Broome Road to Sanderling Avenue	Upgrading from two way two lanes undivided carriageway to a four-lane two-way divided carriageway	$1,500,000
Guy Street from Hunter Street to Port Drive	Upgrading from two way two lanes undivided carriageway to a four-lane two-way divided carriageway	$1,820,000
Intersection of Port Drive/Guy Street	Upgrading to roundabout controlled intersection	$960,000
Total		**$27,926,000**

7.2 Recommended Development Contribution Methodology

There are a number of methodologies that have been applied around the world. The Shire has indicated a requirement to provide a rate for the contribution in the cost of new road infrastructure by each new residential dwelling. A few number of contribution methodologies are provided below:

Table 7.2 : Residential Development Contribution Methodologies

Method	Description
Trip Demand – Traffic Ratio Methodology	Calculates the developer contribution based on the overall level of traffic growth, both from developments and general background growth, in relation to the existing base traffic levels.
Distance from Infrastructure	Establishes a level of contribution based on the distance between the proposed development and the proposed infrastructure scheme.
Trip Demand – Traffic Growth Methodology	Calculates developer contributions based on the percentage of the development traffic relative to the projected overall growth in the total number of trips on the network, but does not consider the base traffic in the calculation.
Trip Assessment	Calculates the developer contributions based on the level of impact the development has on a road network.
Developer Pays All	In this method, all future development is dependent on the introduction of new infrastructure to accommodate demand associated with those developments.

Jacobs recommends that the Shire of Broome utilise the Trip Demand - Traffic Growth methodology for the following reasons:

- It is considered the fairest - this method calculates the developer contributions based on the percentage of the development traffic relative to the overall growth in the total number of trips on the network;
- It is relatively simple - It does not consider the base traffic in the calculation. The base traffic does not contribute under this methodology as it has effectively paid for the network it utilises and as it does not need the future infrastructure;
- It is not exposed to variances of assumptions regarding assignment and distribution in the traffic model; and
- This method provides a clear and sound basis with linkages to the local government's strategic and financial planning processes.

The rate of contribution, in the road infrastructure improvement or the cost rate per trip projected by any new development for each new development, is calculated as per following:

$$\text{cost rate per dwelling} = \frac{\text{Total Road Infrastructure Improvement Cost by 2031}}{\text{Shire of Broome Townsite Average Daily Traffic Growth from 2016 to 2031}} * \text{Daily Trip Generation rate per Dwelling}$$

The above cost rates then need to be multiplied by the number of dwellings to get the total amount of contribution for the development.

It is also noted that traffic growth from 2016 to 2031 is calculated based on the difference between the total number of trips within the network in 2016 and 2031.

In order to calculate the average daily traffic growth, the total growth of the peak hour traffic needs to be divided by the average ratio of peak hour traffic volumes over daily traffic volumes which is about **8%** (as described in **Section 2.1**). Total PM peak hour traffic within the network in 2016 and 2031 are shown in table **Table 7.3** below.

Table 7.3 : Total Number of Trips within the Network during PM Peak Hour

Year	Total Peak Hour Traffic within the network
2016	6420
2031	10667
Total Growth	4247

On the basis of the above, average daily traffic growth within the Shire of Broome townsite from 2016 to 2031 is estimated to be approximately 53087.

8. Conclusions and Recommendations

Jacobs has been appointed by the Shire of Broome to undertake a traffic study for the Broome Townsite to identify network improvements required up until 2031 to inform the preparation of Development Contribution Plan (DCP). The study also considers infrastructure needs for the ultimate development of all areas zoned for development under Local Planning Scheme No. 6 which is nominally expected to be undertaken by 2051.

The Shire is also considering relocating the existing airport, currently located north-west of Chinatown, to a location outside of the study area. Therefore an additional network was developed for 2051 to incorporate the airport relocation.

This traffic study examined existing traffic conditions for the study area and analysed the future 2031 and 2051 traffic and development scenarios in order to identify the impact on the existing and proposed road network. The following intersections have been identified for road infrastructure improvements to increase capacity and level of service:

- **By 2031**:
    - Frederick Street/ Cable Beach Road East;
    - Port Drive/ Guy Street;
    - Broome Road between Short Street and Sandpiper Avenue;
    - Sandpiper Avenue between Broome Road and Sanderling Drive; and
    - Guy Street between Hunter Street and Port Drive.
- **By 2051 without Airport Relocation:**
    - Broome Road between Short Street and Frederick Street;
    - Cable Beach Road East between Frederick Street and Reid Road Magabala Road;
    - Magabala Road between Gubinge Road and Fairway Drive;
    - Intersection of Broome Road/ Sandpiper Avenue;and
    - Intersection of Broome Road/Gubinge Road.
- **By 2051 with Airport Relocation**
    - Magabala Road between Gubinge Road and Fairway Drive.
    - Intersection of Broome Road/Gubinge Road

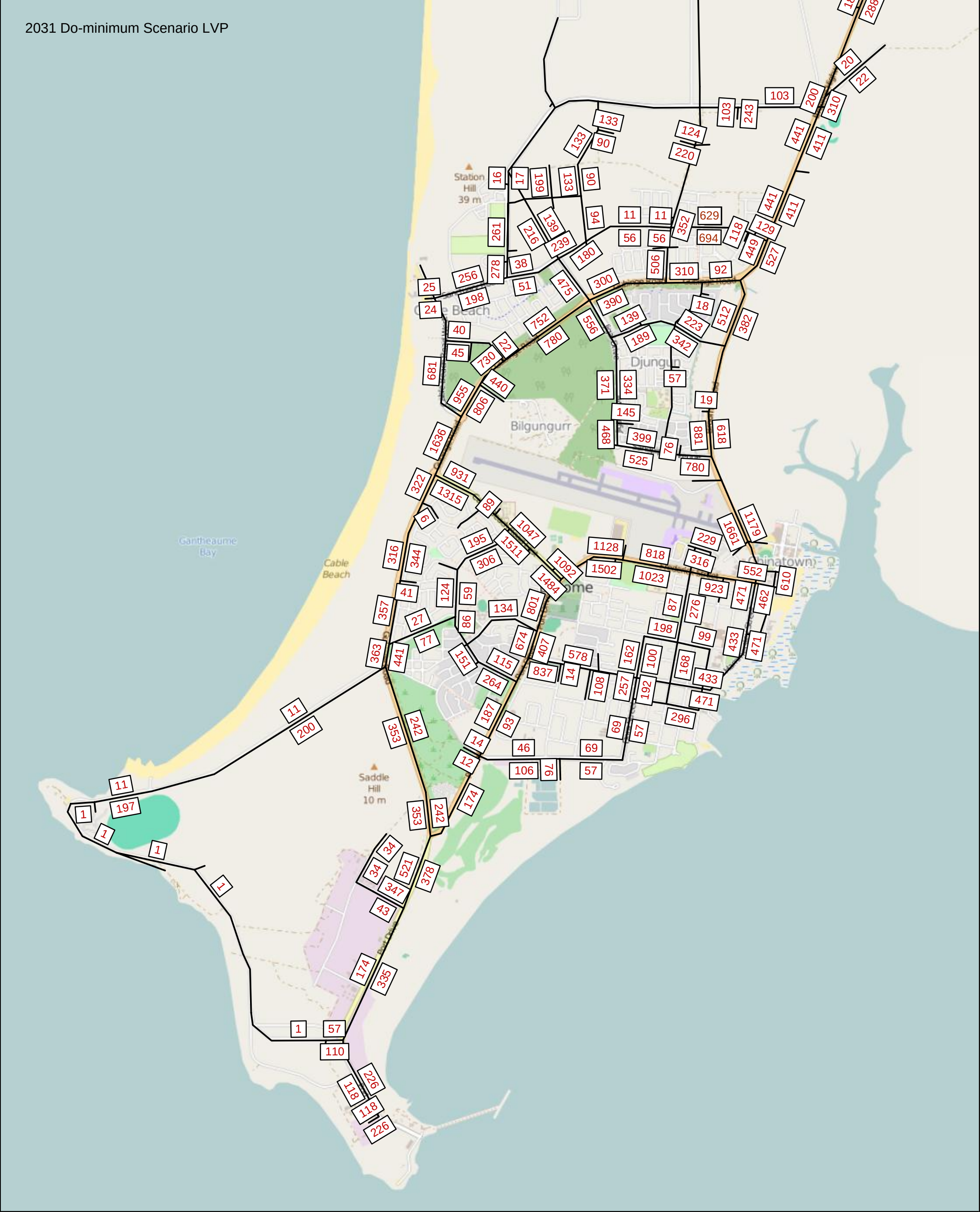
A number of development contribution methodologies that have been applied around the world. Jacobs recommends that the Shire of Broome utilise the Trip Demand - Traffic Growth methodology for calculating development contributions.

A cost rate per dwelling can be calculated based on the total cost of infrastructure improvements recommended in this report.

