ATTACHMENT 2
TRAFFIC IMPACT ASSESSMENT
SMEC

Revised Coolum Beachside Development

Traffic Impact Assessment

5 February 2015

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1 INTRODUCTION

SMEC has been appointed to undertake the civil engineering services assessment for a proposed revisioning of the Beachside Precinct of the previous Coolum Hyatt Masterplan.

As part of the civil engineering services, a traffic impact assessment (TIA) is required. SMEC has previously completed a draft TIA in September 2013.

Due to a review of the accesses and amended scale and scope of the development, a revised TIA is required. This report presents the revised TIA for the proposed Beachside Precinct revisioning.

The Beachside Precinct is located on the eastern side of David Low Way generally between Tanah Street East and Warragah Parade.

The report is structured as follows:

- Section 2 presents a summary of previous studies for earlier development applications for the subject site;
- Section 3 provides an assessment of the existing situation and background traffic;
- Section 4 discusses the proposed development;
- Section 5 presents the findings of the capacity analysis of the proposed development on the main intersections ;
- Section 6 provides a summary of the internal road network and parking requirements; and
- Conclusions and recommendations are provided in Section 7.

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2 PREVIOUS STUDIES

2.1 Scope

A number of consultants' reports have been previously prepared for development applications in relation to a number of precinct developments, comprising residential lots and establishing a Resort Community. In 2005, Sinclair Knight Merz produced a Traffic Impact Assessment (TIA) for the "Coolum Development" [1] ("SKM 2005 TIA"). The report was attached as a traffic impact analysis to the Material Change of Use Development Application Report for the Hyatt Coolum Master Plan and Moderate Urban Subdivision dated December 2005.

It assessed the traffic impact of four precincts in the study area, namely Vantage, Visage, Links and Beachside. The four precincts combined comprised of 494 residential lots and 142 units. Of these, the Beachside Precinct accounted for 354 residential lots and 76 units.

Subsequent to this, an updated TIA was submitted in June 2006[2] ("SKM 2006 TIA"), in which the scale of the development application changed slightly. The revised TIA consisted of five precincts, namely Vantage, Central Resort, Gold, Central and Beach Side. The five precincts combined comprised of 429 residential lots and 288 units.

SKM produced a subsequent report in 2011[3] ("SKM 2011") that specifically investigates the intersection of David Low Way and Suncoast Beach Drive. The report recommended that the David Low Way/ Suncoast Beach drive intersection be upgraded to a signalised intersection by 2021, but that it will operate satisfactorily until 2020.

As stated in Section 1, SMEC produced a TIA in September 2013. That report has been revised to accommodate the changes in scale and scope of the proposed development.

2.2 Existing Road Network

The performance of existing intersections were analysed in the 2005 SKM report. The intersections analysed were:

- South Coolum Road;
- David Low Way/ Beach Road;
- David Low Way/ Warran Road;
- David Low Way/ Tanah Street; and
- David Low Way/ Suncoast Beach Road.

For the scenario without the development, in 2005 all of the intersections above were operating acceptably.

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[1] Sinclair Knight Merz; Coolum Development Traffic Impact Assessment; December 2005
[2] Sinclair Knight Merz; Hyatt Regency Coolum Development; June 2006
[3] Sinclair Knight Merz; Hyatt Regency Coolum Development David Low Way / Suncoast Beach Drive Intersection Analysis; April 2011

2.3 Current Approval

The impact of the proposed Hyatt development was subsequently analysed in the 2005 SKM Report. By 2023, without the development in place, assuming background traffic growth only, the intersections above generally had satisfactory performance, with the exception of:

- David Low / Beach Road; and
- David Low Way / Suncoast Beach Drive.

These two intersections were analysed in more detail in the 2011 report and found to require upgrading by 2021, as mentioned above. Mitigating measures were proposed for these two intersections.

The proposed masterplan as analysed by SKM yielded an additional approximate 6,000 trips per day or 500 trips per peak hour. This excludes trips from the elements of the Masterplan that had already been operating at the time of writing of the SKM report. Of these, Beachside accounted for approximately 4,000 trips per day or 335 trips per hour.

Findings from the report indicated that David Low Way / Beach Road will be over capacity. A modified intersection was investigated which provided satisfactory results. The report also indicated that Suncoast Beach Drive had large delays by 2023, and a signalised option was analysed as an alternative, which provided satisfactory results. The other intersections generally operated acceptably.

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3 EXISTING SITUATION

3.1 Road Network

The development is proposed on the eastern side of David Low Way, between Warran Road and Tanah Street East. Access will be off David Low Way. An existing entrance exists off David Low Way in the form of a roundabout.

A site location plan is presented in the figure below.

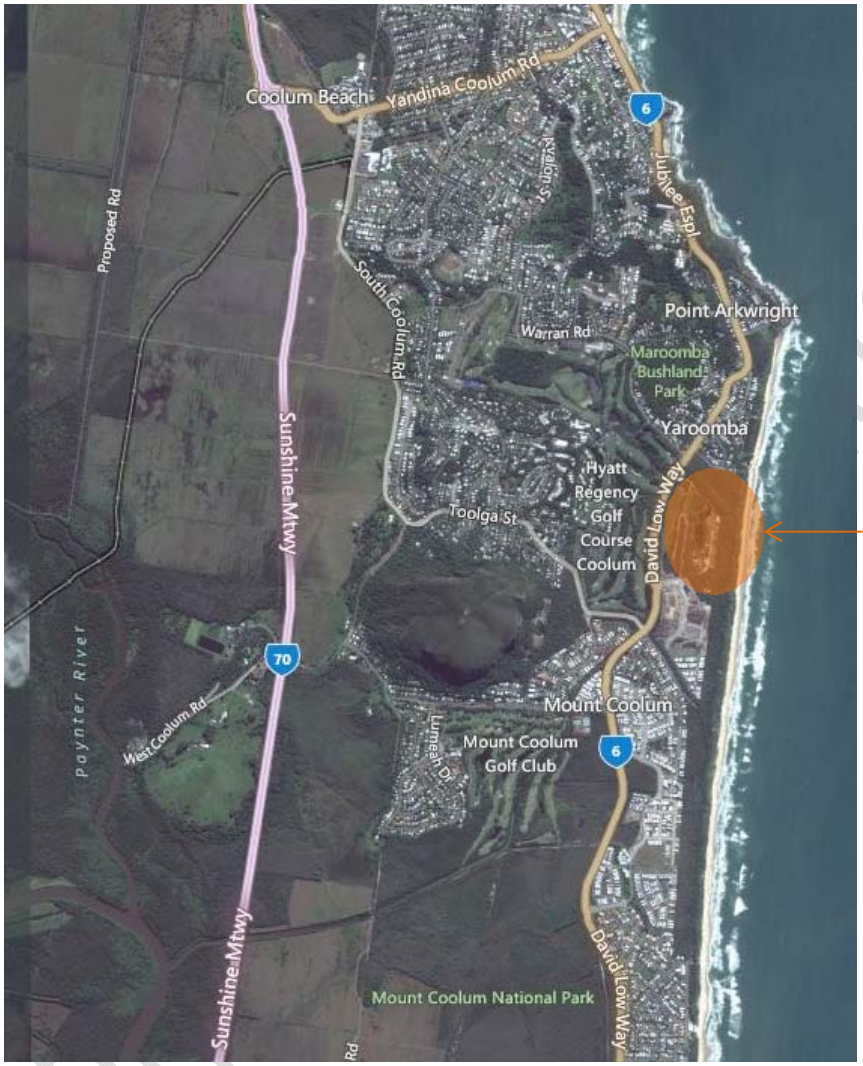

Figure 1: Site Location Plan

David Low Way is a two lane arterial road with a speed limit of 80kph, which reverts to 60kph northbound approximately halfway between Tanah Street and Warran Street. David Low Way forms a main north south mobility link for local traffic in the Coolum Area, and runs parallel and to the east of the Sunshine Motorway. Long distance trips are expected to use the Sunshine Motorway.

Currently, at the location of the proposed development, David Low Way carries approximately 350 and 450 vehicles per hour per direction in the peak hours, increasing north of Beach Road to approximately 550 and 650 vehicles per hour per direction. There is an existing shared user path along David Low Way in the vicinity of the proposed development.

Beach Road is a two lane east west sub-arterial linking David Low Way to the Sunshine Motorway. It has a posted speed limit of 60kph.

There are a number of bus services that use David Low Way, servicing Noosa, Maroochydore and Caloundra. Bus stops are located at Warragah Parade, near Tanah Street East and at Suncoast Beach Drive in the vicinity of the proposed development.

3.2 Traffic Counts

Traffic counts were undertaken on Tuesday 16 July 2013. The weather was fine, and the traffic counts were undertaken outside of school holiday periods. The traffic counts consisted of a 12-hour video survey capturing classified turning counts of all movements. Recent upgrades at the Runway Drive / Suncoast Boulevard were incorporated in the intersection counts.

The traffic count data was used to derive background traffic data for the purposes of undertaking the TIA.

The count data provides traffic volumes at 15 minute intervals throughout the day. The peak hours are taken as the highest combination of 15 minute intervals in both the AM and PM periods. The count data indicated that for each intersection analysed, the traffic volume was larger in the PM peak than the AM peak. The PM peak hours were therefore identified as the critical peak hour.

The 2013 PM peak background traffic data, without the development, is summarised in the figure below, based on the traffic counts.

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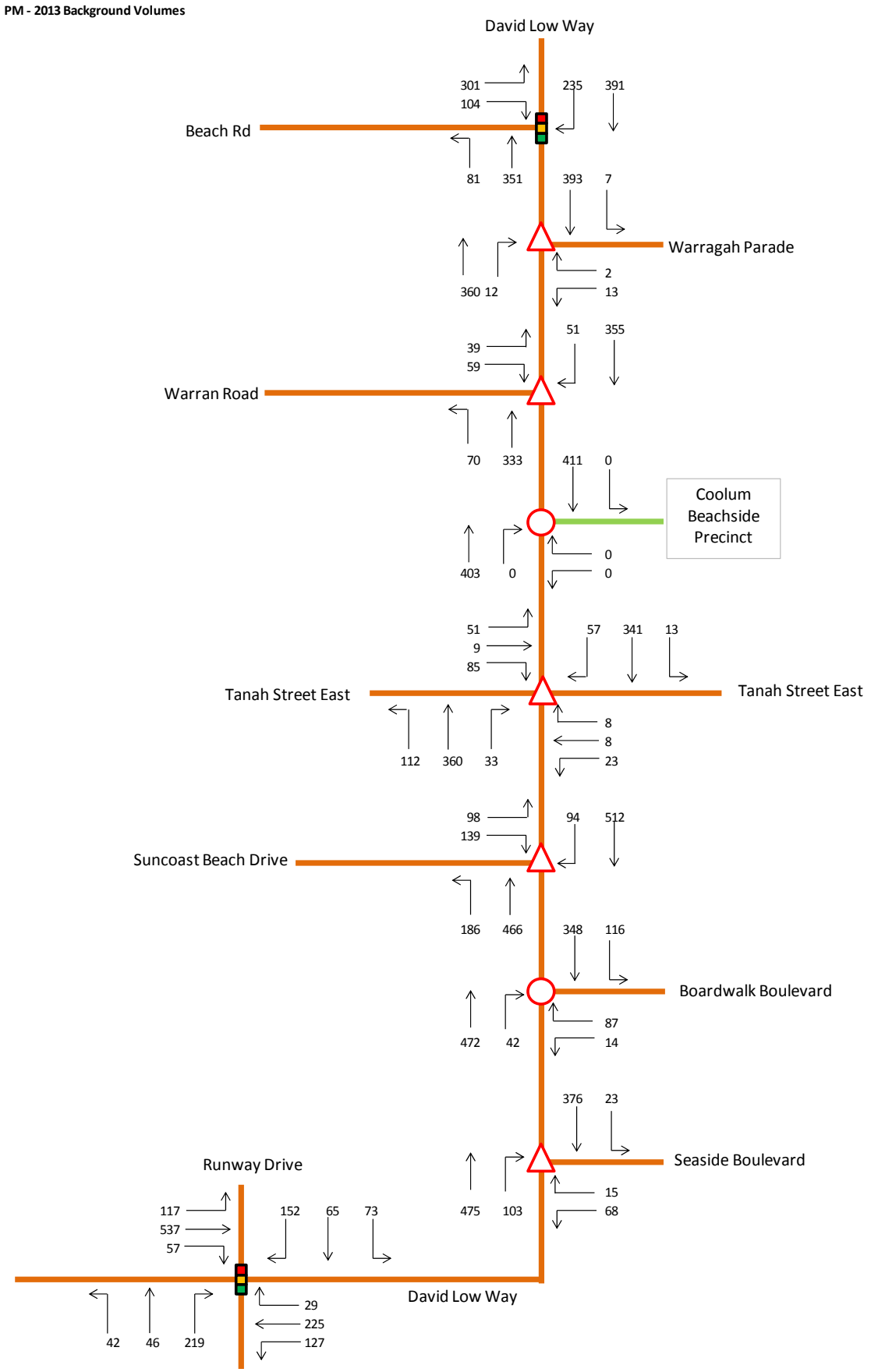

Figure 2: 2013 PM Peak Background Traffic Volumes

An annual background growth rate of 2% per year was applied to account for general traffic growth in the area, not linked to specific development proposals being assessed in this report. This is consistent with the previous SKM Reports which found a 2% growth rate was appropriate, based on historical traffic growth in the area.

The purpose of the traffic impact assessment is to evaluate the effect the proposed development will have over and above what would have occurred without the development. It is therefore necessary to evaluate a "without development" baseline scenario, for the existing and future years, and compare those results with the "with development" scenario. Note that the "without development" baseline scenario includes approved developments not yet constructed, such as the Hyatt Beachside development.

The scale and timeframe for the proposed development is discussed in more detail in Section 4.

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4 PROPOSED DEVELOPMENT

An alternative development scheme for the balance undeveloped Beachside land was prepared to facilitate the original intent of the resort hotel project whilst achieving a longer term commercial viability. The scheme includes a 5 Star Hotel, associated retail and commercial facilities, and residential apartments to be developed on a staged basis. Further to recent community consultation a revised layout has been developed to address identified issues and concerns including:

- Separation between the hotel precinct uses and the existing residential uses
- Acquisition of additional land to be brought into the proposed development.

The revised layout includes the a new entry to David Low Way and a revised traffic assessment.

4.1 Scope of Development

The proposed development consists of a 5 Star resort hotel and associated retail and commercial facilities, and various residential buildings. The final extent of the retail and commercial facilities have not been locked away, however preliminary assumptions regarding their scale and size have been included in the analysis described in this report.

An area density schedule has been supplied for "Coolum Beachside"[4] and is shown in 0.

The development is proposed to be developed over a number of stages. As this staging has not been finalised, the preliminary staging provided in the area density schedule has been assumed for the purposes of this analysis. The staging is outlined in Table 1 and 0.

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[#4] Hassell; Coolum Beachside Area Density Schedule; December 2014

Table 1: Development Proposal

Land Use	Number of units/size	Staging
Hotel Precinct	411 rooms/units	
Hotel Serviced apartments Retail	251 rooms 160 units 3000 m^2	Stage 1 Stage 1 Stage 1
Residential Apartments	1140 units	
Northern Precinct	Building 1:40 units Building 2:40 units Building 3: 50 units Building 4: 80 units Building 5: 70 units Building 6: 70 units Building 7: 70 units Building 8: 70 units Building 9: 70 units Building 10: 70 units Building 11: 100 units Building 12: 50 units Building 13: 100 units Building 14: 100 units Building 15: 80 units Building 16: 80 units	Stage 2 Stage 2 Stage 3 Stage 3 Stage 4 Stage 4 Stage 5 Stage 5 Stage 6 Stage 6 Stage 7 Stage 7 Stage 8 Stage 8 Stage 9 Stage 9
TOTAL	**1300 units** **251 hotel rooms** **3000m^2 retail**	

For the purposes of this report, the intersections have been evaluated for future year performance in 2024, i.e. in 10 years' time. It is assumed that all stages of the development will have been completed by that time.

