

**CJ101-05/04 COMMUNITY CONSULTATION PROCESS ON  
THE PROPOSED EXTENSION OF OCEAN  
REEF ROAD – STATUS REPORT - [07131]  
[02154]**

**WARD** - Marina

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**PURPOSE**

To provide information to the Commissioners on a request from the Ocean Reef Coastal Stakeholders (ORCS) to include consideration of a Community Recreation Amenity purpose as part of the community consultation process on the proposed extension of Ocean Reef Road.

**EXECUTIVE SUMMARY**

The Joint Commissioners resolved on 17 February 2004 to undertake community consultation on the detailed design of the extension of Ocean Reef Road. (*CJ009-02/04 refers*).

The City has recently received a letter dated 20 April 2004 from the Ocean Reef Coastal Stakeholders (ORCS) requesting the Joint Commissioners revisit their earlier decision on the consultation process and include consideration of a Community Recreation Amenity purpose for the land.

In considering the issues raised by this report the Joint Commissioners may wish to expand the existing consultation process to enable the ORCS request be accommodated within existing parameters of the previous resolution. This is not determined by the City to be a substantial departure from the previous resolution.

**It is recommended that the Joint Commissioners APPROVE an expansion to the consultation process endorsed by Council at its meeting on 17 February 2004 in relation to the proposed extension of Ocean Reef Road, to take consideration of recreational, environmental and amenity issues along this corridor.**

**BACKGROUND**

Council received and supported a report in September 2003 to construct the final section of Ocean Reef Road between Hodges Drive and Shenton Avenue. (*CJ218-09/03 refers*)

On 11 November 2003 Council rescinded its previous resolution to enable full community consultation to occur on all aspects of the proposed road extension.

In February 2004 the Joint Commissioners received the Report CJ-009-02/04 that outlined and recommended a consultation approach be developed in partnership with the ORCS and in accordance with Council resolution of 11 November 2003.

The Joint Commissioners rescinded the previous motion of 11 November 2003 and resolved at its meeting on 17 February 2004 to:

- 1 *APPROVE a programme of consultation to be undertaken with key stakeholders on the detailed design of the extension of Ocean Reef Road from Hodges Drive through to Shenton Avenue being the model outlined in the 'Consulting Citizens' material;*
- 2 *NOTE that the consultation costs shall not exceed \$14,000 for external consultants;*
- 3 *NOTE that the key stakeholder group shall include representation from residents whose property abuts that section of Ocean Reef Road to be constructed, and equal representation from the Ocean Reef Stakeholders Group and the Ocean Reef Action Group;*
- 4 *LIST this project for consideration in the 2004/05 Five Year Capital Works Program.*

## **DETAILS**

The following timeline describes the events that have occurred since Council's resolution on 17 February 2004.

February 2004	Council adopts resolution to consult on detailed design of the road
March 2004	City develops brief and process to appoint an independent facilitator
April 2004	City appoints a facilitator
April 2004	City and facilitator meets with Premier & Cabinet officers
April 16 2004	Meeting to outline process methodology with ORCS convened
April 20 2004	Letter received from ORCS requesting expanded consultation process and a meeting with Commissioners
May 4 2004	Meeting to outline process methodology with Ocean Reef Action Group (ORAG) convened
May 11 2004	Report to Council on progress to date and issues arising

The ORCS, during their meeting on April 16, 2004, have requested that the consultation process be extended from detailed road design only, to consideration of an alternative option - that the land be used for community recreation and amenity purpose. They also requested that a meeting be convened between their group and the Commissioners. The ORCS have since made this request formally in a letter to the City received on April 20, 2004.

The current resolution of Council enabling the consultation process does not allow for consideration of any issues other than the detailed design of the road. It is considered that the request being proposed by the ORCS can be included into the existing process to the extent that the issues around community recreation and amenity are canvassed and assessed during the process.

### **Proposed Outline of the Consultation Process**

The proposed consultation methodology developed to date makes reference to the State Government's "Consulting Citizens" guides. The process in summary will involve forming a working group from the 4 key stakeholder groups being (1) the City of Joondalup, (2) the ORCS, (3) the ORAG and (4) other groups or community individuals. The working group would have a maximum representation of 3 from each group.

The Working Group would be required to formulate and agree a final process that would be implemented through a broader community workshop process. The workshop(s) would consist of a maximum of 50 participants that would be drawn through an equal representation process formulated by the Working Group from the 4 key stakeholder groups.

It is envisaged within the existing financial constraints that a maximum of two workshops can be accommodated. The first workshop would:

- Seek to provide information and gather feedback from community regarding issues surrounding the corridor including recreational, environmental and amenity issues that may be raised
- Collect requirements for detailed design options to be produced.

The data collected from the workshop would be provided to the City's design engineers who will provide various concept designs for the road extension based on community views, which have been integrated into the technical aspects and requirements.

The second workshop would:

- Exhibit the design options for the construction of the road
- Present the issues surrounding recreational, environmental and amenity aspects on this corridor.

The purpose of the workshop would be to seek final agreement on which options should be presented to the entire community and all other stakeholders for comment.

### **Risk Assessment**

There are several risks now associated with the process that need to be highlighted.

1. The process may be disbanded if the two key stakeholder groups ORCS and ORAG do not agree to participate in the process or cannot agree on a process

that includes accepting the clear objectives, adhering to agreed ground rules and to use representative samples from the community.

2. The broadening of the process as requested by the ORCS has been accommodated in the recommendation of this report within the existing set financial parameters. However it is possible that if broader community representation is demanded this would lengthen the process and require further resources which would be the subject of a further report to Council.
3. The broadening of the consultation may increase community expectations that may not be realisable.
4. The broadening of the process may be viewed by others as delaying the process and in particular, may not be acceptable to ORAG who have indicated their opposition to any further delays.

These risks need thorough consideration before any changes are made to the current situation.

### **Financial Implications**

If Council accepts the proposal to broaden the ability to consider the area from a community recreation and amenity perspective and the stakeholder groups agree to the process being put forward then the costs can be contained within the existing financial parameters.

If this is not the case and broad community input is required then more resources will be needed to facilitate increased numbers.

### **COMMENT**

The Ocean Reef Road extension has been the subject of a number of Council motions and rescission motions. There is significant community interest about the issue and an increasing degree of polarisation between the two main stakeholder groups, the Ocean Reef Stakeholders Group and the Ocean Reef Action Group.

Given the issues raised in this report it is necessary for Council to thoroughly consider the position that currently exists surrounding the Ocean Reef Road consultation process and the associated risks.

From a planning perspective the purpose of the land was always for that of a road. The City received a letter from the Department of Planning and Infrastructure on December 23 2003 stating, *“There has always been an expectation that this section of the planned Ocean Reef Road will eventually be constructed to serve both local and recreational traffic needs.”*

Given community interest and views around the matter it may be useful for Council to consider expanding the consultation process to take into account the recreational, environmental and amenity issues along this corridor.

**ATTACHMENTS**

Nil.

**VOTING REQUIRMENTS**

Simple Majority

**RECOMMENDATION**

**That the Joint Commissioners APPROVE an expansion to the consultation process endorsed by Council at its meeting on 17 February 2004 in relation to the proposed extension of Ocean Reef Road, to take consideration of recreational, environmental and amenity issues along this corridor.**

End report.

*The Joint Commissioners did not accept the officers recommendation and resolved as follows:*

**The Joint Commissioners resolved that:**

- 1 these matters are reconsidered at the time the traffic impact study is presented to Council which is expected to be available by the next Council meeting;**
- 2 in the meantime, the consultants to continue with the process involved in the construction of the working group as soon as possible.**

Put and carried 5/0

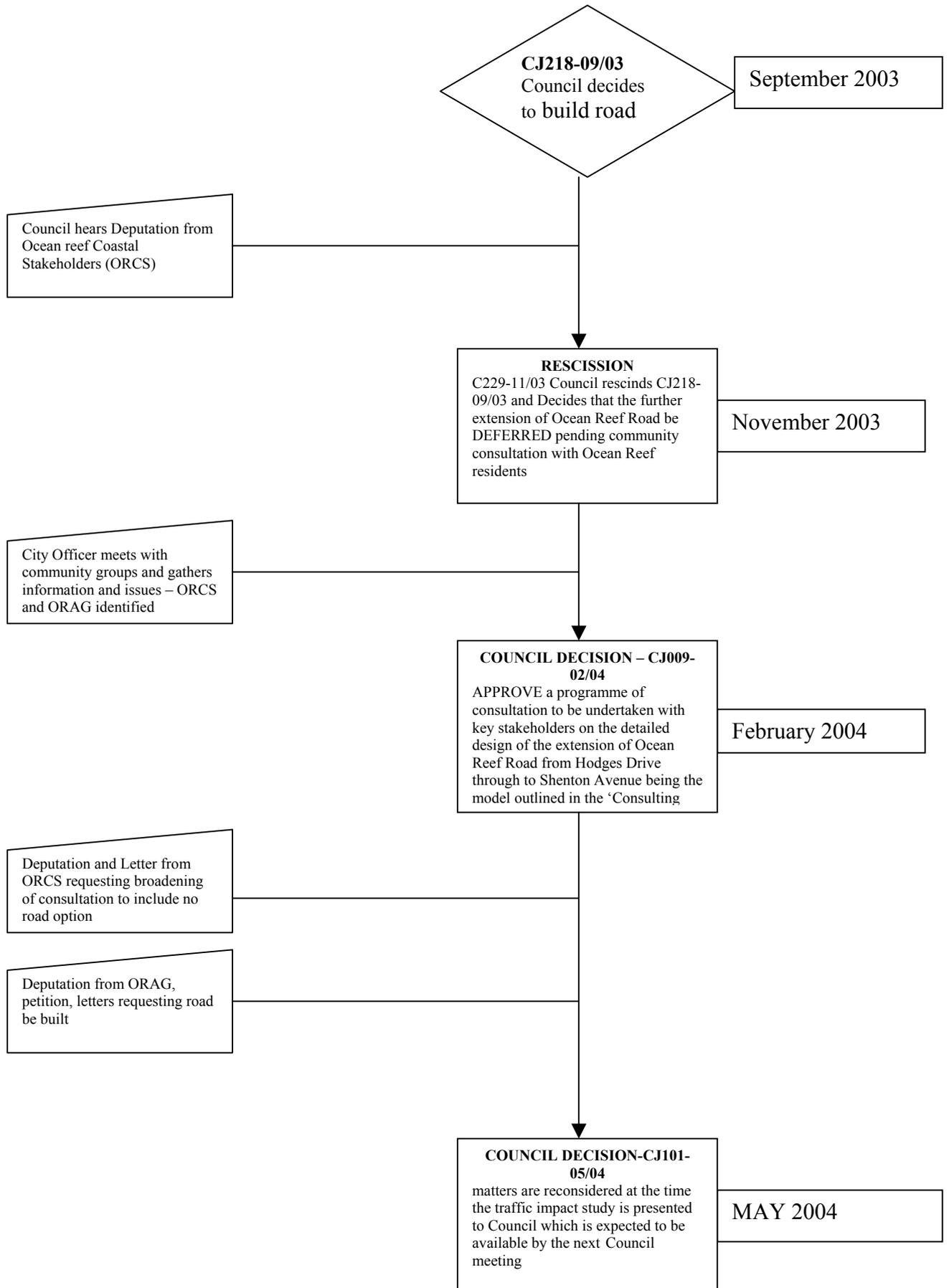
**FLOWCHART OF DECISIONS MADE SINCE SEPTEMBER 2003**

ATTACHMENT B

INPUTS

DECISIONS

DATE



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***Traffic Report for Ocean Reef Road  
CITY OF JOONDALUP***

*17 June 2004  
Reference C383  
Revision A*

## Document Control

**Connell Wagner**

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A	17 June 2004	Final Report	NMC	LHR	KWH	KWH

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Sinclair Knight Merz Traffic Modelling Report	

# 1. Introduction

## 1.1 Background

In 2001, the City of Joondalup appointed Connell Wagner as its preferred consulting engineering group to provide engineering and traffic management services to the City. Since then, Connell Wagner has been involved in numerous projects across the City and through this long standing partnership is familiar with issues surrounding the proposed extension of Ocean Reef Road, Ocean Reef.

