AUSTRALAND

SHELL COVE BOAT HARBOUR PRECINCT MASTERPLAN TRAFFIC AND PARKING ASSESSMENT

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1.0 INTRODUCTION

The report *Shell Cove Boatharbour Precinct Traffic Study* was prepared by Maunsell, with the final report dated 24 March 2009. It was contained in Appendix A of the *Shell Cove Boat Harbour Precinct Concept Plan Application and Environmental Assessment,* prepared by LFA in February 2010. This Maunsell report sets out an analysis of the traffic generation and road and intersection design issues. While this report focussed on the specific traffic generation of the Boat Harbour Precinct, it also took into account the adjoining development planned for Shell Cove. The analysis started with the 2018 Illawarra TRACKS traffic model provided by Shellharbour City Council, and added the proposed land uses in the Boat Harbour Precinct. The outputs from the TRACKS model were the projected daily traffic flows on the Shell Cove and Shellharbour road network. Maunsell applied conversion factors to provide peak hour traffic flows on the road network. These peak hour flows were used to undertake an analysis of individual intersections using the SIDRA traffic model, and from this analysis, the future intersection layouts were recommended.

Since the date of the 2009 Maunsell report, on-going refinements in the design of the Boat Harbour Precinct have been undertaken. To confirm that the planned intersection designs remain appropriate, Australand commissioned Christopher Hallam & Associates Pty Ltd to undertake a review. An analysis has been undertaken of the currently projected traffic of the precinct and a comparison drawn with the previous work. This review has taken into account the precinct layout and land use details now proposed, as well as a change to the road network, with Road B between Road A and Cove Boulevard moved back from the foreshore area. Figure 1 shows the proposed road layout and car parking for Stage 3 of the Precinct development.

This review report is set out as follows:

- Section 2 reviews traffic generation and traffic design issues, including traffic generation rates, road hierarchy, intersections and detailed road treatments;
- Section 3 reviews car parking, as an integral input into the design of the precinct, and
- Section 4 sets out the conclusions.

FIGURE 1 BOAT HARBOUR PRECINCT

2.0 TRAFFIC FORECASTS AND ASSESSMENT

2.1 Traffic Forecasts

Section 3.2 of the Maunsell report discussed *Traffic Forecasts.* The TRACKS model contained *"inherent trip rates created as part of the original model calibration process by other consultants employed by RTA and local Councils."* The TRACKS model projected the total daily traffic generation of Shell Cove to be 50,551 veh/day. Maunsell then used the then current RTA trip generation rates from the RTA *Guide to Traffic Generating Developments* to independently verify the total trip generation. Maunsell found that using these rates, the projected generation was 40,123 veh/day. Thus the TRACKS model projections were 21% higher than the Maunsell projections. The Boat Harbour Precinct accounts for about 35% of the total Shell Cove traffic at full development, or about 18,000 veh/day if based on the TRACKS outputs, or 14,040 veh/day if based on the Maunsell projections.

The analysis of the roads and intersections by Maunsell used the TRACKS projected flows, which, as stated above, are about 21% higher than the Maunsell projections. Maunsell converted the daily traffic flows into peak hour flows using *"directional splits from local traffic counts".* Maunsell noted that *"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".* The projected flows were also used to check peak holiday times by increasing peak flows by 10%, this reflecting observed seasonal trends in traffic flows.

In summary, the traffic flows used by Maunsell in their analysis of roads and intersections was conservative with the use of higher trip generation rates inherent in the TRACKS model and in minimal reduction in peak hour flows for the peak spreading that typically occurs.

To ensure that this analysis by Maunsell remains appropriate, we have re-assessed trip generation rates and applied them to the land use details currently proposed in the Boat Harbour Precinct. Figure 1 shows the current proposal for the Boat Harbour Precinct.

2.2 Traffic Generation Rates

<u>Standard Residential</u>

Maunsell assumed standard rates from the 2002 RTA *Guide to Traffic Generating Developments,* this being 9.0 veh/day/dwelling, or 0.85 veh/hr/dwelling. The RMS has recently published a *Technical Direction TDT 2013/04a,* in August 2013. This provides the results of new traffic surveys and recommends some variations in traffic generation rates compared with those in the 2002 Guide. It distinguishes between sites in the Sydney Region and Regional sites. For Sydney sites the rate is 10.7 veh/day/dwelling while for Regional sites the rate is 7.4 veh/day/dwelling. The 2002 RTA Guide thus gives conservatively higher rates for dwellings in Regional areas. Relying on the 2002 Guide rates is thus conservative.

Medium Density Residential

Maunsell quote the RTA rate of 6 veh/day/dwelling. This is the rate from the 2002 Guide for large (three-bedroom) dwellings. There were no new surveys. The assumption of this rate is thus conservative.

Apartment Unit

Maunsell quote 4 veh/day/dwelling. From the 2002 Guide this is equivalent to a small (one-bedroom) medium density unit. The RMS 2013 surveys suggest for "High density residential flat building" in a Regional location a rate of 4.6 veh/day/unit. This is substantially higher than the recommended Sydney rate of 1.5 veh/day/unit. We are not confident that the Regional rate of 4.6 truly reflects the likely outcomes, particularly with the Regional low density rates being substantially lower. There could be an issue with survey sample size in these rates. We prefer to stick with the original Maunsell rate of 4 veh/day/unit.

Shops and Supermarket

Maunsell suggest rates that do not appear to come from the 2002 Guide. They suggest for supermarkets, 77.5 veh/day/100 sq m , and for shops, 30 veh/day/100 sq m. The 2002 Guide has various ways of estimating trip generation at shopping centres. We recommend using the disaggregated model, with differing rates for each retail type. For the Friday afternoon peak hour, the supermarket rate is 13.8 veh/hr/100 sq m, while for specialty shops it is 5.6 veh/hr/100 sq m. RTA surveys found that the daily traffic generation of shopping centres is about 10 times the afternoon peak hour generation. The resulting daily rates are thus supermarkets, 138 veh/day/100 sq m, and shops, 56 veh/day/100 sq m, with these rates derived from Friday surveys, which is appropriate given that Friday is likely to be the peak weekday at Boat Harbour. For the AM peak hour, from the RMS 2010/2011 shopping centre surveys, the ratio of AM Peak Trips/PM Peak Trips had a mean of 0.55. This can be used to estimate the AM peak hour trips from the PM peak hour trips.

Office and Commercial

Maunsell use the 2002 Guide rate of 10.0 veh/day/100 sq m (and a peak hour rate of 2.0 veh/hr/100 sq m). The RMS 2013 recommended rate is 11.0 veh/day/100 sq m, and peak hour figures of 1.6 veh/hr/100 sq m (AM) and 1.2 veh/hr/100 sq m (PM). This suggests a spreading of the peak movements.

Technology Park

Maunsell suggest a rate of 5.5 veh/day/100 sq m. The RTA 2002 Guide recommends for Factories 5 veh/day/100 sq m and 1 veh/hr/100 sq m, while for Business Parks there is no daily figure but there is a peak hour figure of 1.1 veh/hr/100 sq m. The Maunsell rate is this Business Park rate multiplied by the Factories peak to day expansion factor.

The RMS 2013 document presents different rates for Sydney and for Regional, with the Sydney rate being 4.60 veh/day/100 sq m and the Regional rate being 7.83 veh/day/100 sq m. It would be

prudent to use the new Regional rates. The peak hour rates are 0.70 veh/hr/100 sq m (AM) and 0.78 veh/hr/100 sq m (PM).

Retirement Village

The Maunsell rate of 6 veh/day/dwelling is high, and higher than the standard RTA Guide rate of 2 veh/day/dwelling. RMS 2013 recommend a rate of 2.1 veh/day/dwelling, which is close to the 2002 Guide rate, and with a peak hour rate of 0.4 veh/hr/dwelling, but with this peak rate not occurring during the commuter peak hours. We recommend using the new 2.1 veh/day/dwelling rate.

Hotel

Maunsell suggest a rate of 32 veh/day/100 sq m. However the 2002 RTA Guide provides no rates, so the origin of this rate is not known.

For hotels, we consider that the generation needs to be broken down into accommodation and tavern (bar and bistro). For Accommodation we suggest the use of the 2002 Guide rate for Motels, of 3.0 veh/day/unit and 0.4 veh/hr/unit, assuming one-bedroom units. For two-bedroom units within an apartment hotel, we recommend using the apartment unit regional rates of 4.58 veh/day/unit, 0.53 veh/hr/unit (AM) and 0.32 vceh/hr/unit (PM).

For the Tavern component, the RTA have always recommended that comparisons be drawn with similar developments. With the lack of details on the type of hotel and tavern proposed for the precinct, this is difficult. As a guide, we recommend using the RTA Guide rate for Restaurants, of 60 veh/day/100 sq m and 5.0 veh/hr/100 sq m for the evening peak hour.

Restaurant

As above, we recommend using the RTA 2002 Guide rates of 60 veh/day/100 sq m and 5.0 veh/hr/100 sq m.

Library/Community

Maunsell recommend a rate of 5 veh/day/100 sq m. The RTA 2002 Guide rates for Office/commercial are 10 veh/day/100 sq m and 2.0 veh/hr/100 sq m. The RMS 2013 rates are 11 veh/day/100 sq m, 1.6 veh/hr/100 sq m (AM) and 1.2 veh/hr/100 sq m (PM).