A summary of the proposed land uses comprising the proposed ultimate development is presented below.

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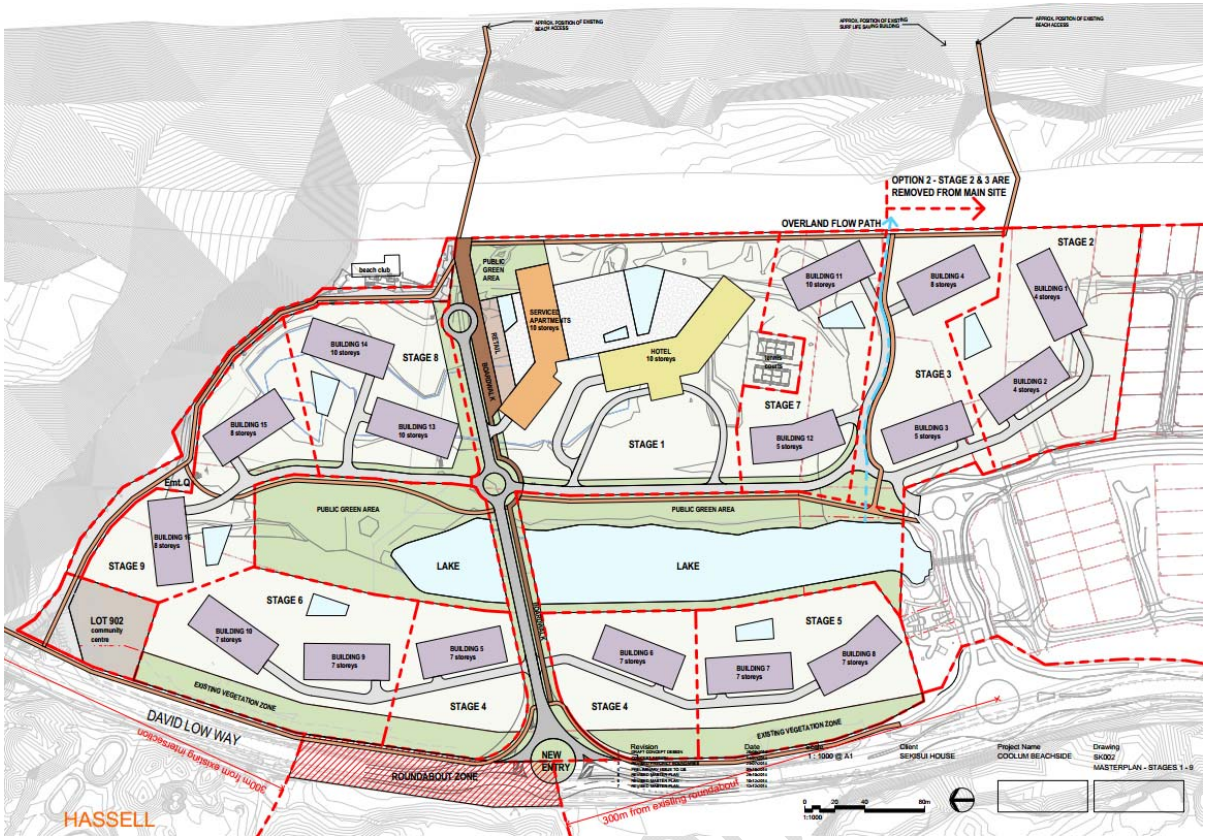

Figure 3: Proposed Development Layout (Source: Hassell)

The figure and table above show that the proposed development will consist of 1,551 units, including a 251 room hotel and 3000m^2 of retail.

4.2 Trip Generation

Trip generation rates were obtained from industry accepted sources. In the first instance, the RTA guide on traffic generating developments was used. The institution of Traffic Engineers (ITE) trip generation rate was used in the case of a resort hotel, as the RTA guidance for this land use was lacking.

A summary of the trip generation rates used is presented overleaf:

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Table 2: Trip Generation Rates

					Weekday Peak Hour vehicle trips (per unit)	
	Type	Source	Factor	Daily	AM	PM
Residential	1-2 bedroom	RTA	Dwelling	4.5	0.45	0.45
	3+ bedroom	RTA	Dwelling	5.75	0.575	0.575
	Detached	RTA	Dwelling	9	0.85	0.85
Hotel	Motel	RTA	Occupied Rooms	3	0.4	0.4
	Resort Hotel	ITE	Rooms	-	0.31	0.42
Commercial	Restaurants	RTA	100m2 GLFA	60	5	5

	Retail	RTA	100m2 GLFA	121	12.3	12.3

As stated in Section 3.2, the PM peak was identified as the critical peak hour from the traffic count data. The resulting number of trips generated in the PM peak hour is presented below:

Table 3: Trip Generation

				Dwellings				
		Type	GFA	TOTAL	1-2 bedroom (80% assumed)	3+ bedroom (20% assumed)	Rooms	Trip Generation PM Peak
Residential	Apartments	Dwelling	-	1300	1040	260	-	618
Hotel	Rooms	Dwelling	-	251	-	-	251	105
Commercial	Retail	RTA	3000	-	-	-	-	369
							Total	1092

This indicates that the development is expected to generate 1092 trips in the peak hour.

For the PM peak period, the IN and OUT rate for residential apartments was assumed to be 65% and 35% respectively. For the hotel rooms, an IN and OUT rate of 43% and 57% was assumed. All trips were assigned to the proposed roundabout access to the development.

A traffic distribution of 60% South via David Low Way, 35% North via David Low Way and 5% North via South Coolum Road has been assumed as per the SKM 2006 TIA.

No allowance has been made for modal split, internal or multipurpose trips. The assumptions will therefore provide a conservative analysis.

The resulting traffic volumes on the road network, based on this traffic generation, in/out split and distribution across the road network, is summarised in Figure 4.

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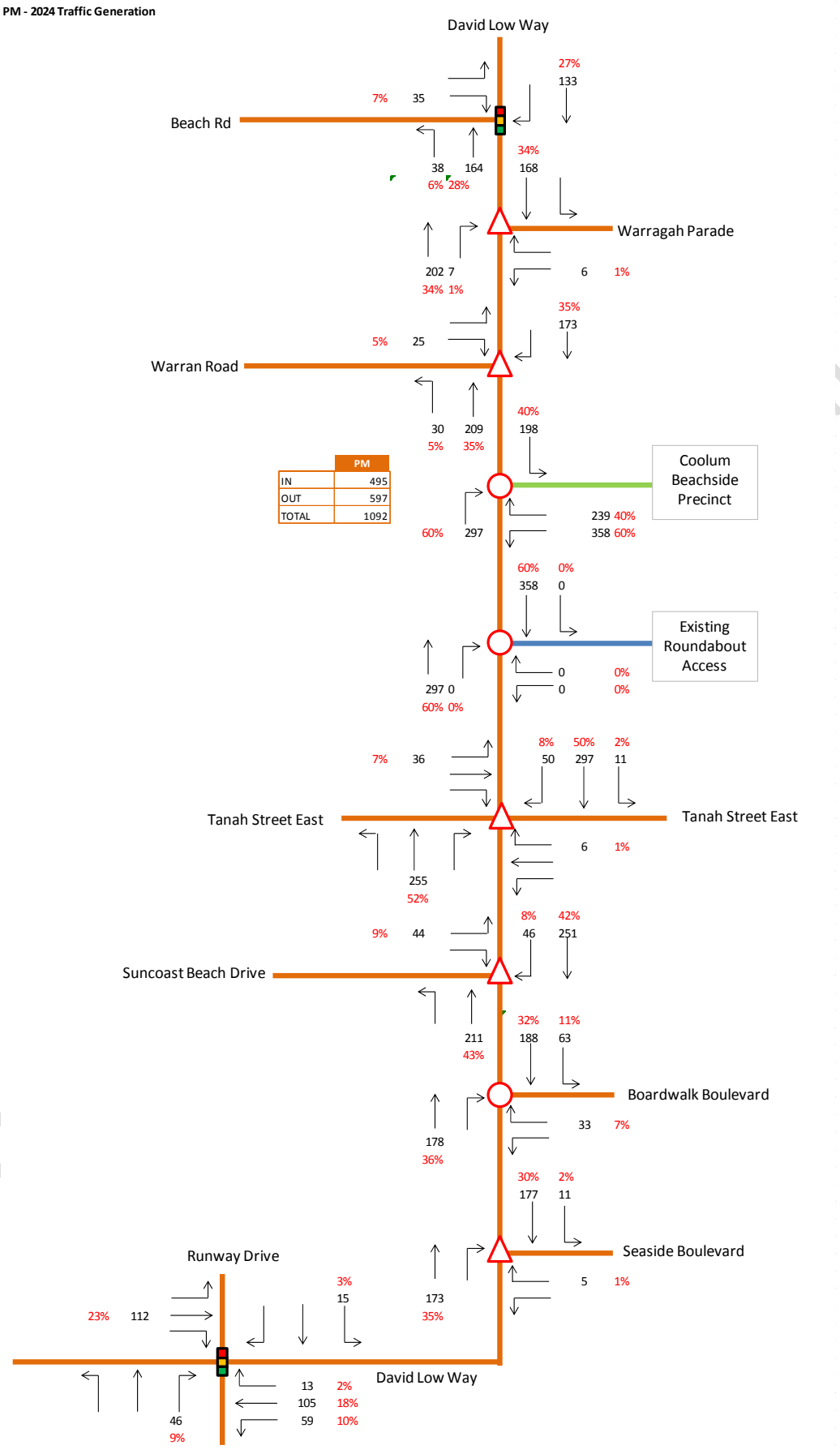

Figure 4: 2024 PM Peak Traffic Generation

5 TRAFFIC ANALYSIS

5.1 Introduction

As discussed above, the traffic impact assessment considers the effect of the proposed development on the surrounding road network over and above the approved baseline. In order to assess this impact, it is necessary to first determine what the road network performance will be, without any proposed development in place. Approved development should be added to the existing background traffic to derive an approved baseline scenario.

The current Coolum Beachside area density schedule (12/12/2014) shows that the development will be constructed in nine stages. It is appropriate to compare the performance of the road network assuming an approved baseline scenario **without** development, to the road network performance **with** the development. This is undertaken for 2024, and the results are discussed in more detail below.

The following intersections are analysed:

- The development access intersection with David Low Way;
- David Low Way / Warran Street;
- David Low Way / Warragah Parade;
- David Low Way / Tanah Street;
- David Low Way / Beach Road;
- David Low Way / Suncoast Beach Road;
- David Low Way / Boardwalk Boulevard;
- David Low Way / Seaside Boulevard; and
- David Low Way / Runway Drive.

The intersection performance is undertaken using SIDRA, an industry standard traffic engineering analysis tool, suitable for stand-alone intersection analysis. Note that SIDRA is not able to determine trip redistribution across the wider road network due to localised congestion, or to determine the interaction of closely spaced intersections. Therefore, results need to be interpreted carefully.

Capacity analysis results for the intersections above for the critical PM peak hour are presented and discussed below, for both with and without development scenarios.

5.2 2024 PM Peak Without Development Scenario

5.2.1 Traffic Volumes

The relevant peak hour traffic volumes for the 2024 PM peak **without development scenario** are presented in Figure 5 below.

As outlined in Section 5.1 above, approved development has been incorporated into the baseline scenario.

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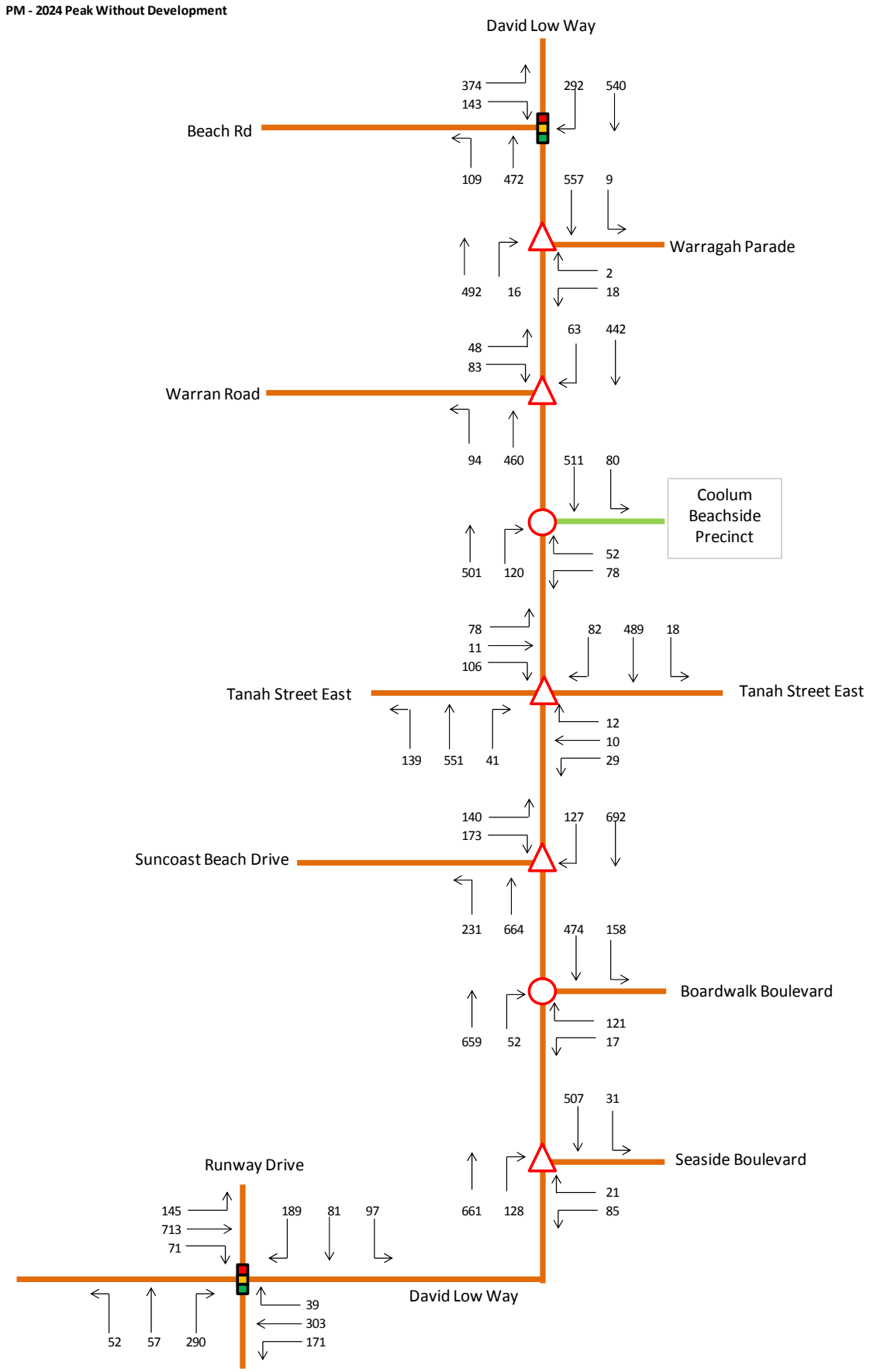

Figure 5: 2024 PM Peak Without Development Scenario (Base + Approved Development)

5.2.2 Warran Road Intersection

The Warran Road / David Low Way intersection is a priority controlled intersection, with the major road being David Low Way. Analysis of this intersection using SIDRA indicated that the intersection is generally expected to operate well. The intersection layout is shown in Figure 6 below.