In late March 2004, the City of Joondalup commissioned Connell Wagner to study the traffic effects of extending Ocean Reef Road from Hodges Drive to Shenton Avenue. In turn, Connell Wagner commissioned Sinclair Knight Merz to undertake the traffic modelling, as Sinclair Knight Merz has the capability and past experience in the Joondalup area to provide the specialised modelled traffic analysis.

## 1.2 Scope of Work

The Scope of Work agreed between the City and Connell Wagner defined the study area as the area bounded by Hodges Drive, Marmion Avenue, Burns Beach Road and Ocean Reef Road. Within this area, an examination of the existing regional traffic modelling data for the study area and an assessment of its impact on the traffic volumes formed the basis of study work to be undertaken. In particular, the study would address the impact on traffic volumes along Constellation Drive, Shenton Avenue, Hodges Drive, Delgado Parade, Naturaliste Boulevard, Burns Beach Road and the proposed extension of Ocean Reef Road.

A local traffic model of the study area was to be prepared using appropriate traffic modelling software. It was agreed that the traffic assessment would be for the years 2003, 2006 and 2011. The year 2003 was used to calibrate the model, as a reasonable database of existing traffic figures exists for this year. The years 2006 and 2011 were chosen as these are years for which Main Roads WA has traffic predictions for the major road network. It was recognised and considered in the assessment that Iluka is not yet fully developed and Main Roads plans to extend the Mitchell Freeway to Burns Beach Road by 2008.

Connell Wagner were to report on the modelling and the wider issues associated with Ocean Reef Road's function in the overall road network and to make recommendation on the extension of Ocean Reef Road.

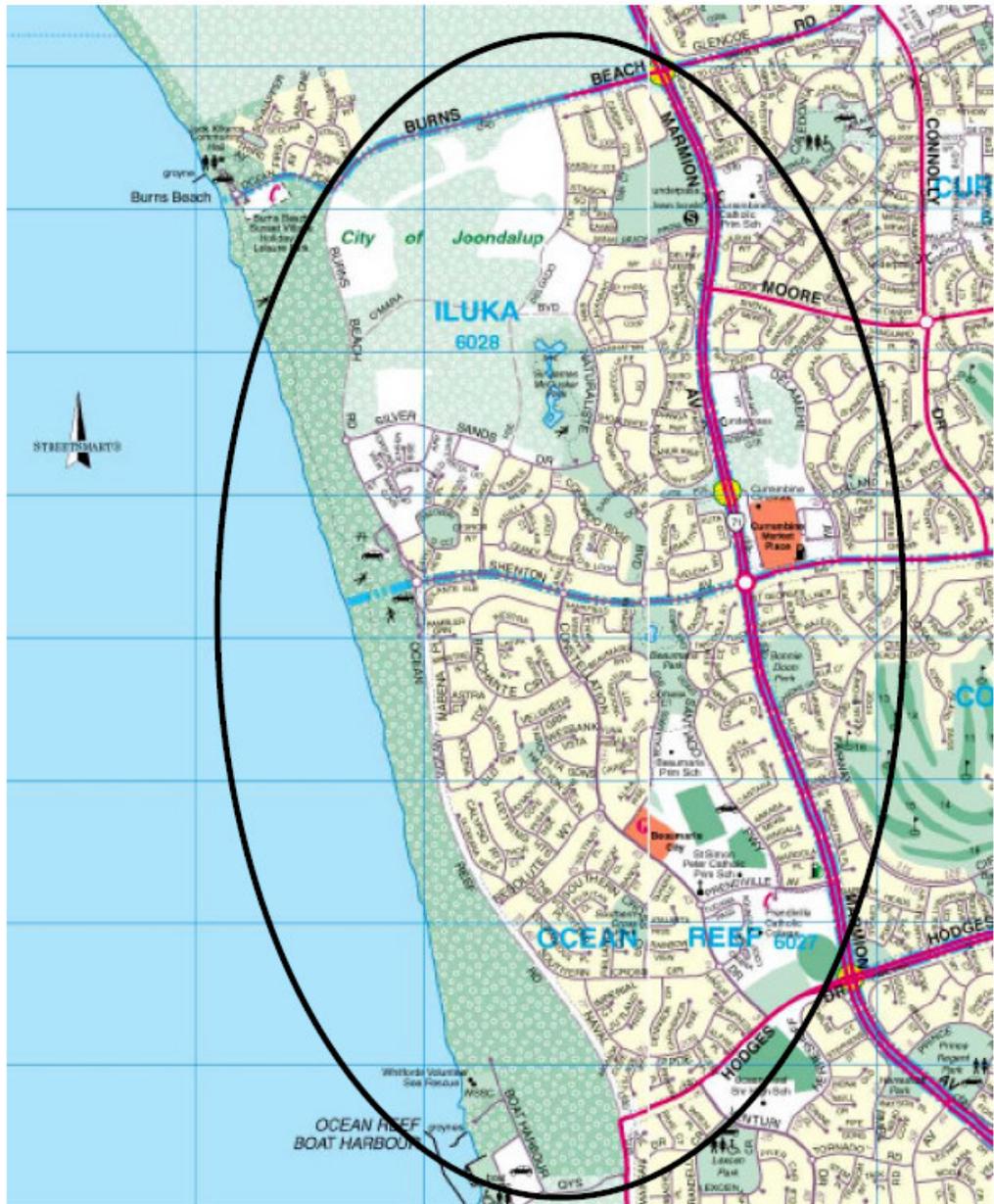
In further discussions, it was agreed that an assessment of the impact of the extension of Ocean Reef Road on Constellation Drive in the morning peak would also be considered. The four schools in the vicinity heavily influence the morning peak on Constellation Drive and so it was important to consider this issue.

## 1.3 Report Format

This report makes comment on the impact on Constellation Drive and Resolute Way of extending Ocean Reef Road from Hodges Drive to Shenton Avenue. Firstly, in terms of traffic volumes produced in the Sinclair Knight Merz report, and secondly, in terms of the road hierarchy and road network planning. From these two analysis information sources, conclusions have been drawn and recommendations made.

## 1.4 Study Area

Figure 1.4 show the study area and is extracted from the Sinclair Knight Merz report.



Map Source: DOLA Street Smart

Figure 1.4 – Study Area

## 2. Traffic Modelling

### 2.1 Traffic Model

Sinclair Knight Merz sourced traffic volumes from the City of Joondalup and Main Roads WA. These volumes were used to model the traffic flows within the study area and crossing into and out of the study area.

The flow of traffic around the study area was modelled by considering the land use, eg. schools, shops and housing. Traffic that passed through the study area was estimated from Main Roads WA's Trips model.

The traffic model was then checked against actual traffic counts, undertaken by the City of Joondalup and Main Roads WA, to ensure a close match between the traffic flows that were being used in the model and those that had been counted. This gives confidence that the traffic model is accurately predicting road network traffic levels.

For future years, ie. 2006 and 2011, data on expected land use changes and road network changes were included in the traffic model and the model used to predict changes in the study area traffic flow. The major changes that have been modelled were the development of Iluka and the extension of the Mitchell Freeway.

### 2.2 Traffic Model Results

The traffic modelling indicates that the absence of the Ocean Reef Road link mainly impacts traffic levels on the roads within the Ocean Reef area, and in particular, Constellation Drive (refer to Table 7 in SKM's report, Appendix A). Therefore, the focus of the report will be on the impact of the proposed Ocean Reef Road on the traffic flows on Constellation Drive and Resolute Way.

### 2.3 Existing Traffic

#### 2.3.1 Existing Situation

The current traffic volume on Constellation Drive, north of Hodges Drive, is approximately 7,500 vehicles per day. The schools that are located to the southern end of Constellation Drive contribute significantly to the traffic volumes. The traffic flow decreases to approximately 6,100 vehicles per day to the south of Shenton Avenue.

Resolute Way currently carries approximately 1,500 vehicles per day, on the eastern end.

#### 2.3.2 Proposed Ocean Reef Road

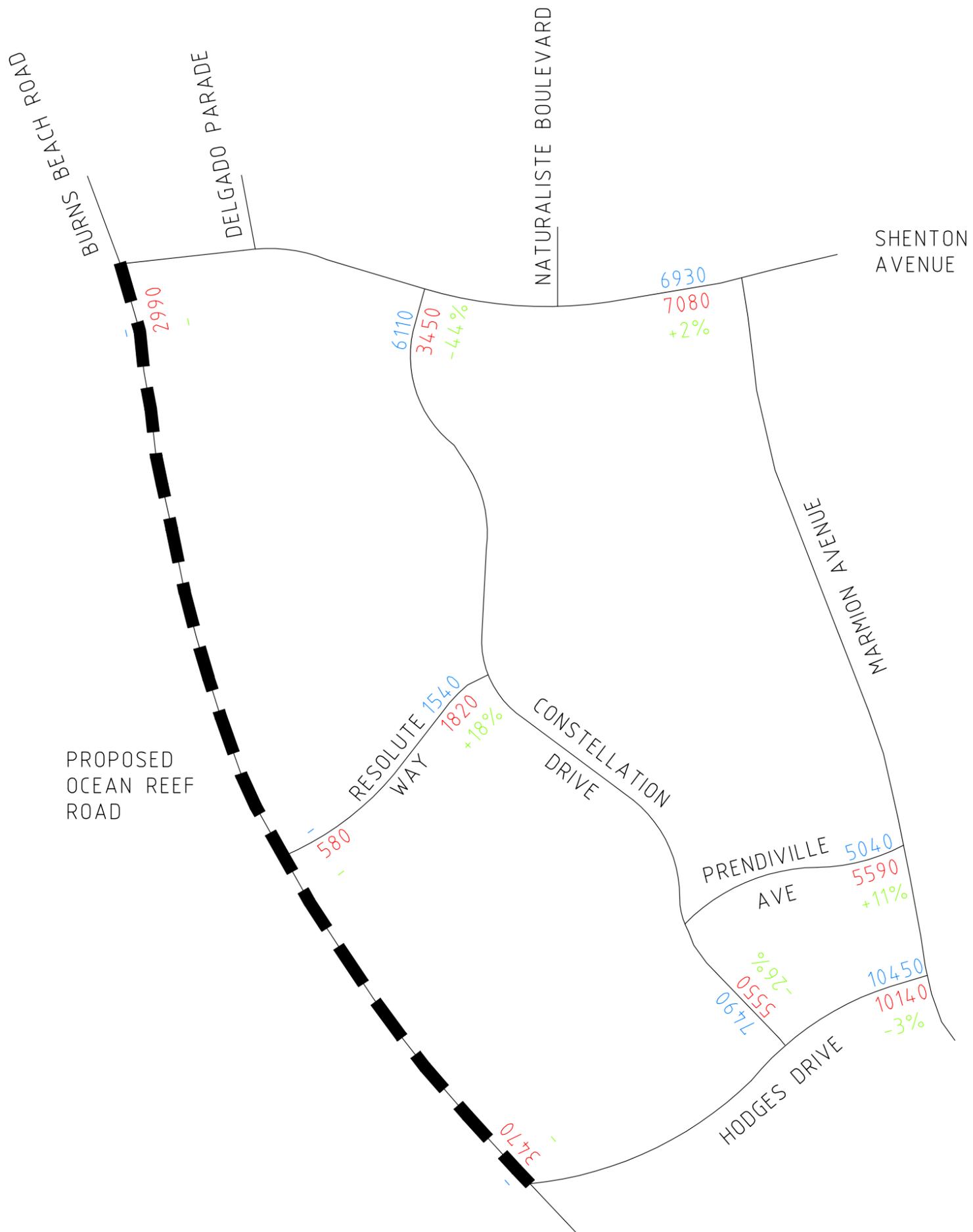
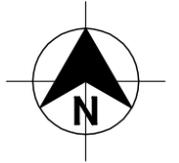
The proposed Ocean Reef Road has been modelled as a single carriageway road operating at 50kph.