With car parking for the Community Centre being at the same rate of one space/40 sq m as the RTA Guide, we recommend using the 2013 rates for this use. For the Library floor area, with lower rates of parking provision, we recommend using the Maunsell rate of 5 veh/day/100 sq m.

Marina

This is a difficult land use to assess. It is a very seasonal use. From our surveys at Rose Bay and Point Piper Marinas on Sydney Harbour, compared with an assumed peak usage in December, the monthly variations between July and January were found to be:

July 53%; August 49%; September 59%; October 59%; November 50%; December 100%; January 79%

Marina usage tends to be busy on Summer weekends and not very busy on weekdays, or out of the warmer months. While some marinas on Sydney Harbour and Pittwater can have weekday evening peak usage through yacht races, this is not expected to be a feature of boat usage at Shell Cove. An important traffic generation will be from the commercial vessels, and even these will have seasonal variations in use, with whale watching only on some months of the year, and with weekends being busier than weekdays. Other commercial uses such as off-shore game fishing and diving will also likely to be busier on the weekend. Transient boat users who call in at the marina when sailing past will have minimal traffic generation, unless they hire a car for a few days.

We have based our traffic generation assessment on observed person movements per hour at Rose Bay & Point Piper Marinas on Summer weekends, with the factoring taking into account the parking supply for Boat Harbour Marina. As separately reviewed, we recommend the provision of 40 car parking spaces for Stage 1 of the marina, including provision for the five commercial vessel berths, with the intent being to undertaken monitoring of parking demand for the marina prior to further marina stages. For this assessment of the ultimate traffic generation of a 300 berth marina, for the balance of the 250 berths, we have assumed the rate of 0.223 spaces per berth, which is the rate for berths longer than 20m that we found in our extensive marina parking research. This requires an additional 55 spaces, taking the total to 95 spaces. Table 2.1 sets out our analysis of the hourly traffic movements on a Summer weekend, for Stage 1 and for Ultimate development of the 300 berth marina, based on surveys at Rose Bay and Point Piper Marinas. Note that the absolute figures for person movements at Rose Bay/Point Piper do not transpose into the car movements shown. The distribution of the person movements has been used to determine the traffic movements, assuming 100% use of the parking provided at some time during the day.

Table 2.1 Summer Weekend Person Movement and Traffic Generation

Time	Rose Bay Persons IN	Rose Bay Persons OUT	Shell Cove S1 Cars IN	Shell Cove S1 Cars OUT	Shell Cove Parking	Shell Cove Cars IN	Shell Cove Cars OUT	Shell Cove Parking
8-9am	7	0	6	0	6	15	0	15
9-10am	14	0	13	0	19	31	0	46
10-11am	15	2	14	2	31	33	4	75
11-12pm	7	3	7	2	36	15	5	85
12-1pm	7	3	6	2	40	15	5	95
1-2pm	2	7	2	6	36	5	15	85
2-3pm	4	8	4	8	32	10	18	77
3-4pm	1	12	1	12	21	3	29	51
4-5pm	0	20	0	19	2	0	46	5
Total	57	55	53	51	-	127	122	-

From Table 2.1 it can be seen that for Stage 1 of the marina, assuming all allocated parking is used, on a Summer weekend day the daily two-way traffic movements will be about 106 veh/day, while for the ultimate development of the marina, with 300 berths, the daily two-way traffic movements will be about 254 veh/day.

For weekdays, the use of the marina will be substantially lower. Again, based on usage rates observed at other marinas over the week, we have conservatively assumed that the weekday generation will be 50% of the weekend generation, or 53 veh/day for the Stage 1 and 127 veh/day for the 300 berth marina. For reviewing weekday peak periods, the same 50% reduction can be assumed, so that for the morning and afternoon peak hours, the traffic movements will be:

Period	Weekday 50 berths	Weekday 300 berths
8-9am	3 veh/hr	8 veh/hr
4-5pm	10 veh/hr	23 veh/hr

As stated, the Stage 1 will include the five commercial vessel berths, which will have substantially higher rates of usage, while the additional 250 berths are assumed to be more typical private berths, with lower rates of use and parking demand.

2.3 Precinct Traffic Generation

As discussed, the TRACKS model assumed the total Shell Cove area to have a generation of 50,551 veh/day, with about 35% of this, or 18,000 veh/day from the Boat Harbour Precinct. The Maunsell assessment found a lower generation from the Boat Harbour Precinct, of about 14,000 veh/day, but to be conservative, Maunsell used the TRACKS outputs in their review of road hierarchy and intersections.

To check that this Maunsell assessment is still valid for the current mix of uses at the Boat Harbour Precinct, we have applied our generation rates set out in Section 2.2 to this current mix. This review includes residential flat buildings along the northern edge of the Precinct, where final apartment yields are not confirmed, but the numbers set out below are the current estimates.

Similarly for the apartment hotel, the assessment is based on the current projection of 110 two-bedroom apartments where 48 of these are dual-key, allowing separate use as 96 one-bedroom rooms. Some apartments within this hotel will be full-time residential. The traffic generation has been based on 96 motel units plus 62 two-bedroom apartments. This apartment hotel will include lobby, reception and various services that will not generate traffic in their own right. Some conference area is likely, but this has been assumed to be used by hotel residents only and not operate as an independent function centre. Current planning does not include public bar and restaurant facilities in this hotel, although there could be a low key lobby bar catering for in-house guests and residents.

Marine Offices

- 301 sq m @ 11/100 sq m/day= 33 veh/day
- AM peak @ 1.6/100 = 5 veh/hr; PM peak @1.2/100 = 4 veh/hr

Restaurants

- 592 sq m internal plus 225 sq m external = 817 sq m GFA assumed
- 817 sq m @ 60/100sq m/day = 490 veh/day
- AM peak 0; PM peak @ 5/100/hr = 41 veh/hr

Supermarket

- 3600 sq m GFA @ 13.8 veh/100 sq m/hr (Friday) = 497 veh/hr PM
- AM figure is 0.55 x 497 = 273 veh/hr
- Daily x10 = 4970 veh/day

Shops

- 1424 sq m GFA @ 5.6 /100 sq m/hr (Friday) = 80 veh/hr PM
- AM figure is 0.55 x 80 = 44 veh/hr
- Daily x 10 = 800 veh/day

Community/Library

- Community 910 sq m @ 10/100 sq m/day = 91 veh/day
- Peak @ 2.0 veh/100 sq m/hr = 18 veh/hr
- Library 685 sq m @ 5/100 sq m /day = 34 veh/day
- Peak @ 1.0 veh/100 sq m/hr = 7 veh/hr

Tavern

- 955 sq m indoors plus 280 sq m outdoors = 1235 sq m total GFA
- Daily 1235 sq m @ 60/100 sq m/day = 741 veh/day
- PM Peak 1235 sq m @ 5/100 sq m/hr = 62 veh/hr
- AM Peak: assume 0.1 x 62 = 6 veh/hr

Residential Apartments - East

- 25 apartments @ 4.58/day = 114 veh/day
- AM peak @ 0.53/hr = 13 veh/hr; PM peak @ 0.32/hr = 8 veh/hr

Residential Apartments – North

- 152 apartments @ 4.58/day = 696 veh/day
- AM peak @ 0.53/hr = 81 veh/hr; PM @ 0.32 = 49 veh/hr

Apartment Hotel

- 96 one-bedroom rooms @ 3.0/room/day =288 veh/day
- 62 two-bedroom units @ 4.58/unit/day = 284
- Peak 96 one-bedroom rooms @ 0.4 veh/room/hr =38 veh/hr AM & PM
- Peak 62 two-bedroom units @ 0.53/unit/hr = 33 veh/hr (AM);
  62 @ 0.32/unit/hr = 20 veh/hr (PM)

Marina

- Stage 1 106 veh/day Weekend, 53 veh/day Weekday
- Stage 1: AM weekday 3 veh/hr; PM weekday 10 veh/hr
- Ultimate: 254 veh/day Weekend, 127 veh/day Weekday
- Ultimate: AM weekday 8 veh/hr; PM weekday 23 veh/hr

Total Precinct

Table 2.2 gives the projected daily and peak hour flows for the Precinct.

Table 2.2 Projected Weekday Traffic Generation of Boat Harbour Precinct

Land Use	Vehicles/Day	AM Peak Veh/Hr	PM Peak Veh/Hr
Marine offices	33	5	4
Restaurants	490	0	41
Supermarket	4970	273	497
Shops	800	44	80
Community/library	125	25	25
Tavern	741	6	62
Residential apartments - East	114	13	8
Residential apartments – North	696	81	49
Apartment hotel	572	71	58
Marina	S1:53; Ult 127	S1 3; Ult 8	S1 10; Ult 23
Total	Ult: 8,668	526	847

Note that some of these trips would be multi-purpose, for example, people shopping and then going to a restaurant or tavern, local residents walking to the restaurants or tavern and marina users using the restaurants or tavern after boating.

With the total weekday trip generation of about 18,000 veh/day that was estimated in the TRACKS modelling, the total in Table 2.2 of 8,668 veh/day is substantially less, and hence the analysis by Maunsell in their 2009 report of road hierarchy and intersections remains valid, with a conservative over-allowance for the total trips. This will allow for higher yields than currently proposed.

