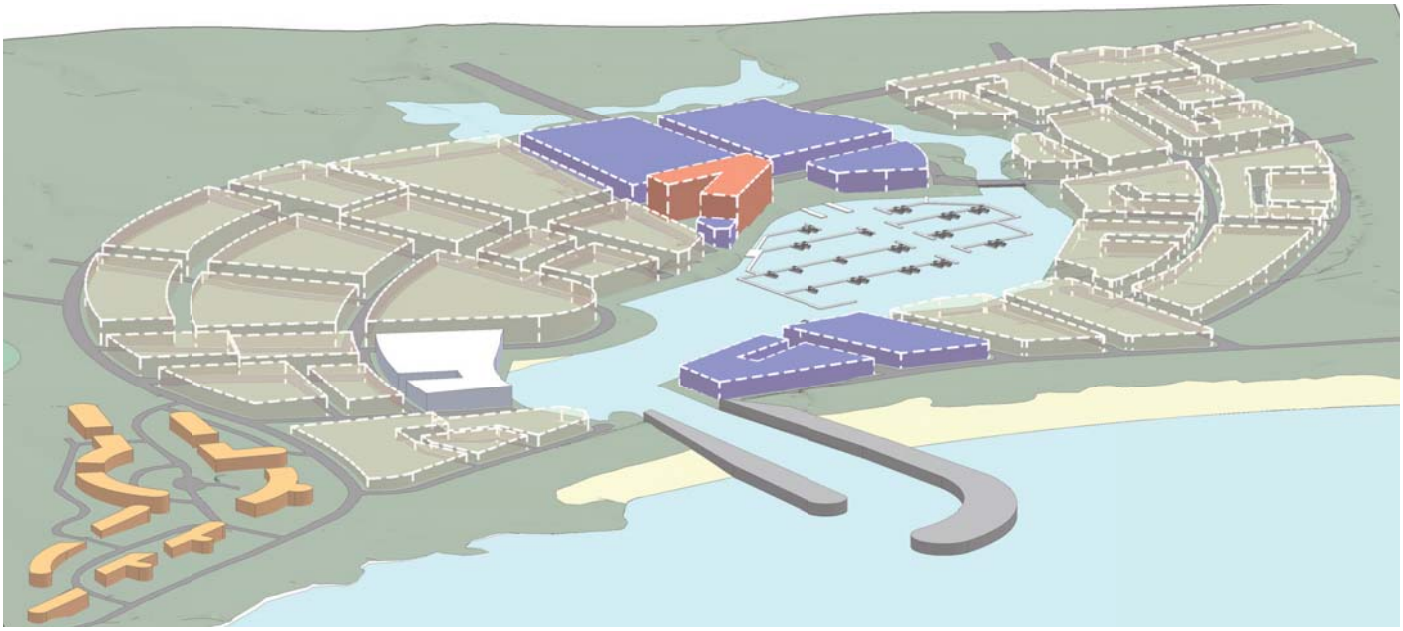

Shell Cove
Boat Harbour Precinct

Concept Plan Application and Environmental Assessment Appendix A - Traffic

prepared by LFA (Pacific) Pty Ltd

date February 2010

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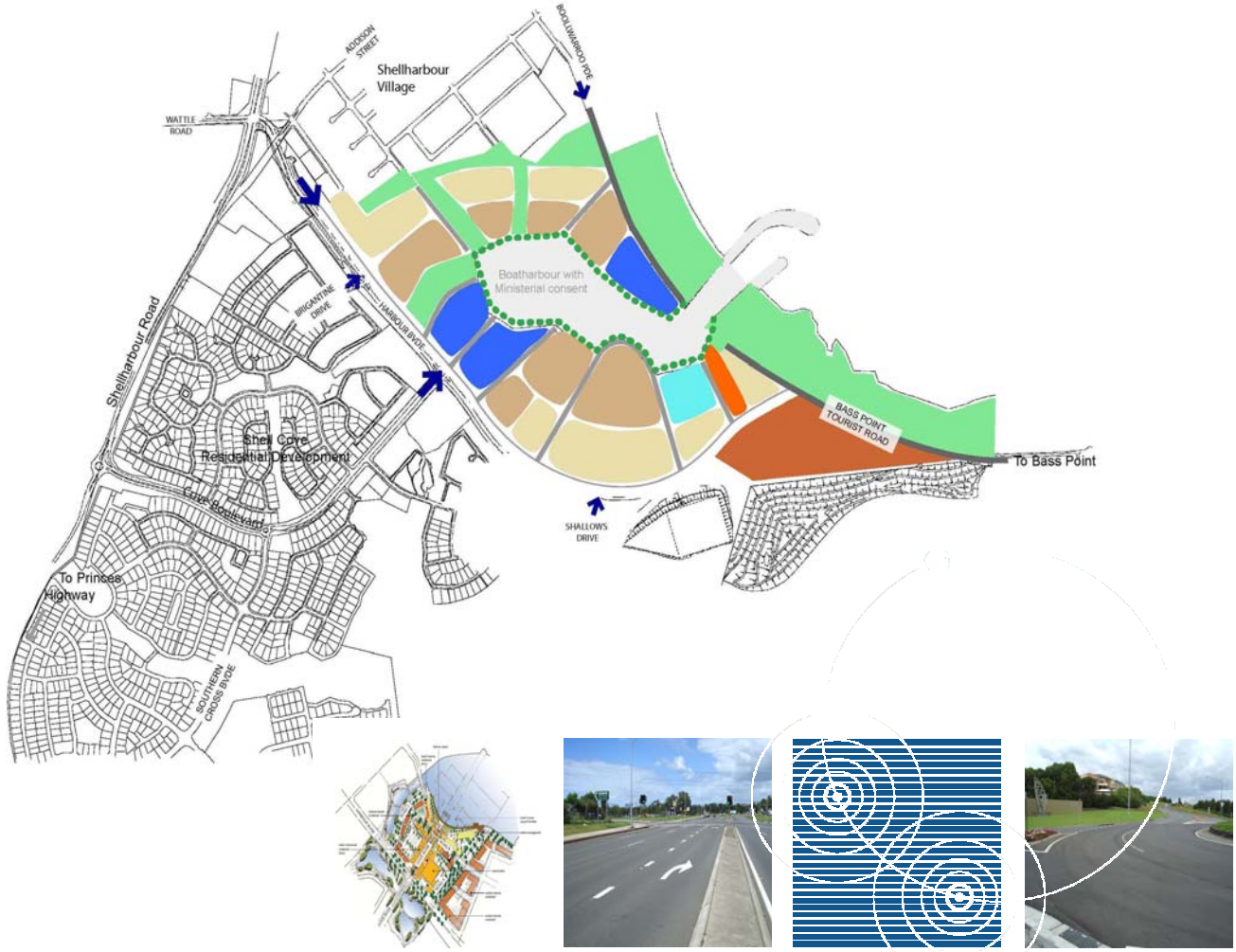

Shell Cove Boatharbour Precinct Traffic Study

Final Report

Australand

24 March 2009

Traffic Study

Prepared for

Australand

Prepared by

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Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
1	25/02/2008	First Draft Report	Andy Crompton ACT Infrastructure Group Manager	
2	06/03/2008	Second Draft Report	Andy Crompton ACT Infrastructure Group Manager	
3	04/12/2008	Draft Final Report	Rod Williams ACT Operations Manager	
4	20/01/2009	Draft Final Report (2)	Rod Williams ACT Operations Manager	
5	24/03/2009	Final Report	Rod Williams ACT Operations Manager	

Table of Contents

List of Figures

List of Tables

Executive Summary

Maunsell was commissioned by Australand to undertake a traffic impact study for the proposed Shell Cove Boat Harbour Precinct, as an input to a Concept Plan Application being prepared by LFA (Pacific) Pty Limited. The report has been prepared to address the traffic and transport planning aspects of the Director General's Environmental Assessment Requirements for the Boat Harbour Precinct.

The latest concept plan for the Boat Harbour Precinct has been assessed in the context of planning for Shell Cove as a whole and its inter-relationship with existing adjoining development. Traffic modelling formed an important component of the assessment, informing the project of likely future traffic volumes and impacts. Traffic forecasts have been produced using the Illawarra TRACKS model used by RTA and local Councils, but updated for Shell Cove by Maunsell as part of this project. The model incorporates expected road network, population and land-use changes in the Illawarra region to 2018. Traffic forecasts have been produced for the full development of Shell Cove.