The traffic modelling shows that if the proposed Ocean Reef Road had been extended to the north of Hodges Drive in 2003, then Constellation Drive, to the north of Hodges Drive, would carry an estimated 26% less traffic. The traffic on Constellation Drive, south of Shenton Avenue, is predicted to fall by an estimated 44%.

Resolute Way would be expected to have an 18% increase in traffic to approximately 1800 vehicles per day on the section of road, to the west of Constellation Drive, with approximately 600 vehicles per day to the east of a connection to the proposed Ocean Reef Road.

Ocean Reef Road, to the south of Hodges Drive, currently carries approximately 4,500 vehicles per day. The traffic modelling indicates that if Ocean Reef Road had been constructed to the north of Hodges Drive in 2003, the new road would carry approximately 3,500 vehicles per day.

Diagram 2.1.2 shows the traffic modelling figures and expected changes in the traffic flow.



### MODELLED TRAFFIC FLOW - EXISTING

**KEY:**

- 7840 VEHICLES PER DAY WITHOUT OCEAN REEF ROAD
- 7290 VEHICLES PER DAY WITH OCEAN REEF ROAD
- 7% PERCENTAGE CHANGE

## 2.4 Traffic 2006

### 2.4.1 Existing Situation

By 2006 it is expected that Main Roads will have extended the Mitchell Freeway past Hodges Drive to Shenton Avenue, which will result in a decrease in the traffic volume on Hodges Drive. The traffic volume on Constellation Drive, north of Hodges Drive, is estimated to be approximately 6,800 vehicles per day in 2006. The estimated traffic flow on Constellation Drive decreases to approximately 5,400 vehicles per day to the south of Shenton Avenue. From the modelling results, the traffic volumes in 2006 are estimated to be of a similar order to that modelled in 2003. Similarly, Resolute Way traffic would remain at approximately 1,500 vehicles per day.

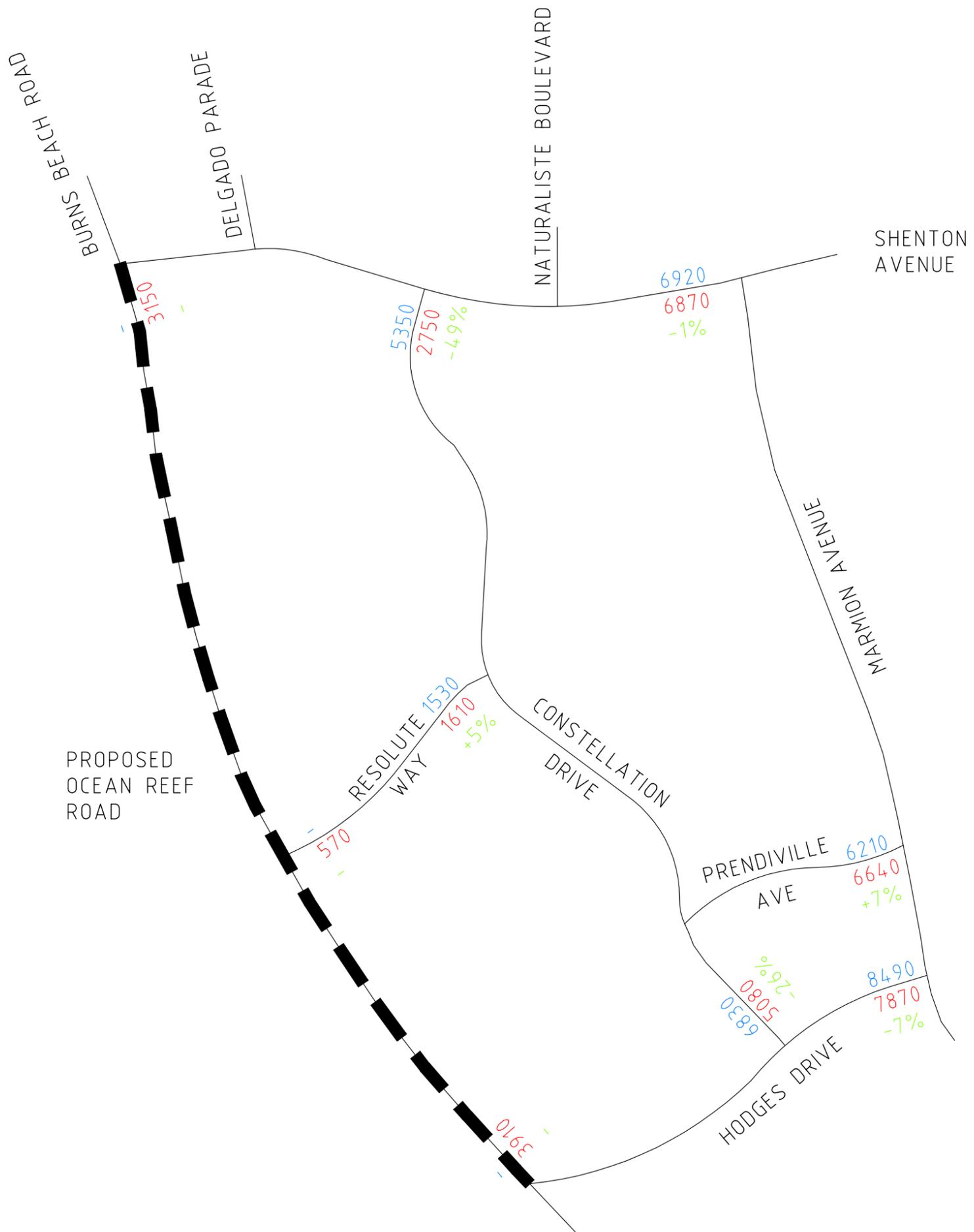
### 2.4.2 Proposed Ocean Reef Road

The traffic modelling shows that if Ocean Reef Road were extended, Constellation Drive, to the north of Hodges Drive, would carry an estimated 26% less traffic. The traffic on Constellation Drive, south of Shenton Avenue, would fall by an estimated 49%.

Resolute Way is predicted to increase to approximately 1600 vehicles per day, to the west of Constellation Drive, which is 200 vehicles per day less than that in 2003 with the proposed Ocean Reef Road. Resolute Way to the east of a connection to the proposed Ocean Reef Road is predicted to carry approximately 600 vehicles per day.

The traffic modelling shows that if the proposed Ocean Reef Road were extended, it would carry approximately 3,900 vehicles per day, to the north of Hodges Drive.

Diagram 2.2.2 shows the traffic modelling figures and expected changes in the traffic flow.



PROPOSED  
OCEAN REEF  
ROAD

KEY:

- 7840 VEHICLES PER DAY WITHOUT OCEAN REEF ROAD
- 7290 VEHICLES PER DAY WITH OCEAN REEF ROAD
- 7% PERCENTAGE CHANGE

MODELLLED TRAFFIC FLOW - 2006

## 2.5 Traffic 2011

### 2.5.1 Existing Situation

By 2011 it is expected that Main Roads will have extended the Mitchell Freeway past Shenton Avenue to Burns Beach Road, giving a decrease in the traffic volume on both Hodges Drive and Shenton Avenue. The traffic volume on Constellation Drive, north of Hodges Drive, is estimated to be approximately 6,700 vehicles per day. The traffic volume on Constellation Drive, south of Shenton Avenue, is estimated to be 7,600 vehicles per day.

Resolute Way traffic would increase to approximately 1,700 vehicles per day by 2011.

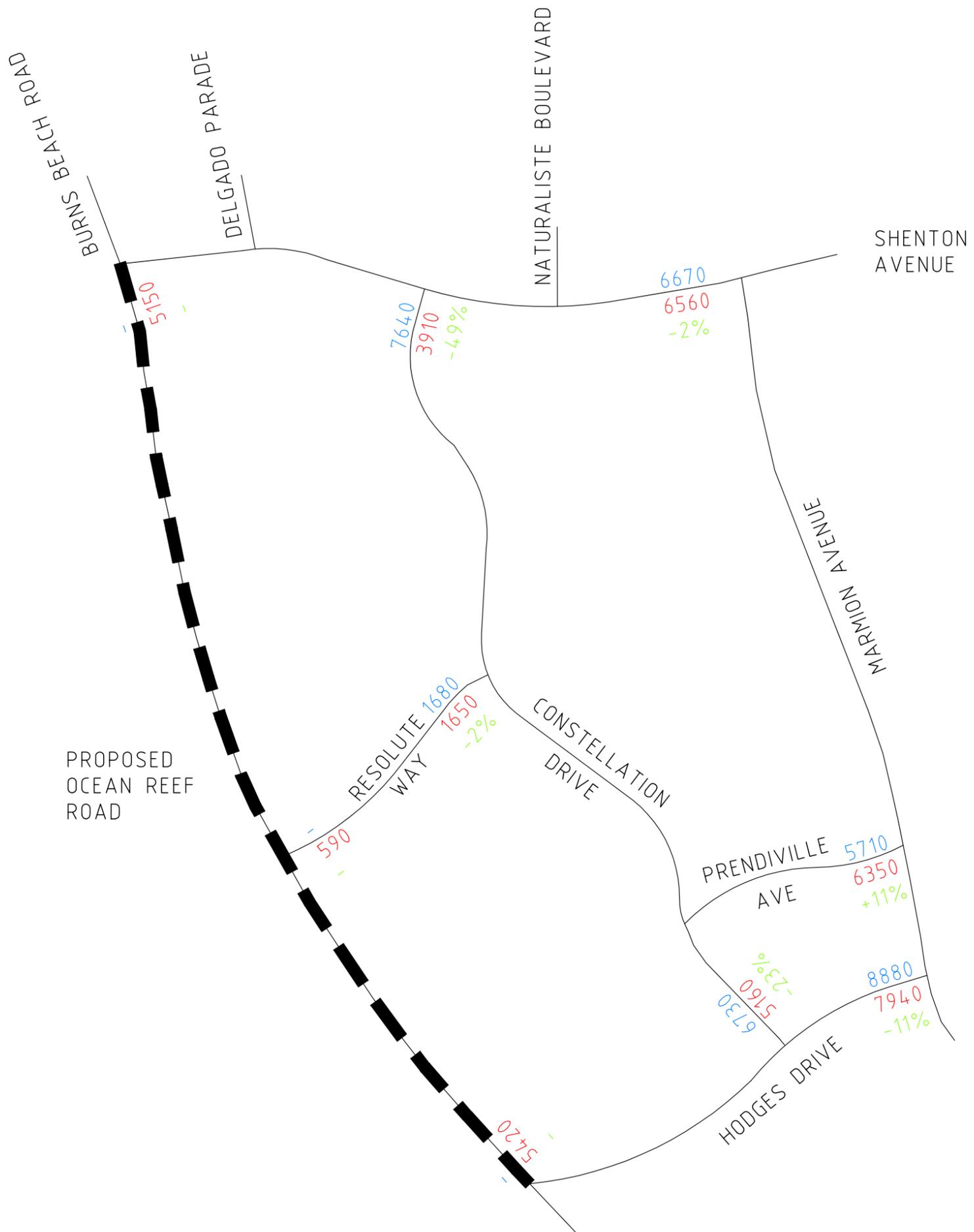
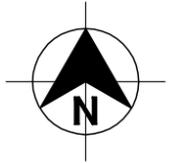
### 2.5.2 Proposed Ocean Reef Road

The traffic modelling indicates that if the proposed Ocean Reef Road were extended, Constellation Drive to the north of Hodges Drive would carry an estimated 23% less traffic. The traffic on Constellation Drive, south of Shenton Avenue, would fall by an estimated 49%. This is similar to the expected falls in the 2006 model.