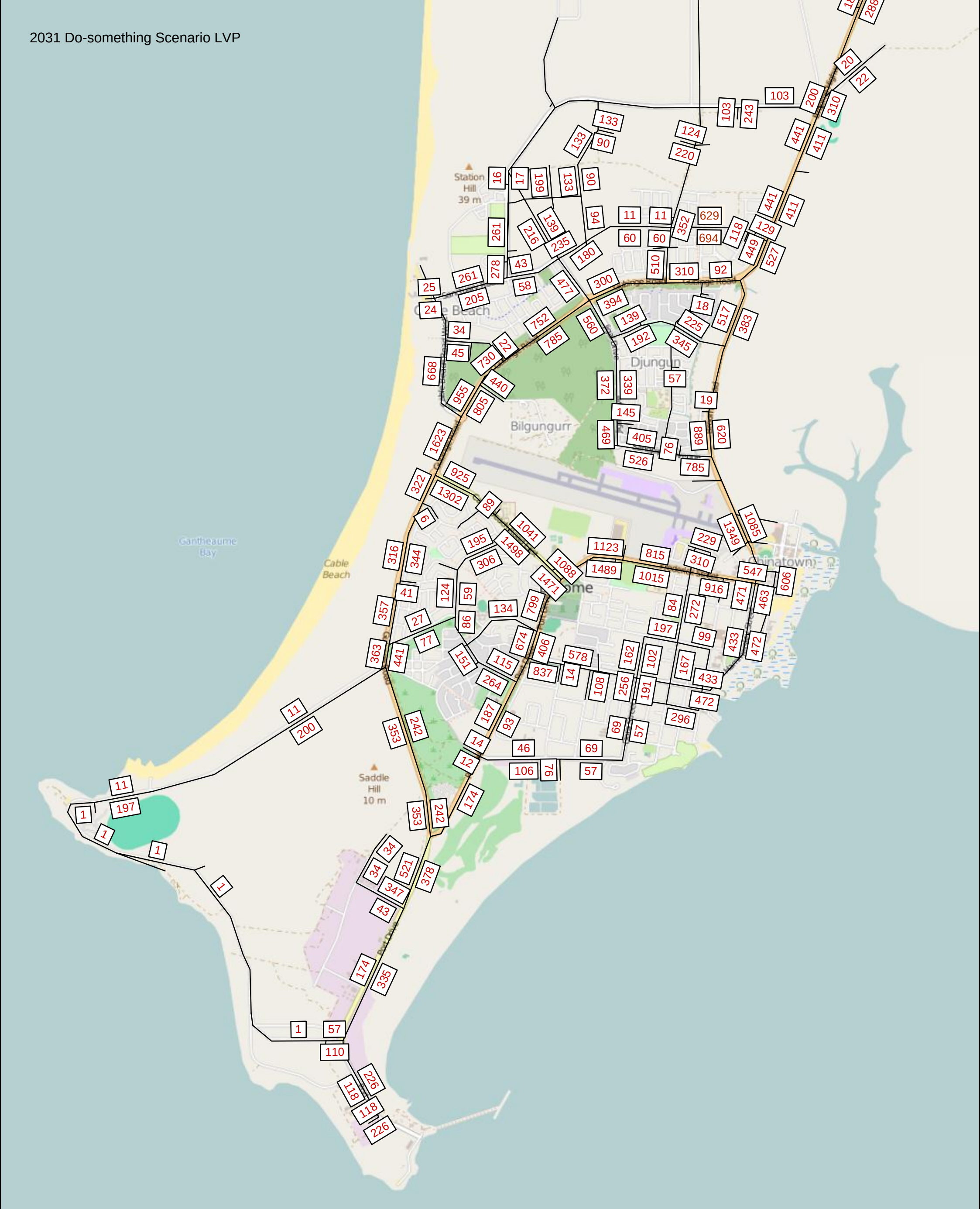
Appendix A. Link Volume Plots

Base 2016 Scenario

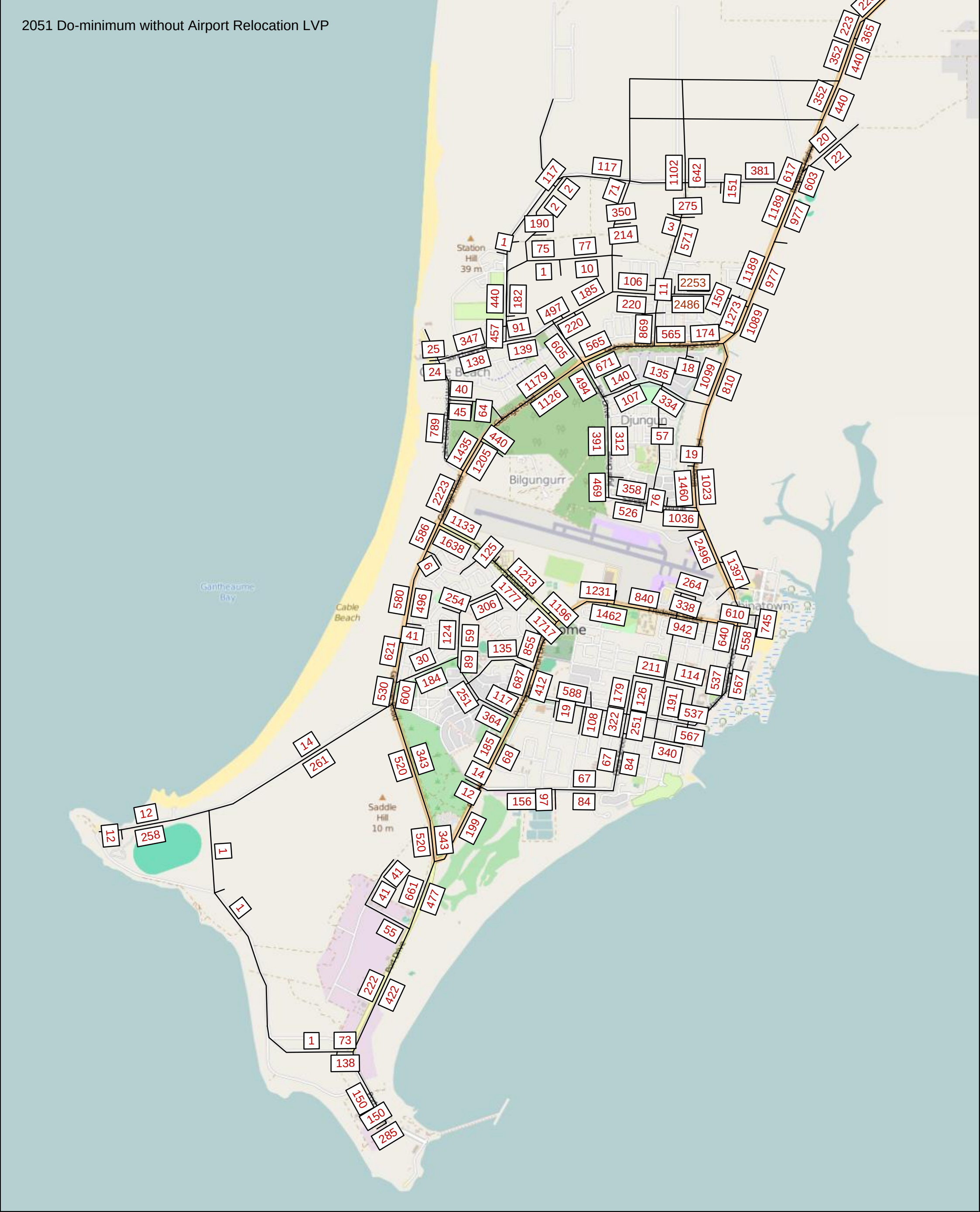
2031 Do-minimum Scenario LVP



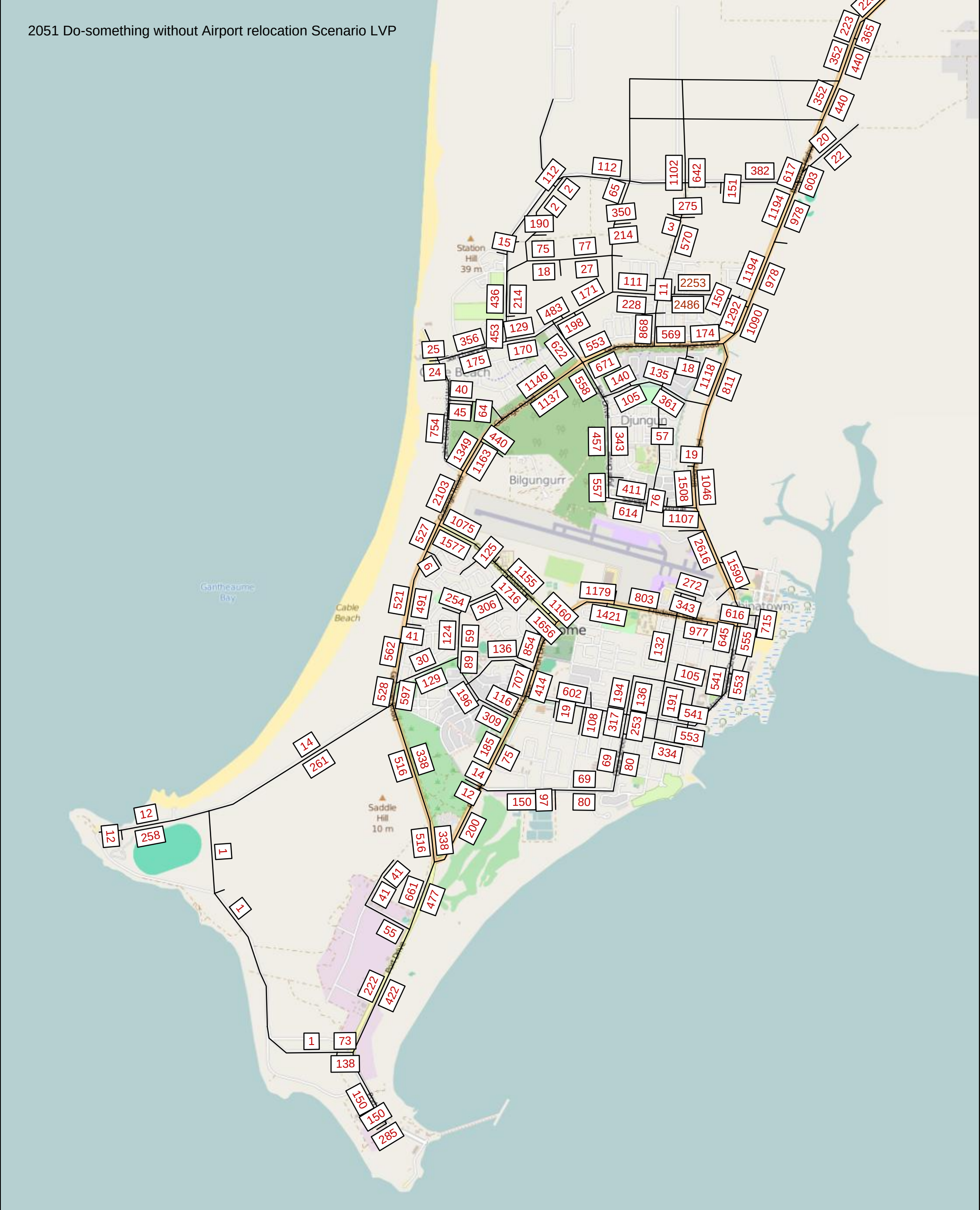