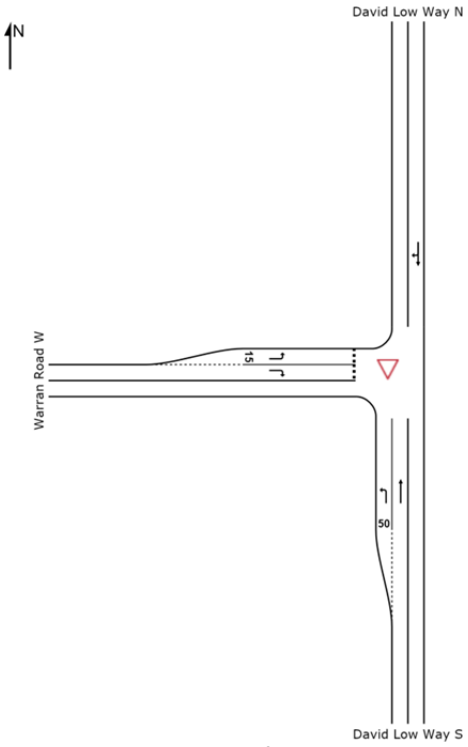

Figure 6: Warran Road / David Low Way Intersection Layout

The operational performance of the intersection during the 2024 PM peaks was undertaken utilising SIDRA 6.0. The results are presented in Table 4 below.

Table 4: Warran Road / David Low Way – 2024 Base PM Peak (Without Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	99	5.0	0.055	5.6	LOS A	0.0	0.0	0.00	0.58	53.4
2	T1	484	5.0	0.256	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		583	5.0	0.256	1.0	NA	0.0	0.0	0.00	0.10	58.7
North: David Low Way N											
8	T1	465	5.0	0.471	23.3	LOS C	11.4	83.3	1.00	0.15	43.0
9	R2	66	5.0	0.471	28.8	LOS D	11.4	83.3	1.00	0.15	41.9
Approach		532	5.0	0.471	24.0	NA	11.4	83.3	1.00	0.15	42.9
West: Warran Road W											
10	L2	51	5.0	0.051	7.9	LOS A	0.2	1.5	0.52	0.68	51.7
12	R2	87	5.0	0.159	11.9	LOS B	0.6	4.5	0.72	0.89	48.7
Approach		138	5.0	0.159	10.4	LOS B	0.6	4.5	0.65	0.81	49.7
All Vehicles		1253	5.0	0.471	11.8	NA	11.4	83.3	0.50	0.20	49.9

Level of Service (LOS) Method: Delay (HCM 2000).
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.

The table above indicates that all movements are at a Level of Service (LOS) D or better. The level of service is an indication of the average delay experienced by drivers, and is presented on a scale from

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A to F, with LOS A being the best and LOS F being unacceptable. A LOS E generally indicates a movement is at or near capacity. A LOS D is generally regarded as acceptable.

The degree of saturation (v/c ratio) is an indication of how close to capacity a particular movement is. Generally, a v/c ratio below 0.85 is considered acceptable, with a v/c ration between 0.85 and 1.00 indicating conditions close to capacity. Results over 1.00 are generally regarded as unacceptable. The results indicate that all v/c ratios are well below 0.85, with a maximum of 0.471.

There does not appear to be significant queuing.

It is therefore concluded that this intersection is operating acceptably in the 2024 base PM peak.

5.2.3 Warragah Parade Intersection

The Warragah Parrade / David Low Way intersection is a priority controlled intersection, with the major road being David Low Way. Analysis of this intersection using SIDRA indicated that the intersection is generally expected to operate well. The intersection layout is shown in the figure below.

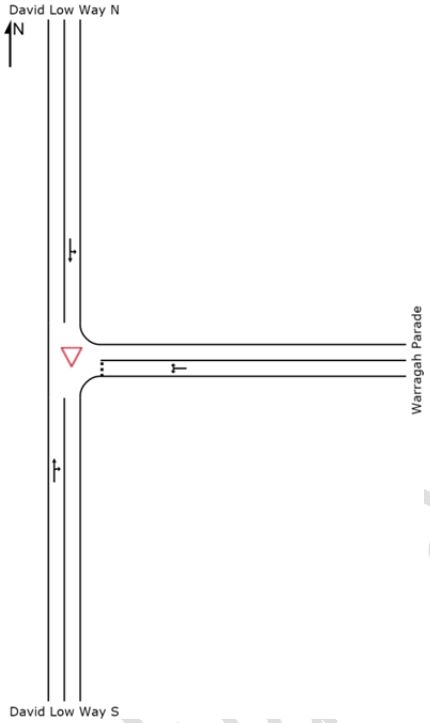

Figure 7: Warragah Parade / David Low Way Intersection Layout

The results are presented in the table overleaf.

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Table 5: Warragah Parade / David Low Way – 2024 Base PM Peak (Without Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
2	T1	632	5.0	0.376	9.9	LOS A	7.4	53.8	1.00	0.03	51.5
3	R2	21	5.0	0.376	15.4	LOS C	7.4	53.8	1.00	0.03	49.6
Approach		652	5.0	0.376	10.1	NA	7.4	53.8	1.00	0.03	51.4
East: Warragah Parade											
4	L2	23	5.0	0.039	10.1	LOS B	0.1	1.1	0.62	0.77	50.1
6	R2	3	5.0	0.039	10.1	LOS B	0.1	1.1	0.62	0.77	49.6
Approach		26	5.0	0.039	10.1	LOS B	0.1	1.1	0.62	0.77	50.0
North: David Low Way N											
7	L2	12	5.0	0.385	5.6	LOS A	0.0	0.0	0.00	0.01	57.9
8	T1	715	5.0	0.385	0.1	LOS A	0.0	0.0	0.00	0.01	59.8
Approach		727	5.0	0.385	0.1	NA	0.0	0.0	0.00	0.01	59.8
All Vehicles		1405	5.0	0.385	4.9	NA	7.4	53.8	0.48	0.03	55.4

Level of Service (LOS) Method: Delay (HCM 2000).
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.

The results indicate that all movements are operating at a LOS C or better, with v/c ratios below 0.4.

5.2.4 Tanah Street East Intersection

The Tanah Street East / David Low Way intersection is a priority controlled intersection, with the major road being David Low Way. Analysis of this intersection using SIDRA indicated that the intersection is generally expected to operate well, although some minor movements are experiencing delays. The intersection layout and results are shown below.

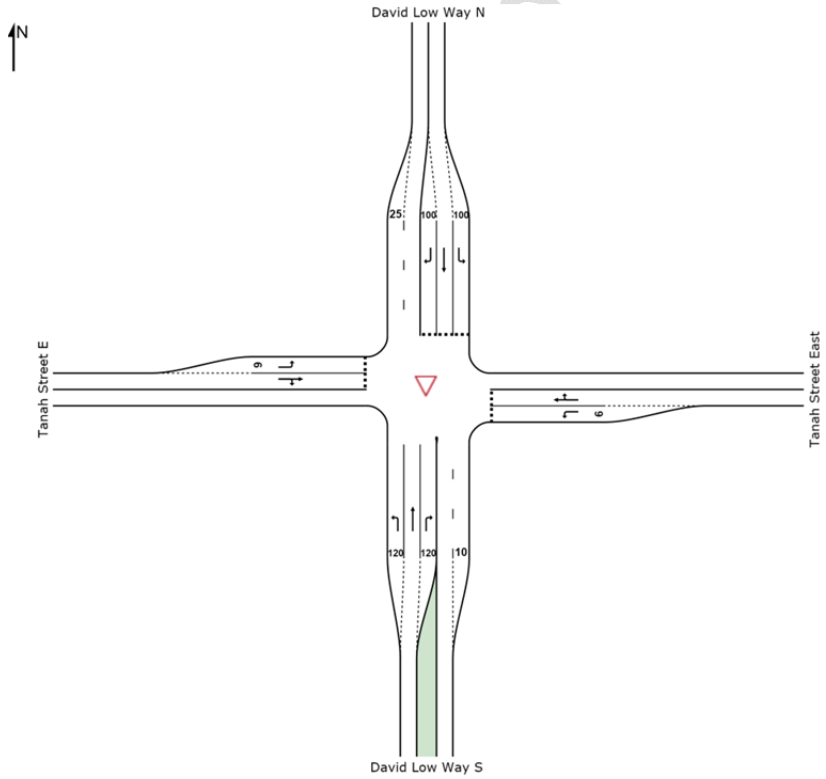

Figure 8: Tanah Street East / David Low Way Intersection Layout

Table 6: Tanah Street East / David Low Way – 2024 Base PM Peak (Without Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	146	5.0	0.082	5.6	LOS A	0.0	0.0	0.00	0.58	53.4
2	T1	580	5.0	0.307	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
3	R2	43	5.0	0.061	8.7	LOS A	0.2	1.5	0.51	0.73	51.1
Approach		769	5.0	0.307	1.6	NA	0.2	1.5	0.03	0.15	58.0
East: Tanah Street East											
4	L2	31	5.0	0.051	9.4	LOS A	0.2	1.3	0.52	0.74	50.6
5	T1	11	5.0	0.344	71.0	LOS F	1.1	8.0	0.95	1.01	27.5
6	R2	13	5.0	0.344	71.6	LOS F	1.1	8.0	0.95	1.01	27.3
Approach		54	5.0	0.344	36.1	LOS E	1.1	8.0	0.71	0.85	37.0
North: David Low Way N											
7	L2	19	5.0	0.017	5.8	LOS A	0.1	0.4	0.14	0.54	53.0
8	T1	515	5.0	0.273	4.5	LOS A	0.0	0.0	0.00	0.52	54.7
9	R2	86	5.0	0.423	28.4	LOS D	1.8	13.0	0.85	1.02	40.0
Approach		620	5.0	0.423	7.9	LOS A	1.8	13.0	0.12	0.59	52.0
West: Tanah Street E											
10	L2	82	5.0	0.096	8.8	LOS A	0.4	2.9	0.58	0.76	51.0
11	T1	12	0.0	0.266	14.9	LOS B	1.2	8.9	0.83	0.88	47.3
12	R2	112	5.0	0.266	15.6	LOS C	1.2	8.9	0.83	0.88	46.7
Approach		205	4.7	0.266	12.8	LOS B	1.2	8.9	0.73	0.83	48.4
All Vehicles		1648	5.0	0.423	6.5	NA	1.8	13.0	0.17	0.42	53.4

Level of Service (LOS) Method: Delay (HCM 2000).
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.

The table above indicates that all movements are at a Level of Service (LOS) D or better, except the through and right turn movements from Tanah Street. These movements have an unacceptable level of service. However, these are relatively minor movements with only 11 and 13 vehicles per hour respectively.

The results indicate that all v/c ratios are well below 0.85, with a maximum of 0.423. There does not appear to be significant queuing.

It is therefore concluded that this intersection in the 2024 base PM peak scenario is operating at an acceptable level.

5.2.5 Beach Road Intersection

The Beach Road / David Low Way intersection is a signal controlled intersection, with the major road being David Low Way. Analysis of this intersection using SIDRA indicated that some movements are approaching capacity. The intersection layout and results are shown overleaf.

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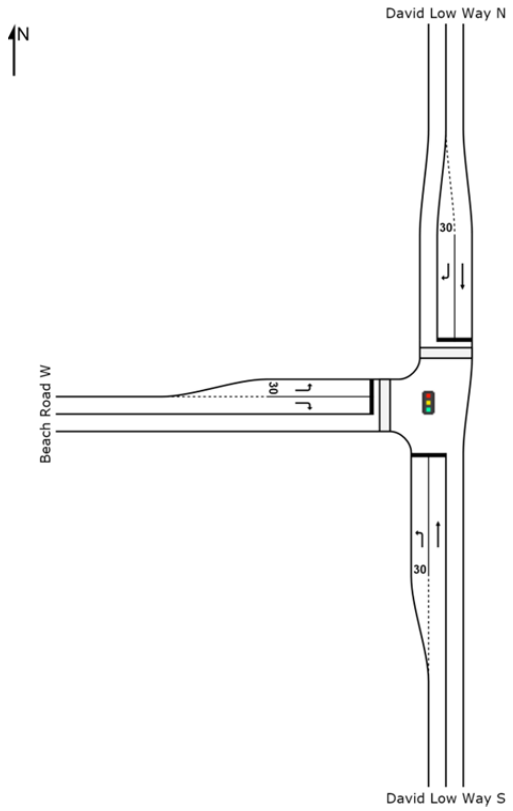

Figure 9: Beach Road / David Low Way Intersection Layout

Table 7: Beach Road / David Low Way – 2024 Base PM Peak (Without Development)

Signals - Fixed Time Cycle Time = 55 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	ODMov	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: David Low Way S											
1	L2	115	5.0	0.235	22.9	LOS C	2.5	18.0	0.82	0.75	42.7
2	T1	497	5.0	1.064	109.4	LOS F	33.2	242.6	1.00	1.83	21.4
Approach		612	5.0	1.064	93.2	LOS F	33.2	242.6	0.97	1.63	23.6
North: David Low Way N											
8	T1	568	5.0	0.754	11.6	LOS B	11.4	83.2	0.70	0.68	50.4
9	R2	307	5.0	1.106	146.6	LOS F	23.5	171.8	1.00	1.74	17.4
Approach		876	5.0	1.106	59.0	LOS E	23.5	171.8	0.80	1.05	30.3
West: Beach Road W											
10	L2	394	5.0	1.033	94.1	LOS F	22.9	167.0	1.00	1.48	23.3
12	R2	151	5.0	0.355	25.2	LOS C	3.5	25.6	0.88	0.78	41.3
Approach		544	5.0	1.033	75.0	LOS E	22.9	167.0	0.97	1.29	26.5
All Vehicles		2032	5.0	1.106	73.6	LOS E	33.2	242.6	0.90	1.29	27.0

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

The table above indicates that three of six movements are at a Level of Service (LOS) C or better. The David Low Way N right turn movement, David Low Way S through movement and Beach Road W left turn movement are at a LOS F, which is unacceptable.

Additionally, some v/c ratios are above 0.85, with a maximum of 1.106, indicating the intersection is at capacity, even without the proposed development.

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There is some queuing evident along David Low Way, with a 95%tile back of queue of 242.6m on David Low South.

It is therefore concluded that the performance of this intersection is unacceptable at the 2024 base PM scenario.

5.2.6 Suncoast Beach Road Intersection

The Suncoast Beach Road / David Low Way intersection is a priority controlled intersection, with the major road being David Low Way. The intersection layout is shown in the figure below. Analysis of this intersection using SIDRA indicated that the intersection is experiencing capacity constraints, as indicated below.

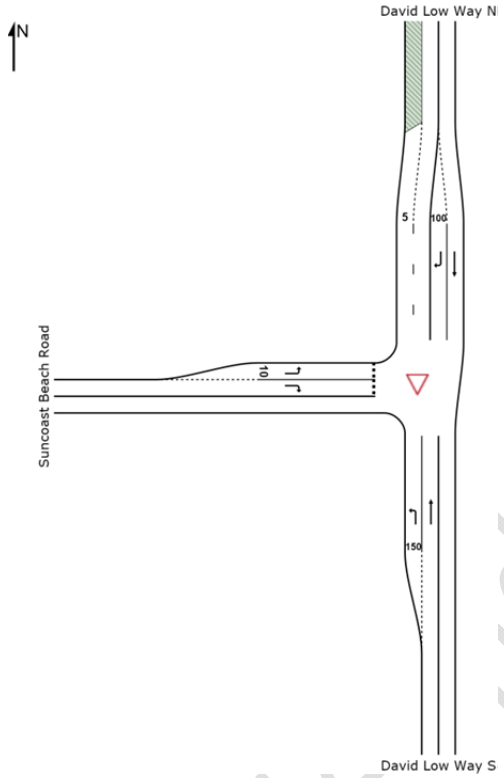

Figure 10: Suncoast Beach Road / David Low Way Intersection Layout

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Table 8: Suncoast Beach Road / David Low Way – 2024 Base PM Peak (Without Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	243	5.0	0.136	5.6	LOS A	0.0	0.0	0.00	0.57	53.4
2	T1	699	5.0	0.370	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		942	5.0	0.370	1.5	NA	0.0	0.0	0.00	0.15	58.1
North: David Low Way N											
8	T1	728	5.0	0.386	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
9	R2	134	5.0	1.123	210.7	LOS F	16.3	119.1	1.00	2.09	13.4
Approach		862	5.0	1.123	32.7	NA	16.3	119.1	0.16	0.32	38.9
West: Suncoast Beach Drive											
10	L2	147	5.0	0.219	10.7	LOS B	0.9	6.7	0.67	0.87	49.7
12	R2	182	5.0	0.716	37.2	LOS E	3.9	28.3	0.95	1.20	36.4
Approach		329	5.0	0.716	25.3	LOS D	3.9	28.3	0.83	1.05	41.4
All Vehicles		2134	5.0	1.123	17.8	NA	16.3	119.1	0.19	0.36	46.0

Level of Service (LOS) Method: Delay (HCM 2000).
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.