Resolute Way would be expected to have a consistent traffic volume to the west of Constellation Drive of approximately 1700vehicles per day, and approximately 600 vehicles per day to the east of a connection to Ocean Reef Road.

The traffic modelling shows that if Ocean Reef Road were extended, it would carry approximately 5,400 vehicles per day, to the north of Hodges Drive. The flow would decrease to an estimated 5,200 vehicles per day to the south of Shenton Avenue.

Diagram 2.3.2 shows the traffic modelling figures and expected changes in the traffic flow.



## MODELLED TRAFFIC FLOW - 2011

### KEY:

- 7840 VEHICLES PER DAY WITHOUT OCEAN REEF ROAD
- 7290 VEHICLES PER DAY WITH OCEAN REEF ROAD
- 7% PERCENTAGE CHANGE

## 3. Road Hierarchy

### 3.1 Definition

Main Roads established five road classifications in its Metropolitan Functional Road Hierarchy ranging from Primary Distributor, such as Mitchell Freeway, to Access Road, which are the low traffic volume residential streets. The road hierarchy has been established to provide an orderly grouping of streets and roads in a framework around which the City can plan and implement various projects. It provides a sound basis for traffic management, transport and land use management planning.

The hierarchy assists the City to consider the effect of their decisions on surrounding areas and streets and helps clarify policies concerning roads within the regional road network.

### 3.2 Existing Situation

The Sinclair Knight Merz report includes a plan of the existing road hierarchy, refer to Appendix A. The road system is well established for Ocean Reef with a logical road network servicing the suburb, apart from the coastal links.

#### 3.2.1 Constellation Drive

Constellation Drive is classified as a Local Distributor, which means that it is expected to carry traffic belonging to or serving the area, rather than through traffic.

#### 3.2.2 Burns Beach Road

Burns Beach Road, to the north of Shenton Avenue, is classified as a Foreshore Access Road. The Western Australian Planning Commission's Policy DC2.6 *Residential Road Planning* notes that Foreshore Access Roads are a type of local distributor that not only carry foreshore bound traffic, but are also needed to carry locally generated traffic. These roads are low speed and low capacity. The Iluka Structure Plan Traffic Report comments that the City of Joondalup has proposed that Burns Beach Road along the foreshore will be constructed as a meandering boulevard that will provide a pleasant route in keeping with the foreshore environment. Part of Burns Beach Road has already been constructed to provide access from Shenton Avenue northwards and has been designed as a low speed two lane road "boulevard" style road.

#### 3.2.3 Ocean Reef Road

Ocean Reef Road to the south of Hodges Drive is classified as a Foreshore Access Road and has a single lane in each direction. The proposed extension would fit the criteria of a Foreshore Access Road, similar to the Burns Beach Road classification, where it is adjacent to the coast.

A small part of Ocean Reef Road exists to the south of Shenton Avenue.

### 3.3 Pedestrians and Cyclists

Foreshore Access Roads should be bicycle and pedestrian friendly, as the road is providing an amenity to the community by allowing it access to the foreshore.

### 3.4 Additional Access Options

With the road network developed, no other access, apart from Ocean Reef Road, can be created to significantly lessen the traffic impact on Constellation Drive.

# 4. Schools

## 4.1 Introduction

This report has focussed on the traffic flows associated with the proposed Ocean Reef Road and the hierarchy of roads within the study area. The high school and two primary schools within the study area and the high school adjacent to the southern boundary of the study area generate a large amount of traffic.

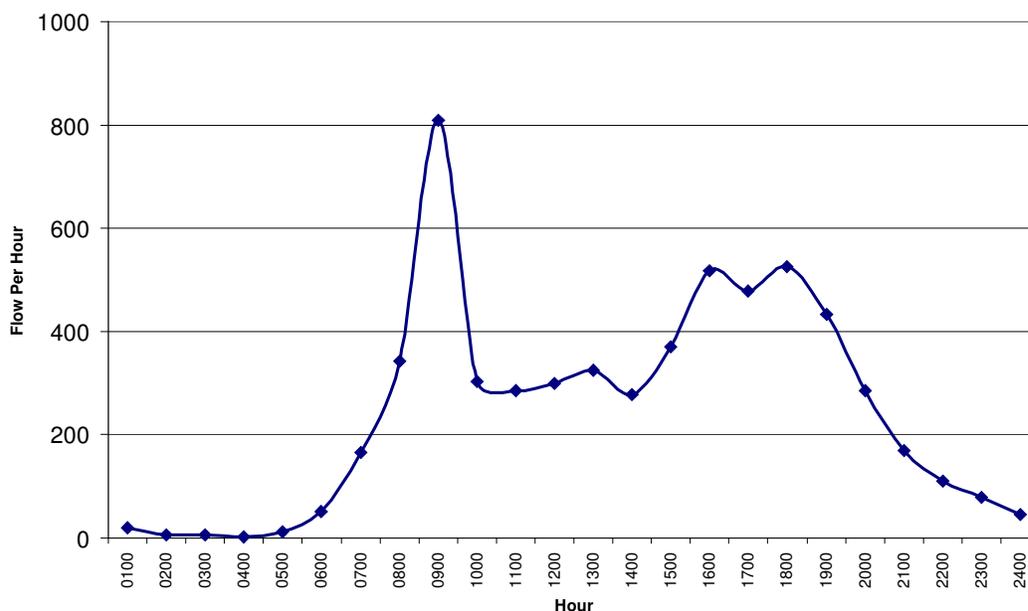
## 4.2 School Traffic

The daily flows for the traffic associated with Prendville College and St Simon Peter Catholic Primary School, are estimated as follows:

Constellation Drive	north Hodges Drive	1,950 vehicles per day
Prendville Avenue	west Marmion Avenue	1,530 vehicles per day
Hodges Drive	west Marmion Avenue	1,570 vehicles per day

The morning peak traffic on these roads is concentrated in the hour 8.00am to 9.00am and is the peak level of traffic during the day. The afternoon peak is less well defined and is between 3.00pm and 6.00pm, as shown in Diagram 4.2.1 below.

### 4.2.1 Constellation Drive South of Prendville



### 4.2.2 Peak Hour

To spread the peak hour in the morning, it may be possible for the schools to arrange staggered start time. This will not reduce the total number of vehicles per day, but it should reduce the morning peak congestion.

The extension of Ocean Reef Road is not expected to impact on the traffic generated by the schools, as these trips will continue on Constellation Drive. However, if Ocean Reef Road were extended, it would provide an alternative route for through traffic on Constellation Drive during the morning peak.

## **5. Conclusion**

The reduction in traffic volume on Constellation Drive warrants the extension of Ocean Reef Road from Hodges Drive to Shenton Avenue.

The linking of the existing Ocean Reef Road to Burns Beach Road creates an important link in the Foreshore Access Road system that provides an amenity to the general community.

The traffic volumes of 4,700 vehicles per day expected on the extended Ocean Reef Road in 2006 suggest that the road cross section should only be a single carriageway in both directions.

In keeping with the surrounding road network, the extended Ocean Reef Road should be classified as a Foreshore Access Road.

## 6. Recommendation

It is recommended that the City extend Ocean Reef Road from Hodges Drive to Shenton Avenue, with a design appropriate to a Foreshore Access Road classification in the City of Joondalup road hierarchy.

# ***Appendix A***

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*Sinclair Knight Merz Traffic Modelling Report*



# Ocean Reef Road Extension

## TRAFFIC MODELLING REPORT

- Connell Wagner
- FINAL DRAFT
- June 2004

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# 1. Introduction

## 1.1 Background

Ocean Reef Road is classified as a District Distributor 'A' and currently terminates at its intersection with Hodges Drive. The City of Joondalup are considering extending Ocean Reef Road to intersect with Shenton Avenue. Traffic modelling is therefore required to determine the traffic impact of the proposed Ocean Reef Road extension on local roads within Ocean Reef and Iluka.

Sinclair Knight Merz have prepared this report on behalf of Connell Wagner to document the traffic modelling process and present the outcomes.

## 1.2 Study Area

The study area is bounded by Hodges Drive, Marmion Avenue, Burns Beach Road and Ocean Reef Road, as shown in **Figure 1**.

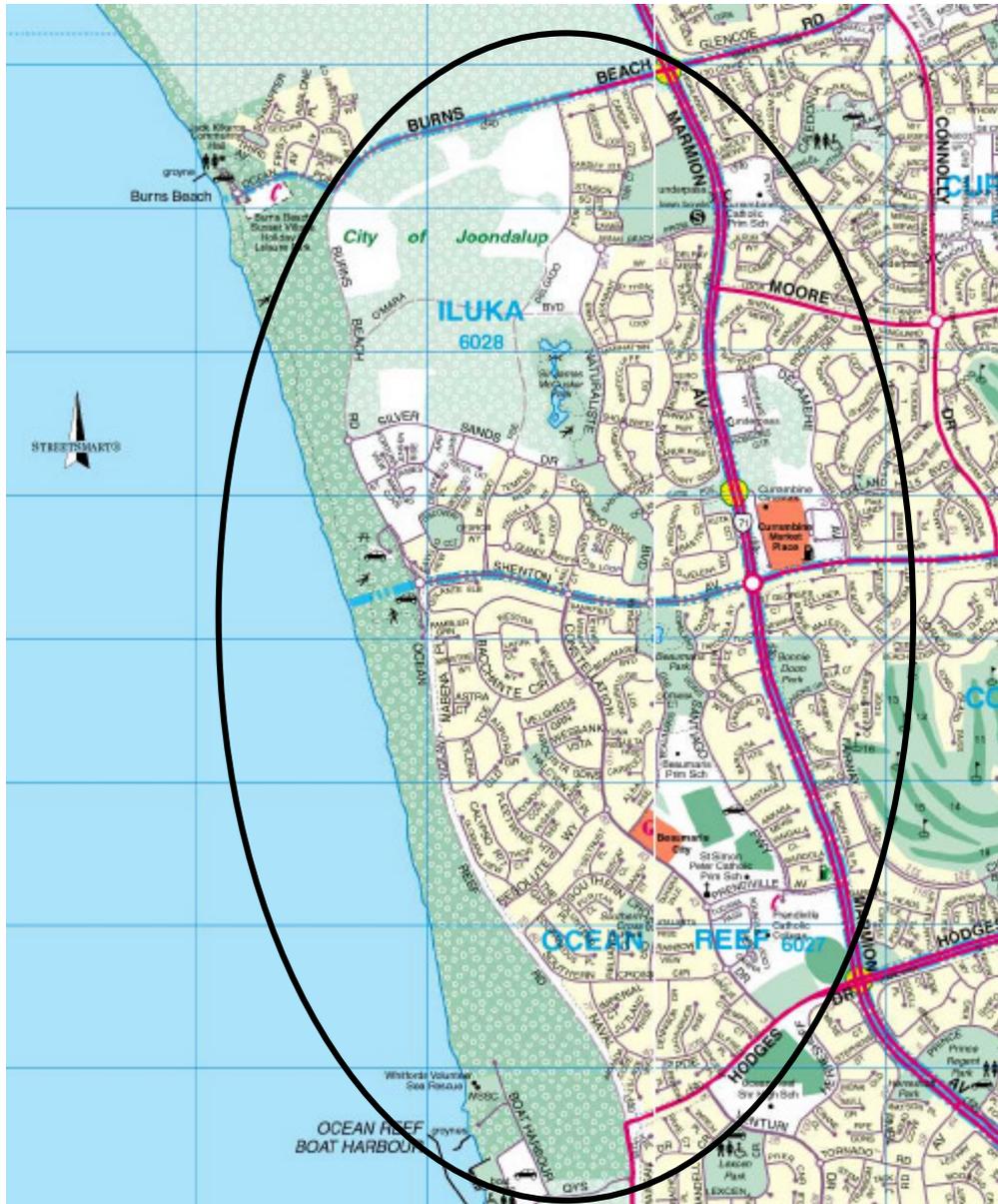
## 1.3 Layout of Report

This report is structured as follows:

- **Section 2** - Reviews the existing conditions regarding traffic volumes and the local road system.
- **Section 3** - Outlines the traffic forecasting methodology undertaken and provides information on the traffic network modelling software used to analyse the existing and future traffic situations.
- **Section 4** - Documents the future land use, planning and road network upgrade assumptions used to predict future traffic conditions.
- **Section 5** – Presents the forecasts volumes for the scenarios analysed.