As a cross-check, we reviewed the land use information in Table 2.1 of the Maunsell report. For the Boat Harbour Precinct, and using our preferred generation rates, we estimated a total daily flow of 13,300 veh/day, plus marina traffic, for a total of under 13,500 veh/day. This compares with our estimate of 8,668 veh/day. For the remaining precinct land uses in the Maunsell Table 2.1, and using our generation rates, we estimate a total daily flow of just under 18,000 veh/day. Added to Boat Harbour Precinct this yields about 31,500 veh/day, a figure less than the 50,500 veh/day projected by the TRACKS model. The traffic flow outputs from the TRACKS model remain conservative.

2.4 Road Hierarchy

Figure 2 shows the Year 2018 daily traffic flows estimated by the TRACKS model, overlayed on Figure 2.2 of the 2009 Maunsell report, with the flows taken from Table 3.2 of the Maunsell report, showing the daily traffic flows within and on the edge of Boat Harbour Precinct. Figure 3 provides a broader view, with the Year 2018 flows overlayed on Maunsell's Figure 2.1.

The road hierarchy design is set out in the *Shell Cove Boat Harbour Precinct (MP07_0027) – Preferred Project Report,* prepared by LFA in November 2010. Figure 3 of this report is reproduced herein as Figure 4. This Figure 4 also shows a dotted outline of a change to Road B, with its section between Road A and Road C moved away from the Boat Harbour, but retaining that section of Road B between Cove Boulevard and Road C. This means that there will be two road links between Cove Boulevard and Road C, thus reducing flows on that section of Road B close to the Harbour, where there will be a high concentration of pedestrians.

Harbour Boulevard

West of Brigantine Drive, Harbour Boulevard is projected to carry 15,200 veh/day. West of Cove Boulevard the projection is 11,800 veh/day, with 13,600 veh/day east of Cove Boulevard. Near Shallows Drive, the flows are down to 5,000-6,000 veh/day. On Figure 4 it is shown as a Type 1A Avenue between Road A and Shellharbour Road, with a 30m reserve and median separation. This road type will carry two lanes per direction. The cross-section in the LFA report shows a 4.0m wide central median. This will have adequate space to provide right-turn lanes at intersections.

The Shellharbour DCP nearest equivalent road is a major collector, carrying over 3,000 veh/day, with the cross-section not specified. At a daily flow of about 14,000 veh/day, the peak hour flow will be of the order of 1400 veh/hr, two-way total. As set out in the RTA *Guide to Traffic Generating Developments,* each lane in a 4-lane divided configuration has a mid-block capacity of 1,900 veh/hr. The proposed four-lane configuration will provide ample capacity.

South of Road A, this road will be an Avenue Type 1B, with a 25m reserve, no median and a carriageway width of 10.6m. This would allow one through traffic lane per direction plus either kerbside parking or provision for bus stops. With the projected flows up to 6,000 veh/day, or about 600 veh/hr, one traffic lane per direction will be ample.

Cove Boulevard

West of Harbour Boulevard the projected flow is 10,100 veh/day. The Maunsell report comments: *"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."* We agree with this assessment.

East of Harbour Boulevard, Cove Boulevard is projected to only carry a daily flow of 1400 veh/day, between Harbour Boulevard and Road B. This flow, being less than 200 veh/hr two-way, can be handled by one lane per direction. Some interference from kerbside parking would be acceptable. There is scope for landscaping work and other non-engineering improvements. Since it might carry

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

FIGURE 2 PROJECTED YEAR 2018 DAILY TRAFFIC FLOWS

FIGURE 3 PROJECTED PRECINCT YEAR 2018 DAILY TRAFFIC FLOWS

to the location e.g. different land use, edge condition, median and water sensitive urban design (WSUD) principles. Refer to **Tables 3, 4, 5 and 6**.

Figure 3: Street Network

FIGURE 4 ROAD HIERARCHY - LFA

scheduled bus services, lane widths need to be at least 3.5m, with adequate kerb radii at intersections.

The current plan – Figure 1 – introduces a road link between Cove Boulevard and Road C mid-way down to the harbour. This will reduce the traffic continuing along Cove Boulevard and through the proposed shared-zone area where Cove Boulevard meets with the north-eastern end of Road B. The shared-zone is further discussed in Section 2.6.

However, these traffic projections were based on the road network shown in Figure 2, where there is no path from this road into the parking area for the supermarket. As shown on Figure 1, this is no longer the case. Some shoppers might choose to use Cove Boulevard to access this parking area instead of using Road A. With one traffic lane per direction, Cove Boulevard will still have ample capacity.

The following review of roads is based on the Maunsell traffic projections. In our review of intersections, we have used our more recent traffic projections based on the Precinct traffic generation shown in Table 2.2.

Road A

Road A will carry the highest traffic flows in the precinct because it will access most of the car parking and will also provide an access into the residential precinct to the south-east. The projected flow of 5700 veh/day might be high if some shoppers use Cove Boulevard instead, to access the supermarket parking area. (This figure is higher than the projections for the Stage 1 application.)

Figure 4 shows Road A to be a Type 3A *main circulating street,* with a reserve of 19.5m and carriageway width of 10.6m if it is a bus route. If not a bus route the reserve would be 18.5m, with a carriageway width of 10.0m. At 5700 veh/day, the peak flow will be of the order of 600 veh/hr two-way, where one traffic lane per direction will be adequate. The proposal is for a 7.5m carriageway, excluding parking, providing one travel lane per direction, plus indented parking along the southern side. If required, indented bus stops might be added.

East of the first cross-junction, past the entrance to the supermarket parking area, flows will reduce. Kerbside parking is still preferred to be parallel rather than at right-angles, as is proposed.

East of its junction with Road B, Road A will curve to the South. At the curve, an access driveway will be located for access to the car parking and service areas to the north-east. This access will be a private road. Just south of the curve, another driveway will provide access into another parking area.

Road B

The only projected traffic flows for Road B are between Road A and Cove Boulevard, with 900 veh/day, and between Cove Boulevard and Road C, of 1100 veh/day. The flows east of Road A are probably higher. Road B is shown on Figure 4 as a Type 3A road, with a reserve of 18.5-19.5m and a carriageway width of 10.0-10.6m. At about 1,000 veh/day, one lane per direction is ample, and unstressed.

The layout shown on Figure 1 is different to the original proposal for Road B. There will now be a road – designated Road 12 – that passes in front of the supermarket and provides access to the supermarket parking. This is proposed to be a private road, in effect a parking access road, but will also carry regular bus services. The proposal is for this road to have one travel lane per direction, each 3.5m wide, plus an indented area along the eastern side, providing a bus stop plus car parking.

For that section of Road B between Cove Boulevard and Road C, the projected flow is 1100 veh/day. This section will incorporate a shared-zone, as will be discussed. Figure 4 shows this to be a Type 3A road. This section includes a community/library. Kerbside parking is desirable for convenient access into this community centre. Design options have included both parallel parking and right-angle parking. From a traffic engineering point of view, parking would be better if kept parallel. From a community accessibility point of view, right-angle parking, to maximise the spaces immediately adjacent to the centre might be preferred. Right-angle parking does require about 6m of roadway for cars to turn from and into when accessing the parking, which means that general through traffic movement is affected when parking manoeuvres are taking place. However from a consideration of the projected traffic flows, this would not be unacceptable. This area in front of the community centre would almost be an extension of the shared zone. In conclusion, this road does not need to be a Type 3A road and could be either reduced in width if parallel parking is proposed or left as currently planned and allow right-angle parking off it.

Road C

Road C is to be a Type 3A road. With a projected traffic flow of 2700 veh/day, one traffic lane per direction will be ample.

Other Boat Harbour Precinct Streets

South of Road A and immediately east of Harbour Boulevard there will be a road accessing the residential area to the south-east, Precinct C. Figure 4 shows this as a Type 3B road, with a road reserve of 15.5m and a carriageway width of 7.5m. While acknowledging that residential yields will vary with the on-going planning of Shell Cove, a current estimate for this precinct is 72 medium density apartments plus 148 higher density apartments. Based on our generation rates, this will generate about 1100 veh/day. With two approach roads off Harbour Boulevard, Road A and another to the South, Road A might carry about 600 veh/day into this precinct, which might be split 300 veh/day into the subject road and 300 veh/day into the eastern end of Road B. For the subject road with a 7.5 m Type 3B carriageway, this level of flow is satisfactory.

The relocated section of Road B that will link Road A with Cove Boulevard provides access to the supermarket parking area. This is planned to be a bus route. It is planned to be a private road. Traffic lanes are recommended to be at least 3.5m width. The proposal is for a 7.0m carriageway, plus an indented bus bay and indented car parking bays along the eastern side.

Similarly for the northern extension of the above road past the supermarket, since it is likely to be a bus route, a similar cross-section is likely, with 3.5m wide travel lanes. As a special urban road, it might be fine-tuned in its cross-section, with a variation factor being whether parallel parking is provided on one or both sides.

The final minor road within the Precinct is the short east-west parking access road parallel and to the north of Cove Boulevard. It will essentially function as the centre aisle of a parking area. A carriageway width of 7.0m would be adequate, with right-angle parking outside this width.