The table above indicates that the right turn from David Low Way (N) and right turn from Suncoast Beach Road are operating at LOS F and E respectively. Furthermore, the v/c ratio for the right turn is 1.123, indicating the intersection is at capacity even without the proposed development.

It is therefore concluded that the performance of this intersection is unacceptable in the 2024 base PM scenario.

5.2.7 Boardwalk Boulevard Intersection

The Boardwalk Boulevard / David Low Way intersection is a two-lane roundabout. The SIDRA analysis indicates that the intersection is operating well. The intersection layout and results are shown below.

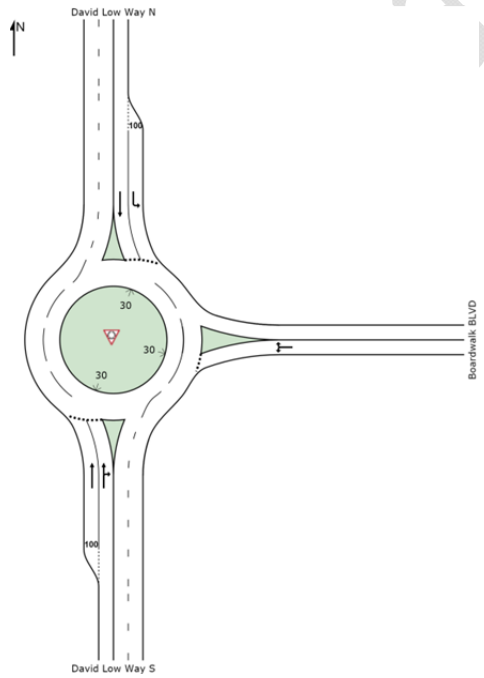

Figure 11: Boardwalk Boulevard / David Low Way Intersection Layout

Table 9: Boardwalk Boulevard / David Low Way – 2024 Base PM Peak (Without Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
2	T1	846	5.0	0.327	4.2	LOS A	2.4	17.3	0.41	0.44	55.8
3	R2	67	5.0	0.327	10.1	LOS B	2.3	16.6	0.43	0.47	55.7
Approach		913	5.0	0.327	4.6	LOS A	2.4	17.3	0.41	0.44	55.8
East: Boardwalk BLVD											
4	L2	22	5.0	0.219	6.8	LOS A	1.1	8.4	0.62	0.79	50.5
6	R2	155	5.0	0.219	12.6	LOS B	1.1	8.4	0.62	0.79	52.1
Approach		177	5.0	0.219	11.9	LOS B	1.1	8.4	0.62	0.79	51.9
North: David Low Way N											
7	L2	203	5.0	0.164	4.0	LOS A	0.9	6.8	0.24	0.44	55.3
8	T1	609	5.0	0.363	3.8	LOS A	2.7	19.5	0.26	0.36	56.9
Approach		812	5.0	0.363	3.9	LOS A	2.7	19.5	0.25	0.38	56.5
All Vehicles		1902	5.0	0.363	5.0	LOS A	2.7	19.5	0.37	0.45	55.7

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
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.

The table above indicates that all movements are at a Level of Service (LOS) B or better with a maximum v/c ratio of 0.363. No significant queuing is expected.

It is concluded that this intersection is operating acceptably in the 2024 PM base scenario.

5.2.8 Seaside Boulevard Intersection

The Seaside Boulevard / David Low Way intersection is a priority controlled intersection. The SIDRA analysis indicates that the intersection is operating well. The intersection layout and results are shown below.

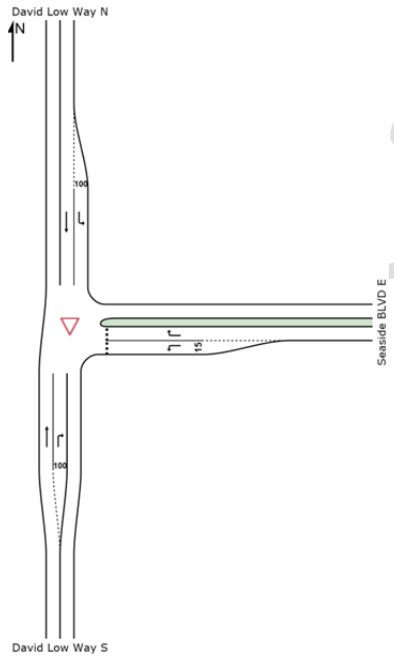

Figure 12: Seaside Boulevard / David Low Way Intersection Layout

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Table 10: Seaside Boulevard / David Low Way – 2024 Base PM Peak (Without Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
2	T1	849	5.0	0.449	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
3	R2	164	5.0	0.295	11.4	LOS B	1.2	8.7	0.65	0.89	49.0
Approach		1013	5.0	0.449	1.9	NA	1.2	8.7	0.11	0.14	57.8
East: Seaside BLVD E											
4	L2	109	5.0	0.133	9.1	LOS A	0.5	4.0	0.60	0.80	50.8
6	R2	27	5.0	0.098	18.1	LOS C	0.3	2.2	0.86	0.94	45.0
Approach		136	5.0	0.133	10.9	LOS B	0.5	4.0	0.65	0.83	49.5
North: David Low Way N											
7	L2	40	5.0	0.022	5.6	LOS A	0.0	0.0	0.00	0.58	53.4
8	T1	651	5.0	0.345	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		691	5.0	0.345	0.4	NA	0.0	0.0	0.00	0.03	59.5
All Vehicles		1840	5.0	0.449	2.0	NA	1.2	8.7	0.11	0.15	57.7

Level of Service (LOS) Method: Delay (HCM 2000).
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.

The table above indicates that all movements are at a Level of Service (LOS) C or better with a maximum v/c ratio of 0.449. No significant queuing is expected.

It is concluded that the performance of this intersection is acceptable in the 2024 PM base scenario.

5.2.9 Runway Drive Intersection

The Runway Drive / Suncoast Boulevard South / David Low Way intersection is a newly upgraded signalised intersection, generally operating well. The intersection layout and results are shown below.

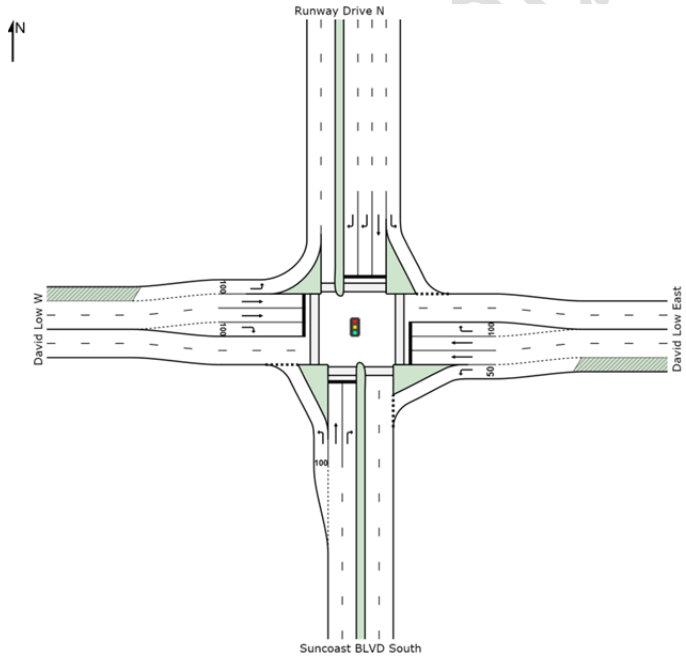

Figure 13: Runway Drive / Suncoast Boulevard South / David Low Way Intersection Layout

Table 11: Runway Drive / Suncoast Boulevard South / David Low Way – 2024 Base PM Peak (Without Development)

Signals - Fixed Time Cycle Time = 90 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	ODMov	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: Suncoast BLVD South											
1	L2	67	5.0	0.068	7.7	LOS A	0.6	4.3	0.28	0.62	52.4
2	T1	73	5.0	0.184	31.8	LOS C	2.7	19.5	0.86	0.67	39.5
3	R2	372	5.0	0.779	42.2	LOS D	16.4	119.7	0.99	0.91	35.1
Approach		512	5.0	0.779	36.2	LOS D	16.4	119.7	0.88	0.83	37.3
East: David Low East											
4	L2	220	5.0	0.184	7.2	LOS A	1.4	10.2	0.29	0.63	52.9
5	T1	389	5.0	0.320	24.9	LOS C	6.5	47.4	0.80	0.66	42.7
6	R2	50	5.0	0.422	49.3	LOS D	2.2	16.3	0.97	0.76	32.9
Approach		659	5.0	0.422	20.9	LOS C	6.5	47.4	0.64	0.66	44.5
North: Runway Drive N											
7	L2	125	5.0	0.191	18.4	LOS B	3.0	22.0	0.63	0.72	45.5
8	T1	104	5.0	0.261	32.4	LOS C	3.9	28.3	0.88	0.69	39.3
9	R2	243	5.0	0.254	33.9	LOS C	4.2	30.9	0.83	0.76	38.1
Approach		471	5.0	0.261	29.5	LOS C	4.2	30.9	0.79	0.74	40.1
West: David Low W											
10	L2	186	5.0	0.104	5.7	LOS A	0.0	0.0	0.00	0.53	54.8
11	T1	916	5.0	0.752	31.2	LOS C	18.8	137.5	0.96	0.87	39.8
12	R2	91	5.0	0.329	36.9	LOS D	3.4	24.9	0.86	0.77	36.8
Approach		1193	5.0	0.752	27.7	LOS C	18.8	137.5	0.80	0.81	41.3
All Vehicles		2836	5.0	0.779	27.9	LOS C	18.8	137.5	0.78	0.77	41.0

Level of Service (LOS) Method: Delay (HCM 2000).
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.

The table above indicates that all movements are at a Level of Service (LOS) D or better with a maximum v/c ratio of 0.779.

There is some queuing evident along David Low Way, with a 95%tile back of queue of 137.5m on David Low W.

It is therefore concluded that this intersection is operating acceptably in the 2024 base PM scenario, although it is approaching capacity.

5.3 2024 PM Peak With Development Scenario

5.3.1 Traffic Volumes

The relevant peak hour traffic volumes for the 2024 PM peak **with development scenario** are presented in the figure overleaf.

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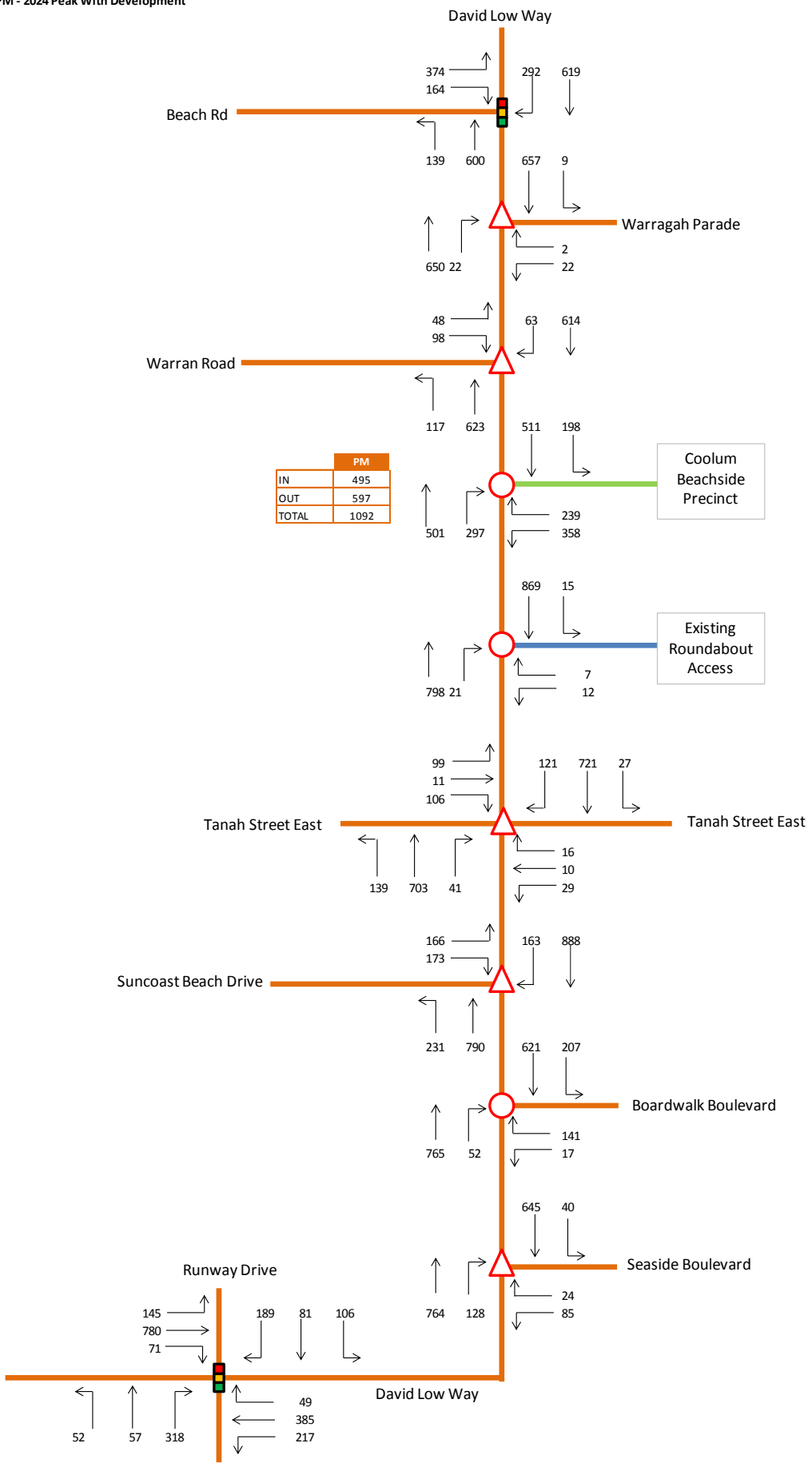

Figure 14: 2024 PM Peak With Development Scenario

5.3.2 Coolum Beachside Access

The access to the development is along David Low Way, in the form of a new roundabout. It has been assumed that this is the only entry and exit point for the Coolum Beachside development. The roundabout layout is shown in the figure below.

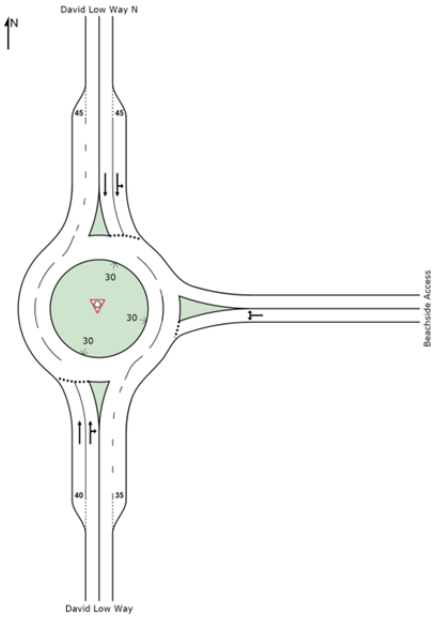

Figure 15: Main Access Point / David Low Way Roundabout Layout

The operational performance of the intersection during the 2024 PM peaks was undertaken utilising SIDRA 6.0. The results are presented in the table below.

