TTM Consulting (GC) Pty Ltd
Suite 1, 72 Davenport Street
Southport Qld 4215
PO Box 352 Southport BC QLD 4215

t (07) 5591 9177
f (07) 5591 9188
e ttmgoldcoast@ttmgroup.com.au
ABN 39 093 345 156

Proposed Residential Subdivision
Angels Beach North

Traffic Engineering Assessment

Prepared for

North Angels Beach (Development) Pty Ltd

22 July 2004
ttmref: 30208rep

TABLE OF CONTENTS

1. Introduction

TTM have been engaged by North Angels Beach (Development) Pty Ltd to conduct a traffic engineering assessment of their proposal to develop a residential estate at North Angels Beach, Ballina.

This report forms part of a Development Application to be lodged with the Ballina Shire Council. The following issues have been assessed during the study:

- *the potential impact of development traffic upon surrounding roads and intersections;*
- *access design and capacity;*
- *road network design; and*
- *provision for cyclists and pedestrians;;*

This report is an amended version of the one prepared as part of the Angels Beach North – Master Plan July 2004.

2. Proposed Development Plan

The proposed plan of subdivision (see Figure 2.2) provides a total yield of 60 detached house allotments, 1 duplex allotment and two community titles sites having capacity for approximately 45 townhouse style dwellings.

It is proposed that vehicular access to the proposed development be gained via a new road connection to the Angels Beach Drive / Coast Road intersection. It is proposed that a roundabout be constructed at this intersection.

The proposed internal road network is fully connective and maximises the opportunity for active frontages to open space areas.

The main road through the site (with a 22.0 metre reserve) will link Angels Beach Drive to future development to the north. Other roads within the estate will have a reserve width of 16.0 metres. It is proposed that a single lane roadway provide access to a small number of allotments that front the park proposed to be located adjacent to the western boundary of the site.