■ Figure 1 Study Area



Map Source: DOLA Street Smart



## 2. Existing Conditions

### 2.1 Road Hierarchy

The existing road hierarchy for the study area is illustrated **Figure 2**.

### 2.2 Existing Traffic Volumes

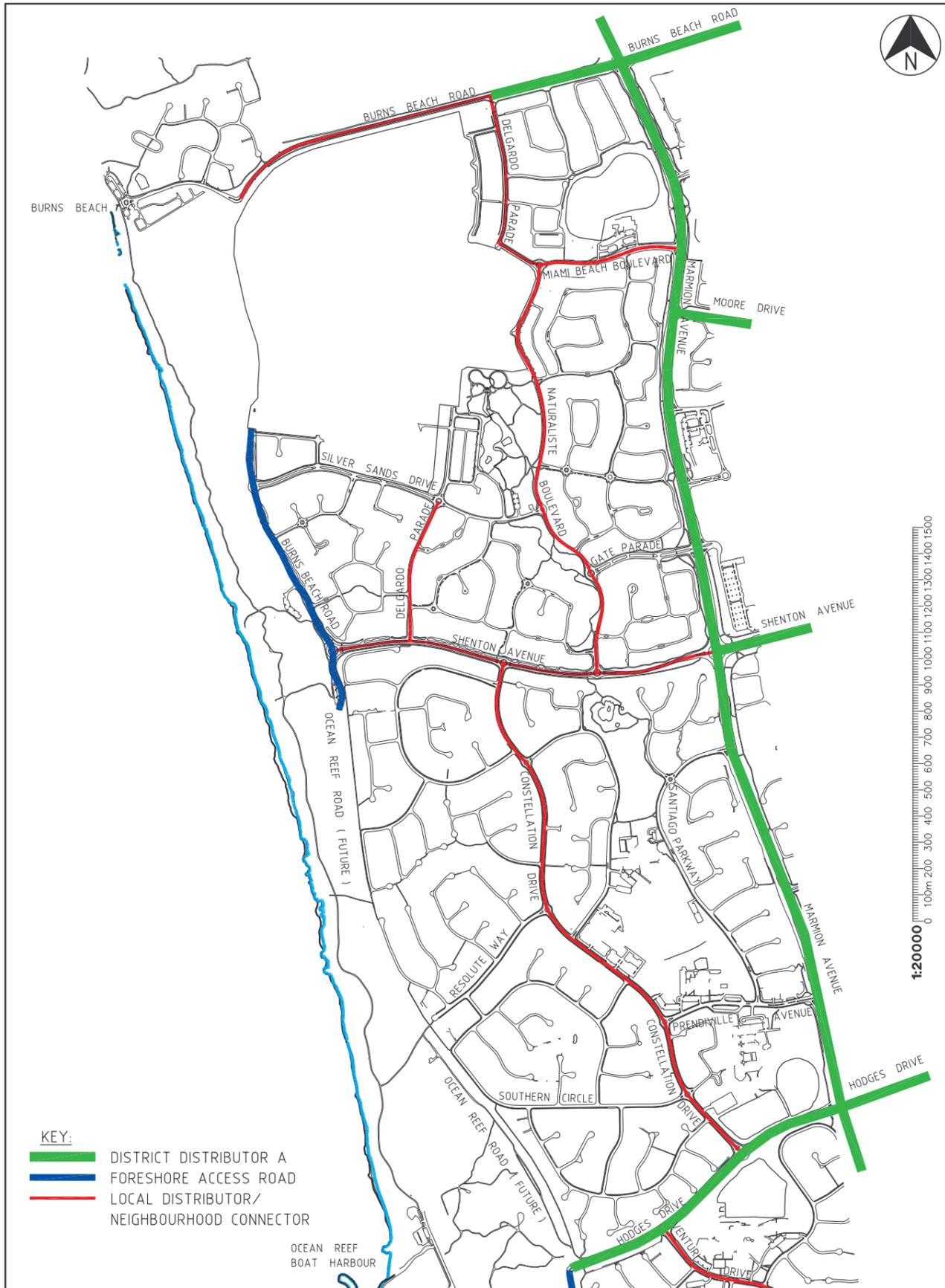
Existing traffic volumes have been sourced from Main Roads WA or the City of Joondalup and are shown in **Table 1**. Where counts for 2003 were not available, data from an earlier year was obtained.

#### ■ Table 1 Summary of Existing Traffic Count Data

Road	Section	Volume (Vpd)	Date	Source
<b>Screenline 1: North of Shenton Avenue</b>				
Burns Beach Road	North of Shenton Ave	1000	2004	Estimate
Delgado Parade	North of Shenton Ave	2070	2004	City of Joondalup
Naturaliste Boulevard	North of Shenton Ave	1510	2004	City of Joondalup
Marmion Avenue	North of Shenton Ave	33800	2003	Main Roads WA
<b>Screenline 2: South of Shenton Avenue</b>				
Constellation Drive	South of Shenton Ave	6320	2004	City of Joondalup
Marmion Avenue	South of Shenton Ave	38000	2003	Main Roads WA
<b>Screenline 3: North of Hodges Drive</b>				
Constellation Drive	North of Hodges Dr	7400	2000	City of Joondalup
Marmion Avenue	North of Hodges Dr	38100	2003	Main Roads WA
<b>Screenline 4: South of Hodges Drive</b>				
Ocean Reef Road	South of Hodges Drive	4600	2002	Main Roads WA
Venturi Drive	South of Hodges Drive	3900	2000	Main Roads WA
Marmion Avenue	South of Hodges Drive	22000	2003	Main Roads WA
<b>Screenline 5: West Marmion Avenue</b>				
Burns Beach Road	West of Marmion Ave	2030	2004	City of Joondalup
Miami Beach Promenade	West of Marmion Ave	1500	2004	Estimate
Ocean Gate Parade	West of Marmion Ave	1450	2004	Estimate
Shenton Avenue	West of Marmion Ave	6980	2004	City of Joondalup
Santiago Parkway	West of Marmion Ave	1150	2004	City of Joondalup
Prendiville Avenue	West of Marmion Ave	4960	2004	City of Joondalup
Hodges Drive	West of Marmion Ave	10240	2002	Main Roads WA
<b>Screenline 6: East Marmion Avenue</b>				
Burns Beach Road	East of Marmion Ave	10370	2004	Main Roads WA
Caledonia Avenue	East of Marmion Ave	1890	2003	Main Roads WA (model)



Road	Section	Volume (Vpd)	Date	Source
Moore Drive	East of Marmion Ave	6400	2003	Main Roads WA (model)
Delamere Avenue	East of Marmion Ave	900	2003	Main Roads WA (model)
Hobsons Gate	East of Marmion Ave	700	2003	Main Roads WA (model)
Cinema Access	East of Marmion Ave	3010	2004	Main Roads WA
Shenton Avenue	East of Marmion Ave	12210	2003	Main Roads WA
Diablo Way	East of Marmion Ave	5070	2001	Main Roads WA (model)
Hodges Drive	East of Marmion Ave	26040	2004	Main Roads WA



**OCEAN REEF ROAD EXTENSION TRAFFIC STUDY  
ROAD HIERARCHY**

**FIGURE 2**



## 3. Modelling Methodology

### 3.1 Transport Modelling Package

Sinclair Knight Merz has developed an up-to-date traffic modelling tool for the Ocean Reef Road Extension traffic study, using the internationally recognised EMME/2 software platform.

EMME/2 is currently used in 59 countries by over 700 organisations. EMME/2 users include local and state governments, transit agencies, consulting firms and universities. It is widely used throughout Australia and New Zealand, with the WA Department for Planning and Infrastructure using EMME/2 for the:

- Future Perth Strategic Transport Evaluation project; and
- To forecast passenger demand on the Perth-Mandurah rail line.

EMME/2 represents a road network as a series of links (roads) and nodes (intersections). The traffic generating land uses are represented as a number of zones connected to the network.

For this application, a 24-hour average weekday model was developed. The average weekday was selected as it represents the typical activity on the area's roads, while a 24-hour time period was considered appropriate as the nature of the new road is likely to change travel patterns more than the short periods of congestion experienced at the key intersections during peak periods.

The Ocean Reef Road Extension EMME/2 model has been developed for private vehicular traffic only.