Table 12: Main Access Point / David Low Way – 2024 PM Peak (With Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way											
2	T1	527	5.0	0.451	4.8	LOS A	3.9	28.5	0.57	0.54	54.4
3	R2	313	5.0	0.451	10.4	LOS B	3.9	28.5	0.60	0.57	54.0
Approach		840	5.0	0.451	6.9	LOS A	3.9	28.5	0.58	0.55	54.3
East: Beachside Access											
4	L2	377	5.0	0.776	13.0	LOS B	9.8	71.4	0.94	1.12	48.0
6	R2	252	5.0	0.776	18.8	LOS B	9.8	71.4	0.94	1.12	49.6
Approach		628	5.0	0.776	15.4	LOS B	9.8	71.4	0.94	1.12	48.7
North: David Low Way N											
7	L2	208	5.0	0.203	5.4	LOS A	1.2	8.9	0.53	0.59	54.2
8	T1	538	5.0	0.390	5.0	LOS A	3.0	21.6	0.58	0.49	55.2
Approach		746	5.0	0.390	5.1	LOS A	3.0	21.6	0.57	0.51	54.9
All Vehicles		2215	5.0	0.776	8.7	LOS A	9.8	71.4	0.68	0.70	52.8

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
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.

The table above indicates that the North and South movements along David Low Way are at a Level of Service (LOS) B or better and v/c ratios are below 0.85, with a maximum of 0.776.

It is therefore concluded that the performance of the access point will be acceptable in the 2024 PM scenario with development.

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A sensitivity analysis was carried out for this intersection to determine the effect of additional retail floor space as part of the proposed development. It was found that with 6000m2 of retail space, the number of trips generated IN and OUT of the development in the PM peak would increase to 680 and 781 respectively. SIDRA analysis for 2024 indicated that the intersection performance at this traffic level would deteriorate below acceptable limits, with a LOS E predicted for the eastern leg left and right movements and Degree of Saturation (DoS) exceeding 1.00. More detailed analysis would be required to determine the level of additional upgrading required at this location to accommodate the additional trips associated with 6000m2 of retail space.

5.3.3 Warran Road Intersection

With the proposed development, Warran Road is expected to experience delays and a deteriorating level of service, as indicated in the table below.

Table 13: Warran Road / David Low Way – 2024 PM Peak (With Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	123	5.0	0.069	5.6	LOS A	0.0	0.0	0.00	0.58	53.4
2	T1	656	5.0	0.347	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		779	5.0	0.347	0.9	NA	0.0	0.0	0.00	0.09	58.8
North: David Low Way N											
8	T1	646	5.0	0.711	82.2	LOS F	26.1	190.8	1.00	0.13	25.4
9	R2	66	5.0	0.711	87.8	LOS F	26.1	190.8	1.00	0.13	25.0
Approach		713	5.0	0.711	82.7	NA	26.1	190.8	1.00	0.13	25.4
West: Warran Road W											
10	L2	51	5.0	0.065	9.2	LOS A	0.3	1.9	0.60	0.77	50.7
12	R2	103	5.0	0.336	20.7	LOS C	1.3	9.8	0.88	1.00	43.6
Approach		154	5.0	0.336	17.0	LOS C	1.3	9.8	0.79	0.92	45.7
All Vehicles		1645	5.0	0.711	37.8	NA	26.1	190.8	0.51	0.19	36.8

Level of Service (LOS) Method: Delay (HCM 2000).
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.

As indicated, vehicles from David Low Way N are experiencing unacceptable delays, with a LOS F predicted. There is also excessive queuing predicted, with queues approaching 190.8m on David Low Way.

It is therefore concluded that this intersection is operating unacceptably in the 2024 PM scenario with the development.

5.3.4 Warragah Parade Intersection

With the proposed development, Warragah Parade Street is expected to operate well and does not require upgrading, as indicated in Table 14 overleaf.

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Table 14: Warragah Parade / David Low Way – 2024 PM Peak (With Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
2	T1	684	5.0	0.407	9.8	LOS A	8.0	58.5	1.00	0.04	51.5
3	R2	23	5.0	0.407	15.3	LOS C	8.0	58.5	1.00	0.04	49.6
Approach		707	5.0	0.407	10.0	NA	8.0	58.5	1.00	0.04	51.4
East: Warragah Parade											
4	L2	23	5.0	0.037	9.8	LOS A	0.1	1.0	0.61	0.75	50.3
6	R2	2	5.0	0.037	9.7	LOS A	0.1	1.0	0.61	0.75	49.8
Approach		25	5.0	0.037	9.8	LOS A	0.1	1.0	0.61	0.75	50.3
North: David Low Way N											
7	L2	9	5.0	0.371	5.6	LOS A	0.0	0.0	0.00	0.01	58.0
8	T1	692	5.0	0.371	0.1	LOS A	0.0	0.0	0.00	0.01	59.8
Approach		701	5.0	0.371	0.1	NA	0.0	0.0	0.00	0.01	59.8
All Vehicles		1434	5.0	0.407	5.2	NA	8.0	58.5	0.50	0.04	55.2

Level of Service (LOS) Method: Delay (HCM 2000).
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.

All movements are operating at a LOS C or better and v/c ratios are below 0.85 with a maximum of 0.407.

It is therefore concluded that the performance of this intersection is acceptable in the 2024 PM scenario with the development.

5.3.5 Tanah Street Intersection

The intersection performance of Tanah Street with the development is unacceptable, as indicated in the table below.

Table 15: Tanah Street / David Low Way – 2024 PM Peak (With Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	146	5.0	0.082	5.6	LOS A	0.0	0.0	0.00	0.58	53.4
2	T1	740	5.0	0.392	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
3	R2	43	5.0	0.090	11.6	LOS B	0.3	2.2	0.65	0.85	49.1
Approach		929	5.0	0.392	1.5	NA	0.3	2.2	0.03	0.13	58.2
East: Tanah Street East											
4	L2	31	5.0	0.081	13.4	LOS B	0.3	1.9	0.70	0.87	47.9
5	T1	11	5.0	1.548	867.7	LOS F	10.3	75.3	1.00	1.45	3.9
6	R2	17	5.0	1.548	868.3	LOS F	10.3	75.3	1.00	1.45	3.9
Approach		58	5.0	1.548	417.4	LOS F	10.3	75.3	0.84	1.15	7.6
North: David Low Way N											
7	L2	28	5.0	0.026	5.9	LOS A	0.1	0.7	0.16	0.54	52.9
8	T1	759	5.0	0.402	4.5	LOS A	0.0	0.0	0.00	0.52	54.7
9	R2	127	5.0	0.987	124.7	LOS F	9.3	67.9	1.00	1.67	19.5
Approach		915	5.0	0.987	21.3	LOS C	9.3	67.9	0.14	0.68	43.6
West: Tanah Street E											
10	L2	104	5.0	0.156	10.4	LOS B	0.6	4.5	0.66	0.85	49.9
11	T1	12	0.0	0.537	33.1	LOS D	2.7	19.6	0.99	1.02	38.3
12	R2	112	5.0	0.537	33.8	LOS D	2.7	19.6	0.99	1.02	37.9
Approach		227	4.7	0.537	23.0	LOS C	2.7	19.6	0.84	0.94	42.6
All Vehicles		2129	5.0	1.548	23.6	NA	10.3	75.3	0.19	0.48	42.7

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Level of Service (LOS) Method: Delay (HCM 2000).
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.

There are a number of movements at a LOS F, and v/c ratios exceeding 1.00.

It is therefore concluded that this intersection is operating unacceptably in the 2024 PM scenario with development.

5.3.6 Beach Road Intersection

The intersection performance of Beach Road, with the development in place, indicates capacity constraints and long delays and is summarised in Table 16 below.

Table 16: Beach Road / David Low Way – 2024 PM Peak (With Development)

Signals - Fixed Time Cycle Time = 60 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	146	5.0	0.258	22.4	LOS C	3.3	23.8	0.78	0.76	42.9
2	T1	632	5.0	1.194	219.4	LOS F	67.1	490.0	1.00	2.57	13.0
Approach		778	5.0	1.194	182.3	LOS F	67.1	490.0	0.96	2.23	15.0
North: David Low Way N											
8	T1	652	5.0	0.797	13.3	LOS B	14.8	107.7	0.68	0.70	49.2
9	R2	307	5.0	1.165	201.4	LOS F	29.6	215.7	1.00	1.89	13.8
Approach		959	5.0	1.165	73.6	LOS E	29.6	215.7	0.79	1.08	27.0
West: Beach Road W											
10	L2	394	5.0	1.140	180.5	LOS F	35.6	259.7	1.00	1.85	15.0
12	R2	173	5.0	0.444	28.5	LOS C	4.6	33.4	0.91	0.79	39.9
Approach		566	5.0	1.140	134.2	LOS F	35.6	259.7	0.97	1.53	18.5
All Vehicles		2303	5.0	1.194	125.2	LOS F	67.1	490.0	0.89	1.58	19.5

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

As indicated above, a number of movements are operating at a LOS F and some movements have a v/c ratio of 1.00 or higher. Long queue lengths are also expected.

It is therefore concluded that the performance of this intersection is unacceptable in the 2024 PM scenario with development.

5.3.7 Suncoast Beach Road Intersection

The intersection performance of Suncoast Beach Road, with the development in place, indicates capacity constraints and long delays, summarised overleaf.

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Table 17: Suncoast Beach Road / David Low Way – 2024 PM Peak (With Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	243	5.0	0.136	5.6	LOS A	0.0	0.0	0.00	0.57	53.4
2	T1	832	5.0	0.440	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1075	5.0	0.440	1.3	NA	0.0	0.0	0.00	0.13	58.3
North: David Low Way N											
8	T1	935	5.0	0.495	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
9	R2	172	5.0	2.265	1220.3	LOS F	67.5	492.8	1.00	3.45	2.8
Approach		1106	5.0	2.265	189.3	NA	67.5	492.8	0.16	0.53	14.6
West: Suncoast Beach Drive											
10	L2	175	5.0	0.327	13.6	LOS B	1.5	10.8	0.77	0.96	47.8
12	R2	182	5.0	1.501	523.7	LOS F	43.9	320.5	1.00	3.35	6.2
Approach		357	5.0	1.501	273.9	LOS F	43.9	320.5	0.89	2.18	10.8
All Vehicles		2538	5.0	2.265	121.6	NA	67.5	492.8	0.19	0.59	19.9

Level of Service (LOS) Method: Delay (HCM 2000).
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.

As indicated above, a number of movements are operating at a LOS F, and some movements have a v/c ratio of 1.00 or higher. Long queue lengths are also expected.

It is therefore concluded that the performance of this intersection is unacceptable in the 2024 PM scenario with development.

5.3.8 Boardwalk Boulevard Intersection

The intersection performance of Boardwalk Boulevard, with the development in place, indicates the intersection is operating well, as indicated in the table below.

Table 18: Boardwalk Boulevard / David Low Way Roundabout Option – 2024 PM Peak (With Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
2	T1	805	5.0	0.306	4.2	LOS A	2.2	16.0	0.40	0.43	55.9
3	R2	55	5.0	0.306	10.0	LOS B	2.1	15.4	0.41	0.46	55.8
Approach		860	5.0	0.306	4.5	LOS A	2.2	16.0	0.40	0.43	55.9
East: Boardwalk BLVD											
4	L2	18	5.0	0.212	7.1	LOS A	1.1	8.2	0.64	0.80	50.2
6	R2	148	5.0	0.212	12.9	LOS B	1.1	8.2	0.64	0.80	51.8
Approach		166	5.0	0.212	12.3	LOS B	1.1	8.2	0.64	0.80	51.6
North: David Low Way N											
7	L2	218	5.0	0.173	4.0	LOS A	1.0	7.3	0.22	0.43	55.4
8	T1	654	5.0	0.384	3.8	LOS A	2.9	21.1	0.23	0.35	57.1
Approach		872	5.0	0.384	3.8	LOS A	2.9	21.1	0.23	0.37	56.6
All Vehicles		1898	5.0	0.384	4.9	LOS A	2.9	21.1	0.34	0.44	55.8

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
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.

All movements are operating at a LOS B or better and v/c ratios are below 0.85 with a maximum of 0.384.

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It is therefore concluded that this intersection is operating acceptably in the 2024 PM scenario with the development.

5.3.9 Seaside Boulevard Intersection

The intersection performance of Seaside Boulevard, with the development in place, indicates the intersection is operating well, as indicated in the table overleaf.

Table 19: Seaside Boulevard / David Low Way – 2024 PM Peak (With Development)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
2	T1	804	5.0	0.426	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
3	R2	135	5.0	0.254	11.5	LOS B	1.0	7.0	0.66	0.88	48.9
Approach		939	5.0	0.426	1.7	NA	1.0	7.0	0.09	0.13	58.0
East: Seaside BLVD E											
4	L2	89	5.0	0.114	9.3	LOS A	0.5	3.4	0.61	0.80	50.7
6	R2	25	1.0	0.110	22.1	LOS C	0.4	2.6	0.88	0.95	43.0
Approach		115	4.1	0.114	12.1	LOS B	0.5	3.4	0.67	0.83	48.7
North: David Low Way N											
7	L2	42	5.0	0.023	5.6	LOS A	0.0	0.0	0.00	0.58	53.4
8	T1	679	5.0	0.359	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		721	5.0	0.359	0.4	NA	0.0	0.0	0.00	0.03	59.5
All Vehicles		1775	4.9	0.426	1.8	NA	1.0	7.0	0.09	0.13	57.9

Level of Service (LOS) Method: Delay (HCM 2000).
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.

All movements are operating at a LOS C or better and v/c ratios are below 0.85 with a maximum of 0.426.

It is therefore concluded that this intersection is operating acceptably in the 2024 PM scenario with the development.

5.3.10 Runway Drive Intersection

The intersection performance of Runway Drive with the development in place indicates the intersection is operating acceptably, as indicated in the table overleaf.

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Table 20: Runway Drive / Suncoast Boulevard South / David Low Way – 2024 PM Peak (With Development)

Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles											
Mov ID	ODMov	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: Suncoast BLVD South											
1	L2	55	5.0	0.053	5.9	LOS A	0.1	0.4	0.02	0.55	53.9
2	T1	60	5.0	0.201	47.8	LOS D	3.1	22.6	0.91	0.70	33.7
3	R2	335	5.0	0.700	48.8	LOS D	17.8	130.2	0.96	0.85	33.0
Approach		449	5.0	0.700	43.4	LOS D	17.8	130.2	0.84	0.79	34.8
East: David Low East											
4	L2	228	5.0	0.165	6.8	LOS A	1.6	12.0	0.21	0.61	53.2
5	T1	405	5.0	0.330	32.8	LOS C	8.9	65.1	0.80	0.67	39.1
6	R2	52	5.0	0.243	33.4	LOS C	1.9	14.1	0.87	0.73	38.3
Approach		685	5.0	0.330	24.2	LOS C	8.9	65.1	0.61	0.65	42.8
North: Runway Drive N											
7	L2	112	5.0	0.154	17.4	LOS B	2.9	21.3	0.53	0.69	46.1
8	T1	85	5.0	0.285	48.7	LOS D	4.5	32.6	0.92	0.72	33.5
9	R2	199	5.0	0.208	42.4	LOS D	4.5	33.0	0.82	0.75	35.0
Approach		396	5.0	0.285	36.7	LOS D	4.5	33.0	0.76	0.73	37.2
West: David Low W											
10	L2	153	5.0	0.085	5.7	LOS A	0.0	0.0	0.00	0.53	54.8
11	T1	821	5.0	0.669	37.6	LOS D	20.7	151.3	0.92	0.80	37.2
12	R2	75	5.0	0.214	30.9	LOS C	2.9	20.8	0.77	0.72	39.2
Approach		1048	5.0	0.669	32.5	LOS C	20.7	151.3	0.78	0.76	39.2
All Vehicles		2579	5.0	0.700	32.8	LOS C	20.7	151.3	0.74	0.73	38.9

Level of Service (LOS) Method: Delay (HCM 2000).
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

All movements are operating at a LOS D or better and v/c ratios are below 0.85 with a maximum of 0.700.