2031 Do-something Scenario LVP



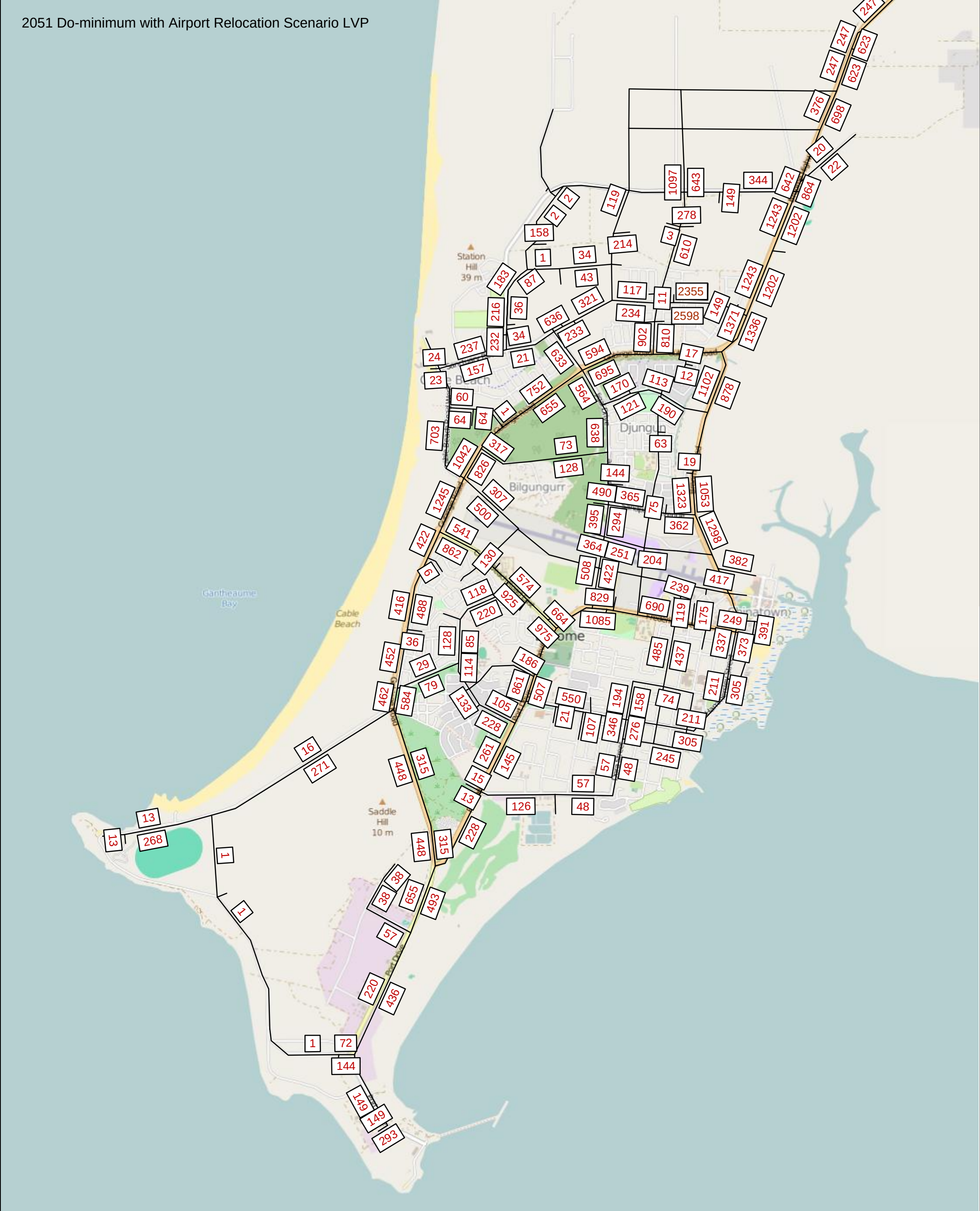
2051 Do-minimum without Airport Relocation LVP



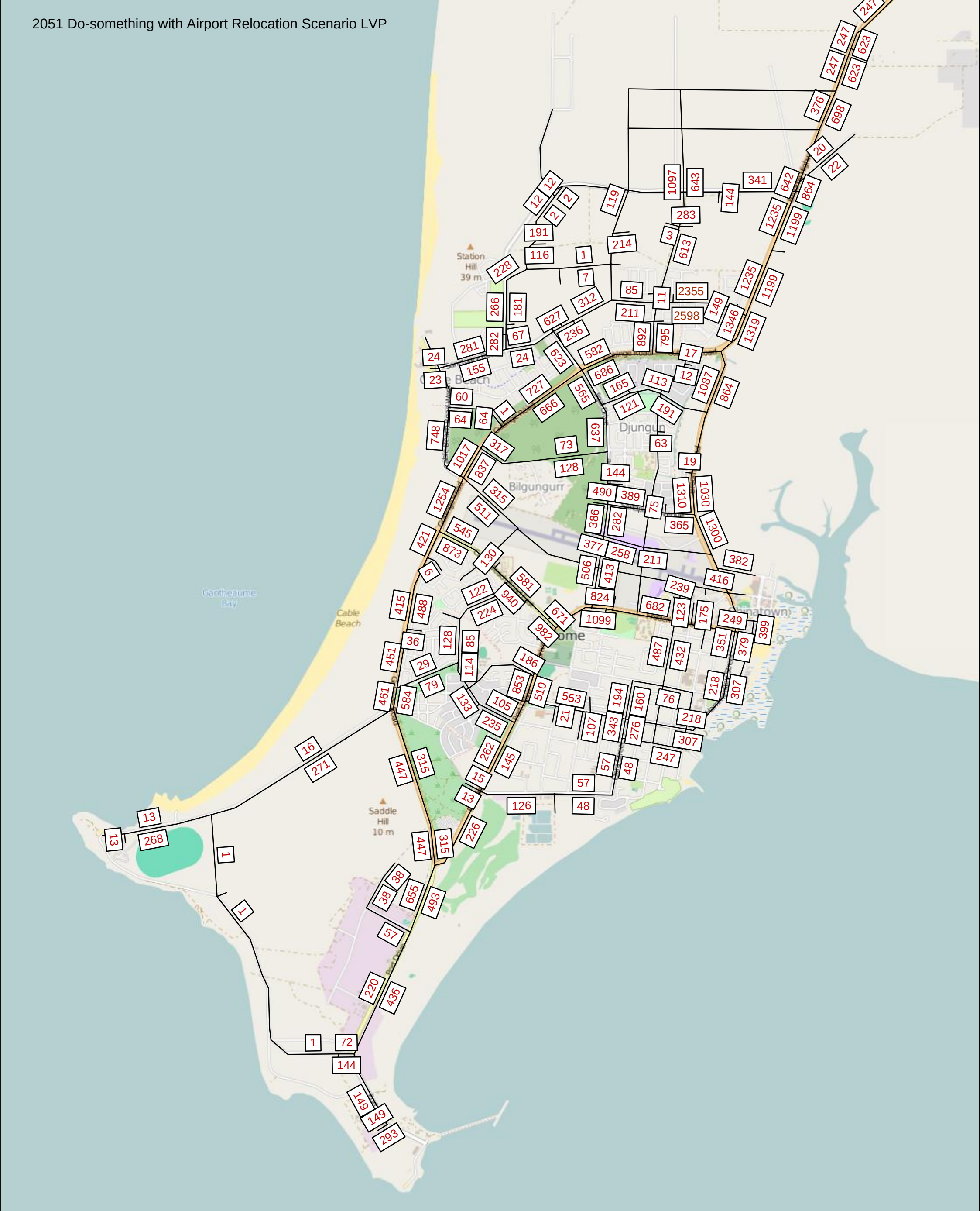
2051 Do-something without Airport relocation Scenario LVP