The key findings contained in this report are:

- The existing and proposed road network within Shell Cove has been designed to have sufficient capacity to safely and efficiently cater for additional traffic generated by the Boat Harbour Precinct.
- Key intersections on Shellharbour Road that will service the development will have sufficient capacity to safely and efficiently cater for the full development of Shell Cove. A detailed traffic assessment and preliminary design have been produced for the proposed intersections of Harbour Boulevarde with Shellharbour Road, Addison Street and Brigantine Drive. This includes a revised layout at the Shellharbour Road/Harbour Boulevarde/Wattle Road intersection, new traffic signals at the Addison Street/ Harbour Boulevarde intersection and a single lane roundabout at the Brigantine Avenue/ Harbour Boulevarde intersection.
- There will be good access to the Boat Harbour Precinct from the existing and planned road network.
- Good access will be maintained to the Bass Point Reserve via the proposed main road network in Shell Cove, reducing existing traffic flows and impacts on local streets in Shellharbour Township.
- There will be strong road and pathway interconnections within the Boat Harbour Precinct and to adjoining existing and planned developments. The development and associated road network have been designed to minimise traffic impacts on existing development, but to provide strong pedestrian and bicycle connections.
- Adequate parking will be provided as part of developments in the Boat Harbour Precinct, in accordance with Council guidelines.
- Preliminary planning for the commercial centre, marina facilities and business park indicates that service vehicles will be able to readily access these businesses from the main roads serving Shell Cove (ie., Harbour and Cove Boulevarde).
- All new intersections serving the Boat Harbour Precinct will be designed with adequate sight distances and for safe and efficient operation. A single lane roundabout is recommended at the Harbour Boulevarde / Cove Boulevarde intersection and at the adjacent Road A/ Harbour Boulevarde intersection.
- The completion of a connection between Cove Boulevarde and Addison Street via Harbour Boulevarde will enable improved routing of existing bus services in the area. It will also mean that the Boat Harbour Precinct will be well served by local bus routes.
- The Boat Harbour Precinct will be designed to provide easy pedestrian and cyclist access to the harbour, together with cycle parking and comprehensive directional signage. Provision will be made for safe and efficient movements of pedestrians across Harbour Boulevarde, with linkages to proposed shared pathways on Harbour Boulevarde. Internal movements to the harbour foreshore will be facilitated by a proposed shared access at the eastern end of Cove Boulevarde.

The planned Boat Harbour Precinct development will meet the needs of both new and existing Shell Cove residents, as well as staff and visitors to the growing commercial areas of Shell Cove, while containing impacts on surrounding communities. The Boat Harbour Precinct can be successfully linked to the existing and proposed road network without placing undue stress or pressure on the existing road system or adjoining uses.

1.0 Introduction

1.1 Study Purpose

Maunsell was commissioned by Australand to undertake a traffic impact study for the proposed Shell Cove Boat Harbour Precinct, as input to a Concept Plan Application being prepared by LFA (Pacific) Pty Limited.

In November 1996 the Minister for Planning approved a proposed Boat Harbour and associated Marina at Shell Cove. The surrounding Boat Harbour Precinct has since been the subject of a number of detailed planning studies, reviews and public consultations.

This report has been prepared to address the traffic and transport planning aspects of the Director General's Environmental Assessment Requirements for the Boat Harbour Precinct. In particular, a traffic impact study is required in accordance with Table 2.1 of RTA's Guide to Traffic Generating Developments.

1.2 Background

Maunsell have undertaken a recent review of traffic and transport aspects of the latest structure plan for Shell Cove (Maunsell 2008). This report draws on information undertaken as part of this review, but in the context of the Boat Harbour Precinct.

The traffic forecasts produced in this current study were based on the use of the 2018 Illawarra TRACKS model, with updated land-use and road network assumptions for Shell Cove using the latest structure plan information. This model incorporates land-use and road network data for the whole Illawarra region. It provides estimates of daily traffic flows, which can be converted to peak hour estimates to analyse AM, PM and holiday peak hour intersection performance.

1.3 Scope of Work

The primary focus of this report is the traffic and transport impacts of the proposed Shell Cove Boat Harbour Precinct development. Specific requirements that are to be addressed in this report include:

- The capacity of the road network to safely and efficiently cater for additional traffic generated by the Precinct;
- Access to and within the Precinct;
- Indicative servicing and parking arrangements;
- The operation of key intersections;
- Connectivity to existing developments;
- Impact on public transport;
- Provision of access for pedestrians and cyclists to, through and within the Precinct; and
- Identification of suitable mitigation measures, if required to ensure the efficient and safe functioning of the road network. This should include the identification of pedestrian movements and appropriate provision for shared path/ cycleway/ public transport for existing and proposed roads.

In addition, intersection modelling has to be undertaken for all key junctions with the existing arterial road network that will service the development, as well as key intersections within Shell Cove that will directly access the Boat Harbour Precinct. The modelling should consider AM, PM and holiday peak volumes.

As part of these analyses, appropriate consultation is to be undertaken with government agencies and summarised in this report. In addition, electronic copies of the SIDRA input and output files, movement summaries and queue lengths are to be submitted to RTA for evaluation.

1.4 Structure of Report

This report has been structured into the following chapters:

- **Chapter 2** outlines the proposed concept plan and development for the Boat Harbour Precinct;
- **Chapter 3** provides the traffic modelling assumptions, traffic forecasts and road network performance results for Shell Cove and the surrounding network;
- **Chapter 4** provides an assessment of all traffic and transport elements of the proposed Boat Harbour Precinct development; and
- **Chapter 5** provides a summary of the primary conclusions from the assessment of the development of the Boat Harbour Precinct.

2.0 The Proposed Structure Plan

2.1 Overall Development

An outline plan of the current proposed structure plan for Shell Cove that formed the basis for the traffic modelling and analyses in this report is shown in **Figure 2-1**. The Shell Cove area has a number of precincts:

- A predominantly residential precinct west of Harbour Boulevarde, comprised of 10 stages of development;
- The mixed-use Boat Harbour Precinct east of Harbour Boulevarde, comprised of 8 sub-precincts; and
- The Quarry Buffer Zone, currently earmarked for district playing fields and a business park.

This assessment only relates to lands surrounding the approved Boat Harbour and includes the following elements:

- A commercial mixed use core including a landmark hotel;
- A business park precinct;
- Standard, medium and high density residential housing;
- A comprehensive network of open space and wetlands;
- Vehicular access and street network;
- A possible hotel (or residential uses); and
- Ancillary marina facilities (carparking, maintenance, boat ramp and potential dry stack).

Table 2-1 provides a summary of proposed land-uses in Shell Cove. BMD Consulting provided land-use data on Stages 1 to 7 of the residential precinct, which are either constructed or generally approved for development. LFA provided land-use data for the remaining areas. The data for the Boat Harbour Precinct was based on the LFA Masterplan (LFA January 2008); more details of which are provided in Section 2.2.

Table 2-1: Assumed Shell Cove Land-use Distribution

Precinct/Area	Standard Residential Lots	Small Residential Lots [1]	Apartment Units	Commercial GFA (sqm)	Other
Stages 1 to 7	1431	107	0	0	Primary school, golf club
Stages 8 to 10	333	140	0	0	Bowling club, retirement village
Boat Harbour	190	374	674	21,500	Marina, boat ramp
QBZ	0	0	0	30,000 [2]	District playing fields
Totals	**1954**	**621**	**674**	**51,500**	

Notes: 1. Includes integrated housing lots and medium density housing

2. A 30,000m^2 GFA business park is preferred, but two sizes of park were modelled (30,000 and 45,000m^2 GFA)

Source: Base map - LFA (2009)

Figure 2-1: Shell Cove Structure Plan

2.2 Boat Harbour Precinct

The Boat Harbour Precinct will have some relatively intensive traffic generating activities associated with it. This precinct is expected to incorporate:

- a 300 wet berth marina;
- the town centre – about 8,000 m^2 of commercial/retail space on the western side of the Boat Harbour;
- 150 room hotel in the western Commercial Precinct and potential allowance for a 100 room hotel in the harbour entrance precinct;
- 1,238 residential dwellings, including 674 apartments, 374 medium density lots and 190 standard lots;
- a 2 lane public boat ramp and trailer parking area;
- boat haulout area and maritime maintenance provision; and
- possible inclusion of a dry storage facility for up to 200 boats (alternatively residential).

There are two alternative mixed use options for the eastern commercial area to the north of the Boat Harbour entrance:

1. 112 residential lots, including 15 apartments, 75 medium density lots and 22 standard lots; or
2. A 100 room hotel and 53 residential lots.

A possible plan of the proposed Commercial Precinct, to be located at the end of Cove Boulevarde, is shown in **Figure 2-2**. It is expected to include a 6 storey hotel, a 4,000 m^2 supermarket, 4,000 m^2 of other retail commercial, 650 m^2 library, about 161 residential units and a community park.

Source: Base map - LFA (2008)

Note: This is a preliminary conceptual plan of what the Centre might look like. It has a secondary purpose of labelling some of the streets used in later tables showing traffic forecasts.

Figure 2-2: A Potential Shell Cove Town Centre Concept Plan

3.0 Traffic Forecasts and Assessment

3.1 Introduction

Two forms of traffic modelling have been undertaken:

1. Strategic network modelling to produce estimates of daily traffic forecasts on key roads in Shell Cove, including local streets within the Boat Harbour Precinct.
2. Intersection modelling of peak hour performance for key intersections affected by the proposed development.

The strategic modelling was undertaken using the 2018 Illawarra TRACKS model provided by Shellharbour Council. The main inputs to the model are a description of the road network and land-use for the whole of the Illawarra region. These inputs were updated for the Shell Cove development using the latest information from LFA and BMD Consulting, summarised in Chapter 2.