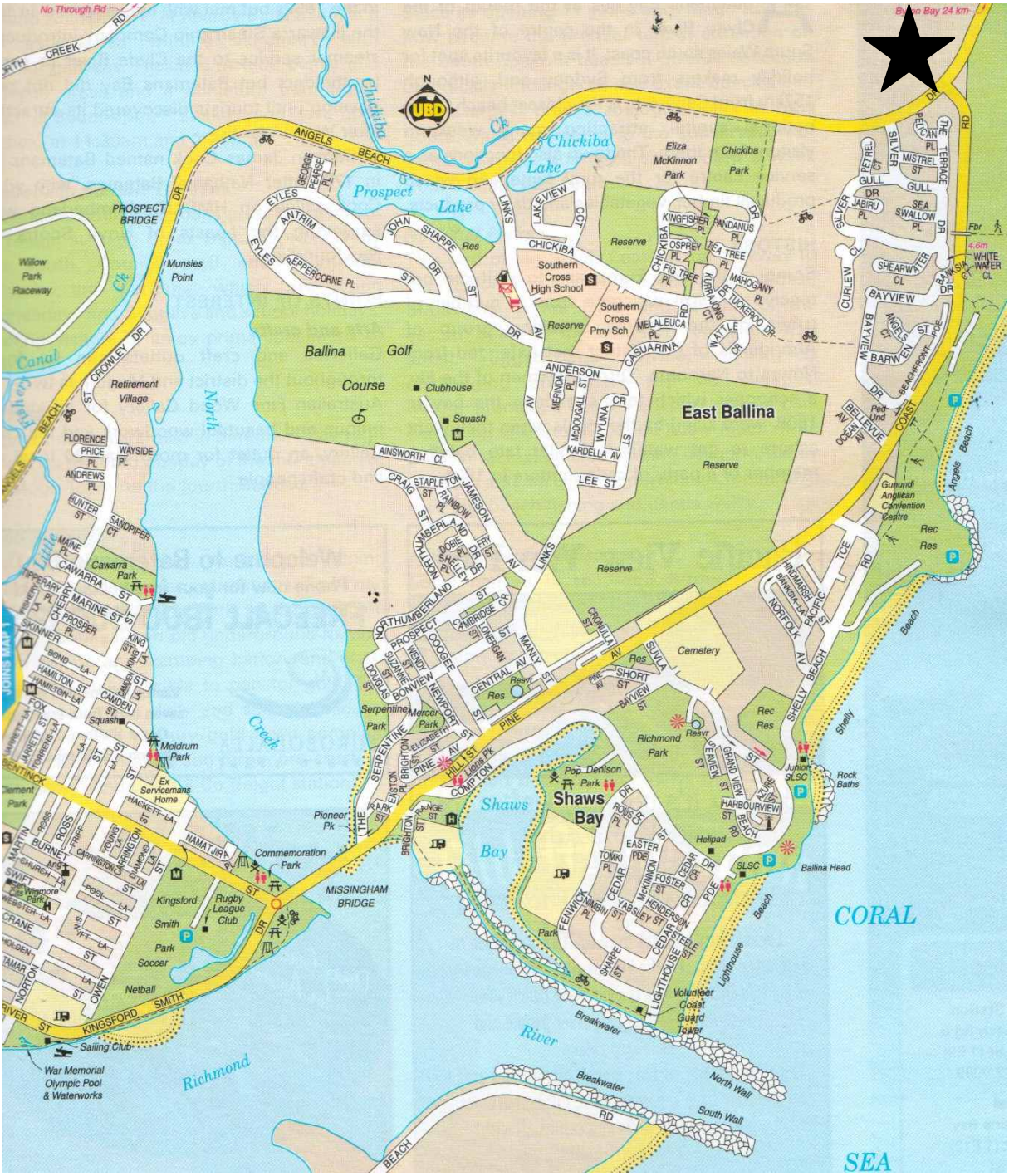


Figure 2.1 – Location of Subject Site

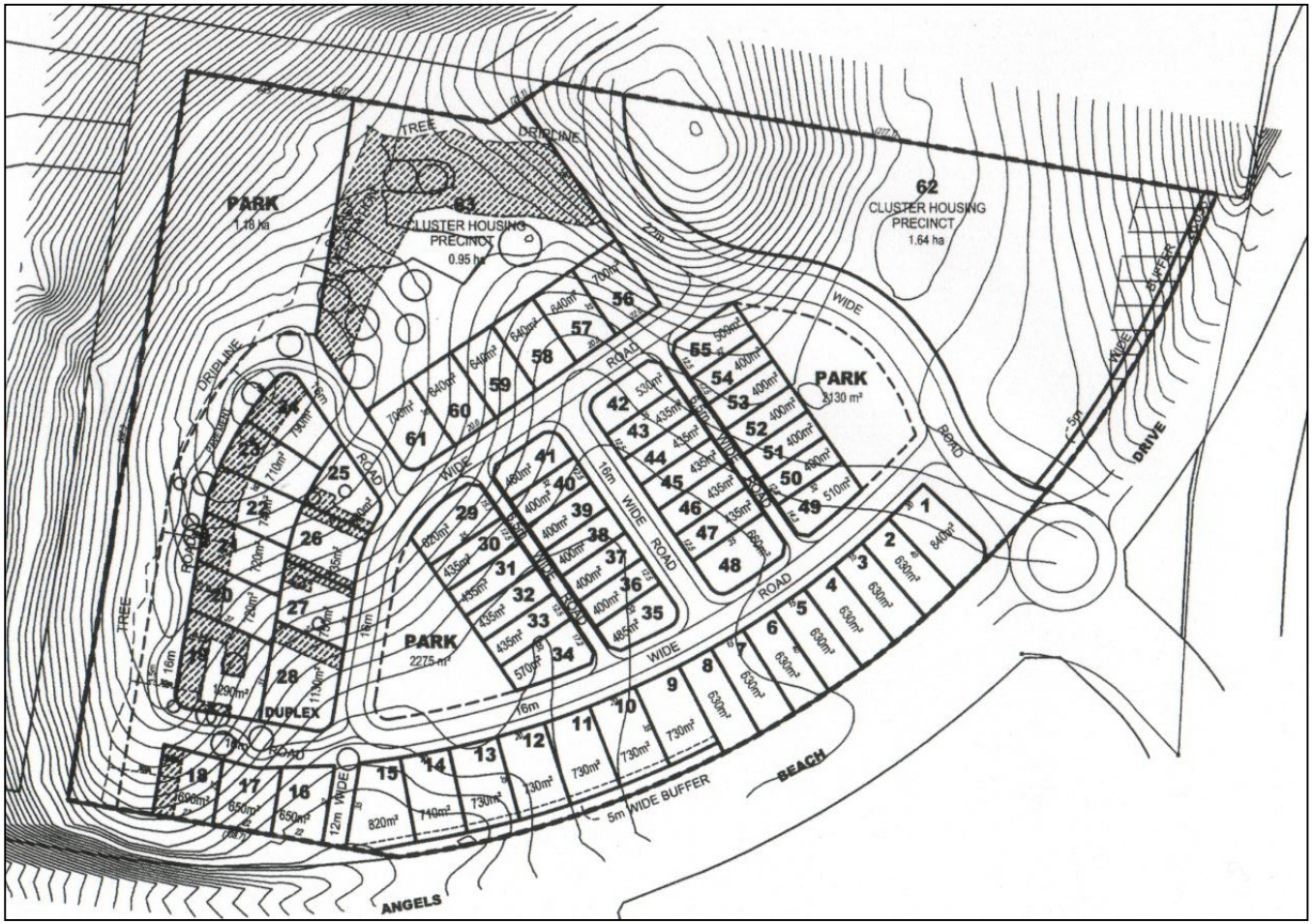


Figure 2.2 – Proposed Development Plan

3. Local Traffic Environment

3.1 Existing Road & Traffic Conditions

Angels Beach Drive forms the southern boundary of the subject site. It is a two lane road and functions as a sub-arterial road within the surrounding road hierarchy, providing for travel between Byron Bay / Lennox Head and Ballina. The speed limit of the road changes from 80 Km / Hr to 100 Km / Hr just north of the Coast Road intersection.

As shown in Figure 3.1.1, the Angels Beach Drive / Coast Road intersection consists of a priority 'T' junction with Angels Beach Drive being the major road. Auxiliary left and right turning lanes are provided in the northern and western approaches.

TTM conducted a traffic count at the Angels Beach Drive / Coast Road intersection on Wednesday, 19 February 2003. The results of this survey are shown in Table 3.1. The traffic counts indicate that Angels Beach Drive is currently carrying in the order of 10,100 and 11,400 vehicles per day to the west and north of Coast Road, respectively.

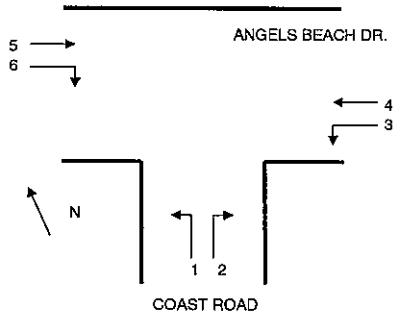
Surveyed morning and afternoon peak hour traffic movements are summarised in Figures 3.1.2 and 3.1.3, respectively.