2051 Do-minimum with Airport Relocation Scenario LVP



2051 Do-something with Airport Relocation Scenario LVP



Appendix B. Cost Estimates

Job Estimate		PROJECT : CBRE Port Drive								
	Engineering Estimate	ACCOUNT : Right Turn Pocket N/E								
		BUDGET : SoB Concept								
CODE	DESCRIPTION	Quant Compact	UNIT	LSE QUANT	UNIT	LABOUR Inc 100% OH	PLANT	MAT	TOTAL RATE	ESTIMATE
PRELIMINARY										
	DESIGN (Eng Overheads)	5%								$ 5,319.29
	SURVEY (pickup & setout) Eng Overheads	5%								$ 5,319.29
	PROJECT MANAGEMENT (Eng overheads)	5%								$ 5,319.29
	TRAFFIC MANAGEMENT	10	Day						$ 1,000.00	$ 10,000.00
	MOBILISATION/DEMOBILISATION	0	LS						$ -	$ -
	Clearing grubbing and mulching of vegetation	0	LS							$ -
	Heritage Clearance / Cultural Monitors	2	Day						$ 1,000.00	$ 2,000.00
SERVICES										
	Service Locating	0	hr						$ 150.00	$ -
	TELSTRA Relocation	0	m			Contractor			$ 500.00	$ -
	POWER Relocation	0	m			Contractor			$ 500.00	
	LIGHT POLE RELOCATION	2	item			Contractor			$ 15,000.00	$ 30,000.00
	LIGHT POLE - NEW	0	item			Contractor			$ 18,000.00	$ -
	GAS Relocation	0	item			Contractor				$ -
	WATER Relocation	0	m			Contractor			$ 500.00	$ 20,000.00
	Water Meter Connection	0	Item			Contractor			$ 6,000.00	$ -
	Removal of Trees	*	item			Parks and Gardens			Varies	$ -
EARTHWORKS										
	TOPSOIL STRIPPING FOR RESPREAD	0	m³			$ 2.50	$ 2.50		$ 5.00	$ -
	EARTHWORKS-CUT(to spoil)	0	m³	0	m³	$ 6.00	$ 8.00	$ 54.00	$ 68.00	$ -
	EARTHWORKS-CUT(to fill)	0	m³			$ 7.60	$ 8.00		$ 15.60	$ -
	EARTHWORKS-FILL(spread)	0	m³			$ 7.00	$ 4.00	$ 10.00	$ 21.00	$ -
ROADWORKS										
	REMOVE KERB	100	m			$ 3.00	$ 6.50	$ 1.40	$ 10.90	$ 1,090.00
	REMOVE/BREAKUP CONCRETE	0	m³			$ 4.00	$ 10.00	$ 30.00	$ 44.00	$ -
	SAW CUT EXISTING BITUMEN	0	m			$ 31.50			$ 31.50	$ -
	EXISTING SEAL Rip, crush and blend	0	m²			Contractor			$ 7.50	$ -
	EXISTING SEAL Rip, crush and dispose	0	m²			Contractor			$ 3.50	$ -
	EARTHWORKS /Sub grade-FILL(supply, compact, trim)	0	m³	0	m³	$ 8.00	$ 6.00	$ 10.00	$ 24.00	$ -
	PAVEMENT-SUBGRADE(rip 150mm deep, water, compact and trim)	450	m²			$ 3.00	$ 5.50		$ 8.50	$ 3,825.00
	PAVEMENT-BASE(supply to site as per contract NO RT) m3 compact (design) to Tonne loose	67.5	m³	142	Tonne	Contractor		$ 49.00	$ 49.00	$ 6,945.75
	PAVEMENT-BASE(supply to site as per contract RT ALLOW) m3 compact (design) to Tonne loose	0	m³	0	Tonne compact	Contractor		$ 43.00	$ 43.00	$ -
	PAVEMENT-BASE(lay in compact and final trim to design levels)	450	m²			Contractor			$ 32.70	$ 14,715.00
	PAVEMENT TESTING	0	each			Contractor			$ 305.00	$ -
SURFACING		0								
	PRIME	450	m²			Contractor			$ 3.50	$ 1,575.00
	PRIMERSEAL(10mm agg.)	0	m²			Contractor			$ 5.54	$ -
	PRIMERSEAL(14mm agg.)	0	m²			Contractor			$ 6.22	$ -
	TWO COAT SEAL (14mm/7mm agg)	450	m²			Contractor			$ 10.30	$ 4,635.00
	SEAL(7mm agg.)	0	m²			Contractor			$ 5.70	$ -
	SEAL(10mm agg.)	0	m²			Contractor			$ 6.10	$ -
	SEAL(14mm agg.)	0	m²			Contractor			$ 6.84	$ -
	ASPHALT(25mm thick)	0	m²			Contractor			$ 40.00	$ -
	Brick Paving	0	m²			Contractor			$ 150.00	$ -
	Profiling	0	m²			Contractor			$ 10.00	$ -
	ASPHALT(40mm thick)	0	m²			Contractor			$ 45.00	$ -
	MOBILISATION/DEMOBILISATION	0								$ -
KERBING										
	PREPARATION FOR KERBING	100	m			$ 1.00	$ 2.00	$ -	$ 3.00	$ 300.00
	KERB-MOUNTABLE	0	m			Contractor			$ 33.50	$ -
	KERB-SEMIMOUNTABLE	100	m			Contractor			$ 40.00	$ 4,000.00
	KERB-BARRIER (ALLOW EXTRA FOR PAVING)	0	m			Contractor			$ 35.00	$ -
	EXCAVATION FOR KEY or FLUSH	100	m			$ 4.00	$ 6.00	$ -	$ 10.00	$ 1,000.00
	EXTRA FOR KERB KEY - CONC ONLY	100	m			Contractor			$ 12.00	$ 1,200.00
	Hand Makeup's	2	m			Contractor			$ 50.00	$ 100.00
	Island ends	0	m			Contractor			$ 80.00	$ -
	MAINT KERBS < 20m Inc. old kerb removal	0	m			Contractor			$ 80.00	$ -
	KERB-FLUSH	0	m			Contractor			$ 80.00	$ -

DRAINAGE										
	Supply & Lay 300 dia RCP <2m Deep	0	m			Contractor				$ -
	Supply & Lay 450 dia RCP <2m Deep	0	m			Contractor			$ 878.00	$ -
	Supply & Lay 600 dia RCP <2m Deep	0	m			Contractor			$ 1,060.00	$ -
	Supply & Lay 750 dia RCP <2m Deep	0	m			Contractor			$ 1,200.00	$ -
	Supply & Lay 900 dia RCP <2m Deep	0	m			Contractor			$ 1,520.00	$ -
	Box culvert installation including base slab 600x300	0	m			Contractor			$ 395.00	$ -
	Box culvert installation including base slab 300x1200	0	m			Contractor			$ 1,445.00	$ -
	Box culvert installation including base slab 1200x1200	0	m			Contractor			$ 1,880.00	$ -
	Grated Pit	0	Item			Contractor			$ 2,507.00	$ -
	Double Grated Pit	0	Item			Contractor			$ 5,000.00	$ -
	Side Entry Pit	0	Item			Contractor			$ 3,280.00	$ -
	Man hole 1.2m deep	0	Item			Contractor			$ 2,067.00	$ -
CONCRETE WORKS										
	CONCRETE Crossovers Domestic	0	m²			Contractor			$ 90.00	$ -
	CONCRETE Crossovers Industrial	0	m²			Contractor			$ 112.00	$ -
	CONCRETE PATH		m²			Contractor			$ 74.00	$ -
	COLOURED CONCRETE/FAUX BRICK	0	m²			Contractor			$ 90.00	$ -
	BRICK PAVING	0	m²			Contractor			$ 110.00	$ -
	PRAM RAMPS	0	No			Contractor			$ 700.00	$ -
MISCELLANEOUS										
	VERGE BACKFILL & CLEAN UP	200	m			$ 3.00	$ 7.00	$ 5.00	$ 15.00	$ 3,000.00
	LINE MARKING - NEW (markout, air blast and paint)	200	m						$ 5.00	$ 1,000.00
	LINE MARKING - RENEW (airblast and paint)	0	m						$ 4.00	$ -
	LINE MARKING - REMOVAL (water blast)	200	m						$ 5.00	$ 1,000.00
	SIGNS(temporary & permanent)	0	Item						$ 600.00	$ -
	TGSI'S	0	Item						$ 500.00	$ -
	REMOVAL OF BOLLARDS	0	Item						$ 100.00	$ -
	Retaining wall 3 courses, core filled, footing	0	m			Contractor			$ 250.00	$ -
Pre Contingency SUB TOTAL										$ 106,385.75
Contingencies 20%										$ 21,277.15
SUB TOTAL									$	127,662.90
Optional Extra										
	LANDSCAPING	200	m²			$ 30.00	$ 30.00	$ 50.00	$ 110.00	$ 22,000.00
TOTAL INCLUDING ENG OVERHEADS									$	165,620.76

Job Estimate		PROJECT : CBRE Port Drive								
	Engineering Estimate	ACCOUNT : Left Turn Pocket S/W								
		BUDGET : SoB Concept								
CODE	DESCRIPTION	Quant Compact	UNIT	LSE QUANT	UNIT	LABOUR Inc 100% OH	PLANT	MAT	TOTAL RATE	ESTIMATE
PRELIMINARY										
	DESIGN (Eng Overheads)	5%								$ 10,759.29
	SURVEY (pickup & setout) Eng Overheads	5%								$ 10,759.29
	PROJECT MANAGEMENT (Eng overheads)	5%								$ 10,759.29
	TRAFFIC MANAGEMENT	10	Day						$ 1,000.00	$ 10,000.00
	MOBILISATION/DEMOBILISATION	0	LS						$ -	$ -
	Clearing grubbing and mulching of vegetation	0	LS							$ -
	Heritage Clearance / Cultural Monitors	2	Day						$ 1,000.00	$ 2,000.00
SERVICES										
	Service Locating	0	hr						$ 150.00	$ -
	TELSTRA Relocation	0	m			Contractor			$ 500.00	$ -
	POWER Relocation	0	m			Contractor			$ 500.00	$ 100,000.00
	LIGHT POLE RELOCATION	2	item			Contractor			$ 15,000.00	$ 30,000.00
	LIGHT POLE - NEW	0	item			Contractor			$ 18,000.00	$ -
	GAS Relocation	0	item			Contractor				$ -
	WATER Relocation	0	m			Contractor			$ 500.00	$ 20,000.00
	Water Meter Connection	0	Item			Contractor			$ 6,000.00	$ -
	Removal of Trees	*	item			Parks and Gardens			Varies	$ -
EARTHWORKS										
	TOPSOIL STRIPPING FOR RESPREAD	0	m³			$ 2.50	$ 2.50		$ 5.00	$ -
	EARTHWORKS-CUT(to spoil)	0	m³	0	m³	$ 6.00	$ 8.00	$ 54.00	$ 68.00	$ -
	EARTHWORKS-CUT(to fill)	0	m³			$ 7.60	$ 8.00		$ 15.60	$ -
	EARTHWORKS-FILL(spread)	0	m³			$ 7.00	$ 4.00	$ 10.00	$ 21.00	$ -
ROADWORKS										
	REMOVE KERB	100	m			$ 3.00	$ 6.50	$ 1.40	$ 10.90	$ 1,090.00
	REMOVE/BREAKUP CONCRETE	0	m³			$ 4.00	$ 10.00	$ 30.00	$ 44.00	$ -
	SAW CUT EXISTING BITUMEN	0	m			$ 31.50			$ 31.50	$ -
	EXISTING SEAL Rip, crush and blend	0	m²			Contractor			$ 7.50	$ -
	EXISTING SEAL Rip, crush and dispose	0	m²			Contractor			$ 3.50	$ -
	EARTHWORKS /Sub grade-FILL(supply, compact, trim)	0	m³	0	m³	$ 8.00	$ 6.00	$ 10.00	$ 24.00	$ -
	PAVEMENT-SUBGRADE(rip 150mm deep, water, compact and trim)	450	m²			$ 3.00	$ 5.50		$ 8.50	$ 3,825.00
	PAVEMENT-BASE(supply to site as per contract NO RT) m3 compact (design) to Tonne loose	67.5	m³	142	Tonne	Contractor		$ 49.00	$ 49.00	$ 6,945.75
	PAVEMENT-BASE(supply to site as per contract RT ALLOW) m3 compact (design) to Tonne loose	0	m³	0	Tonne compact	Contractor		$ 43.00	$ 43.00	$ -
	PAVEMENT-BASE(lay in compact and final trim to design levels)	450	m²			Contractor			$ 32.70	$ 14,715.00
	PAVEMENT TESTING	0	each			Contractor			$ 305.00	$ -
SURFACING		0								
	PRIME	450	m²			Contractor			$ 3.50	$ 1,575.00
	PRIMERSEAL(10mm agg.)	0	m²			Contractor			$ 5.54	$ -
	PRIMERSEAL(14mm agg.)	0	m²			Contractor			$ 6.22	$ -
	TWO COAT SEAL (14mm/7mm agg)	450	m²			Contractor			$ 10.30	$ 4,635.00
	SEAL(7mm agg.)	0	m²			Contractor			$ 5.70	$ -
	SEAL(10mm agg.)	0	m²			Contractor			$ 6.10	$ -
	SEAL(14mm agg.)	0	m²			Contractor			$ 6.84	$ -
	ASPHALT(25mm thick)	0	m²			Contractor			$ 40.00	$ -
	Brick Paving	0	m²			Contractor			$ 150.00	$ -
	Profiling	0	m²			Contractor			$ 10.00	$ -
	ASPHALT(40mm thick)	0	m²			Contractor			$ 45.00	$ -
	MOBILISATION/DEMOBILISATION	0								$ -
KERBING										
	PREPARATION FOR KERBING	100	m			$ 1.00	$ 2.00	$ -	$ 3.00	$ 300.00
	KERB-MOUNTABLE	0	m			Contractor			$ 33.50	$ -
	KERB-SEMIMOUNTABLE	100	m			Contractor			$ 40.00	$ 4,000.00
	KERB-BARRIER (ALLOW EXTRA FOR PAVING)	0	m			Contractor			$ 35.00	$ -
	EXCAVATION FOR KEY or FLUSH	100	m			$ 4.00	$ 6.00	$ -	$ 10.00	$ 1,000.00
	EXTRA FOR KERB KEY - CONC ONLY	100	m			Contractor			$ 12.00	$ 1,200.00
	Hand Makeup's	2	m			Contractor			$ 50.00	$ 100.00
	Island ends	0	m			Contractor			$ 80.00	$ -
	MAINT KERBS < 20m Inc. old kerb removal	0	m			Contractor			$ 80.00	$ -
	KERB-FLUSH	0	m			Contractor			$ 80.00	$ -