The intersection modelling was undertaken using SIDRA3 using turn flows derived from TRACKS. This provided directions with regards to the size, form and control of key intersections under future peak hour traffic loads.

TRACKS and SIDRA3 data files were provided to RTA during the course of the project, with a specific focus on the proposed new intersections of Shellharbour Rd/ Wattle Rd/ Harbour Bvde and Addison St/ Harbour Bvde. The results of this work and associated design plans were discussed with RTA. This work was also discussed in the context of broader planning for the Shell Cove area, including the future layout and operation of Cove Bvde/Shellharbour Rd and the Boat Harbour Precinct.

3.2 Traffic Forecasts

3.2.1 Comparison of TRACKS Model and RTA Trip Generation

The TRACKS model created as part of this project now includes 43 traffic zones in Shell Cove. Each of these zones has estimates of dwellings, population and employment used in the TRACKS trip estimation process. The trip estimates from TRACKS were produced from inherent trip rates created as part of the original model calibration process by other consultants employed by RTA and local Councils. These rates were not changed as part the modelling undertaken for this project.

The daily trip estimates from TRACKS for each Shell Cove traffic zone were compared with independent trip estimates obtained by applying RTA trip generation rates from the RTA Guide to Traffic Generating Developments (shown in **Table 3-1**). The application of the RTA trip rates revealed that the total trip estimates for Shell Cove from the TRACKS model are about 21% higher than those estimated using RTA rates (TRACKS – 50,551 vehs/day; RTA – 40,123 vehs/day).

The amount of vehicular trips generated by the Boat Harbour Precinct is about 35% of all trips generated by the full development of Shell Cove. This represents up to about 18,000 veh/day, using the TRACKS model trip rates.

3.2.2 Traffic Forecasts

The latest traffic forecasts for key sections of roads in Shell Cove is summarised in **Table 3-2**. It shows estimates of 2018 average daily traffic flows with and without the development of the Boat Harbour Precinct. The model forecasts with the Boat Harbour Precinct development are based on full development of Shell Cove, using the assumptions outlined in Chapter 2, and the assumed level of regional traffic inherent in the Illawarra TRACKS model. The TRACKS model data has been given to RTA for review.

Table 3-1: Daily Trip Rates Used in a Comparison of Trip Generation Estimates

Land-use Category	RTA Trip Rate (veh/day)
Standard residential	9 trips/lot
Medium density residential	6 trips/lot
Apartment unit	4 trips/lot
Supermarket	77.5 trips/100sqm
Shops	30 trips/100sqm
Office	10 trips/100sqm
Technology park	5.5 trips/100sqm
Retirement village	6 trips/lot
Hotel	32 trips/100sqm [1]
Library	5 trips/100sqm [1]

Note: 1. No RTA rates available for Hotel or Library and relatively high (conservative) rates were adopted.
2. These are relatively high rates, reflecting a low level of public transport usage in Shellharbour.

Table 3-2: 2018 Daily Traffic Flow Forecasts

Street Name	Location	Without Boat Harbour Precinct Uses [1]	With Boat Harbour Precinct Uses [2]
Addison Street	east of Harbour Boulevarde	5000	5100
Bass Point Road	east of Road B	1900	5700
	south of Business Park	1900	1900
Brigantine Drive	west of Harbour Boulevarde	0	3800
	east of Harbour Boulevarde	0	2700
	east of Road B	0	1700
Boollwarroo Pde	north east of Road B	200	700
Cove Boulevarde	east of Shellharbour Road	8000	16500
	east of Southern Cross Boulevarde	3000	11500
	west of Harbour Boulevarde	0	10100
	east of Harbour Boulevarde	0	1400
Harbour Boulevarde	north of Addison Street	0	19100
	north of Brigantine Drive	0	15200
	north of Cove Boulevarde	0	11800
	south of Cove Boulevarde	0	13600
	north of Shallows Drive	0	5100
	south of Shallows Drive	1900	5900
Road A	east of Harbour Boulevarde	0	5700
Road B	north of Bass Point Road	0	700
	south of Cove Boulevarde	0	900
	north of Cove Boulevarde	0	1100
Road C	east of Harbour Boulevarde	0	2700
Shallows Drive	South of Cove Boulevarde	2600	2600
	west of Harbour Boulevarde	1900	2000
Shellharbour Road	north of Mary Street	30000	37100
	south of Wattle Road	20000	22700
Southern Cross Boulevarde	south of Cove Boulevarde	6500	6900
	east of Shellharbour Road	5800	5900
Wattle Road	west of Shellharbour Road	8000	11200

Source: 1. Manually derived from 2018 TRACKS forecasts with full development
2. Illawarra 2018 TRACKS model, updated by Maunsell (2007) assuming full development of Shell Cove by 2018

Note: Refer to **Figure 2-1** for street names in the Boat Harbour Precinct

The forecasts without the Boat Harbour Precinct were derived from these model forecasts using a manual estimation process. They assume that:

- The Boat Harbour and marina are not built;
- The proposed temporary road connection to Bass Point Reserve remains via Cove Bvde;
- The Boat Harbour Precinct roads are not built; and
- Harbour Bvde is not built.

The main changes in traffic flows that are expected to occur as a result of the development of the Boat Harbour Precinct are:

- *Harbour Boulevarde*
  Harbour Bvde will need to be built to service the Boat Harbour Precinct development. The major access to Shell Cove is currently Cove Bvde. Harbour Bvde will form a second major access from Shellharbour Rd to Shell Cove. It will directly service a number of important land-uses in the Boat Harbour Precinct, including the proposed town centre, district playing fields and Business Park. With development of the Boat Harbour Precinct, traffic flows will vary along its length, from about 2,000 veh/day north of Bass Point Reserve to about 20,000 veh/day near Shellharbour Rd.
  - A design exists and is currently being considered by RTA for the section of Harbour Bvde north of and including the Brigantine Dr intersection. Analyses of the latest traffic forecasts and intersection operation for this section of road indicate that the proposed design will ensure satisfactory operation at proposed intersections of Harbour Bvde with Addison St and Shellharbour Rd. This is discussed in more detail in Section 3.3.
  - Traffic forecasts for the section of Harbour Boulevarde between Brigantine Dr and Road A vary between 12,000 veh/day to 14,000 veh/day. A median is preferable in this section of road to assist with the development of right turn bays at intersections and car park accesses, as well as to aid pedestrian movements adjacent to the town centre. All access to properties and car parks should preferably be via controlled (eg., priority) intersections along this section of road. On-street parking could be allowed on this section of road if sufficient road width is provided in the design for one lane of traffic to pass cars manoeuvring in or out of car parks.
  - Traffic forecasts for the section of Harbour Boulevarde between Road A and Shallows Dr vary from 4,000 veh/day to 6,000 veh/day based on current model forecasts. Thus, multiple direct driveway accesses are not preferable in this section of road. Any driveway accesses should be restricted to forwards entry and exit to commercial or residential multi-unit blocks. On-street parking could be incorporated in the design for this section of road.
  - Traffic forecasts for the section of Harbour Boulevarde between Shallows Dr and the northern access to the Business Park are expected to be 5,000 veh/day to 7,000 veh/day. Again, multiple direct driveway accesses are not preferable in this section of road and should either be via side-streets, a service road or forwards entry and exit driveways servicing multiple lots. On-street parking could be incorporated in the design for this section of road.
  - Traffic forecasts for the section of Harbour Boulevarde between the southern and northern accesses to the Business Park are expected to vary from 3,000 veh/day to 4,000 veh/day. The section of road north of the proposed boat ramp access road and potential dry berth stack will be busiest and should preferably have restricted driveway access. On-street parking could be incorporated in the design for this section of road.
  - Traffic flows are forecast to be less than 2,000 veh/day south of the Business Park, associated with traffic accessing Bass Point Reserve.

- *Cove Bvde (west of Harbour Boulevarde)*
  Cove Bvde has already been built as a 2-lane 2-way road as far east as Shallows Dr. The likely traffic flows between Southern Cross Boulevarde and Harbour Boulevarde are 10,000 veh/day to 12,000 veh/day. This will be a busy road. A 2-lane cross-section is adequate for traffic capacity, but there needs to be adequate width to enable the future development of bus bays, turning lanes and pedestrian refuges. The current cross-sectional design for Cove Bvde provides for this (11m roadway in a 25m road reserve). No on-street parking should be allowed along here.
- *Boat Harbour Precinct Streets*
  The traffic model includes a relatively detailed representation of the Boat Harbour Precinct (based on the preliminary concept depicted in **Figure 2-2**). It includes forecasts for all key streets in this precinct, including the eastern end of Cove Bvde, Brigantine Dr, Road A, Road B and the extension of Shallows Dr east of Harbour Boulevarde.
  - Most of the Boat Harbour Precinct streets will be lightly trafficked and can easily cater for on-street parking and safe pedestrian movements. The latest structure plan encourages the predominant use of the Harbour Boulevarde and Cove Bvde to access developments within the Boat Harbour Precinct, in preference to Road B. In addition, a planned shared pedestrian/vehicle area around the intersection of Road B with Cove Bvde will further discourage use of Road B by through traffic. On-street parking can be incorporated into the design of all roads in this precinct.
  - Road A will be the busiest street, directly servicing the main car park for the town centre. It is also likely to carry the majority of the traffic that will access the proposed hotel. Traffic forecasts for this road vary from about 3,000 veh/day at its eastern end to 5,700 veh/day near the Harbour Boulevarde intersection.
  - Road B is an important road, connecting Brigantine Dr in the north to Cove Bvde in the town centre, Road A, the proposed hotel and the Harbour Boulevarde near the Business Park in the south. Current traffic forecasts along Road B generally show less than 2,000 veh/day. The only exception may be some increased traffic in the vicinity of the hotel access, depending on final access arrangements. A direct connection to Road A is preferable, as shown in the current concept plan.
  - Road C provides access to the northern part of the harbour precinct. Current plans indicate that this road would attract about 2,700 veh/day, which means it will be relatively lightly trafficked for the nature of the road.
  - Other streets in the precinct would generally carry less than 2,000 veh/day.
- *Shallows Dr*
  Traffic volumes should be contained below 2,500 veh/day on Shallows Drive, to be consistent with the functional and environmental capacity of this road. The Cove Boulevarde – Harbour Boulevarde– Bass Point Tourist Road connection will need to be built to provide an alternative route to Bass Point and avoid excessive traffic volumes on Shallows Drive in the long-term.