Angels Beach Drive / Coast Road (Viewing from the North)

Figure 3.1.1

TRAFFIC ENGINEERING

Manual Intersection Count



Client:
Survey Location: Angels Beach Road / Coast Road, East Ballina
Survey Date: Wednesday, 19 February 2003
Survey Period: 7:00am - 6:00pm
Weather: Fine

TIME	INTERSECTION MOVEMENT NUMBER						TOTAL	CUMUL.	PEDESTRIANS		
	1	2	3	4	5	6		HOUR	A	B	C
7:00-7:15am	0	3	1	34	40	2	80	-			
7:15-7:30am	6	6	4	54	52	3	125	-			
7:30-7:45am	8	13	10	86	60	7	184	-			
7:45-8:00am	8	5	17	86	63	4	183	572			
8:00-8:15am	10	27	28	150	64	7	286	778			
8:15-8:30am	5	22	31	200	69	7	334	987			
8:30-8:45am	12	25	26	146	95	5	309	1112			
8:45-9:00am	7	13	40	177	54	5	296	1225			
9:00-9:15am	4	24	26	124	68	4	250	1189			
9:15-9:30am	12	27	26	120	72	8	265	1120			
9:30-9:45am	11	17	14	78	44	6	170	981			
9:45-10:00am	7	13	16	88	50	4	178	863			
10:00-10:15am	4	25	25	100	57	2	213	826			
10:15-10:30am	11	18	14	83	50	10	186	747			
10:30-10:45am	4	18	18	75	58	6	179	756			
10:45-11:00am	5	20	15	90	73	5	208	786			
11:00-11:15am	12	15	17	64	61	8	177	750			
11:15-11:30am	5	14	17	93	60	7	196	760			
11:30-11:45am	4	12	16	101	63	11	207	788			
11:45-12:00pm	6	11	15	80	68	7	187	767			
12:00-12:15pm	3	9	11	79	55	5	162	752			
12:15-12:30pm	4	10	10	84	67	7	182	738			
12:30-12:45pm	3	11	7	71	58	6	156	687			
12:45-1:00pm	4	12	8	67	55	4	150	650			
1:00-1:15pm	3	12	8	72	60	2	157	713			
1:15-1:30pm	2	19	13	69	63	2	168	674			
1:30-1:45pm	9	21	13	60	57	1	161	648			
1:45-2:00pm	7	32	15	78	75	7	214	700			
2:00-2:15pm	8	25	11	79	75	3	201	744			
2:15-2:30pm	4	27	13	65	78	4	191	767			
2:30-2:45pm	11	20	17	56	63	4	171	777			
2:45-3:00pm	4	30	16	94	79	6	229	792			
3:00-3:15pm	2	18	9	77	63	9	178	769			
3:15-3:30pm	4	26	22	101	76	7	236	814			
3:30-3:45pm	1	26	17	61	89	7	201	844			
3:45-4:00pm	2	30	10	91	114	5	252	867			
4:00-4:15pm	2	23	12	99	167	12	315	1004			
4:15-4:30pm	3	24	16	94	154	14	305	1073			
4:30-4:45pm	4	18	13	100	174	12	321	1193			
4:45-5:00pm	6	26	1	89	155	10	287	1228			
5:00-5:15pm	7	28	12	90	173	5	315	1228			
5:15-5:30pm	12	31	22	68	174	6	313	1236			
5:30-5:45pm	5	30	23	81	151	11	301	1216			
5:45-6:00pm	9	18	20	73	111	11	242	1171			
PERIOD TOTAL	**260**	**854**	**695**	**3927**	**3607**	**278**	**9621**	-	**0**	**0**	**0**
AM Peak Hour	**34**	**87**	**125**	**673**	**282**	**24**	**1225**	-	**0**	**0**	**0**
PM Peak Hour	**29**	**103**	**48**	**347**	**676**	**33**	**1236**	-	**0**	**0**	**0**

Table 3.1

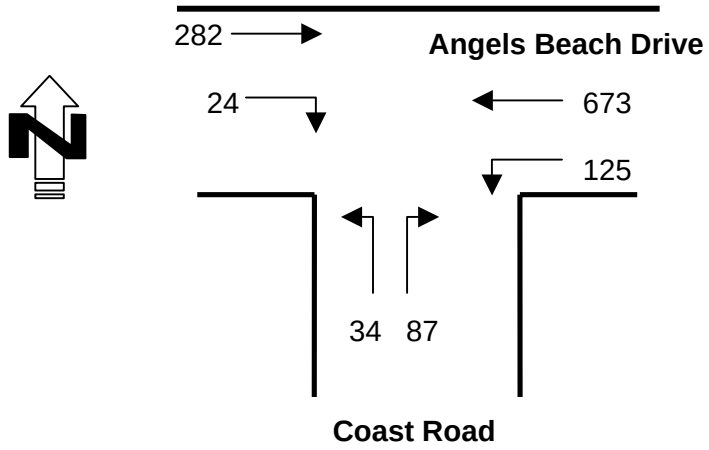


Figure 3.1.2 – Surveyed Morning Peak Hour Traffic Movements
Angels Beach Drive / Coast Road
Wednesday, 19 February 2003