DRAINAGE										
	Supply & Lay 300 dia RCP <2m Deep	0	m			Contractor				$ -
	Supply & Lay 450 dia RCP <2m Deep	0	m			Contractor			$ 878.00	$ -
	Supply & Lay 600 dia RCP <2m Deep	0	m			Contractor			$ 1,060.00	$ -
	Supply & Lay 750 dia RCP <2m Deep	0	m			Contractor			$ 1,200.00	$ -
	Supply & Lay 900 dia RCP <2m Deep	0	m			Contractor			$ 1,520.00	$ -
	Box culvert installation including base slab 600x300	0	m			Contractor			$ 395.00	$ -
	Box culvert installation including base slab 300x1200	0	m			Contractor			$ 1,445.00	$ -
	Box culvert installation including base slab 1200x1200	0	m			Contractor			$ 1,880.00	$ -
	Grated Pit	0	Item			Contractor			$ 2,507.00	$ -
	Double Grated Pit	0	Item			Contractor			$ 5,000.00	$ -
	Side Entry Pit	0	Item			Contractor			$ 3,280.00	$ -
	Man hole 1.2m deep	0	Item			Contractor			$ 2,067.00	$ -
CONCRETE WORKS										
	CONCRETE Crossovers Domestic		m²			Contractor			$ 90.00	$ -
	CONCRETE Crossovers Industrial	0	m²			Contractor			$ 112.00	$ -
	CONCRETE PATH	100	m²			Contractor			$ 74.00	$ 7,400.00
	COLOURED CONCRETE/FAUX BRICK	0	m²			Contractor			$ 90.00	$ -
	BRICK PAVING	0	m²			Contractor			$ 110.00	$ -
	PRAM RAMPS	2	No			Contractor			$ 700.00	$ 1,400.00
MISCELLANEOUS										
	VERGE BACKFILL & CLEAN UP	200	m			$ 3.00	$ 7.00	$ 5.00	$ 15.00	$ 3,000.00
	LINE MARKING - NEW (markout, air blast and paint)	200	m						$ 5.00	$ 1,000.00
	LINE MARKING - RENEW (airblast and paint)	0	m						$ 4.00	$ -
	LINE MARKING - REMOVAL (water blast)	200	m						$ 5.00	$ 1,000.00
	SIGNS(temporary & permanent)	0	Item						$ 600.00	$ -
	TGSI'S	0	Item						$ 500.00	$ -
	REMOVAL OF BOLLARDS	0	Item						$ 100.00	$ -
	Retaining wall 3 courses, core filled, footing	0	m			Contractor			$ 250.00	$ -
Pre Contingency SUB TOTAL										$ 215,185.75
Contingencies 20%										$ 43,037.15
SUB TOTAL									$	258,222.90
Optional Extra										
	LANDSCAPING	200	m²			$ 30.00	$ 30.00	$ 50.00	$ 110.00	$ 22,000.00
TOTAL INCLUDING ENG OVERHEADS									$	312,500.76

Job Estimate		PROJECT : CBRE Port Drive								
	Engineering Estimate	ACCOUNT : Exit Lane N/W								
		BUDGET : SoB Concept								
CODE	**DESCRIPTION**	**Quant Compact**	**UNIT**	**LSE QUANT**	**UNIT**	**LABOUR Inc 100% OH**	**PLANT**	**MAT**	**TOTAL RATE**	**ESTIMATE**
PRELIMINARY										
	DESIGN (Eng Overheads)	5%								$ 5,537.29
	SURVEY (pickup & setout) Eng Overheads	5%								$ 5,537.29
	PROJECT MANAGEMENT (Eng overheads)	5%								$ 5,537.29
	TRAFFIC MANAGEMENT	10	Day						$ 1,000.00	$ 10,000.00
	MOBILISATION/DEMOBILISATION	0	LS						$ -	$ -
	Clearing grubbing and mulching of vegetation	0	LS							$ -
	Heritage Clearance / Cultural Monitors	2	Day						$ 1,000.00	$ 2,000.00
SERVICES										
	Service Locating	0	hr						$ 150.00	$ -
	TELSTRA Relocation	0	m			Contractor			$ 500.00	$ -
	POWER Relocation	0	m			Contractor			$ 500.00	
	LIGHT POLE RELOCATION	2	item			Contractor			$ 15,000.00	$ 30,000.00
	LIGHT POLE - NEW	0	item			Contractor			$ 18,000.00	$ -
	GAS Relocation	0	item			Contractor				$ -
	WATER Relocation	0	m			Contractor			$ 500.00	$ 20,000.00
	Water Meter Connection	0	Item			Contractor			$ 6,000.00	$ -
	Removal of Trees	*	item			Parks and Gardens			Varies	$ -
EARTHWORKS										
	TOPSOIL STRIPPING FOR RESPREAD	0	m³			$ 2.50	$ 2.50		$ 5.00	$ -
	EARTHWORKS-CUT(to spoil)	0	m³	0	m³	$ 6.00	$ 8.00	$ 54.00	$ 68.00	$ -
	EARTHWORKS-CUT(to fill)	0	m³			$ 7.60	$ 8.00		$ 15.60	$ -
	EARTHWORKS-FILL(spread)	0	m³			$ 7.00	$ 4.00	$ 10.00	$ 21.00	$ -
ROADWORKS										
	REMOVE KERB	100	m			$ 3.00	$ 6.50	$ 1.40	$ 10.90	$ 1,090.00
	REMOVE/BREAKUP CONCRETE	0	m³			$ 4.00	$ 10.00	$ 30.00	$ 44.00	$ -
	SAW CUT EXISTING BITUMEN	0	m			$ 31.50			$ 31.50	$ -
	EXISTING SEAL Rip, crush and blend	0	m²			Contractor			$ 7.50	$ -
	EXISTING SEAL Rip, crush and dispose	0	m²			Contractor			$ 3.50	$ -
	EARTHWORKS /Sub grade-FILL(supply, compact, trim)	0	m³	0	m³	$ 8.00	$ 6.00	$ 10.00	$ 24.00	$ -
	PAVEMENT-SUBGRADE(rip 150mm deep, water, compact and trim)	450	m²			$ 3.00	$ 5.50		$ 8.50	$ 3,825.00
	PAVEMENT-BASE(supply to site as per contract NO RT) m3 compact (design) to Tonne loose	67.5	m³	142	Tonne	Contractor		$ 49.00	$ 49.00	$ 6,945.75
	PAVEMENT-BASE(supply to site as per contract RT ALLOW) m3 compact (design) to Tonne loose	0	m³	0	Tonne compact	Contractor		$ 43.00	$ 43.00	$ -
	PAVEMENT-BASE(lay in compact and final trim to design levels)	450	m²			Contractor			$ 32.70	$ 14,715.00
	PAVEMENT TESTING	0	each			Contractor			$ 305.00	$ -
SURFACING		0								
	PRIME	450	m²			Contractor			$ 3.50	$ 1,575.00
	PRIMERSEAL(10mm agg.)	0	m²			Contractor			$ 5.54	$ -
	PRIMERSEAL(14mm agg.)	0	m²			Contractor			$ 6.22	$ -
	TWO COAT SEAL (14mm/7mm agg)	450	m²			Contractor			$ 10.30	$ 4,635.00
	SEAL(7mm agg.)	0	m²			Contractor			$ 5.70	$ -
	SEAL(10mm agg.)	0	m²			Contractor			$ 6.10	$ -
	SEAL(14mm agg.)	0	m²			Contractor			$ 6.84	$ -
	ASPHALT(25mm thick)	0	m²			Contractor			$ 40.00	$ -
	Brick Paving	0	m²			Contractor			$ 150.00	$ -
	Profiling	0	m²			Contractor			$ 10.00	$ -
	ASPHALT(40mm thick)	0	m²			Contractor			$ 45.00	$ -
	MOBILISATION/DEMOBILISATION	0								$ -
KERBING										
	PREPARATION FOR KERBING	100	m			$ 1.00	$ 2.00	$ -	$ 3.00	$ 300.00
	KERB-MOUNTABLE	0	m			Contractor			$ 33.50	$ -
	KERB-SEMIMOUNTABLE	100	m			Contractor			$ 40.00	$ 4,000.00
	KERB-BARRIER (ALLOW EXTRA FOR PAVING)	0	m			Contractor			$ 35.00	$ -
	EXCAVATION FOR KEY or FLUSH	100	m			$ 4.00	$ 6.00	$ -	$ 10.00	$ 1,000.00
	EXTRA FOR KERB KEY - CONC ONLY	100	m			Contractor			$ 12.00	$ 1,200.00
	Hand Makeup's	2	m			Contractor			$ 50.00	$ 100.00
	Island ends	0	m			Contractor			$ 80.00	$ -
	MAINT KERBS < 20m Inc. old kerb removal	0	m			Contractor			$ 80.00	$ -
	KERB-FLUSH	0	m			Contractor			$ 80.00	$ -