Bus Route Implications

The *Preferred Project Report* (LFA November 2010) set out indicative bus routes on its Figure 5. This indicated a bus route along Harbour Boulevard between Bass Point Road and Shellharbour Road, along Cove Boulevard between Shellharbour Road and Harbour Boulevard and along the east-west road just to the north of Road C. This figure does not indicate any direct bus access into the Boat Harbour Precinct. The Maunsell Traffic Report (March 2009) does not provide any more detail.

Current bus route planning is for buses to approach the Precinct along Cove Boulevard and along both Harbour Boulevard approaches. Within the Precinct, buses would travel along Road C, the western section of Road A, the new cross-link between Road A and Road C and Cove Boulevard between Harbour Boulevard and the above cross-link. An alternative for southbound buses would be to turn left into Cove Boulevarde and right into Road 12. The best route for northbound buses is not certain. While a bus could turn right into Road A, left into Road 12 and then left into Cove Boulevarde, the question is, where will the bus stop? An option would be the southern kerb of Cove Boulevarde. The basic Type 3A reserve with a 10.6m carriageway is the standard road type for a bus route, although with these roads being urban/main street roads, a variation on the standard cross-section might be acceptable. We suggest minimum travel lane widths of 3.5m. For kerbside bus stops on public roads, a 3.0m width is suggested. Kerbside parking at 2.3m on public roads would be adequate. On private roads with lower travel speeds, lesser indent widths might be acceptable. Once the final routes are known, intersection designs should be checked for their adequacy for bus movements.

2.5 Intersections

The intersections on the edge of and within the Precinct have been reviewed. The comments and recommendations made in the Maunsell (2009) report are provided in italics at the start of each intersection discussion. Our SIDRA analysis has been based on the Precinct peak hour flows shown on Table 2.2, plus the Maunsell predicted major road flows shown on Figure 3. These design flows are shown on Figure 5.

Harbour Boulevard/Cove Boulevard

> *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.

The peak hour traffic modelling by Maunsell found that a one-lane roundabout would provide adequate capacity, with less queuing than with traffic signals. Under signal control, the intersection modelling found that in the year 2018 AM peak hour there would be queuing of around 70m on the Harbour Boulevard North approach and on the Cove Boulevard West approach, with a level of service of B. In the Year 2018 PM peak hour queuing of about 110m on the Harbour Boulevard South approach was predicted, with a level of service of B. For the Year 2018 Holiday Peak queuing of about 120m on the Harbour Boulevard South approach was predicted, again with a level of service of B. A level of service of B represents *"good with acceptable delays and spare capacity"* operation, from the RTA's *Guide to Traffic Generating Developments.*

A roundabout is the preferred treatment, from a traffic efficiency point of view. The approaches from Harbour Boulevard are two plus two lanes in cross-section, the approach from Cove Boulevard East is a one plus one lane undivided road while the approach from Cove Boulevard West is a one plus one lane divided road. The Harbour Boulevard North approach would be channelled down to a single lane approach, with a one-lane roundabout. For the Harbour Boulevard South approach, we recommend that the two approach lanes be maintained, to assist the left turn. The Cove Boulevard single lane approaches would provide for left plus through plus right turns.

The disadvantage of a roundabout is that it does not provide active pedestrian safety measures. It relies on the use of pedestrian refuges in the medians, to allow pedestrians to cross the roads in two movements. This was recognised in the analysis by Maunsell. Pedestrian refuges are not regulatory devices, unlike marked pedestrian crossings, and hence refuges are not subject to a warrant. They should follow principles of safe design. The most recent RMS Technical Direction on Pedestrian Refuges is TDT 2011/01a, published in 2011. Traffic and pedestrian volume warrants or ranges for application are not given. Refuges can be adopted instead of marked crossings when a) there is insufficient pedestrian and/or vehicle volumes, b) inadequate sight distance for drivers, and/or c) excessive vehicle approach speed. Based on the Year 2018 predicted traffic flows along Harbour Boulevard near Cove Boulevard – 11,800-13,600 veh/day – the peak hour directional flows are likely to exceed 500 veh/hr. By this level, pedestrians, particularly aged pedestrians, tend to find it difficult to cross the street. Crossing one traffic lane to reach a refuge is clearly easier than crossing two lanes of traffic. We echo the concern raised by Maunsell about the possible need for traffic

signals in the long term, for pedestrian safety, given that Cove Boulevard will be a key pedestrian approach route into the Boat Harbour Precinct.

This review raises the question as to whether money should be spent on the roundabout option which will be the better traffic option, or the traffic signals, which are not as optimal as a roundabout for traffic, but substantially better for pedestrian safety. If signals are desirable in the long term, would it be better to construct them now? A roundabout would probably be more expensive than an intersection designed for signal control, in terms of civil works, but signal costs include not only the hardware but also on-going maintenance. Signals have an advantage because of pedestrian safety considerations, but a roundabout is also feasible. A traffic signal option would see three-lane approaches on Harbour Boulevard, including right-turn bays in the medians, a two-lane approach on Cove Boulevard West, including a right-turn bay in the median, and ideally a similar two-lane approach from Cove Boulevard East.

The current proposal is for a roundabout, with one circulating lane, and with Cove Boulevarde having one lane approaches. Harbour Boulevarde would have one approach lane from the North, plus a 4.0m median, while from the South it would have a left-turn plus a through-right lane. This has been modelled in the SIDRA program. Table 2.3 reproduces guidelines to the modelling outputs, as taken from the RMS *Guide to Traffic Generating Developments,* with the modelling results set out in Table 2.4. Full results are set out in the Appendix.

Table 2.3 Level of Service Criteria for Intersections

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

Table 2.4 SIDRA Modelling of Harbour Boulevarde & Cove Boulevarde – Roundabout

Approach	Move	AM Delay (secs/veh)	AM Level Of Service	AM 95% Queue (m)	PM Delay (secs/veh)	PM Level Of Service	PM 95% Queue (m)
Harbour Bvd	Left	6	A	9	7	A	8
South	Thru	6	A	21	6	A	20
	Right	10	A	21	10	A	20
Cove Bvd	Left	11	A	8	10	A	15
East	Thru	11	A	8	11	A	15
	Right	15	B	8	15	B	15
Harbour Bvd	Left	10	A	67	9	A	58
North	Thru	10	A	67	9	A	58
	Right	14	A	67	13	A	58
Cove Bvd	Left	10	A	46	10	A	39
West	Thru	11	A	46	10	A	39
	Right	15	B	46	14	A	39
ALL	All	9.6	A	(67)	9.2	A	(58)

Table 2.4 indicates satisfactory operation, with low delay levels and a good level of service. Queues will occur, mainly on the Harbour Boulevarde North and Cove Boulevarde West approaches.

Harbour Boulevard/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.*

The Year 2018 peak hour intersection modelling by Maunsell found that a one-lane roundabout at this junction would operate well in all peak periods, with a level of service of A, the highest level.

While the through traffic flows along Harbour Boulevard are projected to be substantial, the flows into and out of Road A are lesser. A one-lane roundabout is recommended, and is proposed. South of Road A, Harbour Boulevarde is proposed to have a 12.0m combined two-way carriageway, while the carriageway will be divided north of Road A.

The current proposal is for a one-lane roundabout. This has been modelled with SIDRA. Table 2.5 sets out the results, with further details in the Appendix.

Table 2.5 SIDRA Modelling of Harbour Boulevarde & Road A – Roundabout

Approach	Move	AM Delay (secs/veh)	AM Level Of Service	AM 95% Queue (m)	PM Delay (secs/veh)	PM Level Of Service	PM 95% Queue (m)
Harbour Bvd	Thru	4	A	29	5	A	33
South	Right	9	A	29	9	A	33
Road A	Left	8	A	1	8	A	7
East	Right	13	A	1	13	A	7
Harbour Bvd	Left	4	A	27	5	A	30
North	Thru	5	A	27	5	A	30
ALL	All	4.7	A	(29)	5.4	A	(33)

Table 2.5 indicates satisfactory operation of a one-lane roundabout, providing adequate capacity.

Harbour Boulevard/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.

The Maunsell intersection modelling at this junction looked at a one-lane roundabout and found very good operation, with a level of service of A.

The projected traffic flows are less than for Road A. Priority control, as recommended in the Maunsell report, is supported. A right-turn bay should be provided in the median. The Harbour Boulevard approaches would otherwise be in two lanes, with the southbound approach being left plus through in the kerb lane and a through lane next to the median. Northbound would be two through lanes plus the right-turn lane in the median. Table 2.6 summarises the SIDRA analysis results.

Table 2.6 SIDRA Modelling of Harbour Boulevarde & Road C - Priority

Approach	Move	AM Delay (secs/veh)	AM Level Of Service	AM 95% Queue (m)	PM Delay (secs/veh)	PM Level Of Service	PM 95% Queue (m)
Harbour Bvd	Thru	0	A	0	0	A	0
South	Right	9	A	0	9	A	1
Road C	Left	31	C	7	25	B	2
East	Right	31	C	7	25	B	2
Harbour Bvd	Left	6	A	0	6	A	0
North	Thru	0	A	0	0	A	0
ALL	All	1.1	na	(7)	0.5	na	(1)

Table 2.6 indicates satisfactory operation under priority control. Should delays to the right turn out of Road C become higher, drivers have other route options, including the use of the Cove Boulevarde roundabout.