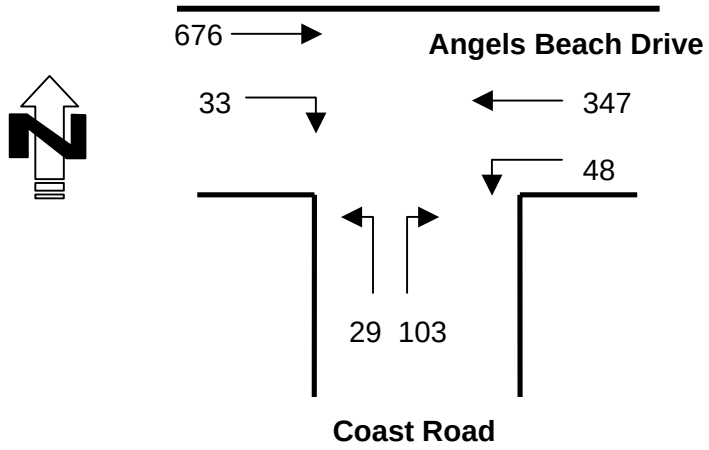


Figure 3.1.3 – Surveyed Afternoon Peak Hour Traffic Movements
Angels Beach Drive / Coast Road
Wednesday, 19 February 2003

Capacity analysis undertaken in accordance with Austroads guidelines indicates that the Angels Beach Drive / Coast Road intersection is currently 22% and 25% saturated during the morning and afternoon peak hours, respectively. A summary of this analysis is provided as Appendix A1.

3.2 Estimated Future Traffic Conditions

Traffic growth in the surrounding area is likely to be relatively high during the next ten years with considerable development potential in the East Ballina and Lennox Head area. A traffic growth rate of 3% per annum has been adopted in order to estimate future (2013) traffic volumes. It is noted that traffic forecasting undertaken for the Ballina Road Network Study indicates that there will be negligible traffic growth along Angels Beach Drive over the next ten years. Subsequently, a 3% growth rate is considered to be conservative (high).

Resultant estimates of year 2013 peak hour volumes are shown in Figures 3.2.1 and 3.2.2.

Capacity analysis indicates that the existing Angels Beach Drive / Coast Road intersection will be approximately 40% and 50% saturated during the year 2013 morning and afternoon peak hours, respectively. A summary of this analysis is provided as Appendix A2.

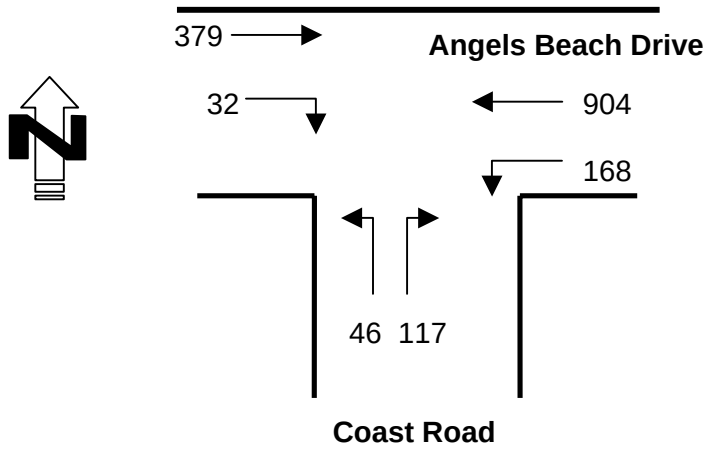


Figure 3.2.1 –Estimated Future (2013) AM Peak Hr Traffic Movements Angels Beach Drive / Coast Road

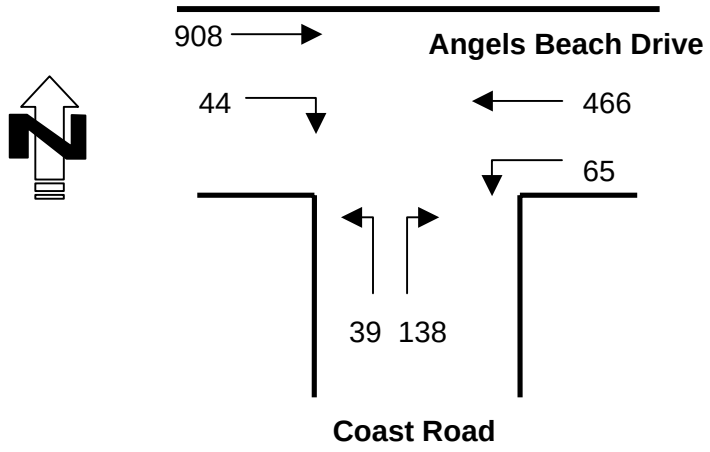


Figure 3.2.2 – Estimated Future (2013) PM Peak Hr Traffic Movements Angels Beach Drive / Coast Road

4. Development Traffic Estimates

4.1 Traffic Generation

It is estimated that the proposed development will generate traffic at the following rates:

Dwelling Type	***Daily***	***Peak Hour***
Detached houses -	*9.0 trips / dwelling*	*0.85 trips / dwelling*
Duplex / Townhouses -	*6.5 trips / dwelling*	*0.5 trips / dwelling*

Application of the above rates to the proposed development plan results in the following estimates of daily and peak hour traffic generation.