DRAINAGE										
	Supply & Lay 300 dia RCP <2m Deep	0	m			Contractor				$ -
	Supply & Lay 450 dia RCP <2m Deep	0	m			Contractor			$ 878.00	$ -
	Supply & Lay 600 dia RCP <2m Deep	0	m			Contractor			$ 1,060.00	$ -
	Supply & Lay 750 dia RCP <2m Deep	0	m			Contractor			$ 1,200.00	$ -
	Supply & Lay 900 dia RCP <2m Deep	0	m			Contractor			$ 1,520.00	$ -
	Box culvert installation including base slab 600x300	0	m			Contractor			$ 395.00	$ -
	Box culvert installation including base slab 300x1200	0	m			Contractor			$ 1,445.00	$ -
	Box culvert installation including base slab 1200x1200	0	m			Contractor			$ 1,880.00	$ -
	Grated Pit	0	Item			Contractor			$ 2,507.00	$ -
	Double Grated Pit	0	Item			Contractor			$ 5,000.00	$ -
	Side Entry Pit	0	Item			Contractor			$ 3,280.00	$ -
	Man hole 1.2m deep	0	Item			Contractor			$ 2,067.00	$ -
CONCRETE WORKS										
	CONCRETE Crossovers Domestic	0	m²			Contractor			$ 90.00	$ -
	CONCRETE Crossovers Industrial	0	m²			Contractor			$ 112.00	$ -
	CONCRETE PATH	40	m²			Contractor			$ 74.00	$ 2,960.00
	COLOURED CONCRETE/FAUX BRICK	0	m²			Contractor			$ 90.00	$ -
	BRICK PAVING	0	m²			Contractor			$ 110.00	$ -
	PRAM RAMPS	2	No			Contractor			$ 700.00	$ 1,400.00
MISCELLANEOUS										
	VERGE BACKFILL & CLEAN UP	200	m			$ 3.00	$ 7.00	$ 5.00	$ 15.00	$ 3,000.00
	LINE MARKING - NEW (markout, air blast and paint)	200	m						$ 5.00	$ 1,000.00
	LINE MARKING - RENEW (airblast and paint)	0	m						$ 4.00	$ -
	LINE MARKING - REMOVAL (water blast)	200	m						$ 5.00	$ 1,000.00
	SIGNS(temporary & permanent)	0	Item						$ 600.00	$ -
	TGSI'S	0	Item						$ 500.00	$ -
	REMOVAL OF BOLLARDS	0	Item						$ 100.00	$ -
	Retaining wall 3 courses, core filled, footing	0	m			Contractor			$ 250.00	$ -
Pre Contingency SUB TOTAL										$ 110,745.75
Contingencies 20%										$ 22,149.15
SUB TOTAL									$	132,894.90
Optional Extra										
	LANDSCAPING	200	m²			$ 30.00	$ 30.00	$ 50.00	$ 110.00	$ 22,000.00
TOTAL INCLUDING ENG OVERHEADS									$	171,506.76

Job Estimate		PROJECT : Sandpiper Ave								
	Engineering Estimate	ACCOUNT : Divided Carriageway								
		BUDGET : SoB Concept								
CODE	**DESCRIPTION**	**Quant Compact**	**UNIT**	**LSE QUANT**	**UNIT**	**LABOUR Inc 100% OH**	**PLANT**	**MAT**	**TOTAL RATE**	**ESTIMATE**
PRELIMINARY										
	DESIGN (Eng Overheads)	5%								$ 54,311.73
	SURVEY (pickup & setout) Eng Overheads	5%								$ 54,311.73
	PROJECT MANAGEMENT (Eng overheads)	5%								$ 54,311.73
	TRAFFIC MANAGEMENT	30	Day						$ 1,000.00	$ 30,000.00
	MOBILISATION/DEMOBILISATION		LS						$ -	$ -
	Clearing grubbing and mulching of vegetation	4700	m²						$ 1.50	$ 7,050.00
	Heritage Clearance / Cultural Monitors	10	Day						$ 1,000.00	$ 10,000.00
SERVICES										
	Service Locating	10	hr						$ 150.00	$ 1,500.00
	TELSTRA Relocation	40	m			Contractor			$ 500.00	$ 20,000.00
	POWER Relocation	0	m			Contractor			$ 500.00	
	LIGHT POLE RELOCATION	6	item			Contractor			$ 15,000.00	$ 90,000.00
	LIGHT POLE - NEW	5	item			Contractor			$ 18,000.00	$ 90,000.00
	GAS Relocation	0	item			Contractor				$ -
	WATER Relocation	0	m			Contractor			$ 500.00	$ 20,000.00
	Water Meter Connection		Item			Contractor			$ 6,000.00	$ -
	Removal of Trees	*	item			Parks and Gardens			Varies	$ -
EARTHWORKS										
	TOPSOIL STRIPPING FOR RESPREAD	250	m³			$ 2.50	$ 2.50		$ 5.00	$ 1,250.00
	EARTHWORKS-CUT(to spoil)	705	m³	846	m³	$ 6.00	$ 8.00	$ 54.00	$ 68.00	$ 57,528.00
	EARTHWORKS-CUT(to fill)	0	m³			$ 7.60	$ 8.00		$ 15.60	$ -
	EARTHWORKS-FILL(spread)		m³			$ 7.00	$ 4.00	$ 10.00	$ 21.00	$ -
ROADWORKS										
	REMOVE KERB	940	m			$ 3.00	$ 6.50	$ 1.40	$ 10.90	$ 10,246.00
	REMOVE/BREAKUP CONCRETE	188	m³			$ 4.00	$ 10.00	$ 30.00	$ 44.00	$ 8,272.00
	SAW CUT EXISTING BITUMEN	20	m			$ 31.50			$ 31.50	$ 630.00
	EXISTING SEAL Rip, crush and blend	4700	m²			Contractor			$ 7.50	$ 35,250.00
	EXISTING SEAL Rip, crush and dispose	0	m²			Contractor			$ 3.50	$ -
	EARTHWORKS /Sub grade-FILL(supply, compact, trim)		m³	0	m³	$ 8.00	$ 6.00	$ 10.00	$ 24.00	$ -
	PAVEMENT-SUBGRADE(rip 150mm deep, water, compact and trim)	705	m²			$ 3.00	$ 5.50		$ 8.50	$ 5,992.50
	PAVEMENT-BASE(supply to site as per contract NO RT) m3 compact (design) to Tonne loose	940	m³	1974	Tonne	Contractor		$ 49.00	$ 49.00	$ 96,726.00
	PAVEMENT-BASE(supply to site as per contract RT ALLOW) m3 compact (design) to Tonne loose	0	m³	0	Tonne compact	Contractor		$ 43.00	$ 43.00	$ -
	PAVEMENT-BASE(lay in compact and final trim to design levels)	4700	m²			Contractor			$ 32.70	$ 153,690.00
	PAVEMENT TESTING	20	each			Contractor			$ 305.00	$ 6,100.00
SURFACING		0								
	PRIME	4700	m²			Contractor			$ 3.50	$ 16,450.00
	PRIMERSEAL(10mm agg.)	0	m²			Contractor			$ 5.54	$ -
	PRIMERSEAL(14mm agg.)	0	m²			Contractor			$ 6.22	$ -
	TWO COAT SEAL (14mm/7mm agg)	4700	m²			Contractor			$ 10.30	$ 48,410.00
	SEAL(7mm agg.)	0	m²			Contractor			$ 5.70	$ -
	SEAL(10mm agg.)	0	m²			Contractor			$ 6.10	$ -
	SEAL(14mm agg.)	0	m²			Contractor			$ 6.84	$ -
	ASPHALT(25mm thick)	0	m²			Contractor			$ 40.00	$ -
	Brick Paving	940	m²			Contractor			$ 150.00	$ 141,000.00
	Profiling	100	m²			Contractor			$ 10.00	$ 1,000.00
	ASPHALT(40mm thick)	0	m²			Contractor			$ 45.00	$ -
	MOBILISATION/DEMOBILISATION	0								$ -
KERBING										
	PREPARATION FOR KERBING	1880	m			$ 1.00	$ 2.00	$ -	$ 3.00	$ 5,640.00
	KERB-MOUNTABLE		m			Contractor			$ 33.50	$ -
	KERB-SEMIMOUNTABLE	1880	m			Contractor			$ 40.00	$ 75,200.00
	KERB-BARRIER (ALLOW EXTRA FOR PAVING)	0	m			Contractor			$ 35.00	$ -
	EXCAVATION FOR KEY or FLUSH	1880	m			$ 4.00	$ 6.00	$ -	$ 10.00	$ 18,800.00
	EXTRA FOR KERB KEY - CONC ONLY	1880	m			Contractor			$ 12.00	$ 22,560.00
	Hand Makeup's	20	m			Contractor			$ 50.00	$ 1,000.00
	Island ends	10	m			Contractor			$ 80.00	$ 800.00
	MAINT KERBS < 20m Inc. old kerb removal	0	m			Contractor			$ 80.00	$ -
	KERB-FLUSH	0	m			Contractor			$ 80.00	$ -
DRAINAGE										