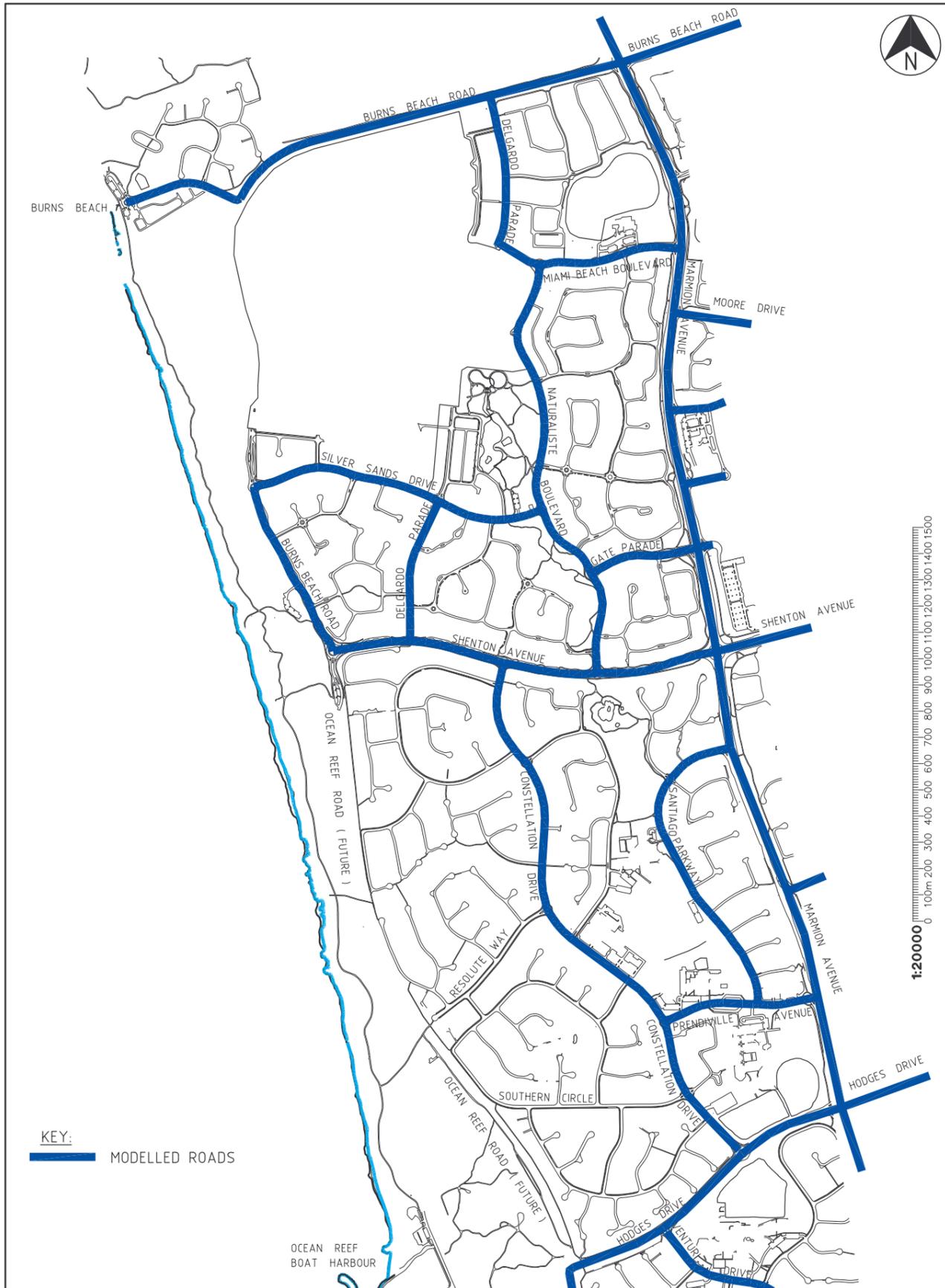
### 3.2 Modelling Process

In order to determine the impacts of the Ocean Reef Road extension, it was necessary to build and calibrate a model of the existing road network within Ocean Reef and Iluka. The process of developing and calibrating the base model is described in the following sections.

### 3.3 Modelled Road Network

The modelled road network comprises all the key routes within the area, such as local distributors and the major access roads and is shown in **Figure 3**. Some minor local roads have not been included as they have little influence on the traffic operation of the network.

The road network coding was based on the road hierarchy discussed in Section 2. Different road categories were given different traffic capacities through the use of volume-delay functions. These functions change the travel time based on the amount of traffic using that section of road. Higher-order roads with more lanes are given more capacity and hence their travel times will not be affected as significantly by large volumes of traffic as a local road. The EMME/2 model attempts



KEY:  
 MODELLED ROADS



**OCEAN REEF ROAD EXTENSION TRAFFIC STUDY  
 BASE YEAR ROAD NETWORK**

**FIGURE 3**



to minimise the journey time and hence tends to concentrate traffic on the roads with the higher capacity.

The road categories used in the model are shown in **Table 2**.

■ **Table 2 Model Road Categories**

Road Category	Streets Applied To	Nominal Capacity Per Lane <sup>1</sup>	Operational Speeds
1	Marmion Ave, Hodges Dr (east of Marmion Ave), Shenton Ave (east of Marmion Ave)	10,000 vpd	70 kph
2	Burns Beach Rd, Moore Dr, Shenton Ave (west of Marmion Ave), Hodges Dr (west of Marmion Ave), Ocean Reef Rd, Venturi Dr	5,000 vpd	50 kph
3	Constellation Dr, Prendiville Ave, Santiago Pway, Delgado Pde, Naturaliste Blvd, Silver Sands Dr, Ocean Gate Pde, Miami Beach Prom	4,000 vpd	40 kph

Note 1: Nominal Capacity is the theoretical capacity of the road. It can be exceeded. However, the travel time on the link will increase rapidly.

Several roads were cut by the model boundaries. Traffic continuing on these roads was represented by additional traffic generating and attracting zones (external zones). They include:

- Marmion Avenue, north of Burns Beach Road;
- Burns Beach Road, east of Marmion Avenue;
- Caledonia Avenue, east of Marmion Avenue;
- Moore Drive, east of Marmion Avenue;
- Delamere Avenue, east of Marmion Avenue;
- Hobsons Gate, east of Marmion Avenue (represented by Delamere Avenue zone);
- Ocean Gate Parade, east of Marmion Avenue (represented by Delamere Avenue zone);
- Shenton Avenue, east of Marmion Avenue;
- Diablo Way, east of Marmion Avenue;
- Hodges Drive, east of Marmion Avenue;
- Marmion Avenue, south of Hodges Drive;
- Venturi Drive, south of Hodges Drive; and
- Ocean Reef Road, south of Hodges Drive.

Traffic volumes for each of these external zones were obtained from the MRWA model. However, as the MRWA model only exists for the years 2001, 2006, 2011 (ie at 5 year intervals), external zone traffic volumes for the base year (2003) were extrapolated from the years 2001 and 2006.



Where these extrapolated volumes differed from the observed existing volumes, the observed (actual) volumes were used. This process is summarised in **Appendix A**.

### 3.4 Base Year Landuse Data

The modelled area was divided into 17 traffic generating and attracting zones. The zone boundaries are shown in **Figure 4**.

The number of dwellings within each zone was determined from aerial photography of the study area, supplemented by MRWA model inputs. Retail and employee data was sourced from the *Directory of Shopping Centres – Western Australia 2001* produced by the Property Council of Australia Limited.

In addition, estimates of the primary and secondary school enrolments were sourced directly from the schools themselves.

The data sets assembled for input to the generation stage are summarised in **Table 3**. Full details for each zone are listed in **Appendix B**.

#### ■ Table 3 Summary of Base Year Land Use Data

Landuse Category	Study Area Statistics
Occupied Private Dwellings	2,590
Primary/Secondary Enrolments	2,510
TAFE/Tertiary Enrolments	0
Business/Commercial Floor Area (m <sup>2</sup> )	5,150
Total Employees	280

### 3.5 Model Structure

The traditional four-step model includes the following processes:

- Trip Generation;
- Mode Split;
- Trip distribution; and
- Trip assignment.

In this instance the trip generation step only considered private vehicle motorised trips therefore the mode split process was not required.

Private vehicle was selected as the appropriate mode to assess the traffic impacts of the proposed extension of Ocean Reef Road. These road network changes will have minor impacts (if any) on bus services, therefore alternative modes were not considered.





### 3.5.1 Trip Generation

The purpose of the trip generation model is to produce 24-hour trip productions and attractions for input into the trip distribution procedure. These trips include:

- Trips originating in the study area to any destination;
- Trips terminating in the study area from any destination; and
- Through trips originating and terminating outside the study area but using roads within and around the study area.

#### 3.5.1.1 Trip Productions (Trip Originating in the Study Area)

The 24-hour trip production model was based on combined trip rates dating back to the 1986 travel survey and the Road Reserves Review. A trip production rate of 7.17 trips per household was used. Production trip rates based on the Road Reserves Review are still current, and are accepted as an industry standard in Western Australia when developing traffic models.

Trips produced within the study area are destined for attractions both within and outside of the model area.

### 3.5.2 Trip Attractions (Trips Terminating in the Study Area)

While trip productions represent the number of trips associated with each household, trip attractions represent the destination side of the traffic model, ie the destinations within the study area.

Trips are attracted to work places, education facilities, shopping facilities, community facilities and residential areas. The trip attraction rates have been based on those determined from the 1986 Travel Survey:

Work Attractions	=	1.365 trips per job
Education Attractions	=	0.8 trips per primary/secondary enrolment
	+	0.897 trips per tertiary enrolment
Other Attractions	=	1.138 trips per dwelling units
		0.8 trips per m <sup>2</sup> retail floor area
		0.711 trips per school enrolment
		1.006 trips per job

These rates include trips to the model area originating within and from outside the model area.

Attraction trip rates based on the Road Reserves Review are still current, and are accepted as an industry standard in Western Australia when developing traffic models.



### 3.5.2.1 Through Trips

External through trips were obtained from a sub-area cordon of the MRWA Trips model.

The MRWA model only exists for the years 2001, 2006, 2011 (ie at 5 year intervals), therefore through trips and external trips for the base year (2003) were extrapolated from the MRWA regional traffic model sub area analysis of the for the years 2001 and 2006.

### 3.5.3 Trip Distribution

Trip distribution is the process whereby two-dimensional matrices of trips are produced from the one-dimensional production and attraction matrices. The distribution for the model has attempted to take into account the different travel patterns experienced within Ocean Reef and Iluka. Trips within the study area have been distributed based on the following formula, which minimises the length of travel distance:

$$f = (\text{distance})^{-2}$$

External to inner area, inner area to external and external through trips were distributed separately based on the proportions obtained from the MRWA Trips model.

Where the external zone traffic volumes from the MRWA model differed from the observed existing volumes (see **Appendix A**), the observed (actual) volumes were used. The external to external trip percentages therefore had to be modified to reflect the same number of internal-external and external-internal trips as determined by the MRWA model.

### 3.5.4 Assignment

The EMME/2 assignment model uses a linear approximation algorithm to solve the capacity restrained highway assignment.

The trips are distributed around the network by EMME/2 in such a way that their total travel time is minimised. The shortest travel time calculations are based for the road network and take into consideration the road type, average speed and number of lanes along each route. This is done in several iterations to allow the congestion to be included in the travel time calculations.

## 3.6 Calibration

The traffic count data provided by Main Roads WA and the City of Joondalup (as shown in **Table 1**) was used to calibrate the base model. A total of 26 link counts were used in the calibration process.

The calibration process for this project involved minor adjustments to the traffic functions of the roads within the study area. The number of trips in the base model was adjusted using the 'select



link' method. This involves factoring up or down all trips on one link so that the modelled volumes match more closely with the surveyed volumes.

The results are shown in **Table 4** which reports surveyed and modelled link volumes for a variety of locations arranged into six screenlines.

The 'Mean Absolute Difference' (MAD) is a measure of how well the model matches the surveyed traffic volumes across the whole model. A MAD of 10% is generally considered reasonable for a traffic network model. A MAD ratio of 3.80% was achieved for this model and indicates that the model is well calibrated. Overall, the model estimates approximately 2.5% more trips than were surveyed, which is an acceptable fit.

A discrepancy between actual and modelled volumes that could not be resolved during the calibration process was:

- An overestimate of trips on Marmion Avenue north of Burns Beach Road (this is however outside of the study area).