Further discussion is warranted in relation to Shallows Dr.

The model forecast reflects the risk that Shallows Drive could be used as a rat-run to avoid peak hour delays at the Cove Bvde/ Harbour Boulevarde intersection. A number of options for the design of the Stage 10 roads were considered that reduce the risk of rat-running on Shallows Drive which led to a review of the design of Stage 10, to ensure that Shallows Drive does not provide a long-term option to bypass the proposed intersection at Cove Boulevarde and Harbour Boulevarde.

Some initiatives should also be implemented to manage travel speeds on local streets. The form of treatment will depend on what type of traffic control is implemented at the intersection of Cove Bvde and Harbour Bvde. It is recommended that a roundabout be installed which will reduce the likelihood of rat running through Shallows Drive

3.3 Intersection Performance

3.3.1 Peak Hour Performance Results

The capacity of an urban road network is usually controlled by the capacity of the intersections within that network. Average delay is commonly used to assess the actual performance of intersections, with Level of Service used as a simple index to describe the performance of intersections. A summary of the Level of Service indicators is shown in **Table 3-3**.

Table 3-3: Level of Service Criteria for Intersections

Level of Service	Average Delay / Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays	At capacity; requires other control mode
F	>70	Roundabouts require other control mode	At capacity; requires other control mode

Source: Guide to Traffic Generating Developments, RTA 1993

Modelling of peak hour intersection performance was undertaken using SIDRA3. Peak hour flow estimates used in the intersection modelling were derived from the daily TRACKS traffic forecasts by applying peak to day factors and estimating AM and PM peak directional splits from local traffic counts[1]. This is likely to give a relatively high estimate of peak hour flows and thus a conservative estimate of intersection operation. Peak hour spreading will occur in the longer-term, reducing the peak to day factor.

Holiday peak flows were derived by factoring PM peak flows using the results of an analysis of weekly traffic flow variations on major roads in the area. The analysis of weekly flow variations indicated that traffic in Shellharbour could increase by up to 10% during holiday periods. The most noticeable increases will be in the PM peak. Thus, further analyses of intersections were undertaken by factoring PM flows up by 10% to reflect holiday peak travel.

As noted in Section 3.2.1, the TRACKS traffic forecasts are already relatively high compared with the use of RTA rates (about 21% higher on average). This means that the analyses that follow reflect high demand events with a relatively low frequency of occurrence during the year.

A summary of the results of SIDRA3 intersection modelling for key intersections affected by the proposed development is given in **Table 3-4**. A discussion of the results for each intersection follows the table.

[1] Major and minor movements were defined for each peak and turn movement at each intersection. A peak to day factor of 10% was applied to minor movements and 6.7% for major movements. These factors were derived from recent RTA traffic volume data in the area

Table 3-4: Predicted Intersection Performance (with full development)

Intersection	2018 AM Peak		2018 PM Peak		2018 Holiday Peak	
	Overall LoS	Comment	Overall LoS	Comment	Overall LoS	Comment
Shellharbour Rd / Mary St (signals)	A	Operates well in the AM Peak	B	Queuing of over 120m on Shellharbour Rd Nth approach	A	Queuing of over 120m on Shellharbour Rd Nth approach
Shellharbour Rd / Harbour Bvde / Wattle Rd (signals)	C	Queue lengths could potentially extend over 120m in the AM peak	D	Queue lengths could potentially extend over 200m on the northern approach in the PM peak	D	Queue lengths could potentially extend over 230m on the northern approach in the PM peak
Addison St / Harbour Bvde (signals)	A	Operates well in the AM Peak	A	Vehicles could occasionally queue from Shellharbour Rd through this intersection.	A	Vehicles could occasionally queue from Shellharbour Rd through this intersection.
Harbour Bvde / Brigantine Dr (roundabout – single lane approaches)	A	Operates well in AM Peak	A	Operates well in PM Peak	A	Queuing on Harbour Boulevarde Sth of around 90m
Harbour Bvde / Cove Bvde (signals)	B	Queuing of around 70m on Harbour Boulevarde Nth approach and Cove Bvde	B	Queuing of around 110m on Harbour Boulevarde Sth approach	B	Queuing of around 120m on Harbour Boulevarde Sth approach
Harbour Bvde / Road A (roundabout)	A	Operates well in the AM peak	A	Operates well in PM Peak	A	Operates well in the Holiday Peak
Harbour Bvde / Road C (roundabout)	A	Operates well in the AM peak	A	Operates well in PM Peak	A	Operates well in the Holiday Peak
Shellharbour Rd / Cove Bvde (roundabout)	B	Queuing of about 130m on Lakewood Bvde	B	Queuing of about 190m on the Shellharbour Rd Nth approach	F	Significant delays and queueing on Shellharbour Rd Nth

* The Shellharbour Rd/ Harbour Boulevarde and Addison St/ Harbour Boulevarde intersection have been modelled as isolated intersections in SIDRA3. The actual performance of these intersections are likely to be worse than shown, due to queue interactions between these intersections and the need to adjust the signal timings to manage queues.

3.3.2 Shellharbour Rd / Mary St

The Shellharbour Rd / Mary St intersection will operate well in all peak periods, even though significantly higher traffic flows are predicted on Shellharbour Rd.

3.3.3 Shellharbour Rd / Wattle Rd / Harbour Boulevarde

The Shellharbour Rd / Wattle Rd / Harbour Bvde intersection was analysed using SIDRA to determine the adequacy of proposed layout of this intersection and the nearby Addison St / Harbour Bvde intersection. The proposed layouts of these intersections are shown in **Figure 3-1**.

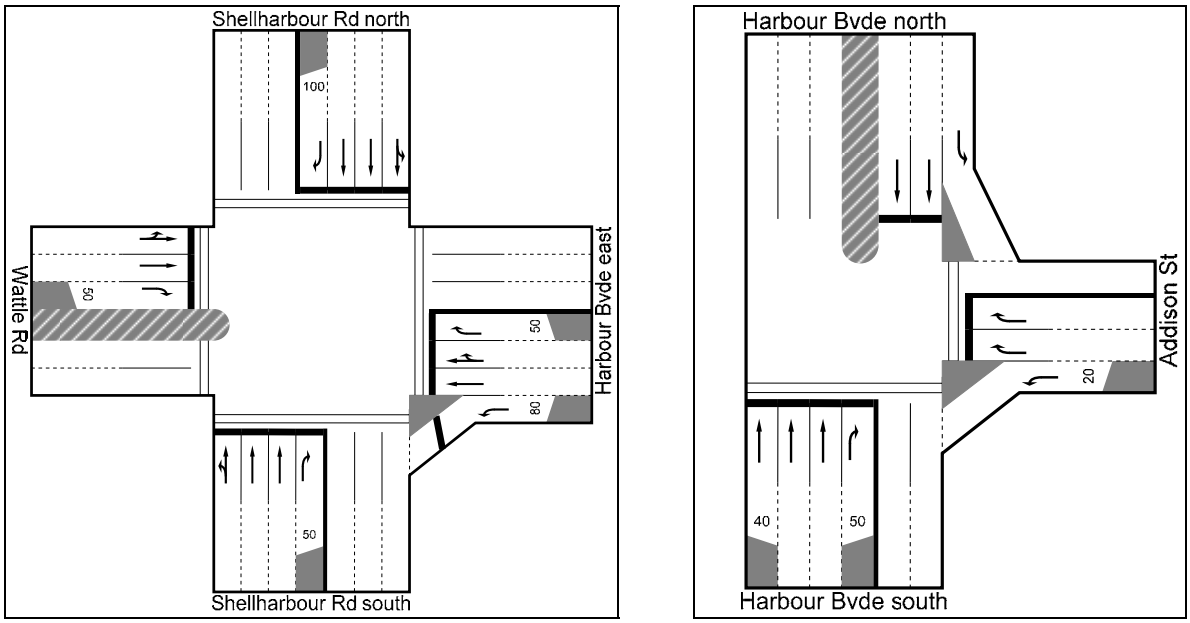


Figure 3-1: Proposed Intersection Layouts (as tested in SIDRA – not to scale)

Key elements of the latest intersection configurations shown in **Figure 3-1** include:

- Converting the left turn slip lane from Harbour Bvde onto Shellharbour Rd to a signalised left turn – improving safety for pedestrians;
- Defining a short right turn lane on the Harbour Bvde approach to Shellharbour Rd; and
- Extension of the southbound right turn storage lane in Shellharbour Road from about 50m to 100m, excluding deceleration taper.