	Supply & Lay 300 dia RCP <2m Deep	0	m			Contractor				$ -
	Supply & Lay 450 dia RCP <2m Deep	0	m			Contractor			$ 878.00	$ -
	Supply & Lay 600 dia RCP <2m Deep	0	m			Contractor			$ 1,060.00	$ -
	Supply & Lay 750 dia RCP <2m Deep	0	m			Contractor			$ 1,200.00	$ -
	Supply & Lay 900 dia RCP <2m Deep	0	m			Contractor			$ 1,520.00	$ -
	Box culvert installation including base slab 600x300	0	m			Contractor			$ 395.00	$ -
	Box culvert installation including base slab 300x1200	0	m			Contractor			$ 1,445.00	$ -
	Box culvert installation including base slab 1200x1200	6	m			Contractor			$ 1,880.00	$ 11,280.00
	Grated Pit	0	Item			Contractor			$ 2,507.00	$ -
	Double Grated Pit	0	Item			Contractor			$ 5,000.00	$ -
	Side Entry Pit	0	Item			Contractor			$ 3,280.00	$ -
	Man hole 1.2m deep	0	Item			Contractor			$ 2,067.00	$ -
	Conc. Chute Drains	6	m			Contractor			$ 200.00	$ 1,200.00
CONCRETE WORKS										
	CONCRETE Crossovers Domestic	0	m²			Contractor			$ 90.00	$ -
	CONCRETE Crossovers Industrial	0	m²			Contractor			$ 112.00	$ -
	CONCRETE PATH	940	m²			Contractor			$ 74.00	$ 69,560.00
	COLOURED CONCRETE/FAUX BRICK	0	m²			Contractor			$ 90.00	$ -
	BRICK PAVING	0	m²			Contractor			$ 110.00	$ -
	PRAM RAMPS	4	No			Contractor			$ 700.00	$ 2,800.00
MISCELLANEOUS										
	VERGE BACKFILL & CLEAN UP	940	m			$ 3.00	$ 7.00	$ 5.00	$ 15.00	$ 14,100.00
	LINE MARKING - NEW (markout, air blast and paint)	940	m						$ 5.00	$ 4,700.00
	LINE MARKING - RENEW (airblast and paint)	0	m						$ 4.00	$ -
	LINE MARKING - REMOVAL (water blast)		m						$ 5.00	$ -
	SIGNS(temporary & permanent)	10	Item						$ 600.00	$ 6,000.00
	TGSI'S	3	Item						$ 500.00	$ 1,500.00
	REMOVAL OF BOLLARDS	0	Item						$ 100.00	$ -
	Retaining wall 3 courses, core filled, footing	0	m			Contractor			$ 250.00	$ -
Pre Contingency SUB TOTAL										$ 1,086,234.50
Contingencies 20%										$ 217,246.90
SUB TOTAL									$	1,303,481.40
Optional Extra										
	LANDSCAPING (reinstate entry)	300	m²			$ 30.00	$ 30.00	$ 50.00	$ 110.00	$ 33,000.00
TOTAL INCLUDING ENG OVERHEADS									$	1,499,416.58

Job Estimate		PROJECT : Guy Street								
	Engineering Estimate	ACCOUNT : Divided Carriageway								
		BUDGET : SoB Concept								
CODE	**DESCRIPTION**	**Quant Compact**	**UNIT**	**LSE QUANT**	**UNIT**	**LABOUR Inc 100% OH**	**PLANT**	**MAT**	**TOTAL RATE**	**ESTIMATE**
PRELIMINARY										
	DESIGN (Eng Overheads)	5%								$ 65,746.35
	SURVEY (pickup & setout) Eng Overheads	5%								$ 65,746.35
	PROJECT MANAGEMENT (Eng overheads)	5%								$ 65,746.35
	TRAFFIC MANAGEMENT	30	Day						$ 1,000.00	$ 30,000.00
	MOBILISATION/DEMOBILISATION	1	LS							$ -
	Clearing grubbing and mulching of vegetation	0	LS							$ -
	Heritage Clearance / Cultural Monitors	15	Day						$ 1,000.00	$ 15,000.00
SERVICES										
	Service Locating	8	hr						$ 150.00	$ 1,200.00
	TELSTRA (Fibre Optic) Relocation	60	m			Contractor			$ 500.00	$ 30,000.00
	POWER Relocation	0	m			Contractor			$ 500.00	
	LIGHT POLE RELOCATION		item			Contractor			$ 15,000.00	$ -
	LIGHT POLE - NEW	7	item			Contractor			$ 18,000.00	$ 126,000.00
	O/H Power relocation	7	item			Contractor			$ 50,000.00	$ 350,000.00
	GAS Relocation	0	item			Contractor				$ -
	WATER Relocation	0	m			Contractor			$ 500.00	$ 20,000.00
	Water Meter Connection		Item			Contractor			$ 6,000.00	$ -
	Removal of Trees	*	item			Parks and Gardens			Varies	$ -
EARTHWORKS										
	TOPSOIL STRIPPING FOR RESPREAD	0	m³			$ 2.50	$ 2.50		$ 5.00	$ -
	EARTHWORKS-CUT(to spoil)	0	m³	0	m³	$ 6.00	$ 8.00	$ 54.00	$ 68.00	$ -
	EARTHWORKS-CUT(to fill)	0	m³			$ 7.60	$ 8.00		$ 15.60	$ -
	EARTHWORKS-FILL(spread)	0	m³			$ 7.00	$ 4.00	$ 10.00	$ 21.00	$ -
ROADWORKS										
	REMOVE KERB	1280	m			$ 3.00	$ 6.50	$ 1.40	$ 10.90	$ 13,952.00
	REMOVE/BREAKUP CONCRETE	120	m³			$ 4.00	$ 10.00	$ 30.00	$ 44.00	$ 5,280.00
	SAW CUT EXISTING BITUMEN	50	m			$ 31.50			$ 31.50	$ 1,575.00
	EXISTING SEAL Rip, crush and blend	3000	m²			Contractor			$ 7.50	$ 22,500.00
	EXISTING SEAL Rip, crush and dispose	0	m²			Contractor			$ 3.50	$ -
	EARTHWORKS /Sub grade-FILL(supply, compact, trim)	0	m³	0	m³	$ 8.00	$ 6.00	$ 10.00	$ 24.00	$ -
	PAVEMENT-SUBGRADE(rip 150mm deep, water, compact and trim)	3200	m²			$ 3.00	$ 5.50		$ 8.50	$ 27,200.00
	PAVEMENT-BASE(supply to site as per contract NO RT) m3 compact (design) to Tonne loose	640	m³	1344	Tonne	Contractor		$ 49.00	$ 49.00	$ 65,856.00
	PAVEMENT-BASE(supply to site as per contract RT ALLOW) m3 compact (design) to Tonne loose	0	m³	0	Tonne compact	Contractor		$ 43.00	$ 43.00	$ -
	PAVEMENT-BASE(lay in compact and final trim to design levels)	3200	m²			Contractor			$ 32.70	$ 104,640.00
	PAVEMENT TESTING	20	each			Contractor			$ 305.00	$ 6,100.00
SURFACING		0								
	PRIME	3200	m²			Contractor			$ 3.50	$ 11,200.00
	PRIMERSEAL(10mm agg.)	3200	m²			Contractor			$ 5.54	$ 17,728.00
	PRIMERSEAL(14mm agg.)	0	m²			Contractor			$ 6.22	$ -
	TWO COAT SEAL (14mm/7mm agg)	0	m²			Contractor			$ 10.30	$ -
	SEAL(7mm agg.)	0	m²			Contractor			$ 5.70	$ -
	SEAL(10mm agg.)	0	m²			Contractor			$ 6.10	$ -
	SEAL(14mm agg.)	0	m²			Contractor			$ 6.84	$ -
	ASPHALT(25mm thick)	0	m²			Contractor			$ 40.00	$ -
	Brick Paving	640	m²			Contractor			$ 150.00	$ 96,000.00
	Profiling	100	m²			Contractor			$ 10.00	$ 1,000.00
	ASPHALT(40mm thick)	3200	m²			Contractor			$ 45.00	$ 144,000.00
	MOBILISATION/DEMOBILISATION	1							$ 30,000.00	$ 30,000.00
KERBING										
	PREPARATION FOR KERBING	1280	m			$ 1.00	$ 2.00	$ -	$ 3.00	$ 3,840.00
	KERB-MOUNTABLE	0	m			Contractor			$ 33.50	$ -
	KERB-SEMIMOUNTABLE	1280	m			Contractor			$ 40.00	$ 51,200.00
	KERB-BARRIER (ALLOW EXTRA FOR PAVING)	0	m			Contractor			$ 35.00	$ -
	EXCAVATION FOR KEY or FLUSH	600	m			$ 4.00	$ 6.00	$ -	$ 10.00	$ 6,000.00
	EXTRA FOR KERB KEY - CONC ONLY	600	m			Contractor			$ 12.00	$ 7,200.00
	Hand Makeup's	10	m			Contractor			$ 50.00	$ 500.00
	Island ends	10	m			Contractor			$ 80.00	$ 800.00
	MAINT KERBS < 20m Inc. old kerb removal	0	m			Contractor			$ 80.00	$ -
	KERB-FLUSH	0	m			Contractor			$ 80.00	$ -

DRAINAGE										
	Supply & Lay 300 dia RCP <2m Deep	0	m			Contractor				$ -
	Supply & Lay 450 dia RCP <2m Deep	0	m			Contractor			$ 878.00	$ -
	Supply & Lay 600 dia RCP <2m Deep	0	m			Contractor			$ 1,060.00	$ -
	Supply & Lay 750 dia RCP <2m Deep	0	m			Contractor			$ 1,200.00	$ -
	Supply & Lay 900 dia RCP <2m Deep	0	m			Contractor			$ 1,520.00	$ -
	Box culvert installation including base slab 600x300	0	m			Contractor			$ 395.00	$ -
	Box culvert installation including base slab 300x1200	0	m			Contractor			$ 1,445.00	$ -
	Box culvert installation including base slab 1200x1200	0	m			Contractor			$ 1,880.00	$ -
	Grated Pit	0	Item			Contractor			$ 2,507.00	$ -
	Double Grated Pit		Item			Contractor			$ 5,000.00	$ -
	Side Entry Pit	2	Item			Contractor			$ 3,280.00	$ 6,560.00
	Man hole 1.2m deep	0	Item			Contractor			$ 2,067.00	$ -
CONCRETE WORKS										
	CONCRETE Crossovers Domestic	0	m²			Contractor			$ 90.00	$ -
	CONCRETE Crossovers Industrial	28	m²			Contractor			$ 112.00	$ 3,136.00
	CONCRETE PATH	640	m²			Contractor			$ 74.00	$ 47,360.00
	COLOURED CONCRETE/FAUX BRICK	0	m²			Contractor			$ 90.00	$ -
	BRICK PAVING	300	m²			Contractor			$ 110.00	$ 33,000.00
	PRAM RAMPS	6	No			Contractor			$ 700.00	$ 4,200.00
MISCELLANEOUS										
	VERGE BACKFILL & CLEAN UP	1280	m			$ 3.00	$ 7.00	$ 5.00	$ 15.00	$ 19,200.00
	LINE MARKING - NEW (markout, air blast and paint)	1280	m						$ 5.00	$ 6,400.00
	LINE MARKING - RENEW (airblast and paint)	0	m						$ 4.00	$ -
	LINE MARKING - REMOVAL (water blast)		m						$ 5.00	$ -
	SIGNS(temporary & permanent)	8	Item						$ 600.00	$ 4,800.00
	TGSI'S	3	Item						$ 500.00	$ 1,500.00
	REMOVAL OF BOLLARDS	0	Item						$ 100.00	$ -
	Retaining wall 3 courses, core filled, footing	0	m			Contractor			$ 250.00	$ -
Pre Contingency SUB TOTAL										$ 1,314,927.00
Contingencies 20%										$ 262,985.40
SUB TOTAL									$	1,577,912.40
Optional Extra										
	LANDSCAPING	400	m²			$ 30.00	$ 30.00	$ 50.00	$ 110.00	$ 44,000.00
TOTAL INCLUDING ENG OVERHEADS									$	1,819,151.45