Cove Boulevard/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.*

This recommendation was based on the road layout shown on Figure 4, with Road B being a single route from Road A (and South) to Road C, close to the harbour area. This is no longer the preferred layout, as shown on Figure 1. Discussion of the shared zone at the eastern junction of Cove Boulevard and Road B is set out in the following Section.

At the four-way cross junction of Cove Boulevard and the relocated sections of Roads B, closer to Harbour Boulevard, Cove Boulevard should be the priority road, as the avenue leading to the harbour. An analysis has been undertaken using SIDRA 6 of the projected peak hour flows applied to a simple one lane per approach junction. This indicated that all movements would function at a level of service of A, with the overall intersection delay commensurate with this good level of operation.

The detailed design will need to take into account bus movements, after these have been finalised.

Road A/Road B East

This was originally an offset cross-junction. The current design simply has a right-angle bend, with separated parking area access driveways, so priority is clear.

Road A/Road B West

At the more western junction of Road A with Road B, near the front (western) side of the supermarket, the cross-junction will aligned as a standard cross-junction. Road A traffic would have priority. An analysis of the projected peak hour traffic has been undertaken using SIDRA 6. All movements will have a level of service of A, with the overall intersection delay commensurate with this level of service. Simple one lane approaches would be the minimum treatment. On the Road A approach from the West, a left turn lane and a through-right-turn lane would be desirable. On other approaches, single left+through+right turn lanes would be satisfactory.

Road B/Road C

There are two junctions of Road C with the original alignment of Road B and the additional cross-link from Cove Boulevard. Priority to Road C traffic would be appropriate, with simple priority control adequate.

2.6 Shared Zone

A shared traffic zone at the junction of Cove Boulervard and Road B East was recommended in the Maunsell report. On the original Precinct road layout, Road B immediately west of Cove Boulevard had a projected Year 2018 daily traffic flow of 1100 veh/day. With the deletion of the section of Road B east of Cove Boulevard at this point, and the provision of an alternative “Road B” further to

the west, linking Road A with Road C, these flows are too high. The peak hour flows in this section of Road B are not likely to be more than 100 veh/hour, based on the TRACKS modelling. Our recent modelling, as shown on Figure 5, indicates two-way peak hour flows of under 50 veh/hr. This is thus a lightly trafficked street, which makes it suitable for operation as a shared zone.

The RMS Technical Direction TTD 2014/003 *Design and implementation of shared zones including provision for parking* sets out the RMS's current guidelines. Under these guidelines, a Category 1 shared zone is recommended, with no kerbs on the perimeter of the carriageway, but using different coloured and textured surface treatments to differentiate the vehicle carriageway from the purely pedestrian area.