Table 4.1 – Estimated Daily & Peak Hour Directional Splits

Daily Traffic (vpd)			*Morning Peak Hour (vph)*			*Afternoon peak Hour (vph)*		
In	*Out*	*Total*	*In*	*Out*	*Total*	*In*	*Out*	*Total*
416	*416*	*832*	*20*	*80*	*100*	*60*	*40*	*100*

Note: Assumes residential traffic directional split of 80% out / 20% in during the morning peak and 40% out / 60% in during the afternoon peak.

4.2 Traffic Distribution

It is estimated that approximately 60% - 70% of proposed development traffic will travel west towards the Ballina town centre. Furthermore, it is estimated that 60% of westbound traffic will turn right and use Angels Beach Drive, the balance will use the Coast Road / Pine Avenue route.

Resultant estimates of peak hour development traffic movements at the Angels Beach Drive / Coast Road intersection are shown in Figures 4.2.1 and 4.2.2.

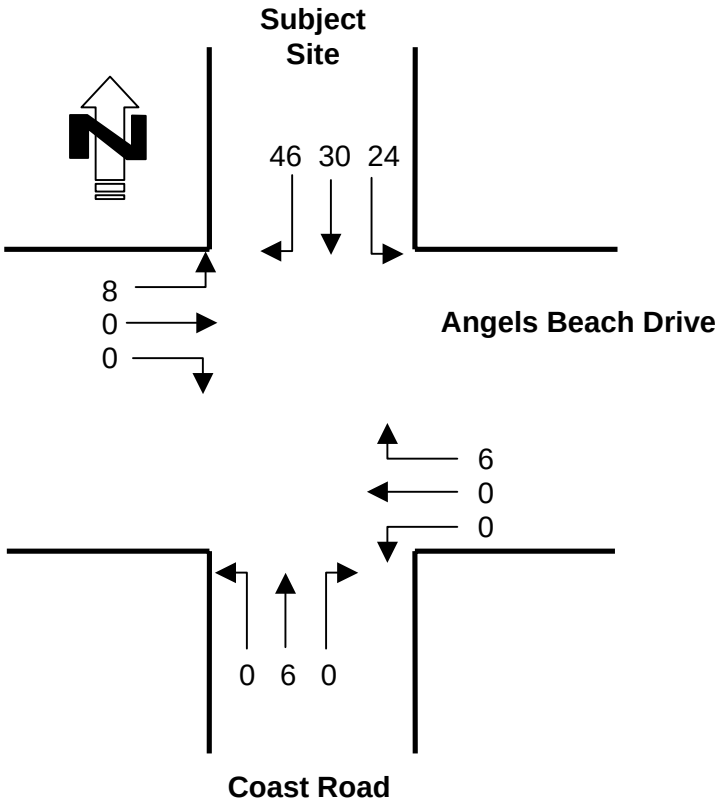


Figure 4.2.1 – Estimated Morning Peak Hour Development Traffic
Angels Beach Drive / Coast Road Intersection

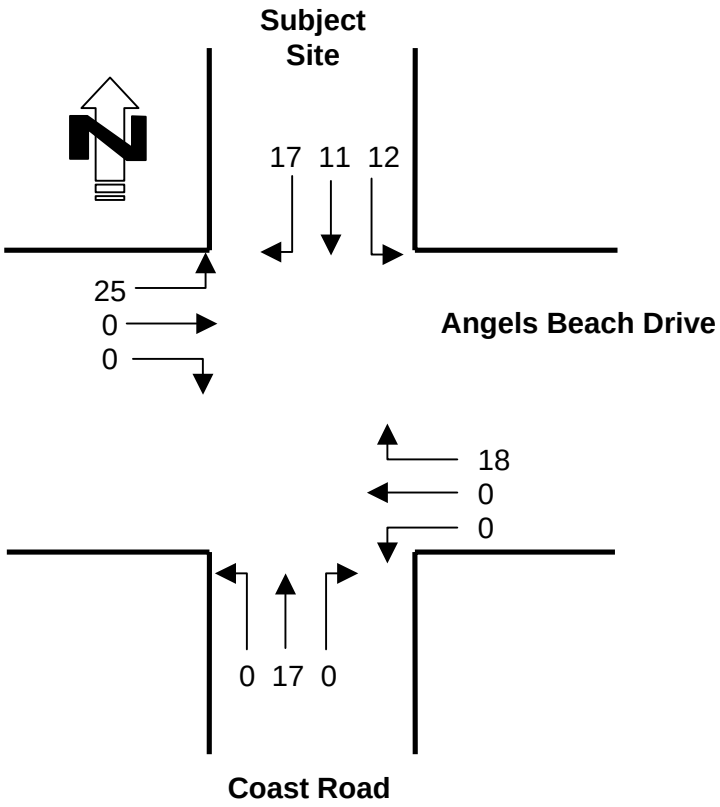


Figure 4.2.2 – Estimated Afternoon Peak Hour Development Traffic
Angels Beach Drive / Coast Road Intersection

5. Traffic Impact

As discussed previously, the Applicant proposes to construct a roundabout at the Angels Beach Drive / Coast Road intersection. A roundabout is considered desirable (regardless of the proposed development) as it would address current safety issues at the intersection caused by the topography of Angels Beach Drive and the relatively high travel speeds (80 – 100 Km / Hr). It would also accommodate medium – long term traffic growth expected along the route and future development on the property located directly to the north of the subject site. It is expected that traffic generated by future development on that property will access the external road network through the subject site.

It estimated that the potential lot yield of the adjacent property is similar to the subject site. For the purposes of this assessment, it has been assumed that the adjacent rural property to the north, if it is ever rezoned, will ultimately have a similar traffic generation to the proposed development.