The proposed new Addison St / Harbour Bvde intersection will be located in close proximity to the existing Shellharbour Rd intersection (approx. 60m to the south). As a result, its signal phasing and timing will need to be co-ordinated and determined by the busier Shellharbour Rd intersection.

For this analysis, the signal phase timings were optimised for future peak hour conditions at the Shellharbour Rd / Wattle Rd / Harbour Bvde intersection, using SIDRA3. These timings were then applied to both intersections to assess their future levels of performance (2018). It should be noted that the co-ordinated phases between this intersection and Addison St / Harbour Bvde would need to be offset to allow for adequate clearance time. This cannot be modelled directly in SIDRA, but would be required as part of the final design and operation.

The future Shellharbour Rd / Wattle Rd / Harbour Bvde intersection is expected to operate within capacity during both future peak periods, with an overall Level of Service 'C' in the AM peak and 'D' in the PM peak hour. It is expected to have a slightly higher overall Degree of Saturation (DoS) in the PM peak (0.875) compared to the AM peak (0.741).

The analysis shows that the 95th percentile queue on the Harbour Bvde approach is likely to extend beyond 100m in peak hours – through the nearby Addison St intersection (around 60m to the south). The SIDRA software has difficultly in modelling closely spaced intersections and analyses them in isolation. In reality, queuing can be minimised across the intersection via offset ('clearance') phasing. However, this is likely to increase the queuing on Harbour Bvde south of Addison St.

Both Shellharbour Rd approaches are expected to experience mild levels of congestion. Queue lengths could potentially extend over 200m on the northern approach in the PM and holiday peaks, reducing to about 130m in the AM peak. This is acceptable given the arterial nature of the road, available queueing space and the expected peak hour volumes.

More details of analyses of the Harbour Bvde / Shellharbour Rd intersection are available in a recent report by Maunsell - the Shell Cove Master Plan Review (Maunsell, 17th March 2008). Detailed design plans are also available that have been developed in consultation with RTA and Shellharbour Council.

3.3.4 Harbour Bvde / Addison St

The proposed Addison St / Harbour Bvde intersection is expected to operate at an overall LoS 'A' in all future peak periods, with spare operating capacity. The analysis shows that the 95th percentile queue on the Harbour Bvde south approach is likely to extend to about 70m in the AM peak. Queues will be less in other peak periods. Actual queueing here is likely to be longer, as a result of the phasing co-ordination with the Shellharbour Rd intersection. In reality, when the 'clearance' phases are implemented, this queuing could extend to around 120m.

The northern Harbour Bvde approach is expected to experience queuing of almost 65m in the future holiday peak hour, but much less queuing in other peaks. This will mean that the queue could occasionally extend back into the nearby Shellharbour Rd intersection (60m away). Minimal queuing and delays are expected on all other approaches.

An additional short 'through' lane for northbound traffic will be provided on Harbour Bvde. This will link into the signalised left turn lane at Shellharbour Rd (see **Figure 3-1**).

More details of analyses of the Harbour Bvde / Addison St intersection are available in a recent report by Maunsell - the Shell Cove Master Plan Review (Maunsell, 17th March 2008). Detailed design plans are also available that have been developed in consultation with RTA and Shellharbour Council.

3.3.5 Harbour Boulevarde / Brigantine Dr

The Harbour Boulevarde / Brigantine Dr roundabout will operate well with single lane approaches. The demand for left turns from Harbour Boulevarde to Brigantine Dr has been substantially reduced in the latest structure plan and a south-bound lane dedicated for left turns is no longer warranted here, as shown in the earlier SMEC design (SMEC, December 2006).

3.3.6 Harbour Boulevarde / Road A

The Harbour Boulevarde / Road A intersection will not work satisfactorily under priority control, so either a roundabout or signals are needed here. A single-lane roundabout would be most efficient. It would provide a pedestrian refuge on each leg of the intersection to allow pedestrians to cross more easily here and should be adequate for the forecast traffic volumes at this location.

3.3.7 Harbour Boulevarde / Road C

The Harbour Boulevarde / Road C intersection will operate satisfactorily under priority control. Queue lengths in the critical PM peak are expected to be less than 24m 95% of the time.

3.3.8 Shellharbour Rd/Cove Bvde

The Shellharbour Rd / Cove Bvde roundabout is expected to be relatively congested in the AM and PM commuter peak periods in future. Significant queuing on the southbound approach of Shellharbour Rd is predicted in the PM peak (over 190m) and on Lakewood Bvde in the AM peak (about 130m). This is based on the proposed modified intersection arrangement with two lane approaches on Shellharbour Rd and the left-turn slip lane deleted.

The roundabout may not operate satisfactorily in holiday peak periods, with significant queueing predicted on Shellharbour Rd North. The intersection may need to be reconstructed as a signalised intersection in the longer-term future. This would better manage the predicted high peak traffic flows on Shellharbour Rd and allow for safer crossing of Shellharbour Rd by pedestrians and cyclists. It is important to note that the TRACKS model traffic forecasts are relatively conservative (high), when compared with trip estimates derived from RTA trip rates. Also, holiday peak flows will be an infrequent occurrence and it is not reasonable to design for these flows.

3.3.9 Harbour Boulevarde / Cove Bvde

The Harbour Bvde / Cove Bvde intersection would operate efficiently as a single-lane roundabout. However, traffic signals may be an option here in the longer-term, to enable easier pedestrian movements during peak periods if high traffic volumes occur on Harbour Bvde near Cove Bvde.

The effective queuing space between the Cove Bvde / Harbour Bvde and Road A / Harbour Bvde intersections is about 100m. This would be a potential problem for both the signals and roundabout arrangement at the Harbour Bvde / Cove Bvde intersection.

An analysis of intersection operation under roundabout and signalised control indicated that:

- For the roundabout option, queues in excess of 100m would only occur in the PM peak. This could be reduced to 36m with a short additional lane for northbound left turns from Harbour Bvde into Cove Bvde.
- Queues beyond 100m are likely to occur at several periods of the day with signals.

Queues would be significantly less in other time periods.

The choice of signals or a roundabout affects network efficiency, the risk of rat running through Stage 10 residential streets and pedestrian movements. A roundabout is recommended, although it may affect the movement of pedestrians in the longer-term future when traffic volumes build on Harbour Bvde.

3.3.10 Consultation with Government Authorities

The TRACKS and SIDRA modelling have been discussed with RTA and Shellharbour Council staff and data files provided to both authorities. As part of a parallel project, the detailed design of the northern section of Harbour Bvde, including the key intersections with Shellharbour Rd, Addison St and Brigantine Dr were developed in consultation with RTA and Shellharbour Council staff. Discussions were also undertaken in relation to the impacts of the proposed development on the broader road, bicycle, bus and pedestrian network.

4.0 Assessment of Boat Harbour Precinct Plan Elements

4.1 Introduction

This chapter provides a commentary on traffic and transport aspects of various key elements of the Boat Harbour Precinct. The following elements are considered:

- Roads and intersections, drawing on the analyses in Chapter 3;
- Public transport routes and coverage;
- Parking needs;
- Pedestrian and cyclist facilities;
- Dry stack facility; and
- Possible hotel in the Harbour Entrance Precinct.

As part of this work, discussions were undertaken with RTA and Shellharbour Council staff in relation to the various elements of the planning of the proposed development and its potential impacts on the surrounding road and transport network.

4.2 Roads and Intersections

These elements have already been assessed and commentary provided in Chapter 3, both in terms of roads in the Boat Harbour precinct and the broader road network. Key aspects from this assessment for the Boat Harbour precinct roads are highlighted and expanded upon here.

4.2.1 Roads

Harbour Boulevarde

The nature of Harbour Boulevarde will vary along its length, from a 2-lane rural road at its southern end where it will align with the existing Bass Point Rd to a 4-lane divided urban road at its northern end. It will service a number of important land-uses in Shell Cove and surrounds, including the proposed town centre, Boat Harbour precinct, district playing fields and Business Park.

A design exists for the section of Harbour Boulevarde north of and including the Brigantine Dr intersection. A review of the latest traffic forecasts and intersection operation for this section of road indicate that the number of southbound lanes can be reduced from two to one, south of the proposed service road access.

A median is preferable in the section of Harbour Boulevarde between Brigantine Dr and Road A to assist with the development of right turn bays at intersections and car park accesses, as well as to aid pedestrian movements adjacent to the town centre. All access to properties and car parks should preferably be via controlled (eg, priority) intersections along this section of road. On-street parking could be allowed on this section of road if sufficient road width is provided in the design for one lane of traffic to pass cars manoeuvring in or out of car parks.