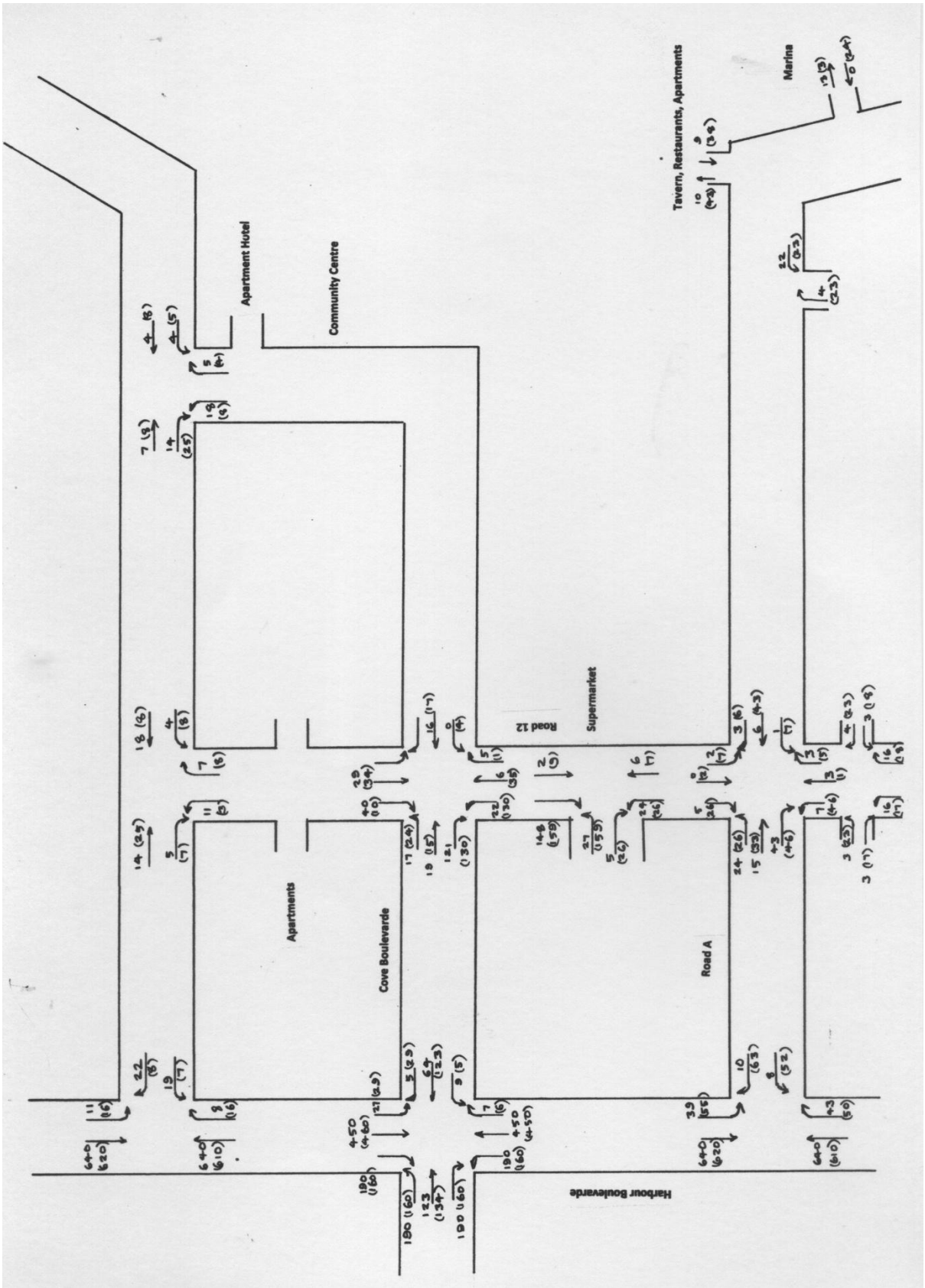

FIGURE 5 PROJECTED PEAK HOUR TRAFFIC FLOWS

10 AM peak; (10) PM peak

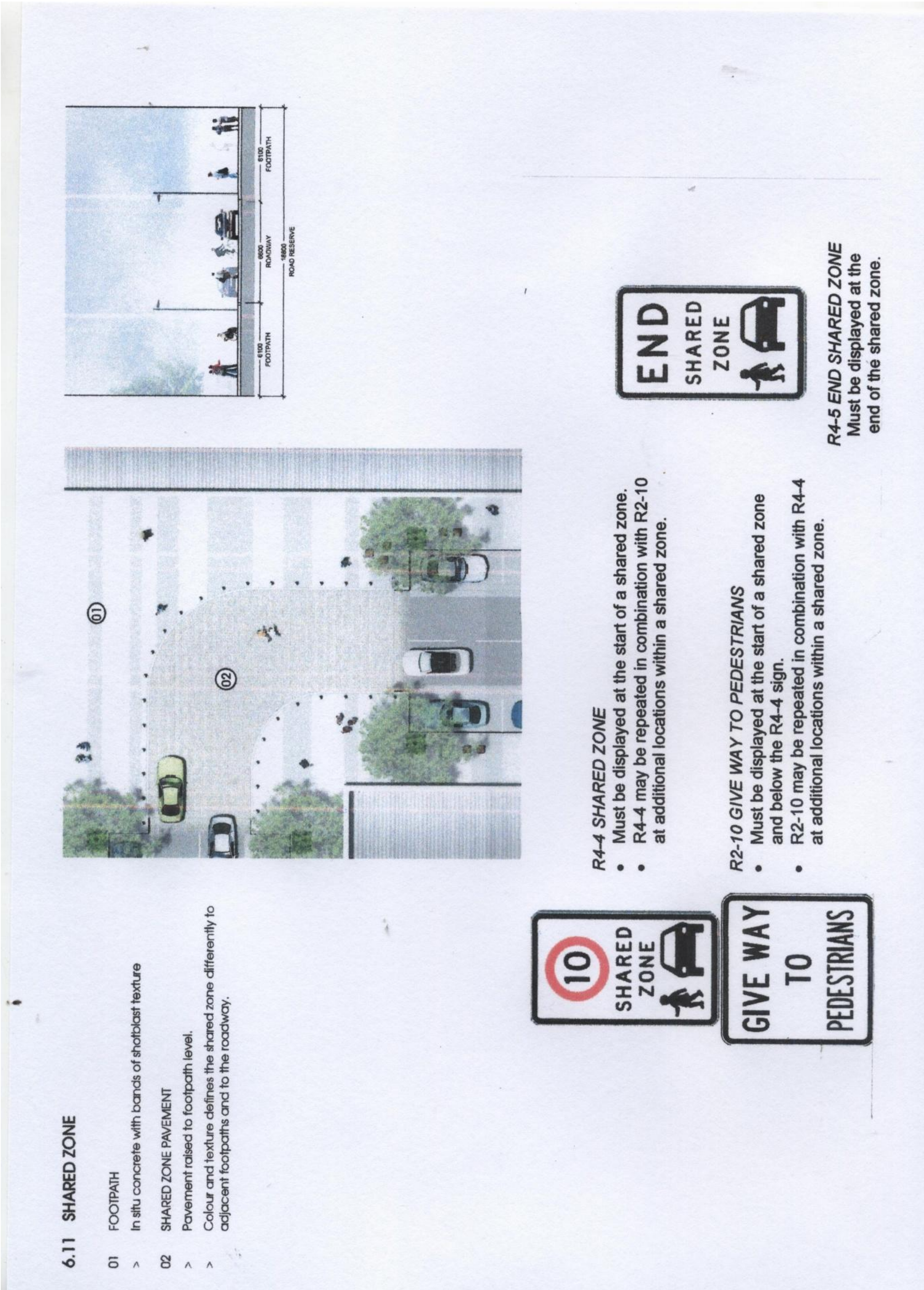

FIGURE 6 SHARED ZONE DESIGN

An indicative design of the shared zone is shown on Figure 6, together with the regulatory signage. This design makes the bend in the road network essentially a crossing point for vehicles and pedestrians, where pedestrians have right of way. This is an appropriate Category 1 design. It does not propose any kerbside parking within the shared zone, although there will be kerbside parking on the approaches. On the Cove Boulevard approach parallel kerb parking is proposed. On the Road B approach the alternatives are either right-angle parking or parallel parking. With the level of traffic movement and also the desire to keep traffic speeds low, right-angle parking could be considered, if convenient and accessible parking near the community/library centre is a priority.

At the entrances to this shared zone, speed humps or platforms are not recommended. Rather, an initial band of coarser texture material is suggested as an easy visual indicator, followed by brick or other textured surface. Figure 6 shows path indicators outside the carriageway. These do not and should not need to function as a pedestrian barrier. Rather, they will provide an indication, particularly to the driver, of the vehicular path.

As required by NSW Road Rule 83, all drivers must give way to pedestrians at all times in shared zones. A *Give Way to Pedestrians* (R2-10) sign must be installed below each *Shared Zone* (R4-4) sign. A speed limit sign indicating a maximum of 10 km/h must be installed at each entrance. These signs are illustrated on Figure 6.

The shared zone is a speed zone and as such must be approved by the RMS.

3.0 CAR PARKING

3.1 Introduction

This Section has been prepared to provide guidance on the appropriate rates of car parking to be provided at Shell Cove Harbour Precinct. This Section takes into account the following:

- Shellharbour City Council Development Control Plan – Chapter 13
- Roads & Traffic Authority (RMS) *Guide to Traffic Generating Developments*
- Research reports by RMS: *Land Use Traffic Generation – Data and Analysis*
- RMS Technical Direction TDT 2013/04a and background surveys
- Research by Christopher Hallam & Associates Pty Ltd

3.2 Car Parking Rates

Retail Premises

DCP rates are:

- Retail shop 1 space/35 sq m GFA
- Supermarket 1 space/20 sq m GFA plus bike/motorbike parking

RMS *Guide* rates are:

- Model: specialty shop 4.5 spaces/100 sq m GLFA; supermarket 4.2 spaces/100 sq m GLFA
- Rates for centres up to 10,000 sq m GLFA: 6.1 spaces/100 sq m GLFA

The RMS Technical Direction TDT 2013/04a provides new traffic generation rates for a range of land uses, including shopping centres. However it does not recommend any revised car parking rates. Comparing the new traffic generation rates with those in the October 2002 Guide, the new rates are quite similar to the old rates, which suggests that parking rates are probably not much different. A background report by Halcrow, for the RMS *Trip Generation and Parking Demand Surveys of Shopping Centre – Analysis Report* (September 2011) does provide information on parking demand. Three regional shopping centres were surveyed. The peak parking demands were:

Site	GLFA (sq m)	Thursday	Friday	Saturday
Mittagong	15,552	1/31.5 sq m	1/31.5sq m	1/26.8 sq m
Warriewood	22,143	1/25.6 sq m	1/26.7 sq m	1/19.0 sq m
Shellharbour	41,040	1/21.3 sq m	1/21.5 sq m	1/21.2 sq m

This report by Halcrow recommends a rate of parking for a centre of up to 20,000 sq m, of one space/27.0 sq m GLFA. However this was for a sample of one centre, being the Mittagong centre.

Traditionally, peak parking rates reduce with increasing centre size. The Shellharbour Square survey provides an important benchmark. Note that this centre includes a range of retail areas, including supermarkets. The peak rates have not changed much over time. Surveys by the RTA in 1990 when the centre had 27,859 sq m GLFA found peak rates of 1 space/23.8 sq m GLFA on a Thursday and 1 space/20.5 sq m GLFA on a Friday. One difference to keep in mind is that the RTA/RMS rates are based on gross leasable floor areas while the DCP rates are based on gross floor areas.

If the Shell Cove Stage3 retail uses are assessed using the DCP rates, the figures are:

Supermarket	3,600 sq m @ 1/20 sq m	= 180 spaces
Retail	1323 sq m @ 1/35 sq m	=38
Total	4,923 sq m	= 218 spaces, or 1 space/22.6 sq m overall

Bearing these figures in mind, we recommend that the current DCP rates be used for the Shell Cove retail parking, for a total of 218 spaces.

Restaurant

The DCP rate is: 1 / 4 sq m "customer area (both internal & outdoor plus 2 spaces/3 staff present on the site at any one time".

In comparison, the RTA Guide rate is 15 spaces/100 sq m GFA, or 1 space/3 seats.

In terms of times of peak demand and the overlap with other uses in Shell Cove, the Friday and Saturday lunchtime periods will see some overlaps with peak parking demands for the shops and tavern, and on the weekend, the marina also. However the peak times for the restaurants are likely to be on Friday and Saturday night. Shopping centre peak parking demands are usually 11.30am-12.30pm on Fridays and Saturdays. On Friday and Saturday evenings shopping centres have much reduced levels of activity.

The initial Shell Cove parking assessments appear to be based using the GFA as the customer area, which is not correct, and using the rate of 1 space/4 sq m. While external customer areas are probably similar to GFA, the internal areas will include kitchen, toilets and maybe a servery area. In the Shell Cove layout the toilets are external but the kitchen/servery are still internal.

We have reviewed the RTA's *Land Use Traffic Generation – Data & Analysis 15 – Restaurants* report, to get some understanding of the relationship between GFA and customer area. While this document is dated (1981), it is still a useful guide for the floor areas review. Averaged over ten restaurants, the mean "Eating Area/GFA" was 71.8%. The mean peak parking demand rate was 1 space/6.66 sq m GFA, which is equivalent to 15 spaces/100 sq m GFA, which is where the rate in the Guide comes from. Note that this includes staff parking, which was included in the surveys. These surveys were for a weekend evening only. Surveys were not undertaken of lunchtimes.

In Shell Cove, while the lunchtime dining trade might be significant, on Fridays and Saturdays and maybe Sundays, the evening trade could be higher. The mean mode split by private car in the RTA evening surveys was 85% car. The daytime mode split by private car at Shell Cove could be lower than the equivalent evening mode split. This suggests that a level of parking provision for the peak

evening demand might be higher than for a lunchtime peak demand. Thus the application of the RTA rate of 15 spaces per 100 sq m GFA should provide adequate evening peak parking but might be excessive for lunchtime peak parking. In the evening, other land uses in Shell Cove such as retail and the marina will have lower parking demands. We consider that the application of the RTA peak evening rate of 15 spaces/100 sq m GFA will be conservative if applied to Shell Cove because this rate reflects evening peak demands rather than lunchtime peak demands. One advantage of using the RTA rate is that it is based on GFA, rather than customer area. In conclusion, for the planning of the parking provision for Shell Cove Boat Harbour Precinct we recommend the application of the RTA rate instead of the DCP rate. We are not aware of the quantitative basis of the DCP rate, whereas we are fully aware of the quantitative basis of the RTA rate.

The current planning for Stage 3 of Boat Harbour is for 592 sq m GFA internal plus 225 sq m external seating area, for a total of 817 sq m GFA. Application of a rate of 15 spaces/100 sq m GFA gives a demand of 123 parking spaces. This includes staff parking.

Community Uses

The DCP has rates of 1 space/40 sq m GFA for general community uses and 1 space/50 sq m GFA for Library. The RTA Guide does not cover this use. We suggest that the DCP rates be applied. On current proposed areas:

General 910 sq m @ 1/40 = 23 + Library 685 sq m @ 1/50 = 14, plus 4 staff, for a total of 41 spaces.