The performance of the proposed roundabout at the Angels Beach Drive / Coast Road intersection has been assessed using aaSIDRA 2.0. Design peak hour traffic volumes are shown in Figures 5.1.1 and 5.1.2. The modelled roundabout configuration consists of two circulating lanes, a 25 metre diameter central island and two entry lanes in each approach (the left lane being a short lane of 50m length).

A summary of this analysis (for the 2013 peak hour with development traffic) is provided in Table 5.1. As shown, the analysis indicates that the proposed roundabout will operate satisfactorily beyond year 2013 traffic conditions.

aaSIDRA output is provided as Appendix B.

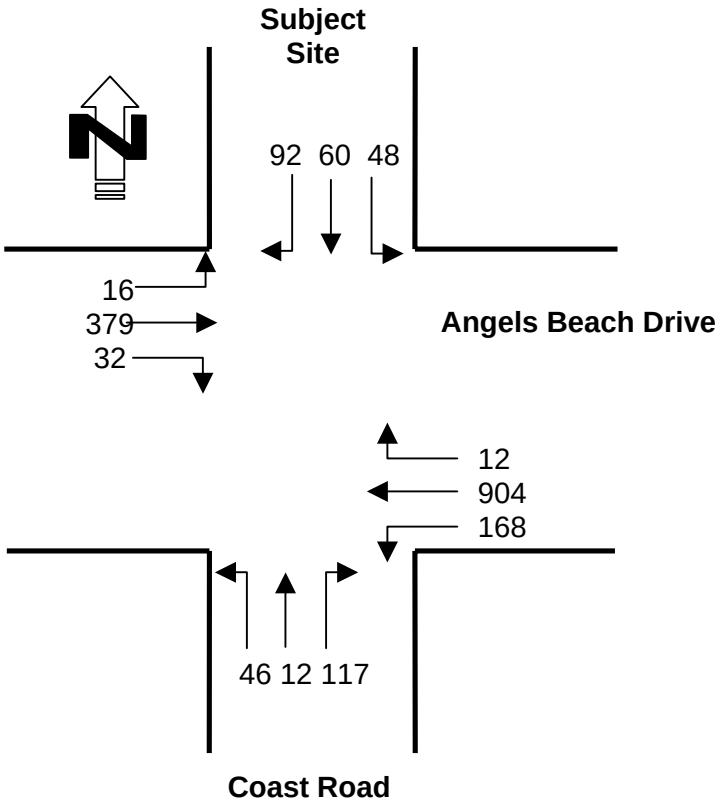


Figure 5.1.1 – Design Morning Peak Hour Traffic Volumes
(2013 Background + Prop Dev + Future Dev to North)
Angels Beach Drive / Coast Road Intersection

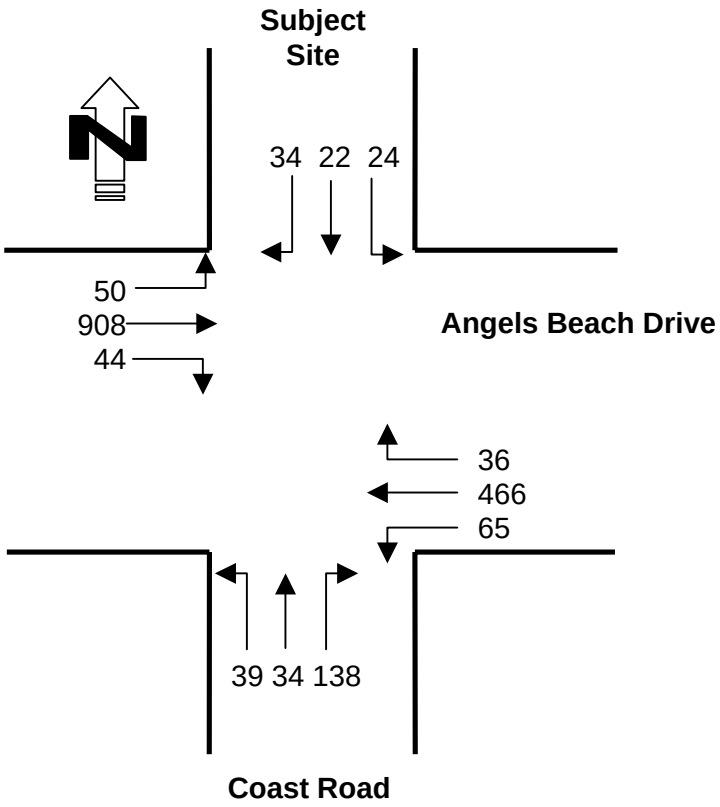


Figure 5.1.2 – Design Afternoon Peak Hour Traffic Volumes
(2013 Background + Prop Dev + Future Dev to North)
Angels Beach Drive / Coast Road Intersection

Table 5.1 – Estimated Performance of Angels Beach Drive / Coast Road aaSIDRA Analysis