It is therefore concluded that this intersection is operating acceptably in the 2024 PM scenario with the development.

5.3.11 Summary

A summary of the performance of each intersection both with and without the development is shown in the table below.

Table 21: 2024 Intersection Performance Summary With and Without Development

Intersection	2024 Without Development	2024 With Development	Upgrade Required
Access Point	-	Acceptable	-
Warran Road	Acceptable	Unacceptable	Yes
Warragah Parade	Acceptable	Acceptable	-
Tanah Street East	Acceptable	Unacceptable	Yes
Beach Road	Unacceptable	Unacceptable	Yes
Suncoast Beach Road	Unacceptable	Unacceptable	Yes
Boardwalk Boulevard	Acceptable	Acceptable	-

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Intersection	2024 Without Development	2024 With Development	Upgrade Required
Seaside Boulevard	Acceptable	Acceptable	-
Runway Drive	Acceptable	Acceptable	-

The table above shows that four intersections are underperforming in the 2024 PM peak **with development scenario** and will require upgrading. Of these four intersections, Beach Road and Suncoast Beach Road would have required upgrading **without** the proposed development.

Upgrade options have been assessed to mitigate these underperforming intersections and the results are presented in Section 5.4.

5.4 Proposed Upgrades

Potential upgrades have been analysed in order to mitigate the deteriorating performance of the intersections of Warran Road, Tanah Street, Beach Road and Suncoast Beach Road.

5.4.1 Warran Road Intersection

In order to mitigate the unacceptable performance of the Warran Road intersection in Section 5.2.2, a scenario with the intersection being upgraded to a signalised intersection was analysed. The result of this analysis is presented below.

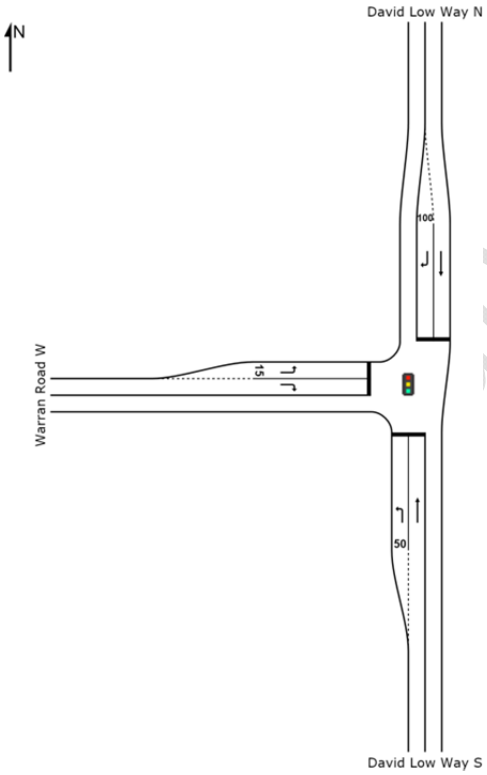

Figure 16: Signalised Warran Road / David Low Way Intersection Layout

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Table 22: Signalised Warran Road / David Low Way Option – 2024 PM Peak (With Development)

Signals - Fixed Time Cycle Time = 100 seconds (User-Given Cycle Time)

Movement Performance - Vehicles											
Mov ID	ODMov	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: David Low Way S											
1	L2	123	5.0	0.093	9.4	LOS A	1.6	12.0	0.30	0.65	50.6
2	T1	656	5.0	0.475	5.5	LOS A	12.5	91.4	0.43	0.39	55.0
Approach		779	5.0	0.475	6.1	LOS A	12.5	91.4	0.41	0.43	54.3
North: David Low Way N											
8	T1	646	5.0	0.462	5.4	LOS A	12.2	89.4	0.43	0.39	55.1
9	R2	66	5.0	0.180	15.0	LOS B	1.4	10.6	0.46	0.70	46.8
Approach		713	5.0	0.462	6.3	LOS A	12.2	89.4	0.43	0.42	54.2
West: Warran Road W											
10	L2	51	5.0	0.201	47.7	LOS D	2.2	16.4	0.92	0.74	33.1
12	R2	103	5.0	0.455	49.3	LOS D	4.8	34.7	0.96	0.78	32.5
Approach		154	5.0	0.455	48.7	LOS D	4.8	34.7	0.94	0.77	32.7
All Vehicles		1645	5.0	0.475	10.2	LOS B	12.5	91.4	0.47	0.46	51.1

Level of Service (LOS) Method: Delay (HCM 2000).
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

The results above indicate that all movements are at a LOS D or better and v/c ratios are below 0.85.

It is therefore concluded that the signalisation of Warran Road will produce acceptable operation of the intersection in 2024 PM scenario with development.

5.4.2 Tanah Street Intersection

In order to improve the performance of this intersection, signalisation is required. A signalised intersection will operate satisfactory. The layout of the signalised intersection is shown in the figure below.

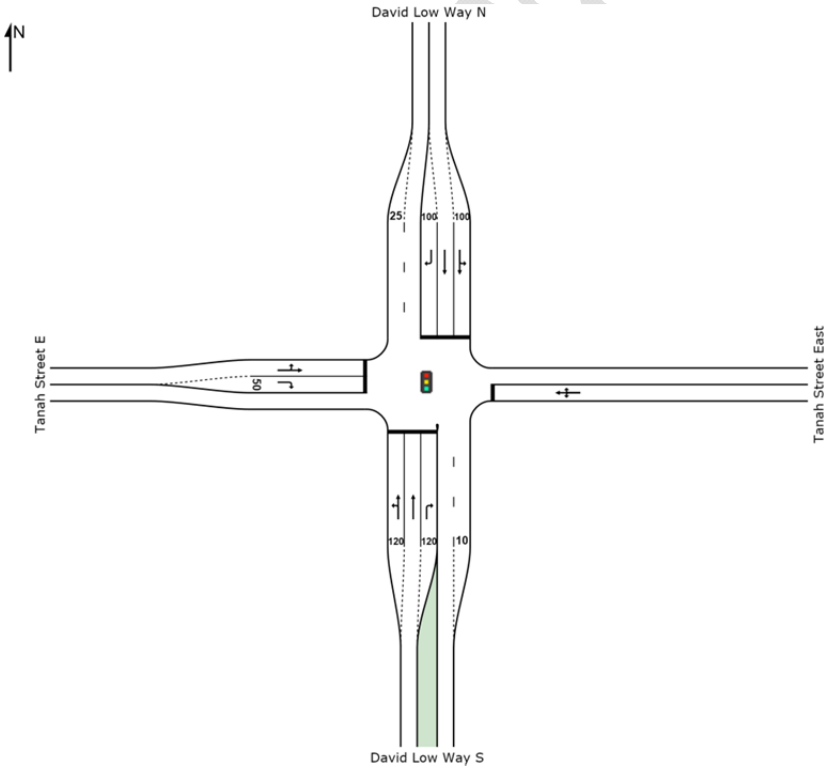

Figure 17: Signalised Tanah Street / David Low Way Intersection Layout

The results are presented in the table overleaf.

Table 23: Signalised Tanah Street / David Low Way Option – 2024 PM Peak (With Development)

Signals - Fixed Time Cycle Time = 85 seconds (User-Given Cycle Time)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	146	5.0	0.187	20.2	LOS C	3.8	27.5	0.63	0.72	44.2
2	T1	740	5.0	0.845	27.8	LOS C	30.6	223.1	0.95	0.95	41.1
3	R2	43	5.0	0.256	46.2	LOS D	1.8	12.8	0.96	0.73	33.4
Approach		929	5.0	0.845	27.5	LOS C	30.6	223.1	0.90	0.91	41.1
East: Tanah Street East											
4	L2	31	5.0	0.317	49.5	LOS D	2.5	18.1	0.96	0.81	32.9
5	T1	11	5.0	0.317	43.9	LOS D	2.5	18.1	0.96	0.81	33.4
6	R2	17	5.0	0.317	49.5	LOS D	2.5	18.1	0.96	0.81	32.9
Approach		58	5.0	0.317	48.5	LOS D	2.5	18.1	0.96	0.81	33.0
North: David Low Way N											
7	L2	28	5.0	0.152	19.9	LOS B	3.1	22.7	0.61	0.55	46.6
8	T1	759	5.0	0.759	20.5	LOS C	23.2	169.6	0.86	0.78	44.8
9	R2	127	5.0	0.755	51.1	LOS D	5.7	41.8	1.00	0.88	32.1
Approach		915	5.0	0.759	24.7	LOS C	23.2	169.6	0.87	0.79	42.5
West: Tanah Street E											
10	L2	104	5.0	0.778	52.6	LOS D	5.3	38.5	1.00	0.90	31.8
11	T1	12	0.0	0.778	47.0	LOS D	5.3	38.5	1.00	0.90	32.4
12	R2	112	5.0	0.756	52.1	LOS D	5.1	36.9	1.00	0.88	31.9
Approach		227	4.7	0.778	52.0	LOS D	5.3	38.5	1.00	0.89	31.9
All Vehicles		2129	5.0	0.845	29.5	LOS C	30.6	223.1	0.90	0.85	40.2

Level of Service (LOS) Method: Delay (HCM 2000).
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

With signalisation, the intersection performance improves and all movements are at LOS D or better, and v/c ratios are below 0.85.

It is therefore concluded that the signalisation of Tanah Street will produce acceptable performance of the intersection in 2024 PM scenario with development.

5.4.3 Beach Road Intersection

An intersection upgrade is required to mitigate the unacceptable results shown in Section 5.3.6. Increasing the turning lanes and reconfiguring the lane controls improves the intersection performance to an acceptable level. A possible upgrade is shown in the layout below.

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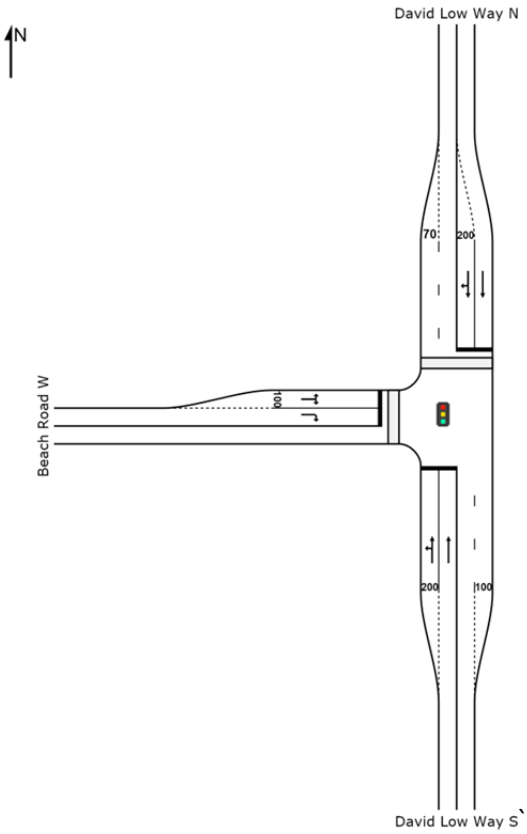

Figure 18: Beach Road / David Low Way Intersection Upgrade Option Layout

The operational performance of the intersection during the 2024 PM peaks was undertaken utilising SIDRA 6.0. The results are presented in the table below.

Table 24: Beach Road / David Low Way Upgrade Option – 2024 PM Peak (With Development)

Signals - Fixed Time Cycle Time = 90 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	146	5.0	0.323	27.7	LOS C	6.8	49.9	0.76	0.73	41.2
2	T1	632	5.0	0.811	30.7	LOS C	24.3	177.2	0.94	0.91	39.7
Approach		778	5.0	0.811	30.1	LOS C	24.3	177.2	0.91	0.88	40.0
North: David Low Way N											
8	T1	652	5.0	0.816	10.6	LOS B	17.8	129.6	0.54	0.49	50.7
9	R2	307	5.0	0.816	44.5	LOS D	17.8	129.6	1.00	0.94	34.4
Approach		959	5.0	0.816	21.4	LOS C	17.8	129.6	0.69	0.64	44.0
West: Beach Road W											
10	L2	394	5.0	0.439	21.1	LOS C	11.0	80.6	0.69	0.78	43.6
12	R2	173	5.0	0.542	43.0	LOS D	7.1	52.0	0.96	0.81	34.4
Approach		566	5.0	0.542	27.7	LOS C	11.0	80.6	0.77	0.79	40.3
All Vehicles		2303	5.0	0.816	25.9	LOS C	24.3	177.2	0.78	0.76	41.7

Level of Service (LOS) Method: Delay (HCM 2000).
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

The intersection performance is improved, although it is still experiencing some capacity constraints. Delays are all at LOS D or better, and v/c ratios at or below 0.85.

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It is therefore concluded that increasing lane lengths of the Beach Road will produce acceptable operation for the intersection in 2024 PM scenario with development.

5.4.4 Suncoast Beach Road Intersection

An intersection upgrade is required to mitigate the unacceptable results shown in Section 5.3.7. A signalised option was analysed and found to deliver acceptable operating conditions. A layout of this option is shown in the figure below.

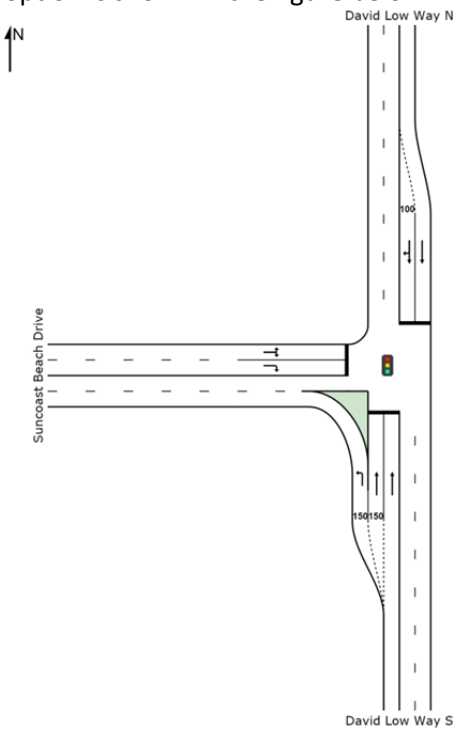

Figure 19: Suncoast Beach Road / David Low Way Signalisation Option Layout

The results are presented in the table below.

Table 25: Suncoast Beach Road / David Low Way Signalisation Option – 2024 PM Peak (With Development)

Signals - Fixed Time Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: David Low Way S											
1	L2	243	5.0	0.136	5.7	LOS A	0.0	0.0	0.00	0.53	54.8
2	T1	832	5.0	0.587	21.8	LOS C	13.1	95.9	0.86	0.74	44.2
Approach		1075	5.0	0.587	18.1	LOS B	13.1	95.9	0.66	0.69	46.3
North: David Low Way N											
8	T1	935	5.0	0.579	8.7	LOS A	14.5	106.0	0.57	0.52	52.2
9	R2	172	5.0	0.579	31.6	LOS C	10.6	77.2	0.90	0.80	39.8
Approach		1106	5.0	0.579	12.2	LOS B	14.5	106.0	0.62	0.56	49.8
West: Suncoast Beach Drive											
10	L2	175	5.0	0.592	37.2	LOS D	8.1	59.4	0.95	0.82	36.6
12	R2	182	5.0	0.592	41.8	LOS D	8.1	59.4	0.98	0.81	35.1
Approach		357	5.0	0.592	39.5	LOS D	8.1	59.4	0.97	0.81	35.8
All Vehicles		2538	5.0	0.592	18.6	LOS B	14.5	106.0	0.69	0.65	45.8

Level of Service (LOS) Method: Delay (HCM 2000).
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.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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As indicated above, all movements are operating at a LOS D or better and the v/c ratios are all below 0.85.