Tavern

For "Hotel", the DCP uses the rates for "Club", plus parking for accommodation (one per unit) and one space for any resident manager. For "Licensed Club", the DCP requires "15 spaces/100 sq m, minimum, of licensed internal floor plus outdoor areas", plus spaces for function room(s) and one space per staff member

Without detailed architectural plans of the future tavern, it is hard to assess the likely licensed floor area. Looking at the RTA's *Land Use Traffic Generation Data and Analysis 13 – Hotels* (1980), the relationship between GFA and licensed areas can be reviewed. Over nine hotels surveyed by the RTA – and these were traditional suburban hotels – the range in "Licensed Area/GFA" was 22.5% to 78.3%, with a mean of 44.5%. A modern tavern is likely to be more streamlined than a traditional suburban hotel, and more space efficient. Then again, one option is a boutique brewery tavern, with brewing equipment featured, taking space. In the absence of more information, we suggest using the restaurant mean figure of Eating Area/ GFA of 71.8%, which might be high. Applied to the proposed allocation of 955 sq m internal, this calculates to 686 sq m. Added to the proposed 280 sq m of external seating area – and assuming no external serveries or bar – this total of 966 sq m applied at the rate of 15 spaces/100 sq m yields a demand for 145 spaces. The DCP adds one space per employee, which presumably relates to the maximum number of employees present at any one time. We are not clear on staffing levels, but an allowance of 5 staff appears reasonable, taking the total tavern parking to 150 spaces.

The times of peak demand will have some overlap with the retail and restaurant uses, at lunchtime on Fridays and the weekend, but might peak in a late Summer weekend afternoon, when retail and restaurant parking demands would be lower.

Apartment Hotel

For any bars in such an hotel, the parking should be assessed as per Tavern above. For any restaurants within, the parking should be assessed as per Restaurant above. The DCP adds one space per accommodation unit plus one space for a resident manager. We suggest that the accommodation component of this hotel be assessed at the Serviced Apartment rates of:

1 space/1-2 bedroom apartment plus 1.5 spaces/3 bedroom apartment.

Residential Flat Building

For resident parking, we recommend the DCP rates of 1.0 space/one bedroom apartment plus 1.5 spaces/two + bedroom apartment.

For visitor parking, the DCP rates of 0.25 spaces/one bedroom apartment and 0.5 spaces/two + bedroom apartment are too high. Based on their research the RTA recommend in their Guide a visitor rate of 0.2 spaces/apartment, over all sizes. This research found that peak visitor parking demand was in the evening on Friday and Saturdays. At these times many of the land uses in the Boat Harbour Precinct are quiet, with the shops and marina uses at low levels of usage. Given the provision of public parking for the range of uses in the Precinct, we recommend that there be no additional visitor parking provided for any residential apartments. While there might be times when residents might entertain in a busier weekend lunchtime period, the probability is not high.

Marina

Extensive background research on marina traffic and parking issues is set out in our September 2012 report *The Traffic and Parking Implications of Marina Developments.* Extensive surveys in the Sydney area have found that boats are irregularly used, and interestingly, boats in wet marina berths are used less frequently than boats on swing moorings. For boats in wet marina berths, the recommended rates of parking provision, for Summer weekend demands, are:

- Wet berth < 20m boat length 0.166 spaces/berth
- Wet berth> 20m boat length 0.223 spaces/berth

The RTA Guide is out of date on marina uses. Chris Hallam was the primary author of the RTA's *Guide to Traffic Generating Developments.* The Guide rates of 0.6 spaces per wet berth, 0.2 spaces per dry berth and 0.5 spaces per employee were based on information available prior to the extensive surveys of marinas that we undertook.

AS3962-2001 also presents rates, these being:

- Wet berth 0.3-0.6 spaces/berth
- Dry berth 0.2-0.4 spaces /berth
- Employees 0.5 spaces/employee

The planned Boat Harbour marina is proposed to be developed in stages, with the first stage to contain 50 wet berths, including three large and two small commercial vessel berths, plus a small boat brokerage business. The staging will provide an opportunity to monitor actual parking

demands associated with the marina use, to fine-tune the additional parking required for future marina stages.

The activities whose parking demands are the hardest to estimate are the commercial vessels, which would probably include whale watching cruises, dive boats and game fishing operators. Whale watching is seasonal. One operator at Jervis Bay advertises whale watching cruises between May and November, and hence not overlapping with often busier Summer boating activities. However this operator's main whale watch boat (www.dolphinwatch.com.au – "Spirit of Jervis Bay") is a 17m long catamaran with multiple viewing points. It appears to be able to accommodate at least 40 passengers. It also has smaller vessels. A dive boat might only take 6-8 divers. This type of use might be less popular at Shell Cove compared with Jervis Bay, given the latter's more sheltered waters. A game fishing boat might take similar numbers. With the proposed staging of the marina development, an initial provision of a certain level of parking could be planned, but monitoring undertaken to determine if the expansion of the private use berths should be accompanied with a higher rate of parking provision, to make up for any deficiencies in the parking for the commercial berths.

With the boat brokerage, the overall rate of parking demand could be lower than for individual private users of berths because boats are stored there awaiting prospective buyers.

With the berths leased by individuals, we understand that they are expected to be local residents of the immediate area or in the sub-region. With the off-shore nature of the location, boats are likely to be at the larger end of the range, compared with boats on marinas on Sydney Harbour. Larger boats carry larger numbers of passengers, but parking demand also depends on the average usage. A substantial component of the use of boats on Sydney Harbour and on Pittwater is for lunchtime social cruises. Cruising off-shore or close to the shore might not hold the same attraction for all members of the family of the boat owner. This might lead to a lower overall usage rate compared with boats on Sydney Harbour.

Another type of user of the marina is likely to be transient boat/yacht owners, cruising up and down the coast, where Shell Cove might prove to be an attractive place to stop for a few days. The nature of this type of user is that they would not have associated car parking, unless they hired a car for a few days.

For Stage 1 of the marina, we suggest a minimum rate of parking provision of 5 spaces for each of the five commercial vessel berths and 0.3 spaces per berth for the balance of 45 berths, for a total of 40 parking spaces. If the commercial parking proves too much, subsequent stages need to provide less parking, and vice versa.

On-going monitoring of boat usage and parking demands can be undertaken via a number of ways. The marina manager could undertake simple counts of the boats in use by looking out on the marina at say 12noon on a Saturday and on a Sunday. Commercial vessel operators would have business records of trips made and passengers per trip. A condition of their lease of a berth could be to provide monthly summaries to the marina manager. They might also be requested to undertaken occasional surveys of the total cars parked per group, by simply asking the question when their passengers boarded the boat. An alternative might be to have reserved parking for boat users who

lease berths, but this would be less efficient in managing shared use of the total parking supply, and would not reflect the potential major parking demands associated with charter vessel operations.

Note that the office areas designated Marine Services and Marine Specialty, totalling 301 sq m will manage the marina. Their parking needs to be added, at the office rate of one space per 40 sq m, so an additional 8 spaces.

For the ultimate marina development with 300 berths, the Stage 1 development with 50 berths has a recommended parking allocation of 40 spaces. For the balance of 250 private berths, we recommend the application of the recommended rate of 0.166 spaces per berth, so this will add a demand for 42 spaces. Adding 8 spaces for office staff, the total marina parking demand will be 90 spaces.

3.3 Peak Parking Demand

Not all of the land uses will have their peak parking demands at the same time. We have reviewed research on time of day demands and have obtained information on expected tavern trading patterns for the proposed tavern. We have assumed that the restaurants have the same trading patterns as the tavern. Table 3.1 sets out the expected peak parking demands and the distribution at key times.

Table 3.1 Peak Parking Demand Distribution

Land Use	Peak Parking	Friday 12.00pm	Friday 7.00pm	Saturday 12.00pm	Saturday 7.00pm	Sunday 12.00pm
Shops	218	(100%) 218	(10%) 22	(100%) 218	(10%) 22	(70%) 153
Tavern	150	(60%) 90	(100%) 150	(90%) 135	(100%) 150	(70%) 105
Restaurants	123	(60%) 74	(100%) 123	(90%) 110	(100%) 123	(70%) 86
Community	41	(100%) 41	(20%) 8	(70%) 29	(0%) 0	(20%) 8
Marina	90	(50%) 45	(0%) 0	(100%) 90	(0%) 0	(100%) 90
Total	622	468	303	582	295	442

The figures in Table 3.1 indicate that the desired parking supply to cater for the peak parking demand will be approximately 580 spaces.

4.0 CONCLUSIONS

1. A concept plan for the Shell Cove Boat Harbour Precinct has been prepared, including plans for the road network, with work undertaken by Maunsell in their *Shell Cove Boatharbour Precinct Traffic Study.* We have reviewed this study and the underlying assumptions and agree with its conclusions. In doing so, we have undertaken our own traffic generation assessment and compared the figures with those assumed in the Maunsell study. Our traffic generation figures are lower than those prepared by Maunsell, and hence the road network they recommended will provide adequate capacity for the future traffic flows.
2. In reviewing the future traffic generation of the current concept plan for the Precinct, we have prepared up to date traffic flow projections that have enabled a re-assessment of the capacity of intersections on Harbour Boulevarde in the vicinity of Boat Harbour Precinct. This re-assessment has indicated that the major intersections will provide adequate capacity. Roundabouts have been assumed at the junctions with Cove Boulevarde and Road A, while priority control has been assumed at the intersection with Road C.
3. The observation has been made that a roundabout at the junction of Harbour Boulevarde and Cove Boulevarde will provide ample road capacity, but would not be as safe for pedestrians as traffic signals. For this reason we have suggested that any intersection design allow the possible future installation of traffic signals, for pedestrian safety considerations.
4. The installation of a Shared Zone at the eastern end of Cove Boulevarde is supported, with projected peak hour flows of less than 100 vehicles per hour.
5. The car parking needs of the full development of the Precinct have been reviewed and parking rates recommended. The total quantum of parking for the ultimate full development has been recommended, taking into account the relative times of peak parking demands of different land use components.