Multiple direct driveway accesses are not preferable in the section of Harbour Boulevarde between Road A and the proposed boat ramp access road. Any driveway accesses should be restricted to forwards entry and exit to commercial or residential multi-unit blocks. On-street parking could be incorporated in the design for this section of road.

Cove Boulevarde (west of Harbour Boulevarde)
Cove Boulevarde has already been built as a 2-lane 2-way road as far east as Shallows Dr. A 2-lane cross-section is adequate for traffic capacity, but there needs to be adequate width to enable the future development of bus stops, turning lanes and pedestrian refuges. The current cross-sectional design for Cove Boulevarde provides for this (11m roadway in a 25m road reserve). No on-street parking should be allowed for here.

Cove Boulevarde (east of Harbour Boulevarde)
The town centre road layout and car park access arrangements shown in a concept plan for the town centre (**Figure 2-2**) and used in the traffic modelling will mean that this section of Cove Boulevarde will be lightly trafficked. It will be suited to the creation of a Pedestrian Share Zone in the town centre core area, extending to Road B and the harbour foreshore.

Road A
Road A is likely to be one of the busiest street in the Boat Harbour Precinct, directly servicing the main car park for the town centre and carrying the majority of the traffic that will access the proposed hotel. It will still be relatively easy for pedestrians to cross the eastern end of the street where pedestrian volumes are likely to be higher, but not the western end during peak periods. A proposed roundabout at the intersection with Harbour Boulevarde would provide a pedestrian refuge to allow pedestrians to stage their crossing at the western end.

Road B
Road B will be an important road, connecting Brigantine Drive in the north to Cove Boulevarde in the town centre, Road A, the proposed hotel and the Harbour Boulevarde near the Business Park in the south. The road network shown in a concept plan for the town centre (**Figure 2-2**), land-use and car park access pattern will encourage traffic to use Harbour Boulevarde rather than Road B. Thus, Road B is likely to be a relatively lightly trafficked road, providing opportunities for developing an attractive environment along this road corridor. Direct frontage access to properties, on-street parking and good pedestrian amenity can be encouraged along Road B.

Road C
Road C will provide access to the northern part of the Town Centre. It is likely to be a relatively lightly trafficked road, providing opportunities for developing an attractive environment along this road corridor. Direct frontage access to properties, on-street parking and good pedestrian amenity can be encouraged along Road C.

Brigantine Dr (east of Harbour Boulevarde)
The latest concept plan for Shell Cove substantially reduces the expected traffic predicted to use Brigantine St east of Harbour Boulevarde, as well as the Shellharbour Township connection to Boolwarroo Pde. Direct frontage access to properties, on-street parking and good pedestrian amenity can be encouraged along Brigantine Drive. Importantly, Brigantine Drive could form part of a future bus route and thus should be of sufficient width for buses.

Brigantine Dr (west of Harbour Boulevarde)
The latest traffic forecasts indicate that a short section of Brigantine Dr west of Harbour Boulevarde should have restricted driveway access and no parking. It indicates that this should apply back to the first intersecting street (ie., for about 50m). However, this should be reviewed when plans are finalised for the Stage 8 development.

Other Boat Harbour Precinct Streets
All other Boat Harbour Precinct streets will be lightly trafficked, providing considerable scope for an attractive, accessible and safe environment for these streets.

Shellharbour Township Connections
The latest structure plan has resulted in a reduction in traffic forecast to use Boollwarroo Pde, so that it will be a quieter street than it is currently. Bass Point traffic that currently uses Boollwarroo Pde will be diverted to Cove Bvde during construction of the harbour and then to Cove Boulevarde and Harbour Boulevarde following completion of the harbour.

Good access to Shellharbour Rd will still be maintained to Addison St, following the connection of Harbour Bvde. The latest traffic forecasts for Addison St are similar to previous ones, indicating that the traffic environment on Addison St will not alter significantly as a result of development in Shell Cove.

4.2.2 Intersections

Brigantine Dr / Harbour Boulevarde
A single lane roundabout is recommended here. However, a south-bound lane dedicated for left turns, shown in earlier designs by SMEC, is no longer warranted here.

Cove Bvde / Harbour Boulevarde
A single lane roundabout is recommended here, although it may affect the movement of pedestrians in the longer-term future when traffic volumes build on Harbour Bvde. This may lead to the need to consider traffic signals. The choice of signals or a roundabout affects network efficiency, the risk of rat running through Stage 10 residential streets and pedestrian movements.

Road A / Harbour Boulevarde
A single-lane roundabout is recommended here. It would provide a pedestrian refuge on each leg of the intersection to allow pedestrians to cross more easily here and should be adequate for the forecast traffic volumes at this location.

Road C / Harbour Boulevarde
A priority controlled intersection is recommended here. For safety, a right turn pocket should be provided in the Harbour Bvde median for turns into Road C.

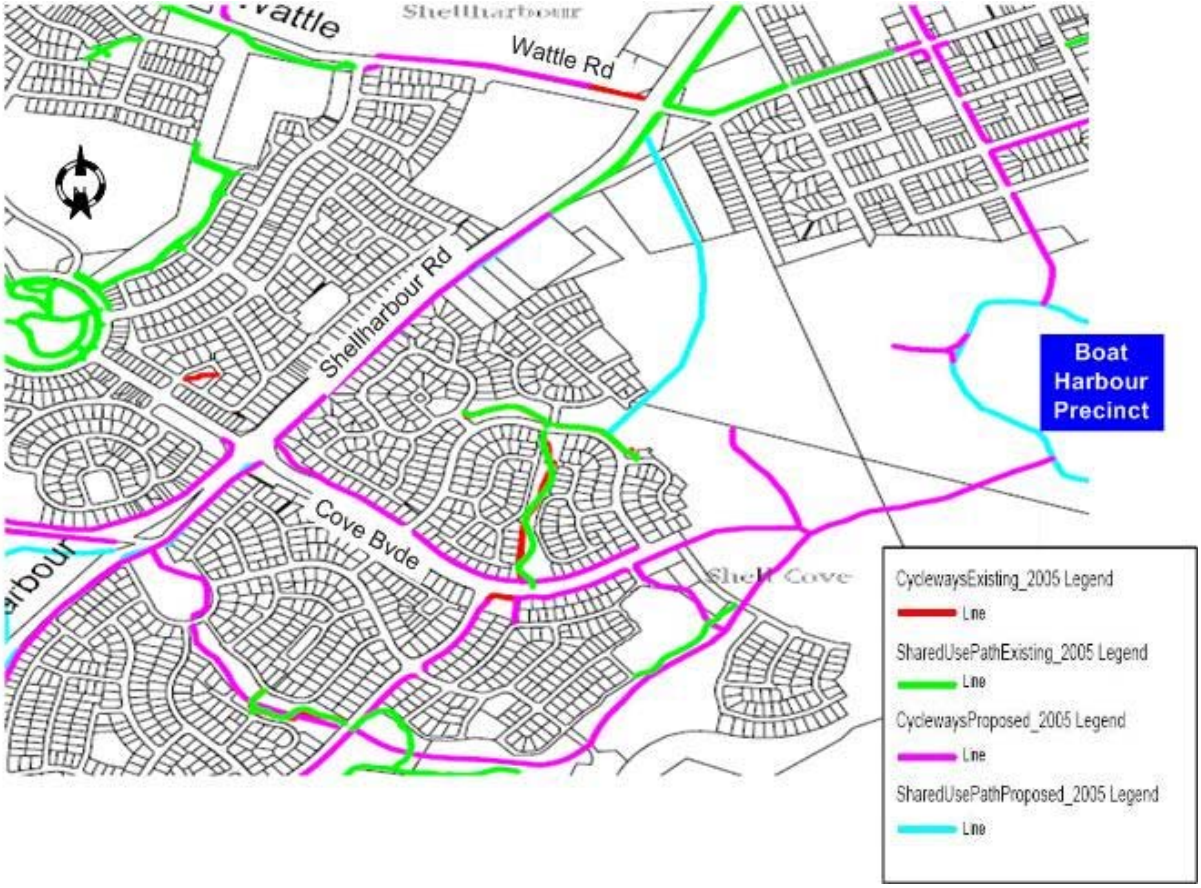
Cove Bvde / Road B
This intersection is suited to a Pedestrian Share Zone. It would enable a safe and attractive linkage between the town centre and the harbour. It would also encourage traffic to use Harbour Boulevarde to access key land-uses in the Boat Harbour Precinct rather than Road B, providing opportunities for developing an attractive environment along this road corridor.

4.3 Pedestrian and Cyclists

The current cycleway plan for Shellharbour shown in **Figure 4-1** indicates the locations of existing and proposed cycle paths and shared use paths. The plan is based on the use of off-road cycle facilities and there are currently no on-road cycle lanes planned in Shellharbour.

The pedestrian and cycle network of the new development will be integrated into the existing pedestrian and cycle network, particularly for access to existing recreation areas. The cycleway links shown in the plan within and in the vicinity of the Shell Cove urban development are reasonably accurate for existing developed areas, but are being refined as part of the detailed design of the remaining undeveloped area.