■ **Table 4 Calibration Results**

Road	Section	Existing Volume	Modelled Volume	Difference	Difference (%)	Absolute Diff (%)
<b>Screenline 1: North of Shenton Avenue</b>						
Burns Beach Road	North of Shenton Ave	1000	1036	36	4%	4%
Delgado Parade	North of Shenton Ave	2070	1888	-182	-9%	9%
Naturaliste Boulevard	North of Shenton Ave	1510	1662	152	10%	10%
Marmion Avenue	North of Shenton Ave	33800	39640	5840	17%	17%
<b>Total Screenline 1</b>		<b>38380</b>	<b>44266</b>	<b>5846</b>	<b>15%</b>	<b>16%</b>
<b>Screenline 2: South of Shenton Avenue</b>						
Constellation Drive	South of Shenton Ave	6320	6114	-206	3%	3%
Marmion Avenue	South of Shenton Ave	38000	38236	236	1%	1%
<b>Total Screenline 2</b>		<b>44320</b>	<b>44350</b>	<b>30</b>	<b>0%</b>	<b>1%</b>
<b>Screenline 3: North of Hodges Drive</b>						
Constellation Drive	North of Hodges Dr	7400	7486	86	1%	1%
Marmion Avenue	North of Hodges Dr	38100	37718	-382	-1%	1%
<b>Total Screenline 3</b>		<b>45500</b>	<b>45204</b>	<b>-296</b>	<b>1%</b>	<b>1%</b>
<b>Screenline 4: South of Hodges Drive</b>						
Ocean Reef Road	South of Hodges Drive	4600	4900	300	7%	7%
Venturi Drive	South of Hodges Drive	3900	4184	284	7%	7%
Marmion Avenue	South of Hodges Drive	22000	22220	220	1%	1%
<b>Total Screenline 4</b>		<b>30500</b>	<b>31304</b>	<b>804</b>	<b>3%</b>	<b>3%</b>
<b>Screenline 5: West Marmion Avenue</b>						
Burns Beach Road	West of Marmion Ave	2030	1510	-520	-26%	26%
Miami Beach Prom	West of Marmion Ave	1500	1540	40	3%	3%
Ocean Gate Parade	West of Marmion Ave	1450	1244	-206	-14%	14%
Shenton Avenue	West of Marmion Ave	6980	6932	-48	-1%	1%
Santiago Parkway	West of Marmion Ave	1150	1114	-36	-3%	3%
Prendiville Avenue	West of Marmion Ave	4960	5038	78	2%	2%
Hodges Drive	West of Marmion Ave	10240	10446	206	2%	2%
<b>Total Screenline 5</b>		<b>28310</b>	<b>27824</b>	<b>-486</b>	<b>-2%</b>	<b>4%</b>
<b>Screenline 6: East Marmion Avenue</b>						
Burns Beach Road	East of Marmion Ave	10370	10352	-18	0%	0%
Caledonia Avenue	East of Marmion Ave	1890	1884	-6	0%	0%
Moore Drive	East of Marmion Ave	6400	6386	-14	0%	0%
Delamere equivalent	East of Marmion Ave	4610	4606	-4	0%	0%
Shenton Avenue	East of Marmion Ave	12210	12352	142	1%	1%
Diablo Way	East of Marmion Ave	5070	5048	-22	0%	0%
Hodges Drive	East of Marmion Ave	26040	26406	366	1%	1%
<b>Total Screenline 6</b>		<b>66590</b>	<b>67034</b>	<b>444</b>	<b>1%</b>	<b>1%</b>
<b>TOTAL ALL screenlines</b>		<b>253600</b>	<b>259942</b>	<b>6342</b>	<b>3%</b>	<b>4%</b>
				<b>Mean Absolute Difference</b>		<b>3.80%</b>



## 4. Future Scenarios

The years 2006 and 2011 have been selected as the forecast horizons, where the local traffic impacts of the Ocean Reef Road extension would be determined.

### 4.1 Forecast Land Use Data

In order to ascertain the traffic demands within the study area for the forecast years, land use data was extracted from the MRWA regional traffic model.

**Table 5** shows the MRWA regional traffic model predicted traffic increases (and therefore increase in landuse intensity) between 2003 and 2006, and between 2003 and 2011.

#### ■ Table 5 MRWA Regional Model Traffic (Land Use) Growth

MRWA Zone No.	Modelled Zone No. (see Figure 4)	2003 – 2006 Growth (%)	2003 – 2011 Growth (%)
1	101	34.8%	73.7%
2	103, 106, 107, 110	16.2%	16.4%
3	102, 1040, 105, 108, 109	61.8%	84.0%
4	111, 113, 114	0%	0%
5	112, 115, 116, 117	1.6%	1.9%

Base year land uses within these zones or zone groups have therefore been factored up by these growth factors.

The data set assembled for input into the 2006 and 2011 EMME/2 model is summarised in **Table 6**. Full details for each zone are listed in **Appendix C** (for 2006) and **Appendix D** (for 2011).

#### ■ Table 6 Summary of Forecast Year Land Use Data

Landuse Category	Study Area Statistics
<b>Forecast Year 2006</b>	
2006 Occupied Private Dwellings	3,100
Primary/Secondary Enrolments	2,540
TAFE/Tertiary Enrolments	0
Business/Commercial Floor Area (m <sup>2</sup> )	5,190
Total Employees	280
<b>Forecast Year 2011</b>	
2006 Occupied Private Dwellings	3,270
Primary/Secondary Enrolments	2,540
TAFE/Tertiary Enrolments	0
Business/Commercial Floor Area (m <sup>2</sup> )	5,220
Total Employees	290



#### **4.2 Trip Distribution for Forecast Years**

A number of regional road network changes are likely to come into effect prior to 2011. The Mitchell Freeway will be extended to Shenton Avenue by 2006, with a further extension to Burns Beach Road expected to be completed by 2008. These road network changes will affect the trip distribution pattern of the inner to external area, external to inner area and external through trips.

The trip distribution ratios have been obtained from the MRWA Trips Model, which takes into account the regional road network changes. These distribution ratios have been corrected to account for differences between the 2003 derived modelled volumes and the 2003 actual observed counts (as shown in **Appendix A**).

#### **4.3 Scenarios for Testing**

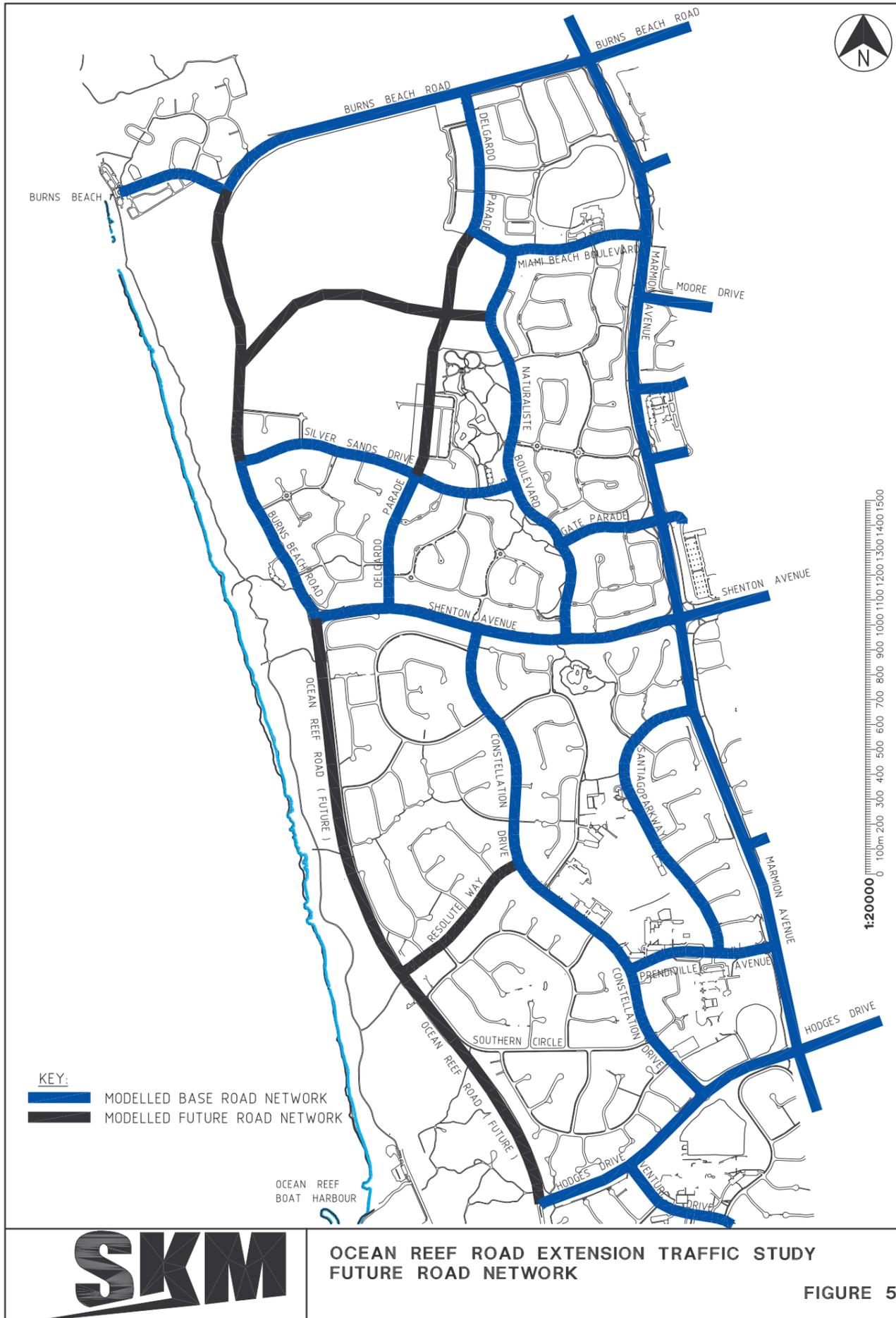
A further five road network and land use scenarios were modelled, as follows:

- Base year (2003) with the Ocean Reef Road extension.
- 2006 land use and road network with no Ocean Reef Road extension.
- 2006 land use and road network with Ocean Reef Road extension.
- 2011 land use and road network with no Ocean Reef Road extension.
- 2011 land use and road network with Ocean Reef Road extension.

In addition to the extension of Ocean Reef Road, the following road network changes were made to the 2006 and 2011 models, as shown in **Figure 5**.

- Burns Beach Road extension;
- Completion of Omara Boulevard;
- Completion of Delgado Parade;
- Connection of Resolute Way to Ocean Reef Road (in scenarios with the Ocean Reef Road extension).

The forecast volumes for each of the modelled scenarios are presented in Section 5.





## 5. Forecast Volumes For Network Scenarios

### 5.1 Comparison of Traffic Volumes

Modelled traffic volumes for each of the calibrated and forecast scenarios are compared in **Table 7**.

■ **Table 7 Forecast Daily Traffic Volumes for Modelled Scenarios**

Road	Section	Ex Volume	Base Model (2003)	2003 With ORR	2006 Without ORR	2006 With ORR	2011 Without ORR	2011 With ORR
<b>Screenline 1: North of Shenton Avenue</b>								
Burns Beach Road	North of Shenton Ave	1000	1040	1040	3150	3760	3920	5000
Delgado Parade	North of Shenton Ave	2070	1890	2490	2980	3090	3940	4310
Naturaliste Bvard	North of Shenton Ave	1510	1660	1420	1980	1590	2410	1900
Marmion Avenue	North of Shenton Ave	33800	39640	39100	37830	37930	38260	37160
<b>Screenline 2: South of Shenton Avenue</b>								
Constellation Drive	South of Shenton Ave	6320	6110	3450	5350	2750	7640	3910
Marmion Avenue	South of Shenton Ave	38000	38240	37890	38690	38090	39120	37920
Ocean Reed Road	South of Shenton Ave	-	-	2990	-	3190	-	4950
<b>Screenline 3: North of Hodges Drive</b>								
Constellation Drive	North of Hodges Dr	7400	7490	5550	6830	5080	6730	5160
Marmion Avenue	North of Hodges Dr	38100	37720	36190	35230	33370	35890	33010
Ocean Reef Road	North of Hodges Dr	-	-	3470	-	3910	-	5420
<b>Screenline 4: South of Hodges Drive</b>								
Ocean Reef Road	South of Hodges Dr	4600	4900	4900	4900	4900	4900	4900
Venturi Drive	South of Hodges Dr	3900	4180	4180	3880	3880	4200	4200
Marmion Avenue	South of Hodges Dr	22000	22220	22220	22270	22270	24180	24180
<b>Screenline 5: West Marmion Avenue</b>								
Burns Beach Road	West of Marmion Ave	2030	1510	1490	2830	3600	6700	8610
Miami Beach Prom	West of Marmion Ave	1500	1540	1620	1800	1840	2010	2110
Ocean Gate Parade	West of Marmion Ave	1450	1240	1190	1650	1850	2490	2310
Shenton Avenue	West of Marmion Ave	6980	6930	7080	6920	6870	6670	6560
Santiago Parkway	West of Marmion Ave	1150	1110	1150	1170	1170	1060	1060
Prendville Avenue	West of Marmion Ave	4960	5040	5590	6210	6640	5710	6350
Hodges Drive	West of Marmion Ave	10240	10450	10140	8490	7870	8880	7940
<b>Screenline 6: East Marmion Avenue</b>								
Burns Beach Road	East of Marmion Ave	10370	10350	10350	11410	11410	33340	33340
Caledonia Avenue	East of Marmion Ave	1890	1880	1880	1840	1840	1900	1900
Moore Drive	East of Marmion Ave	6400	6390	6390	9290	9290	6570	6570
“Delamere “	East of Marmion Ave	4610	4610	4610	5170	5170	4920	4920
Shenton Avenue	East of Marmion Ave	12210	12350	12350	17080	17080	9550	9550
Diablo Way	East of Marmion Ave	5070	5050	5050	4390	4390	4690	4690
Hodges Drive	East of Marmion Ave	26040	26410	26410	19060	19060	13760	13760
<b>Other Roads</b>								
Resolute Way	West of Constellation Dr	n/a	1540	1820	1530	1610	1680	1650
Resolute Way	East of Ocean Reef Rd	-	-	580	-	620	-	590