It is therefore concluded that signalising the Suncoast Beach Road intersection will produce acceptable results for the intersection in 2024 PM scenario with development.

5.5 Staging Requirements

The previous section has shown that four intersections require upgrading. It is appropriate to investigate the likely staging required of these upgrades. Analysis of the network performance at various interim staging years was therefore undertaken.

The intersection analysis described in the previous section indicated that the following intersections require upgrading to accommodate the full development by 2024:

- Warran Road;
- Tanah Street;
- Beach Road; and
- Suncoast Beach Drive.

The upgrade requirements for these intersections will be triggered by the development staging. In order to assess when the intersection upgrades will be required, the performance of the intersections were analysed after various stages of the proposed development.

The trip generation for each stage was calculated and is shown in the figure below.

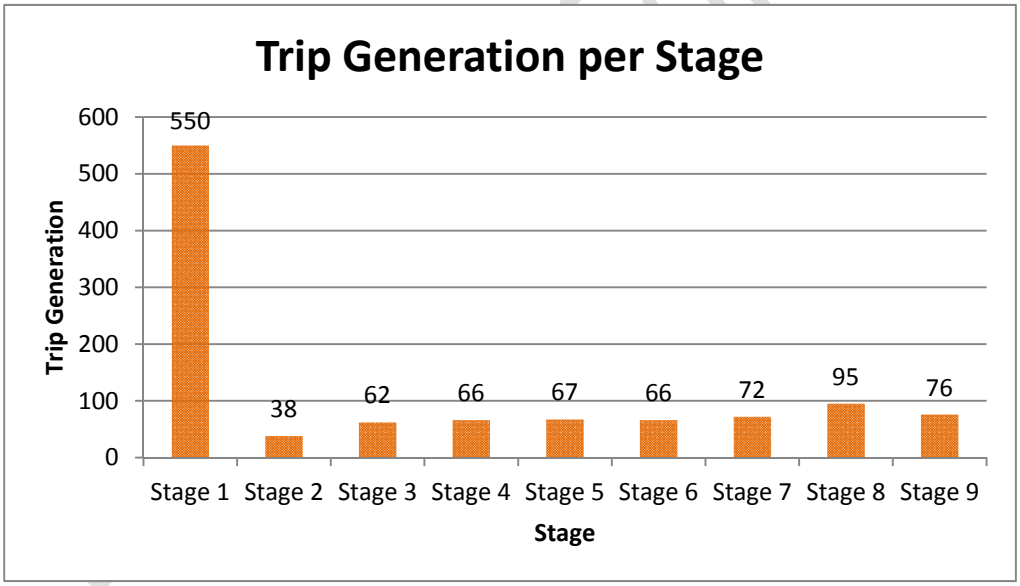

Figure 20: Trip Generation per Stage

These trips were distributed throughout the network according to the overall trip distribution assumptions mentioned previously. The operational performance of each relevant intersection was undertaken utilising SIDRA 6.0. The results are presented below.

5.5.1 Warran Road Intersection

With the proposed stages of construction, Warran Road is expected to experience delays and a deteriorating level of service at the completion of Stage 5. The results are presented in the table below.

Table 26: Warran Road / David Low Way – 2019 PM Peak Stage 5 Completed

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	105	5.0	0.059	5.6	LOS A	0.0	0.0	0.00	0.58	53.4
2	T1	549	5.0	0.291	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		655	5.0	0.291	0.9	NA	0.0	0.0	0.00	0.09	58.8
North: David Low Way N											
8	T1	555	5.0	0.535	33.8	LOS D	15.1	110.1	1.00	0.12	38.3
9	R2	60	5.0	0.535	39.3	LOS E	15.1	110.1	1.00	0.12	37.4
Approach		615	5.0	0.535	34.3	NA	15.1	110.1	1.00	0.12	38.3
West: Warran Road W											
10	L2	46	5.0	0.051	8.3	LOS A	0.2	1.5	0.55	0.71	51.4
12	R2	88	5.0	0.203	14.4	LOS B	0.8	5.7	0.79	0.92	47.1
Approach		135	5.0	0.203	12.3	LOS B	0.8	5.7	0.71	0.85	48.5
All Vehicles		1404	5.0	0.535	16.6	NA	15.1	110.1	0.51	0.18	46.8

Level of Service (LOS) Method: Delay (HCM 2000).
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.

The table above shows vehicles from David Low Way N are experiencing unacceptable delays, with a LOS E predicted. The v/c ratios are all below 0.85.

It is therefore concluded that this intersection will need to be upgraded prior to the completion of Stage 5.

5.5.2 Tanah Street Intersection

With the proposed stages of construction, Tanah Street intersection is expected to experience delays and a deteriorating level of service in a major movement at the completion of Stage 5. The results are presented in the table below.

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Table 27: Tanah Street / David Low Way – 2019 PM Peak Stage 5 Completed

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	133	5.0	0.074	5.6	LOS A	0.0	0.0	0.00	0.58	53.4
2	T1	623	5.0	0.330	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
3	R2	39	5.0	0.065	9.8	LOS A	0.2	1.6	0.56	0.78	50.3
Approach		795	5.0	0.330	1.4	NA	0.2	1.6	0.03	0.13	58.2
East: Tanah Street East											
4	L2	27	5.0	0.056	10.9	LOS B	0.2	1.3	0.59	0.80	49.6
5	T1	9	5.0	0.547	133.6	LOS F	1.7	12.6	0.98	1.05	18.7
6	R2	14	5.0	0.547	134.2	LOS F	1.7	12.6	0.98	1.05	18.6
Approach		51	5.0	0.547	67.3	LOS F	1.7	12.6	0.77	0.91	28.1
North: David Low Way N											
7	L2	24	5.0	0.022	5.8	LOS A	0.1	0.6	0.14	0.54	53.0
8	T1	624	5.0	0.331	4.5	LOS A	0.0	0.0	0.00	0.52	54.7
9	R2	104	5.0	0.557	35.1	LOS E	2.6	18.8	0.89	1.08	37.3
Approach		753	5.0	0.557	8.8	LOS A	2.6	18.8	0.13	0.60	51.3
West: Tanah Street E											
10	L2	87	5.0	0.108	9.1	LOS A	0.4	3.2	0.60	0.79	50.8
11	T1	11	0.0	0.304	18.6	LOS C	1.4	10.1	0.88	0.91	45.2
12	R2	101	5.0	0.304	19.2	LOS C	1.4	10.1	0.88	0.91	44.6
Approach		199	4.7	0.304	14.7	LOS B	1.4	10.1	0.76	0.85	47.2
All Vehicles		1797	5.0	0.557	7.8	NA	2.6	18.8	0.17	0.43	52.3

Level of Service (LOS) Method: Delay (HCM 2000).
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.

The intersection is performing unacceptably, with movements at a level of service of E or F. The results indicate that all v/c ratios below 0.85, with a maximum of 0.557. There does not appear to be significant queuing.

It should be noted that the through and right turn movement for East Tanah Street E had a LOS F at earlier stages of the development. However, these movements are relatively minor movements with only 9 and 14 vehicles per hour respectively. It is not expected that an upgrade will be required until a major movement at the intersection is performing unacceptably.

This indicates that it will be necessary for this intersection to be upgraded prior to the completion of Stage 5.

5.5.3 Beach Road Intersection

The Beach Road intersection is expected to experience delays and a deteriorating level of service at the completion of Stage 2. The results are presented in the table overleaf.

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Table 28: Beach Road / David Low Way – 2016 PM Peak Stage 2 Completed

Signals - Fixed Time Cycle Time = 55 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	112	5.0	0.214	21.9	LOS C	2.3	17.0	0.79	0.75	43.1
2	T1	481	5.0	0.968	50.2	LOS D	20.9	152.3	1.00	1.37	32.9
Approach		593	5.0	0.968	44.9	LOS D	20.9	152.3	0.96	1.25	34.4
North: David Low Way N											
8	T1	516	5.0	0.674	8.9	LOS A	8.9	65.3	0.67	0.60	52.3
9	R2	262	5.0	1.005	71.9	LOS F	12.7	92.6	1.00	1.36	27.0
Approach		778	5.0	1.005	30.1	LOS C	12.7	92.6	0.78	0.85	39.8
West: Beach Road W											
10	L2	336	5.0	0.844	34.3	LOS C	10.4	75.9	1.00	1.00	37.6
12	R2	137	5.0	0.323	25.0	LOS C	3.2	23.1	0.87	0.77	41.4
Approach		473	5.0	0.844	31.6	LOS C	10.4	75.9	0.96	0.93	38.7
All Vehicles		1843	5.0	1.005	35.2	LOS D	20.9	152.3	0.88	1.00	37.6

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

The intersection is performing unacceptably, with a movement at a level of service of F. The results show v/c ratios above 1.00, with a maximum of 1.005. This indicates the intersection is over capacity. There is moderate queuing, with a 95% back of queue distance of 152m.

This indicates that the intersection will need to be upgraded prior to the completion of Stage 2.

5.5.4 Suncoast Beach Road Intersection

With the proposed stages of construction, Suncoast Beach Road intersection is expected to experience delays and a deteriorating level of service at the completion of Stage 1. The results are presented in the table below.

Table 29: Suncoast Beach Road / David Low Way – 2015 PM Peak Stage 1 Completed

Movement Performance - Vehicles											
Mov ID	ODMov	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	v/c	sec		veh	m		per veh	km/h
South: David Low Way S											
1	L2	204	5.0	0.114	5.6	LOS A	0.0	0.0	0.00	0.58	53.4
2	T1	628	5.0	0.333	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		833	5.0	0.333	1.4	NA	0.0	0.0	0.00	0.14	58.2
North: David Low Way N											
8	T1	688	5.0	0.365	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
9	R2	126	5.0	0.780	55.4	LOS F	4.5	33.0	0.95	1.27	30.9
Approach		815	5.0	0.780	8.6	NA	4.5	33.0	0.15	0.20	52.3
West: Suncoast Beach Drive											
10	L2	132	5.0	0.171	9.6	LOS A	0.7	5.2	0.63	0.84	50.5
12	R2	153	5.0	0.496	24.1	LOS C	2.3	16.7	0.90	1.06	41.9
Approach		284	5.0	0.496	17.4	LOS C	2.3	16.7	0.78	0.96	45.5
All Vehicles		1932	5.0	0.780	6.8	NA	4.5	33.0	0.18	0.28	53.4

Level of Service (LOS) Method: Delay (HCM 2000).
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.

The intersection is performing unacceptably, with the right turn movement along David Low Way North at a level of service of F. The results show v/c ratios below 0.85, with a maximum of 0.780.

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There does not appear to be significant queuing.

It is therefore concluded that this intersection will need to be upgraded prior to the completion of Stage 1.

5.5.5 Summary

A summary of the upgrade requirements for the intersection, linked to the development staging is presented below.

Table 30: Development Stage When Intersection Upgrades Required

Intersection	Staging
Warran Road	Upgrade is required to accommodate completion of Stage 5 of development
Tanah Street East	Upgrade is required to accommodate completion of Stage 5 of development
Beach Road	Upgrade is required to accommodate completion of Stage 2 of development
Suncoast Beach Road	Upgrade is required to accommodate completion of Stage 1 of development

It is recommended that the intersections are upgraded before the completion of the above stages.

It may be practical to undertake the upgrade of more than one intersection at a time, to provide a better outcome to the road network performance and limit the number of individual instances of road works on the existing road network. A possible schedule could see the upgrade of Beach Road and Suncoast Beach Road prior to the end of Stage 1 followed by the upgrade of Warran Road and Tanah Street East prior to the end of Stage 5.

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6 INTERNAL ROAD NETWORK AND PARKING

6.1 Internal Road Network

The internal road network was assessed in terms of its functional requirements, and a series of applicable cross sections were produced. These are being refined, but preliminary cross sections are presented below.