Scenario / Movement	***Performance Parameter***	
	Degree of Saturation (%)	***95th%ile Queue (m)***
2013 AM Peak (With Dev)	*39.5*	*18*
Northern leg – left	*10.5*	*4*
Northern leg – through	*10.5*	*4*
Northern leg – right	*10.5*	*4*
Eastern leg – left	*39.5*	*17*
Eastern leg – through	*39.5*	*18*
Eastern leg – right	*39.4*	*18*
Southern leg – left	*9.6*	*1.52*
Southern leg – through	*9.6*	*1.35*
Southern leg – right	*14.7*	*1.66*
Western leg – left	*17.0*	*6*
Western leg – through	*17.0*	*6*
Western leg – right	*17.0*	*6*
2013 PM Peak (With Dev)	*38.0*	*17*
Northern leg – left	*6.0*	*2*
Northern leg – through	*6.0*	*2*
Northern leg – right	*6.0*	*2*
Eastern leg – left	*19.7*	*7*
Eastern leg – through	*19.7*	*8*
Eastern leg – right	*19.7*	*8*
Southern leg – left	*9.2*	*3*
Southern leg – through	*9.1*	*3*
Southern leg – right	*13.6*	*5*
Western leg – left	*37.9*	*17*
Western leg – through	*37.9*	*17*
Western leg – right	*38.0*	*17*

6. Summary of Conclusions & Recommendations

The proposed development plan contains a total yield of 60 detached housing allotments, one duplex allotment and approximately 45 townhouse style dwellings. Access to the estate is proposed to gained via the Angels Beach Drive / Coast Road intersection where a roundabout is proposed to be constructed.

It is estimated that the proposed development will generate in the order of 832 vehicle movements per day and that 70% of this traffic will travel westbound via either the Coast Road or Angels Beach Drive routes.

aaSIDRA analysis indicates that the proposed roundabout will perform satisfactorily under a ten year design horizon. This analysis considers the potential link between the subject site and future potential development on the property immediately to the north.

APPENDIX A

Capacity Analysis

a) Angels Beach Drive / Coast Road (Existing 2003 AM Peak)
b) Angels Beach Drive / Coast Road (Existing 2003 PM Peak)

Angels Beach Drive / Coast Road Intersection Performance (2003 - Without Development)

Parameter	Morning Peak Hour		Afternoon Peak Hour	
	Right turn from Coast Road	Right turn from Angels Beach Drive	Right turn from Coast Road	Right turn from Angels Beach Drive
Critical Acceptance Gap (secs) =	6	4	6	4
Follow-up Headway (secs) =	4	2	4	2
Minor Stream (vph) =	87	24	103	33
Minor Stream flow Rate (vps) =	0.02	0.01	0.03	0.01
Major Stream (vph) =	1091	798	1080	395
Major Stream Flow Rate (vps)	0.30	0.22	0.30	0.11
Absorption Capacity (C) =	252	918	255	1293
Practical Absorption Capacity (vph) =	202	735	204	1034
Utilisation Ratio (u) =	0.35	0.03	0.40	0.03
Average Delay (secs) =	17.69	2.53	19.24	1.07
95th%ile Queue length (no. veh) =	3	< 1	3	< 1

Angels Beach Drive / Coast Road Intersection Performance (2013 - Without Development)

Parameter	Morning Peak Hour		Afternoon Peak Hour	
	Right turn from Coast Road	Right turn from Angels Beach Drive	Right turn from Coast Road	Right turn from Angels Beach Drive
Critical Acceptance Gap (secs) =	6	4	6	4
Follow-up Headway (secs) =	4	2	4	2
Minor Stream (vph) =	117	32	138	44
Minor Stream flow Rate (vps) =	0.03	0.01	0.04	0.01
Major Stream (vph) =	1399	1072	1450	531
Major Stream Flow Rate (vps)	0.39	0.30	0.40	0.15
Absorption Capacity (C) =	172	726	162	1152
Practical Absorption Capacity (vph) =	138	581	129	922
Utilisation Ratio (u) =	0.68	0.04	0.85	0.04
Average Delay (secs) =	59.01	3.90	140.94	1.55
95th%ile Queue length (no. veh) =	9	< 1	>9	< 1

APPENDIX B

aaSIDRA 2.0 Analysis

a) Angels Beach Drive / Coast Road (2013 AM Peak / With Dev Traffic)
b) Angels Beach Drive / Coast Road (2013 PM Peak / With Dev Traffic)

Intersection Summary

akcelik & associates
aaTraffic SIDRA

Angels Beach Drive / Coast Road

Performance Measure	Vehicles	Persons
Demand Flow	1988 veh/h	2982 pers/h
Degree of Saturation	0.395	
Capacity (Total)	9021 veh/h	
95% Back of Queue (m)	18 m	
95% Back of Queue (veh)	2.4 veh	
Control Delay (Total)	3.60 veh-h/h	5.39 pers-h/h
Control Delay (Average)	6.5 s/veh	6.5 s/pers
Level of Service	LOS A	
Level of Service (Worst Movement)	LOS B	
Total Effective Stops	1999 veh/h	2998 pers/h
Effective Stop Rate	1.01 per veh	1.01 per pers
Travel Distance (Total)	1215.8 veh-km/h	1823.8 pers-km/h
Travel Distance (Average)	612 m	612 m
Travel Time (Total)	24.8 veh-h/h	37.2 pers-h/h
Travel Time (Average)	44.9 secs	44.9 secs
Travel Speed	49.0 km/h	49.0 km/h
Operating Cost (Total)	665 $/h	665 $/h
Fuel Consumption (Total)	134.8 L/h	
Carbon Dioxide (Total)	337.5 kg/h	
Hydrocarbons (Total)	0.528 kg/h	
Carbon Monoxide (Total)	26.89 kg/h	
NOX (Total)	0.920 kg/h	

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2013 AM Peak Hour
With Proposed Development