## Appendix A External Zone Volumes and Trip Distribution

External Zone (Roads Cut by Traffic Model Boundaries)		External Zone MRWA Model Traffic Estimates				Actual Traffic Counts 2003/ 2004	2003 Corrected Counts <sup>1</sup>	2006 Corrected Counts <sup>2</sup>	2011 Corrected Counts <sup>3</sup>
Number	Description	2001 Volumes	2006 Volumes	2011 Volumes	2003 Volumes (derived)				
1	Marmion Ave, north of Burns Beach Rd	21806	34729	45564	26975	32960	<b>32960</b>	34730	45560
2	Burns Beach Road, east of Marmion Ave	4948	5850	33362	5309	10370	<b>10370</b>	<b>11430</b>	33360
3	Caledonia Aveune, east of Marmion Ave	1910	1850	1914	1886	n/a	1890	1850	1910
4	Moore Drive, east of Marmion Ave	4461	9297	6576	6395	n/a	6400	9300	6580
5	Delamere Equivalent (includes Delamere Ave, Hobsons Gate and Ocean Gate Pde),	1553	1898	1804	1691	4610	<b>4610</b>	<b>5170</b>	<b>4920</b>
6	Shenton Aveune, east of Marmion Ave	2986	16935	6601	8566	12210	<b>12210</b>	16940	<b>9410</b>
7	Diablo Way, east of Marmion Avenue	5508	4411	4709	5069	n/a	5070	4410	4710
8	Hodges Drive, east of Marmion Ave	19380	11707	8386	16311	26040	<b>26040</b>	<b>18690</b>	<b>13390</b>
9	Marmion Ave, south of Hodges Drive	16541	16599	18042	16564	22000	<b>22000</b>	<b>22050</b>	<b>23960</b>
10	Venturi Drive, south of Hodges Drive	2537	2223	2421	2411	3900	<b>3900</b>	<b>3600</b>	<b>3920</b>
11	Ocean Reef Road, south of Hodges Drive	1652	4203	4558	2672	4600	<b>4600</b>	<b>4600</b>	4560
		83282	109702	133937	93850	116690	130050	132770	152280

Numbers in **bold** indicate mrwa model estimates have been corrected, as described below:

1: 2003 model estimates corrected to actual observed counts when MRWA derived estimates significantly differed from the actual observed count.

2: 2006 counts corrected by multiplying 2003 corrected counts by growth from mrwa 2003 to mrwa 2006 if 2006 mrwa estimates were less than 2003 observed.

3: 2011 counts corrected by multiplying 2003 corrected counts by growth from mrwa 2003 to mrwa 2011.

Zone	MRWA model estimates - 2003 (derived)					corrected volumes and trip distribution				
	vols	50% vols	E-E%	E-E	I-E	Vols	50% vols	E-E%	E-E	I-E
1	26975	13487.6	0.926	12487.892	999.70812	32960	16480	0.939	15480.292	999.70812
2	5309	2654.4	0.687	1822.4302	831.96983	10370	5185	0.840	4353.0302	831.96983
3	1886	943	0.719	677.85924	265.14076	1890	945	0.719	679.85924	265.14076
4	6395	3197.7	0.795	2543.1106	654.58939	6400	3200	0.795	2545.4106	654.58939
5	1691	845.5	0.756	638.92423	206.57577	4610	2305	0.910	2098.4242	206.57577
6	8566	4282.8	0.565	2421.0492	1861.7508	12210	6105	0.695	4243.2492	1861.7508
7	5069	2534.6	0.784	1987.0285	547.57148	5070	2535	0.784	1987.4285	547.57148
8	16311	8155.4	0.619	5047.655	3107.745	26040	13020	0.761	9912.255	3107.745
9	16564	8282.1	0.774	6412.7624	1869.3376	22000	11000	0.830	9130.6624	1869.3376
10	2411	1205.7	0.584	704.68089	501.01911	3900	1950	0.743	1448.9809	501.01911
11	2672	1336.2	0.605	808.21496	527.98504	4600	2300	0.770	1772.015	527.98504
					11373.393					11373.393

Zone	MRWA model estimates - 2006					corrected volumes and trip distribution				
	vols	50% vols	E-E%	E-E	I-E	Vols	50% vols	E-E%	E-E	I-E
1	34729	17364.5	0.926	16080.139	1284.3608	34730	17365	0.926	16080.639	1284.3608
2	5850	2925	0.668	1954.0579	970.94206	11430	5715	0.830	4744.0579	970.94206
3	1850	925	0.702	649.47113	275.52887	1850	925	0.702	649.47113	275.52887
4	9297	4648.5	0.849	3945.2841	703.21593	9300	4650	0.849	3946.7841	703.21593
5	1898	949	0.757	718.33296	230.66704	5170	2585	0.911	2354.333	230.66704
6	16935	8467.5	0.638	5402.2932	3065.2068	16940	8470	0.638	5404.7932	3065.2068
7	4411	2205.5	0.763	1682.1687	523.33134	4410	2205	0.763	1681.6687	523.33134
8	11707	5853.5	0.563	3296.1685	2557.3315	18690.088	9345	0.726	6787.7123	2557.3315
9	16599	8299.5	0.783	6500.3846	1799.1154	22050	11025	0.837	9225.8846	1799.1154
10	2223	1111.5	0.557	618.80255	492.69745	3600	1800	0.726	1307.3025	492.69745
11	4203	2101.5	0.539	1133.4364	968.06361	4600	2300	0.579	1331.9364	968.06361
					12870.461					12870.461

Zone	MRWA model estimates - 2011					corrected volumes and trip distribution				
	vols	50% vols	E-E%	E-E	I-E	Vols	50% vols	E-E%	E-E	I-E
1	45564	22782	0.932	21235.062	1546.9377	45560	22780	0.932	21233.062	1546.9377
2	33362	16681	0.864	14416.227	2264.7732	33360	16680	0.864	14415.227	2264.7732
3	1914	957	0.722	690.62963	266.37037	1910	955	0.721	688.62963	266.37037
4	6576	3288	0.588	1932.0236	1355.9764	6580	3290	0.588	1934.0236	1355.9764
5	1804	902	0.755	681.37568	220.62432	4920	2460	0.910	2239.3757	220.62432
6	6601	3300.5	0.234	770.69933	2529.8007	9409.523	4705	0.462	2174.9608	2529.8007
7	4709	2354.5	0.780	1836.0128	518.48718	4710	2355	0.780	1836.5128	518.48718
8	8386	4193	0.363	1521.2575	2671.7425	13390	6695	0.601	4023.2575	2671.7425
9	18042	9021	0.755	6806.7675	2214.2325	23960	11980	0.815	9765.7675	2214.2325
10	2421	1210.5	0.557	673.86134	536.63866	3920	1960	0.726	1423.3613	536.63866
11	4558	2279	0.612	1394.8748	884.12519	4600	2300	0.616	1415.8748	884.12519
					15009.709					15009.709



## Appendix B Base Year Land Use Data (2003)

<b>Emme/2 Zone</b>	<b>Dwelling Units</b>	<b>Population</b>	<b>Primary/ Secondary Enrolments</b>	<b>Tertiary Enrolments</b>	<b>Retail GFA (m<sup>2</sup>)</b>	<b>Employees</b>
101	101	283	0	0	100	10
102	0	0	0	0	0	0
103	155	434	0	0	0	0
104	150	420	0	0	0	0
105	72	202	0	0	0	0
106	144	403	0	0	0	0
107	220	616	0	0	0	0
108	184	515	0	0	0	0
109	186	521	0	0	0	0
110	91	255	0	0	0	0
111	453	1268	0	0	0	0
112	270	756	750	0	0	70
113	206	577	0	0	0	0
114	0	0	820	0	5000	107
115	105	294	0	0	0	0
116	198	554	0	0	0	0
117	53	148	938	0	50	90
<b>Total</b>	<b>2588</b>	<b>7246</b>	<b>2508</b>	<b>0</b>	<b>5150</b>	<b>277</b>



## Appendix C Forecast Year Land Use Data – 2006

<b>Emme/2 Zone</b>	<b>Dwelling Units</b>	<b>Population</b>	<b>Primary/ Secondary Enrolments</b>	<b>Tertiary Enrolments</b>	<b>Retail GFA (m<sup>2</sup>)</b>	<b>Employees</b>
101	136	381	0	0	135	13
102	210	588	0	0	0	0
103	180	504	0	0	0	0
104	243	680	0	0	0	0
105	100	280	0	0	0	0
106	167	469	0	0	0	0
107	256	716	0	0	0	0
108	200	560	0	0	0	0
109	205	574	0	0	0	0
110	106	296	0	0	0	0
111	453	1268	0	0	0	0
112	274	768	762	0	0	71
113	206	577	0	0	0	0
114	0	0	820	0	5000	107
115	107	299	0	0	0	0
116	201	563	0	0	0	0
117	54	151	953	0	51	91
<b>Total</b>	<b>3098</b>	<b>8674</b>	<b>2535</b>	<b>0</b>	<b>5186</b>	<b>283</b>



## Appendix D Forecast Year Land Use Data – 2011

<b>Emme/2 Zone</b>	<b>Dwelling Units</b>	<b>Population</b>	<b>Primary/ Secondary Enrolments</b>	<b>Tertiary Enrolments</b>	<b>Retail GFA (m<sup>2</sup>)</b>	<b>Employees</b>
101	175	491	0	0	174	17
102	308	862	0	0	0	0
103	180	505	0	0	0	0
104	276	773	0	0	0	0
105	100	280	0	0	0	0
106	168	469	0	0	0	0
107	256	717	0	0	0	0
108	200	560	0	0	0	0
109	205	574	0	0	0	0
110	106	297	0	0	0	0
111	453	1268	0	0	0	0
112	275	770	764	0	0	71
113	206	577	0	0	0	0
114	0	0	820	0	5000	107
115	107	300	0	0	0	0
116	202	565	0	0	0	0
117	54	151	956	0	51	92
<b>Total</b>	<b>3271</b>	<b>9160</b>	<b>2540</b>	<b>0</b>	<b>5225</b>	<b>287</b>