The diverse range of community, recreational and employment travel needs at the local level will be well served by the planned road and pedestrian network. The local road and pathway network will provide good access to local points of interest such as the Shellharbour Township, the town centre and the harbour. There will also be strong linkages provided to the school and recreation areas.



Source: City of Shellharbour (2005); extract from citywide plan

Figure 4-1: Shellharbour City Cycleway and Shared Use Path Plan 2005

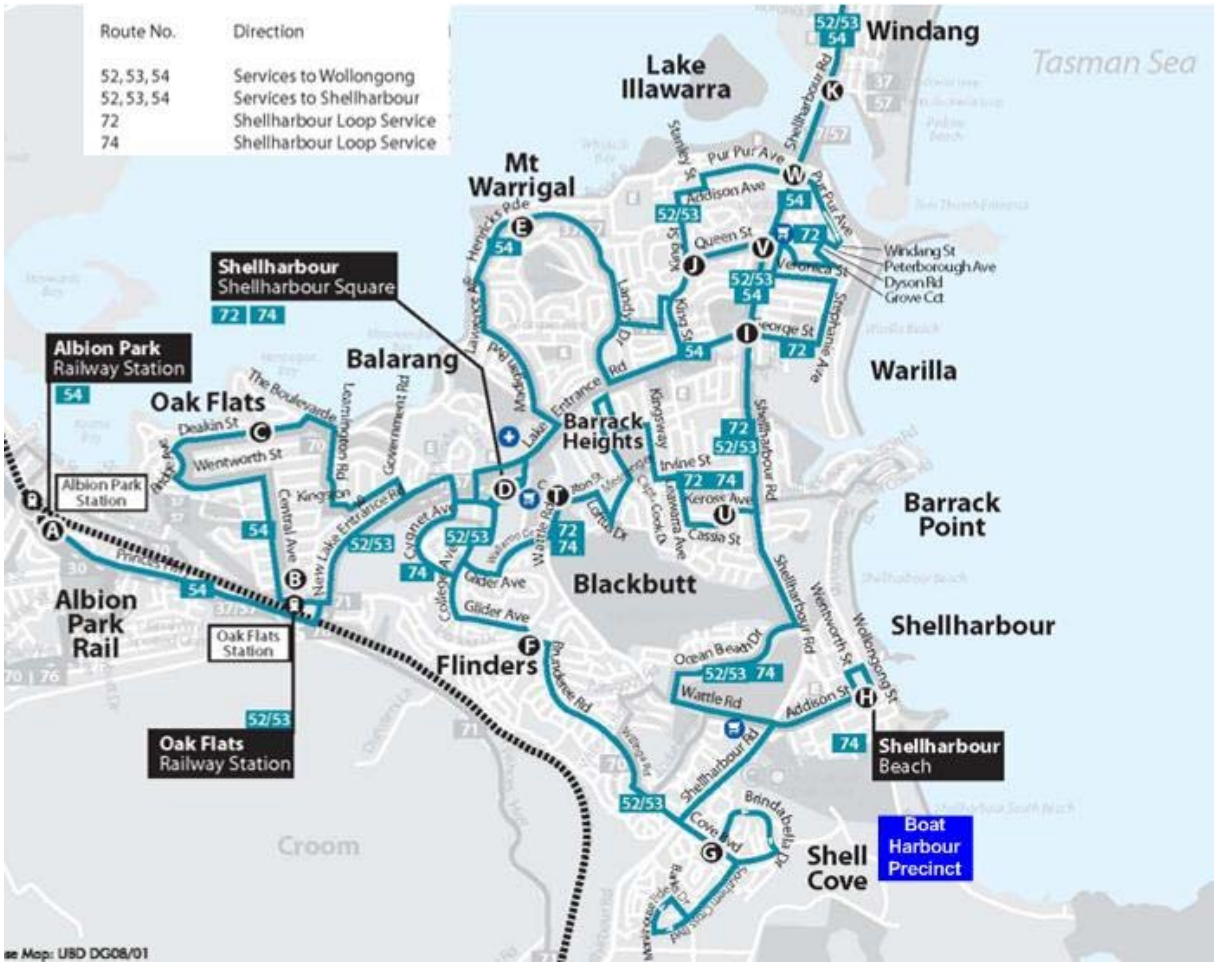
Footpaths should generally be provided on all roads within the site to ensure that pedestrians have a choice of travel within the precinct. The pedestrian network should be designed to ensure that a minimum target 85 per cent of residents live within an actual 400m walk distance of a public transport service.

Local streets should be available for use by cyclists and managed and maintained to ensure that cycling on these routes is safe and convenient. In order to achieve this, measures would include maintaining the road surface to an acceptable standard, ensuring that drainage covers are designed with cyclists in mind, managing on-street parking to ensure cycle safety and enforcing traffic speed and parking regulations.

Pedestrian safety is an issue where cycleway and pathway systems lead to busy roads requiring at-grade crossings. In terms of future development areas, this is a particular problem that will need to be addressed in the design of roads and pathways in the vicinity of the town centre.

4.4 Public Transport

Public transport usage is relatively small in Shellharbour (less than 5%). Buses currently service Shell Cove and this will continue to be the primary form of public transport in the area. Existing bus routes are shown in **Figure 4-2**.



Source: Premier Illawarra, extract from Shellharbour regional route map

Figure 4-2: Public Transport Routes

It is likely that routes 52 and 53 will be rerouted via Harbour Bvde, rather than using Shellharbour Rd, when that road is constructed through to Cove Bvde. This will result in more direct routing of these buses, making them more attractive to Shell Cove residents and for serving the Boat Harbour Precinct.

The public transport network will grow with the development and services are expected to be consistent with the current levels. Key aspects of achieving higher public transport usage include:

- Good service delivery
- Good local accessibility
- Improved competitiveness of public transport

Service Delivery

In July 2004, the Ministry of Transport (MoT) replaced the 1991 Minimum Service Level (MSL) requirements with Service Planning Guidelines. The Service Planning Guidelines reflect the NSW Government focus on delivery of an integrated network of bus services that utilise strategic corridors. The guidelines are also intended to enable greater flexibility for operators to target resources at existing and potential demand, and allow the provision of flexible 'demand responsive' routes and timetables for services in low demand areas and at low demand times.

In terms of coverage, 90% of households should be within 400 metres of a bus route or rail station during commuter peaks and day times. During night-time periods 90% of households should be within 800m of a bus route or rail station. For the 10% of households not serviced by regular route services or areas without sufficient patronage to sustain 60 minute frequencies, flexible alternatives may be considered.

To achieve this in Shell Cove Boat Harbour Precinct, provision needs to be made for future bus routes on Cove Bvde, Harbour Boulevarde and Brigantine Drive - Boolwarroo Pde. Buses will also need to service the district playing fields and the Business Park. This will mean that some buses will need to loop through the main internal road serving the Business Park and consideration will need to be made for this in the design of the internal road system.

Local Accessibility

Local accessibility can defined as a permeable network. An appropriate target for local accessibility is to aim for 85 per cent of residents to live within an actual 400 metre walk distance of a public transport stop, rather than a 400 metre 'crow-fly' distance. This can be achieved in Shell Cove Boat Harbour Precinct by planning for appropriate locations for bus stops. They should be located close to the main pedestrian pathway system serving the development and central to major activity nodes (eg., town centre).

Competitiveness of Public Transport

Improving the competitiveness of bus services is difficult as these movements are subject to the delays experienced by other road users on the road network. The existing mode split proportions of residential areas surrounding Shell Cove are a fair indication of the likely travel characteristics if a community were developed with no additional transport infrastructure. With no additional infrastructure or policy intervention, increased numbers of Shell Cove residents and visitors are likely to continue to rely on the car to travel to and from Shell Cove.

4.5 Parking

A parking analysis has been undertaken for the Boat Harbour Precinct based on the expected distribution of land-uses in the precinct provided by LFA (LFA 2008). The analysis is based on the parking requirements for each of the land-uses specified by Shellharbour City Council's 'Car Parking Policy - 6th July 1992', where applicable, and AS 3962–2001 for the Marina. **Table 4-1** provides a summary of the parking supply rates used in the analysis.

Table 4-1: Parking Supply Rates Used for the Parking Assessment

Landuse	Council parking rates
Marina	0.5 per berth*
Hotel	Bar area – 1 per 4m^2 Lounge – 1 per 5m^2 Dining areas – 1 per 4m^2 Accommodation – 1 per unit Employee – 1 per 3 employees
Office / Commercial (throughout the precinct)	1 per 40m^2
Retail (small)	1 per 35m^2
Supermarket	1 per 20m^2
Residential (apartments > 90m^2)	1.5 per unit Visitors – 3 for first 12 units and then 1 for each 6 units thereafter.
Technology Park	1 per 40m^2

* AS 3962-2001 defines a range from 0.3 to 0.6 spaces per berth

These parking supply rates appear to be well founded, and are generally similar to the RTA's published rates (where available). The key similarities / differences are detailed below:

- The office / commercial rate used is the same as those specified by RTA.
- The residential rate used by Council is somewhat conservative and will provide more spaces than those required using RTA rates (assuming all 154 units are 3 bedrooms).
- Council has used a parking supply rate of 1 per 40m^2 for a Business Park, which will provide more spaces than the RTA's rate of 1 per 66m^2 for a Business Park.
- Council has a clear definition for parking at a supermarket (1 per 20m^2), whereas the RTA has somewhat old data, which is determined by the floor area of the centre.
- The RTA does not have any published rates for the Marina, Hotel or small retail area.