Job Estimate		PROJECT : Port Drive Guy Street								
	Engineering Estimate	ACCOUNT : Roundabout								
		BUDGET : SoB Concept								
CODE	**DESCRIPTION**	**Quant Compact**	**UNIT**	**LSE QUANT**	**UNIT**	**LABOUR Inc 100% OH**	**PLANT**	**MAT**	**TOTAL RATE**	**ESTIMATE**
PRELIMINARY										
	DESIGN (Eng Overheads)	5%								$ 35,135.00
	SURVEY (pickup & setout) Eng Overheads	5%								$ 35,135.00
	PROJECT MANAGEMENT (Eng overheads)	5%								$ 35,135.00
	TRAFFIC MANAGEMENT	40	Day						$ 1,350.00	$ 54,000.00
	MOBILISATION/DEMOBILISATION	2500	LS						$ -	$ -
	Clearing grubbing and mulching of vegetation	0	LS							$ 5,000.00
	Heritage Clearance / Cultural Monitors	15	Day						$ 1,000.00	$ 15,000.00
SERVICES										
	Service Locating	10	hr						$ 150.00	$ 1,500.00
	TELSTRA Relocation	20	m			Contractor			$ 500.00	$ 10,000.00
	O/H POWER Relocation	1	item			Contractor			$ 30,000.00	$ 30,000.00
	LIGHT POLE RELOCATION	5	item			Contractor			$ 15,000.00	$ 75,000.00
	LIGHT POLE - NEW	5	item			Contractor			$ 18,000.00	$ 90,000.00
	GAS Relocation	0	item			Contractor				$ -
	WATER Relocation	0	m			Contractor			$ 500.00	$ 20,000.00
	Water Meter Connection	1	Item			Contractor			$ 6,000.00	$ 6,000.00
	Removal of Trees	*	item			Parks and Gardens			Varies	$ -
EARTHWORKS										
	TOPSOIL STRIPPING FOR RESPREAD		m³			$ 2.50	$ 2.50		$ 5.00	$ -
	EARTHWORKS-CUT(to spoil)	300	m³	360	m³	$ 6.00	$ 8.00	$ 54.00	$ 68.00	$ 24,480.00
	EARTHWORKS-CUT(to fill)	0	m³			$ 7.60	$ 8.00		$ 15.60	$ -
	EARTHWORKS-FILL(spread)	0	m³			$ 7.00	$ 4.00	$ 10.00	$ 21.00	$ -
ROADWORKS										
	REMOVE KERB		m			$ 3.00	$ 6.50	$ 1.40	$ 10.90	$ -
	REMOVE/BREAKUP CONCRETE	0	m³			$ 4.00	$ 10.00	$ 30.00	$ 44.00	$ -
	SAW CUT EXISTING BITUMEN	0	m			$ 31.50			$ 31.50	$ -
	EXISTING SEAL Rip, crush and blend	0	m²			Contractor			$ 7.50	$ -
	EXISTING SEAL Rip, crush and dispose	0	m²			Contractor			$ 3.50	$ -
	EARTHWORKS /Sub grade-FILL(supply, compact, trim)	0	m³	0	m³	$ 8.00	$ 6.00	$ 10.00	$ 24.00	$ -
	PAVEMENT-SUBGRADE(rip 150mm deep, water, compact and trim)	2000	m²			$ 3.00	$ 5.50		$ 8.50	$ 17,000.00
	PAVEMENT-BASE(supply to site as per contract NO RT) m3 compact (design) to Tonne loose	400	m³	840	Tonne	Contractor		$ 49.00	$ 49.00	$ 41,160.00
	PAVEMENT-BASE(supply to site as per contract RT ALLOW) m3 compact (design) to Tonne loose	0	m³	0	Tonne compact	Contractor		$ 43.00	$ 43.00	$ -
	PAVEMENT-BASE(lay in compact and final trim to design levels)	2000	m²			Contractor			$ 32.70	$ 65,400.00
	PAVEMENT TESTING	10	each			Contractor			$ 305.00	$ 3,050.00
SURFACING		0								
	PRIME	2000	m²			Contractor			$ 3.50	$ 7,000.00
	PRIMERSEAL(10mm agg.)	0	m²			Contractor			$ 5.54	$ -
	PRIMERSEAL(14mm agg.)	0	m²			Contractor			$ 6.22	$ -
	TWO COAT SEAL (14mm/7mm agg)		m²			Contractor			$ 10.30	$ -
	SEAL(7mm agg.)	0	m²			Contractor			$ 5.70	$ -
	SEAL(10mm agg.)	2000	m²			Contractor			$ 6.10	$ 12,200.00
	SEAL(14mm agg.)	0	m²			Contractor			$ 6.84	$ -
	ASPHALT(25mm thick)	0	m²			Contractor			$ 40.00	$ -
	Brick Paving	0	m²			Contractor			$ 150.00	$ -
	Profiling	0	m²			Contractor			$ 10.00	$ -
	ASPHALT(40mm thick)	2000	m²			Contractor			$ 45.00	$ 90,000.00
	MOBILISATION/DEMOBILISATION	0								$ -
KERBING										
	PREPARATION FOR KERBING	600	m			$ 1.00	$ 2.00	$ -	$ 3.00	$ 1,800.00
	KERB-MOUNTABLE	0	m			Contractor			$ 33.50	$ -
	KERB-SEMIMOUNTABLE	600	m			Contractor			$ 40.00	$ 24,000.00
	KERB-BARRIER (ALLOW EXTRA FOR PAVING)	0	m			Contractor			$ 35.00	$ -
	EXCAVATION FOR KEY or FLUSH	600	m			$ 4.00	$ 6.00	$ -	$ 10.00	$ 6,000.00
	EXTRA FOR KERB KEY - CONC ONLY	600	m			Contractor			$ 12.00	$ 7,200.00
	Hand Makeup's	10	m			Contractor			$ 50.00	$ 500.00
	Island ends	12	m			Contractor			$ 80.00	$ 960.00
	MAINT KERBS < 20m Inc. old kerb removal	0	m			Contractor			$ 80.00	$ -
	KERB-FLUSH	40	m			Contractor			$ 80.00	$ 3,200.00

DRAINAGE										
	Supply & Lay 300 dia RCP <2m Deep	0	m			Contractor				$ -
	Supply & Lay 450 dia RCP <2m Deep	0	m			Contractor			$ 878.00	$ -
	Supply & Lay 600 dia RCP <2m Deep	0	m			Contractor			$ 1,060.00	$ -
	Supply & Lay 750 dia RCP <2m Deep	0	m			Contractor			$ 1,200.00	$ -
	Supply & Lay 900 dia RCP <2m Deep	0	m			Contractor			$ 1,520.00	$ -
	Box culvert installation including base slab 600x300	0	m			Contractor			$ 395.00	$ -
	Box culvert installation including base slab 300x1200	0	m			Contractor			$ 1,445.00	$ -
	Box culvert installation including base slab 1200x1200	0	m			Contractor			$ 1,880.00	$ -
	Grated Pit	0	Item			Contractor			$ 2,507.00	$ -
	Double Grated Pit	0	Item			Contractor			$ 5,000.00	$ -
	Side Entry Pit	0	Item			Contractor			$ 3,280.00	$ -
	Man hole 1.2m deep	0	Item			Contractor			$ 2,067.00	$ -
CONCRETE WORKS										
	CONCRETE Crossovers Domestic	0	m²			Contractor			$ 90.00	$ -
	CONCRETE Crossovers Industrial	0	m²			Contractor			$ 112.00	$ -
	CONCRETE PATH	600	m²			Contractor			$ 74.00	$ 44,400.00
	COLOURED CONCRETE/FAUX BRICK	0	m²			Contractor			$ 90.00	$ -
	BRICK PAVING	300	m²			Contractor			$ 110.00	$ 33,000.00
	PRAM RAMPS		No			Contractor			$ 700.00	$ -
MISCELLANEOUS										
	VERGE BACKFILL & CLEAN UP	450	m			$ 3.00	$ 7.00	$ 5.00	$ 15.00	$ 6,750.00
	LINE MARKING - NEW (markout, air blast and paint)	600	m						$ 5.00	$ 3,000.00
	LINE MARKING - RENEW (airblast and paint)	0	m						$ 4.00	$ -
	LINE MARKING - REMOVAL (water blast)		m						$ 5.00	$ -
	SIGNS(temporary & permanent)	6	Item						$ 600.00	$ 3,600.00
	TGSI'S	3	Item						$ 500.00	$ 1,500.00
	REMOVAL OF BOLLARDS	0	Item						$ 100.00	$ -
	Retaining wall 3 courses, core filled, footing	0	m			Contractor			$ 250.00	$ -
Pre Contingency SUB TOTAL										$ 702,700.00
Contingencies 20%										$ 140,540.00
SUB TOTAL									$	843,240.00
Optional Extra										
	LANDSCAPING	100	m²			$ 30.00	$ 30.00	$ 50.00	$ 110.00	$ 11,000.00
TOTAL INCLUDING ENG OVERHEADS									$	959,645.00