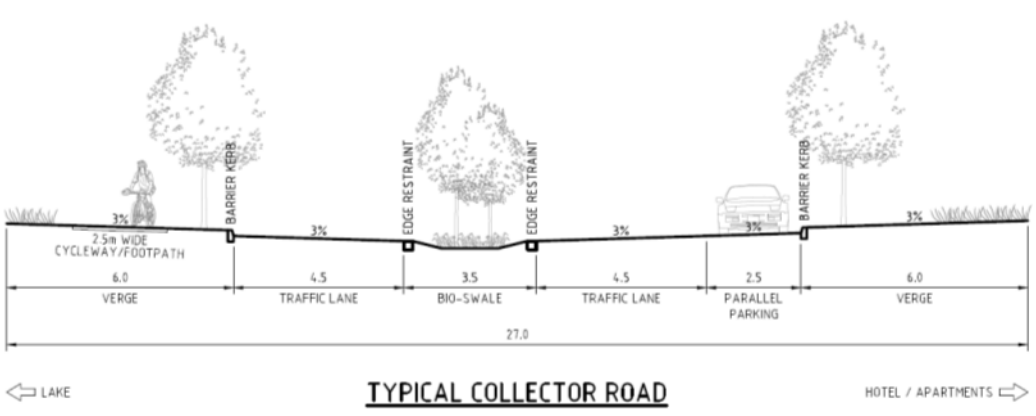

Figure 21: Collector road typical cross section

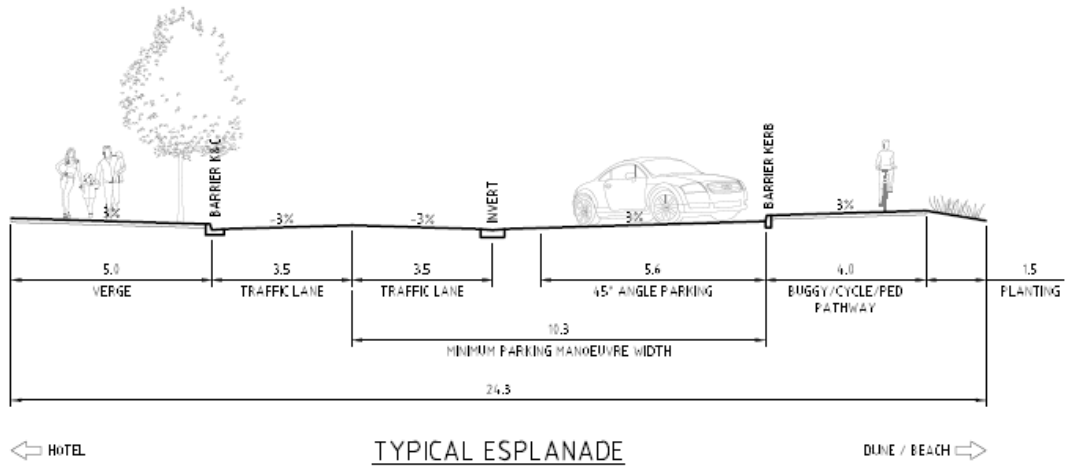

Figure 22: Esplanade typical cross section

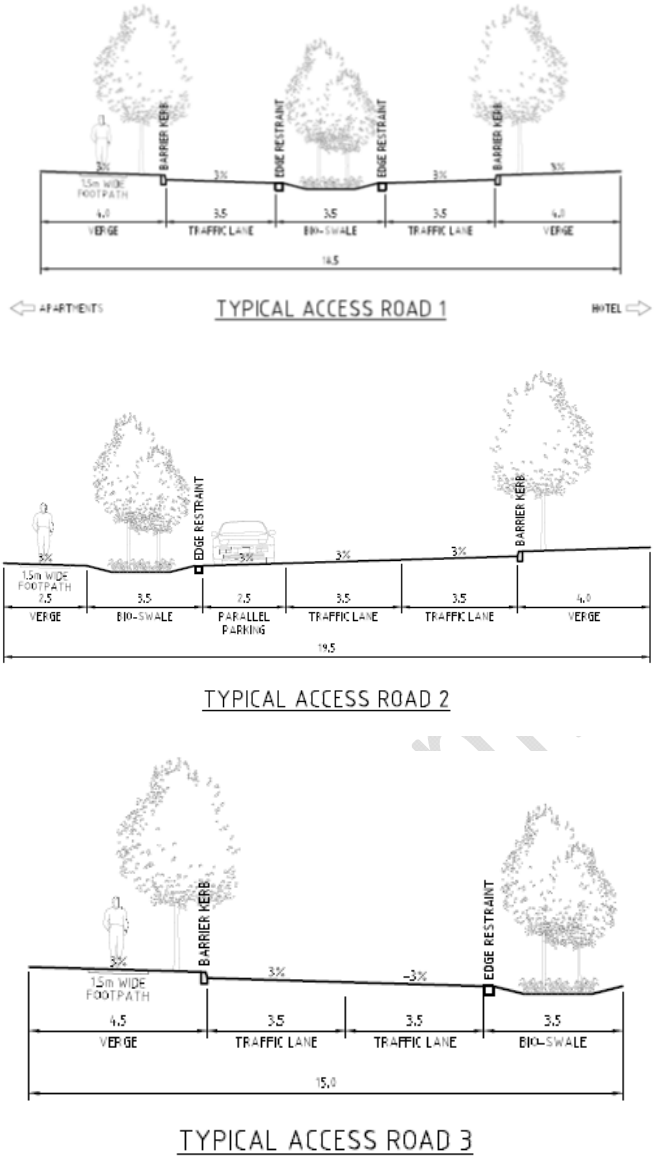

Figure 23: Access road typical cross sections

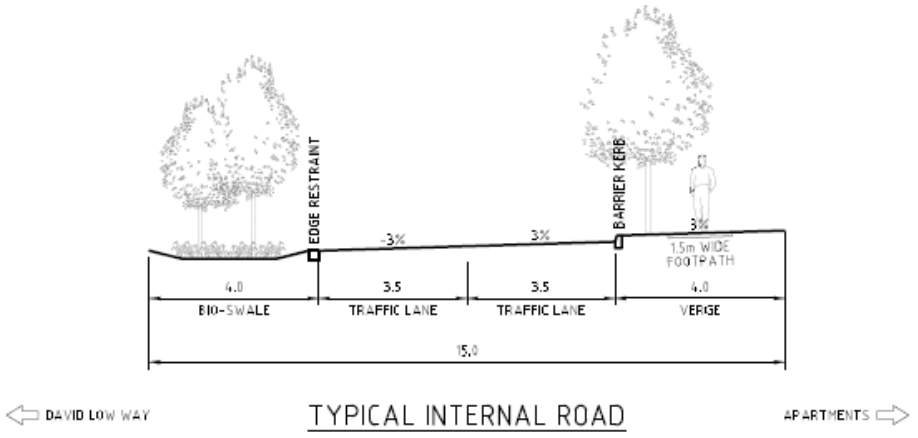

Figure 24: Internal Road typical cross section

6.2 Parking Requirements

Parking rates for residential units and serviced apartments are calculated as per the Sunshine Coast Planning Scheme (2014) at 1 parking space per unit, plus 0.25 spaces per unit for visitor parking. This results in 1,300 parking spaces for units plus 325 spaces for visitors. The Sunshine Coast Planning Scheme also requires for multiple dwellings the provision of:

- 1 motorcycle bay for every 10 dwellings (114 bays required for the residential component and 16 for the services apartments); and
- 1 bicycle bay per dwelling and an additional bicycle bay for every 4 dwellings (1425 for the residential component and 200 bays for the services apartments).

Restaurant and retail requirements are taken from the planning scheme also, with 1 space required per $20m^2$ for shops. At $3000m^2$ of retail, 150 spaces are required for parking. Motorcycle parking is at a rate of 1 bay per $100m^2$ GFA (30 motorcycle bays). Bicycle parking is also required at a rate of 1 space per $100m^2$ GFA for customers plus of 1 space per $100m^2$ GFA for staff (bike racks to accommodate 60 bicycles).

The scheme does not provide specific guidance for resort hotels but recommends 'sufficient spaces to accommodate number of vehicles likely to be parked at any one time'.

The RTA provides guidance at 1 space / 5 rooms for 5 star hotels, but their data include city hotels, and their guidance provides a caveat that the correlation of observed data is poor. Using this rate results in approximately 51 spaces required. The Gold Coast Planning Scheme Constraint Code 4 for Car Parking, Access and Transport Integration provides guidance at 1 space per room for the first 75 rooms and then 1 space per 10 rooms for every room thereafter. This results in approximately 93 spaces required. The required number of spaces would be highly dependent on the accessibility by taxis or shuttle buses from the airport, curtesy buses, etc available in the development.

The client has obtained additional advice from hotel consultants and potential operators on the operational requirements for the proposed hotel. Based on these discussions, a requirement of 78 car parks was identified which is based on approximately 30% of the rooms. This rate would appear reasonable based on the two calculations above.

In terms of beachside visitors there is no requirement under the planning scheme to include additional parking. Tweed Shire has guidance of 30 spaces for every 100m of beach access being used. A review of Maroochydore, Mooloolaba and Coolum indicated parking provision around 31, 33 and 38 respectively. These areas all have Surf Clubs at the locations analysed, which would attract visitors as they typically have restaurants and associated leisure activities.

Provision of 30-35 spaces per 100m of beach access being used is considered appropriate, however we should also consider the colocation of uses, multipurpose and internal trips accommodated in the earlier calculations. It is expected that this analysis in total is conservative due to multipurpose and internal trips for retail and beachside visitors. Typical reductions are in the order of 25% to 30% for similar type developments.

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The number of parking spaces required as per our assessment is summarised in the table below.

Table 31*:* Parking Spaces Required for the separate land uses

Land Use	Scheme Requirement	Parking Assessment	Parking Provision *
Hotel	Sufficient spaces to accommodate number of vehicles likely to be parked at any one time.	78 car	140 car
Retail	*1 car space/20m^2 GFA* *1 motorcycle space/100m^2 GFA* *2 bicycles spaces/100m^2 GFA*	150 car 30 motorcycle 60 bicycle	178 car 30 motorcycle 60 bicycle
Serviced apartments	1 car space/dwelling + 1 visitor space/4 dwellings 1 motorcycle space/10 dwellings 1 bicycle space/dwelling + 1 visitor cycle space/4 dwellings	200 car 16 *motorcycle* *200 bicycle*	200 car 16 *motorcycle* *200 bicycle*
Sub total		428 car 46 motorcycle 260 bicycle	518 car 46 motorcycle 260 bicycle
Multiple Dwellings (residential units)	1 car space/dwelling + 1 visitor space/4 dwellings 1 motorcycle space/10 dwellings 1 bicycle space/dwelling + 1 visitor cycle space/4 dwellings	1425 car *114 motorcycle* *1425 bicycle*	1340 car *114 motorcycle* *1425 bicycle*
Sub Total		1853 car *160 motorcycle* *1685 bicycle*	1858 car *160 motorcycle* *1685 bicycle*
Beach access/on-street parking	NA	30-35 spaces per 100m of beach front access being used say 109	114 ^
Reduction in demand due to multipurpose and internal trips	NA	-77 spaces	
TOTAL		**1885 car** **160 motorcycle** **1685 bicycle**	**1972 car** **160 motorcycle** **1685 bicycle**

*Parking proposed as per area density schedule in 0

^This value is nominated as On-Street Parking

It has been assumed that the on-street parking will adequately provide for the amount of beach front access (approximately 320m).

An analysis of the parking for the precinct shows that:

- the proposed parking for the residential unit component of the development is less than the parking required under the Sunshine Coast Planning Scheme;
- the proposed car park for the retail component would meet requirements when reconfigured to include motorcycle bays; and
- the proposed car park provision for the serviced apartments meets the Sunshine Coast Planning Scheme requirements.

6.3 Service Vehicle Requirements

The Draft Sunshine Coast Planning Scheme provides guidance on the requirements for service vehicles. As per AS2890.2-2002 (Commercial Vehicles) standards, the following are the typical design vehicles to be used:

- 19m Semi-Trailer Articulated Vehicle (AV) 19m long x 2.5m wide
- Refuse Vehicle Medium Rigid Vehicle (MRV) 8.8m long x 2.5m wide

For residential units, there is no specific requirement for service vehicle parking. For a resort/hotel development, the service vehicle parking requirement is only stated as "sufficient to meet demands". It is recommended that the number of service vehicle parking bays be confirmed in consultation with the hotel operational assessment, but is likely to be in the order of two to three service vehicle spaces. The access requirements and location for parking areas for the service vehicles will be finalised in consultation with the development application. It is recommended that the service vehicle parking bays be provided in the basement parking areas, near service entrances.

For retail, the parking requirement is for three vans and four service vehicles. These should be provided near service entrances.

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7 CONCLUSIONS AND RECOMMENDATIONS

This report provides a summary of initial traffic impact results, associated with a proposed hotel, residential and resort development at Coolum, on the Sunshine Coast.

The development is proposed on the eastern side of David Low Way, between Warrane Road and Tanah Street East. Access will be off David Low Way. Currently, at the location of the proposed development, David Low Way carries approximately 350 and 450 vehicles per hour per direction in the peak hours, increasing north of Beach Road to approximately 550 and 650.

Traffic counts were undertaken on Tuesday 16 July 2013. The traffic count data was used to derive background traffic data for the purposes of undertaking the TIA.

The proposed development consists of residential buildings, a hotel and associated retail and commercial facilities.

The development is expected to generate 1092 trips in the peak hour. The PM Peak hour is regarded as the critical peak.

The following intersections were analysed:

- The development access intersection with David Low Way;
- David Low Way / Warran Street;
- David Low Way / Warragah Parade;
- David Low Way / Tanah Street;
- David Low Way / Beach Road;
- David Low Way / Suncoast Beach Road;
- David Low Way / Boardwalk Boulevard;
- David Low Way / Seaside Boulevard; and
- David Low Way / Runway Drive.

A summary of the intersection performance in each 2024 scenario is shown in the table below.

Table 32: 2024 Intersection Performance Summary With and Without Development

Intersection	2024 Without Development	2024 With Development	Upgrade Required
Access Point	-	Acceptable	-
Warran Road	Acceptable	Unacceptable	Yes
Warragah Parade	Acceptable	Acceptable	-
Tanah Street East	Acceptable	Unacceptable	Yes
Beach Road	Unacceptable	Unacceptable	Yes
Suncoast Beach Road	Unacceptable	Unacceptable	Yes
Boardwalk Boulevard	Acceptable	Acceptable	-
Seaside Boulevard	Acceptable	Acceptable	-
Runway Drive	Acceptable	Acceptable	-

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With the development, the following intersections require upgrading:

- Warran Road;
- Tanah Street;
- Beach Road; and
- Suncoast Beach Road.

The upgrade requirements for these intersections will be triggered by the development staging. In order to assess when the intersection upgrades will be required, the performance of the intersections were analysed after various stages of the proposed development. A summary of the upgrade requirements for the intersections linked to the development staging is presented below.

Table 33: Development Stage When Intersection Upgrades Required

Intersection	Staging
Warran Road	Upgrade is required to accommodate completion of Stage 5
Tanah Street East	Upgrade is required to accommodate completion of Stage 5
Beach Road	Upgrade is required to accommodate completion of Stage 2
Suncoast Beach Road	Upgrade is required to accommodate completion of Stage 1

It is recommended that the intersections are upgraded before the completion of the above stages.

The number of parking spaces required is summarised below.

Table 34*:* Car Parking Spaces Required for the separate land uses

Land Use	Parking Requirement	Parking Proposed*
Hotel	78	140
Retail	150	178
Serviced apartments	200	200
Multiple Dwellings (residential units)	1425	1340
Beach access/on-street parking	30-35 spaces per 100m of beach front access being used say 109	114^

An analysis of the parking for the precinct shows that the proposed parking is greater than the parking required across the site.

It is recommended that the number of service vehicle parking bays be confirmed in consultation with the hotel operational assessment, but is likely to be in the order of two to three service vehicle spaces.

For retail and restaurants, the parking requirement is for three vans and four service vehicles.

Private and Confidential

APPENDIX A COOLUM BEACHSIDE AREA DENSITY SCHEDULE (12/12/2014)

Private and Confidential

STAGE	NUMBER OF UNITS	No. of Units (Stage 2&8 single loaded)	NUMBER OF STOREYS	HEIGHT to top floor level (m)	HEIGHT approx to roof (m)	G.F.A. (Council Defined) sqm.	Gross Building AREA (sqm.)	CARPARKING PROPOSED
STAGE 1								
Hotel	251	251	10	31.5	40	16865	19399	140
Serviced Apartments	160	160	9	25.5	33.5	16587	19683	200
Retail				Note: add 3.2m for each Level of Basement above ground		3000	3000	178
TOTAL	**411**	**411**				**36452**	**42082**	**518**
STAGE 2								
Building 1	40	28	4	9	13.5	3940	4540	65
Building 2	40	28	4	9	13.5	3940	4540	65
TOTAL	**80**	**56**				**7880**	**9080**	**130**
STAGE 3								
Building 3	50	50	5	12	16.5	4925	5675	65
Building 4	80	80	8	21	25.5	7880	9080	85
TOTAL	**130**	**130**				**7880**	**9080**	**150**
STAGE 4								
Building 5	70	70	7	18	22.5	6895	7945	85
Building 6	70	70	7	18	22.5	6895	7945	85
TOTAL	**140**	**140**				**13790**	**15890**	**170**
STAGE 5								
Building 7	70	70	7	18	22.5	6895	7945	85
Building 8	70	70	7	18	22.5	6859	7945	85
TOTAL	**140**	**140**				**13754**	**15890**	**170**
STAGE 6								
Building 9	70	70	7	18	22.5	6895	7945	85
Building 10	70	70	7	18	22.5	6895	7945	85
TOTAL	**140**	**140**				**13790**	**15890**	**170**
STAGE 7								
Building 11	100	100	10	27	31.5	9850	11350	105
Building 12	50	50	5	12	16.5	4925	5675	65
TOTAL	**150**	**150**				**14775**	**17025**	**170**
STAGE 8								
Building 13	100	70	10	27	31.5	9850	11350	105
Building 14	100	70	10	27	31.5	9850	11350	105
TOTAL	**200**	**140**				**19700**	**22700**	**210**
STAGE 9								
Building 15	80	80	8	21	25.5	7880	9080	85
Building 16	80	80	8	21	25.5	7880	9080	85
TOTAL	**160**	**160**				**15760**	**18160**	**170**
BEACH ACCESS / ON STREET PARKING		**30-35 Spaces per 100m of beach**						**114**
TOTAL (Stages 1 to 9)	**1551**	**1467**				**143781**	**165797**	**1972**
MOTORBIKE / BICYCLE								
Stage 1 - Motorbikes								16
Stage 2-9 - Motorbikes								114
Retail- Motorbikes								30
Stage 1 - Bicycles								200
Stage 2-9 - Bicycles								1425
Retail- Bicycles								60
TOTAL								**1845**

SITE AREA	**181,341sqm.**
SITE AREA	**18.1 hectares**
SITE COVER	**16%**

Apartment Area / Floor	
Council G.F.A.	**985 sqm.**
Gross Building	**1,135 sqm.**

Dwellings / sqm.	**1 / 117 sqm.**
Dwellings / hectare	**.012 / hectare**