APPENDIX SIDRA MODELLING RESULTS

MOVEMENT SUMMARY

Site: Harbour BVD & Cove BVD - roundabout

Future AM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Harbour Bvd South											
1	L2	200	5.0	0.214	6.2	LOS A	1.3	9.3	0.53	0.62	53.0
2	T1	474	5.0	0.384	5.8	LOS A	2.8	20.7	0.57	0.57	53.6
3	R2	7	5.0	0.384	10.0	LOS A	2.8	20.7	0.57	0.57	53.4
Approach		681	5.0	0.384	5.9	LOS A	2.8	20.7	0.56	0.59	53.5
East: Cove Bvd East											
4	L2	9	5.0	0.157	10.6	LOS A	1.1	7.7	0.87	0.83	50.0
5	T1	67	5.0	0.157	10.8	LOS A	1.1	7.7	0.87	0.83	51.1
6	R2	5	5.0	0.157	15.1	LOS B	1.1	7.7	0.87	0.83	50.9
Approach		82	5.0	0.157	11.1	LOS A	1.1	7.7	0.87	0.83	50.9
North: Harbour Bvd North											
7	L2	28	5.0	0.719	9.6	LOS A	9.2	66.9	0.89	0.88	50.0
8	T1	474	5.0	0.719	9.9	LOS A	9.2	66.9	0.89	0.88	51.1
9	R2	200	5.0	0.719	14.2	LOS A	9.2	66.9	0.89	0.88	50.9
Approach		702	5.0	0.719	11.1	LOS A	9.2	66.9	0.89	0.88	51.0
West: Cove Bvd West											
10	L2	200	5.0	0.626	10.4	LOS A	6.3	46.1	0.86	0.95	49.3
11	T1	129	5.0	0.626	10.7	LOS A	6.3	46.1	0.86	0.95	50.3
12	R2	200	5.0	0.626	14.9	LOS B	6.3	46.1	0.86	0.95	50.2
Approach		529	5.0	0.626	12.2	LOS A	6.3	46.1	0.86	0.95	49.9
All Vehicles		1995	5.0	0.719	9.6	LOS A	9.2	66.9	0.77	0.80	51.5

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Harbour BVD & Cove BVD - roundabout

Future PM
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Harbour Bvd South											
1	L2	168	5.0	0.195	6.7	LOS A	1.1	7.9	0.54	0.65	52.9
2	T1	474	5.0	0.395	6.1	LOS A	2.8	20.5	0.59	0.61	53.5
3	R2	6	5.0	0.395	10.4	LOS A	2.8	20.5	0.59	0.61	53.3
Approach		648	5.0	0.395	6.3	LOS A	2.8	20.5	0.58	0.62	53.4
East: Cove Bvd East											
4	L2	5	5.0	0.293	10.4	LOS A	2.0	14.8	0.88	0.88	49.8
5	T1	129	5.0	0.293	10.6	LOS A	2.0	14.8	0.88	0.88	50.9
6	R2	31	5.0	0.293	14.9	LOS B	2.0	14.8	0.88	0.88	50.7
Approach		165	5.0	0.293	11.4	LOS A	2.0	14.8	0.88	0.88	50.8
North: Harbour Bvd North											
7	L2	31	5.0	0.683	8.6	LOS A	8.0	58.1	0.85	0.82	50.7
8	T1	484	5.0	0.683	8.8	LOS A	8.0	58.1	0.85	0.82	51.8
9	R2	168	5.0	0.683	13.1	LOS A	8.0	58.1	0.85	0.82	51.6
Approach		683	5.0	0.683	9.9	LOS A	8.0	58.1	0.85	0.82	51.7
West: Cove Bvd West											
10	L2	168	5.0	0.578	9.9	LOS A	5.3	38.9	0.84	0.92	49.7
11	T1	141	5.0	0.578	10.2	LOS A	5.3	38.9	0.84	0.92	50.8
12	R2	168	5.0	0.578	14.4	LOS A	5.3	38.9	0.84	0.92	50.6
Approach		478	5.0	0.578	11.6	LOS A	5.3	38.9	0.84	0.92	50.3
All Vehicles		1975	5.0	0.683	9.2	LOS A	8.0	58.1	0.76	0.78	51.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Harbour Bvd/Road A - 1 lane roundabout

Future AM
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Harbour Bvd South											
2	T1	674	5.0	0.441	4.4	LOS A	4.0	29.1	0.11	0.42	55.6
3	R2	45	5.0	0.441	8.7	LOS A	4.0	29.1	0.11	0.42	55.4
Approach		719	5.0	0.441	4.7	LOS A	4.0	29.1	0.11	0.42	55.6
East: Road A East											
4	L2	8	5.0	0.025	7.9	LOS A	0.1	1.0	0.65	0.67	50.5
6	R2	11	5.0	0.025	12.5	LOS A	0.1	1.0	0.65	0.67	51.4
Approach		19	5.0	0.025	10.5	LOS A	0.1	1.0	0.65	0.67	51.0
North: Harbour Bvd North											
7	L2	41	5.0	0.481	4.4	LOS A	3.7	27.4	0.24	0.42	54.0
8	T1	674	5.0	0.481	4.7	LOS A	3.7	27.4	0.24	0.42	55.2
Approach		715	5.0	0.481	4.6	LOS A	3.7	27.4	0.24	0.42	55.1
All Vehicles		1453	5.0	0.481	4.7	LOS A	4.0	29.1	0.18	0.42	55.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Harbour Bvd/Road A - 1 lane roundabout

Future PM
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Harbour Bvd South											
2	T1	642	5.0	0.494	4.8	LOS A	4.5	33.1	0.35	0.45	54.5
3	R2	53	5.0	0.494	9.1	LOS A	4.5	33.1	0.35	0.45	54.3
Approach		695	5.0	0.494	5.1	LOS A	4.5	33.1	0.35	0.45	54.5
East: Road A East											
4	L2	55	5.0	0.159	8.2	LOS A	0.9	6.7	0.69	0.77	50.3
6	R2	66	5.0	0.159	12.8	LOS A	0.9	6.7	0.69	0.77	51.2
Approach		121	5.0	0.159	10.7	LOS A	0.9	6.7	0.69	0.77	50.8
North: Harbour Bvd North											
7	L2	58	5.0	0.488	4.5	LOS A	4.1	30.0	0.28	0.43	53.8
8	T1	653	5.0	0.488	4.7	LOS A	4.1	30.0	0.28	0.43	55.0
Approach		711	5.0	0.488	4.7	LOS A	4.1	30.0	0.28	0.43	54.9
All Vehicles		1526	5.0	0.494	5.4	LOS A	4.5	33.1	0.34	0.47	54.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: Harbour Bld & Road C - priority

Future AM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Harbour Bvd South											
2	T1	674	5.0	0.178	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
3	R2	8	5.0	0.013	9.4	LOS A	0.0	0.3	0.56	0.69	50.4
Approach		682	5.0	0.178	0.1	NA	0.0	0.3	0.01	0.01	59.8
East: Road C East											
4	L2	20	5.0	0.281	31.3	LOS C	0.9	6.7	0.79	0.89	38.8
6	R2	23	5.0	0.281	31.3	LOS C	0.9	6.7	0.79	0.89	38.7
Approach		43	5.0	0.281	31.3	LOS C	0.9	6.7	0.79	0.89	38.7
North: Harbour Bvd North											
7	L2	12	5.0	0.182	5.6	LOS A	0.0	0.0	0.00	0.02	57.9
8	T1	674	5.0	0.182	0.0	LOS A	0.0	0.0	0.00	0.01	59.9
Approach		685	5.0	0.182	0.1	NA	0.0	0.0	0.00	0.01	59.8
All Vehicles		1411	5.0	0.281	1.1	NA	0.9	6.7	0.03	0.04	58.8

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: Harbour Bld & Road C - priority

Future PM
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Harbour Bvd South											
2	T1	642	5.0	0.170	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
3	R2	17	5.0	0.026	9.3	LOS A	0.1	0.7	0.56	0.72	50.4
Approach		659	5.0	0.170	0.3	NA	0.1	0.7	0.01	0.02	59.7
East: Road C East											
4	L2	7	5.0	0.094	25.2	LOS B	0.3	2.0	0.75	0.81	41.5
6	R2	8	5.0	0.094	25.2	LOS B	0.3	2.0	0.75	0.81	41.4
Approach		16	5.0	0.094	25.2	LOS B	0.3	2.0	0.75	0.81	41.4
North: Harbour Bvd North											
7	L2	17	5.0	0.177	5.6	LOS A	0.0	0.0	0.00	0.03	57.8
8	T1	653	5.0	0.177	0.0	LOS A	0.0	0.0	0.00	0.01	59.8
Approach		669	5.0	0.177	0.2	NA	0.0	0.0	0.00	0.01	59.8
All Vehicles		1344	5.0	0.177	0.5	NA	0.3	2.0	0.02	0.03	59.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.