A summary of possible parking infrastructure in the precinct is shown in **Table 4-2**. It should be noted that it does not include a dry berth facility, the boat ramp or district playing fields.

Table 4-2: Proposed Parking Supply by Landuse

Landuse	No. of spaces
Marina	150
Hotel	289
Office / Commercial (throughout the precinct)	241
Supermarket	58
Residential	258
Technology Park (30,000m^2)	725
TOTAL	**1,721**

Given the lack of published rates, parking for the dry berth facility may be best estimated in a similar manner to the Marina – calculated by the number of berths (as outlined in **Table 4-1**). The parking requirement for the boat ramp and district playing fields will be in accordance with Council's requirements.

4.6 Dry Stack Facility

A dry stack facility for up to 200 boats is under consideration for the Boat Harbour Precinct. Typically, this type of land-use generates higher traffic volumes on weekends and would not impact greatly on the critical commuter AM and PM peak periods. The road network will have more spare operating capacity on the weekends, so the operation of a dry berth facility is likely to impose only minor impacts on the surrounding road network.

The alternative option for the dry stack site is to provide for residential development there. This would generate a similar amount of traffic to the dry stack facility, but peak traffic demand would occur during the critical weekday commuter peaks.

4.7 Harbour Entrance Precinct

As noted in Section 2.2, there are two potential alternative uses proposed for this precinct – one incorporating residential uses only and another 100 room hotel and some residential uses. The latter use would result in higher daily trip rates for the Harbour Entrance Precinct. It would mean about an extra 1,100 vehs/day, resulting in the following increases in traffic volumes on nearby streets:

- 800 more vehs/day on Brigantine Dr east of Road B, increasing flows to 2,500 vehs/day; and
- 300 more vehs/day on Boollwarroo Pde, increasing flows to 1,000 vehs/day.

It will also result in some relatively small increases in traffic volumes on Harbour Bvde and Cove Bvde.

These increases in traffic can be readily accommodated by the existing and proposed road network.

4.8 Traffic Demand Management

The Shell Cove Boat Harbour Precinct can be a good example of urban development in an outer suburb, by providing a package of measures designed to:

- Provide a realistic transport choice for public transport users;
- Ameliorate the negative impacts of additional car use; and
- Facilitate a walkable community with good access to employment.

There are many transport and land-use management tools available to help achieve these objectives. The key concept is to reduce the overall vehicle traffic generation, which can be done in a number of ways including:

- Altering land-use and development densities;
- Increasing public transport usage;
- Increasing pedestrian and bicycle usage;
- Increasing telecommuting; and / or
- Personalised travel planning.

5.0 Conclusions

5.1 Roads

The existing and proposed road network within Shell Cove has been designed to have sufficient capacity to safely and efficiently cater for additional traffic generated by the Boat Harbour Precinct. The Boat Harbour precinct can be successfully linked to the existing and proposed road network without placing undue stress or pressure on the existing road system or adjoining uses.

There will be good access to the Boat Harbour Precinct from the existing and planned road network. Good access will be maintained to the Bass Point Reserve via the proposed main road network in Shell Cove, reducing existing traffic flows and impacts on local streets in Shellharbour Township.

The key conclusions in relation to specific road elements are:

- Harbour Boulevarde
  - This is an important new access road needed to service the Boat Harbour Precinct traffic
  - A preliminary design for this road has been produced and traffic analyses indicate that the road and its intersections can operate safely and efficiently under forecast traffic
- Cove Boulevarde
  - This existing road currently forms the major access to Shell Cove and it has been designed to cater for increased traffic from the Boat Harbour Precinct
- Boat Harbour Precinct Streets
  - Traffic flows on these streets will be relatively light, enabling on-street parking and relatively easy and safe movement of pedestrians and cyclists
  - The streets around the proposed Town Centre will have adequate capacity to service expected traffic demands
  - The plan for the Boat Harbour Precinct enables safe and efficient access of service vehicles from Harbour Bvde
- Shellharbour Township Streets
  - There will be a reduction in traffic using local streets in Shellharbour Township, largely because access to Bass Point Reserve is going to be via Cove Bvde and Harbour Bvde in future rather than via local Township streets

5.2 Intersections

Key intersections on Shellharbour Road that will service the development will have sufficient capacity to safely and efficiently cater for the full development of Shell Cove. All new intersections serving the Boat Harbour Precinct will be designed with adequate sight distances and for safe and efficient operation.

A detailed traffic assessment and preliminary design have been produced for the proposed intersections of Harbour Boulevarde with Shellharbour Road, Addison Street and Brigantine Drive. This includes a revised layout at the Shellharbour Road/Harbour Boulevarde/Wattle Road intersection, new traffic signals at the Addison Street/ Harbour Boulevarde intersection and a single lane roundabout at the Brigantine Avenue/ Harbour Boulevarde intersection.

The key conclusions in relation to specific intersections are:

- Shellharbour Rd / Harbour Boulevarde / Wattle Rd
  - The existing signalised intersection of Shellharbour Rd / Wattle Rd can be readily modified to enable a new connection with Harbour Bvde, with minimal changes or impacts to Shellharbour Rd.
- Addison St / Harbour Boulevarde
  - This new intersection will need to be signalised and linked with the signals at Shellharbour Rd / Wattle Rd.
- Brigantine Dr / Harbour Boulevarde
  - A single lane roundabout is recommended here. However, a south-bound lane dedicated for left turns is no longer warranted.
- Cove Bvde / Harbour Boulevarde
  - A single lane roundabout is recommended here.
- Road A / Harbour Boulevarde
  - A single-lane roundabout is recommended here.
- Road C / Harbour Boulevarde
  - A priority controlled intersection is recommended here.
- Cove Bvde / Shellharbour Rd
  - This existing roundabout will operate satisfactorily at full development of Shell Cove.
- Cove Bvde / Road B
  - This intersection is suited to a Pedestrian Share Zone. It would enable a safe and attractive linkage between the town centre and the harbour.

5.3 Pedestrians and Cyclists

There will be strong road and pathway interconnections within the Boat Harbour Precinct and to adjoining existing and planned developments. The development and associated road network have been designed to minimise traffic impacts on existing development, but to provide strong pedestrian and bicycle connections.

The Boat Harbour Precinct will be designed to provide easy pedestrian and cyclist access to the harbour, together with cycle parking and comprehensive directional signage. Provision will be made for safe and efficient movements of pedestrians across Harbour Boulevarde, with linkages to proposed shared pathways on Harbour Boulevarde. Internal movements to the harbour foreshore will be facilitated by a proposed shared access at the eastern end of Cove Boulevarde.

The key recommendations are:

- A Pedestrian Share Zone in the town centre core.
- Footpaths should generally be provided on all roads within the site to ensure that pedestrians have a choice of travel within the precinct.
- The pedestrian network should be designed to ensure that a minimum target 85 per cent of residents live within an actual 400m walk distance of a public transport service.
- Local streets should be available for use by cyclists and managed and maintained to ensure that cycling on these routes is safe and convenient.

The pedestrian and cycle network of the new development will be integrated into the existing pedestrian and cycle network, particularly accessing recreation areas. Other important conclusions and recommendations for pedestrians and cyclists are contained in **Section 4.3**.

5.4 Public Transport

The key conclusions are:

- Provision needs to be made for future bus routes on Cove Bvde, Southern Cross Boulevarde, Harbour Boulevarde and Brigantine Dr - Boolwarroo Pde.
- The completion of a connection between Cove Boulevarde and Addison Street via Harbour Boulevarde will enable improved routing of existing bus services in the area. It will also mean that the Boat Harbour Precinct will be well served by local bus routes.
- Some buses will need to run through the main internal road serving the Business Park and consideration will need to be made for this in the design of the internal road system.
- At least 85 per cent of residents to live within an actual 400 metre walk distance of a public transport stop.
- The provision of high quality rail infrastructure at the proposed future rail station near the future road interchange between Princes Hwy and Shellharbour Rd. This is a prerequisite of achieving sustainable mode split targets for the area.
- The public transport network will grow with the development and services are expected to be consistent with the current levels.

5.5 Parking

The key conclusions are:

- Adequate parking will be provided as part of developments in the Boat Harbour Precinct, in accordance with Council guidelines.
- Preliminary planning for the commercial centre, marina facilities and business park indicates that service vehicles will be able to readily access these businesses from the main roads serving Shell Cove (ie., Harbour and Cove Boulevarde).
- A recent concept plan indicates that a parking supply of about 996 spaces should be provided for marina, hotel, commercial and residential uses in the mixed use core of the Boat Harbour Precinct. These can be provided in a combination of on-site or on-street locations in the precinct.
- A parking supply of about 725 spaces needs to be provided in the Business Park Precinct, for a 30,000m^2 GFA development.