Movement Summary

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aaTraffic SIDRA

Angels Beach Drive / Coast Road

Roundabout

Vehicle Movements

Mov No	Turn	Dem Flow (veh/h)	Cap (veh/h)	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Eff. Stop Rate	Aver Speed (km/h)	Oper Cost ($/h)
Coast Road										
1	L	48	498	0.096	10.5	LOS B	3	1.52	46.7	17
2	T	13	135	0.096	7.4	LOS A	3	1.35	48.7	4
3	R	123	839	0.147	15.6	LOS B	5	1.66	42.9	48
Approach		**184**	**1472**	**0.147**	**13.7**	**LOS B**	**5**	**1.60**	**44.1**	**69**
Angels Beach Drive (East)										
4	L	177	448	0.395	6.9	LOS A	17	1.07	49.3	55
5	T	952	2411	0.395	5.0	LOS A	18	0.88	51.2	293
6	R	13	33	0.394	11.6	LOS B	18	1.34	44.0	4
Approach		**1142**	**2893**	**0.395**	**5.4**	**LOS A**	**18**	**0.92**	**50.8**	**353**
New Road										
7	L	51	484	0.105	6.8	LOS A	4	1.22	43.4	18
8	T	63	607	0.105	4.7	LOS A	4	0.98	45.0	22
9	R	97	920	0.105	12.8	LOS B	4	1.46	39.9	42
Approach		**212**	**2010**	**0.105**	**9.0**	**LOS A**	**4**	**1.26**	**42.1**	**82**
Angels Beach Drive (West)										
10	L	17	100	0.170	5.8	LOS A	6	0.98	49.5	6
11	T	399	2346	0.170	4.7	LOS A	6	0.83	51.8	140
12	R	34	200	0.170	12.7	LOS B	6	1.35	44.7	15
Approach		**450**	**2646**	**0.170**	**5.4**	**LOS A**	**6**	**0.87**	**51.0**	**161**
All Vehicles		**1988**	**9021**	**0.395**	**6.5**	**LOS A**	**18**	**1.01**	**49.0**	**665**

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Intersection Summary

akcelik & associates
aaTraffic SIDRA

Angels Beach Drive / Coast Road

Performance Measure	Vehicles	Persons
Demand Flow	1960 veh/h	2940 pers/h
Degree of Saturation	0.380	
Capacity (Total)	9155 veh/h	
95% Back of Queue (m)	17 m	
95% Back of Queue (veh)	2.4 veh	
Control Delay (Total)	3.44 veh-h/h	5.16 pers-h/h
Control Delay (Average)	6.3 s/veh	6.3 s/pers
Level of Service	LOS A	
Level of Service (Worst Movement)	LOS B	
Total Effective Stops	1920 veh/h	2880 pers/h
Effective Stop Rate	0.98 per veh	0.98 per pers
Travel Distance (Total)	1197.0 veh-km/h	1795.5 pers-km/h
Travel Distance (Average)	611 m	611 m
Travel Time (Total)	24.1 veh-h/h	36.2 pers-h/h
Travel Time (Average)	44.3 secs	44.3 secs
Travel Speed	49.6 km/h	49.6 km/h
Operating Cost (Total)	675 $/h	675 $/h
Fuel Consumption (Total)	152.5 L/h	
Carbon Dioxide (Total)	381.9 kg/h	
Hydrocarbons (Total)	0.514 kg/h	
Carbon Monoxide (Total)	28.67 kg/h	
NOX (Total)	1.079 kg/h	

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2013 PM Peak Hour
With Proposed Development

Movement Summary

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Angels Beach Drive / Coast Road

Roundabout

Vehicle Movements

Mov No	Turn	Dem Flow (veh/h)	Cap (veh/h)	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Eff. Stop Rate	Aver Speed (km/h)	Oper Cost ($/h)
Coast Road										
1	L	41	448	0.092	8.5	LOS A	3	1.31	48.2	14
2	T	36	394	0.091	5.4	LOS A	3	1.07	49.8	11
3	R	145	1064	0.136	14.0	LOS B	5	1.51	43.8	56
Approach		**222**	**1906**	**0.136**	**11.6**	**LOS B**	**5**	**1.40**	**45.4**	**81**
Angels Beach Drive (East)										
4	L	68	345	0.197	6.6	LOS A	7	1.00	50.0	21
5	T	491	2491	0.197	4.6	LOS A	8	0.79	52.2	150
6	R	38	193	0.197	11.2	LOS B	8	1.29	44.6	13
Approach		**597**	**3029**	**0.197**	**5.2**	**LOS A**	**8**	**0.84**	**51.4**	**184**
New Road										
7	L	25	435	0.060	9.2	LOS A	2	1.42	42.0	9
8	T	23	401	0.060	6.9	LOS A	2	1.27	44.0	8
9	R	36	602	0.060	14.8	LOS B	2	1.56	38.9	16
Approach		**86**	**1438**	**0.060**	**10.9**	**LOS B**	**2**	**1.44**	**41.1**	**33**
Angels Beach Drive (West)										
10	L	53	140	0.379	6.2	LOS A	17	1.08	48.8	19
11	T	956	2521	0.379	5.0	LOS A	17	0.90	51.0	337
12	R	46	121	0.380	13.0	LOS B	17	1.37	44.3	20
Approach		**1055**	**2782**	**0.379**	**5.4**	**LOS A**	**17**	**0.93**	**50.5**	**376**
All Vehicles		**1960**	**9155**	**0.380**	**6.3**	**LOS A**	**17**	**0.98**	**49.6**	**675**

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